# Profitability and Risk of Market Timing Strategies Using Passively Managed Funds

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## Abstract

The aim of this thesis was to extend previous trend-following literature to consider if trend-following strategies which used unit trusts would have the same improvements in returns, risk-adjusted returns, volatilities, and maximum drawdowns as has been found in previous studies. As unit trusts are only created and redeemed once a day, it could be possible that this delay would have an impact on results, but they are also accessible, relatively inexpensive, and already in use by retail investors. The aim was to discover the mechanics of trend following and to investigate the creation of a strategy which would be of benefit to a UK-based investor.

Chapter 2 confirmed for unit trusts the previous findings that over long periods, trend following was able to reduce volatility, improve maximum drawdowns, and increase risk adjusted returns for the HSBC FTSE 100 unit trust over 21 years. Previous trend-following studies invest in a cash-like asset when signalled to be out of equity markets. This thesis instead reviewed the use of a UK government bond as well as cash when not invested in equity markets. When used in combination with the FTSE 100, the inclusion of gilts in the strategy increased returns and risk-adjusted returns while continuing to offer a large reduction in risk measured through volatility and maximum drawdown. The typical 200-day moving average was found to be sufficient but was not the optimum strategy for this market over the 21 years studied. Instead, the use crossovers and trading monthly provided the best performances. When reviewed on a yearly basis over 1- 10 years, results for trend following were not as compelling with less consistency in returns and Sharpe ratios, but volatility and maximum drawdowns were still improved.

Chapter 3 examined trend following with unit trusts for 7 different equity indexes cumulatively over 1-10 and 15 years. The strategies did not perform as well over the 15 years as they had previously. This was partially due to where the start date of the investments fell in the market cycle. Years which started invested in equities and were able to exit after a fall, such as 2007 and 2008 were able to outperform a buy and hold. Alternatively, if the strategy started around the bottom of the market trough, such as in 2009 and 2016, the strategy had a delayed entry into equity markets which often lead to the trend-following strategy to outperform. This chapter also found that different market characteristics such as low volatility, high returns, and large maximum drawdowns were beneficial for a trend following strategy to be able to outperform. When compared to the underlying equity market, the only way that a trend-following strategy will be able to outperform is if there is a large drawdown with which it can exit. Otherwise, the best the strategy can do in an upward market, is to equal the buy and hold. The addition of UK government bonds to the trend-following strategies was able to provide additional returns even when used as the alternative investment to international equity markets while continuing to also provide similar and significant measure of risk reduction as a trend-following strategy which instead moved to cash. As different markets have different characteristics, so too do they have different optimum strategies. A 200-day moving average again would suffice, but just as investing in international markets allows for greater diversification, these different characteristics also allow for different optimum strategies.

Chapter 4 created trend-following portfolios using unit trusts and found that although the results were mixed for the individual markets, the combination of assets into a portfolio was able to provide improved risk-adjusted returns, volatilities, and maximum drawdowns compared to the individual markets and a 100% equity buy and hold portfolio. When compared to buy and hold 60% equity and 40% cash or gilts portfolios, the trend-following portfolio was able to deliver similar levels of risk reduction with much great returns more similar to the 100% equity portfolio. The trend-following portfolios were therefore able to deliver reductions in risk above that which was available through diversification alone. The gilt versions of the portfolios again increased the average returns and risk-adjusted returns while still providing significant levels of risk reduction. A review of the market disruption caused by the spread of the coronavirus found that trend-following was adept at exiting a falling market and reducing risk, but the delayed reinvestment impacted overall performance.

## Declaration and Statement

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed …… 

Date 11 January 2021

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used, the extent and nature of the correction is clearly marked in a footnote(s).

Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

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STATEMENT 2

I hereby give consent for my thesis, if accepted, to be available for photocopying and for inter-library loan, and for the title and summary to be made available to outside organisations.

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# 1 Introduction

## 1.1 Motivation

### The Issues Facing Retail Investors

With the rise of defined contribution pension schemes, retail investors are increasingly finding themselves responsible for their own investment decisions. Unfortunately, they have also been found to be unskilled at timing investments. (Authers, 2015; Frazzini and Lamont, 2008; Malkiel, 2012; Odean 1998, 1999; Sharpe, 1991) As Frazzini and Lamont (2008) put it simply, "individual investors have a striking ability to do the wrong thing." (p. 319)

The 22nd edition of Dalbar's Quantitative Analysis of Investor Behavior (QAIB) report (2016) measured returns made by investors in US funds. Over 30 years, the annualised return of the S&P 500 was 10.35% and the annualised return of the Barclays Aggregate Bond Index was 6.73% with inflation averaging 2.6%, but the average investor only returned 3.66% in equities, 0.59% in fixed income funds, and 1.65% in asset allocation funds. In 2015, the S&P returned 1.38% and the Barclays Aggregate Bond Index returned 0.55%, while investors in equity funds returned -2.28%, fixed income funds returned -3.11% and asset allocation funds returned -3.48%. These negative returns were exacerbated by inflation of 0.95%.

The QAIB report (2016) found that the leading cause of underperformance was investor behaviour including "panic selling, excessively exuberant buying and attempts at market timing". In 22 of the 30 years studied, equity investors underperformed the equity index. (Dalbar, 2016) In these instances, investors would have been much wealthier investing passively than letting sentiment get the better of them. Instead, they often panicked at big market turning points - selling at the bottom and missing the rebound or cashing out on the way back up and giving up too early on market rallies. Large economic disturbances, such as the 2008 global financial crisis, can add to the skittish investor behaviour discussed above. It therefore was not a surprise when Authers (2015) noted in his discussion about the 21st Dalbar QAIB that only around 15% of investors wanted to beat the market, but around double that showed an extreme aversion to loss.

Alternatively, Hoffmann and Shefrin (2014) found that individuals who considered themselves to be technical traders and traded options in the Netherlands from 2000-2006 were more likely to make poor trading decisions, traded more frequently, and held more concentrated portfolios resulting in a higher ratio of nonsystematic risk and lower returns than other investors. Hoffman and Shefrin (2014) found that these investors suffered from the opposite problem of overconfidence and excessive optimism.

Another option would be to invest in a managed fund. There is evidence to support the proposition that some actively managed funds, especially those which are not "closet index" funds disguised as active funds, can deliver consistent outperformance compared to a benchmark especially in countries in which low-cost passive alternatives are popular (Cremers and Petajisto, 2009; Cremers, Ferreira, Matos, Starks, 2016) and that there was some performance persistence for UK pension funds to a one year period (Tonks 2004). But, there has also been a growing recognition that expensive active funds do not deliver the promised outperformance despite the high costs relative to cheaper passive funds. Pension funds were found to have negative returns due to both international market timing and stock selection (Blake and Timmermann, 2005) and there has been evidence that UK pooled equity pension funds were unable to time the market (Clare, Cuthbertson, Nitzshe and Thomas, 2008).

The FCA (2017) reported, in a study of the performance of investment funds in the UK '... our evidence suggests that, on average, both actively managed and passively managed funds did not outperform their own benchmarks after fees'. Therefore, there are greater recommendations for passive investments with lower management fees. (Malkiel, 2012) This allows an investor to take part in the general upward trajectory of equities with minimum costs diminishing their investment. If an investor had a long investment horizon and could "ride out" a downturn, with the expectation that markets would eventually regain their losses, then this investment strategy could work. But a traditional buy and hold proposition with an allocation of 60% in domestic equities and 40% in domestic bonds has been considered increasingly risky with volatility largely dominated by equities and was considered "archaic" (Clare, Seaton, Smith, and Thomas, 2016a).

Those approaching retirement may also feel the need to lower their risk through a "glide-path" strategy, which incrementally decreases the equity content of their portfolio, especially when faced with the recent memory of market falls in the late 1990s, 2003, 2009,

or even 2020. Although most equity markets rebounded quickly after March 2020, it took over four years from both the 2003 and 2009 corrections to regain the losses from the previous peaks in 2000 and 2007. This would not seem like a viable option for those approaching retirement as four years could be longer than an investor would be willing to wait.

It is also not possible to minimise risk completely as it has been suggested that an equity allocation of 50-70% would be required to ensure portfolio longevity even through retirement (Bengen,1994; Guyton and Klinger, 2006). Diversification can help minimise risk to some extent, but international equity markets have been found to be more highly correlated as markets fall (Longin and Solnik, 2001; Ang and Bekaert, 2002; Amira, Taamouti and Tsafack, 2011), especially since 2008 (Straatman, 2013; Scott, Stockton, and Donaldson, 2019), and as evidenced through the late 1990s, 2008, and 2020, thus reducing diversification benefits from international equity asset allocations.

Another consideration is the Financial Conduct Authority's (FCA) recommendation that advisors consider not only an investor's attitude to risk, but also their appropriate capacity for loss (Clare and Thomas, 2014). Capacity for loss is a scientific measurement, compared to capacity for risk, as it assesses an individual's ability to absorb falls in the value of investments and the impact this would have on their standard of living. An investor's capacity for loss when in accumulation could be as high as 100% as losses can generally be recovered before any income would be required, but this drops significantly when entering decumulation as any loss could have a material impact on income and standard of living.

As well as concerns around acceptable levels of risk and capacity for loss, investors in the final years of accumulation and the beginning of decumulation also have the highest levels of sequence risk, the order in which the positive and negative returns occur for an investment (Suarez, Suarez, and Walz, 2015; Clare, Seaton, Smith, and Thomas, 2016b, 2017, 2021). If a fall in values occurred just before or at the beginning of decumulation, this could have a significant detrimental impact on the portfolio's value and would cause a reduction in either portfolio longevity or the withdrawal rate. Either way, this would have a direct impact on a retiree's standard of living and cause unnecessary stress and worry purely due to the unfortunate timing of retirement and the sequence of returns surrounding it.

Having found that trend-following strategies would provide superior risk-adjusted returns, volatilities and maximum drawdowns compared to a buy and hold strategy, (Faber,

2007; ap Gwilym, Clare, Seaton, and Thomas 2010; Good Harbour, 2015; Clare, Seaton, Smith, and Thomas, 2013, 2016a) and had the added benefit of limiting sequence risk (Clare *et al.* 2016b, 2017, 2021), this type of strategy could help address some of these key issues. Trend-following strategies provide clear enter and exit signals from the markets to remove any behavioural biases which could seep into the decision-making process and potentially lead investors to making inopportune trade decisions. As investors are typically more concerned with investment losses than gains and as trend-following strategies greatly reduce maximum drawdowns, this would allow investors to feel more comfortable with their investments in times of market falls as well as address capacity for loss and sequence risk. Finally, as trend-following strategies invest in equity markets the majority of the time, an investor could have a high enough equity content to ensure portfolio longevity while minimising volatility. One motivation for this research is to investigate whether an investor or an advisor, on behalf of their investors, could create and manage such a strategy, simply and successfully, and how they might go about doing so.

## 1.2 Aims, Objectives, and Research Questions

The overall aim of this thesis was to consider if trend-following strategies using funds utilised by retail investors, namely unit trusts, could provide positive returns and risk-adjusted returns while reducing volatilities and maximum drawdowns as has been found in previous studies. Most previous research on trend-following has investigated using commodities, equity markets, futures contracts, bond markets (Faber, 2007; Clare *et al.* 2013, 2016a; Hurst, Ooi and Pedersen 2017), but little research has been carried out in regard to unit trusts which are well-known, relatively inexpensive, passive investments with low transaction costs and are regularly used by retail investors within investment accounts. If trend-following strategies with unit trusts were able to provide benefits in terms of returns, volatility, or maximum drawdowns, then the further aim of this thesis was to discover the mechanics of creating a simple strategy using trend following which would be of benefit to an investor of any age, but particularly an investor who was either risk averse, approaching retirement, or in retirement and taking income from their pension. Being UK based, the focus was naturally on UK investors, but the implications can be extrapolated to investors interested in trend following anywhere.

The objective of Chapter 2 was to investigate whether trend-following strategies utilising unit trusts could provide investors with favourable risk-adjusted returns, and also minimise volatility and maximum drawdowns through the use of a FTSE 100 unit trust over a period of 21 years. The second objective was to discover whether an optimum trend-following strategy could be identified by comparing results from different lengths of moving averages and crossovers, daily versus monthly trading, and to see if the use of UK Government bonds (gilts) as an alternate investment instead of cash could provide additional benefits in terms of higher returns or lower volatility. Previous trend-following and momentum research typically invested into cash or a cash-like asset when out of equities, but gilts could provide a step down in risk from equities with more potential return than from cash.

A related objective to this was to investigate the performance of a trend-following strategy using a FTSE 100 unit trust on a year-by-year basis over 10 years as well as over the 21-years studied. Most previous research (ap Gwilym *et al.*, 2010; Clare *et al.*, 2013, 2016a, Hurst *et al.*, 2017) examines cumulative performance of trend following over a long period as it gives an indication to how a strategy would perform over long periods. Shorter time frames can be volatile and therefore not reflect the aim or the benefits of a long-term strategy, but this can also hide the experience for the investor, especially as most investment platforms are now online, allowing investors direct access at all times to review their investment progress.

The objective of Chapter 3 was to investigate whether an optimum trend-following strategy could be identified for other international index funds. This would determine whether there were different optimum strategies for different markets. Most previous studies utilised a 200-day moving average, especially when reviewing more than one market (Mills, 1997; Ellis and Parbery, 2005; Faber 2007, Clare *et al.*, 2013, 2016a). As some markets such as the US and UK may be more efficient than others, such as the emerging markets or the Pacific, it could be that different trend-following signals would perform differently for different markets.

The objective for Chapter 4 was to combine the international indexes into a portfolio to determine if the individual fund's trend-following strategies could create a well-diversified portfolio which would provide further protections from loss, over and above diversification alone, while also providing returns or risk-adjusted returns that could either match or outperform the same assets bought and held without any trend following, a "buy and hold" portfolio, or a portfolio which held 60% in equities and 40% in either UK government bonds

or cash. This was reviewed over a period of 5 years and 15 years cumulatively, and also over the market instability throughout 2020 due to Covid.

**Research Questions Explored**

The research questions explored through each chapter are as follows:

Chapter 2:

1. Is it possible to create a simple trend-following strategy that provides superior returns, risk-adjusted returns, volatilities, or maximum drawdowns using the HSBC FTSE 100 unit trust over a period of 21 years?
2. Is there an optimum trend-following strategy or range of strategies which outperforms the buy and hold strategy when examining 12 moving averages and 23 different crossovers with the duration lengths of 5-450 days either trading daily or monthly?
3. Would the use of gilts instead of cash when out of equities help or hinder a trend-following strategy?
4. Are the results from trend-following strategies consistent from year-to-year?

Chapter 3:

1. Do trend-following strategies applied to a range of international stock market indices for the FTSE 250, US, Europe, Japan, Pacific, and emerging markets outperform the buy and hold for each market in terms of returns, risk-adjusted returns, volatility, and maximum drawdown over 1-10 years and 15 years cumulatively?
2. Does the inclusion of UK government bonds, gilts, into the strategy instead of cash as the alternative asset when exiting equities provide any support for trend-following strategies in international markets as they may not have the relationship to international equities as they would for the UK market?
3. Are there different optimum strategies for different markets?

Chapter 4:

1. Does combining the optimum trend-following strategies, for each of the markets investigated in chapters 2 and 3, into a portfolio provide better returns, risk-adjusted

returns, volatilities, and maximum drawdowns when compared to either a 100% equity portfolio or the popular mixed portfolio allocation containing 60% equity with either a 40% cash or 40% gilt allocation?

2. Does the use of gilts instead of cash when out of equities continue to support the use of trend-following strategies as part of a portfolio?
3. How did trend-following strategies perform over the coronavirus crisis of 2020?

Throughout the rest of this chapter, the previous literature regarding trend-following and momentum strategies has been reviewed with the aim of identifying gaps in this literature to motivate the investigations carried out in this thesis. This chapter concludes with a summary of this thesis' results and unique contributions, and the organisation for the rest of the thesis.

## 1.3 Literature Review

### 1.3.1 What is technical trading?

Technical trading strategies are based solely on utilising past and present market prices, trends, volume, and other publicly available market data. This can include anything from chartists searching for signals such as head-and-shoulders, resistance and support levels, to momentum strategies. Momentum strategies include both cross-sectional and time-series momentum. Cross-section momentum compares the performance of individual assets across a market and buys the "winners" while shorting the "losers". Time series momentum strategies, also known as trend-following strategies, buy (sell) when the price of a stock moves above (below) a point determined using moving averages, breakouts (or breakaways) or crossovers over a set number of days. Unlike fundamental analysis, which is concerned with fundamental statistics and research about individual companies and the market, technical analysis searches for patterns or changes in prices and other market data to dictate trading.

Technical analysis has been in use since Charles Dow in the late 19$^{th}$ century developed the Dow theory through a series of articles from 1899 to 1902 in the Wall Street Journal. (Ostgaard, 2008) It has been considered the first form of investment analysis to be widely used and was developed before fully disclosed financial information was available (Brock, Lakonishok, and LeBaron, 1992). Ellis and Parbery's (2005) discussion of early academic studies considered technical trading systems such as those by Alexander (1961, 1964), Fama and Blume (1966), and Jensen and Bennington (1970) to be unsuccessful.

Later studies in the US market by Pruitt and White (1988) and Sweeney (1988) found that trend-following strategies were successful in outperforming the market. Brock *et* al (1992) stated that, "Although many earlier studies concluded that technical analysis is useless, the recent studies on predictability of equity returns from past returns suggest that this conclusion might have been premature."

### 1.3.2 Momentum and Trend-Following Supporting Evidence

Numerous studies now exist which provide support for both momentum and trend-following strategies and their abilities to provide abnormal returns for a variety of assets in many different contexts.

DeBondt and Thaler (1985), one early and often cited work proving the success of momentum strategies, used technical analysis in the form of cross-sectional momentum to study behavioural bias in the form of overreaction. They set out to test if extreme movements in prices would be followed later by corrections and if this could be predictive in nature. They calculated the difference in monthly returns for common stocks in the New York Stock Exchange from January 1926 to December 1982 comparing the bottom 35 stocks in a 'loser portfolio' to the top 35 stocks in a 'winners portfolio' based on a foundation phase of 3 years, 5 years, 2 years and 1 year. The results showed that the bottom 35 stocks outperformed the market by 19.6% on average while the winner portfolio earned about 5% less than the market. The overreaction effect was asymmetric as the returns were much higher for the group of losers than the loss by the winners. The residual difference between the two was 24.6% confirming their overreaction hypothesis. There was no discussion about risk or volatility but, in their conclusion, they briefly mentioned that the losing portfolio after 36 months earned about 25% more than the winning portfolio "even though the latter are significantly more risky."

Lukac and Brorsen (1989) studied both returns and volatilities using two technical trading systems with daily futures commodity prices from Dunn & Hargitt Commodity Data Bank using a channel system (also called breakout or breakaways) and a directional movement system (similar to moving averages) over 21 years from 1965 to 1985. They tested a re-optimised strategy by selecting an optimum parameter of 5 to 60-days for use the following year based on data either from the previous one to five-year period or based on all cumulative data. A periodic re-optimisation strategy was also tested where the parameter was

used for the same number of years as was used for the optimisation. (The optimised strategy used the selected parameter for x years after the period of optimisation of x years and was repeated every x years). They also tested fixed parameters from 5 to 60-days in increments of 5. All the strategies tested had significant mean profits above zero except for the shortest 5-day parameter channel system.

Their results reflected the success of both the technical trading systems they tested in terms of excess returns (excluding the 5-day fixed parameter channel system) against a negative and significantly smaller mean return for the buy and hold strategy. The directional movement system for re-optimized parameters had smaller standard deviations and therefore higher t-values which they directly related to a higher Sharpe ratio when compared to the channel system. When the parameters were fixed, the directional movement system for parameters 40-days and under had smaller standard deviations and higher t-values but lower average mean returns from 15-days and longer than the equivalent parameters for the channel system. From 45-days and longer, the t-values and returns for the channel system were higher and the standard deviations were similar. The highest t-values were 55-days for the channel system with a mean return of 59.04% and 30-days for the directional movement system with a return of 50.47%. The higher t-values were mainly due to smaller standard deviations showing the best risk/return trade-off. Overall, any parameter 40-days to 60-days for both systems were equally successful with similar standard deviations, t-stats and returns.

Other more recent studies found further evidence for momentum. Jegadesh and Titman (1993) found that trading systems for US shares which bought well-performing stocks and sold poor-performing stocks provided significant abnormal returns. Rouwenhurst (1998) found firms representing 60-90% of the market capitalisation of 12 European countries from 1978 to 1995 exhibited medium-term return continuation. Erb and Harvey (2006) found historical evidence that momentum-based strategies provided attractive returns for futures commodities. Asness, Moskowitz, and Pedersen (2013) found support for momentum across a wide variety of international assets. Menkoff, Sarno, Schmeling and Schrimpf (2012) found that cross-sectional momentum for currencies existed from 1976 to 2010 over 48 different currencies. Hurst, Ooi, and Pedersen (2017) found that over a century, time-series momentum strategies were able to perform well over each decade studied delivering strong, positive average returns and a low correlation to other traditional asset classes across 29 commodity markets, 11 equity indices, 15 bond markets and 12 currency pairs from 1880 to 2016. Babu, Levine, Ooi, Pedersen, Stamelos (2018) extended previous momentum literature with the use

of additional traditional assets, over those which had previously been studied, as well as further alternative assets which were not part of original study to provide out-of-sample evidence. Using as 12-month time series momentum strategy, they continued to find strong evidence for momentum performance across traditional assets with even higher Sharpe ratios for the alternative assets.

Asness, Frazzini, Isreal and Moskowitz (2014) also systematically discussed and discarded what they consider the top 10 myths around momentum strategies. In each instance they cited evidence from previous papers or their own results using Kenneth French's publicly available dataset to refute each myth in support of a momentum strategy or a combined strategy of both value and momentum. For example, one of the myths they refuted was that momentum strategies are too "small and sporadic" to be profitable. Asness *et al.* (2014) instead found that momentum strategies provide the largest return and Sharpe ratio when compared to other factors (small minus big, and high minus low). Another myth discussed was that returns could not be captured by long-only investors. Asness *et al.* (2014) found that the long side of the up-minus-down factor contributed at least half of the profits, if not more, signifying that a long-only portfolio would still provide profitable returns. Another often cited criticism of momentum which was discussed is the belief that momentum does not survive or is seriously limited by trading costs. Asness *et al.* (2014) argued that previous studies estimated costs for the average investor which they stated would be "about ten times larger" than that of an institutional manager or the studies did not consider transaction costs in their design at all. Instead, they noted that when estimating real-world transaction costs, momentum trading would easily have survived.

As trend following and momentum strategies are very similar, the success of momentum-based studies would provide support for the same underlying factors which allow trend-following to be successful, although trend-following strategies do not apply shorting techniques which short the "losers". Zakamulin and Giner (2020) examined the comparative performance of momentum and moving average signals. They constructed a theoretical model which presented a feasible explanation for why the performance of a moving average rule was better than the performance of a momentum rule. They found that although the two strategies were similar, and this similarity increased as price trends became stronger, moving average rules had better ability to sustain forecast accuracy with respect to future returns than momentum rules and therefore were better forecast indicators for future returns.

Trend following has been intuitively used in practice for decades and commonly used for futures and commodities (Ostgaard 2008). The academic study of trend-following has also enjoyed support in studies over long periods for many different asset classes. Brock *et al* (1992) explored simple moving averages and trading-range breaks using the Dow Jones Industrial Average from 1897 to 1986. Their buy (sell) signals were consistently followed by abnormally higher (lower) returns which could not be explained by other models. They also found that there was less volatility after a buy signal than a sell signal. They did not consider costs but suggested that the strategy could be used for pension funds or future markets where these costs could be limited.

Ellis and Parbery, (2005) used a 200-day moving average and an adaptive moving average (AMA) with the Australian All Ordinaries, the Dow Jones Industrial Average, and the S&P 500 from 1980-2002. They found that the AMA outperformed the 200-day simple moving average and the buy and hold. There were also significantly more trades when using the AMA, so when including costs, the AMA no longer outperformed and a long-term, passive buy and hold strategy was superior.

Faber (2007) used a simple 10-month moving average approach across a broad range of US asset classes and found that using trend following as a disciplined way to implement asset allocation decisions to produce multi-asset class portfolios produced higher returns with lower volatility. When looking at the S&P 500 from 1900-2005, Faber found that trend following increased risk-adjusted returns with a Sharpe ratio of 0.29 for the buy-and-hold (B&H) and 0.43 for trend-following (TF) but also increased absolute returns (B&H: 9.75%, TF: 10.66%) while reducing the standard deviation (B&H:19.91%, TF:15.38%) and maximum drawdown (B&H:83.66%, TF: 49.98%).

However, these findings hide the fact that the trend-following approach underperformed in roughly 40% of the 105 years studied. (Faber, 2007) This may be because the trend-following approach could only match the buy and hold during “roaring bull markets” and initially underperformed due to being out of equity markets as the trend formed. Its strength lay in its ability to escape prolonged and lengthy bear markets, adding value over the course of an entire business cycle. (Faber, 2007) In combining 5 diverse asset classes into an equally weighted portfolio (the S&P 500, an international developed markets index, a commodity index, a real estate index, and US 10-year T-bills over 30 years), Faber (2007)

also noted that the 10-month moving average strategy was able to produce equity-like returns with bond-like volatility and drawdowns.

Ap Gwilym, Clare, Seaton, and Thomas (2010) studied momentum and trend following approaches across 32 different international markets from 1970 -2008 and found that in developed markets profits from momentum trading strategies had diminished over the past two decades, although including emerging markets helped to improve performance. They found that a 10-month moving average trend-following filter over a momentum strategy improved risk adjusted returns on a portfolio on international equities when compared to a buy and hold approach without sacrificing momentum outperformance. They concluded that a combination of momentum and trend-following strategies could work together to reduce volatility without diminishing returns or increasing portfolio turnover.

Clare Seaton, Smith, and Thomas (2013) studied several different technical trading strategies from 10 to 450 days using the S&P 500 and found that a 200-day moving average trend-following rule was superior to a passive buy-and-hold investment from 1988-2011 and that end-of-month trading was sufficient. Asness, Ilmanen, Maloney (2015) combined the use of trend following with a contrarian CAPE ratio strategy and found that the combined strategy smoothed returns and provided a smaller drawdown than either CAPE or a binary trend-following strategy alone. Clare, Seaton, Smith, and Thomas (2016a) tested several different combinations of trend-following, risk-parity, momentum, volatility-adjusted momentum, and flexible asset allocation strategies on developed, emerging market, government bonds, commodities, and country-level real estate asset allocations. They found that trend-following improved returns, Sharpe Ratios, maximum drawdowns, and volatilities, and that using individual country indexes further improved performance.

Neville, Draaisma, Funnell, Harvey, Van Hemert (2021) reviewed strategies specifically for use during inflationary regimes and found that trend-following strategies performed particularly well especially for bond and commodity trend following. They felt that this was due to the fact that inflation “shocks” do not occur overnight and instead play to the strength of a trend strategy.

Alternatively, studies by Taylor (2014) found that momentum-based technical trading rules in the form of moving averages and breakout strategies studied from 1928-2012 on the Dow Jones Industrial Average had profits which were confined to small periods from the 1960’s to the 1980’s, relied on the ability of an individual to be able to short stocks, and had

deteriorated in later periods. Urquhard, Gebka and Hudson (2015) found that the predictive power of moving averages had diminished since 1987 and instead that a moving average rule that anticipated market signals a day in advance was able to provide excess profits.

Given that so much evidence now exists supporting trend-following and momentum strategies, what does this suggest in terms of the traditional financial paradigms such as the efficient market hypothesis (EMH)? A pure version of the EMH would not be able to explain any abnormal excess returns over and above the market itself, therefore research in support of trend following and momentum would appear to be inconsistent with the EMH. But there may be more to current interpretations of the EMH than that which the pure approach would leave one to believe.

### 1.3.3 Trend Following, Momentum and The Efficient Market Hypothesis

The efficient markets hypothesis (EMH) asserts that prices fluctuate randomly and reflect economic fundamentals. The origins of the EMH can be traced back to both Paul A. Samuelson (1965) and Eugene F. Fama (1965a, 1965b) independently. Samuelson studied market price fluctuations and considered these changes to be derived from competition between investors. Fama (1965) believed that EMH was a market system in which price fluctuations converged to their fundamental values. Fama (1970) described three levels of market efficiency: weak-form, based only on historic prices; semi-strong-form, which includes all publicly available information; and strong-form, which further includes all relevant information for price formation. The theory of EMH was based on "frictionless" markets (Samuelson, 1965) and "rational" investors (Fama 1965a, 1965b). Although, Fama (1970) himself noted that although there was strong-form evidence at the time, it could not be the case in reality that all information was reflected in prices, especially as corporate insiders and specialist have information which the general public do not, and that the EMH theory was a useful starting point for comparisons.

According to the EMH, prices constitute a "random walk" as price changes are expected to move randomly from historic prices. If all price changes incorporate news immediately, then, as news is impossible to predict, it would also be impossible to predict prices which fully incorporate such news. Therefore, all prices would be uncorrelated to previous prices.

Since the establishment of the EMH, there have been a number of empirical studies which have both challenged and confirmed this theory of random walk of prices. Evidence of short-term positive dependence in day-to-day price changes and serial correlations (Lo and MacKinlay, 1999) and technical analysis which had predictive power (Lo, Mamaysky, and Wang, 2000) leads to a rejection of the random walk model. Alternatively, some believe that due to transaction costs and commissions these positive correlations could not be converted into positive returns and lacked statistical significance. (Odeon, 1999; Lesmond, Schill, and Zhou, 2004) Therefore, there would not be sufficient evidence to reject the efficient markets model. (Fama 1970,1991; Malkiel, 2003, 2012)

Tests for market efficiency have not only been based on price correlations and the random walk of prices, but also on conditions stated in terms of expected returns. In an efficient market neither technical analysis, based on past stock prices, or fundamental analysis, based on the company financial information, would be able to provide greater returns than those returned by a portfolio of randomly selected stocks. (Malkiel, 2003) Alternatively, if a strategy could provide abnormal returns compared to the market, then market prices must not fully incorporate all information and therefore must not be completely unpredictable, disproving the EMH.

Many papers have found support for abnormal returns using both momentum and trend-following strategies which therefore appear to refute the hypothesis for market efficiency. Trend-following and momentum studies such as the ones by DeBondt and Thaler (1985), Jegadesh and Titman (1993), Conrad and Kaul (1998), Rouwenhorst (1998), Erb and Harvey (2006), Faber (2007), ap Gwilym, Clare, Seaton, and Thomas (2010), Asness *et al* (2013, 2015), and Clare *et al.* (2013, 2016a, 2017), to name a few, found support for abnormal returns or price correlations, which would therefore have been found to disprove the efficient market hypothesis.

In light of studies such as these, tests for the EMH appear to have been relaxed and have moved away from "frictionless" markets with entirely "rational" participants to one in which a strategy would be unable to create "a portfolio trading opportunity which enables investors to earn extraordinary risk adjusted returns" or where markets do not allow investors to earn "above-average returns without accepting above average risks." Malkiel (2003)

As the EMH suggests that prices "fully" reflect all news, in pure form this would almost certainly be false. Even Fama (1970) noted that this was unlikely to be true, but that

the efficient market hypothesis would continue as an "approximation of reality". Grossman and Stiglitz (1980) argued that not only are perfectly efficient markets an impossibility, but that if markets were perfectly efficient, there would be no incentive or profit for gathering information, there would be little reason to trade, and markets would eventually collapse. The degree to which the markets are inefficient would determine the amount of effort investors would be willing to use to gather and trade on that information.

### 1.3.4 Explanations for Abnormal Returns

Although over time it has become clear that modifications in market prices occur which would not if investors were 'rational', there are a few possible explanations for price changes that do not refute the essence of the EMH as defined by Fama (1970), that prices are driven by rational investors working towards true market value and final price discovery. They are that the existence of abnormal returns is a reward for higher levels or risk and that individuals could have different expectations and beliefs about future prices (Ledford, Harvey, Sargaison, 2014).

#### 1.3.4.a Rational Investor Explanations

The first would be a rational expectation that higher-than-average returns were a risk premium and provide compensation for higher-than-expected risk. For example, Jegadesh and Titman (1993) is an often cited and early work in support of momentum which found evidence for cross-sectional momentum strategies consisting of two parts, the purchase of assets which have performed well recently (going long the winners) combined with the short sale of assets which have performed poorly recently (short the losers). It could be said that the combination of these two trades could create a higher level of risk than a long only position justifying the higher-than-expected returns.

A second explanation for high momentum returns could be that returns are caused by natural market friction which has been exploited by rational investors who have different views or expectations on future markets, such as those in the late 1990s when there was a prevailing belief that rising technology stock prices were based on real fundamental changes in values. As fundamental market values are based on an individual's expectations of future

payments and dividends from company and future interest rates, this could explain the higher expected returns due to rational investors.

Both explanations would still fit within Malkiel's (2012) interpretations of the EMH. They both give explanations of rational investors with rational beliefs pushing prices towards real fundamental values.

### 1.3.4.b Behavioural, Non-rational Explanations

A new approach to finance, behavioural finance, has emerged to address the existence of behavioural biases and the shortcomings of the pure EMH, as the traditional financial paradigm of rational investors who fully incorporate new information into to their beliefs about prices, as described by Bayes' law, and make reasonable choices consistent with the capital market line and Savage's Subjective Expected Utility (Barberis and Thaler, 2003). Behavioural biases are often cited as reasons to explain why prices deviate from their fundamental values allowing trend-following strategies to provide abnormal returns. (Hurst, Ooi, Pedersen, 2010, 2017; Malkiel, 2012; Clare *et al.* 2016a)

There are two aspects of behavioural finance, "limits to arbitrage" and the psychological behavioural biases at play when investors make decisions given their personal beliefs. (Barberis and Thaler, 2003). As "irrational" investors push market prices away from fundamental values, there are "limits to arbitrage" which hinder the ability of rational players to both identify miscalculations in market prices and limit their ability and desire to want to act to bring market prices back to their rational fundamental values. Market participants do not act in a frictionless, riskless market. The ability and time required to identify a miscalculation, wait the required length of time for the correction, and create a strategy which could take advantage of the mispricing, such as short selling, could be both costly, timely, and risky. One would also have to hope that irrational traders do not further push prices away from their fundamental values making the original calculations increasingly riskier.

Both aspects are important in explaining why trends could be created and why they continue, allowing trend-following strategies to create excess returns. Widely recognised as the founders of behavioural finance, Kahneman and Tversky (1979) combined economics with psychological observations of an individual's beliefs to create the first insights into an individual's investment behaviour including ***loss aversion***: individuals give a stronger negative value to losses than they do the same relative gain, i.e. they have a bias towards

avoiding losses over seeking gains; ***diminishing sensitivity***: the value of both losses and gains decreases as the size increases; and ***reference dependence***: that the value of the gains and losses are felt relative to a reference point. Other behavioural biases include, but are not limited to herding, extrapolation, overconfidence, feedback, underreaction, anchoring, and confirmation bias which are detailed below. (Barberis and Thaler, 2003; Hurst *et al.*, 2010, 2017; Malkiel, 2012; Hoffmann and Shefrin, 2014; Clare *et al.*, 2016a)

**Herding**: As investors become aware of the start of a trend, a herd mentality could take over as others see the sudden rise (drop) in prices and invest in (exit) markets perpetuating the current trend and becoming a self-fulfilling prophecy.

**Extrapolation:** Investors extrapolate the current trend in their calculations for continued expected returns.

**Overconfidence:** Investors believe they are better than they are, and they therefore may trade more frequently, and may not manage or control risk properly.

**Feedback:** As prices go up (down) as expected, investors believe that they were correct in their belief that prices would continue the path as expected**.**

**Underreaction:** Due to **limited processing** abilities and the large amount of available information, investors take time to fully digest and integrate new information into their fundamental beliefs in a timely fashion. There could also be further delays to assimilating information due to slow **information diffusion** with professional investors almost certainly receiving access to economic information more quickly than retail investors. Both information diffusion and limited processing could cause reduced reaction times, underreaction to news, and cause prices to change slowly allowing a trend to appear over time. Also, investors may also be wary of locking in a loss and holding on to assets which decrease in value for longer than they would if they were acting more 'rationally' slowing the development of a downward trend.

**Anchoring:** Investors can start with a value, possibly arbitrary, and make slight adjustments from that initial value. They can therefore anchor their price expectations on a historical price, such as the one at which they originally invested, which could further lead to underreactions. For example, an investor may hold onto a stock whose value is dropping for longer than they should because they have "anchored" their expectations around the price at which they bought the stock, or higher.

**Confirmation Bias:** Investors emphasise information which confirms their beliefs while devaluing that which do not, and can even misinterpret information which goes against their beliefs such that they believe that the information is actually in their favour.

Critics to the ideas behind behavioural finance found that underreaction was as common as overreaction and therefore such biases would tend to disappear with different models, risk levels and statistical approaches (Fama, 1998). Schwert (2001) believed that researchers themselves were so focused on challenging wisdom such as the EMH, that they would, every now and again, find a technique which could produce a statistically significant result and challenge the EMH. Schwert (2001) also stated that even if there was an anomaly such as the January-effect, once published it would quickly be exploited and would disappear. More recent papers such as those by Asness *et al.* (2014) countered arguments against momentum-based strategies and Hurst *et al.* (2017) found abnormal returns over a century expose the weaknesses in the EMH due to their ability to find excess returns over and above market returns.

### 1.3.5 Does the Existence of Abnormal Returns Disprove the EMH?

Even Malkiel (2003), a vocal advocate of the random walk, the efficient market hypothesis, and passive investing, admitted that market pricing was not always perfect and that there were times, such as the internet "bubble" in the late 1990s, when the market made mistakes and were instead driven by irrational investors and psychological factors which influenced securities prices. Malkiel's (2012) more realistic and less idealistic stance on the market is that:

> 'The market eventually corrects any irrationality – albeit in its own slow, inexorable fashion. Anomalies can crop up, markets can get irrationally optimistic, and often they attract unwary investors. But, eventually, true value is recognized by the market, and this is the main lesson investors must heed… Markets are not always or even usually correct. But NO ONE PERSON OR INSTITUTION CONSISTENTLY KNOWS MORE THAN THE MARKET."

In short, the existence of bubbles and anomalies which allow strategies to outperform for some time, according to Malkiel (2012), does not necessarily refute the EMH. There may be opportunities in the short term to exploit and even push prices further away from their

fundamental values, but eventually markets will correct themselves proving the EMH eventually to be correct.

It could therefore be argued, the ability of a technical strategy to earn abnormal returns is consistent with the story of the short-term movements and anomalies which are allowed within Malkiel's (2012) interpretation of the EMH, and it is irrelevant to argue whether the empirical support of momentum and trend following proves or disproves the EMH. Either way, from an individual investor's perspective, it would not make sense to sit out the rise in market values away from fundamental prices if it could take months or even years for the prices to correct themselves as they did in the late 1990s. At the time, the fundamentalist conventional belief could have been that technological advances warranted those prices as they were based on expected future earnings, future growth rates, etc. and as such were thought to be realistic expectations based on the then prevalent fundamental values and economic information. In hindsight, the drive of prices upwards displayed errors for both the fundamentalist and the market which might not have been apparent at the time.

Another theory, the adaptive market hypothesis (AMH) states that the strategy's success is dependent on the particular market environment. Contrary to the EMH, a strategy's performance may vary based on the market conditions with the implication that a market's efficiency varies over time. Urquhart *et al.* (2015) found that post-1987 the predictive power of moving averages diminished and believed that one of the reasons this occurred was because as the strategy was exploited, its ability to create excess returns diminished, supporting the AMH. Urquhart *et al.* (2015) also found that a predictive one day forward moving average strategy was still able to provide excess returns after the market had adapted to the original moving average strategy.

Regardless of the theory behind "bubbles" and how long it could take to correct, if in practice a strategy could provide the ability to continue investing as prices move upward or exit as share prices move downward then such a strategy could improve an investors performance or potentially better match an investor's personal preferences. As trend following has been found to provide abnormal returns and to reduce volatility and maximum drawdowns (Faber 2007, ap Gwilym *et al*. 2010, Clare *et al.* 2013, and Asness *et al.* 2015), it could be an especially appropriate strategy for a risk averse investor to pursue.

The fact is that, regardless of financial theory, bubbles in financial markets occur from time to time. Prices both rise above and fall below fundamental values as they did

during the Dutch tulip bulb crisis, or the 1990's dot.com bubble. Whether the price bubbles exist for purely behavioural reasons, irrational investor exuberance, a reward for taking on higher levels of risk, or any other behavioural tenet or economic reasoning, and even if it is just a matter of time before a correction might occur, these bubbles can last for months and even years at a time. It could leave an investor wistful to exit an investment due to a belief that markets are incorrect in their pricing and watch lost potential returns continue upwards as shares continue to be "overvalued". Or, if a correction were to occur, even one which was not necessarily stock specific but systematic instead, it could take a share price below its rational expected value and it could be sometime before investors were coaxed back into the market to push prices back to their expected higher fundamental values for the investment to recover. In essence, it does not matter why bubbles exist, but just that they do, and it would be best to avoid large falls if possible and to take advantage of rising investments. The problem would be timing the changes adeptly, and trend following has been found to help identify when to exit markets and has been found to significantly reduce maximum drawdowns and volatility and to help reduce sequence risk.

### 1.3.6 Sequence Risk in Decumulation

As more companies move from defined benefit to defined contribution pension schemes, individuals are faced with complicated investment decisions. Generally, an individual reaching retirement would ideally want to maximise their quality of life without depleting their finances. Alternatively, there is also the risk that an individual would have lived more frugally than necessary with a reduced quality of life. During decumulation investments are sold on a regular basis to provide an income regardless of market movements. Several factors to consider when approaching retirement are the income withdrawal rate, the unknown length of time for which income would be needed, any initial monetary requirements, the potential for desired inheritance, the amount invested in equities versus other safer investments or cash, and the strategy which would be employed. A miscalculation in any of these points could lead to a failure in portfolio longevity.

Although these are all important points to consider for an investor in the decumulation phase, the issue of sequence risk, the order in which good and bad returns occur, also has a large impact on the experience of someone in both accumulation and decumulation. As the rates which occur at the beginning of an investment are applied sequentially and

compounded, they have the largest impact. If a negative return were to occur relatively early during the withdrawal phase of an investment, the final value of the investment would be drastically reduced purely due to the order of negative and positive returns. Two strategies could have the same average return, variance, cumulative returns and even Sharpe ratios, but the year in which retirement begins and the order in which their returns occur will impact both the rate at which income can be withdrawn and the longevity of their portfolio.

There has been much debate about the most efficient withdrawal rate strategy. A constant 4% withdrawal rate was found to be sufficient by Bengen (1994) for portfolio longevity versus average life expectancy in the US with an equity allocation of 50% to 75% most appropriate. Several more recent articles consider different adaptive strategies for withdrawal rates and portfolio allocations. Guyton and Klinger (2006) develop performance-based withdrawal rate adjustment rules over 40 years with different equity allocations and found that with these rules a portfolio containing 65% equities could have sustainable withdrawal rates of 5.2-5.6% over 40 years with a 99% confidence standard rising to 5.7-6.2% at a 95% confidence standard. Frank, Mitchell, and Blanchett (2011) recognised the issue of sequence risk and considered four variables for the retirement distribution problem: time, withdrawal rate, equity portfolio allocation, and the probability of failure. They suggested rules which adjust depending on how returns deviate from historical averages and that modifying the withdrawal amount instead of portfolio allocation was more effective at managing exposure to sequence risk. Blanchet, Kowara, and Chen (2012) created a measure called the "Withdrawal Efficiency Rate" and Suarez, Suarez, and Waltz (2015) created an analytical measure to determine the "Perfect Withdrawal Amount" and "Perfect Withdrawal Rate". Both were constructed from probability distributions of withdrawal rates to perform longevity risk and utility maximisation analysis and in the process created a new measure of sequence risk.

Clare, Seaton, Smith, and Thomas (2016b, 2017, 2021) used the same methods, perfect withdrawal amount, and sequence risk measure as Suarez *et al* (2015) to show that a simple trend-following filter smoothed returns, lead to higher withdrawal rates and was cheaper and more straight forward than options, thus appealing to a wider array of investors. They argue that as returns are inherently unpredictable, it is not possible to tactically modify asset allocations to avoid large losses while a de-risking/glide path investment strategy could leave an investor without enough equities with which to earn returns to maintain their withdrawals which also could be costly. Instead, Clare *et al.* (2017) found that for a 100% US

equity investment, a trend-following strategy led to smoother outcomes with improved decumulation experiences. Although they do not find a mathematical link between reduced maximum drawdowns and reduced sequence risk, the two were empirically related and could be improved with simple trend following. Clare *et al.* (2021) continued this research with a 10-month moving average across UK and global equity indexes, gilts, commodities, and property from 1971-2015 individually and as UK equity and gilts portfolios with a split of 60%/40% and 30%/70% as well as an equally weighted multi-asset portfolio and found that trend following increased real returns, reduced volatility, and reduced maximum drawdowns. There was also a reduction in the variation of perfect withdrawal rates which removed the lowest PWR without much reduction in unusually high outcomes which could make it easier to target sustainable withdrawal rates.

To address the possibility of portfolio longevity failure and the reduction of sequence risk, the search for a solution often centred around a suitable withdrawal rate (Bengen, 1994) or the use of an adaptive strategy (Guyton and Klinger, 2006, Frank *et al*., 2011). There could also be the suggestion to de-risk a portfolio using a glide path method by reducing the equity content and increasing the cash or fixed income allocation to provide a portfolio with lower levels of risk. But systematically reducing the equity content also reduces the ability for investments to grow and could also be a risk to the longevity of the portfolio. Bengen (1994), Guyton and Klinger (2006), Clare *et al.* (2017, 2021) and Frank *et al.* (2011) all found that the reduction of equity allocation was detrimental to the value of the portfolios. The use of options could also be considered, but for the majority of pension investors this type of investment would be too expensive or too complicated to include in a pension portfolio. Alternatively, a trend-following portfolio could be used which Faber (2007) and Clare *et al.* (2016, 2017, 2021) found reduced maximum drawdowns and volatility while also typically increasing risk-adjusted returns. The latter also found that trend following provided a reduction in sequence risk and typically had higher rates of perfect withdrawal amounts.

### 1.3.7 Underlying Market Conditions

Mills (1997) found that the moving average (MA) trading rules outperformed the buy-and-hold in periods when the underlying index was driftless and markets were less efficient. When a clear trend began to dominate, the MA performed poorly. This contradicts Ellis and Parbery (2005) who stated that MAs perform poorly "in ranging markets characterised by no

clear trend in movement" (p.400). The nature of MAs and markets in general would require a mixture of both. An upward trend would be required to provide a positive return, even if this makes it difficult for a trend-following strategy to outperform. To outperform, a clear downward trend would be needed to create a moving average signal to come out of the losses sustained by the buy-and-hold.

The research supports the findings of both Ellis and Parbery (2005) and Mills (1997). It is important to have a clear upward trend, as suggested by Ellis and Parbery (2005), for trend-following strategies to be profitable as they will partake in the positive returns, but they are less likely to outperform the buy-and-hold strategy if they join in after the trend is already established. They will still also be able to reduce losses in persistent clear downward trends and it is in these instances that the trend-following strategy will be able to outperform. Ellis and Parbery's (2005) strategy is also most likely suited to medium/long term duration strategies as they are most likely to gauge longer trends in movement. Mills (1997) was also correct. If the underlying market conditions are driftless, then the success of a trend following strategy would depend on the duration of the strategy chosen. If too short, the strategy would most likely whipsaw and if too long, the strategy would provide the same return as the buy and hold. If the criteria of success were to outperform a benchmark buy-and-hold, then some volatility or a strong downward trend would be needed for there to be a clear opportunity for trend-following strategies to outperform.

### 1.3.8 On Optimisation

The strategy and durations chosen for a technical trading strategy can make a significant difference to the strategy's success and profitability. Utilising a duration which is too short can lead to 'whipsawing', buying, and selling too frequently, and potentially mistaking small price movements as changes in trend. In an extreme case of whipsawing, an investor would sell every time the price dropped and buy every time the price had risen, essentially selling low and buying high, leading to a very short-lived strategy. The large number of transactions involved when whipsawing can also greatly increase transaction costs further reducing the original investment. Alternatively, durations which are too long would lead to missing market movements completely and selling when the markets are on the rebound or buying after a peak when markets are on the way down.

The use of optimisation techniques to find parameters which would be useful for all market conditions and all time periods has been argued to be futile. Praetz (1976) stated that "there is nothing to say under different conditions in the future which filter size and strategy will be profitable." And, although the results from Lukac and Brorsen's (1989) research supported technical trading in the form of breakouts and moving averages, their main consideration was a discussion on the successfulness of optimisation.

Lukac and Brorsen (1989) tested a directional movement system (moving averages) and a channel (breakout) system for 5-60 days and found that all strategies generated a higher mean return the buy-and-hold, except for the shortest 5-day parameter for the channel system. To determine if it would be possible to find one optimum parameter, the returns were then compared against each other. As they all appeared to outperform the buy-and-hold with similar mean returns, the strategies were not dissimilar to each other. Lukac and Brorsen (1989) therefore concluded that "efforts to select an 'optimal parameter' are futile".

Another plausible conclusion may not be that optimisation did not work, but that optimisation does work for a range of successful parameters. If Lukac and Brorsen (1989) were looking for one duration parameter to consistently outperform in a way that is radically different from the others with only a 5-day increment, this would only be apparent if there were many continuous large swings in prices. Moving averages work as a smoothing device. Breakaways would also only signal a trade if the current price was higher or lower than the average of the previous x-days prices. The strategies only incurred a large difference in return and volatility if the parameter chosen was relatively small, such as the 5 or 10-day parameters which were the least successful for Lukac and Brorsen (1989). What set these two parameters apart in their relative lack of success was that because the lengths were so short, they most likely suffered from whipsawing and the higher transaction costs associated with the larger number of transactions. All other strategies, which had closer parameter values, would have reacted at a similar time and therefore had similar standard deviations, t-stats, and returns which were not significantly different from each other. As the majority of Lukac and Brorsen's (1989) results were positive, due to testing durations with similar lengths, they left the "possibility of selecting an optimal range" instead of one optimum parameter still open.

Lukac and Brorsen (1989) also added the caveat that different tests in different times could produce different results: "These results are valid only for the parameter sets, systems and strategies chosen. Extreme parameter sets, a different system, or a different strategy may

alter the results. For example, if one were to consider parameters as low as one and as high as 200 or 300, then optimisation might have helped." Testing parameters with ranges as wide as these may also have provided results with a larger degree of differentiation between them.

Ellis and Parbery (2005) quoted a paper that was published one year earlier than Lukac and Brorsen (1989) in which a 200-day duration was chosen stating, "Following Colby and Meyers (1988) a common standard of comparison against which alternative trading methods can be compared is the 200-day simple moving average (SMA200)." Ellis and Parbery (2005) also stated that Levy (1966) suggested using a 200-day duration over twenty years earlier as it was generally thought to be long enough to avoid losses due to whipsawing and yet still responsive enough to pick up any persistent changes in direction. Mills (1997) considered it to be "the most popular MA rule". Finally, Clare *et al*. (2013) selected the 200-day moving average as their top choice for both maximising return and reducing volatility, but also tested durations from 10 to 450 days. A 200 or 300-day parameter is therefore not as extreme as Lukac and Brorsen (1989) might have believed.

Many of the results by Lukac and Brorsen (1989) and Clare *et al.* (2013) showed clear ranges which provided similar and successful returns. As well as searching for the highest return and the best risk-adjusted return, it could also be important to note the breadth of the number of successful MAs within a strategy or duration which could make a strategy appear more durable and therefore potentially more successful than another. It is this optimum range that this thesis was looking for in both strategy and duration.

## 1.4 Gaps in Previous Literature

### 1.4.1 Why Open-Ended Investment Companies?

Not many, if any previous research specifically reviewed the implications of trend following on unit trusts. Unit trusts are readily available, have low transaction costs, and they are very popular in most investors' pensions or investment accounts. To create a realistic pension strategy, open-ended investment companies (OEICs or unit trusts) were selected. Many passive unit trusts are already in use within pensions as a low-cost alternative with diversified market returns. As little trend-following research has been completed using unit trusts, it was important to study if their idiosyncrasies had an impact on their effectiveness within a trend following strategy. For example, as unit trusts are only created or redeemed

once a day, there would be a delay of at least one day between the sale of an asset and the purchase of another. This could have an impact on the ability of trend following using unit trusts to effectively time the market and therefore warrants further investigation before considering their use as part of a simple trend-following strategy. Most previous research would not have been required to take this delay into account.

As unit trusts are frequently used by investors of all types, the limited research on unit trust trend following could also leave out behavioural biases which, although difficult to quantify, could have an impact on results making trend-following either more or less effective.

On one hand, using highly liquid, well-known, well-used, passive, index-tracking unit trusts could reduce opportunities for the use of trend-following strategies as information on these indexes and the underlying markets could be more heavily documented, well publicised and all relevant information regarding the fund could be more readily dissipated, making these funds more efficient. The investor pool, although readily available to and used by retail investors, could still be dominated by 'rational' professional investors who would and could exploit any inconsistencies to fundamental values.

Alternatively, if information diffusion occurred at different rates depending on the type of investor and market, it could be possible that trend-following strategies would react differently purely due to this fact. These funds are invested in large quantities by investment houses, investment professionals, pension funds, and by retail investors. This large array of investor types may increase the information diffusion time from one type of investor compared to another. The proportion of retail investors in a well-used OEIC could lead to the conclusion that the asset is subject to less rational investment mentality and could be more heavily influenced by behavioural biases than the indexes themselves. Or the purchase from large institutional and long-term investors such as pension funds could make price changes slower as it is less likely that these types of investors would switch assets or modify their allocations regularly, allowing shifts away from fundamental values to continue and fundamental price discovery to be slowed. This could lead to the expectation that the slower trend from the use of an OEIC would support the ability of trend-following strategies to have larger expected returns than the underlying buy and hold investment.

Although this thesis has not compared the results of unit trust trend following to the indexes themselves, it is possible that the results could be skewed due to the higher

percentage of inexperienced retail investors, more stable pension funds, or due to expectations or announcements based on the success, reputation, and longevity of the fund provider itself. It is for these reasons that the study of unit trusts warranted further research.

### 1.4.2 The Use of UK Government Bonds

With all previous trend following research by Faber (2007), ap Gwilym *et al.* (2010) and Clare *et al.* (2013, 2016, 2016a, 2017,2021) when a position was not invested in equities, the allocation instead was held in cash and earned the 3-month Treasury Bill interest rate. This thesis investigated the use of UK government bonds (gilts) instead of cash when signalled to be out of equities. This could provide a step-down risk approach to equities and could also potentially provide further returns than a cash proxy. If successful, this could provide an alternative method for using trend following than has previously been suggested. The potential for further returns compared to cash is largely based on the assumption of a negative correlation between equity and bond returns (i.e., the exit from equity due to negative returns will be partly offset by positive returns from bond investment). The evidence for such a negative correlation is mixed and period dependent (Baele, Bekaert and Inghelbrecht (2010). However, the evidence shows that the correlation between stocks and bonds has been negative for most of the period since 2000 (the period of study in this thesis).

### 1.4.3 Study of the Investor's Experience

Most previous studies reviewed trend-following strategies over long periods, from 20 to 60 or even 100 years. (Faber, 2007; ap Gwilym *et al.,* 2010; Clare *et al.,* 2013; Hurst, Ooi, Pedersen, 2017) Although this is interesting for long-term investors, it does not explain what the experience would be like for an actual investor, reviewing their pension pot yearly, or more frequently. Faber (2007) found that although over whole business cycles trend-following strategies were able to provide returns which outperformed, but in over 40% of the individual years he had studied they did not. As investments are typically designed for the long term this would make sense. Shorter time periods are more volatile and may not reveal the true value of an investment. It is only over time that a, usually upward, pattern may develop sufficiently to prove the worth of the strategy. Unfortunately for most investors, not many begin investing early enough to find a study over 100 years to be a realistic display of their final investment values. Therefore, this thesis investigated different cumulative results

based on both the maximum amount of data available for the clean share class versions of the well-used unit trusts studied as well as shorter data sets. For the FTSE 100 this was 21 years cumulatively and 1-10 years discreetly. For other international markets this was from 1-15 years cumulatively for differing investment time frames, and finally as a portfolio from 15 and 5 years. These time frames are useful to consider different investment experiences over different time frames.

### 1.4.4 Trend-Following through 2020

As the market volatility in 2020 caused by the coronavirus and the exceptional market conditions which followed were recent, there was not yet any published research regarding the use of trend-following throughout the year. One would have assumed that the initial large falls in values would allow a trend-following strategy to quickly signal an exit and therefore perform well. But, as the markets also rebounded within a few months, but continued to stay at prices lower than the average of any long durations, this could hinder the trend-following strategies ability to return to equity markets. The study of trend-following over this time was also therefore of interest.

## 1.5 Results and Contributions

### Chapter 2

The results in chapter 2 of this thesis confirmed trend-following results from previous studies that even with the use of a HSBC FTSE 100 unit trust trend-following strategies increased returns, risk-adjusted returns and minimised volatilities and maximum drawdowns over the cumulative 21-year period studied (Faber, 2007; ap Gwilym et al.,2010; Clare et al., 2013; and Hurst et al., 2017). The results found that the majority of moving averages which traded at the end of the month had superior returns, and risk-adjusted returns if the durations were either 150, 200 or over 300-days. Crossovers with durations of and over 100 vs 300-days all had returns and risk adjusted returns which outperformed the buy and hold. Volatilities across all strategies and maximum drawdowns across all but the very shortest strategies greatly improved with the use of trend following. This led to an even larger number

of strategies outperforming when including volatility as part of the risk-adjusted returns in the form of Sharpe ratios.

The search for an optimum strategy did find that the 200-day moving average was able to outperform in terms of improved returns, Sharpe ratios, volatilities, and maximum drawdowns, but only when trading monthly. Also, the 450-day end of month moving average and the 150 v 350-day crossovers had higher returns and Sharpe ratios than the 200-day moving average over the cumulative 21 years.

The addition of UK government bonds when not invested in the FTSE 100 added further returns when compared to the same trend-following strategy which instead traded into cash. There was a slight increase in volatility when compared to strategies which traded into cash, but there was still a similar overall reduction in volatility and maximum drawdowns when using gilts or cash when compared to the buy and hold. Although these results may have been specific to this time, these results warrant further research as a strategy which over this period reduced volatility and maximum drawdowns when compared to the buy and hold but also improved returns and Sharpe ratios when compared to both the strategies which trade into cash and the buy and hold.

The yearly results were not as consistent or as promising for an investor. For brevity's sake only the end of month moving averages were studied over discrete individual 1-to-10-year periods. As each year was much shorter than a whole business cycle, there were many years, especially for longer moving averages, for which the returns and other results for the trend-following strategies were exactly the same as the underlying FTSE 100. The shorter the duration the more likely there were to be underperformances as well as a few out performances. The most consistent durations to have returns which did not underperform were again the longest of 450-days, but even when this duration was used the strategy underperformed for three of the ten years.

The contributions of this chapter were to extend the current trend-following literature regarding the practical use of trend following through investments in unit trusts and was unique for this specific 21-year period. The chapter also found similarly to previous studies that the 200-day moving average trading at the end of the month continued to outperform the buy and hold in terms of improved returns, risk-adjusted returns, volatilities, and maximum drawdowns which is approximately equivalent to the 10 month moving average used by Faber (2007) and ap Gwilym et al. (2010), but also that a 450-day moving average trading at

the end of the month and a 150 v 350 day crossover provided better returns and Sharpe ratios than the 200-day moving average. A unique contribution to trend-following literature from this chapter was the finding that the use of gilts instead of cash in a trend-following strategy when moving from equities was beneficial in terms of the comparative statistics and should be considered for further research. The study of yearly results confirmed Faber (2007)'s assessment that trend-following strategies must be held over whole business cycles to allow the strategy time to outperform and reduce losses. From a practical point of view the main contribution was to act as a proof of concept that trend-following strategies using unit trusts would continue to provide the same benefits as found through earlier studies of improved risk-adjusted returns, volatilities, and maximum drawdowns.

**Chapter 3**

Chapter three found the results for trend-following strategies across international equity markets were not as convincing as those in Chapter 2. Only a few of the markets over the 15 years studied were able to provide returns which outperformed the underlying equity markets when trading into cash. When also reviewing the shorter cumulative 1-to-10-year time periods with only a change in the start date, it became apparent that the timing of the start of a trend-following strategy in relation to the underlying market cycle was a strong factor in the success of the strategy having returns which were able to outperform the underlying equity market. If the trend-following strategy started investing in equities before a market correction, it would react quickly to the correction, exit equity markets quickly and re-enter after the fall in values, therefore outperforming the market as was found in Chapter 2 and in the cumulative years studied in this chapter from 2007 and 2008. Alternatively, as was found in this chapter and in cumulative study of trend following starting in years such as 2009 or 2016, all of which were at the bottom of the market correction, these strategies were typically out of equities at the start of the period reviewed and had a delayed entry into markets with rising values. This delay, based on the length of the duration of the strategy, would cause the trend-following strategy to therefore underperform.

A review of the underlying equity markets themselves, revealed that the international markets for which trend-following strategies were able to outperform had some defining characteristics such as reduced volatilities, large maximum drawdowns, and strong returns. The reduced volatility and strong returns helped to enable a clear trend to form, but when

comparing the strategy to a buy and hold of the underlying equity market, the most important factor was a large drawdown which would give the trend-following strategy the chance to outperform. Otherwise, the highest return the strategy would be able to achieve in an upward market, would be the return on the underlying equity itself instead of any chance to outperform. The fact that these trend-following strategies used unit trusts instead of indices appeared to have no impact on the efficiency of the strategy in terms of returns. The strategies continued to have reduced volatilities and maximum drawdowns which allowed for some improvement in Sharpe ratios.

The use of UK government bonds (gilts) when not invested in the underlying equity market continued to be successful even when paired with international unit trusts. There was some slight added volatility when compared to strategies which instead invested in cash, but this was minor compared to the overall reduction in volatility when compared to the equity markets themselves. The use of gilts increased returns and risk-adjusted returns and continued to deliver large reductions in maximum drawdowns confirming the ability to reduce risk compared to the equity market while still adding some returns compared to the strategies which instead moved to cash.

Finally, there did appear to be different optimum strategies for different international markets. As the markets have different underlying characteristics, the strategies which had the highest returns were also different. Some markets, such as the emerging markets and the Pacific found that strategies which reacted more quickly, had higher returns while markets such as America and Japan, found slower strategies which stayed in the equity markets performed better. Most moderate durations were adept at reducing volatility and maximum drawdowns. There did not appear to be much difference between end of month moving averages and crossovers traded either at the end of the month or daily as both slowed trading down compared to a moving average. The largest factor in the success was the length of moving averages used. For example, the shortest 5- and 10-day moving averages often had negative returns, while for some markets the longer crossovers were too long and mistimed the underlying market movements completely. A one size fits all strategy, such as the 200-day moving average, was not the optimum strategy across each market, but when traded at the end of the month continued to provide reductions in volatility and maximum drawdowns. Slight variations to a medium duration length strategy modified depending on the market appeared to be more beneficial in terms of returns.

The main contributions of this chapter were to further extend the current trend-following literature regarding the practical use of trend following through investments in unit trusts and was unique for this specific 15-year and 1-to-10-year cumulative periods. Unit trusts were found to have similar results as would be expected from indices with the main drivers of returns being either the place in the market cycle at the start of the study or the characteristics of the movements in the underlying market. Another contribution was the unique inclusion of gilts instead of cash into the strategies when out of equity markets. Strategies which included gilts had increased returns and risk-adjusted returns when compared to the strategies which instead invested in cash while also reducing risk similarly to the strategies which used cash and to a much larger degree than when compared to the underlying equity market. The final contribution is the thorough review of differing lengths of trend-following strategies across international markets. Clare *et al.* 2013 reviewed moving averages from 10 to 450 days and crossovers with similar durations for the S&P 500, but in subsequent papers moved to a 10-month moving average (Clare *et al.* 2014, 2016a) as was used by Faber 2007 most likely for simplicity's sake. Through this research the 200-day moving average was found to be sufficient, but it was not the optimum strategy across each market. As markets are able to offer diversification within a portfolio due to their differences, there would be no reason to expect that they would therefore not have different optimum strategies. Although there were some characteristics of successful trend-following strategies across all markets, such as using either an end of month moving average or crossover of trading either daily or monthly, the addition of gilts always improved returns, and choosing a duration of medium length but slightly varied depending on the market.

**Chapter 4**

The results in chapter 4 found that through combining the international equity unit trusts into a portfolio delivered reduced volatility and maximum drawdowns compared to a 100% equity portfolio or 60% equity and 40% cash or gilts (60/40) portfolios. A simple 60/40 buy and hold portfolio was able to reduce volatility and maximum drawdowns but this reduction came at a cost to returns and risk-adjusted returns. The combination of unit trusts with a trend-following overlay allowed for higher returns than the 60/40 portfolios and better risk-adjusted returns than the 100% equity portfolio and the 60/40 portfolios over 15 years with an equally weighted portfolio and over 5 years with both an equally weighted and UK-based asset allocations. Creating a portfolio of unit trusts invested in different international

markets with a trend-following overlay did not have returns which outperformed the buy and hold equity strategy over this time period but did deliver better than equity-like risk-adjusted returns with better than 60/40 cash or gilt portfolio volatilities and maximum drawdowns.

The addition of gilts to the trend-following portfolios over 15 and 5 years provided extra returns allowing the trend-following portfolio strategies to have the highest risk-adjusted returns measured by Sharpe and Sortino ratios, and better maximum drawdowns than the 100% equity and both 60/40 portfolios. There was a slight increase in volatilities when adding gilts to the trend-following portfolios, but again this was more than made up for by the increased return as the Sharpe and Sortino ratios were highest for the strategies which used gilts than the strategies which used cash or any of the buy and hold 100% equity or 60/40 portfolios.

Finally, the trend-following portfolios were not able to perform well over the market disruption caused by the coronavirus in 2020. This was due to a few factors. The first was the short one-year time frame. Previous research in Chapter 2 showed that trend-following often did not outperform over short one-year periods. Trend-following strategies need whole business cycles to be able to provide returns which outperform (Faber, 2007). Secondly, the market movements within the year were so sudden and sharp that although the 200-day moving average was able to time the market exit, it was unable to time the re-entry into the market. The 50/150-day crossover mistimed both the exit and the re-entry due to the length of the durations used and because the strategies only traded monthly.

The specific contributions of this chapter were the extension of trend-following strategies using unit trusts in creating portfolios. The volatilities, maximum drawdowns, and risk-adjusted returns in the form of the Sharpe and Sortino ratios were much higher when the strategies were combined within a portfolio than they were across most of the individual markets and when compared to the underlying 100% equity buy and hold. This displayed not only the effects of diversification, but that trend-following portfolio can provide further risk-reduction benefits than diversification alone. Not many, if any, studies have completed a direct comparison to 60/40 portfolios as trend-following strategies are usually compared to other types of strategies or a buy and hold portfolio. Although obviously there is still a risk of a sudden fall, it was a testament to the degree to which a trend-following strategy portfolio, even through the use of retail unit trust investments, could reduce risk that their Sharpe and Sortino ratios are on par with a portfolio that had a 40% allocation to a much less risky asset.

A further contribution was that the use of gilts as the alternative asset continued to provide further returns when included as part of a trend-following portfolio while continuing to minimise volatility and maximum drawdowns. This suggests the possibility of further research into other types of alternative assets such as money market funds, investment grade bonds, or gold. The final contribution was the study of trend-following over the sudden correction and recovery in 2020. Due to the nature of the market falls due to lockdowns and the rapid rebounds due to significant government intervention, the movements were difficult to time. It could be that given the nature of the announcements, the information was also absorbed quickly making the markets more efficient than they normally would have been. This could lead to further research into the re-entry of markets either through the use of different signals to exit and re-enter markets, volatility signals, or another type of dynamic trend-following strategy to identify turning points such as one discussed by Garg, Goulding, Harvey and Mazzoleni (2020).

### 1.6 Organisation of the Remainder of the Thesis

As the review of the existing literature around trend following was examined within this chapter, chapters 2 and 3 move straight into an empirical study of the impact of trend-following on unit trusts for the FTSE 100 and other international markets respectively. A separate review of the relevant literature regarding portfolio construction and diversification was completed for chapter 4. A summary of what was considered in each chapter is as follows:

Chapter 2 reviewed the use of trend-following using the HSBC FTSE 100 unit trust with different trend-following strategies such as daily v monthly trading, 12 different durations of moving averages and 23 different crossover combinations, trading into either gilts or cash as the alternative investment when not invested in equities, and using two different timing versions over 21 years to determine the impact of trend following on unit trusts in terms of returns, risk-adjusted returns, volatilities and maximum drawdowns as compared to the buy and hold of the FTSE 100 index. The review of yearly results for moving averages traded at the end of the month was also completed over 1- 10 years to determine the experience for an investor investing in the HSBC FTSE 100 unit trust using trend following.

Chapter 3 considered the impact of trend following on 7 different international equity unit trust indexes for the FTSE 100, FTSE 250, America, Japan, Europe, Pacific, and the emerging markets over 15 years. In an effort to find an optimum strategy overall or for each of the individual markets, the same strategies were tested for each market as were reviewed in Chapter 2. The results were reviewed by duration and strategy for their impact on returns, volatility, maximum drawdown, and Sharpe ratios as well as their connection to the underlying equity market.

Chapter 4 combined the 7 international unit trust indexes into trend-following portfolio trading into both cash and gilts to review the portfolios returns, risk-adjusted returns, volatility and maximum drawdowns compared to a 100% equity benchmark portfolio and a 60% equity and 40% cash or gilts portfolio over 15 years with an equally weighted asset allocation and over 5 years with both an equally weighted and UK focused asset allocation. As an important extension of this work, the period over 2020 and the coronavirus crisis was also studied to investigate how the trend-following portfolios performed through a one-year crisis that was out of sample and current.

# 2 Trend Following Utilising a FTSE 100 Unit Trust

## 2.1 Introduction

Previous research found that trend-following strategies were able to improve risk-adjusted returns while reducing volatilities and maximum drawdowns when compared to a portfolio of the same assets bought and held for long periods of time (a buy and hold portfolio). Much of this research centred more theoretically around indexes (Faber, 2007; ap Gwilym *et al.*, 2010; Clare *et al.*, 2013; and Hurst *et al.*, 2017). The aim of this thesis was to review the use of unit trusts as a part of a trend-following strategy to ensure that these previous findings were valid given that unit trusts only trade once a day and have a large variation in investor type. This could cause unit trusts to both complete trades more slowly and incorporate news at a different speed than would be apparent in an index, potentially impacting the ability of a trend-following strategy to time decisions. As the purpose of this thesis was of a more practical nature, it did not compare unit trust results with the indexes themselves. Instead, it aimed to discover if the mechanics of unit trusts were such that trend following for a retail investor using unit trusts was able to provide the same benefits that trend following provided through the study of indexes.

The objectives therefore for this chapter were three-fold. The first was to confirm that trend-following with a unit trust would provide favourable risk-adjusted returns and minimise volatility and maximum drawdowns when compared to a portfolio which bought the FTSE 100 unit trust and did not trade throughout the periods reviewed (the buy and hold). As this thesis investigated trade strategies for an investor based in the UK, the FTSE 100 was selected as a proof of concept for unit trusts. The second objective was to complete a thorough review of trend-following strategies to discover if there was an optimum strategy or strategies which would best provide returns and protection from loss over the maximum dataset available for the selected unit trust but also over discrete one-year time frames. The last objective was to examine if the use of a UK government bond fund when signalled to be out of equities would be able to provide further returns than moving the position to cash or if it would contribute to further losses and what impact this

would have on Sharpe ratios, volatilities and maximum drawdowns. Overall, this chapter aimed to identify a simple trend-following solution which could be explained and utilised easily by a retail investor or an advisor considering the practicalities of unit trusts.

Therefore, the research questions addressed in this chapter are:

- Is it possible to create a simple trend-following strategy using the HSBC FTSE 100 unit trust that provides superior risk-adjusted returns, volatilities, and maximum drawdowns compared to buying and holding the same unit trust over a period of 21 years?
- Is there an optimum trend-following strategy or range of strategies which outperforms when studying: 12 moving averages and 23 crossover combinations with moving average duration lengths of 5 to 450 days, trading daily or at the end of the month?
- Would the addition of UK government bonds as the alternative asset when not invested in equities provide any further benefits or hinder the strategy's returns, volatilities, and maximum drawdowns?
- Are the results from these strategies consistent over much shorter, one-year time periods?

The rest of this chapter is divided into three sections: 2.2 methodology, 2.3 the results of the varying trend-following strategies on returns, risk-adjusted returns, volatility, and maximum drawdown for the FTSE 100 over 21 years and on a yearly basis, and 2.4 summary and conclusion.

## 2.2 Methodology

Following the method of Faber (2007) and Clare *et al.* (2013, 2016a), this thesis studied trend-following strategies using moving averages (MA) and crossovers (XO), but instead of using non-tradeable indices, a unit trust was utilised as a tradeable strategy. The MA or XO strategies' decision to invest into either the equity fund or alternatively into cash or gilts was a binary one. This decision was solely based on the performance of the equity index. Although the alternative investment had a direct impact on the success of the strategy, it was not considered for decision making.

The equity unit trust used was the HSBC FTSE 100 index. As this thesis was concerned with the practical implications of trend-following for an investor within the UK, the FTSE 100 was selected for review in the first instance as a test for trend-following utilising unit trusts. The HSBC unit trust was chosen as it had the longest history of all the clean-share class, passive unit trusts for the FTSE 100. When gilts were the alternative, the UK government bond fund used was the Legal & General All Stocks Gilt Index unit trust. When cash was used as the alternative, it was not invested in a cash proxy like Faber (2007) and Clare *et al.* (2013, 2016a) who invested in US Treasury bills. The cash therefore did not accrue any interest or fees and remained at the same amount as when the equity was sold.

All prices were sourced from Datastream from Oct 1994 to Oct 2017. After an initialisation period of 450 days (the longest moving average duration), the maximum number of full years which were available was 21 years.[1] The UK Treasury Bill 3-month tender was used for the risk-free rate needed for the Sharpe ratio.

The MA and XO rules were as follows:

1. MA rule: If the current price ($P_t$) was higher than the average price for the previous 'n' days ($MA_{t:t-n}$), buy equities. Otherwise, sell equities for cash/gilts.

$$P_t > MA_{t:t-n} \quad (1)$$

2. XO rule: If the shorter MA ($MA1_{t-n1}$) was higher than the longer MA ($MA2_{t:t-n2}$), buy equities. Otherwise, sell equities and hold cash/gilts.

$$MA1_{t-n1} > MA2_{t:t-n2} \quad (2)$$

Moving averages and crossovers are similar in technique as crossovers compare two different moving averages against each other, but they also behave differently. Some articles refer to moving averages as crossovers with a 1 day vs. 'x' days moving average. The moving average rule for this thesis compared a single day's price to a long run average of the previous 'n' days – 5 days equates to a week,

[1] Different share classes of each fund are issued based on minimum investment and other factors. The class used for this thesis is the clean share class with lower fees as would likely be used when investing through a pension or investment fund on a wrap platform.

20 days to about a month, and 200 days to about 10 months. A moving average is a trend line of prices that have been smoothed over time to limit the effect of any small changes or outliers. If today's price has gone over or under the moving average, a trade instruction is signalled. The longer the duration of the moving average, the steadier the trend line will be, and the slower it will be to change direction. An especially long duration moving average such as 450 days equates to the average of around 2 years' worth of prices. Any single day's price change would have very little impact when averaged with 449 other days. For moving averages, one half of the equation is smoothed while the current price is reactive. Any large change in the current price would immediately trigger a trade. Therefore, simple moving average trading allows for the identification of a trade signal to happen quickly when the price moves over the trend line, but could also lead to an increase in trading, increasing transaction costs, the chance of whipsawing and even a reduction in return.

A simple moving average will react to a change in prices faster than a crossover as a crossover is two smoothed moving averages over differing durations compared against each other, or two differing smoothed trend lines. A 5-day vs 10-day crossover compares the average price for a week to that of two weeks. A 150-day vs 350-day crossover compares about 7.5 months to about a year and a half. A change in prices will therefore take longer to impact the shorter of the two moving averages of a crossover than it would take to impact the shorter of the two comparisons for a simple moving average, the single day's price. This delay in responsiveness in the shorter moving average of the crossover requires a change in price over several days to create a signal, therefore a crossover will be slower to react than a moving average and slower to recognise when a trend has developed but might be better at recognising a trend and much less likely to whipsaw with fewer transaction.

As unit trusts are only created and redeemed once a day, the process of moving from one asset to another requires a two-day transaction period after the decision has been made. Moving to or from cash can be completed in one transaction on one day. In order for the longer transaction time to be mimicked when using cash and also to allow for a more protective approach, there were two different versions of the trades studied: one more reactive version which traded as soon as possible and

one more conservative version which when trading daily or to cash took two days to complete.

The first day in either version was the day that a change in assets was instructed, Day 1. The first version traded into cash on the day following the instruction, Day 2, with no further action. If the first version traded into gilts, the second asset was purchased on Day 3 as soon as the cash amount available from the sale on Day 2 was confirmed. If the signal changes on Day 2 after the sale and suggested that the strategy invested back into the original holding, the first version bought on Day 3 whatever was recommended on Day 2 even if it was to return back into the same investment just sold on Day 2.

The second version when trading into cash sold immediately on Day 2, but when repurchasing equities waited for two consecutive days with the same buy signal before the purchase was completed. This was originally to mimic the extra day for the sale of the gilt fund (on Day 2) before the purchase of equities on Day 3, but also acted to protect against whipsawing by staying in the less risky asset until the same buy decision was confirmed for two days in a row. It therefore could have taken longer than two days, if necessary, for the purchase of equities to occur. The second version was more conservative and reduced the amount of whipsawing but was also slightly less responsive to fundamental changes in direction.

This study examined 12 different MA durations ranging from 5 to 450 days and 23 different XO duration pairs ranging from the shortest pair of a 5-day moving average compared to a 10-day moving average to the longest crossover which compared a 250-day moving average to a 450-day moving average. This range of moving averages was almost identical to the range studied by Clare *et al.* (2013) who studied 10 to 450 days with only the addition of the 5-day duration. Inherent in the fact that crossovers are two different moving averages compared against each other, there were many more crossover possibilities than there were moving averages. This lead to almost twice as many crossover durations to be considered than moving averages. Every MA and XO combination was run on a cumulative basis over 21 years and on a yearly basis over 1-10 years discretely until September 2017.

To summarise the various strategies tested, besides the length of the duration of the moving averages chosen, the following characteristics of each strategy were

also compared. While the first two have been discussed by many papers in the past, the last two were believed to be new. The third between the use of cash or UK government bonds (gilts) was a new comparison which had not been reviewed before and the final was for further clarification to examine if a more cautious approach would make a difference to the results.

- Simple moving averages versus crossovers
- Daily trading versus end of month trading
- Using cash or gilts as the alternative investment
- Version 1 versus Version 2 for reinvestment

### 2.2.1 Comparator Statistics

The main comparative statistics used to judge the success of each strategy are annualised return, annualised volatility, annualised Sharpe ratio, and maximum drawdown.

**Returns**

Simple returns and annualised returns allow an investor to see what percentage change their historical, ex post, investment would have been returned given the start and end values or prices over the time period selected. It is one of the most important statistics an investor can use to evaluate one investment proposition with another strategy or a benchmark as it is used to ensure that an investment performed as expected and essentially equates to an investors "bottom line".

Daily and overall returns are both calculated using the equation:

$$Return = \frac{(End\ price - Beginning\ price)}{Beginning\ Price}$$

To create an annualised return from the overall return, the following calculation is used:

$$Annualised\ Return = (1 + Return)^{\left(\frac{1}{N}\right)} - 1$$

Where

- N = number of periods over which the original return is calculated.

**Volatility**

The issue with using returns or annualised returns in isolation as a performance evaluation method is that it leaves out the important issue of risk measured in terms of volatility associated with that investment. An investment opportunity with a high return may be appealing but is typically accompanied by higher levels of risk. Without taking into consideration the volatility involved in an investment, the investment with the highest returns would also appear to be favourable regardless of the investors' appetite for risk. Returns alone only explain part of the story. In order to accurately compare investments, volatility is also required.

The standard deviation is the dispersion of returns from the mean. The equation is the square root of the sum of squared differences from the mean divided by the number of samples in the time period.

$$\sigma_x = \sqrt{\frac{\sum(x_i - x_{avg})^2}{N}}$$

Where

- $x_i$ is each individual return
- $x_{avg}$ is the average of the returns
- $N$ is the size of the dataset

From this the annualised volatility is calculated by multiplying the standard deviation by the square root of the frequency of data per year. For example, for daily data the value for T = 252, weekly data T = 52, and monthly data T = 12.

$$Annualised\ Volatility = \sigma_i * \sqrt{T}$$

Where

- $T$ is the frequency of the data per year.

**Sharpe Ratio**

The Sharpe ratio combines both return and volatility to create a measure of risk-adjusted return. This takes into consideration the excess return earned by a strategy above the return from a risk-free investment given the amount of volatility of the investment. A high Sharpe ratio equates to a high return given the amount of risk or volatility in the underlying asset. The Sharpe ratio is important to exhibit the risk-return trade-off to balance the past returns of an investment to its level of risk and is therefore an important measure for risk averse investors.

Sharpe (1966) originally created the widely used performance analytic to eb called the reward-to-variability ratio, now known as the Sharpe ratio. He further clarified the Sharpe ratio in 1994 differentiating between ex-post historical versions and ex-ante version for expected results. The Sharpe ratio used within this thesis is based on data ex-post to measure "the historic average differential return per unit of historic variability of the differential return" (Sharpe 1994).

The differential of the return of the investment can be subtracted from the return of a benchmark for comparison or here, the risk-free rate over time which was the UK Treasury Bill 3-month tender.

$$D_t = R_t - R_{Rft}$$

Where:

- $D_t$ = the differential of the investment return from the risk-free return at time t
- $R_{It}$ = Return of the investment at time t
- $R_{Rft}$ = Return of the risk-free asset over time

The average of the returns of the differentials ($\underline{D}$) for the sample period T:

$$\underline{D} = \frac{1}{T} \sum_{t=1}^{T} D_t$$

The standard deviation of the differentials of the returns is calculated as:

$$\sigma_D = \sqrt{\frac{\sum_{t=1}^{T}(D_t - \underline{D})^2}{T-1}}$$

Although both Sharpe (1994) and Dowd (2000) stated the importance of using the different return in both the average calculation and in the standard deviation calculations, most recent research appears to instead have used the standard deviation from the investment's return instead of the differential. Lillelien (2013) and Lo (2002), as well as several asset management textbooks for example, Maginn, Tuttle, McLeavey, & Pinto (2007) and Brown & Reilly (2009) used this more simplified version instead:

$$Sharpe\ Ratio = \frac{\underline{R_i} - \underline{R_f}}{\sigma_i}$$

Where:

- $\underline{R_i}$ = the average of the individual investment returns
- $\underline{R_f}$ = the average return of the risk-free rate
- $\sigma_i$ = the standard deviation of the investment as calculated above

Clare et al (2013) appeared to use the annualised excess return over the annualised standard deviation of the return though they do not specify the equation in their research.

To annualise the Sharpe ratio, it was multiplied by the square root of 252 due to the use of daily data.

$$Annualised\ Sharpe\ Ratio_{historic} = Sharpe\ Ratio * \sqrt{252}$$

**Maximum Drawdown**

Maximum Drawdown calculates the difference between the greatest peak to the next lowest trough over time, reflecting the maximum amount of loss an investor

would have experienced. A reduction in maximum drawdown would benefit any investor as it would signal a steadier, less-volatile investment with a reduction in potential loss. It is especially important to someone who regularly sells portions of their investment or pension for income and would therefore be forced to realise losses due to selling at a reduced price, further decreasing their investment base. Clare *et al.* (2017, 2021) found that although there was not a mathematical link between maximum drawdown and sequence risk, that the two were empirically related. A large maximum drawdown could therefore lead to a higher level of sequence risk. Therefore, it would be useful to compare the potential decrease or increase in maximum drawdowns when using a trend-following strategy as a method for also reducing sequence risk.

Maximum Drawdown: $$Min_{1:d}\left(\frac{NAV_t}{MAX(NAV_{1:t})} - 1\right)$$

Where:

- d = total number of days

## 2.3 Results

As there were so many variations to choose from, the results differ widely depending on which specific parameters and strategy were chosen. In an attempt to locate an optimum strategy, the parameters which had the most impact on the results was the duration, the number of days for which the moving average or crossover was calculated. The shortest durations had very different results to the longest durations. However, it was not only the results of specific durations which could be of interest, but also the breadth of the 'successfulness' across durations for each strategy. For example, if there was only one successful duration for a strategy, it could be due to luck ex-ante in choosing the correct combination or potentially data-mining ex-post. However, if several durations across a strategy appeared to be equally successful, then there was more confidence in the ability of the strategy as a whole to provide consistent results.

### 2.3.1 Cumulative Results

In order to see the overall effect of trend-following, the results needed to be reviewed over the longest time period available. Faber (2007) found that the benefit of trend following was apparent over whole business cycles due to its ability to exit the market when there was a sustained downturn. As business cycles last for many years, the best way to test trend following would be to look at the annualised return, annualised volatility, Sharpe ratio and maximum drawdown over the maximum number of years. For the HSBC FTSE 100 unit trust, the maximum amount of data available after the 450-day initiation period was 21 full years.

#### 2.3.1.1 Annualised Returns

The returns for each of the different strategies and durations on a cumulative basis for 21 years were shown in Table 2.1. Every trend following strategy, except for the two daily moving average strategies which traded into cash, had several durations which had a return higher than the 5.80% return of the buy and hold. Three of the daily moving average durations to gilts outperformed the buy and hold. Exactly half, 6, of the end of month moving averages into cash outperformed, and the majority of the end of month moving averages to gilts and all crossovers to either cash or gilts outperformed the buy and hold. Overall, of the durations and strategies 56% outperformed the buy and hold and 44% underperformed. The highest overall return for any strategy and duration combination was the version 1, 50/150 daily crossover to gilts which yielded an annual return of 8.77% over the 21-year period.

**Moving Averages vs. Crossovers**: When trading daily over 21 years to cash, none of the moving averages outperformed the buy and hold annualised return and only 31% of all the moving averages outperformed the buy and hold. Trading at the end of month and trading into gilts increased the number of moving average strategies which outperformed. Most of the end of month moving averages with durations over 150 days outperformed with both longer durations and end of month trading slowing down a moving average strategies' responsiveness and substantially reducing the number of transactions as shown in Table 2.2, while still increasing their returns. The exception to this was daily moving averages with the three longest durations underperforming the buy and hold and more moderate length durations.

Apparently on a daily moving average basis, the longest durations missed the trend with both reduced transactions numbers but also reduced returns.

Crossovers had a much higher percentage of durations, 69%, which outperformed. Although it was not possible to compare moving averages directly to crossovers, they were similar as end of month moving averages and all crossovers had medium to longer durations which outperformed. Daily crossover returns were generally higher than the returns for daily moving averages of similar durations and strategies. This may also have had to do with the fact that daily crossovers slowed down trading compared to daily moving averages therefore waiting for more of a trend to appear before acting. Daily crossovers again had dramatically reduced transaction numbers when compared to daily moving averages. When trading at the end of the month, the differences between moving averages and crossovers in returns and transaction numbers were less pronounced. End of month crossovers continued to have less transactions than end of month moving averages, but the transaction numbers and the returns between the two were similar. Both crossovers and end of month moving averages appeared to be superior in both number of outperformances and in actual returns.

**Daily vs. End of month trading**: When comparing similar daily strategies to end of month strategies, i.e., daily moving averages to cash version 1 to end of month moving averages to cash version 1, trading at the end of the month had a higher number of durations which outperformed than trading daily. Overall, end of month trading outperformed over 64% of the strategies and durations while daily trading only outperformed over 50% of the strategies and durations. For moving averages, trading at the end of the month for both cash and gilts instead of daily always had a higher number of outperformances and always provided a higher return.

For crossovers, trading at the end of the month had a higher number of durations which outperformed, but when comparing similar strategies, the end of the month version did not always have a higher amount of return. When trading into cash, there were an equal number of outperformances and underperformances for daily and end of month trading. The number of durations which outperformed for gilts was slightly higher for end of month trading than daily trading. But, when

looking at actual returns, trading at the end of the month was not as obviously beneficial to crossovers as it was to moving averages. In fact, the highest return over all crossovers was a daily crossover into gilts, 50/150. For cash crossovers, the highest return was an end of month crossover, 150/350.

Crossovers seemed to delay trading enough to mitigate any influence of a change from daily to end of month trading. This was evidenced by the fact that the difference between daily and end of month transaction numbers for crossovers, after the shortest duration combinations, was minimal with most of the medium to longer term durations having an almost equal number of transactions and similar returns. The difference in the number of transactions and returns between daily and end of month trading for moving averages was significant throughout all durations.

While trading at the end of the month appeared to have a clear advantage for moving averages, it seemed to have only a slight advantage for crossovers in the number of outperformances but was similarly effective to daily trading in actual returns.

**Cash vs. Gilts**: Trading into gilts instead of to cash had a significantly higher number of durations which outperformed whether trading daily, at the end of month, or using a moving average or crossover. In total, using gilts outperformed 70% of the time while moving to cash only outperformed 46% of the time. This was even higher when trading at the end of month. Also, almost every crossover, besides the shortest duration combinations, outperformed the buy and hold when using gilts as the alternative investment. Using gilts instead of cash also always provided a higher return.

Quantitative easing and government corporate bond buying programmes have buoyed bond markets over the past few years. With this artificial government support, bond prices including UK gilt prices have moved similarly upwards with equity markets. Using gilts as the alternative investment instead of cash with quantitative easing allowed for bond investments to provide a return regardless of equity movements and at times a higher return than the upward equity returns otherwise available. This gave every gilt strategy and duration an extra boost.

The high number of transactions when trading into gilts did not represent whipsawing or a high number of trade decisions. Trading into or out of gilts when selling equities required two transactions for every decision, one to sell/buy equities and the other to buy/sell gilts. For a cash strategy, the number of transactions represented the number of trade decisions. For gilt strategies, this number would be expected to be twice the number of the equivalent transactions for the equivalent cash strategy, as it was for end of month trades. For daily trading, the gilt strategies had less than double the number of trades when compared to the equivalent cash strategies. This was because buying and selling gilts added an extra day to each equity trade decision. When trading into and out of cash, the decision to move in and out of equities happened daily. When trading into and out of gilts, the decision to move in or out of equities was then followed with an extra day to sell / purchase gilts (or potentially equities back). As the gilt versions of the strategies already had superior percentages of performance and higher returns, it is difficult to say if this reduction in transaction numbers helped the gilt strategies or if it was just the unusually high gilt returns. Either way, for this period, the gilt strategies in all variations were superior.

Although gilts provided extra returns over this period due to the support from quantitative easing, this may not be the case going forward. More research would be required to see if strategies using gilts as the alternative asset could continue to outperform the buy and hold under normal market conditions.

**Version 1 vs Version 2**: The extra day or two difference between version 1 and version 2, did not appear to have made a substantial difference to the returns. At times the first version, with a quicker response, outperformed the second with a more cautious approach and vice versa. The number of times each version outperformed was the same regardless of strategy or duration. The difference between the two versions was not enough to impact the outperformance of the strategy versus the buy and hold or against each other.

**Duration**: The shortest moving average durations of 5 – 25 days and the crossover combinations of 5-day v 10-day (5/10) moving averages and 10-day v 20-day (10/20) moving averages not only did not outperform but for daily trading had negative annualised returns. This shows the danger of excessive whipsawing when

using the durations which are too short. The medium moving average durations of 150, 200 and 300 outperformed compared to the buy and hold except for when trading daily into cash. Almost all the end of month durations over 150 days (100 days for the gilt strategies) outperformed except for a 250-day moving average. For cash strategies trading at the end of month, the longest duration was the best with a 7.55% annualised return for the 450-day moving average. For strategies trading into gilts on a daily and end of month basis, the best returns were for a 150-day duration. The highest return for all moving averages was the 150-day end of month moving average trading into gilts with an 8.22% annualised return.

For crossovers, all strategies which traded either daily or at the end of month over 100/300 days outperformed. This time the longest crossover for a cash strategy did not have the highest return on a daily or monthly basis. Instead the 150/350 had the highest returns with a 6.95% return when trading daily and a 7.69% return when trading monthly for version 1. Almost all gilt crossovers from 25/100 days trading daily or 25/50 trading at the end of month outperformed except for a 5/200 crossover trading daily. For data in this period, the best performing crossover was a 150/350 with all versions outperforming the buy and hold and it also had the best returns for strategies trading into cash daily and for strategies trading monthly into both cash and gilts. The highest return overall crossovers and moving averages was the 50/150 crossover trading daily into gilts.

The simple 200-day moving average strategy which moves into cash was the most frequent trend following strategy used in prior studies such as Ellis and Parbery, (2005) who considered it the "common standard of comparison", Mills (1997) who stated it as "the most popular MA rule", and Clare *et al.* (2013) to name just a few. In this study, the 200-day moving average to cash did not outperform daily, but it did when trading at the end of the month where it had the second highest return for cash trading of 6.93%. The 5/200-day crossover would appear to be remarkably similar to a 200-day moving average as it is only the first part of the equation comparing either today's price or the previous week's price to the average of 200 days. Yet, the results are quite different. The 5/200-day crossover did not outperform at all when trading into cash on a daily or end of month basis and was one of the few crossover strategies which did not outperform when trading into gilts daily.

The results supported the use of a moving average duration of 150, 200 or 300-days when trading daily into gilts or when trading into cash or gilts at the end of the month, as well as strategies which traded at the end of month with durations from 300-450 days, or crossovers with durations over 100/300 days. The breadth of crossovers and moving averages which outperformed at these durations gives a higher level of confidence that they could outperform in the future. Also, as there were so many of similar durations which outperformed, there was some leeway to have selected a duration which may not have been most optimum but would still be preferable to the benchmark buy and hold of the FTSE 100. It was also very clear that short durations were especially unprofitable. There was therefore an equal, if not more so, level of confidence in the choice not to select short durations for use.

#### 2.3.1.2 Volatility

The annualised volatility of the end of day values over 21 years, as shown in Table 2.3, was greatly reduced by all trend following strategies. Interestingly, the strategies with the lowest volatilities were the ones with the lowest returns (Table 2.1) and tended to trade most frequently (Table 2.2). Trading using moving averages, trading into cash when out of equities, trading daily and using the shortest durations all had the lowest volatilities. Trading infrequently with longer durations using crossovers and trading into gilts while only trading at the end of the month all had higher volatilities, but also higher returns, less trade decisions and still had less volatility than the buy-and-hold.

The lowest annualised volatility on Table 2.3 was the shortest duration tested, the 5-day moving average, version 2, trading into cash. When trading into cash, the money was just set aside so there is no volatility at all when invested in the alternative cash investment. The highest volatility, except for the buy-and-hold, was the longest duration combination tested and the slowest to react, the 250/450-day crossover trading into gilts. To visually compare the volatility of these two strategies, as well as the buy-and-hold of equity and gilts, the daily returns over 21 years are shown in Graph 2.1. It was easy to see when looking at daily returns that the highest volatilities in order were the FTSE100, the 250/450 crossover, the 5-day

moving average, gilts and then of course cash which was not shown on the graph as there was no return.

Graph 2.2 shows the cumulative 21-year returns for all four strategies. The 5-day MA tended to whipsaw, as it continually traded in and out of equities to the detriment of the overall return. While the strategy with the highest volatility, the 250/450 XO, tended to move similarly to the buy-and-hold, it still managed to come out of sustained downward equity movements allowing for more return than the buy-and-hold and less volatility.

A reduction in volatility is associated with a reduction in risk, but volatility measures are only part of the investment picture. In this instance, the strategies which were tested with the lowest volatilities also had the shortest durations and negative returns. Investing in a short duration strategy, like the 5-day MA, appeared to be safer than investing in a more moderate trend following duration, but it was much less profitable. It would have been better to invest in either gilts with lower volatility or cash with no volatility than in the 5-day MA.

One exception to the lower volatility, lower return theme seen in most of the other strategies was the 150-day MA which has the lowest volatility for the end of the month moving average version 1 strategy trading to cash. The 150-day MA also had a moderate number of transactions and outperformed the buy-and-hold in annualised return, and the 250/450 end of month crossover trading into gilts discussed above.

With all the trend-following strategies' volatilities around 10-14% and the FTSE 100 fund volatility of 18.5%, it was clear that using a trend-following strategy with unit trusts continued to reduce volatility by approximately a third compared to the buy-and-hold. Many moderate to long durations also outperformed the buy-and-hold returns showing that the reduction in risk did not have to be at the expense of return.

#### 2.3.1.3 Sharpe Ratio

The Sharpe ratio was calculated from a combination of the strategies' excess return (the strategy's return over the return available from the risk-free rate which in

this case was the daily return of the 3-month UK Treasury Bill) and the strategies' standard deviation to create a risk-adjusted return. Unsurprisingly, the results for the Sharpe Ratio in Table 2.4 were similar to the annualised returns listed in Table 2.1. Because the Sharpe ratio takes volatility into consideration and the volatilities for all the strategies were lower than the buy and hold, there was a much higher percentage, 68%, of Sharpe ratios which outperformed the buy and hold compared to the 56% which outperformed for annualised returns. There was an increase in the number of Sharpe ratios which outperformed for every type of strategy, with all the strategies except moving averages outperforming the majority, 62-80%, of the time.

The same strategies which had the highest returns also had the highest Sharpe ratios for each strategy. The highest return overall, the 50/150 daily crossover trading into gilts version 1 had the highest annualised return of 8.81% and the highest Sharpe ratio of 52.54%. The highest strategy trading into cash was the 150/350 end of month crossover version 1 with a return of 7.69% and a Sharpe ratio of 42.19%. The highest moving average was the end of month 150-day moving average trading into gilts with a Sharpe ratio of 48.49% and a return of 8.22%.

Again, gilts always outperformed cash. Longer durations outperformed for any end of month moving average over 150-days and crossovers with the first moving average over 50-days increasing the number of outperformances compared to annualised returns. There were also more Sharpe ratios for daily moving averages that outperformed for than annualised returns, but they were again centred around the 150, 200, 300 and 400-day durations. For moving averages, daily trading had lower Sharpe ratios than their end of month versions. For crossovers, the difference between daily and end of month trading was not as clear. Some crossover durations had higher Sharpe ratios for daily trading than end of month trading and vice versa. There were more crossovers which outperformed than moving averages with usually higher Sharpe ratios for crossovers. The two different versions tended to be similar with neither outperforming the other consistently.

Interestingly, there were also more durations which had negative Sharpe ratios than there were that had negative returns. This only occurred in the shortest durations because they had returns which were lower than the return's available from

investing in the risk-free rate. It would have been better to invest in gilts or the 3-month UK T-Bill than to invest in these short duration trend following strategies.

The Sharpe ratio shows the amount of risk which is undertaken to achieve a return. Typically end of month trading, crossovers and trading into gilts all performed better, but the other strategies also had a high percentage of outperformances when volatility was considered. More than half of the strategies' durations' Sharpe ratios outperformed the buy and hold Sharpe ratio of 0.260153.

#### 2.3.1.4 Maximum Drawdowns

Almost all the strategies and durations had a smaller maximum drawdown than the -50.4% drawdown of the buy and hold of the HSBC FTSE 100 with many of the medium to longer term durations having less than half of that, as shown on Table 2.5. The strategy with the smallest maximum drawdown was the 50/150 crossover trading daily and into gilts, version 1 which also had the highest annualised return and Sharpe ratio. The smallest maximum drawdowns for strategies which traded into cash were the 50/150 daily crossover version 2, closely followed by the end of month 300-day moving average version 1.

For moving averages, trading at the end of the month had smaller maximum drawdowns than trading daily for every duration and all of the moving averages which traded at the end of month had better drawdowns than the buy and hold. For crossovers, end of month trading had slightly smaller maximum drawdowns when either both moving averages or even just the first moving average contained a shorter duration making the crossover similar to a simple moving average. Daily trading was slightly better for crossovers with medium durations, but most medium to long term durations had remarkably similar drawdowns and almost all the daily crossovers over 100/250 and end of month crossovers from 150/300 had the same maximum drawdown of -22.85%. There was also not much of a clear pattern of improvement in maximum drawdowns when comparing between cash and gilts, version 1 and version 2, or even between crossovers and moving averages.

For all except the shortest durations, maximum drawdowns were considerably reduced when using a trend following strategy. Only a few had smaller

maximum drawdowns than the -18.93% for the L&G All Stocks Gilt index over the 21 years, but most were close - and most of the trend-following strategies had much more gilt-like maximum drawdowns than equity maximum drawdowns as suggested by Faber (2007). In fact, the much used 200-day moving average trading at the end of the month into cash had one of the top 10 smallest maximum drawdowns of only -21.04%. The reduction in maximum drawdowns could be one of the most important aspects of a trend-following strategy for some types of investors such as those taking into from their investments and concerned about sequence risk. For those selling their investments to receive an income, any reduction in the underlying value of their investment portfolio would require more of the investment to be sold to create the same amount of income. This would have a lasting impact on the overall investment amount and the length of time that the investment would last.

#### 2.3.1.5 Cumulative Results Conclusion

Over 21 years from 1996 to 2017, the trend following approach allowed for not only higher returns, but also higher Sharpe ratios, lower volatilities, and smaller maximum drawdowns. When looking at returns and Sharpe ratios, many of the moving averages which had medium to long term durations and traded at the end of month as well as crossovers which traded both daily or monthly outperformed the buy and hold. Trend following was even more successful at reducing risk as every strategy had a lower volatility than the equity buy and hold benchmark and almost all of the strategies and durations had smaller maximum drawdowns than the equity buy and hold.

### 2.3.2 Yearly Results

While looking at the cumulative results over 21 years shows the ability of trend-following strategies to reduce drawdowns and volatility while often also increasing Sharpe ratios and returns, it was also important to see how trend-following strategies compared to the buy and hold on a yearly basis. Most investors receive statements quarterly and would therefore like to see these benefits throughout their investment. It is also important to note that for a market trending

upward, many of the trend-following strategies with longer durations would hold the FTSE 100 index for the duration of the period and therefore have the same results as the buy and hold as it would have been invested in the market for the whole year.

As there are too many results to review over 10 years for each of the different durations and strategies, only the results from the moving averages trading at the end of month version 1 and trading into either cash or gilts were detailed further. These were chosen as they performed well on a cumulative basis, are more concise than the crossovers and the 200-day moving average is often the trend-following strategy used by practitioners and academics.

#### 2.3.2.1 Returns

The best moving averages which traded to cash over 21 years were the 450 and 200-day moving averages with cumulative returns of 7.55% and 6.93% respectively. When looking at the returns on a yearly basis as shown in Table 2.6, the returns were not as favourable as they were cumulatively. The 450-day MA only outperformed in one year – when it provided no return. This was a positive result as the buy and hold for the year had a -28.76% return. It also provided exactly the same return as the buy and hold for 6 of the years and underperformed for 3 of them. The 200-day moving average was better at outperforming as it had higher returns for 3 of the years, but only provided the same return for 2 of the years and returned less for the other 5. These findings were consistent with Faber (2007) where the trend-following approach under-performed in roughly 40% of the 105 years studied.

When trading into gilts, the results were similar. The best moving averages strategies when trading into gilts were the 150 and 200-day moving averages providing cumulative returns of 8.22% and 8.08% respectively. Again, any moving average over 100-days trading into gilts outperformed the buy and hold, but on a yearly basis the returns were not as consistent. Both moving averages outperformed for four of the years, were equal to the buy and hold for two of the years and underperformed for 4 of the years.

The worst year for both moving averages trading into cash or gilts was the first year that the strategies were invested, year 10, with a negative return of -0.74%

(25-day MA to gilts) to -16.93% (50-day MA to cash) when the buy and hold returned a positive return of 5.94%. Almost all but the very shortest moving averages provided a negative return in that year. This would make most investors question the success of such a strategy.

Although on a cumulative basis, a large range of end of month moving averages outperformed, seemingly providing confidence in trend following strategies, on a yearly basis the results were not as favourable. The longer the moving average, the more likely it was to be in equities throughout the year, thus providing the same return as the buy and hold. The shorter the moving average the more likely it was to both outperform and underperform. Years in which the HSBC FTSE 100 unit trust had particularly bad returns, such as year 9, all the trend-following strategies outperformed, but years in which the HSBC FTSE 100 unit trust had high returns or whipsawed were harder to outperform when the best result was to be in equities. This also provides further evidence that the strength of trend-following strategies lies over whole market cycles, particularly its ability to avoid large drops in value such as the -28.76% return in year 9.

#### 2.3.2.2 Volatility

Trend-following strategies real strength was shown to be risk reduction even when reviewing on a yearly basis as displayed in the volatility results on Table 2.7. Almost all strategies and durations provided returns which were either better than the buy and hold or equal to it – especially in longer durations when the strategy was most likely to be in equities. The 450-day moving average again had the same volatilities for 6 years as the buy and hold, but also outperformed in all 4 other years. The shorter 150 and 200-day moving averages had lower volatilities in all the years, except for the two that were equal to the buy and hold.

Similar to the cumulative results, the shorter durations were most likely to have the best volatilities, even though they were less likely to have a return which outperformed. The longer durations were more likely to be invested in the buy and hold. Either way, volatilities were vastly improved with trend following strategies.

#### 2.3.2.3 Sharpe Ratios

Given that Sharpe ratios consider both the return and volatility, it was again no surprise that the Sharpe ratios in Table 2.8 had similar but improved results compared to the yearly returns. The 450-day moving average had six years with the same Sharpe ratio as the buy and hold, but also two which outperformed and two which underperformed – better than the three in which it underperformed in regard to returns. The 150 and 200-day moving averages to cash also had the same two years which were equal to the buy and hold and three which outperformed but there was a slight difference in the years which outperformed. Year 3 had five moving average strategies which traded into cash with returns which outperformed but did not have any Sharpe ratios which did. Instead, there were 8 Sharpe ratios which outperformed in year 2 while there were not any returns that outperformed in year 2. There was due to a large difference in volatility for year 2. The buy and hold had a volatility of 1.14% while most of the trend following strategies were well below 1%. The difference in volatility was not as pronounced for year 3.

Although the 200-day moving average strategy trading into gilts had Sharpe ratios with the same number of outperformances as returns, the 150-day moving average added another year to the years with outperformances, year 8. There were therefore five years in which the 150-day moving average trading into gilts outperformed, two years in which they were equal and only three which underperformed compared to the buy and hold.

Similar to the returns, the years that the buy and hold had large negative Sharpe ratios were the ones in which all trend following strategies outperformed, specifically year 9. Sharpe Ratios for moving averages trading into gilts had a higher number of outperformances then trading to cash. The higher returns compensated for the slightly higher volatilities. Overall, there were more outperformances with Sharpe ratios than returns. In any individual year, the trend-following strategies may not have Sharpe ratios which always outperform, but they do often provide a better risk-adjusted return, especially when strategies used longer durations. For example, in 80% of the years, the 450-day moving average had Sharpe ratios that were either equal to the buy and hold or outperformed it.

#### 2.3.2.4 Maximum Drawdowns

The cumulative maximum drawdown statistics as shown on Table 2.5 were overwhelmingly positive. Over the whole 21 years almost all durations and strategies had better drawdowns than the buy and hold, except for the very shortest of durations. On a yearly basis, trend following strategies still had better drawdowns the majority of the time but were not as overwhelming consistent as shown in Table 2.9. Again, in years of extreme disaster for the HSBC FTSE 100 unit trust, such as year 9 with a -18.76% drawdown, the trend-following strategies were easily able to outperform. Other years such as the first year, year 10, and years 6 and 4 were a bit more difficult. Still the 450-day moving average was equal to or outperformed for 80% of the years, only underperforming for two of them. The 150 and 200-day moving averages were equal to or outperformed for 70% of the years, underperforming for only 3 of them. Out of those years, year 1 was the only year that was significantly worse.

Overall, yearly drawdowns for trend following strategies were better or the same as the buy and hold for the majority of the years. When looking at periods as short as a year, it is difficult to outperform every year, but none of the maximum drawdowns were as large as the buy and hold drawdown in year 9 – which a trend-following strategy has shown to avoid.

#### 2.3.2.5 Yearly Results Conclusion

On a yearly basis, the results were not as consistent as the cumulative results. The returns for many of the strategies with longer durations were improved or the same as the buy and hold while strategies with shorter durations had an increased likelihood of outperformance and underperformance. Trend-following strategies had a few extra strategies which outperformed in terms of Sharpe ratios compared to the number which outperformed in regard to returns due to the inclusion of volatility in the Sharpe ratio calculations. The maximum drawdowns for most years were improved when using a trend following strategy, but the biggest improvement when using a trend following strategy was to volatility. Almost every duration for both end of month trading into cash or into gilts was either equal to the buy and hold or outperformed it.

When looking at results on a yearly basis, the benefits of trend following were still apparent in terms of drawdowns and volatility, but less apparent in terms of returns and Sharpe ratios. A trend-following investor who was looking frequently at their investment reports could at times be concerned about their investment returns, especially in years where the trend-following strategy underperformed the buy and hold. Still, trend-following strategies delivered a reduction in volatility and maximum drawdowns over periods with significant drops in value and never approached the extent of the FTSE 100 drawdown in year 9 of -28.76%.

## 2.4 Conclusion

At the outset this chapter aimed to answer four main research questions. Did trend-following strategies continue to have the same success with risk-adjusted returns, volatility and maximum drawdowns as found in previous studies (Faber, 2007; ap Gwilym *et al.*,2010; Clare *et al.*, 2013; and Hurst *et al.*, 2017)? Was it possible to find an optimum strategy through a thorough review of moving averages and crossovers which traded on a daily and monthly basis as well as across a number of different durations? Was the use of UK government bonds (gilts) instead of cash when out of equity markets help or hinder the trend-following strategies? And lastly, were the results consistent from one year to the next to discover the experience of a trend-following investor?

First, the delays caused using unit trusts did not appear to hinder the trend-following strategies ability to provide superior risk-adjusted returns or reductions in volatility and maximum drawdowns. The results for unit trusts were similar to those found previously as mentioned above. The majority of the trend-following strategies studied were able to outperform the return of the underlying HSBC FTSE 100 unit trust buy and hold over 21 years. There were also large improvements to the strategies' risk-adjusted returns in the form of Sharpe ratios mainly due to the fact that every single trend-following strategy studied had volatilities which were much smaller than the buy and hold. A similar almost complete improvement across all strategies for maximum drawdowns was also apparent with reductions as great as half of the buy and hold's maximum drawdown. Another point to note, was that

there was little difference between the two versions studied. Although there were delays to the second version compared to the first, this neither made it more profitable nor more cautious. This further confirmed that the extra day required when utilising unit trusts was not consequential in the comparator statistics and that using a tradeable asset, such as a unit trust, even with trading delays and a mixture of retail as well as professional investors, could still be used within a trend-following strategy.

Secondly, in the search for an optimum strategy this chapter reviewed moving averages and crossovers, trading daily or at the end of the month and the choice of duration. There were some strategies which clearly did not perform well, as well as many that did. The shortest moving averages and crossovers not only underperformed, but also typically provided negative returns. Even though the shortest durations had the lowest volatilities, this was still not enough to improve Sharpe ratios and in fact made them many times worse than the buy and hold. Alternatively, moving averages with medium to long durations from 150-days which traded at the end of the month or crossovers which traded either daily or at the end of the month from 100 v 300 days provided better returns, Sharpe ratios, volatilities and drawdowns compared to the buy and hold.

If the strategy had a duration which was too short, the strategy would signal a change in assets too frequently which would cause whipsawing, mistiming the FTSE 100, and losses in values. If the timing of the drop in equity market values was such that the trend-following strategy was able to trigger a sell at a relatively high price and also the underlying market had a slow enough recovery that the buyback of equities was at a lower price than the sale, essentially selling high and buying low, then the trend-following strategy was able to create extra return compared to the buy and hold as was found through many of the strategies studied here over 21-years. When pursuing an optimum strategy over this period, for moving averages there were definite improvements in both return and Sharpe ratio around the 150- and 200-day moving averages and the 450-day moving average all trading at the end of the month which had the highest return and highest Sharpe ratios. But, the trend-following strategy with the highest overall return was the 150 v 350 day crossover. The strategy with the highest Sharpe ratios were again the 150 v 350 day crossover when trading to cash, but the 50 v 150 day crossover when trading into gilts. This

reflects that there were differences when gilts were used as the alternative investment instead of cash to the trend-following strategy, but this was found to boost returns.

Thirdly, the use of gilts instead of cash as the alternative asset when not invested in equities improved both returns and Sharpe ratios. The strategies which used cash when trading were 'pure' strategies as they allowed for confirmation that trend-following strategies with unit trusts were able to provide excess returns, especially when trading monthly. These strategies would not have therefore been impacted by any movements in prices or volatility caused by gilts as they are investments with their own levels of volatility and returns separate from their function as an alternative asset. But investing in gilts as the alternative to equities always improved returns and Sharpe ratios when compared to their cash equivalents. As a step-down approach from the risk which an equity asset carries compared to a government bond asset, the use of gilts instead of cash as the alternative to equities over this period still reduced risk when compared to the equity FTSE 100 buy and hold and added returns. This could have been due to exceptional circumstances around gilts during this time due to government intervention and quantitative easing which may not continue. Another potential explanation for these excess returns could be that when out of equities, the investment in bonds provided some lift even if the timing of the re-entry into equity markets was delayed. This is an interesting contribution to the current literature which could benefit from further research to determine if gilts could still be an option as an alternative investment in a trend-following strategy instead of the basic movement into cash or a cash-like proxy.

Finally, on a yearly basis, trend following strategies were not as consistent as they are cumulatively. In years with strong underlying returns, trend-following strategies were less able to outperform and there were inconsistencies in results from year to year based on duration and strategy selected. In an era where investors monitor their investments often and regularly online, this may not consistently provide robust enough returns and could be uncomfortable for an investor to experience. Even so, trend-following strategies were still able to provide a reduction in risk on a yearly basis as almost every strategy and duration had volatilities which were better than the buy and hold. The majority of the durations and strategies also still had better yearly maximum drawdowns. As business cycles continue over years, the benefit to returns and Sharpe ratios was not always apparent on a yearly

basis. The strengths of trend following are best when viewed over a whole business cycle as suggested by Faber (2007).

This chapter contributed to current literature through the confirmation that unit trusts had the same improvement in risk-adjusted returns (Sharpe ratios), volatilities and maximum drawdowns when a trend-following strategy was applied as found in previous studies by Faber (2007), ap Gwilym *et al.* (2010), Clare *et al.* (2013), and Hurst *et al.* (2017). Through the use of the HSBC FTSE 100 unit trust, this chapter found that trend following performed significantly in regard to these performance metrics especially in years when equity markets had large drawdowns. Over time, this was enough to not only improve risk but also overall performance.

A further contribution was to confirm that the 200-day moving average, but only when trading monthly, was able to slightly outperform the buy and hold with the added advantage of lower volatilities and maximum drawdowns and much higher Sharpe ratios. But in the search for an optimum strategy, over this time period, a much longer moving average of 450-day or two moving averages compared against each other as a crossover (the 150 vs 350) had even higher returns. Although investors are always in search of returns, the value of trend-following strategies continued to appear to be the significant reduction in risk through reductions in volatility and maximum drawdowns. And, to that respect, any of the longer moving averages trading at the end of the month and longer crossovers outperformed the buy and hold in terms of returns and Sharpe ratios, and all had significantly improved volatilities and maximum drawdowns.

The study of the use of gilts as the alternative asset when not in equities instead of a cash proxy was unique to this thesis and a contribution which warrants further review. It was found to be a potential for excess returns for trend-following strategies when suggested to be out of equity markets while continuing to reduce risk compared to the benchmark buy and hold of the equity market.

The final contribution was that the further study of trend-following using unit trusts on a yearly basis exposed the experience of the investor as one which was not as comfortable as the cumulative results would have one believe, again confirming Faber (2007). The most consistent results were again with the longest moving

averages trading at the end of the month, but the 150- and 200-day moving averages were most likely to outperform in terms of returns and Sharpe ratios. As with all investment strategies, there will be times when a trend-following strategy struggles to outperform.

This thesis was written to add contributions to the ever-increasing literature on trend following but additionally to identify how trend following can be used by retail investors. This chapter has shown that using an investment vehicle commonly used by retail investors, namely unit trusts, investors can still utilise a trend-following strategy to minimise risk while still partaking in the majority of upward equity movements. This chapter also supports previous literature in that trend-following strategies may best benefit those that will utilise the strategy over whole market cycles as well as those specifically concerned with volatility, maximum drawdown, and sequence risk (rather than only on returns) such as investors nearing or in retirement. In the next chapter the same trend-following strategies are tested across other international markets.

## Table 2.1: HSBC FTSE 100 Unit Trust Cumulative 21-Year Returns

| Annualised Return | Year 21 |
|---|---|
| HSBC FTSE 100 Index | 5.80% |
| L&G All Stocks Gilt Inc | 1.50% |

Positive Returns
Outperforms Buy and Hold
Higest Positive Return
Higest Outperforms Buy and Hold

| Years 21 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Cash 1 | -3.15% | -1.61% | 0.59% | 1.31% | 2.56% | 4.11% | 4.84% | 4.15% | 5.08% | 4.87% | 4.92% | 4.72% |
| MA - Cash 2 | -2.26% | -0.71% | 0.48% | 2.01% | 3.19% | 5.30% | 5.09% | 3.63% | 5.10% | 4.87% | 5.12% | 4.46% |
| MA - Gilt 1 | -2.99% | -0.79% | -0.26% | 2.30% | 4.45% | 6.32% | 5.91% | 4.63% | 5.81% | 4.93% | 5.37% | 4.45% |
| MA - Gilt 2 | -2.61% | -0.94% | 0.01% | 2.86% | 4.51% | 6.67% | 5.87% | 4.41% | 5.88% | 5.02% | 5.47% | 4.40% |
| EOM MA - Cash 1 | 2.28% | 3.55% | 3.18% | 3.63% | 5.35% | 6.36% | 6.93% | 5.48% | 6.44% | 6.15% | 6.52% | 7.55% |
| EOM MA - Cash 2 | 1.34% | 2.33% | 1.98% | 2.20% | 4.63% | 5.86% | 6.52% | 5.29% | 6.09% | 6.01% | 6.27% | 7.36% |
| EOM MA - Gilt | 1.58% | 1.72% | 3.14% | 5.45% | 6.85% | 8.22% | 8.08% | 6.37% | 7.09% | 6.80% | 6.92% | 7.80% |

| Summary Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All |
| Higher | 26 | 111 | 64 | 73 | 70 | 67 | 137 |
| Lower | 58 | 50 | 76 | 32 | 70 | 38 | 108 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 31.0% | 68.9% | 45.7% | 69.5% | 50.0% | 63.8% | 55.9% |
| % Lower | 69.0% | 31.1% | 54.3% | 30.5% | 50.0% | 36.2% | 44.1% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | -0.17% | -0.54% | 1.74% | 3.66% | 5.15% | 6.64% | 4.22% | 4.11% | 5.64% | 5.46% | 5.66% | 6.41% | 6.50% | 6.76% | 6.18% | 6.95% | 6.12% | 6.58% | 6.84% | 6.39% | 6.39% | 6.66% | 5.86% |
| XO - Cash 2 | -0.10% | -0.97% | 1.77% | 3.87% | 5.19% | 6.73% | 4.27% | 4.42% | 5.51% | 5.63% | 5.78% | 6.39% | 6.43% | 6.92% | 6.32% | 6.99% | 6.29% | 6.48% | 6.80% | 6.50% | 6.38% | 6.54% | 5.91% |
| XO - Gilt 1 | -0.60% | -0.67% | 4.79% | 6.36% | 7.45% | 8.81% | 5.47% | 6.36% | 6.73% | 6.09% | 6.47% | 7.19% | 7.10% | 7.48% | 6.83% | 7.79% | 6.90% | 7.02% | 7.39% | 6.75% | 6.76% | 6.93% | 6.13% |
| XO - Gilt 2 | -0.37% | -0.61% | 4.79% | 6.37% | 7.45% | 8.77% | 5.59% | 6.36% | 6.73% | 6.09% | 6.47% | 7.19% | 7.10% | 7.48% | 6.83% | 7.79% | 6.90% | 7.02% | 7.34% | 6.75% | 6.76% | 6.93% | 6.13% |
| EOM XO - Cash 1 | 2.41% | 2.33% | 3.47% | 4.80% | 5.41% | 5.44% | 5.39% | 5.03% | 4.73% | 5.31% | 6.56% | 6.35% | 6.55% | 6.64% | 6.83% | 7.69% | 6.45% | 6.72% | 6.70% | 6.76% | 6.65% | 6.82% | 6.12% |
| EOM XO - Cash 2 | 1.61% | 1.43% | 2.86% | 4.52% | 5.62% | 5.51% | 5.36% | 4.95% | 5.05% | 5.42% | 6.46% | 6.28% | 6.45% | 6.62% | 6.81% | 7.66% | 6.27% | 6.75% | 6.57% | 6.69% | 6.54% | 6.71% | 6.07% |
| EOM XO - Gilt | 0.92% | 3.75% | 5.84% | 6.67% | 7.05% | 7.06% | 7.01% | 6.59% | 6.14% | 6.15% | 6.99% | 6.63% | 6.99% | 7.22% | 7.40% | 8.55% | 6.73% | 7.33% | 6.92% | 6.80% | 6.81% | 7.21% | 6.25% |

Table 2.1: This table shows the annualised return over 21 years for 2 versions of moving average (MA) and crossover (XO) strategies on the HSBC FTSE 100 Unit Trust trading daily and at the end of month (EOM) moving into either cash or gilts when signalled to sell out of the FTSE 100. Annualised 21-year returns which were positive are shown in yellow. The highest returns which did not outperform the buy and hold are shown in red. Annualised returns which outperformed the buy and hold are shown in green. The highest annualised return per strategy type is shown in purple.

The inset summary table shows the number of times each startegy outperformed/underperformed the buy and hold (higher/lower) with the percentages of each listed in the last two rows. It is clear that crossover strategies (XO) which trade at the end of the month (EOM) and trade into gilts have the highest percentages of outperformance.

## Table 2.2: HSBC FTSE 100 Unit Trust Cumulative Number of Transactions over 21 Years

| Years 21 | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | | | | | | | | | | | |
| MA - Cash 1 | 1433 | 1005 | 627 | 417 | 299 | 223 | 179 | 153 | 97 | 109 | 89 | 81 | | | | | | | | | | | |
| MA - Cash 2 | 1088 | 750 | 440 | 305 | 221 | 163 | 123 | 113 | 81 | 77 | 75 | 63 | | | | | | | | | | | |
| MA - Gilt 1 | 2292 | 1610 | 982 | 647 | 463 | 341 | 279 | 235 | 159 | 177 | 149 | 139 | | | | | | | | | | | |
| MA - Gilt 2 | 2126 | 1494 | 896 | 587 | 423 | 325 | 253 | 221 | 155 | 159 | 139 | 127 | | | | | | | | | | | |
| EOM MA - Cash 1 | 129 | 125 | 135 | 101 | 59 | 43 | 35 | 33 | 29 | 23 | 19 | 13 | | | | | | | | | | | |
| EOM MA - Cash 2 | 128 | 124 | 134 | 100 | 59 | 43 | 35 | 33 | 29 | 23 | 19 | 13 | | | | | | | | | | | |
| EOM MA - Gilt | 258 | 250 | 268 | 200 | 117 | 85 | 69 | 65 | 57 | 45 | 37 | 25 | | | | | | | | | | | |
| Moving Average 1 | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
| Moving Average 2 | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 631 | 288 | 121 | 69 | 55 | 37 | 89 | 43 | 27 | 27 | 21 | 15 | 11 | 11 | 13 | 9 | 9 | 9 | 11 | 11 | 9 | 9 | 9 |
| XO - Cash 2 | 631 | 288 | 121 | 69 | 55 | 37 | 89 | 43 | 27 | 27 | 21 | 15 | 11 | 11 | 13 | 9 | 9 | 9 | 11 | 11 | 9 | 9 | 9 |
| XO - Gilt 1 | 1175 | 569 | 241 | 135 | 109 | 71 | 165 | 85 | 53 | 53 | 41 | 29 | 21 | 21 | 25 | 17 | 17 | 17 | 19 | 21 | 17 | 17 | 17 |
| XO - Gilt 2 | 1169 | 569 | 241 | 135 | 109 | 71 | 165 | 85 | 53 | 53 | 41 | 29 | 21 | 21 | 25 | 17 | 17 | 17 | 19 | 21 | 17 | 17 | 17 |
| EOM XO - Cash 1 | 119 | 142 | 95 | 49 | 41 | 31 | 41 | 37 | 27 | 25 | 19 | 15 | 11 | 11 | 11 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| EOM XO - Cash 2 | 119 | 142 | 95 | 49 | 41 | 31 | 41 | 37 | 27 | 25 | 19 | 15 | 11 | 11 | 11 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| EOM XO - Gilt | 237 | 282 | 188 | 97 | 81 | 61 | 81 | 73 | 53 | 49 | 37 | 29 | 21 | 21 | 21 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |

Table 2.2: This table shows the number of transactions over 21 years for 2 versions of moving average (MA) and crossovers (XO) strategies on the HSBC FTSE 100 Unit Trust trading daily and at the end of month (EOM) moving into either cash or gilts when signalled to sell out of the FTSE 100.

## Table 2.3: HSBC FTSE 100 Unit Trust Cumulative 21-Year Volatility

| Annualised Vol | Year 21 |
|---|---|
| HSBC FTSE 100 Index | 18.506% |
| L&G All Stocks Gilt In | 6.33% |

Positive Returns
Outperforms Buy and Hold
Higest Positive Return
Higest Outperforms Buy and Hold

| Years 21 | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | | | | | | | | | | | | |
| MA - Cash 1 | 11.88% | 11.76% | 11.59% | 11.27% | 11.29% | 11.44% | 11.67% | 11.76% | 12.04% | 12.28% | 12.53% | 12.63% | | | | | | | | | | | | |
| MA - Cash 2 | 9.92% | 10.55% | 10.94% | 10.71% | 10.98% | 11.23% | 11.47% | 11.64% | 11.95% | 12.12% | 12.32% | 12.52% | | | | | | | | | | | | |
| MA - Gilt 1 | 10.89% | 11.44% | 11.75% | 11.62% | 11.69% | 11.94% | 12.11% | 12.31% | 12.60% | 12.75% | 12.97% | 13.08% | | | | | | | | | | | | |
| MA - Gilt 2 | 10.61% | 11.22% | 11.60% | 11.39% | 11.62% | 11.90% | 12.08% | 12.28% | 12.57% | 12.73% | 12.91% | 13.08% | | | | | | | | | | | | |
| EOM MA - Cash 1 | 12.93% | 12.57% | 12.51% | 11.93% | 12.00% | 11.92% | 12.08% | 12.39% | 12.73% | 12.96% | 13.08% | 13.32% | | | | | | | | | | | | |
| EOM MA - Cash 2 | 12.79% | 12.45% | 12.35% | 11.82% | 11.94% | 11.88% | 12.05% | 12.35% | 12.72% | 12.95% | 13.07% | 13.31% | | | | | | | | | | | | |
| EOM MA - Gilt | 13.52% | 13.20% | 12.97% | 12.48% | 12.53% | 12.50% | 12.67% | 12.98% | 13.29% | 13.52% | 13.62% | 13.79% | | | | | | | | | | | | |
| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 | |
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 | |
| XO - Cash 1 | 11.67% | 11.57% | 12.24% | 11.87% | 11.92% | 11.96% | 11.70% | 12.02% | 12.26% | 12.53% | 12.90% | 13.08% | 13.26% | 13.35% | 13.45% | 13.57% | 13.62% | 13.49% | 13.66% | 13.60% | 13.77% | 13.63% | 13.70% | |
| XO - Cash 2 | 10.90% | 11.34% | 12.16% | 11.80% | 11.86% | 11.93% | 11.61% | 11.98% | 12.23% | 12.50% | 12.88% | 13.08% | 13.25% | 13.34% | 13.42% | 13.55% | 13.61% | 13.49% | 13.66% | 13.59% | 13.75% | 13.63% | 13.70% | |
| XO - Gilt 1 | 11.62% | 12.06% | 12.79% | 12.41% | 12.49% | 12.56% | 12.26% | 12.58% | 12.82% | 13.09% | 13.44% | 13.62% | 13.81% | 13.89% | 13.93% | 14.06% | 14.12% | 13.99% | 14.15% | 14.12% | 14.26% | 14.15% | 14.21% | |
| XO - Gilt 2 | 11.60% | 12.06% | 12.79% | 12.41% | 12.49% | 12.55% | 12.24% | 12.58% | 12.82% | 13.09% | 13.44% | 13.62% | 13.81% | 13.89% | 13.93% | 14.06% | 14.12% | 13.99% | 14.15% | 14.12% | 14.26% | 14.15% | 14.21% | |
| EOM XO - Cash 1 | 13.60% | 11.92% | 12.38% | 12.60% | 12.35% | 12.45% | 12.49% | 12.53% | 12.52% | 12.93% | 13.09% | 13.23% | 13.35% | 13.42% | 13.45% | 13.60% | 13.67% | 13.62% | 13.63% | 13.67% | 13.73% | 13.70% | 13.75% | |
| EOM XO - Cash 2 | 13.48% | 11.79% | 12.28% | 12.52% | 12.28% | 12.41% | 12.45% | 12.49% | 12.48% | 12.91% | 13.08% | 13.22% | 13.34% | 13.41% | 13.43% | 13.59% | 13.66% | 13.62% | 13.62% | 13.67% | 13.73% | 13.69% | 13.75% | |
| EOM XO - Gilt | 14.11% | 12.50% | 12.93% | 13.09% | 12.86% | 13.00% | 13.03% | 13.08% | 13.06% | 13.50% | 13.62% | 13.75% | 13.87% | 13.94% | 13.94% | 14.08% | 14.17% | 14.12% | 14.13% | 14.19% | 14.24% | 14.19% | 14.26% | |

Table 2.3: This table shows the annualised volatility over 21 years for 2 versions of moving average (MA) and crossovers (XO) strategies on the HSBC FTSE 100 Unit Trust trading daily and at the end of month (EOM) moving into either cash or gilts when signalled to sell out of the FTSE 100. The annualised volatilities which were lower than the buy and hold are shown in green which the lowest volatility per strategy type shown in purple.

## Table 2.4: HSBC FTSE 100 Unit Trust Cumulative 21-Year Sharpe Ratios

| Annualised SR | Year 21 |
|---|---|
| HSBC FTSE 100 Index | 26.02% |
| L&G All Stocks Gilt In | -11.20% |

Positive Returns
Outperforms Buy and Hold
Higest Positive Return
Higest Outperforms Buy and Hold

| Years 21 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Cash 1 | -39.79% | -27.42% | -9.56% | -3.99% | 6.47% | 19.20% | 24.83% | 19.35% | 26.28% | 24.47% | 24.55% | 23.02% |
| MA - Cash 2 | -40.91% | -23.46% | -11.72% | 1.44% | 11.77% | 29.14% | 27.11% | 15.29% | 26.57% | 24.63% | 26.25% | 21.18% |
| MA - Gilt 1 | -42.95% | -21.47% | -16.24% | 4.55% | 21.72% | 35.94% | 32.47% | 22.64% | 31.00% | 24.46% | 27.39% | 20.75% |
| MA - Gilt 2 | -40.85% | -23.43% | -14.30% | 9.03% | 22.26% | 38.66% | 32.26% | 20.95% | 31.53% | 25.12% | 28.12% | 20.42% |
| EOM MA - Cash 1 | 5.16% | 14.39% | 11.70% | 15.20% | 28.38% | 36.20% | 40.16% | 28.86% | 35.32% | 32.87% | 35.24% | 41.87% |
| EOM MA - Cash 2 | -1.92% | 5.27% | 2.49% | 3.81% | 22.94% | 32.49% | 37.20% | 27.51% | 32.83% | 31.87% | 33.53% | 40.58% |
| EOM MA - Gilt | 0.61% | 1.31% | 11.40% | 28.51% | 38.64% | 48.49% | 47.08% | 34.37% | 38.75% | 36.42% | 37.04% | 42.46% |

| Summary Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All |
| Higher | 37 | 129 | 88 | 78 | 87 | 79 | 166 |
| Lower | 47 | 32 | 52 | 27 | 53 | 26 | 79 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 44.0% | 80.1% | 62.9% | 74.3% | 62.1% | 75.2% | 67.8% |
| % Lower | 56.0% | 19.9% | 37.1% | 25.7% | 37.9% | 24.8% | 32.2% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | -15.65% | -19.01% | 0.53% | 15.42% | 26.95% | 38.31% | 19.89% | 18.88% | 30.25% | 28.51% | 29.49% | 34.50% | 34.82% | 36.46% | 32.38% | 37.36% | 31.71% | 35.00% | 36.44% | 33.55% | 33.33% | 35.29% | 29.89% |
| XO - Cash 2 | -16.99% | -23.29% | 0.76% | 17.13% | 27.38% | 39.03% | 20.41% | 21.24% | 29.33% | 29.79% | 30.35% | 34.34% | 34.36% | 37.56% | 33.35% | 37.60% | 32.86% | 34.31% | 36.21% | 34.28% | 33.26% | 34.52% | 30.20% |
| XO - Gilt 1 | -19.39% | -18.80% | 23.38% | 35.32% | 43.02% | 52.54% | 28.96% | 34.97% | 37.18% | 32.27% | 34.33% | 38.84% | 37.90% | 40.24% | 35.93% | 41.90% | 36.10% | 37.08% | 39.20% | 35.16% | 35.00% | 36.23% | 31.07% |
| XO - Gilt 2 | -17.56% | -18.35% | 23.38% | 35.36% | 43.02% | 52.26% | 29.90% | 34.97% | 37.18% | 32.27% | 34.33% | 38.84% | 37.90% | 40.24% | 35.93% | 41.90% | 36.10% | 37.08% | 38.88% | 35.16% | 35.00% | 36.23% | 31.07% |
| EOM XO - Cash 1 | 6.48% | 4.95% | 13.86% | 23.63% | 28.41% | 28.51% | 28.10% | 25.40% | 23.22% | 27.00% | 35.50% | 33.81% | 35.04% | 35.53% | 36.76% | 42.19% | 33.84% | 35.68% | 35.60% | 35.87% | 35.05% | 36.24% | 31.52% |
| EOM XO - Cash 2 | 0.79% | -2.40% | 9.18% | 21.60% | 30.02% | 29.01% | 27.90% | 24.80% | 25.58% | 27.77% | 34.87% | 33.36% | 34.38% | 35.40% | 36.61% | 42.00% | 32.66% | 35.89% | 34.72% | 35.47% | 34.34% | 35.55% | 31.24% |
| EOM XO - Gilt | -3.26% | 15.93% | 30.73% | 36.31% | 39.34% | 39.16% | 38.74% | 35.71% | 32.62% | 32.08% | 37.52% | 34.88% | 37.11% | 38.43% | 39.61% | 46.67% | 34.92% | 38.85% | 36.20% | 35.33% | 35.33% | 37.93% | 31.73% |

Table 2.4: This table shows the annualised Sharpe ratios over 21 years for HSBC FTSE 100 Unit Trust using 2 versions of moving average (MA) and crossovers (XO) strategies trading daily and at the end of month (EOM) moving into either cash or gilts when signalled to sell out of the FTSE 100. Sharpe ratios which were positive are shown in yellow. Sharpe ratios which outperformed the buy and hold are shown in green which the highest Sharpe ratio per strategy type shown in purple.

The inset summary table shows the number of times each strategy outperformed/underperformed the buy and hold (higher/lower) with the percentages of each listed in the last two rows. It is clear that crossover strategies (XO) which traded at the end of the month (EOM) and into gilts had the highest percentage of outperformance.

## Table 2.5: HSBC FTSE 100 Unit Trust Cumulative 21-Year Maximum Drawdowns

| Max Drawdown | Year 21 |
|---|---|
| HSBC FTSE 100 Index | -50.43% |
| L&G All Stocks Gilt In | -18.93% |

Positive Returns
Outperforms Buy and Hold
Higest Positive Return
Higest Outperforms Buy and Hold

| Years 21 | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | | | | | | | | | | | |
| MA - Cash 1 | -66.09% | -56.47% | -41.76% | -44.92% | -38.23% | -37.43% | -34.04% | -30.03% | -29.55% | -30.58% | -26.02% | -24.50% | | | | | | | | | | | |
| MA - Cash 2 | -56.63% | -46.14% | -35.89% | -34.57% | -28.87% | -25.62% | -24.14% | -35.40% | -25.56% | -26.67% | -22.83% | -23.59% | | | | | | | | | | | |
| MA - Gilt 1 | -63.14% | -50.25% | -37.92% | -29.59% | -20.85% | -27.37% | -26.85% | -33.53% | -28.62% | -31.04% | -22.84% | -29.08% | | | | | | | | | | | |
| MA - Gilt 2 | -62.63% | -52.90% | -40.37% | -29.33% | -20.38% | -27.07% | -25.85% | -35.66% | -28.59% | -29.67% | -24.80% | -29.56% | | | | | | | | | | | |
| EOM MA - Cash 1 | -38.79% | -32.28% | -30.34% | -35.68% | -27.91% | -25.25% | -21.04% | -23.74% | -20.21% | -21.97% | -21.97% | -22.85% | | | | | | | | | | | |
| EOM MA - Cash 2 | -40.18% | -31.13% | -30.85% | -37.12% | -27.58% | -24.84% | -21.89% | -24.77% | -21.46% | -22.53% | -22.53% | -22.85% | | | | | | | | | | | |
| EOM MA - Gilt | -46.06% | -35.71% | -28.58% | -29.01% | -26.06% | -24.55% | -23.41% | -23.43% | -22.69% | -27.42% | -26.07% | -22.85% | | | | | | | | | | | |
| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | -44.00% | -48.70% | -37.83% | -34.94% | -40.77% | -21.18% | -34.09% | -28.75% | -25.93% | -34.81% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% |
| XO - Cash 2 | -36.60% | -57.23% | -37.43% | -31.74% | -37.95% | -20.17% | -34.86% | -29.18% | -28.27% | -32.08% | -22.85% | -22.85% | -22.85% | -22.85% | -22.97% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% |
| XO - Gilt 1 | -47.39% | -56.33% | -28.48% | -27.38% | -32.88% | -18.52% | -34.31% | -26.10% | -28.10% | -33.80% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% |
| XO - Gilt 2 | -45.60% | -56.09% | -28.48% | -27.38% | -32.88% | -18.78% | -32.35% | -26.10% | -28.10% | -33.80% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% |
| EOM XO - Cash 1 | -35.67% | -44.63% | -39.26% | -28.96% | -27.68% | -32.65% | -26.86% | -30.54% | -40.97% | -36.08% | -24.20% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -24.16% |
| EOM XO - Cash 2 | -36.45% | -45.78% | -40.66% | -28.57% | -26.19% | -31.97% | -27.46% | -31.34% | -39.22% | -34.11% | -24.40% | -23.94% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -25.18% |
| EOM XO - Gilt | -46.27% | -38.46% | -31.37% | -28.73% | -31.33% | -29.38% | -27.16% | -28.52% | -40.19% | -36.96% | -24.40% | -24.55% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -22.85% | -23.06% | -22.85% | -22.85% |

Table 2.5: This table shows the maximum drawdowns for moving average and crossovers strategies trading daily and at the end of month moving into either cash or gilts when signalled to sell out of the FTSE 100 over 21 years for the HSBC FTSE 100 Unit Trust. Maximum drawdowns which were smaller than the buy and hold are in green while the smallest maximum drawdown for each strategy is shown in purple.

## Table 2.6: HSBC FTSE 100 Unit Trust 1-10 Year Returns

| EOM MA-Cash version 1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| Year 10 | 10.34% | 3.83% | -2.23% | -16.93% | -16.33% | -15.54% | -7.38% | -5.07% | -5.07% | -5.07% | -5.07% | -5.07% |
| Year 9 | -3.76% | -12.74% | 0.89% | -12.61% | 15.74% | 15.74% | 9.33% | 4.12% | 4.12% | 0.00% | 0.00% | 0.00% |
| Year 8 | 1.07% | 0.74% | 4.51% | 11.94% | 2.90% | 7.10% | 6.42% | 2.58% | 2.58% | 12.85% | 12.85% | 12.85% |
| Year 7 | 5.19% | 0.07% | 1.60% | 0.56% | 8.16% | 8.16% | 8.16% | -1.13% | 4.14% | 4.14% | 4.14% | 4.14% |
| Year 6 | 0.59% | 0.59% | -3.06% | 12.41% | 2.36% | 1.84% | -3.74% | -3.74% | -0.65% | -0.65% | 3.22% | 3.22% |
| Year 5 | 12.30% | 13.28% | 13.93% | 10.63% | 10.63% | 17.24% | 17.24% | 17.24% | 17.24% | 17.24% | 17.24% | 17.24% |
| Year 4 | -1.86% | -3.31% | -2.34% | -1.14% | 0.12% | 4.70% | 4.70% | 4.70% | 7.82% | 7.82% | 7.82% | 7.82% |
| Year 3 | -13.84% | -3.48% | -12.59% | -7.12% | -5.03% | -5.03% | -5.03% | -13.52% | -13.52% | -8.31% | -7.20% | -7.20% |
| Year 2 | 8.72% | 8.11% | 10.92% | 12.20% | 7.40% | 13.56% | 13.56% | 10.11% | 10.99% | 4.70% | 4.70% | 10.99% |
| Year 1 | 2.40% | 3.60% | 5.87% | -0.22% | 13.88% | 13.88% | 13.88% | 13.88% | 13.88% | 13.88% | 13.88% | 13.88% |

| HSBC FTSE 100 Buy and Hold | |
|---|---|
| Year 10 | 5.94% |
| Year 9 | -28.76% |
| Year 8 | 12.85% |
| Year 7 | 4.14% |
| Year 6 | 10.86% |
| Year 5 | 17.24% |
| Year 4 | 7.82% |
| Year 3 | -7.20% |
| Year 2 | 15.23% |
| Year 1 | 13.88% |

| EOM MA-Gilt version 1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| Year 10 | 11.23% | 5.36% | -0.74% | -14.95% | -14.48% | -15.92% | -8.75% | -5.52% | -5.52% | -5.52% | -5.52% | -5.52% |
| Year 9 | -3.78% | -13.97% | 5.42% | -4.07% | 22.18% | 22.18% | 12.04% | 7.49% | 7.49% | 6.61% | 6.61% | 6.61% |
| Year 8 | 2.22% | -7.28% | -1.13% | 10.05% | 5.16% | 12.34% | 6.93% | 1.45% | 1.45% | 12.85% | 12.85% | 12.85% |
| Year 7 | 2.64% | -4.45% | -1.18% | 3.54% | 10.05% | 10.05% | 10.05% | -1.21% | 4.14% | 4.14% | 4.14% | 4.14% |
| Year 6 | -0.73% | -0.73% | -5.30% | 18.27% | 5.30% | 5.47% | -1.04% | -1.04% | 2.47% | 2.47% | 5.06% | 5.06% |
| Year 5 | 7.17% | 6.74% | 9.83% | 10.94% | 10.94% | 17.24% | 17.24% | 17.24% | 17.24% | 17.24% | 17.24% | 17.24% |
| Year 4 | -1.78% | -1.49% | 0.72% | 1.04% | -1.66% | 3.04% | 3.04% | 3.04% | 7.82% | 7.82% | 7.82% | 7.82% |
| Year 3 | -10.89% | 2.29% | -9.04% | -2.25% | 2.53% | 2.53% | 2.53% | -7.79% | -7.79% | -5.75% | -7.20% | -7.20% |
| Year 2 | 22.79% | 10.72% | 10.26% | 16.25% | 6.11% | 15.44% | 15.44% | 14.66% | 14.33% | 14.95% | 14.95% | 14.33% |
| Year 1 | 1.65% | 0.54% | 7.05% | 2.48% | 13.88% | 13.88% | 13.88% | 13.88% | 13.88% | 13.88% | 13.88% | 13.88% |

| | |
|---|---|
| | Returns equal to the Buy and Hold |
| | Highest Return less than Buy and Hold |
| | Greater than the Buy and Hold |
| | Higest Outperforming Buy and Hold |

Table 2.6: This table shows the yearly returns for moving average strategies which traded at the end of month moving into either cash or gilts when signalled to sell out of the FTSE 100. Yellow denotes a return which was equal to the buy and hold. Red denotes the highest return which was less than the buy and hold. Green denotes returns which were higher than the buy and hold. Purple denotes the highest return which outperformed the buy and hold.

## Table 2.7: HSBC FTSE 100 Unit Trust 1-10 Year Volatility

| EOM MA-Cash version 1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| Year 10 | 0.68% | 1.02% | 1.06% | 0.90% | 0.94% | 0.87% | 0.86% | 0.92% | 0.92% | 0.92% | 0.92% | 0.92% |
| Year 9 | 1.54% | 1.61% | 1.32% | 1.11% | 0.74% | 0.74% | 0.60% | 0.35% | 0.35% | 0.00% | 0.00% | 0.00% |
| Year 8 | 0.54% | 0.76% | 0.68% | 0.78% | 0.85% | 0.90% | 0.96% | 1.02% | 1.02% | 1.08% | 1.08% | 1.08% |
| Year 7 | 0.67% | 0.55% | 0.68% | 0.80% | 0.85% | 0.85% | 0.85% | 1.16% | 1.18% | 1.18% | 1.18% | 1.18% |
| Year 6 | 1.01% | 1.01% | 0.97% | 0.68% | 0.74% | 0.71% | 0.57% | 0.57% | 0.71% | 0.71% | 0.75% | 0.75% |
| Year 5 | 0.54% | 0.58% | 0.55% | 0.72% | 0.72% | 0.76% | 0.76% | 0.76% | 0.76% | 0.76% | 0.76% | 0.76% |
| Year 4 | 0.45% | 0.47% | 0.44% | 0.50% | 0.58% | 0.62% | 0.62% | 0.62% | 0.65% | 0.65% | 0.65% | 0.65% |
| Year 3 | 0.56% | 0.44% | 0.63% | 0.57% | 0.60% | 0.60% | 0.60% | 0.79% | 0.79% | 0.86% | 0.89% | 0.89% |
| Year 2 | 0.86% | 0.96% | 1.05% | 0.82% | 0.86% | 0.66% | 0.66% | 0.62% | 0.56% | 0.28% | 0.28% | 0.56% |
| Year 1 | 0.40% | 0.27% | 0.46% | 0.61% | 0.70% | 0.70% | 0.70% | 0.70% | 0.70% | 0.70% | 0.70% | 0.70% |

| HSBC FTSE 100 Buy and Hold | |
|---|---|
| Year 10 | 0.99% |
| Year 9 | 2.18% |
| Year 8 | 1.08% |
| Year 7 | 1.18% |
| Year 6 | 1.18% |
| Year 5 | 0.76% |
| Year 4 | 0.65% |
| Year 3 | 0.89% |
| Year 2 | 1.14% |
| Year 1 | 0.70% |

| EOM MA-Gilt version 1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| Year 10 | 0.72% | 1.03% | 1.09% | 0.94% | 0.97% | 0.93% | 0.92% | 0.97% | 0.97% | 0.97% | 0.97% | 0.97% |
| Year 9 | 1.58% | 1.64% | 1.36% | 1.21% | 0.91% | 0.91% | 0.82% | 0.68% | 0.68% | 0.60% | 0.60% | 0.60% |
| Year 8 | 0.63% | 0.80% | 0.73% | 0.81% | 0.87% | 0.91% | 0.97% | 1.02% | 1.02% | 1.08% | 1.08% | 1.08% |
| Year 7 | 0.72% | 0.63% | 0.72% | 0.82% | 0.87% | 0.87% | 0.87% | 1.17% | 1.18% | 1.18% | 1.18% | 1.18% |
| Year 6 | 1.03% | 1.03% | 1.00% | 0.76% | 0.80% | 0.77% | 0.68% | 0.68% | 0.78% | 0.78% | 0.81% | 0.81% |
| Year 5 | 0.59% | 0.62% | 0.59% | 0.72% | 0.72% | 0.76% | 0.76% | 0.76% | 0.76% | 0.76% | 0.76% | 0.76% |
| Year 4 | 0.48% | 0.49% | 0.47% | 0.51% | 0.58% | 0.61% | 0.61% | 0.61% | 0.65% | 0.65% | 0.65% | 0.65% |
| Year 3 | 0.66% | 0.55% | 0.69% | 0.64% | 0.65% | 0.65% | 0.65% | 0.81% | 0.81% | 0.87% | 0.89% | 0.89% |
| Year 2 | 0.92% | 1.00% | 1.06% | 0.85% | 0.89% | 0.72% | 0.72% | 0.69% | 0.66% | 0.52% | 0.52% | 0.66% |
| Year 1 | 0.48% | 0.44% | 0.51% | 0.63% | 0.70% | 0.70% | 0.70% | 0.70% | 0.70% | 0.70% | 0.70% | 0.70% |

Equal to the Buy and Hold

Less than the Buy and Hold

Lowest Outperforming Buy and Hold

Table 2.7: This table shows the yearly volatility for moving average strategies which traded at the end of month moving into either cash or gilts when signalled to sell out of the FTSE 100. Yellow denotes volatility which was equal to the buy and hold. Green denotes volatility which was less than the buy and hold. Purple denotes the lowest volatility which outperformed the buy and hold.

## Table 2.8: HSBC FTSE 100 Unit Trust 1-10 Year Sharpe Ratios

| EOM MA-Cash version 1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving A | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| Year 10 | 3.00% | 0.00% | -2.13% | -9.62% | -8.86% | -9.24% | -5.27% | -3.84% | -3.84% | -3.84% | -3.84% | -3.84% |
| Year 9 | -0.55% | -2.77% | 0.49% | -4.60% | 7.17% | 7.17% | 5.04% | 2.98% | 2.98% | 0.00% | 0.00% | 0.00% |
| Year 8 | 0.68% | 0.51% | 2.54% | 5.70% | 1.49% | 3.15% | 2.76% | 1.28% | 1.28% | 4.63% | 4.63% | 4.63% |
| Year 7 | 2.91% | -0.04% | 0.93% | 0.41% | 3.70% | 3.70% | 3.70% | 0.03% | 1.73% | 1.73% | 1.73% | 1.73% |
| Year 6 | 0.58% | 0.58% | -0.88% | 6.68% | 1.37% | 1.12% | -2.52% | -2.52% | -0.20% | -0.20% | 1.78% | 1.78% |
| Year 5 | 8.25% | 8.31% | 9.10% | 5.59% | 5.59% | 8.22% | 8.22% | 8.22% | 8.22% | 8.22% | 8.22% | 8.22% |
| Year 4 | -1.67% | -2.76% | -2.12% | -0.89% | 0.14% | 2.95% | 2.95% | 2.95% | 4.55% | 4.55% | 4.55% | 4.55% |
| Year 3 | -10.21% | -3.20% | -8.05% | -4.94% | -3.25% | -3.25% | -3.25% | -6.80% | -6.80% | -3.62% | -2.95% | -2.95% |
| Year 2 | 3.92% | 3.39% | 4.11% | 5.53% | 3.39% | 7.41% | 7.41% | 5.97% | 7.01% | 5.69% | 5.69% | 7.01% |
| Year 1 | 2.38% | 5.07% | 4.88% | 0.09% | 7.36% | 7.36% | 7.36% | 7.36% | 7.36% | 7.36% | 7.36% | 7.36% |

| HSBC FTSE 100 Buy and Hold | |
|---|---|
| Year 10 | 0.60% |
| Year 9 | -5.59% |
| Year 8 | 4.63% |
| Year 7 | 1.73% |
| Year 6 | 3.79% |
| Year 5 | 8.22% |
| Year 4 | 4.55% |
| Year 3 | -2.95% |
| Year 2 | 5.15% |
| Year 1 | 7.36% |

| EOM MA-Gilt version 1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving A | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| Year 10 | 3.29% | 0.56% | -1.52% | -8.25% | -7.68% | -8.83% | -5.51% | -3.78% | -3.78% | -3.78% | -3.78% | -3.78% |
| Year 9 | -0.49% | -3.01% | 1.75% | -1.17% | 8.28% | 8.28% | 5.04% | 3.58% | 3.58% | 3.43% | 3.43% | 3.43% |
| Year 8 | 1.35% | -3.43% | -0.48% | 4.71% | 2.43% | 5.11% | 2.93% | 0.87% | 0.87% | 4.63% | 4.63% | 4.63% |
| Year 7 | 1.47% | -2.75% | -0.54% | 1.78% | 4.40% | 4.40% | 4.40% | 0.02% | 1.73% | 1.73% | 1.73% | 1.73% |
| Year 6 | 0.10% | 0.10% | -1.72% | 8.61% | 2.67% | 2.82% | -0.45% | -0.45% | 1.39% | 1.39% | 2.55% | 2.55% |
| Year 5 | 4.57% | 4.15% | 6.15% | 5.71% | 5.71% | 8.22% | 8.22% | 8.22% | 8.22% | 8.22% | 8.22% | 8.22% |
| Year 4 | -1.48% | -1.20% | 0.54% | 0.77% | -1.05% | 1.97% | 1.97% | 1.97% | 4.55% | 4.55% | 4.55% | 4.55% |
| Year 3 | -6.64% | 1.54% | -5.14% | -1.31% | 1.53% | 1.53% | 1.53% | -3.60% | -3.60% | -2.34% | -2.95% | -2.95% |
| Year 2 | 8.74% | 4.21% | 3.87% | 6.94% | 2.79% | 7.66% | 7.66% | 7.60% | 7.74% | 10.05% | 10.05% | 7.74% |
| Year 1 | 1.45% | 0.58% | 5.24% | 1.72% | 7.36% | 7.36% | 7.36% | 7.36% | 7.36% | 7.36% | 7.36% | 7.36% |

| |
|---|
| Equal to the Buy and Hold |
| Highest SR less than the Buy and Hold |
| Greater than the Buy and Hold |
| Higest Outperforming Buy and Hold |

Table 2.8: This table shows the yearly Sharpe ratios for moving average strategies which traded at the end of month moving into cash and gilts. Yellow denotes a SR which was equal to the buy and hold. Green denotes any SR which was higher than the buy and hold. Purple denotes the highest SR which outperformed the buy and hold.

## Table 2.9: HSBC FTSE 100 Unit Trust 1-10 Year Maximum Drawdowns

| EOM MA-Cash version 1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| Year 10 | -8.61% | -16.84% | -16.84% | -20.02% | -19.44% | -18.68% | -16.84% | -16.84% | -16.84% | -16.84% | -16.84% | -16.84% |
| Year 9 | -20.41% | -26.10% | -14.84% | -19.58% | -8.39% | -8.39% | -8.39% | -3.20% | -3.20% | 0.00% | 0.00% | 0.00% |
| Year 8 | -8.01% | -11.57% | -7.64% | -7.63% | -14.43% | -14.43% | -15.63% | -18.67% | -18.67% | -16.20% | -16.20% | -16.20% |
| Year 7 | -6.50% | -6.16% | -6.70% | -10.48% | -7.09% | -7.09% | -7.09% | -17.52% | -17.52% | -17.52% | -17.52% | -17.52% |
| Year 6 | -11.13% | -11.13% | -12.53% | -7.68% | -10.95% | -10.95% | -12.34% | -12.34% | -12.34% | -12.34% | -12.34% | -12.34% |
| Year 5 | -4.26% | -4.26% | -5.89% | -10.71% | -10.71% | -10.71% | -10.71% | -10.71% | -10.71% | -10.71% | -10.71% | -10.71% |
| Year 4 | -8.78% | -10.13% | -7.66% | -8.11% | -8.11% | -7.00% | -7.00% | -7.00% | -5.95% | -5.95% | -5.95% | -5.95% |
| Year 3 | -16.40% | -8.16% | -16.40% | -10.31% | -10.31% | -10.31% | -10.31% | -15.91% | -15.91% | -14.91% | -13.89% | -13.89% |
| Year 2 | -11.77% | -13.96% | -13.96% | -7.48% | -11.52% | -6.34% | -6.34% | -5.61% | -5.61% | -1.95% | -1.95% | -5.61% |
| Year 1 | -5.48% | -3.02% | -3.93% | -5.74% | -5.74% | -5.74% | -5.74% | -5.74% | -5.74% | -5.74% | -5.74% | -5.74% |

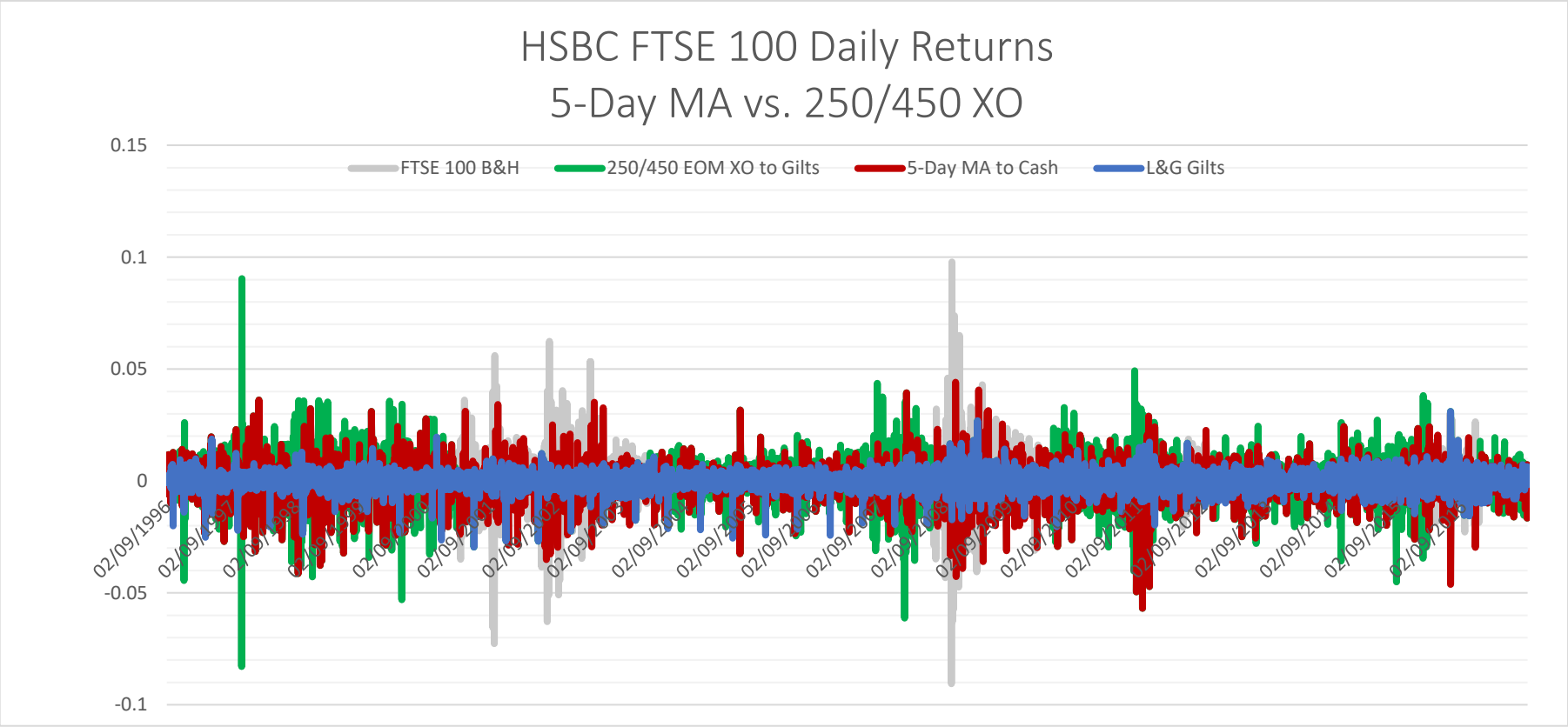
| HSBC FTSE 100 Buy and Hold | |
|---|---|
| Year 10 | 5.94% |
| Year 9 | -28.76% |
| Year 8 | -16.20% |
| Year 7 | -17.52% |
| Year 6 | -10.95% |
| Year 5 | -10.71% |
| Year 4 | -5.95% |
| Year 3 | -13.89% |
| Year 2 | -13.96% |
| Year 1 | -5.74% |

| EOM MA-Gilt version 1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| Year 10 | -7.12% | -16.84% | -16.84% | -20.89% | -20.45% | -21.79% | -16.84% | -16.84% | -16.84% | -16.84% | -16.84% | -16.84% |
| Year 9 | -22.31% | -27.13% | -13.78% | -14.31% | -8.39% | -8.39% | -13.03% | -7.29% | -7.29% | -7.29% | -7.29% | -7.29% |
| Year 8 | -10.52% | -17.57% | -12.70% | -8.56% | -15.48% | -14.43% | -15.22% | -19.56% | -19.56% | -16.20% | -16.20% | -16.20% |
| Year 7 | -10.40% | -10.12% | -10.08% | -9.40% | -7.09% | -7.09% | -7.09% | -17.52% | -17.52% | -17.52% | -17.52% | -17.52% |
| Year 6 | -10.97% | -10.97% | -14.63% | -7.68% | -13.04% | -13.04% | -14.81% | -14.81% | -14.81% | -14.81% | -14.81% | -14.81% |
| Year 5 | -6.74% | -6.74% | -7.27% | -10.71% | -10.71% | -10.71% | -10.71% | -10.71% | -10.71% | -10.71% | -10.71% | -10.71% |
| Year 4 | -12.25% | -12.00% | -9.91% | -9.74% | -9.74% | -8.48% | -8.48% | -8.48% | -5.95% | -5.95% | -5.95% | -5.95% |
| Year 3 | -17.89% | -10.60% | -16.35% | -10.11% | -8.57% | -8.57% | -8.57% | -12.54% | -12.54% | -12.54% | -13.89% | -13.89% |
| Year 2 | -8.74% | -14.88% | -13.96% | -7.48% | -12.47% | -6.34% | -6.34% | -5.61% | -5.61% | -2.69% | -2.69% | -5.61% |
| Year 1 | -6.31% | -8.18% | -4.94% | -5.83% | -5.74% | -5.74% | -5.74% | -5.74% | -5.74% | -5.74% | -5.74% | -5.74% |

| |
|---|
| Higest Drawdown Outperforming Buy and Hold |
| Highest Drawdown less than Buy and Hold |
| Greater than the Buy and Hold |
| Equal to the Buy and Hold |

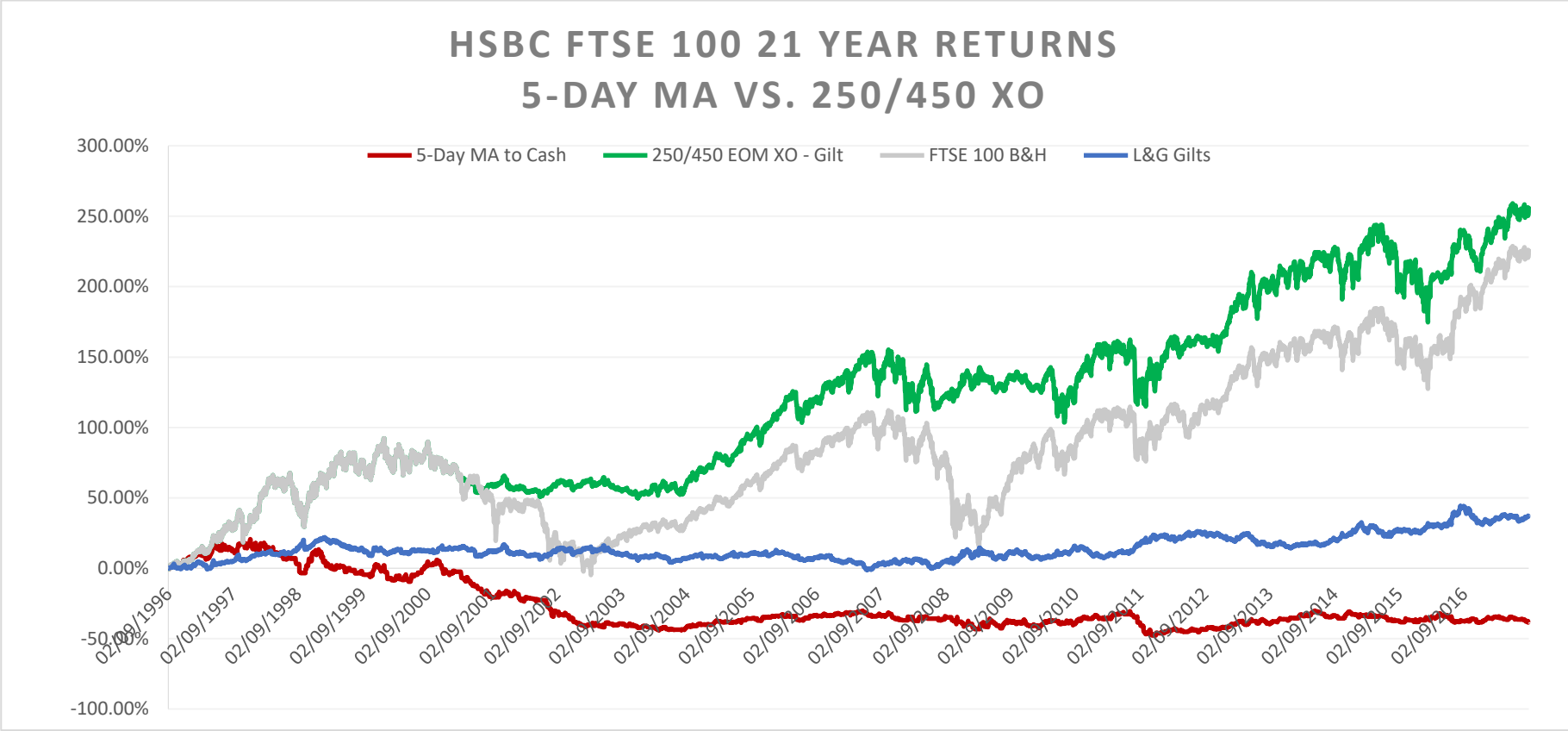
Table 2.9: This table shows the yearly drawdowns for moving average strategies which traded the end of month moving into either cash or gilts when signalled to sell out of the FTSE 100. Yellow denotes a drawdown which is equal to the buy and hold. Green denotes drawdowns which are smaller than the buy and hold. Purple denotes the smallest drawdown outperforming the buy and hold.

## Graph 2.1: HSBC FTSE 100 Daily Returns




Graph 2.1: This chart shows the daily returns of the 5-day MA to cash versus the 250/450 end of month crossover to gilts and the buy and hold for equities and gilts. The FTSE 100 had the highest volatility, followed by the crossover, the moving average and then a buy-and hold of gilts.

## Graph 2.2: HSBC FTSE 100 Cumulative 21 Year Returns




Graph 2.2: This chart shows the cumulative returns over 21 years of the 5-day MA to cash versus the 250/450 end of month crossover to gilts and the buy and hold for equities and gilts. Although there was less volatility in the 5-day moving average to cash compared to the crossover or equity buy-and-hold, there was also much less return.

# 3 Trend Following Across Different Equity Markets

## 3.1 Introduction

The investigation of trend-following strategies for the FTSE 100 over 21 years in Chapter 2, found they provide superior returns and risk-adjusted returns while significantly reducing both volatility and drawdowns over the course of whole business cycles. However, it was also found that for shorter time periods, although the strategies continued to reduce volatility, overall returns were not found to consistently outperform the buy and hold. For some of the individual years, the trend-following strategy produced large negative returns while the buy and hold produced a positive return. There were also large variations in returns depending on which trend-following duration was chosen.

The aim of this chapter was to complete a thorough study of trend following for other markets to investigate if there were different optimum trend-following strategies for different markets with the objective of eventually combining the strategies into one portfolio as discussed in chapter 4. As some markets are likely to be more efficient than others, it could be possible that different versions of the strategies would perform differently for the different markets. Previous research by Faber (2007) across US stocks, foreign stocks, bonds, real estate, and commodities found that simple moving average timing models were able to outperform a buy and hold with significantly reduced volatility, maximum drawdown and higher Sharpe ratios. Clare *et al.* (2013) similarly found a substantial improvement in risk-adjusted returns, reduced volatility and drawdowns when combining momentum with trend following across a diverse set of developed and emerging markets, commodities, government bonds and property. Clare *et al.* (2016a) also found trend-following improved returns, Sharpe ratios, maximum drawdowns, and volatilities across individual country indexes. A further review of previous trend-following literature can be found in the introduction in Chapter 1 as it pertains to the whole thesis.

The objective of this chapter was to extend the research completed in Chapter 2 in a similar way to that of Faber (2007) and Clare *et al.* (2013, 2016a) across 7 international equity index tracking unit trusts. Index tracking unit trusts were

selected as they are easily accessible, readily available, have low management fees, and high liquidity.

The specific research questions explored in this chapter were:

- Having found success over 21 years through the HSBC FTSE 100 unit trust, did the trend-following strategies for the international indexes the FTSE 250, US, Europe, Japan, Pacific and emerging markets have returns, risk-adjusted returns, volatilities and maximum drawdowns which outperformed the buy and hold for each market over 1-10 years and 15 years cumulatively?
- Does the use of UK government bonds, gilts, instead of cash as the alternative asset when not invested in equities provide comparable results for international markets as they did for the FTSE 100 as gilts may not have the same relationship to international equities as they would for the UK equity market?
- Were there different optimum strategies for different markets?

The rest of this chapter is divided into three sections: 3.2 methodology, 3.3 a review of the results of trend-following on each of the individual unit trusts over 15 years in an attempt to determine if there were optimum trend following strategies for each market, and 3.4 summary and conclusion.

## 3.2 Methodology

Following the methodology used in Chapter 2 and from Faber (2007) and Clare *et al.* (2013, 2016a), this chapter studies moving averages and crossovers across several different equity markets. Instead of using indices, this thesis utilises unit trusts which are available for purchase by retail investors. Unit trusts are created and redeemed once a day. The unit trusts chosen were mainly HSBC unit trusts because their passive index funds had the longest amount of historical data for a clean share class from a well-known fund provider for each of the international markets which were included. The funds chosen were therefore the HSBC FTSE 100 index, HSBC FTSE 250 index, HSBC America index, HSBC European index, HSBC Japan index, HSBC Pacific-ex Japan index, and Blackrock Emerging Markets

index[1]. If another provider would have had a clean share class with a similar length of historical data, this could have been used instead. As this thesis has mainly used passive tracking index funds, the selection of a similar fund from any well-known fund provider would have had comparable results as one of the main statistics often used to differentiate one passive fund from another is tracking error, how close the passive fund is to the underlying index it is tracking. The selection of mainly HSBC funds over any other provider would therefore have been expected to have little impact. The most important concern when selecting the funds was which fund had the most amount of data available. The HSBC FTSE 100 unit trust was also included in the research for this chapter for comparison purposes and because the period studied was different from the period studied in Chapter 2.

When not in equities, the alternative investment was either cash or the Legal and General All Stocks Gilt Index fund. Unlike Faber (2007) and Clare *et al.* (2013, 2016a), when the strategy used cash as the alternative investment it was not invested in a US T-bill cash proxy. As it does not accrue any interest or fees, the value of the cash investment did not change. A money market fund could also be used as an alternative investment but was not selected for this thesis as these funds typically do not provide much of a return over cash but continue to charge fees. This could be an extension for further trend-following research. Although the alternative investment has a direct impact on the success of the strategy, it did not drive any of the decision making.

The international markets were selected based on those which would typically be included in the equity-portion of a UK asset allocation.

The UK Treasury Bill 3-month tender was used for the risk-free rate required for the Sharpe ratios. All prices were sourced from Datastream with 15 years as the maximum amount of data available across all indexes after the initialisation period.[2]

[1] The Blackrock Emerging Market Index is an active not passive fund. This was used because there were no other emerging market unit trust funds which dated back to 2000.

[2] The accumulation version of many of the funds which are used only became available from the first of November 2000. The data retrieved is therefore from Nov 2000 to Oct 2017. After an initialisation period of 450 days for the maximum duration considered, the longest number of full years available across all the different unit trusts for each of the different markets studied is 15 years.

The MA/XO rules were the same as those used in Chapter 2 and are as follows:

1. MA rule: If the current price ($P_t$) was higher than the average price for the previous 'n' days ($MA_{t:t-n}$), invest in equities. Otherwise, sell equities and invest in cash or gilts.

$$P_t > MA_{t:t-n}$$

2. XO rule: If the shorter MA ($MA1_{t-n1}$) was higher than the longer MA ($MA2_{t:t-n2}$), invest in equities. Otherwise, sell equities and invest in cash or gilts.

$$MA1_{t-n1} > MA2_{t:t-n2}$$

Twelve different moving average durations were tested from 5 days to 450 days and 23 different crossover combinations were tested with the shortest duration combination of 5 days vs 10 days to the longest combination being 250 days vs 450 days. Each market was run on a yearly basis over 1-10 years and cumulatively over 1-10 years and over 15 years from September 2002 – September 2017.

The results have been completed for both daily and end of the month trade decisions. Two versions of each of the strategies that were tested in Chapter 2 have again been completed for this chapter. Again, the first version traded as soon as cash funds were verified with the most recent instruction.[3] The second version was more risk-averse: it required the buy to have the same signal two days in a row and for cash strategies, mimicked the one-day trading lag for the sale of gilts.[4]

The main comparative statistics used to judge the success of each strategy were annualised return, annualised volatility, annualised Sharpe Ratio, and maximum drawdown. Further information about these statistics can be found in

[3] When cash was used as the alternative investment, the sell or buy can be completed on Day 2 with no further action. When gilts were used, the signal on Day 2 was used regardless of what was sold on Day 2. I.e. If the signal switched from Day 1 to Day 2, the strategy invested back into the strategy as soon as possible, even if it was back into the same investment just sold. When trading on a monthly basis, this whipsawing could not occur as the trade decisions only happened once a month. This version also assumed that the second leg of the trade could be arranged the day after the first leg of the trade was agreed and the amount of cash which was available for the second trade was confirmed. This is called 'trade on trade' and depends on the platform pre-funding the second trade before the first trade has settled. The availability of this depends on the platform which is used for trading.

[4] A more in-depth description of the two versions was listed in the first Chapter.

Chapter 2. The rest of this paper reviewed the performance of each market individually.

## 3.3 Results

When looking on a cumulative basis, it would make sense to look at the longest period which would be available across all markets. For the unit trusts used in this chapter, this was 15 years after a 450-day initialisation period to cover cumulative results which started from September 2002 and ended in September 2017. Table 3.1 shows the buy and hold returns and further statistics by market on the left and the average statistics for all the trend-following strategies for each market broken down by strategy type overall on the right. The middle section of this table shows the number and percentage of each trend-following strategy type which outperforms or underperforms the buy and hold.

Throughout this thesis, both cash and gilts have been utilised when out of equities. Most previous studies have only used cash. The use of cash does allow for a cleaner measure of the strategies' ability to time the market without the addition of any extra volatility or modification of returns by the inclusion of gilts. Therefore, it was important to first consider the cash results to determine the ability of trend-following strategies to time the market while looking at the gilt results to see if their inclusion modified the performance of the strategy such as through providing any extra return.

### 3.3.1 15-Year Cumulative Returns

To gauge the success of any investment, including a trend-following strategy, the most important and most obvious statistic for investors to consider would be the strategies' returns. The results in chapter 2 which covered the FTSE 100 over 21 years displayed that the trend-following strategies outperformed the buy and hold for the majority of the strategies were 111 (68.9%) crossovers outperformed, 73 (69.5%) strategies trading into gilts outperformed, 67 (63.8%) strategies trading at the end of the month outperformed, and 137 (55.9%) strategies overall outperformed.

The returns for the trend-following strategies over the 15 years studied in this chapter did not perform as well compared to the 21 years studied in chapter 2. In fact, most of the strategies did not outperform the buy and hold and the overall average return for all cumulative trend-following strategies (Table 3.1) and for each individual strategy (Table 3.2) was far below that of each respective individual unit trust buy and hold for every market. Only the FTSE 100, the FTSE 250 and the emerging market unit trusts had any cash strategies which outperformed the buy and hold and there were only a few for each market. The unit trusts for America, Japan, Europe, and the Pacific did not have any cash trend-following strategy and duration combinations which outperformed the buy and hold with some of them having a few gilt strategies which were able to outperform.

Over the cumulative 15-year period, the market which had the most trend-following strategies outperform when investing into cash and overall strategies was the FTSE 250 with 21 out of 140 strategies trading into cash (15%) and 30 out of 105 strategies trading into gilts (28.6%) outperforming to total 51 (20.8%) of all strategies outperforming. Of these 42 (26.1%) out of 119 were crossovers and 9 out of 75 were moving averages. (Table 3.1) These results, for the best market studied, was less than half of the percentage of outperformances found for the FTSE 100 over 21 years.

For the cumulative 15 years, this was followed by the FTSE 100 which had only 4 trend-following strategies which traded into cash (2.9% out of 140) and 27 (25.7%) strategies which traded into gilts to total 31 strategies overall outperformed (12.7%). Of the outperforming strategies, 22 were crossovers (13.7%) and 9 were moving averages (10.7%). This was again a large difference from the results from the 21 years in Chapter 2 which had just over 45% (64 out of a total 140) of all the moving averages or crossovers trading into cash outperform (Table 2.1) and almost 70% of strategies trading into gilts outperform (73 out of 105). The last market which had any cash strategies outperform was the emerging markets with only 2 cash strategies outperforming (1.4%) along with 21 gilt strategies (20%) to total only 23 strategies overall outperforming (9.4%) (9 crossovers and 14 moving averages).

Of the four markets which did not have any cash strategies outperform, there were some gilt strategies which were still able to outperform with the extra return

that gilts provided. HSBC Europe had 11 gilt strategies outperform (10.5%) overall (7 moving averages, 4 crossovers), followed by HSBC Pacific with 9 strategies which traded into gilts (8.6%) (4 moving averages and 5 crossovers) and Japan with 5 strategies which traded into gilts outperforming (4.8%) (4 crossovers and 1 moving average). The HSBC American index did not have any strategies, trading into either cash or gilts, which outperformed. (Table 3.1)

The dismal performance over 15 years compared to 21 years reveals the difference the period studied can make in the success of an investment strategy whether a buy and hold strategy or a trend-following one. These overall numbers demonstrate that trend following may work better in some markets than others and, as was shown in Chapter 2, that using gilts as the alternative investment when out of the equity markets instead of cash provided further returns with the average returns for strategies which traded into gilts always higher than the returns for the strategies which traded into cash as shown on Table 3.1.

### 3.3.2 Importance of Time Period Selected

The timing of the start of an investment is important to the overall outcome of the investment. Many of the unit trusts included in this chapter only launched in November 2000. A buy and hold investment into each of them from the 1st of November is shown in Graph 3.2 to indicate the movement of their prices (including the 450-day initiation period used to establish the trends and before any trend-following strategy investments could start). The earliest possible investment date for this chapter was at the first relative trough in values around September 2002 as shown in Graph 3.3 and these investments were based on the trends throughout the initiation period.

Without trend-following, the annualised returns from each of the unit trusts used for each market from Nov 2000 are shown in Graph 3.2 and were much lower than the annualised return from the same investments which instead started in Sept 2002 in Graph 3.3. The dramatic difference between the annualised returns is only due to the first two years of the investment, as the rest of the price changes were obviously the same and they both end at the same point. Although one would hope a longer investment would have a higher return, this is not always the case. The first

two years of negative returns shown in the investment from Nov 2000 had a lasting and great negative influence for every market's buy and hold overall final values.

The movement of prices for the HSBC FTSE 100 Index unit trust used in Chapter 2 from September 1994 – September 2017 (including the initialisation period) is shown in Graph 3.1. If it had been possible to include data before 2000 in this chapter, the clear, mainly upward trajectory of prices from 1998-2000, as demonstrated by the FTSE 100, most likely would have ensured that all trend-following strategies would have been invested before the fairly consistent downward trend signalled by the drop in market values from 2000-2002 and an early move out of equities. Including the period containing this price drop and the initiation period before, would have allowed trend-following strategies to exit well before the trough, removing most of these losses, and outperforming the buy and hold. This stabilises and smooths the returns by exiting equities at a higher level than it re-joins when the markets would have rebounded.

Using the FTSE 100 index, the only market for which there was data pre-2000 for an initiation period, investing in a 200-day moving average strategy from November 2000 and trading at the end of the month had an annualised return of 5.86%. This strategy was invested in the index for the month of November, exited equities in December, and did not invest in equities again until November 2003. This did miss some of the rebound, hence the lower annualised return than the buy and hold from Sept 2002 (7.02% Graph 3.3) but was much higher than the 3.71% annualised return over the same period from November 2000.

While investing from 1996 in the FTSE100 in Chapter 2, the relative losses of the buy and hold strategy from 1999-2002 and in 2007-2008 were substantial compared to the initial equity investment and then early exit from equities of the trend-following strategies. Even when the re-entry to equity markets was delayed by longer term moving average and crossover durations, the trend-following strategies were still able to make significant surplus returns. The outperformance of these returns was then carried forward and acted as a buffer against any unfavourable short-term decisions.

The data across all market funds used in this chapter started in 2000 but the strategies were unable to invest until 2002 after the initiation period which also

coincided with market prices at relatively low values as shown in Graphs 3.1 and 3.2. After the trough in 2002, the general trajectory of the markets was upwards, with drops of varying severity from 2007, 2011 and again in 2014. As this chapter's investments started just as the fund prices were near the bottom and rebounding, the best that the trend-following strategies could do was match the market, but with a disadvantaged delay to re-entry depending on the length of the trend-following duration.

This delay to entry at the bottom of a strong upward rebounding market is analogous to allowing a race competitor (the buy and hold strategy) a large early start. The subsequent trend-following competitors can only, at best, ever run as fast as the first, making it impossible to catch up with the starting athlete. Only the passage of time, i.e., the duration of the moving average or crossover, will allow the trend-following competitor to start the race and enter the markets. What can make the difference to the trend-following athlete would be the number of regressions the original competitor made (drops in the market allowing trend-following to catch up) and the distance which was run or the length of time over which the study was completed. If the run were a marathon and not a sprint, more market drops would occur, and there would be more opportunities for the trend-following strategy to catch up to the buy and hold – a similar analogy to the tortoise and the hare. Longer marathon-like studies such as the over 100 years studied by Hurst, Ooi and Pedersen (2017) and Faber (2007) both show favourable results in terms of returns to trend-following strategies.

On the other hand, if the research period started before the trough, the trend-following strategy would be the competitor given a head start by staying relatively still as the first competitor would start in the wrong direction and must turn around and catch up. Over business cycles, the trend-following athlete would most likely continue to lead. This has been shown in the overwhelmingly positive results for trend-following in Chapter 2 and even by the shorter cumulative time frame of the 10-year results in this chapter starting in 2007 until 2017. Table 3.4 shows the total number of cumulative outperformances from 1 to 10 years and over 15 years for all the different trend-following strategies and durations across all markets. The time periods all started in Sept of the relevant year and ended in Sept 2017. The 10-year period, Sept 2007-2017, had the most outperformances with 360 strategies

outperforming across all strategies and markets. Even if the trend-following strategy started only a few months before the tough, such as in the 9-year cumulative results from September 2008 - 2017, the trend-following strategies were still relatively adept at outperforming the buy and hold with 302 strategies across all markets outperforming.

Although the underlying price movements at the start of an investment have a large impact on the ability of a trend-following strategy to outperform, the inevitable drawdowns will contribute to the success of some of the strategies even when given a disadvantageous start. Over the whole 15 years covered in this study, the falls in prices during 2007-2009 contributed to the success of some of the trend-following strategies and their durations. The markets which had the largest drops in values during 2007-2009 were the emerging markets, the Pacific and to some extent the FTSE 250, Europe, and the FTSE 100. This allowed some of the trend-following strategies and durations, especially when including gilts, an opportunity to outperform for some of the markets. For many of the strategies this outperformance during the down periods of 2007-2009 was not large enough to insulate them from both the delayed start in 2002 and other mistimed losses relative to the buy and hold.

Short-term drops in values, especially when combined with general upward markets, are difficult for trend-following strategies to outperform. Short durations which might catch some of these drops in values may find that they whipsaw too frequently at other times. Longer duration strategies may mistime the drop completely and instead register the drop to come out of equity markets when the values are at a low and rebounding while also delaying the re-entry into the market. This would incorrectly time both the exit and the re-entry, reducing the advantage found from exiting equities early and the gains to be found from the rebound in values. For most short-term drops in values, trend following signals which are long enough to avoid being enticed into the foray would be best.

Overall, there are two conclusions which can be drawn regarding the study of the cumulative 15-year results as compared to the results from other time periods. The first is that the timing of the start of a study or the start of an investment makes a significant difference to the relative success of any strategy's returns including a trend-following strategy. Starting at the bottom of the market, as with the 15 years

studied in this chapter and the trend-following delay based on the duration of the strategy studied, renders it much more difficult for the trend-following strategy to outperform the buy and hold on the rebound. While starting around the top of the market just before a drop, as in the 10 and 9 years studied, it renders it much more likely to outperform the buy and hold. The second conclusion is that the longer the study the greater the number of whole business cycles and recessions there will be within the period to provide trend-following strategies with opportunities to outperform and the lesser the importance of short-term drops and unfavourable short-term decisions.

For the 15 years studied in this chapter, starting at the relative trough of market prices might not be long enough for the majority of the trend-following strategies' returns to 'outrun' a buy and hold strategy, but other statistics can also matter to investors such as volatility, maximum drawdown, and risk adjusted returns through Sharpe ratios. Even though the recession in 2007 and 2008 was not as great, sustained, or advantageous to trend-following strategies as the one in 2000-2002, which are not included in this study, some of the more 'successful' trend-following strategies were still able to outperform over the 15 years. Their success depended on the duration and strategy chosen, showing that some of the strategies could make it through tough times for a trend-following strategy.

### 3.3.3 Crossovers or Moving Averages, Trading Daily or Monthly?

#### 3.3.3.1 15-Year Returns for Strategies Trading into Cash: Strategy by Market

Given the variation in the returns and the ability of the different strategies to outperform, it is important to see what patterns exist amongst the different strategy types. The most common trend-following strategy is the 200-day moving average as used by academics and professionals alike. Although this does appear to perform well for most markets, it was worth reviewing whether a moving average or crossover strategy was more likely to have better returns and if trading at the end of the month or daily was more advantageous. It is unlikely that in every given time that one strategy and duration will typically perform the best. It was therefore important to see which strategy type had the most breadth of relatively 'successful' durations.

FTSE 100 Index

Of the four FTSE 100 unit trust strategies which outperformed the 7.02% buy and hold return, two were end of month moving averages version 1, one was a daily crossover version 1 and one was an end of month crossover version 2 (Table 3.2) The strategies which were able to outperform were the monthly traded 150 and 200-day moving averages version 1 with annualised returns of 7.33% and 7.63% respectively, the daily traded 50/150-day crossover version 1 with a return of 7.04%, and the monthly traded 150/350-day crossover version 2 with a return of 7.07%. (Table 3.3) When looking at the average strategy statistics on Table 3.2 and the individual returns on Table 3.3, moving averages trading into cash at the end of the month almost always had higher returns than trading daily with the average return for end of month moving averages of 5.01% compared to the average return for daily moving averages of 3.24%. Daily crossovers had much higher returns than daily moving averages with an average return of 4.80%. End of month crossovers had the highest average returns for any strategy with an average of 5.43% even though the overall highest return duration/strategy combination was trading at the end of the month with a 200-day moving average. Overall, end of month trading was the most important determinant of average results with the end of month crossovers having the highest average return.

FTSE 250 Index

The FTSE 250 had the highest number of cash outperformances amongst all the markets. Out of 140 different cash durations and strategies, the FTSE 250 had 21 outperformances and almost all were crossovers. There was an equal number of 10 daily and 10 monthly crossovers which outperformed the buy and hold annualised return of 11.88% with a range of returns from 11.89% for the 5/200 daily crossover trading to cash to 13.31% for the 50/200 end of month cash crossover. (Table 3.3) The crossovers which outperformed were the 50/200, 5/200, 20/200 and 100/200 for both version 1 and 2 with both daily and monthly trading, plus the 100/250 trading daily and the 50/150 trading monthly again for both version 1 and 2. Only one moving average outperformed and it was the popular 200-day moving average

(version 1) trading at the end of the month with a return of 11.96%. Trading using crossovers had higher returns than moving averages with both end of month and daily crossovers having higher average returns (10.2% and 9.81%) than end of month or daily moving averages (9.53% and 8.72%). (Table 3.2) The overall average annualised return for all crossovers was 10.01% versus an average of 9.13% for all the moving averages. Crossovers trading at the end of the month had the highest overall average return like the FTSE 250.

Emerging Market Index

The emerging market unit trust only had two strategies which traded into cash which outperformed the 12.02% annualised return of the buy and hold: the surprisingly short 25-day daily moving average version 1 with a return of 12.74% and the 100-day moving average version 1 trading at the end of the month with a return of 12.14%. (Table 3.3) Unusually, emerging market trend-following strategies did not have any crossovers which outperformed. The overall annualised average crossover return was only 6.67% compared to a 9.95% average return for moving averages. Trading at the end of the month still slightly outperformed trading daily for moving averages, but the opposite was true for crossovers. The industry standard, the 200-day moving average to cash strategy in emerging markets only outperformed once and that was with the inclusion of gilts and trading at the end of the month. It is notable that the two 'successful' emerging market strategies trading into cash when out of equities did not include crossovers or medium/longer durations which moderate trend-following signals and slow down trading. This might suggest that emerging markets require a trend-following strategy that is different from other more established markets and favours quicker reacting moving averages to crossovers.

American Index

Although the other markets did not outperform their buy and hold counterparts, it is still relevant to discuss the best performing cash trend-following strategies for each of these markets over the 15 years. Although none of the trend-following strategies for the American unit trust outperformed the 9.20% return of the

buy and hold, the best strategies were crossovers with both daily and end of month crossovers having higher average returns (6.24%, 6.95% respectively) than daily and end of month moving averages (4.22% and 5.29% respectively). In both cases end of month strategies outperformed daily strategies and crossovers outperformed moving averages. The daily strategies were impacted by some extremely low, and in some cases negative, returns when using shorter durations most likely caused by whipsawing when combined with the relatively high volatility. When trading once a month, the likelihood of whipsawing with shorter durations diminished, leaving higher overall (and zero negative) returns. It is clear when looking at the individual duration returns on Table 3.3 that the daily moving averages on the whole underperformed the end of month moving averages, but this distinction was not as clear with crossovers when dismissing the shortest durations. When removing these from the calculation and only calculating the average returns for both versions of daily and end of month crossovers from 50/150 to 250/450, the average cash crossover returns still favoured end of month trading to daily trading, but the discrepancy was not as great with daily crossovers having an average of 7.65% to 7.77% for monthly trading. Also, depending on the duration selected, at times the daily versions of the crossovers outperformed the monthly versions and vice versa. In fact, the highest cash strategy return was for the 150/400 daily crossover, version 2, with a return of 8.85%. When crossovers were used for the American market, they appeared to curb the extremes of trading which moving averages experience regardless of whether daily or monthly trading was utilised, and crossovers consistently outperformed moving averages.

Japan Index

Again, none of the trend-following strategies was able to outperform the 6.39% return of the Japanese buy and hold. The Japanese trend-following strategies trading at the end of month outperformed trading daily with end of month moving averages outperforming end of month crossovers (Table 3.2). End of month moving averages had an average annualised return of 4.44% compared to daily moving averages with a return of just 1.91%. End of month crossovers had an average return of 3.87% and daily crossovers had an average return of 3.21%. The use of end of

month trading appeared to reduce whipsawing more than the move to crossovers, but all trend-following strategies helped to reduce the impact of the high amount of volatility. It is interesting to note that end of month moving averages outperformed end of month crossovers. The highest overall cash return was the 100/400 end of month crossover version 1 with a return of 6.35%. As both sides of the crossover are so long, they mainly signalled to stay in the equity market with only 7 transactions over the entire 15 years. This was a much smaller number than the 93 transactions completed by the highest returning moving average strategy, the relatively short 25-day end of month moving average version 1, which had a return of 5.65%.

European Index

With volatility and maximum drawdown percentages similar to Japan, Europe also seemed to have a similar pattern as Japan with their 'successful' strategies trading at the end of the month had higher returns than trading daily with end of month moving averages outperforming end of month crossovers with an annualised return of 6.45% to 6.04% respectively. Daily crossovers outperformed daily moving averages with an average return of 5.69% to 5.31% respectively. (Table 3.2) With the large amount of volatility, trading only at the end of the month helped to reduce whipsawing with all end of month strategies trading to cash outperforming the daily strategies. The end of month moving averages reacted faster than the crossovers and had the highest average returns. The highest return overall was the daily 250-day moving average version 2 with a return of 8.63% followed by a 50v100 end of month crossover version 2 with a return of 8.16%. (Table 3.3)

Pacific Index

The Pacific unit trust moved similarly to emerging markets as shown in Graphs 3.2 and 3.3 and had a similar successful trend-following pattern. Moving averages trading into cash outperformed crossovers with daily trading outperforming end of month trading. Moving averages had an average annualised return of 8.45% daily and 8.18% trading monthly. The daily crossover's average annualised was 6.78%, with end of month crossovers having a relatively close average return of

6.73%. Interestingly, extremely long and extremely short monthly crossovers performed the worst out of all cash strategies. Most of the daily and end of month strategies with medium duration crossovers performed well with some daily versions outperforming monthly versions and vice versa depending on the duration. Although the highest overall cash return was the 50/100 end of month crossover version 1 with a return of 10.46%, there was a larger range of cash end of month moving averages with returns over 9% than any other cash strategy type with 6 out of the 12 moving averages tested having an annualised return over 9% and with one with a return of 8.97%. The only reason the end of month moving average had a lower overall return was due to the 25- and 50-day end of month moving averages returning 4.85% and 5.9% much lower than any of the moving averages.

Different factors appear to be decisive for each of the markets in determining the highest average returns. Trading at the end of the month seems to have been the most important factor as it had the highest average returns for the FTSE 100, followed by using crossovers. For the FTSE 250 and America, crossovers had the highest average returns with end of month trading dominating for both crossovers and moving averages. For Japan and Europe, end of month trading had the highest returns, but end of month moving averages outperformed crossovers, and daily crossovers outperformed daily moving averages, with end of month moving averages having the highest average return. Moving averages appeared to be the most important determinant for returns for the emerging markets and the Pacific. For emerging markets, end of month moving averages outperformed daily moving averages and for the Pacific daily moving averages outperformed monthly moving averages but, in both cases, daily crossovers outperformed monthly crossovers. Most of the markets would appear to have the highest average returns when trading at the end of the month with the FTSE 100, FTSE 250 and America having the highest returns for crossovers while Japan, emerging markets and Europe had the highest with moving averages. The Pacific had the highest average return when trading a moving average daily.

One caveat to this conclusion is that the averages included some extremely short or long durations and daily strategies which would never have been chosen as the strategy for use for some of the selected markets. Averaging all the cash strategies returns for each market across all versions, durations and types of strategy

created an overall annualised return at least a few percentage points less than the buy and hold return for every market. Strategies such as the 5-, 10-and 25-day moving averages, or the 5/10-day crossovers brought down the average returns for the strategy type and the trend-following strategy as a whole for most markets. As shown in Chapter 2, the 5-day moving average for the FTSE 100 frequently whipsawed and was likely to lose money over time. Given the conclusions across all of the markets above and from Chapter 2's conclusions from the FTSE 100, there seems to be a sweet spot in terms of durations and an advantage to trading at the end of month for most markets. Using these optimum duration/strategy combinations could increase the percentage of 'success' and their average annualised returns.

#### 3.3.3.2 15-Year Returns for Strategies Trading into Gilts: Strategy by Market

The results so far appear to show that depending on the period selected 'pure' trend-following strategies trading into cash were not particularly adept at timing the market for returns which outperformed the buy and hold. In an attempt to improve the performance of the trend-following strategies' returns, gilts were also tested in place of cash when out of equity markets. The inclusion of gilts to the trend-following strategies meant that gilts price movements would impact the returns and other statistics without having any bearing on the strategy decisions themselves. As well as providing extra returns, gilts also obviously added more risk than the cash non-investment used in this chapter impacting other relevant statistics such as the volatility, Sharpe ratio and maximum drawdowns. Although gilts are riskier than the 'cash' alternative, they are less risky than the original buy and hold equity investment. Therefore, the addition of gilts to a trend-following strategy would theoretically make it less risky than an asset allocation only buy and hold investment strategy.

Four markets, the Pacific, Europe, Japan, and America, did not have any cash strategies that outperformed the maximum 15-years studied in this chapter. When including gilts to those strategies, all but America had several gilt strategies outperform and all, including America, had higher average returns across the gilt strategies compared to the cash strategies as shown in Table 3.1 and Table 3.2

demonstrating that the addition of gilts did in fact increase the overall returns of the strategies.

It is also important to note that the second versions of the strategies trading into cash were created to mimic the trading delay that occurs when purchasing or selling gilts instead of moving directly to cash when selling or buying equities. This extra day delay for both daily strategies trading into cash or gilts also included a check to ensure that the same signal was sent two days in a row to reduce whipsawing before purchasing either equities or gilts. When only trading at the end of the month, the two versions sent identical signals as the strategy only looked for the trade decision on the last business day of the month. Therefore, the second version of the end of month strategies which traded into gilts was removed as it was redundant.

As end of month trading was often favourable to daily trading in most markets and there were twice as many end of month strategies trading into cash than there were strategies trading into gilts included, there was therefore a bias in the larger number of times a successful end of month strategy trading to cash could be counted compared to end of month strategies trading into gilts. Typically, the same durations were successful in both versions and these strategies would then be counted twice. Even with this bias of double counting successful duration/strategy combinations trading into cash, the addition of gilts added so much extra return, that the overall number of successful strategies was still greatly improved when using gilts. The number of strategies which outperformed is shown on Table 3.1 and Table 3.2. The average statistics across all durations for each strategy, including returns for strategies trading into gilts using both moving averages and crossovers are shown in Table 3.2. The average statistics for all crossovers and moving averages when using gilts only includes the daily version 1 and only the end of month versions so there was not a bias towards daily trading which would be caused by including both daily versions and only one end of month version.

FTSE 250 Index

The markets which had cash returns outperform the buy and hold, the FTSE 100, FTSE 250 and the emerging markets, also had the largest number of strategies

which traded into gilts outperform. The FTSE 250 had the most strategies trading into both cash and gilt outperform in terms of returns of all the markets over 15 years. The inclusion of gilts increased the number of strategies outperforming to 30 from 21 when using cash and increased the average overall return from 9.71% with cash to 10.44% with gilts. As the FTSE 250 had the largest number of trend-following strategies outperform and the second highest buy and hold return, it is unsurprising that it also had by far the highest average return for trend-following strategies trading into both cash and gilt across all markets. (Table 3.1)

Similar to the strategies trading into cash for the FTSE 250, strategies trading into gilts outperformed most often when using crossovers instead of moving averages and in both instances end of month trading outperformed daily trading. Daily gilt moving averages had an average return of 9.13% and only outperformed 3 times amongst both versions as shown in Table 3.2. End of month moving averages outperformed 5 times with an average return of 10.25%. Each daily crossover version outperformed 7 times with an average return of 10.77% and end of month crossovers outperformed the most, 8 times, with the highest average return of 11.23% for all strategies and for all markets. Crossovers also had the highest overall single strategy return. The highest strategy's return when trading into cash was 13.31% for the 50/200 end of month crossover. When using gilts instead of cash, the 50/200 end of month crossover again had the highest return (14.56%) for end of month crossovers using gilts, but the highest overall return when using gilts was 15.04% for the 150/350 daily crossover trading into gilts (Table 3.3). On a like for like strategy/duration basis, at times trading daily provided a higher return than trading monthly and vice versa. It seems that with crossovers the difference between daily and monthly trading was not as great as with moving averages.

FTSE 100 Index

Over 21 years, the FTSE 100 had an impressive 69.5% (73 out of 105) of moving averages and crossovers trading to gilts outperform across all the strategies and durations over 21 years (Table 1.1). This dropped to 25.7% (27 out of 105) of the strategies trading into gilts outperforming over 15 years, much greater than the only 4 cash strategies which outperformed. The average returns when trading to gilts

was 5.45%, higher than when trading to cash which had an overall average return of 4.78% (Table 3.1). Like the strategies trading into cash, trading at the end of the month continued to be the most important factor for strategies which used gilts (Table 3.2). Only one daily moving average, the 150-day (version 2), outperformed with a return of 7.12%, while 5 daily crossovers for each version outperformed. Daily moving averages using gilts had the lowest return of all the FTSE 100 strategies with an average of 3.59% (Table 3.2). Daily crossovers had an average return of 5.8% (1% higher than the equivalent cash daily crossover average return). Half (6 out of 12) of the end of month moving average strategies using gilts of varying durations outperformed with an average return of 5.99% and end of month crossovers were the highest performing strategy overall with an average return of 6.41%. The highest return of all strategies and durations for the FTSE 100 was the 150-day end of month moving average to gilts with a return of 9.13%.

Emerging Markets Index

The emerging markets only had 2 trend-following strategies using cash outperform (out of 140, 1.4%), but using gilts had a much larger impact with 21 versions (20%) outperforming the buy and hold. All strategies using gilts had an average return of 8.86% more than 1% higher than the average for strategies using cash of 7.80% (Table 3.1). Similar to the results for strategies using cash, trading using moving averages outperformed more often than using crossovers, had higher average strategy returns (Table 3.2), and was more consistent. Daily moving averages using gilts outperformed 7 times between the two versions with an average of 10.38% while end of month moving averages outperformed 5 times with only one version, the most often out of any of the emerging market strategies. End of month moving average strategies trading to gilts had the highest average return (11.13%) of all strategies as they did with trading to cash. Crossovers did not perform as well, with only 3 outperformances for each gilt version. Daily crossovers using gilts had a slightly higher average return (7.95%) than end of month crossovers (7.92%), but this was still much lower than the average returns for moving averages. The highest overall strategy return when using cash was the unusually short 25-day daily moving average version 1 which did not outperform for any other version (including the

daily moving average version 2 or when using gilts) or any other market. The strategy trading into gilts with the best performing return was for the 100-day end of month moving average, again a relatively short duration when compared to other markets. (Table 3.3)

Pacific Index

Trend-following strategies trading into cash for the Pacific market had zero outperformances and an average annualised return of 7.29%. Strategies trading into gilts were able to outperform 9 times with an average annualised return of 8.44% (Table 3.1). Similar to the successful strategies for emerging markets and for the strategies using cash for the Pacific market, the most important factor to returns for strategies using gilts for this period appears to be trading using moving averages as opposed to crossovers (Table 3.2). Although there were more crossovers trading into gilts which outperformed (5) than moving averages (4), the average returns for moving averages using gilts (9.32%) were higher than the average returns for crossovers using gilts (8.05%) similar to the results when trading into cash (Table 3.2). Moving averages were also more consistent with 12.5% outperforming compared to only 8.7% of crossovers. Unlike the versions of the strategies which used cash for the Pacific market, trading at the end of the month when using gilts had higher returns for both moving averages and crossovers. End of month moving average strategies using gilts had the highest average return for any of the Pacific strategies (9.36%) followed by the daily moving average strategy with an average return of 9.21%. This was much higher than when using gilts as the crossover strategy's average end of month return of 8.13% or the daily return of 7.97%. Although moving averages were more consistent, the highest overall strategy return when using gilts was the daily traded 50/100 crossover with a return of 12.96% for both versions followed by the same duration trading monthly (12.31%), outperforming the 11.21% buy and hold annualised return (Table 3.3). This duration and strategy combination also had the highest return when trading into cash.

The Pacific market was the one exception where there was a difference between the strategies trading into cash and gilts which had the highest average returns. The strategy using cash which had the highest average return was the daily

moving average strategy while the strategy using gilts with the highest average return was the end of month moving average. The difference appears to be that some of the end of month returns were buoyed by the addition of gilts reducing the impact of the relative loss of return due to the timing which was more pronounced in the versions using cash. In fact, the difference between the two versions was 0.27 for strategies using cash and only 0.15 for the versions using gilts. Given the wide variations across the different durations (Table 3.3), the inclusion of some of the ill-timed shorter or much longer durations would have had a larger impact than the strategy type.

European Index

Europe also did not have any strategies which traded into cash outperform but had 11 strategies which traded into gilts outperform with higher annualised returns than the 9.18% buy and hold return. The average annualised strategy return when using gilts was 6.96%, much higher than the average strategy return when using cash of 5.87%. (Table 3.1) Similarly to the returns for strategies' when using cash, the strategies when using gilts for Europe trading at the end of the month outperformed daily trading with moving averages outperforming more (7) often than crossovers (3). (Table 3.2) End of month moving averages using gilts not only had the largest number of outperformances, but they also had the highest average return with 7.86%. End of month crossovers using gilts had an average return of 7.23%. Daily crossovers using gilts, again like their equivalent cash strategies, had a higher average return than the daily moving averages using gilts with an average return of 6.87% to 6.45%. The overall highest strategy for Europe when trading to gilts, as well as to cash, was the daily traded 250-day moving average with an annualised return of 10.2% (version 2) and 10.18% (version 1). This was followed closely by the 250-day moving average trading instead at the end of month to gilts with a return of 10%. End of month moving averages when using gilts had the most consistent returns with 4 out of 12 moving average durations outperforming the buy and hold (33.33%).

Japanese Index

Japan had five strategies using gilts outperform the 6.39% annualised buy and hold return. The average annualised return increased with the use of gilts from 3.41% for strategies trading into cash to 3.87% for strategies trading into gilts. (Table 3.1) Similar to the strategy results when using cash, for strategies using gilts trading at the end of the month had the highest average returns with end of month moving averages (4.91%) having the highest return, followed by end of month crossovers (4.71%), daily crossovers (3.86%) and daily moving averages (2.56%). (Table 3.2) Even though end of month moving averages had a higher average return, only one moving average strategy using gilts, a 200-day end of month moving average, outperformed the buy and hold with a return of 6.42%. (Table 3.3) Instead, crossovers when using gilts outperformed the most often with both daily versions and the end of month version of the 100/400 crossover outperforming with returns of 6.63% (for both daily versions) and 7.02% (end of month). The Japanese market had so few strategies outperform the buy and hold, that it was easier to discount the use of daily moving averages than to select a specific strategy, but an end of month strategy was most appealing.

American Index

The trend-following strategies for the American market continued to be dominated by the buy and hold with none of the trend-following strategies, even when including gilts, outperforming the buy and hold return of 9.20%. The inclusion of gilts increased the overall annualised average returns for all strategies and durations from 5.96% for strategies using cash to 6.12% for strategies using gilts. (Table 3.1) The pattern of best performing strategies was the same for strategies using gilts as for those using cash, with crossovers and then trading at month end having the highest average returns. End of month crossovers had the highest average annualised returns for any strategy with 7.34%, followed by daily crossovers with a return of 6.62%. Moving averages had much lower average returns of 5.73% and 4.22% for end of month and daily trading, respectively. (Table 3.2) The highest return for strategies using cash was the daily traded 150/400 moving average version 2 (8.85%). (Table 3.3) With the addition of gilts, this crossover continued to have the

highest daily return (8.87%), but the highest return for all the trend-following strategies for the American unit trust was the 50/150 end of month crossover trading into gilts with a return of 9.12%. Due to the strength of the underlying US equity market, for the most part the more often the strategies were in the American unit trust, the better the strategy performed. Strategies which slowed down trading – such as crossovers (especially long duration crossovers) and end of month trading had higher average returns.

Moving to gilts when out of equity markets provided extra return than strategies which moved to cash, allowing more strategies to outperform the buy and hold and for larger average returns over all trend-following strategies and durations. For most markets, the addition of gilts did not change the strategies which had the highest returns for each market. End of month crossovers had the highest average returns and typically the highest number of returns which outperformed when using strategies which traded into both cash and gilts for the FTSE 100, FTSE 250 and the American market. End of month moving averages had the highest number of returns which outperformed and the highest averages for Europe and the emerging markets for strategies which traded into both cash and gilts. After not having any strategies which traded into cash outperform the buy and hold, both Japan and the Pacific had one more end of month crossover which traded into gilts outperform than moving averages but strategies which traded into both cash and gilts had higher average returns with end of month moving averages than with end of month crossovers. This may have been because there were one-off strategies which outperformed and a slim range of strategies which had relatively higher returns. There were also more crossovers durations than moving averages durations tested and many had poor or mediocre performance.

Again, there is the same limitation when looking at the versions of the trend-following strategies which traded into gilts as there was when reviewing the versions of the strategies which traded into cash regarding averaging all the returns for each strategy. The average returns for strategies using gilts included durations which would not have been selected for a particular market and therefore brought down the average of the strategy and trend-following overall. Averaging across strategy types is a rough measure to determine if there was one clear strategy which outperformed another. From the results thus far, it appears that the addition of gilts did not

typically change the best performing strategy from that which was best for the 'cleaner' strategies which traded into cash, but it did increase returns significantly. It would also appear that there was not one strategy which would fit every market. Could it therefore be inferred that these 'winning' strategies had the best timing ability over this period for each individual market, and would the exclusion of inopportune durations impact this assessment?

#### 3.3.3.3 15-Year Returns: Duration

**Is there a Holy Grail of a Winning Duration/Strategy Combination?**

While averaging all the returns for a particular strategy type, including those durations which obviously appear to be unsuitable for a market, could indicate which strategy may be more successful than another, how would one make the jump from a 'winning' strategy type to which duration/strategy combination to follow? Is it sensible or possible to choose a single duration/strategy combination, such as the often cited and used 200-day moving average, which would be acceptable and profitable across all markets?

When reviewing the returns for the 'pure' trend-following strategy which traded into cash on Table 3.3, only one market, the FTSE 100, had the highest return across moving averages and crossovers when using a 200-day moving average and only two had the cash 200-day moving average outperform the buy and hold, the FTSE 100 and 250. Every other market had crossovers or other durations which had higher cash strategy returns than the 200-day moving average. When including gilts instead of cash into the strategy when out of equity markets, none of the markets had the highest return with the 200-day moving average, but most markets, except America and the Pacific, had at least one version of the 200-day moving average trading into gilts outperform the buy and hold. A 200-day moving average trend-following strategy therefore may not always provide the best returns but may provide adequate downside protection and returns across markets. Still, given the average results discussed previously, it seems that a crossover could be a better fit for some of the markets than moving averages and that instead of choosing one duration to use across all markets, it might be better to choose an optimal duration/strategy combination per market.

So, how would one narrow the duration field? When reviewing the returns in Table 3.3, there were clear durations which performed badly for each market and could easily be removed. For most markets these were the extremely short durations such as the 5, 10, and 25-day moving averages and 5/10, 10/20-day crossover durations which whipsawed in and out too frequently and in some instances led to negative returns. In many markets, the extremely long durations also did not perform as well, incorrectly timing the market to delay both the exit and entry to the equity markets.

Removing some of these worst offenders still leads to a large variation of durations and their returns. It would be obvious and easy to select the one duration/strategy combination which used cash (so it would be uninfluenced by the extra returns from gilts) and provided the highest return. But, in other years or time frames this single duration might not be the most efficient and, even worse, might be an anomaly with a 'one-off' high return purely by luck or coincidence.

Durations, even those that seem fairly close to one another, can have varied returns such as the difference for the FTSE 100 between the 100-day daily traded moving average with a return of 3.13% and the 150-day daily traded moving average which had a return of 5.29%. Even though these large variations of returns from durations which were similar exist, these returns were still more likely to have closer returns results than those durations which were much shorter or longer. Again, using the FTSE 100 trading daily, the 5-day moving average had an annualised return of -1.73% and the 200-day moving average had an annualised return of 5.83%. The 200-day moving average's return was much closer to the 150-day return and even the 100-day return than the 5-day return.

There also appear to be ranges of durations for the strategies which performed similarly well. The difference between the returns from the 100-day moving average to the 150-day moving average was a relatively steep jump. As the durations became longer for the FTSE 100, the rest of the returns were much more similar from the 150-day moving average on. Even the 450-day moving average had a return of 4.18%, much closer to the 150-day moving average return than the 100-day moving average return.

It could therefore be useful to narrow down a range of durations to see if a duration/strategy chosen was likely to be close to others which performed similarly well. This could also provide more confidence in a selected duration if it was part of a range of consistent, relatively high returning, 'successful' durations/strategy combinations. Table 3.4 shows the averages of 5 consecutive durations by market for moving averages and crossovers trading into both cash and gilts. This allows for some breadth to incorrectly 'guess' the exact correct duration and allows a narrower, more accurate approach to defining the optimal strategy/duration combination than averaging all the results as was completed previously.

From the heat maps shown in Table 3.4, it is evident there are sections of the 5-duration averages which have high, low, and mediocre returns for each market. When reviewing the results for moving averages for most markets, trading at the end of month had a clear advantage over trading daily for both gilts and cash. The moving average durations which performed the best for the FTSE 100, FTSE 250, America, and Europe were the medium to long durations, from the 100 to 300-day average to the 250 to 450-day average durations. For the emerging markets and the Pacific, the shortest and longest moving averages did not perform well, but the ranges from 50 to 250 (emerging markets) and 100 to 300 (Pacific) to the 200 to 400-day range of average durations had the highest returns. The Japanese market was the clear outlier with all the end of month moving average duration averages having relatively high returns, especially compared to the daily moving averages. In all cases, when looking at moving averages alone, the optimal durations were somewhere in the middle of the duration range trading at the end of month, which would fit a narrative around selecting a 200-day moving average trading monthly.

When reviewing crossovers, there were again clear ranges which performed well. For the FTSE 100, FTSE 250, and the European markets, there were not only clear crossover duration combinations which were too short, but also some that were too long, unlike the duration results from moving averages. The American and Japanese unit trusts had higher returns with longer durations and trading monthly while the lowest returns were the shortest durations and when moving to daily trading. The emerging markets and the Pacific ranges had the highest returns with shorter durations and the lowest returns with the longest crossovers, the opposite of the American and Japanese markets, even when considering the shortest durations

typically whipsaw. The best durations for the Pacific and emerging markets were relatively short but still moderate length durations.

#### 3.3.3.4 Range of Duration Returns

It is interesting to note that the range of returns by duration between the different versions including daily and monthly trading was much more pronounced for moving averages than it was for crossovers as shown in Table 3.5. Across most markets, moderate to long duration crossovers had much less variation in returns than moving averages did as shown by the abundance of green in the table. The average range across all durations shown at the end of the rows on Table 3.5 showed that crossovers had a smaller average range of returns than moving averages for almost every market. Although one or two crossovers had an exceptionally high range of returns, such as the 10/20 for the FTSE 100 with a range of returns of 6.51% for the strategies trading into cash and 7.83% for strategies trading into gilts, the much larger incidence of medium to long crossover durations with much smaller ranges overpowered these anomalies. These one-off durations with a high range of returns therefore had a smaller influence on crossover averages than they did on moving averages. The existence of these outliers does not take away from the fact that the majority of the longer crossover durations had much smaller return ranges than moving averages. The overall average range for the FTSE 100, for example, was 2.34% and 2.53% for moving averages trading into cash and gilts respectively and only 0.96% and 0.90% for crossovers trading into cash and gilts.

The reason for this may be that as moving averages compared a one-day price to an average across a number of days, a daily version was more likely to react more quickly and potentially whipsaw whenever there were jumps in the underlying price. This increase in reaction time for a daily traded moving average compared to a monthly traded moving average also greatly increased the variation of their returns when compared to a slower reacting end of month moving average. Using moving averages for both the short and long side of the comparison (i.e., crossovers) slowed and reduced trading regardless of whether traded daily or monthly. This reduction in reaction time also appeared to minimise the difference between daily and monthly

trading. In fact, the crossover strategy with the highest return swapped between daily and monthly trading from one duration to the next.

The returns across almost all the markets when using gilts (except the FTSE 100 moving averages) had a smaller average range of returns between versions and daily and monthly trading by duration than the strategy's returns when using cash. As adding gilts increased the volatility of a strategy and the range across all durations, one might think that it would also increase the range of returns by duration, but this did not appear to be the case. It could be that the extra returns provided by gilts to the strategy also appeared to reduce the impact of any loss of revenue due to inopportune timing between daily and monthly trading when compared to being in cash. In some cases, the difference was dramatic. The average range of returns for moving averages for emerging markets was 2.52% when using cash and only 1.66% when adding gilts. Gilts may have provided extra return to the strategy when out of equities to help minimise the difference between daily and monthly trading.

Although a smaller range denotes consistency when comparing returns from daily to monthly versions, this was not the case when comparing across durations. One of the advantages of analysing strategies by 5 consecutive durations was to remove outliers which would impact the overall averages, the selection of the optimum strategy, and also impact the range of returns. As some of the smaller or larger durations were unsuccessful for certain markets and would never be selected, this would also skew the range. On the left of the average results for each market on Table 3.4 shows the range across all the duration averages by strategy. It is still interesting to note that the range across the duration averages was higher when moving to gilts across most markets. This appears to be due to the fact that using gilts in the strategy often produced the highest returns per market and therefore also increased the range. The unit trust for America was one exception to this as it surprisingly had higher average consecutive duration returns for crossovers when moving to cash than to gilts (even though the highest overall returns were found when using gilts). This therefore led the crossovers using cash to have larger like for like ranges than the crossovers using gilts. This was not the case for most of the American unit trust moving averages which still had higher returns when moving to gilts and overall a larger range in returns.

In some instances, a smaller range denoted consistency across versions by duration. For example, crossovers moderated the difference between daily and monthly trading or the different versions when compared across strategies. When looking across durations, outliers increased the range even if they were beneficial through increasing the maximum average return. The inclusion of gilts across daily and monthly versions by duration appeared to reduce the range and increased returns. While the inclusion of gilts across all durations typically increased returns, including the highest return, therefore increasing the range. Either way, the inclusion of gilts appeared to have a positive influence over most of the markets.

#### 3.3.3.5 Best Duration Range/Strategy Combination

When reviewing the best duration range and strategy averages by market on Table 3.4, there were similar patterns for the best strategy as were found originally when looking at the averages across all durations. The best return range for both the emerging markets and the Pacific was the relatively short, moderate length duration range of 100-days to 300-days using moving averages trading at the end of the month. The whole strategy average results (Table 3.2) discussed previously for emerging markets and the Pacific trading into gilts had similar moving average findings, but daily moving averages had the highest returns for Pacific strategies trading into cash. As both markets had higher returns when using trend-following strategies which moved more quickly such as moving averages instead of crossovers and short/medium durations instead of longer durations this was not too surprising. But, when narrowing down these strategies to smaller duration ranges, the poorer returns for these markets of the longer duration crossovers and moving averages were excluded and the more precise range of short/moderate durations analysed. Therefore, using moving averages at the end of the month had the highest and second highest returns for both markets.

The trend-following strategies trading into cash for the Japanese and American markets which had the highest returns were identical duration/strategy combination ranges using crossovers trading at the end of month from 100/400-days to 200/450-days. The strategies with the highest average returns when trading into gilts also had durations/strategies which were similar. For strategies which traded

into gilts for the American market, using crossovers with durations from 100/350-days to 150/450-days trading daily had the highest average return and for the Japanese market, end of month crossovers with durations from 150/350 to 200/400 had the highest average return. The strategy averages when trading into gilts discussed earlier had the highest average returns for Japan as end of month moving averages instead of crossovers and for America had end of month crossovers not daily crossovers as suggested by the narrowed consecutive duration averages (Table 3.2). Although these overall averages contradicted the narrowed duration results, the inclusion of gilts to these strategies influenced but did not drive the strategies' timing decisions or their returns. This made these results less accurate at showing the ability of a trend-following strategy or a particular duration to time the market. The strategies which traded into cash were 'pure' timing strategies when studying the successful nature of the different durations, therefore these strategies would be a better indicator of timing success than a strategy which used gilts.

For the Japanese market, end of month moving averages had the highest overall return for all strategies trading into either cash or gilts (Table 3.2). This was due to the much larger range of returns across the end of month crossovers (from 1.30% to 6.35% version 1) than the end of month moving averages (from 3.29% - 5.65% version 1) bringing the crossovers' average down (Table 3.3). End of month crossovers not only had individual returns which were much lower than any of the end of month moving averages, but they also had returns which were much higher. In this instance, narrowing the 'winning' duration strategies to a range of durations which had similar high returns made a difference to which strategy was most profitable instead of the broader unrefined analysis comparing the averages across all strategies. When looking at the individual returns for each duration (Table 3.3), there were a range of crossovers which were most profitable; the 100/400, 150/400, and 200/400-day crossovers which had returns of 6.35%, 6.02%, 5.25% respectively. This was much higher than the highest return from the end of month moving averages which had a return of 5.65% for the relatively short 25-day moving average. The end of month moving averages were more consistent in their returns across all the durations but did not have the highest range of returns. It would therefore appear that using a narrowed range of durations aided the selection of a

potentially more profitable end of month crossover instead of end of month moving averages.

The FTSE 100 and Europe had similar patterns amongst the duration range returns with the longest moving average durations having the highest average returns and the medium range crossovers having the highest returns amongst crossovers. The cash ranges with the overall highest return for both were moderate durations using end of month moving averages, from 150-days to 350-days for the FTSE 100 and 250 to 450-days for Europe (Table 3.4).

This was in line with the results found earlier for Europe as the end of month moving average strategies had the highest overall return across all durations as shown in Table 3.2. However, this was contrary to the earlier results for the FTSE 100 where end of month crossovers were found to have much higher average returns than moving averages and when adding gilts also had a much larger number of outperformances. Although there was more consistency and a smaller range of returns for the FTSE 100 amongst the majority of the end of month moving averages than there was for crossovers, half of the end of month moving average returns were less than 5.5% compared to only 28% (13 out of the 46) for end of month crossovers. This brought the overall average across all durations for moving averages down. But there was also a clear boundary of higher returns for moving averages with durations of 150-days and over. In fact, there were three end of month moving average returns over 7% compared to only one for end of month crossovers. When adding gilts, the best return range was still the 50/100 – 50/200 end of month crossover with an average return of 7.86% followed by the end of month moving average range 150-350 with an average return of 7.8%. Again highlighting, the at times minimal difference amongst end of month moving averages and crossovers. For both the FTSE 100 and Europe, trend-following strategies with a moderate response time appeared to time the market best. These were strategies with medium to long-term durations, trading at the end of the month for moving averages and medium durations for crossovers. Again, the smaller consecutive duration ranges removed the worst returns and helped to identify the highest. In this case, the duration range and strategy with the highest returns were middle of the range durations for the FTSE 100 and moderate to long durations for Europe trading using end of month moving averages.

The heat map for the FTSE 250, shows the clearest sort of rainbow effect of all the markets. (Table 3.4) The best performing duration range/strategy was the 50/150 to 100/200 end of month crossover for both cash and gilts. This was the same result as that provided by the average across all durations. The worst returns were from the quickest trend-following strategies from the top left quarter with the shortest durations and trading daily for both moving averages and crossovers. Moving across the durations on the table to moderate durations and trading at the end of the month had higher returns. This waned for crossovers as the strategies became too long and did not react to time the market effectively, but this result was not seen for moving averages.

Long duration moving averages were quicker to respond than long duration crossovers as they only compared the current price to the average return over x-days. Long duration crossovers must wait for the shorter moving average to cross over the longer moving average and when both of these durations are very long, it can greatly reduce the reaction time of the overall strategy leading to delays and potentially missing the exit and return to equities. This hindered the performance of long duration crossovers for some markets, most notably the emerging markets and the Pacific. Typically, the longer the durations were for both moving averages and crossovers, the smaller the number of transactions occurred over the period and the longer the strategy was in the equity investment. This may be one of the reasons that the American and Japanese markets both favoured the longest, slowest reacting strategy, the end of month crossover with the longest durations possible. Over the 15-years studied, these markets did not favour trend following, had the smallest number of strategies outperform the benchmark and, overall, it would have been best to be in them.

Using five consecutive durations instead of averaging all the durations per strategy was a more concise way to study the optimum duration/strategy combination while also giving confidence in selecting a single duration. These smaller ranges of durations were helpful in removing durations which did not perform well and brought down the average for the whole strategy. For most of the markets this confirmed the earlier optimum strategy results as end of month crossovers for the FTSE 250 and America and end of month moving averages for Europe and emerging markets. For a few markets, there were some slight changes

from end of month crossovers to end of month moving averages for the FTSE 100 and vice versa for Japan. For the Pacific, the optimum strategy changed from daily moving averages to end of month moving averages. In all instances, end of month trading had the highest returns with specific ranges of durations selected to help narrow down a successful strategy. For markets whose optimum strategy was an end of month moving average, using a 200-day moving average trading at the end of the month would fall into or close to their optimum durations. But, for others such as the FTSE 250, America and Japan using a crossover of an opportune duration range would have had a much higher return. This refutes that a single duration and strategy across all markets would be optimal.

Although the use of gilts did not have any impact on the decisions or timing of the trend-following strategies, they improved returns and reduced the range of the returns across strategy by duration. The addition of gilts might have slightly changed the optimum strategy by market, but as they did not influence the decisions of the strategy itself, cannot be used to confirm the ability of the strategy to time the market. The versions which traded into cash should instead be referred to in order to determine the strategy and duration selected. Even though there were some small differences between the optimum durations and strategies when using gilts, in most cases the selected duration/strategies when using cash were the same as when using gilts or the selected strategy when using cash had a return which was fairly similar to the optimum strategy selected when using gilts. Even if the selected strategy when using cash was not the highest gilt strategy, it was often in the top 3-5 highest returning strategies when using gilts and there was usually not much difference in the overall returns.

### 3.3.4 15-Year Underlying Markets

Why were trend-following strategies able to outperform for some of the markets and not others? Is there something specific about the underlying market conditions which affect this? To better understand how the underlying nature of each market impacts the ability of trend-following strategies to outperform, Table 3.7 orders each market's buy and hold statistics from highest to lowest.

There was a large amount of variation in most of these underlying market statistics. For example, there was a great difference in the range of returns from the highest to the lowest as emerging markets returned 12.01% over the 15-years, but the Japanese unit trust only returned 6.39%. The difference for Sharpe ratios was even greater from 62% for the FTSE 250 to 30.70% for Japan. Maximum drawdowns also varied greatly from -55% for emerging markets to -37% for Japan. Market volatilities also varied, but not as much as with other statistics, with the Japanese unit trust having the highest amount of volatility of 20.33% and the FTSE 250 having the least with only 16.87%.

These statistics illustrate the differences in the underlying market conditions and appear to reveal patterns in the underlying markets that suggest that some market conditions make trend-following more profitable for some markets. The three markets which had strategies which traded into cash outperform the buy and hold over the cumulative 15-years studied, the FTSE 250, FTSE 100, and emerging markets, are highlighted in Table 3.7 in light yellow. These three markets also had the most outperformances on a cumulative basis. It is important to again note that cash versions were specifically reviewed to provide a cleaner understanding of the ability of the trend-following strategy to time the market as opposed to the strategies which traded into gilts because they will not include any extra potential returns (or losses) from the gilts investment.

Three key factors in the underlying market conditions appeared to increase the ability of trend-following strategies to outperform: a large drawdown, high returns, and low volatility. Low volatility and high returns helped create clear trend-following signals and were an important factor in the ability of trend-following strategies to identify trends and create profit. But for a trend-following strategy to be able to outperform an underlying buy and hold strategy, a large drawdown was essential.

A large drawdown provides room for a trend-following strategy to exit a downward trend in the equity market, protect any accumulated return and re-enter the market at a higher level than where the equivalent buy and hold would be. The FTSE 250 and emerging markets trend-following strategies had the top two clear outperformances and were in the top three when including outperformances and

equivalent returns. The underlying conditions for both markets had maximum drawdowns of over 50%. This enabled trend-following strategies to have an obvious period to be out of the equities and the chance to outperform. Both markets also had the two highest buy and hold returns. This allowed an upward trend to be established and enabled the trend-following strategies to join in on the rebound from the large drawdowns.

On the flip side the American and Japanese indices had the smallest drawdowns and therefore did not give trend-following strategies much if any opportunity to outperform. The trend-following strategies for both of these markets had the two smallest numbers of outperformances across all of the markets. With annualised returns and Sharpe ratios at the bottom (Japan) or in the middle of the rankings (America) compared to other markets, the trends in both directions may not have been as strong or as clear as for other markets. When prices did travel upward, without a large drawdown the buy and hold strategies outperformed any trend-following strategies due to a delayed re-entry into equities.

The volatility range was not as varied as some of the other statistics, but it did appear that a market with low volatility could help trend-following strategies by creating clear signals and by reducing some of the noise which could potentially lead to whipsawing. The FTSE 100 and FTSE 250 had the lowest volatility out of all the markets and were in the top three for outperformances. While the Japanese market had the highest amount of volatility and struggled to outperform the buy and hold. Although the total range in volatilities was only 3.46%, it would make sense that smaller amounts of volatility would make trends easier to read and create cleaner signals than a market with high amounts of volatility.

For a trend-following strategy to be able to provide a positive return, there needed to be a positive return in the underlying market, the strategy needed to be able to identify an upward trend and join in the equity market. The underlying market conditions which appeared to support trend-following strategies to do this were strong returns and minimal volatility to produce a clear signal. To outperform a buy and hold, the trend-following strategy would have needed to have an opportunity to do so which could only come in the form of a clear drawdown; otherwise, the only

return provided would be at most the same return as the underlying equity buy and hold and it would be impossible for a trend-following strategy to outperform.

### 3.3.5 Further Statistics

One of the most important performance measures for an investment is its return and that applies to trend following as much as any other strategy. However, it is not the only statistic which investors may find relevant or could use to drive their investment choices. All investors have different appetites to risk which will have a direct impact on their selected investments and their expected returns. Some may be in the accumulation stage, decades away from retirement and would be willing to increase their risk for a potential increase in return. Others, on the other hand, may be approaching the decumulation stage and are taking or preparing to take income from their investment. This type of investor is more likely to experience loss aversion[5], be risk averse, and be more concerned about sequence risk. They would therefore put more weight and value in not losing money at this stage in their life than investing in a high risk/high return strategy. To these investors, consistency, and further statistics such as volatility, maximum drawdown, and risk-adjusted returns in the form of Sharpe ratios would be equally important to their investment preferences.

#### 3.3.5.1 15-Year Cumulative: Volatility

Although some of the strategies' returns struggled to outperform against the buy and hold, the use of a trend-following strategy significantly lowered volatility for all markets, all strategies, and all durations. The buy and hold volatilities and the trend-following strategies' average volatilities are available on Table 3.1 across the different strategy types and the overall range for each market and on Table 3.2 for each individual strategy. Over 15 years for every market, every trend-following strategy and duration had significantly lower volatilities than the buy and hold.

[5] Tversky and Kahneman were the first to identify loss aversion which is the tendency of individuals to prefer avoiding a loss than to acquiring a gain. Their articles and discussions became the basis of early behavioural finance and earned Kahneman a Nobel Prize in Economics in 2002. Tversky would most likely have shared that prize had he not passed away in 1996. (Kahneman, 2011)

Japan had the highest underlying market buy and hold volatility of all the markets with a volatility of 20.33% (Table 3.7) and, unsurprisingly, the highest average trend-following volatility across all strategies, using either cash or gilts, of 14.47% (Table 3.1). The use of trend following for the volatile Japanese index created a significant reduction in volatility of 5.85%. The market with the lowest overall average volatility across all trend-following strategies was the FTSE 100 with an average of 11.85%. When compared to the 17.63% volatility of the buy and hold of the FTSE 100, this was again a sizable reduction in volatility of 5.78%. The highest reduction in volatility for any of the markets was 6.20% for the European index which had the second highest buy and hold volatility of 19.85% and an average trend-following volatility of 13.66% across all strategies. The FTSE 250 had the lowest buy and hold market volatility of 16.87% and a trend-following average volatility of 12.15%. This was the lowest reduction in volatility, 4.72%, for a market using trend-following.

When looking at the individual strategies for each market in the volatility heatmaps (Table 3.8), there was a distinct pattern with the top left corner with the shortest durations, moving averages and daily trading typically greener, representing the lowest volatility. Daily trading, shorter durations and using a moving average strategy reacted to underlying price changes more quickly and therefore traded more frequently than trading at the end of the month or using a crossover. This reduced drift, reduced the length of time the strategy would be in the equity market, and in turn reduced the trend-following strategies' volatility.

The bottom right corner with strategies which had the longest durations, used crossovers, traded into gilts, and traded at the end of month appeared in the darkest red, representing the highest volatilities. These strategies and durations were typically the slowest to react and slowest to trade. A strategy using crossovers or trading monthly rode the market for longer and had higher volatilities. The one exception to this was the Japanese unit trust which had the highest average volatility (Table 3.2) and the highest overall volatility for any strategy (Table 3.8) when trading using end of month moving averages.

The inclusion of gilts increased the average volatility for every market by about 0.5% compared to a strategy which instead moved into cash. When cash was

used for the strategies, the money was not invested in a cash-like asset, such as a government bond or T-bill, but was left without any investment at all and as such did not add any volatility. The investment into gilts added a slight amount of volatility, but as shown also increased the returns and the number of strategies which outperformed the buy and hold in every market. Over all of the markets, the use of gilts increased volatility, but also increased the "successfulness" of the strategy.

Usually, lower volatilities signal a reduction in risk, such as the difference between the buy and hold and the average trend-following strategies' volatilities. When the volatilities were relatively similar as is the case within the different trend-following strategies by market, the slight reduction in volatility might not have been ideal. For most markets, shorter durations, trading daily, trading into cash and using moving averages had lower volatilities as shown on Table 3.8 but also typically lower returns. A strategy which reacted too quickly to changes in the market often led to a reduction of upward as well as downward drift for the strategy due to trading too frequently and whipsawing.

Over the 15-years, the strategy with the lowest volatility across all markets was a 5-day moving average version 2 into cash for the FTSE 100 with a volatility of 9.40% and a negative return of -0.57% as shown in Table 3.8. A visual representation is shown in the 21-year FTSE 100 Graph 2.2 from Chapter 2. Although the 5-day daily moving average strategy obviously was much less volatile and smoothed than the buy and hold or the 250/450-day end of month crossover trading into gilts, it also whipsawed too frequently and slowly ate away at final returns ending with a total return of -38% (-2.26% annualised).

The strategy with the largest volatility across all markets was the 250/450 end of month crossover using gilts for emerging markets with a volatility of 16.64% and a return of 4.01% as shown on Tables 3.8 and 3.3. This is not surprising as 1) it appears that using crossovers, gilts, and trading at the end of the month increased volatility; 2) this was the longest duration which was tested; and 3) emerging markets had the third highest underlying market buy and hold volatility of 19.71. Similarly, to the fact that using a strategy with low volatility did not necessarily reduce risk, using a strategy with a high volatility was not necessarily ideal either. As discussed earlier, the optimum strategy found for returns for emerging markets was

moving averages and typically with a relatively short (compared to most other markets) to medium duration. The strategy with the highest volatility for emerging markets had a return of 4.01%. Although not negative as in the extremely low volatility example, this was still one of the lowest returns for emerging markets over the 15 years.

Using any trend-following strategy significantly reduced the strategy's volatility across all markets compared to the buy and hold to such an extent that they were all equally successful. The difference between the strategies themselves in reference to the reduction of volatility was not that relevant. Typically, the strategies which had the highest returns and outperformed most often were not the ones with durations that had the lowest volatilities. The volatility appears to have had little bearing on the ability of a trend-following strategy to outperform or provide higher returns. It also did not appear to signal that any one trend-following strategy was less risky than another. As one trend-following strategy is not likely to be selected over another based solely on the results of their volatilities, the important point is that they all offered a reduction in volatility compared to the buy and hold. Therefore, if lower volatility was desired, then any of the trend-following strategies would have offered an improvement. A different measure such as returns, or Sharpe Ratios, would be more relevant as a deciding factor in strategy selection.

#### 3.3.5.2 15-Year Cumulative: Maximum Drawdown

The maximum drawdown a strategy incurs is important to investors who are adding to or taking income from their investments due to sequence risk. As maximum drawdown is a type of risk measure similar to volatility, one would assume that the two would perform similarly, have similar heatmaps and that the same strategies and durations would prevail. Both volatility and the average maximum drawdown statistics were greatly improved compared to the buy and hold's statistics across all markets and strategies (Tables 3.1 and 3.2). The maximum drawdown averages across the different strategies were relatively close especially when compared to the difference from the buy and hold. And, if studying trend-following strategies using the 200-day moving average, as is frequently done, the maximum drawdown for such a medium duration strategy in almost all

circumstances and markets was greatly reduced compared to the buy and hold. It therefore would not seem consequential which strategy was selected due to the maximum drawdown statistics as any trend-following strategy appeared to greatly reduce the maximum drawdown in the same way as trend following reduced volatility.

When looking closer at the maximum drawdown heatmaps for each market and because there was such a diverse range of durations studied (Table 3.9), there was a large amount of variation from one duration to the next. In fact, the overall range as shown in both Tables 3.1 and 3.9, was almost the same as the buy and hold maximum drawdown itself. This was not the case when reviewing the volatility statistics for which there was little change across the durations and strategies. For maximum drawdowns, there were some differences between strategies, such as using end of month or daily trading for moving averages and shorter crossovers, but overall, the duration chosen appeared to be the larger driver of maximum drawdowns as opposed to strategy. The review of a 200-day moving average alone would not reveal any such discrepancies in maximum drawdowns or any relationship which was dissimilar to volatility.

The heatmaps for volatility suggested that using a trend-following strategy that had signals which reacted more quickly such as using shorter durations or moving averages was found to be advantageous. Surprisingly, this was not necessarily the case for maximum drawdowns. The maximum drawdown heatmaps for the FTSE 100, FTSE 250, American and in some respects the Japanese unit trust are almost the opposite of the volatility heat maps. Typically, the longer durations and crossovers had smaller maximum drawdowns and the highest volatility while the shortest durations and moving averages had the largest drawdowns and the smallest volatility.

The shorter duration strategies for these markets traded frequently and were too short to recognise any long-term trends. Instead, they moved slowly upward and downward on the smaller duration averages slowly reducing returns and mistiming the market. Graph 3.6 compares the 15-year strategy returns for the 5, 200 and 450-day moving averages for the FTSE 100 trading daily and at the end of month. The 5-day and 450-day durations were chosen to use the extremes to identify the maximum

drawdown differences, while the 200-day moving average is the duration most typically used. Trading at the end of the month surprisingly had lower drawdowns than trading daily. End of month moving averages had the smallest drawdown with the longest duration, the 450-day moving average. While for daily trading, the 200-day moving average had the lowest drawdown. Although one would think that a quicker, smaller duration strategy would be able to identify and move more quickly out of a downward trend than a slower strategy, for these markets the trend-following strategies which had better maximum drawdowns were instead the ones which were slower to react than those which were faster.

If the maximum drawdown statistics were not seemingly related to volatility, what could be driving them and were they instead somehow related to something else? When looking at the dates that the maximum drawdowns occurred for each of the durations reviewed in Graph 3.6, it was surprising how varied and far apart these dates were. It could be expected that the underlying market movement would impact all trend-following strategies equally. That the largest drawdown each strategy experienced would be caused by the same large underlying drop in equity prices, but this was not the case. The maximum drawdowns occurred at different times for the different durations and different strategies. The strategies therefore all time each of the equity market drops differently with some of the strategies dealing with the different drops at different times better than others causing the large variation of maximum drawdown dates.

The maximum drawdown specifically allows the study of the ability of the strategy to exit a falling market to reduce its exposure to maximum loss. It does not have any bearing as to how long the strategy will take to re-join an upward market and, in that respect, has less to do with the overall return. But there appeared to be a distinct correlation in a strategy's ability to reduce this exposure to loss and its returns. The maximum drawdown heat maps (Table 3.9) were more correlated with and have a more similar pattern to the strategies' returns (as can be seen in the duration heat maps on Table 3.4) than their volatilities (Table 3.8). The correlations between the maximum drawdowns and the volatilities are also shown at the top of Table 3.9. The correlation to returns was relatively high for all markets while the correlation to volatilities was mixed. A positive volatility correlation would mean that as the maximum drawdown became smaller and the number approached 0, it

would become higher and the volatility would also increase. In this instance a positive correlation with volatility would be the opposite of what would be beneficial for a strategy. The FTSE 100, FTSE 250, American and Japanese unit trusts had positive correlations to volatility and therefore had a negative correlation to what was desired. As their maximum drawdowns reduced in size, their volatilities increased.

For Europe, the emerging markets and the Pacific, the maximum drawdown heatmaps were remarkably similar to both their returns and their volatilities. The overall strategies' maximum drawdown averages (Table 3.1, 3.2, 3.9) were the smallest for moving averages instead of crossovers which coincidentally also had the smallest volatilities. The drawdown correlation to volatilities for Europe was extremely low but was much stronger and negative for the emerging markets and the Pacific. For these two markets a negative correlation would mean that as the drawdown became less negative and moved closer to 0, the volatility would move in the other direction and be reduced. A negative correlation between volatility and maximum drawdown would be advantageous for a strategy. In fact, the Pacific crossover correlation to volatility was higher at -67% than its correlation to its returns which was only 52%. For these markets, the combination of strategies which reduced volatility, also functioned to reduce maximum drawdown, and increase returns. Although there was, at times, a strong correlation between maximum drawdown to volatility, any such correlation appeared to be second to that of returns across all markets.

Similar to returns, maximum drawdowns were improved with the use of gilts across most markets as shown through the overall averages and in almost every case when broken down by each strategy (Table 3.9). This may be in part due to the extra return provided by gilts to soften the equity loss or because gilts typically provided the strategies with higher returns when compared to cash. The one exception to this was for the American unit trust. Although there was not much difference in the overall maximum drawdown average between moving to gilts or cash when out equities, the best single duration range/strategy combination for returns for the US was an end of month crossover to cash. For the FTSE 100, FTSE 250, America and Japan, end of month strategies also had smaller maximum drawdowns than daily trading while the opposite was true for Europe, the emerging markets, and the

Pacific. Typically, the former set of markets had larger returns with slower trend-following strategies while the later performed better with faster reacting strategies. Both findings further confirm the correlation of maximum drawdowns to returns.

When compared to a buy and hold, the only time that a trend-following strategy had an advantage is when it was able to identify and leave equities as their prices fell. In our road race analogy earlier, as a trend-following strategy competitor was only able to keep pace with the buy and hold athlete and unable to run faster, the only time that the trend-following strategy would be able to outperform would have been when the buy and hold athlete backtracked or ran in the wrong direction. The fact that certain strategies identified when to continue running on a safer path (trading into gilts) or even stopping (when trading into cash) instead of following the buy and hold in the wrong direction was the only time trend-following strategies had an advantage.

The maximum drawdown statistic is a reflection on the strategies' ability to time market falls - to identify a significant downward trend and move out of equities in a timely fashion. Although maximum drawdowns are like volatility in that they are both risk related statistics, their actual correlation to volatilities and distribution of values was quite different. Instead, maximum drawdowns appeared to be highly correlated to returns. It may be the ability to identify a significant drawdown trend that provides the strategy the ability to protect returns, minimise losses and ultimately is its only chance to outperform.

#### 3.3.5.3 15-Year Cumulative: Sharpe Ratios

Even though there were not many trend-following strategies which had returns that outperformed compared to the buy and hold over the 15-year studied, the relatively large reduction in volatility when using a trend-following strategy allowed for more strategies across all markets to outperform based on their Sharpe ratios. Sharpe ratios are a measure of risk-adjusted return and consider both return and volatility. The strategies with Sharpe ratios which outperformed the most often were in line with the strategies which outperformed based on returns but with a much greater breadth across the durations. In almost all cases, the durations for which the

strategies' highest return did not outperform the buy and hold often had Sharpe ratios which did.

Average Sharpe Ratios

When reviewing the 15-year average Sharpe ratios for the different strategies in (Table 3.1), the strategies which had higher average returns for each market also typically had higher Sharpe ratios. For example, strategies which used crossovers or which traded at the end of the month had higher average Sharpe ratios for the FTSE 100, FTSE 250, America, and Japan due to their much higher returns even though crossovers and trading monthly typically had higher volatilities. For the Pacific and emerging markets, strategies which used moving averages or trading daily had both higher returns and lower volatilities, naturally leading to also having higher Sharpe ratios. Europe had a slightly (0.01%) higher average return when using crossovers but a higher average Sharpe ratio with moving averages. This was because there was not much difference between moving averages and crossovers in terms of return, but a much higher volatility from crossovers (0.92% higher) than moving averages thus reducing the crossover strategy's average Sharpe ratios.

Most markets had the same individual strategies with the highest average Sharpe ratios (Table 3.2) and the highest returns. In fact, when looking at the individual results from Table 3.10 the heat maps are almost identical to those from the returns (Table 3.4). The Sharpe ratio's correlation to returns for every market was over 98% while it was much smaller for volatilities. The range of Sharpe ratios for each of the markets as shown in Table 3.1 and 3.10, was much larger than the Sharpe ratios themselves. The largest range across any market was 99.18% for the FTSE 100. The highest FTSE 100 Sharpe ratio was 63.31% for a daily gilt 50 v 150-day crossover, while the lowest Sharpe ratio was -35.87% for the same daily gilt crossover strategy but with a duration of 10 v 20 days. It was typically the durations which caused the largest variations across the strategies as opposed to the different strategies themselves. This therefore greatly skewed the average results across a single strategy as was shown through the study from the returns.

Percentages of Outperformance

As well as looking at the averages of the returns and because the ranges across the different markets and strategies were so great, it was also important to review the percentage of strategies which were able to outperform. As there were a larger number of strategies tested using crossovers, trading daily, and trading into cash, it is useful to look at the percentage of the strategies which outperformed instead of the absolute numbers. (Table 3.1) This distinction was not significant when reviewing returns because so few succeeded or when reviewing volatility and drawdown because almost all did. For returns, even with the advantage of a higher number of strategies trading into cash and trading daily, monthly trading and trading using gilts still outperformed more often even in absolute terms. As so few combinations had higher returns than the buy and hold, it was more important to highlight the few combinations which did outperform.

With the reduction in volatility for trend-following strategies across the board, the possibility for Sharpe ratios to outperform was much higher and typically the differences were larger between the percentages of outperformances displayed for individual strategies than with returns, thus reflecting the greater range of outperformance from one strategy to another (Table 3.1). For example, the FTSE 250 had 74.3% of its strategies outperform in terms of Sharpe ratio when trading at the end of the month and 66.4% outperform when trading daily, a difference of 7.9%. When reviewing returns, the FTSE 250 had 22.9% of monthly traded strategies outperform compared to 19.3% of daily strategies. Overall, the larger difference when reviewing Sharpe ratios provided more confidence in the strategy than the 3.6% difference when comparing returns. Although this was not always the case, for most strategies these differences were exaggerated when reviewing Sharpe ratios as opposed to returns.

Although having a high percentage of strategies which outperformed obviously did not necessarily mean that any duration within that selected strategy would outperform, it does indicate the likelihood that a specific duration chosen within that selected strategy would be able to outperform. One caveat to this is that the issue of outperformance was binary. A strategy either did outperform or it did not. It does not reflect variations in the Sharpe ratios, how close to the buy and hold

a strategy might have been, or by how much it outperformed. When the range of moving averages was from 5 – 450 days, the difference between 5 instead of 6 durations outperforming was inconsequential.

For example, for the FTSE 100 when using crossovers and trading into gilts, the difference between end of month trading with a 78.26% outperformance (18 out of 23 strategies) and daily trading with 82.61% (19 out of 23 crossovers) seems to suggest that daily trading would be preferable to end of month trading. It does show that during this period daily trading outperformed more often. But the differences between the Sharpe ratio averages for each strategy indicate that an investor would in fact prefer end of month crossovers with a Sharpe ratio of 39.66% compared to daily crossovers with an average of 35.29%. This again mimics the fact that strategies using an end of month crossover for the FTSE 100 provided the highest returns.

Percentages of outperformance are useful to compare the possibilities of success for a strategy, but also have their limitations. Once there was a clear range of durations which could be established as performing well, there was a fair amount of confidence that moderate durations for that strategy would outperform. Therefore, it would then be important to review the actual Sharpe ratios or averages to determine which strategy would be most beneficial for an investor. Marginal differences in percentages of outperformance should not be overemphasized and must be reviewed in conjunction with strategy averages.

Daily vs. Monthly Trading

The largest difference in the percentage of Sharpe ratio outperformances between trading daily and monthly was 13.3% for the FTSE 100 with monthly trading outperforming for 56.2% of the strategies and durations while trading daily outperformed for 42.9%. (Table 3.1) The FTSE 250 also had more end of month strategies outperform than daily, but both had high percentages of outperformances of 74.3% and 66.4% respectively. Strategies and durations for the FTSE 100 when trading into gilts, at the end of the month, or using crossovers and for any type of strategy for the FTSE 250, all had more than 50% of their strategies outperform. This

meant that it was more likely to pick a trend-following strategy which had a Sharpe ratio which outperformed the buy and hold than not over the 15-year period studied.

Although not as dominant as for the FTSE 100 or 250, monthly trading also had more strategies outperform than daily trading by 8.3% for Japan (16.2% monthly to 7.9% daily) and 5% for America (42.9% monthly and 37.9% daily). The difference between the two was much smaller for Europe at 3.3% (33.3% monthly and 30% daily) and the emerging markets 0.2% (43.8% monthly and 43.6% daily), but for both markets there were still more end of month strategies which outperformed than daily. For the Pacific, trading daily was more likely to outperform by 2.1% than trading monthly (31.4% monthly and 33.6% daily).

The overall percentages of Sharpe ratio outperformance when trading either daily or monthly were high enough to provide a level of confidence that moderate ranges for most markets would outperform. The one exception to this was the Japanese unit trust whose underlying buy and hold returns were the lowest out of every market while it also had the highest amount of volatility. The trend-following strategy outperformances and averages in terms of returns were therefore lower than for most other markets but its volatility averages were still high. Even though this was the case, there were still more outperformances for the Japanese unit trust in terms of Sharpe ratios than there were for returns.

Overall monthly strategies were more likely than daily strategies to have Sharpe ratios which outperformed or the differences between the two were minimal. As the average returns and Sharpe ratios themselves were more likely to be higher with end of month trading than daily trading, these results add further evidence to the support of monthly trading.

Crossovers vs. Moving Averages

Following the same pattern as returns, crossover strategies had a higher percentage of Sharpe ratio outperformances than moving average strategies for the FTSE 100 (56.5% XO to 33.3% MA), FTSE 250 (72.7% XO to 64.3% MA), and Japan (14.3% XO to 6% MA). (Table 3.1) The American fund did not have any strategies which outperformed in terms of returns so a comparison of the numbers or

percentages of outperformance between returns and Sharpe ratios could not be completed, but the American fund did have higher overall and individual strategy average returns when trading with crossovers than moving averages. The American fund also had more crossover strategies outperform in terms of their Sharpe ratios than moving averages (58.4% of crossover strategies and compared to only 4.8% of moving average strategies). The markets for which using moving averages had a higher percentage of strategies which outperformed based on returns, they also had a higher percentage of moving averages outperform based on Sharpe ratios: the emerging markets (70.2% MA to 29.8% XO), Europe (39.3% MA to 27.3% XO), and the Pacific (56% MA to 20.5% XO).

For most of these markets the difference between the percentages of outperformance for crossovers or moving averages was extreme, showing a clear preference for one strategy over another. When using the preferred strategy for all markets, except for Europe and Japan, most of the strategies' durations outperformed with percentages over 50%. For these markets, it was therefore more likely to choose a duration which outperformed in terms of Sharpe ratio than not when using the optimum strategy even though the 15-years studied had few strategies outperform in terms of returns.

Using Gilts vs Cash as the Alternative Investment

The use of gilts as the alternative investment had higher average Sharpe ratios for every market and typically had a much higher percentage of strategies which outperformed. The FTSE 250 was the one exception. When using gilts as the alternative investment 70% of strategies which traded into cash had Sharpe ratios which outperformed followed by 69.5% for strategies which instead used gilts. Both strategies using cash and gilts when out of equities for the FTSE 250 had the highest percentage of strategies overall outperform and the difference between the two was minimal. The lowest percentages of strategies with Sharpe ratios which outperformed were again for Japan with 20% of gilt strategies outperforming and only 5% for cash.

As Sharpe ratios consider both volatility and returns in their calculations, the superior Sharpe ratios when trading into gilts indicates that the slight increase in

volatility from the use of gilts instead of cash was more than offset by the increase in returns. When compared to the buy and hold and trend-following strategy returns, the strategies' Sharpe ratios were greatly increased due to the drastic reduction of volatility across all trend-following strategies increasing their ability to outperform.

Even though volatility was typically higher for end of month trading compared to daily trading and trading into gilts instead of cash, this combination was still the one which for most markets had the highest Sharpe ratios due to higher returns and outperformed the most often. The strategies which had the highest returns for each market also usually had the highest average Sharpe ratios and percentages of durations per strategy outperform. Sharpe ratio performances were driven by and highly correlated to returns but improved and influenced by volatility. Smaller volatilities were important for increasing the breadth of strategies whose Sharpe ratios outperformed when compared to returns and emphasised the difference between strategies.

### 3.3.6 All Cumulative Returns Across All Time Periods

The review of trend-following strategies over 21 years for the FTSE 100 in Chapter 2 and over 15 years across a wider array of markets in this chapter has shown surprisingly different results in terms of returns and Sharpe ratios, but similar improvements to volatility and drawdown. As the majority of these two periods were the same, but the results were not, other shorter periods may also return conflicting results. Usually, the longest period available would be the one studied, but investors invest at different times and therefore could experience vastly different results.

Reviewing the historical, cumulative returns over the past 1-10 as well as 15 years added further information about the strategies to see if the same conclusions could be found for the various equity markets over different cumulative periods. (Table 3.11, 3.12) For these data sets, the end date was always the same, but the start date moved by one year from one cumulative period to the next. Although most of the data covered was the same, the strategies which outperformed over one period underperformed in the next.

Across All Years and Markets

There were a few years which had the highest number of strategies outperform for the individual markets and appeared the most successful for trend following. (Table 3.11, 3.12) For the developed markets, i.e., the FTSE 100, FTSE 250, America, Japan, and Europe, these years were 2007 and 2008 just before the financial crisis. The emerging markets and Pacific were also impacted by this financial crisis, but the largest number of trend-following strategies which outperformed for these markets was surprising later in 2014. Given that trend-following strategies can only perform as well as the buy and hold and will only ever outperform when the buy and hold falters, starting these strategies before a market crisis allowed the trend-following strategies an early head start and even protected against a delayed re-entry into markets. These years were also the top 3 years in the number of cumulative strategies which outperformed across all markets. (Table 3.6)

The years which followed the drops in market values specifically 2009, 2010, 2015 and 2016 were especially difficult for trend-following strategies. The strong upward trend after the market falls made it impossible for trend-following to outperform. As some of the durations studied were as long as 450 business days, it would take a large jump in prices or just the slow passage time to flag a move back into equity markets when averaging prices over 450 days, approximately a year and half. This delayed re-entry into equity markets while there was a strong rebound could explain why these years were difficult for trend-following. The last year, 2016, showed that when the underlying market had a strong upward trend, the best that the trend-following strategy could do was to be in the underlying equity market and therefore the strategy would have the same return as the buy and hold. Although the trend-following strategy would not outperform in this situation, to have the same return as the buy and hold would be the best option for an investor and should be considered a successful result for the trend-following strategy. In further discussions, the use of the term outperformance included both outperformances but also strategies which were equal to the buy and hold over the one-year period.

By Strategy and Duration

Across all the cumulative periods, there were some strategies and durations which clearly performed more consistently than others. The first versions of the strategies, trading into gilts, and trading at the end of the month had a larger number of strategies outperform over the different cumulative periods than trading daily, moving into cash, and using the second versions of the strategies (Table 3.11). This concurs with previous results.

It is harder to ascertain whether moving averages or crossovers were more consistent as shown from earlier conclusions. Moving averages had a higher percentage of outperformances for strategies trading into cash and trading at the end of month into gilts, and for end of month strategies when using either cash or gilts for strategies which were both equal to the buy and hold and outperformed it. Crossovers had the higher percentage when looking at the overall outperformances across all strategies, daily trading using gilts, and daily trading into both cash and gilts for strategies which were both equal to the buy and hold and outperformed it. Crossovers also had the highest absolute number of outperformances.

Percentages show which strategy was most consistent across all years over all durations or strategies and are useful when comparing moving averages to crossovers due to the large difference in the number of durations studied. Crossovers had almost twice as many (23 to 12) durations giving them an opportunity to outperform more often and an automatic advantage in terms of absolute numbers. Using a percentage appeared to bring this back to a level field.

As end of month trading and using gilts were clearly more consistent, using an end of month moving average trading into gilts would appear to be the best strategy given that it had the highest percentage of both outperformances (22.08%) and the number of strategies which were both equal to the buy and hold and outperformed it (28.14%). If looking for a one size fits all approach, this strategy combination numerically works the most often out of all the strategies across all markets and all cumulative periods. This conclusion also fits the narrative of the 200-day moving average being the optimum trend-following strategy. But these percentages could also be influenced by many inopportune strategies based on the way the results were divided.

The results in the bottom half of Table 3.11 tell a different story when reviewed by duration. Both tables had the same overall totals and percentages of outperformance for moving averages and crossovers, but based on how the strategies were divided, the results were quite different. The top five durations across the 7 strategies for the 11 different cumulative periods and across all 7 markets were all crossovers. They also had the highest percentages and absolute numbers of outperformance. Because each duration has the same number of strategies, the order of the top performing strategies based on the duration results using either percentages or absolute numbers were the same. The difference between each duration was the number of times each duration outperformed across the two different versions on a daily or monthly basis and trading into cash and gilts. The 200-day moving average had the most strategies outperform out of all the moving averages followed by the 150-day moving average, but they are only $6^{th}$ and $7^{th}$ respectively out of all durations.

The rainbow effect on the 15-year result charts for returns (Table 3.4), volatility (Table 3.8), maximum drawdowns (Table 3.9), and Sharpe ratios (Table 3.10) show that duration was one of the determining factors of performance for each of these measures. It would therefore follow that over all the cumulative periods the duration chosen was again a more decisive measure of a strategy's success than the different strategy types. In fact, from Table 3.11, it is possible to see that the 5/200-day crossover had a higher number and percentage of outperformances than the 200-day moving average. Narrowing in on durations made a difference to the best performing strategies.

The percentages based on strategy make it clear that trading at the end of month, trading into gilts, and using the first version of the strategies were more consistent outperformers. Narrowing results by duration suggests that crossovers were the clear winners. As the 15-year results suggested that the best strategy and duration combination varied from one market to the next, the results over the different cumulative periods may also show different optimum strategies per market.

FTSE 100

The strategy which outperformed most often over all cumulative historic periods (Table 3.11) for the FTSE 100 was the end of month moving average crossover into gilts as was also found in the overall 15-year results (Table 3.2). In both instances, the most important factor was end of month trading and using gilts. When reviewing just the strategies trading into cash for timing ability over all historic periods, trading at the end of month and using the first version continued to have the highest percentage of outperformances, but moving averages outperformed crossovers. End of month moving averages had a higher number of absolute outperformances and a higher percentage of outperformances plus strategies that were equal to the buy and hold in the last year compared to crossovers or any other strategy which traded into cash.

When including gilts into the strategy over all cumulative periods, there was a much higher number of strategies which outperformed than with strategies which instead traded into cash. After the use of gilts, using a crossover was the most important factor with all strategies dramatically outperforming moving averages (Table 3.12). End of month crossovers followed by daily crossovers had the most outperformances across all strategies when reviewed over all cumulative periods and when trading into gilts.

This concurred with the 15-year results that found that trading at the end of the month was the most important factor with end of month crossovers having the highest average returns, followed by end of month moving averages, and then daily crossovers (Table 3.2). When reviewing the smaller more targeted 5-duration combinations over 15 years trading into cash, the end of month moving averages had the highest returns, but when adding gilts, the end of month crossovers did (Table 3.4). The 15-year risk-adjusted returns in the form of Sharpe ratios also had the highest overall averages with end of month crossovers across all strategies, but the best cash performance was with the 200- and 150-day end of month moving average (Table 3.10). For cash strategies, crossovers tended to have an advantage across all strategies, but more targeted analysis seemed to favour moving averages. When adding gilts, crossovers appeared to have had higher average returns.

The duration outperformance summaries as discussed earlier (Table 3.12) had the same number of strategies (which traded into cash or gilts and either daily or at the end of month) for both moving averages and crossovers. The durations with the top 5 highest percentages and number of individual strategies which either outperformed or were equal to the buy and hold were all crossovers. The highest was the 50/150 crossover which outperformed for 51.95% of the strategies over the cumulative periods. The highest percentage of outperformance for moving averages was the 6$^{th}$ place 150-day moving average with 33.77% of strategies outperforming over the years. The 200-day moving average had the 11$^{th}$ highest number of outperformances across all durations with only 23.38% of strategies over the cumulative periods.

Again, the study of strategies which use cash as the alternative asset displayed the ability of trend following to time the market, but the addition of gilts to the strategies greatly increased the number and percentage of strategies which outperformed. More detailed analysis over all cumulative periods suggests that end of month moving averages outperformed the most often when reviewing just strategies which used cash, but the inclusion of gilts instead recommended crossovers. If choosing one strategy out of all the strategies to invest in, an end of month crossover trading into gilts appeared to have a far superior ability to outperform the market with a large difference in the number of strategies which were able to outperform (or were equal to the market in the last year). End of month moving averages trading into cash only had 12.88% of durations outperform while using gilts instead increased this to 31.82% for end of month moving averages, and 37.55% for end of month crossovers. The strategies which included gilts also reflected in the duration results as the top 5 durations were all crossovers.

FTSE 250 and America

For the FTSE 250 and America, over all the cumulative time periods (Table 3.12) and the 15-year results (Table 3.2, 3.4), crossovers were the clearly dominant factor in determining outperformance. More than twice as many crossovers outperformed than moving averages for strategies using both cash and gilts. For strategies trading into cash (Table 3.12), trading with daily crossovers outperformed

slightly more often than monthly crossovers for both the FTSE 250 and America. When using gilts, this reverted to monthly crossovers outperforming more often than daily crossovers. The difference between daily and monthly crossovers over all the time periods was minimal with slight differences given the time selected. Although moving averages did not perform nearly as well as crossovers for these two markets, trading at the end of the month for moving averages outperformed more often than trading daily. Using gilts, crossovers, and trading at the end of the month was again the best performing strategy with 29.25% of durations outperforming across years for the FTSE 250 and 16.60% for America.

There was a large difference in the percentages of strategies which outperformed by duration over the historic time periods (Table 3.12). For the FTSE 250, a huge 71.43% of the strategies outperformed over all cumulative periods for the 100/200-day crossover. Only 18.18% outperformed for the best performing moving average duration, the 200-day moving average which was only the 11$^{th}$ highest percentage of outperformances across all durations. For the American unit trust, the best performing duration across all strategies and markets was the 100/300-day crossover which outperformed for 37.66% of the strategies over the cumulative periods. The highest moving average duration was the 450-day duration which came 7$^{th}$ out of all durations with only 20.78% of the strategies outperforming. The 200-day moving average tied for the 18$^{th}$ highest number of outperformances with a percentage of 9.09% and only 7 strategies which matched the buy and hold from 2016-2017.

The FTSE 250 had the most strategies outperform (51) over 15 years while the American fund had the least out of all markets (0). Even though this was the case, for most of the moving average durations in most of the years there were very few strategies which outperformed for both the FTSE 250 and American funds. Most of the outperformances for both countries occurred in 2007 and most of the strategies were equal to the buy and hold in 2016. The FTSE 250 was able to outperform with a few of the crossover durations with some consistency across many of the years. The American fund did have more funds outperform with crossovers, but most of these outperformances were centred around a few durations and a few years.

These results again confirmed the earlier 15-year results. The best strategies over all the cumulative periods for the FTSE 250 and the American unit trust were strategies which traded at the end of the month, using crossovers and traded into gilts.

Japan

Over 15 years, the highest average returns for strategies trading into both cash and gilts for Japan were end of month moving averages with the addition of gilts providing extra returns. None of the strategies trading into cash outperformed for Japan, but when using gilts instead there were a few with most of them occurring when using crossovers and trading at the end of the month (Table 3.2). The best targeted 15-year range of 5 consecutive durations for strategies trading into cash and gilts showed a clear advantage when using end of month trading (Table 3.4) and recommended end of month crossovers.

Similar to the targeted 15-year average returns, over all the different historic cumulative periods for cash and gilts, trading at the end of month and using crossovers had the highest number and percentage of durations outperform the most frequently with 9.88% of durations outperforming for strategies trading into cash and 22.13% when using gilts (Table 3.13). Although there was a large advantage to using end of month trading over 15 years, overall years using crossovers and gilts as the alternative investment appeared to have a stronger influence with a much higher jump in the number and percentage of outperformances.

The duration with the highest percentage of strategies which outperformed was the 100/400-day crossover with 28.57% of strategies. The next best performing duration was the 200-day moving average with 20.78% of strategies outperforming or equal to the buy and hold in the last year. The number of strategies which outperformed in any given year were relatively low across all time periods, except for the last year in which all 7 strategies were in equities and therefore equal to the market for most of the durations. Most of the durations did not outperform in most of the years with moving averages outperforming much less than crossovers.

Europe

Europe also did not have any cash strategies outperform over 15 years and like Japan also had the highest average returns for end of month moving averages when using cash. Unlike Japan, when trading with gilts Europe still had the highest number and percentage of strategies outperform when using end of month moving averages (Table 3.2). It also had the highest average 5-duration return when using end of month moving averages for strategies which traded into both cash and gilts (Table 3.4).

The cumulative results show that for strategies trading into cash using crossovers had a much higher number of durations outperform with end of month trading outperforming daily trading. When using gilts instead, daily crossovers outperformed daily moving averages, but end of month moving averages outperformed daily crossovers. There was again little difference between the percentages of moving averages and crossovers, but crossovers had a much larger absolute number of strategies outperform.

This will impact the duration results as they include all strategy types – trading into cash or gilts, trading daily or monthly and both versions of strategies. The duration with the highest and most consistent number of strategies which outperformed was the 50/100 crossover with 31.17% of strategies outperforming. The top moving average was the 250-day moving average with 25.97% of strategies outperforming across all cumulative periods. The 200-day moving average had the 8$^{th}$ highest number with 19.48% of strategies outperforming.

Pacific and Emerging Markets

Over 15 years the Pacific and emerging markets had much higher returns with moving averages. For strategies which traded into cash, the Pacific fund had higher average returns with daily moving averages than end of month moving averages and vice versa for emerging markets. For strategies which traded into gilts, both markets had the highest returns with end of month moving averages.

This was similar to the results over all cumulative periods. For both the Pacific and emerging markets, the strategy when trading into cash with the highest

percentage of outperformances was daily moving averages. For the Pacific strategies which used cash, daily trading outperformed end of month trading with daily crossovers having the second highest number of outperformances. For emerging markets strategies which traded into cash, moving averages had the highest percentage of outperformances with end of month moving averages coming in second instead of daily crossovers. When including gilts, both markets had by far the most outperformances with end of month moving averages. Even though there were more durations studied for crossovers which usually makes the comparison by absolute number difficult, in both of these markets end of month moving averages not only had the highest percentage of outperformances but also the highest number.

When reviewing the duration results for the Pacific, the duration with the highest number of strategies which outperformed was a 50/100 crossover with 46.75% of strategies outperforming. The duration with the second highest number of strategies which outperformed was the 150-day moving average with 37.66% followed by the 200-day moving average with 31.17%. Although most of the crossover durations for most of the years did not perform well, when narrowing down by duration the 50/100 crossover had a high amount of consistency throughout all the years.

Surprisingly, the duration with the highest number of strategies which outperformed for the emerging markets was also a 5/200 crossover with 66.23% of strategies outperforming. This was followed by the 20/200 crossover with 61.04%, and both the 150-day and 200-day moving averages with 58.44%. Most of the crossover durations did not outperform across most of the years while there was more consistency across the durations for moving averages.

When trading into cash, the markets had different strategies which outperformed the most often across all cumulative periods. The FTSE 100 strategy using cash outperformed the most using end of month moving averages; the FTSE 250 and the America - daily crossovers (but end of month crossovers were a very close second); Japan and Europe - end of month crossovers; and emerging markets and the Pacific - daily moving averages.

The addition of gilts brought more uniformity throughout the markets and a higher number and percentage of outperformances. Overall cumulative periods,

trading using gilts always performed better when traded monthly than daily with little difference between the two versions. Most of the markets favoured end of month crossovers, except the Pacific and the emerging markets in terms of absolute numbers and also Europe in terms of percentages with all three markets instead favouring end of month moving averages.

Throughout the 15-year results, the duration, or length of trend-following strategy used, typically had the largest impact on returns, volatility, maximum drawdowns, and Sharpe ratios. Reviewing the cumulative results by duration included 7 different strategies: those trading daily or monthly, using gilts or cash as the alternative asset to equities, and both two versions of each strategy. Therefore, moving averages and crossovers had the same number of strategies and could be compared directly unlike when reviewing by strategy which had a large discrepancy in the number of durations. Surprisingly, the duration strategy with the most outperformances for every market was a crossover, even for those markets such as emerging markets and the pacific which had previously always preferred moving averages.

The 200-day moving average did not perform particularly well across most of the markets. The highest the 200-day moving average was ranked amongst all moving averages and crossovers for the most outperformances was 2$^{nd}$ with Japan and the worst was 18$^{th}$ for the American fund. If just comparing moving averages, the 200-day moving average typically had either the first, second, or in the case of the American fund, third most strategies outperform. If crossovers were not an option, then a 200-day moving average would suffice, but it also would not be the optimum for most markets.

The majority of the crossover and moving average durations did not perform well for most of the cumulative periods. Depending on the market there were typically many years for which a duration did not have many, if any, strategies outperform especially for extremely short or long durations. In some instances, there were few moving averages which outperformed. For example, for the FTSE 100, FTSE 250, America, and Japan there were few moving average durations which performed well across the different cumulative periods.

The difference between end of month moving averages and crossovers for some of the markets is minimal and at times difficult to ascertain with conflicting results, while for others there were great differences. A one size fits all approach does not look to be the optimal strategy across all markets, but a combination of strategies depending on the market might perform the best. Luckily for an investor, the difference between daily and end of month trading is clear with monthly trading not only found to improve returns, be more consistent across all markets, reduce transaction costs and is much simpler to accomplish. Strategies which used gilts again had been found to greatly increase both average returns over 15-years, but also the number and consistency of strategies and durations which outperformed.

## 3.4 Conclusion

This chapter aimed to answer three main research questions. Do trend-following strategies applied to a range unit trusts for international stock market indices for the FTSE 250, US, Europe, Japan, Pacific and emerging markets outperform the buy and hold for each market in terms of returns, risk-adjusted returns, volatility, and maximum drawdown over 1-10 years and 15 years cumulatively? Does the inclusion of UK government bonds, gilts, into the strategy instead of cash as the alternative asset when exiting equities provide any support for trend-following strategies in international markets as they may not have the relationship to international equities as they would for the UK market? Are there different optimum strategies for different markets?

Firstly, the results for the international markets over 15 years were mixed. When reviewing a strategy which traded to cash, to ensure the timing ability was not influenced by the extra returns or volatilities provided by the use of gilts, only a few of the markets had trend-following strategies which outperformed over the whole 15 years studied. This could be due to where along the market cycle the investment started and the underlying market conditions. A trend-following strategy's strength is its ability to exit when markets are tumbling and re-enter when markets pick up again. The use of moving averages and crossovers in upward markets can relatively quickly identify a sustained crash, but its Achilles heel is identifying the following market rebound to re-enter in a timely fashion. If the strategy originally invests while

the underlying market is in an upward trend, the trend-following strategy is likely to be invested in the equity market from the start and therefore have returns which match the underlying market returns. If the period starts shortly before a large market correction, the trend-following strategy will be able to identify the fall in market values, exit equities, and should therefore outperform the underlying market. If on the other hand the investment starts at the bottom of the market, it will delay the original investment into the rising equity market markets, for a period dependent on the length of the trend-following duration, making it much more difficult for the strategy to catch up and more likely for it to underperform. The results from Chapter 2 over 21 years for the HSBC FTSE 100 unit trust were much more favourable because the trend-following strategies all started with investment in the equity markets as the underlying markets were trending upward. In this chapter after the initialisation period, the trend-following strategies started with investments into the alternative assets as the markets were at the bottom of the market cycle and the strategies were therefore behind for the rest of the period.

Some of the markets such as the emerging markets, the FTSE 100 and the FTSE 250 had a few strategies which traded into cash which were able to outperform the buy and hold. The main characteristics of these three markets which were beneficial for trend following appeared to be large drawdowns, low volatility, and high overall return. When the benchmark for comparison was the buy and hold of the same underlying asset as the trend-following strategy was based upon, the best return the trend-following strategies could possibly achieve in an upward market was the buy and hold itself, so having a large maximum drawdown was crucially the only way in which these trend-following strategies could outperform. Without this, the trend-following strategies over this period were unable to make up lost ground due to the poor start or any potentially smaller mistimed movements. Other markets, such as the US, Japan and Europe had much smaller drawdowns, higher volatility, and low to medium returns which gave trend-following strategies little opportunity to outperform. For these three markets and the Pacific, there were not any strategies which traded into cash which were able to outperform their underlying markets.

Mills (1997) found that moving averages strategies outperformed in periods when the underlying index was driftless and markets were inefficient. Alternatively, Ellis and Parbery (2005) found that moving averages performed poorly in markets

characterised by no clear trend. This chapter found that trend-following strategies were best able to perform when the underlying markets had low levels of volatility, high returns, and large maximum drawdowns similar to Ellis and Parbery (2005). It could be that trend following performed poorly in more efficient markets such as the American market and was better able to outperform in markets which are likely to be less efficient such as the emerging markets Ellis (1997).

Besides the mixed outperformance in terms of returns over the 15 years studied, almost all the trend-following strategies across all markets had significant reductions in maximum drawdowns and volatilities as was found in the previous chapter confirming the findings by Faber (2007) and Clare *et al.* (2013, 2016a). The reduction in volatility helped to increase the number of strategies that had risk-adjusted returns which outperformed their underlying equity markets, but even this effect was limited due to the relatively strong returns in the underlying markets. Still, every market had at least one strategy which traded into cash either through moving averages or crossovers which had Sharpe ratios which outperformed the underlying equity market buy and hold.

Over the shorter cumulative time frames, the results based on returns were mixed depending on the timing of the start of the investment and where the underlying market was in its market cycle. The periods which had the largest number of trend-following strategies outperform were the ones which started in 2007 and 2008 just before the market correction enabling the trend-following strategies to minimise the maximum drawdowns and exit the falling markets. The years with the smallest number of strategies which were able to outperform started in 2016 and 2009 at the bottom of the equity market cycle or as the equity markets were picking back up again.

The second research question researched the use of UK government bonds when out of equity markets instead of the usual allocation to cash or a cash-like asset as is typically used in trend-following studies (Faber, 2007, ap Gwilym *et al*., 2010; Clare *et al*., 2013, 2016a). Similar to the results in the previous chapter, there were clear advantages to trading into gilts when compared to moving to cash. The use of gilts as the alternative investment when the strategy was not in the equity index, increased average returns, risk-adjusted returns and the overall number of strategies

which were able to outperform. There was a slight increase in volatility when adding gilts to the strategy, but these strategies continued to have volatilities that were similar to the strategies which instead used cash and more importantly still provided a large reduction to the volatilities of the underlying buy and hold equity market. The increase in returns when using gilts was greater than the increase in volatility as the risk-adjusted returns were all improved with the use of gilts. This may have been due partly to the exceptional performance of gilt markets during this time due to government intervention and quantitative easing. During the time period studied, the addition of UK government bonds to the trend-following strategies was beneficial in terms of returns, volatilities, risk-adjusted returns and maximum drawdowns when compared to the underlying equity buy and hold regardless of the international market studied.

The final question which was extensively studied in this chapter was the search for an optimum strategy for each of the markets. Although the popular 200-day moving average considered the "most popular MA rule" (Mills, 1997; Faber, 2007; Clare *et al.* 2013, 2016a) had some success, it was not the strategy which was most successful across all the markets. If comparing against other moving averages, it often was included or near the top for the performing range with the highest returns, but it was not the most successful strategy consistently across all markets. In fact, a one-size fits all strategy across all markets remains elusive. Just as markets themselves are able to provide diversification from one another, the underlying market conditions are different enough to require different trend-following strategies. There was not a single strategy which always provided the best returns or risk-adjusted returns across all market conditions and all international markets. Instead, it would be wise to use different strategies depending on the market. For example, some markets such as the emerging markets and the Pacific over this period, had higher returns when using trend-following strategies which were able to react quicker: slightly shorter durations and moving averages as opposed to crossovers. While for other more established, and could be considered more efficient markets, such as America and Japan, trend-following strategies had better returns and risk-adjusted returns for slower trend-following strategies with longer durations and crossovers.

The most important factor in determining the returns of the strategies was the length of the moving average or crossovers selected. A 5 or 10-day moving average typically whipsawed and provided negative returns, while a longer moving average or crossover for some of the markets also eventually became too long and missed any downturn completely. For all markets, strategies which used gilts, and a medium length duration (adjusted slightly shorter/longer depending on the market) and traded at the end of the month for moving averages or either daily or monthly for crossovers had the best performance figures.

The specific contributions from this chapter were the use of unit trusts throughout this study to continue the practical application of trend following. Although the results were not as powerful a confirmation for trend following as was found in Chapter 2, they continued to show the strengths and weaknesses of trend-following. Confirming previous research (Faber, 2007, Clare *et al.* 2013, 2016a), trend-following strategies throughout the period studied continued to improve volatilities and maximum drawdowns in times of market correction. The weakness of trend following was mainly in the ability to re-enter equities in a timely fashion or starting off at a disadvantage when at the bottom of an equity correction. Unit trust themselves in this respect continued to react to trend-following strategies as any indices would.

A further unique contribution is the confirmation that the use of UK government bonds, even when paired with an international market, continued to provide added returns and risk-adjusted returns while improving volatility and maximum drawdowns compared to the buy and hold. Although this may be specific to this period due to government support, the benefits in terms of risk reduction from equities, but the possibility of added returns when out of equity markets, continued to prove successful.

The last contribution is the thorough review of differing strategies across international markets. Clare et al. 2013 reviewed moving averages from 10 to 450 days and crossovers with similar durations for the S&P 500, but in subsequent papers moved to a 10-month moving average (Clare et al. 2014, 2016a) as was used by Faber 2007 most likely for simplicity's sake. Although the 200-day moving average is the one most often used in trend-following studies, it was not found to be

the best ‘fit’ for all the market studied. Instead, different markets would be best suited to different strategies just as international markets are able to offer diversification benefits due to their different underlying characteristics.

Although the results over this chapter were mixed for trend-following strategies, the strategies were still able to reduce volatility and had dramatic improvements to maximum drawdowns. Investment protection as opposed to high returns could be more important to individuals at different stages of their investment life cycle, especially those approaching or in retirement and drawing income from their pension. Investors such as these may be risk averse, prefer an investment which may not always outperform but would minimise risk, provide better risk adjusted returns, and help to address sequence risk which would be highest at this time of their lives. Trend following itself may not be a one size fits all approach to investing, but it offers a clear differentiating strategy which in times of market distress operates in a way which is uncorrelated to other market strategies and can instead provide protection with returns.

# Table 3.1: Average 15 Year Trend-Following Statistics by Market

| HSBC FTSE 100 INDEX AC. RETAIL | Year 15 |
|---|---|
| Start Value | 100000000 |
| Number of shares | 1239925 |
| Cash | 48.75 |
| End Value | 276751308.75 |
| Overall Rtn | 176.75% |
| Annualised Rtn | 7.02% |
| Sharpe Ratio | 0.02 |
| Annualised SR (SR*SQRT252) | 0.36 |
| Max Drawdown | -0.4574 |
| | |
| Std Dev of rtn | 0.0111 |
| Annual Vol of rtn | 17.63% |
| kurt of rtn | 6.4583 |
| skew of rtn | -0.1268 |

| 15 Year Returns Summary Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All |
| Higher | 9 | 22 | 4 | 27 | 12 | 19 | 31 |
| Lower | 75 | 139 | 136 | 78 | 128 | 86 | 214 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 10.7% | 13.7% | 2.9% | 25.7% | 8.6% | 18.1% | 12.7% |
| % Lower | 89.3% | 86.3% | 97.1% | 74.3% | 91.4% | 81.9% | 87.3% |

| 15 Year Sharpe Ratio Summary Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All |
| Higher | 28 | 91 | 49 | 70 | 60 | 59 | 119 |
| Lower | 56 | 70 | 91 | 35 | 80 | 46 | 126 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 33.3% | 56.5% | 35.0% | 66.7% | 42.9% | 56.2% | 48.6% |
| % Lower | 66.7% | 43.5% | 65.0% | 33.3% | 57.1% | 43.8% | 51.4% |

| Average Statistics | | | | | | | | Range | |
|---|---|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All | High | Low |
| Avg Rtn | 4.24% | 5.50% | 4.78% | 5.45% | 4.65% | 5.61% | 5.07% | 9.13% | -3.24% |
| Avg Vol | 11.34% | 12.11% | 11.64% | 12.13% | 11.64% | 12.12% | 11.85% | 13.42% | 9.40% |
| Avg SR | 24.38% | 33.51% | 28.61% | 32.75% | 27.19% | 34.64% | 30.38% | 63.31% | -35.87% |
| Max DD | -23.61% | -23.16% | -23.52% | -23.04% | -23.59% | -22.95% | -23.31% | -15.01% | -51.80% |
| Skew | -0.429 | -0.441 | -0.454 | -0.414 | -0.452 | -0.417 | -0.437 | -0.05 | -0.88 |
| txns * | 213.25 | 52.06 | 71.19 | 155.50 | 158.564 | 39 | 107.322 | | |

This summary reflects the number of times the strategy outperforms the buy and hold over 15 years. The total number of strategies is different due to the fact that the the strategy which trades at the end of the month to gilts only has one version and because there are more crossover combinations than moving averages.
*There was only 1 version of the EOM Gilt strategy, so cash and daily statistics contain 2 more strategies.

| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | Year 15 |
|---|---|
| Start Value | 100000000 |
| Number of shares | 2066969 |
| Cash | 39.78 |
| End Value | 538445464.28 |
| Overall Rtn | 438.45% |
| Annualised Rtn | 11.88% |
| Sharpe Ratio | 0.04 |
| Annualised SR (SR*SQRT252) | 0.62 |
| Max Drawdown | -0.5236 |
| | |
| Std Dev of rtn | 0.0106 |
| Annual Vol of rtn | 16.87% |
| kurt of rtn | 5.6605 |
| skew of rtn | -0.5606 |

| 15 Year Returns Summary Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All |
| Higher | 9 | 42 | 21 | 30 | 27 | 24 | 51 |
| Lower | 75 | 119 | 119 | 75 | 113 | 81 | 194 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 10.7% | 26.1% | 15.0% | 28.6% | 19.3% | 22.9% | 20.8% |
| % Lower | 89.3% | 73.9% | 85.0% | 71.4% | 80.7% | 77.1% | 79.2% |

| 15 Year Sharpe Ratio Summary Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All |
| Higher | 54 | 117 | 98 | 73 | 93 | 78 | 171 |
| Lower | 30 | 44 | 42 | 32 | 47 | 27 | 74 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 64.3% | 72.7% | 70.0% | 69.5% | 66.4% | 74.3% | 69.8% |
| % Lower | 35.7% | 27.3% | 30.0% | 30.5% | 33.6% | 25.7% | 30.2% |

| Average Statistics | | | | | | | | Range | |
|---|---|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All | High | Low |
| Avg Rtn | 9.29% | 10.40% | 9.71% | 10.44% | 9.82% | 10.28% | 10.02% | 15.04% | 3.58% |
| Avg Vol | 11.89% | 12.29% | 11.94% | 12.43% | 12.02% | 12.32% | 12.15% | 13.37% | 10.01% |
| Avg SR | 62.37% | 69.07% | 65.56% | 68.39% | 65.75% | 68.14% | 66.77% | 102.23% | 18.75% |
| Max DD | -26.29% | -24.24% | -25.46% | -24.26% | -25.25% | -24.54% | -24.94% | -15.80% | -48.43% |
| Skew | -0.874 | -0.676 | -0.777 | -0.699 | -0.756 | -0.728 | -0.744 | -0.30 | -1.24 |
| txns * | 183.51 | 47.22 | 62.57 | 135.79 | 137.429 | 35.981 | 93.951 | | |

This summary reflects the number of times the strategy outperforms the buy and hold over 15 years. The total number of strategies is different due to the fact that the the strategy which trades at the end of the month to gilts only has one version and because there are more crossover combinations than moving averages.
*There was only 1 version of the EOM Gilt strategy, so cash and daily statistics contain 2 more strategies.

| HSBC AMER.INDEX AC. | Year 15 |
|---|---|
| Start Value | 100000000 |
| Number of shares | 765110 |
| Cash | 123.00 |
| End Value | 374597979.00 |
| Overall Rtn | 274.60% |
| Annualised Rtn | 9.20% |
| Sharpe Ratio | 0.03 |
| Annualised SR (SR*SQRT252) | 0.45 |
| Max Drawdown | -0.3703 |
| | |
| Std Dev of rtn | 0.0117 |
| Annual Vol of rtn | 18.61% |
| kurt of rtn | 5.2502 |
| skew of rtn | -0.0548 |

15 Year Returns Summary Table

| | MA | XO | Cash | Gilt | Daily | EOM | All |
|---|---|---|---|---|---|---|---|
| Higher | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lower | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| % Lower | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

15 Year Sharpe Ratio Summary Table

| | MA | XO | Cash | Gilt | Daily | EOM | All |
|---|---|---|---|---|---|---|---|
| Higher | 4 | 94 | 55 | 43 | 53 | 45 | 98 |
| Lower | 80 | 67 | 85 | 62 | 87 | 60 | 147 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 4.8% | 58.4% | 39.3% | 41.0% | 37.9% | 42.9% | 40.0% |
| % Lower | 95.2% | 41.6% | 60.7% | 59.0% | 62.1% | 57.1% | 60.0% |

Average Statistics

| | MA | XO | Cash | Gilt | Daily | EOM | All | Range High | Range Low |
|---|---|---|---|---|---|---|---|---|---|
| Avg Rtn | 4.74% | 6.71% | 5.96% | 6.12% | 5.67% | 6.52% | 6.03% | 9.12% | -1.35% |
| Avg Vol | 12.50% | 12.98% | 12.65% | 13.04% | 12.62% | 13.08% | 12.81% | 14.24% | 10.41% |
| Avg SR | 27.08% | 40.62% | 35.84% | 36.16% | 33.53% | 39.23% | 35.97% | 60.18% | -19.28% |
| Max DD | -27.31% | -25.36% | -25.65% | -26.54% | -26.56% | -25.33% | -26.03% | -15.19% | -54.75% |
| Skew | -0.124 | -0.006 | -0.038 | -0.059 | -0.057 | -0.034 | -0.047 | 0.17 | -0.61 |
| txns * | 235.69 | 57.10 | 79.60 | 169.97 | 173.436 | 44.8571 | 118.331 | | |

This summary reflects the number of times the strategy outperforms the buy and hold over 15 years. The total number of strategies is different due to the fact that the the strategy which trades at the end of the month to gilts only has one version and because there are more crossover combinations than moving averages.
*There was only 1 version of the EOM Gilt strategy, so cash and daily statistics contain 2 more strategies.

| BLACKROCK EMRG.MKTS. AC. | Year 15 |
|---|---|
| Start Value | 100000000 |
| Number of shares | 1099021 |
| Cash | 79.21 |
| End Value | 547862047.71 |
| Overall Rtn | 447.86% |
| Annualised Rtn | 12.01% |
| Sharpe Ratio | 0.04 |
| Annualised SR (SR*SQRT252) | 0.56 |
| Max Drawdown | -0.5509 |
| | |
| Std Dev of rtn | 0.0124 |
| Annual Vol of rtn | 19.71% |
| kurt of rtn | 5.8435 |
| skew of rtn | -0.3747 |

15 Year Returns Summary Table

| | MA | XO | Cash | Gilt | Daily | EOM | All |
|---|---|---|---|---|---|---|---|
| Higher | 14 | 9 | 2 | 21 | 14 | 9 | 23 |
| Lower | 70 | 152 | 138 | 84 | 126 | 96 | 222 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 16.7% | 5.6% | 1.4% | 20.0% | 10.0% | 8.6% | 9.4% |
| % Lower | 83.3% | 94.4% | 98.6% | 80.0% | 90.0% | 91.4% | 90.6% |

15 Year Sharpe Ratio Summary Table

| | MA | XO | Cash | Gilt | Daily | EOM | All |
|---|---|---|---|---|---|---|---|
| Higher | 59 | 48 | 55 | 52 | 61 | 46 | 107 |
| Lower | 25 | 113 | 85 | 53 | 79 | 59 | 138 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 70.2% | 29.8% | 39.3% | 49.5% | 43.6% | 43.8% | 43.7% |
| % Lower | 29.8% | 70.2% | 60.7% | 50.5% | 56.4% | 56.2% | 56.3% |

Average Statistics

| | MA | XO | Cash | Gilt | Daily | EOM | All | Range High | Range Low |
|---|---|---|---|---|---|---|---|---|---|
| Avg Rtn | 10.24% | 7.22% | 7.80% | 8.86% | 8.30% | 8.19% | 8.25% | 13.62% | 0.82% |
| Avg Vol | 13.76% | 14.57% | 14.10% | 14.54% | 14.14% | 14.49% | 14.29% | 16.64% | 11.49% |
| Avg SR | 62.03% | 41.60% | 46.26% | 51.72% | 49.29% | 47.68% | 48.60% | 83.10% | 1.20% |
| Max DD | -30.00% | -37.80% | -36.32% | -33.54% | -34.77% | -35.61% | -35.13% | -19.91% | -68.29% |
| Skew | -0.332 | -0.414 | -0.393 | -0.376 | -0.399 | -0.368 | -0.386 | 0.01 | -0.87 |
| txns * | 190.61 | 54.32 | 67.05 | 146.38 | 145.507 | 41.7714 | 101.049 | | |

This summary reflects the number of times the strategy outperforms the buy and hold over 15 years. The total number of strategies is different due to the fact that the the strategy which trades at the end of the month to gilts only has one version and because there are more crossover combinations than moving averages.
*There was only 1 version of the EOM Gilt strategy, so cash and daily statistics contain 2 more strategies.

| HSBC JAPAN INDEX ACC | Year 15 |
|---|---|
| Start Value | 100000000 |
| Number of shares | 2175331 |
| Cash | 33.93 |
| End Value | 253208562.33 |
| Overall Rtn | 153.21% |
| Annualised Rtn | 6.39% |
| Sharpe Ratio | 0.02 |
| Annualised SR (SR*SQRT252) | 0.31 |
| Max Drawdown | -0.4189 |
| | |
| Std Dev of rtn | 0.0128 |
| Annual Vol of rtn | 20.33% |
| kurt of rtn | 3.9620 |
| skew of rtn | -0.0934 |

| 15 Year Returns Summary Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All |
| Higher | 1 | 4 | 0 | 5 | 2 | 3 | 5 |
| Lower | 83 | 157 | 140 | 100 | 138 | 102 | 240 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 1.2% | 2.5% | 0.0% | 4.8% | 1.4% | 2.9% | 2.0% |
| % Lower | 98.8% | 97.5% | 100.0% | 95.2% | 98.6% | 97.1% | 98.0% |

| 15 Year Sharpe Ratio Summary Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All |
| Higher | 5 | 23 | 7 | 21 | 11 | 17 | 28 |
| Lower | 79 | 138 | 133 | 84 | 129 | 88 | 217 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 6.0% | 14.3% | 5.0% | 20.0% | 7.9% | 16.2% | 11.4% |
| % Lower | 94.0% | 85.7% | 95.0% | 80.0% | 92.1% | 83.8% | 88.6% |

| Average Statistics | | | | | | | | Range | |
|---|---|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All | High | Low |
| Avg Rtn | 3.25% | 3.80% | 3.41% | 3.87% | 3.09% | 4.30% | 3.61% | 7.02% | -2.33% |
| Avg Vol | 14.28% | 14.57% | 14.26% | 14.75% | 14.29% | 14.72% | 14.47% | 15.99% | 11.54% |
| Avg SR | 15.77% | 19.30% | 16.93% | 19.63% | 14.68% | 22.63% | 18.09% | 38.77% | -24.10% |
| Max DD | -33.93% | -31.57% | -33.16% | -31.34% | -33.40% | -31.02% | -32.38% | -20.02% | -57.54% |
| Skew | -0.296 | -0.272 | -0.279 | -0.282 | -0.312 | -0.238 | -0.280 | 0.09 | -0.65 |
| txns * | 242.56 | 59.71 | 82.21 | 175.99 | 178.664 | 47.3905 | 122.404 | | |

This summary reflects the number of times the strategy outperforms the buy and hold over 15 years. The total number of strategies is different due to the fact that the the strategy which trades at the end of the month to gilts only has one version and because there are more crossover combinations than moving averages.
*There was only 1 version of the EOM Gilt strategy, so cash and daily statistics contain 2 more strategies.

| HSBC EUR.INDEX AC. | Year 15 |
|---|---|
| Start Value | 100000000 |
| Number of shares | 422119 |
| Cash | 8.90 |
| End Value | 373364264.40 |
| Overall Rtn | 273.36% |
| Annualised Rtn | 9.18% |
| Sharpe Ratio | 0.03 |
| Annualised SR (SR*SQRT252) | 0.44 |
| Max Drawdown | -0.4596 |
| | |
| Std Dev of rtn | 0.0125 |
| Annual Vol of rtn | 19.85% |
| kurt of rtn | 4.5657 |
| skew of rtn | -0.1762 |

| 15 Year Returns Summary Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All |
| Higher | 7 | 4 | 0 | 11 | 5 | 6 | 11 |
| Lower | 77 | 157 | 140 | 94 | 135 | 99 | 234 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 8.3% | 2.5% | 0.0% | 10.5% | 3.6% | 5.7% | 4.5% |
| % Lower | 91.7% | 97.5% | 100.0% | 89.5% | 96.4% | 94.3% | 95.5% |

| 15 Year Sharpe Ratio Summary Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All |
| Higher | 33 | 44 | 27 | 50 | 42 | 35 | 77 |
| Lower | 51 | 117 | 113 | 55 | 98 | 70 | 168 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 39.3% | 27.3% | 19.3% | 47.6% | 30.0% | 33.3% | 31.4% |
| % Lower | 60.7% | 72.7% | 80.7% | 52.4% | 70.0% | 66.7% | 68.6% |

| Average Statistics | | | | | | | | Range | |
|---|---|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All | High | Low |
| Avg Rtn | 6.33% | 6.34% | 5.87% | 6.96% | 6.14% | 6.60% | 6.34% | 10.20% | -0.59% |
| Avg Vol | 13.05% | 13.97% | 13.47% | 13.90% | 13.46% | 13.91% | 13.66% | 15.32% | 10.87% |
| Avg SR | 37.63% | 36.46% | 34.06% | 40.59% | 35.80% | 38.29% | 36.86% | 66.06% | -11.81% |
| Max DD | -27.15% | -32.13% | -31.07% | -29.55% | -29.72% | -31.36% | -30.42% | -15.54% | -56.56% |
| Skew | -0.359 | -0.510 | -0.476 | -0.434 | -0.444 | -0.477 | -0.458 | 0.07 | -0.70 |
| txns * | 205.42 | 52.64 | 69.97 | 151.75 | 153.45 | 40.4476 | 105.02 | | |

This summary reflects the number of times the strategy outperforms the buy and hold over 15 years. The total number of strategies is different due to the fact that the the strategy which trades at the end of the month to gilts only has one version and because there are more crossover combinations than moving averages.
*There was only 1 version of the EOM Gilt strategy, so cash and daily statistics contain 2 more strategies.

| HSBC PACIFIC INDEX ACC | Year 15 |
|---|---|
| Start Value | 100000000 |
| Number of shares | 1289656 |
| Cash | 73.76 |
| End Value | 492261768.96 |
| Overall Rtn | 392.26% |
| Annualised Rtn | 11.21% |
| Sharpe Ratio | 0.03 |
| Annualised SR (SR*SQRT252) | 0.55 |
| Max Drawdown | -0.5010 |
| | |
| Std Dev of rtn | 0.0116 |
| Annual Vol of rtn | 18.35% |
| kurt of rtn | 6.2288 |
| skew of rtn | -0.2253 |

| 15 Year Returns Summary Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All |
| Higher | 4 | 5 | 0 | 9 | 4 | 5 | 9 |
| Lower | 80 | 156 | 140 | 96 | 136 | 100 | 236 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 4.8% | 3.1% | 0.0% | 8.6% | 2.9% | 4.8% | 3.7% |
| % Lower | 95.2% | 96.9% | 100.0% | 91.4% | 97.1% | 95.2% | 96.3% |

| 15 Year Sharpe Ratio Summary Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All |
| Higher | 47 | 33 | 34 | 46 | 47 | 33 | 80 |
| Lower | 37 | 128 | 106 | 59 | 93 | 72 | 165 |
| Total | 84 | 161 | 140 | 105 | 140 | 105 | 245 |
| % Higher | 56.0% | 20.5% | 24.3% | 43.8% | 33.6% | 31.4% | 32.7% |
| % Lower | 44.0% | 79.5% | 75.7% | 56.2% | 66.4% | 68.6% | 67.3% |

| Average Statistics | | | | | | | | Range | |
|---|---|---|---|---|---|---|---|---|---|
| | MA | XO | Cash | Gilt | Daily | EOM | All | High | Low |
| Avg Rtn | 8.72% | 7.30% | 7.29% | 8.44% | 7.87% | 7.67% | 7.79% | 12.96% | 3.91% |
| Avg Vol | 12.82% | 13.66% | 13.19% | 13.62% | 13.20% | 13.61% | 13.37% | 15.84% | 10.47% |
| Avg SR | 55.12% | 43.72% | 44.87% | 51.31% | 48.68% | 46.23% | 47.63% | 81.45% | 20.24% |
| Max DD | -26.84% | -30.32% | -29.80% | -28.23% | -28.22% | -30.33% | -29.13% | -17.77% | -50.05% |
| Skew | -0.314 | -0.314 | -0.317 | -0.310 | -0.327 | -0.297 | -0.314 | -0.06 | -0.59 |
| txns * | 187.75 | 52.96 | 66.09 | 143.28 | 142.279 | 41.6952 | 99.1714 | | |

This summary reflects the number of times the strategy outperforms the buy and hold over 15 years. The total number of strategies is different due to the fact that the the strategy which trades at the end of the month to gilts only has one version and because there are more crossover combinations than moving averages.
*There was only 1 version of the EOM Gilt strategy, so cash and daily statistics contain 2 more strategies.

Table 3.1: This table compares the buy and hold statistics on the left to the average statistics for each strategy type on the right by market. The number of strategies which outperformed for each individual trend-following strategy and duration combination are shown in the middle section. The average statistics include all durations and strategies. The second version of the end of month strategies trading into gilts were redundant and therefore excluded from the results. This left one more set of results for end of month strategies trading into cash than end of month strategies trading into gilts for both moving averages and crossovers. This impacted the number of strategies available when comparing strategies which traded into cash versus gilts and daily versus end of month strategies. This does not impact the difference between moving averages and crossovers although there were more crossover duration variations (23) than moving average durations (12).

# Table 3.2: 15-Year Average Statistics and Number of Outperformances Across All Durations by Strategy Trading into Cash and Gilts

| HSBC FTSE 100 INDEX AC. RETAIL | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Buy and Hold | 7.02% | 17.63% | 35.74% | -45.74% | -12.68% | | | | | |
| **Trend-Following Average by Strategy To Cash** | | | | | | **No of Outperformances by Strategy** | | | | |
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 3.22% | 10.92% | 17.06% | -24.60% | -46.54% | 0 | 12 | 1 | 12 | 0 |
| MA2 | 3.26% | 10.46% | 16.75% | -22.72% | -51.25% | 0 | 12 | 1 | 12 | 0 |
| % MA Cash | 3.24% | 10.69% | 16.90% | -23.66% | -48.90% | 0.00% | 100.00% | 8.33% | 100.00% | 0.00% |
| EOMMA1 | 5.36% | 11.72% | 33.53% | -22.96% | -37.99% | 2 | 12 | 6 | 12 | 0 |
| EOMMA2 | 4.67% | 11.66% | 28.07% | -24.19% | -39.04% | 0 | 12 | 6 | 12 | 0 |
| %EOMMACash | 5.01% | 11.69% | 30.80% | -23.58% | -38.52% | 8.33% | 100.00% | 50.00% | 100.00% | 0.00% |
| %MA Cash Total | 4.13% | 11.19% | 23.85% | -23.62% | -43.71% | 4.17% | 100.00% | 29.17% | 100.00% | 0.00% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 4.81% | 11.74% | 28.81% | -23.67% | -46.75% | 1 | 23 | 6 | 23 | 0 |
| XO2 | 4.80% | 11.68% | 28.60% | -24.06% | -47.46% | 0 | 23 | 8 | 22 | 0 |
| % XO Cash | 4.80% | 11.71% | 28.70% | -23.86% | -47.10% | 2.17% | 100.00% | 30.43% | 97.83% | 0.00% |
| EOM XO1 | 5.51% | 12.05% | 34.10% | -22.82% | -45.18% | 0 | 23 | 11 | 23 | 1 |
| EOMXO2 | 5.34% | 12.01% | 32.84% | -23.33% | -45.55% | 1 | 23 | 10 | 23 | 1 |
| % EOM XO Cash | 5.43% | 12.03% | 33.47% | -23.07% | -45.37% | 2.17% | 100.00% | 45.65% | 100.00% | 4.35% |
| % All XOs Cash | 5.11% | 11.87% | 31.09% | -23.47% | -46.24% | 2.17% | 100.00% | 38.04% | 98.91% | 2.17% |

| HSBC FTSE 100 INDEX AC. RETAIL | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Buy and Hold | 7.02% | 17.63% | 35.74% | -45.74% | -12.68% | | | | | |
| **Trend-Following Average by Strategy To Gilts** | | | | | | **No of Outperformances by Strategy** | | | | |
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 3.47% | 11.22% | 18.07% | -24.48% | -44.47% | 0 | 12 | 3 | 12 | 0 |
| MA2 | 3.71% | 11.13% | 19.98% | -23.70% | -44.70% | 1 | 12 | 3 | 12 | 0 |
| % MA Gilt | 3.59% | 11.17% | 19.03% | -24.09% | -44.58% | 4.17% | 100.00% | 25.00% | 100.00% | 0.00% |
| EOM MA | 5.99% | 12.30% | 37.22% | -22.59% | -36.13% | 6 | 12 | 8 | 12 | 0 |
| | | | | | | | | | | |
| %EOMMAGilt | 5.99% | 12.30% | 37.22% | -22.59% | -36.13% | 50.00% | 100.00% | 66.67% | 100.00% | 0.00% |
| % MA Gilt total * | 4.73% | 11.76% | 27.65% | -23.54% | -40.30% | 25.00% | 100.00% | 45.83% | 100.00% | 0.00% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 5.80% | 12.33% | 35.24% | -23.05% | -41.57% | 5 | 23 | 19 | 22 | 0 |
| XO2 | 5.81% | 12.32% | 35.34% | -22.97% | -41.59% | 5 | 23 | 19 | 22 | 0 |
| % XO Gilt | 5.80% | 12.33% | 35.29% | -23.01% | -41.58% | 21.74% | 100.00% | 82.61% | 95.65% | 0.00% |
| EOM XO | 6.41% | 12.64% | 39.66% | -22.24% | -40.67% | 10 | 23 | 18 | 23 | 0 |
| | | | | | | | | | | |
| %EOM XO Gilt | 6.41% | 12.64% | 39.66% | -22.24% | -40.67% | 43.48% | 100.00% | 78.26% | 100.00% | 0.00% |
| % XO Gilt Total* | 6.10% | 12.48% | 37.45% | -22.64% | -41.12% | 32.61% | 100.00% | 80.43% | 97.83% | 0.00% |

* Gilt total % includes daily gilt 1 and EOM gilt values to have equal daily/EOM split

| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Buy and Hold | 11.88% | 16.87% | 62.00% | -52.36% | -56.06% | | | | | |
| **Trend-Following Average by Strategy To Cash** | | | | | | **No of Outperformances by Strategy** | | | | |
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 8.84% | 11.53% | 60.79% | -28.65% | -97.20% | 0 | 12 | 7 | 12 | 0 |
| MA2 | 8.61% | 11.21% | 59.93% | -26.83% | -100.38% | 0 | 12 | 7 | 12 | 0 |
| % MA Cash | 8.72% | 11.37% | 60.36% | -27.74% | -98.79% | 0.00% | 100.00% | 58.33% | 100.00% | 0.00% |
| EOMMA1 | 9.80% | 12.10% | 65.66% | -25.69% | -79.59% | 1 | 12 | 8 | 12 | 0 |
| EOMMA2 | 9.27% | 12.04% | 61.89% | -26.55% | -83.22% | 0 | 12 | 8 | 12 | 0 |
| %EOMMACash | 9.53% | 12.07% | 63.77% | -26.12% | -81.41% | 4.17% | 100.00% | 66.67% | 100.00% | 0.00% |
| %MA Cash Total | 9.13% | 11.72% | 62.07% | -26.93% | -90.10% | 2.08% | 100.00% | 62.50% | 100.00% | 0.00% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 9.83% | 11.98% | 66.36% | -25.31% | -73.14% | 5 | 23 | 16 | 23 | 3 |
| XO2 | 9.79% | 11.91% | 66.34% | -24.84% | -68.94% | 5 | 23 | 15 | 23 | 5 |
| % XO Cash | 9.81% | 11.94% | 66.35% | -25.07% | -71.04% | 21.74% | 100.00% | 67.39% | 100.00% | 17.39% |
| EOM XO1 | 10.30% | 12.18% | 69.15% | -24.21% | -70.97% | 5 | 23 | 19 | 23 | 1 |
| EOMXO2 | 10.09% | 12.15% | 67.69% | -24.39% | -72.14% | 5 | 23 | 18 | 23 | 1 |
| % EOM XO Cash | 10.20% | 12.16% | 68.42% | -24.30% | -71.55% | 21.74% | 100.00% | 80.43% | 100.00% | 4.35% |
| % All XOs Cash | 10.01% | 12.05% | 67.38% | -24.69% | -71.30% | 21.74% | 100.00% | 73.91% | 100.00% | 10.87% |

| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Buy and Hold | 11.88% | 16.87% | 62.00% | -52.36% | -56.06% | | | | | |
| **Trend-Following Average by Strategy To Gilts** | | | | | | **No of Outperformances by Strategy** | | | | |
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 9.22% | 11.89% | 61.45% | -26.15% | -87.70% | 1 | 12 | 8 | 12 | 0 |
| MA2 | 9.04% | 11.82% | 60.27% | -25.83% | -88.54% | 2 | 12 | 8 | 12 | 0 |
| % MA Gilt | 9.13% | 11.85% | 60.86% | -25.99% | -88.12% | 12.50% | 100.00% | 66.67% | 100.00% | 0.00% |
| EOM MA | 10.25% | 12.61% | 66.60% | -24.34% | -75.31% | 5 | 12 | 8 | 12 | 0 |
| | | | | | | | | | | |
| %EOMMAGilt | 10.25% | 12.61% | 66.60% | -24.34% | -75.31% | 41.67% | 100.00% | 66.67% | 100.00% | 0.00% |
| % MA Gilt total * | 9.73% | 12.25% | 64.02% | -25.25% | -81.50% | 25.00% | 100.00% | 66.67% | 100.00% | 0.00% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 10.78% | 12.52% | 70.56% | -23.75% | -61.53% | 7 | 23 | 16 | 23 | 12 |
| XO2 | 10.77% | 12.52% | 70.47% | -23.73% | -61.55% | 7 | 23 | 16 | 23 | 12 |
| % XO Gilt | 10.77% | 12.52% | 70.51% | -23.74% | -61.54% | 30.43% | 100.00% | 69.57% | 100.00% | 52.17% |
| EOM XO | 11.23% | 12.75% | 72.93% | -23.46% | -64.88% | 8 | 23 | 17 | 23 | 11 |
| | | | | | | | | | | |
| %EOM XO Gilt | 11.23% | 12.75% | 72.93% | -23.46% | -64.88% | 34.78% | 100.00% | 73.91% | 100.00% | 47.83% |
| % XO Gilt Total* | 11.00% | 12.64% | 71.74% | -23.61% | -63.21% | 32.61% | 100.00% | 71.74% | 100.00% | 50.00% |

* Gilt total % includes daily gilt 1 and EOM gilt values to have equal daily/EOM split

| HSBC AMER.INDEX AC. | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Buy and Hold | 9.20% | 18.61% | 45.27% | -37.03% | -5.48% | | | | | |
| **Trend-Following Average by Strategy To Cash** | | | | | | **No of Outperformances by Strategy** | | | | |
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 4.38% | 12.16% | 25.27% | -25.43% | -10.78% | 0 | 12 | 0 | 12 | 4 |
| MA2 | 4.05% | 11.59% | 22.91% | -25.93% | -10.90% | 0 | 12 | 0 | 12 | 5 |
| % MA Cash | 4.22% | 11.88% | 24.09% | -25.68% | -10.84% | 0.00% | 100.00% | 0.00% | 100.00% | 37.50% |
| EOMMA1 | 5.62% | 12.95% | 33.07% | -26.47% | -13.18% | 0 | 12 | 1 | 11 | 3 |
| EOMMA2 | 4.95% | 12.88% | 28.24% | -28.92% | -13.65% | 0 | 12 | 1 | 10 | 3 |
| %EOMMACash | 5.29% | 12.92% | 30.65% | -27.69% | -13.42% | 0.00% | 100.00% | 8.33% | 87.50% | 25.00% |
| %MA Cash Total | 4.75% | 12.40% | 27.37% | -26.69% | -12.13% | 0.00% | 100.00% | 4.17% | 93.75% | 31.25% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 6.26% | 12.69% | 37.96% | -26.19% | -1.70% | 0 | 23 | 13 | 18 | 16 |
| XO2 | 6.21% | 12.63% | 37.52% | -26.28% | -1.73% | 0 | 23 | 13 | 19 | 16 |
| % XO Cash | 6.24% | 12.66% | 37.74% | -26.24% | -1.71% | 0.00% | 100.00% | 56.52% | 80.43% | 69.57% |
| EOM XO1 | 7.04% | 12.92% | 43.37% | -23.73% | 2.85% | 0 | 23 | 13 | 20 | 19 |
| EOMXO2 | 6.86% | 12.88% | 42.17% | -24.21% | 3.00% | 0 | 23 | 14 | 20 | 19 |
| % EOM XO Cash | 6.95% | 12.90% | 42.77% | -23.97% | 2.93% | 0.00% | 100.00% | 58.70% | 86.96% | 82.61% |
| % All XOs Cash | 6.59% | 12.78% | 40.25% | -25.10% | 0.61% | 0.00% | 100.00% | 57.61% | 83.70% | 76.09% |

| HSBC AMER.INDEX AC. | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Buy and Hold | 9.20% | 18.61% | 45.27% | -37.03% | -5.48% | | | | | |
| **Trend-Following Average by Strategy To Gilts** | | | | | | **No of Outperformances by Strategy** | | | | |
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 4.16% | 12.30% | 23.02% | -28.97% | -13.09% | 0 | 12 | 1 | 12 | 2 |
| MA2 | 4.28% | 12.17% | 23.97% | -27.72% | -10.84% | 0 | 12 | 0 | 12 | 6 |
| % MA Gilt | 4.22% | 12.23% | 23.50% | -28.35% | -11.97% | 0.00% | 100.00% | 4.17% | 100.00% | 33.33% |
| EOM MA | 5.73% | 13.44% | 33.07% | -27.73% | -14.46% | 0 | 12 | 1 | 11 | 3 |
| | | | | | | | | | | |
| %EOMMAGilt | 5.73% | 13.44% | 33.07% | -27.73% | -14.46% | 0.00% | 100.00% | 8.33% | 91.67% | 25.00% |
| % MA Gilt total * | 4.94% | 12.87% | 28.04% | -28.35% | -13.78% | 0.00% | 100.00% | 8.33% | 95.83% | 20.83% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 6.63% | 13.17% | 39.53% | -26.37% | -3.65% | 0 | 23 | 13 | 20 | 16 |
| XO2 | 6.61% | 13.16% | 39.42% | -26.41% | -3.65% | 0 | 23 | 13 | 20 | 16 |
| % XO Gilt | 6.62% | 13.16% | 39.48% | -26.39% | -3.65% | 0.00% | 100.00% | 56.52% | 86.96% | 69.57% |
| EOM XO | 7.34% | 13.41% | 44.34% | -24.31% | 0.35% | 0 | 23 | 15 | 21 | 19 |
| | | | | | | | | | | |
| %EOM XO Gilt | 7.34% | 13.41% | 44.34% | -24.31% | 0.35% | 0.00% | 100.00% | 65.22% | 91.30% | 82.61% |
| % XO Gilt Total* | 6.98% | 13.29% | 41.94% | -25.34% | -1.65% | 0.00% | 100.00% | 60.87% | 89.13% | 76.09% |

* Gilt total % includes daily gilt 1 and EOM gilt values to have equal daily/EOM split

| BLACKROCK EMRG.MKTS. AC. | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Buy and Hold | 12.01% | 19.71% | 56.26% | -55.09% | -37.47% | | | | | |
| **Trend-Following Average by Strategy To Cash** | | | | | | **No of Outperformances by Strategy** | | | | |
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 10.25% | 13.43% | 63.46% | -30.79% | -38.99% | 1 | 12 | 7 | 12 | 6 |
| MA2 | 9.53% | 13.03% | 59.96% | -29.42% | -35.73% | 0 | 12 | 8 | 12 | 7 |
| % MA Cash | 9.89% | 13.23% | 61.71% | -30.10% | -37.36% | 4.17% | 100.00% | 62.50% | 100.00% | 54.17% |
| EOMMA1 | 10.38% | 14.04% | 62.07% | -30.05% | -29.64% | 1 | 12 | 10 | 12 | 8 |
| EOMMA2 | 9.63% | 13.98% | 57.55% | -31.94% | -30.16% | 0 | 12 | 8 | 12 | 8 |
| %EOMMACash | 10.01% | 14.01% | 59.81% | -31.00% | -29.90% | 4.17% | 100.00% | 75.00% | 100.00% | 66.67% |
| %MA Cash Total | 9.95% | 13.62% | 60.76% | -30.55% | -33.63% | 4.17% | 100.00% | 68.75% | 100.00% | 60.42% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 6.82% | 14.27% | 39.77% | -39.23% | -43.21% | 0 | 23 | 5 | 19 | 9 |
| XO2 | 6.66% | 14.21% | 38.78% | -39.43% | -43.44% | 0 | 23 | 5 | 19 | 8 |
| % XO Cash | 6.74% | 14.24% | 39.28% | -39.33% | -43.32% | 0.00% | 100.00% | 21.74% | 82.61% | 36.96% |
| EOM XO1 | 6.77% | 14.49% | 39.17% | -39.05% | -41.01% | 0 | 23 | 6 | 19 | 7 |
| EOMXO2 | 6.44% | 14.45% | 37.05% | -39.59% | -41.25% | 0 | 23 | 6 | 19 | 7 |
| % EOM XO Cash | 6.61% | 14.47% | 38.11% | -39.32% | -41.13% | 0.00% | 100.00% | 26.09% | 82.61% | 30.43% |
| % All XOs Cash | 6.67% | 14.35% | 38.69% | -39.32% | -42.23% | 0.00% | 100.00% | 23.91% | 82.61% | 33.70% |

| BLACKROCK EMRG.MKTS. AC. | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Buy and Hold | 12.01% | 19.71% | 56.26% | -55.09% | -37.47% | | | | | |
| **Trend-Following Average by Strategy To Gilts** | | | | | | **No of Outperformances by Strategy** | | | | |
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 10.41% | 13.69% | 63.09% | -29.42% | -34.55% | 4 | 12 | 9 | 12 | 7 |
| MA2 | 10.36% | 13.61% | 63.05% | -28.98% | -33.81% | 3 | 12 | 9 | 12 | 7 |
| % MA Gilt | 10.38% | 13.65% | 63.07% | -29.20% | -34.18% | 29.17% | 100.00% | 75.00% | 100.00% | 58.33% |
| EOM MA | 11.13% | 14.55% | 65.02% | -29.42% | -29.43% | 5 | 12 | 8 | 12 | 8 |
| | | | | | | | | | | |
| %EOMMAGilt | 11.13% | 14.55% | 65.02% | -29.42% | -29.43% | 41.67% | 100.00% | 66.67% | 100.00% | 66.67% |
| % MA Gilt total * | 10.77% | 14.12% | 64.06% | -29.42% | -31.99% | 37.50% | 100.00% | 70.83% | 100.00% | 62.50% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 7.95% | 14.77% | 45.66% | -35.54% | -40.82% | 3 | 23 | 9 | 20 | 8 |
| XO2 | 7.95% | 14.77% | 45.64% | -35.54% | -40.83% | 3 | 23 | 9 | 20 | 8 |
| % XO Gilt | 7.95% | 14.77% | 45.65% | -35.54% | -40.82% | 13.04% | 100.00% | 39.13% | 86.96% | 34.78% |
| EOM XO | 7.92% | 15.01% | 45.10% | -36.21% | -39.04% | 3 | 23 | 8 | 20 | 7 |
| | | | | | | | | | | |
| %EOM XO Gilt | 7.92% | 15.01% | 45.10% | -36.21% | -39.04% | 13.04% | 100.00% | 34.78% | 86.96% | 30.43% |
| % XO Gilt Total* | 7.94% | 14.89% | 45.38% | -35.87% | -39.93% | 13.04% | 100.00% | 36.96% | 86.96% | 32.61% |

* Gilt total % includes daily gilt 1 and EOM gilt values to have equal daily/EOM split

| HSBC JAPAN INDEX ACC | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
|---|---|---|---|---|---|
| Buy and Hold | 6.39% | 20.33% | 30.70% | -41.89% | -9.34% |

| Trend-Following Average by Strategy To Cash | | | | | | No of Outperformances by Strategy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 1.72% | 13.88% | 5.65% | -38.80% | -40.60% | 0 | 12 | 0 | 9 | 1 |
| MA2 | 2.10% | 13.30% | 8.37% | -37.54% | -38.68% | 0 | 12 | 0 | 10 | 1 |
| % MA Cash | 1.91% | 13.59% | 7.01% | -38.17% | -39.64% | 0.00% | 100.00% | 0.00% | 79.17% | 8.33% |
| EOMMA1 | 4.51% | 14.78% | 24.05% | -32.24% | -16.76% | 0 | 12 | 1 | 11 | 3 |
| EOMMA2 | 4.36% | 14.69% | 23.09% | -32.58% | -19.28% | 0 | 12 | 0 | 11 | 2 |
| %EOMMACash | 4.44% | 14.74% | 23.57% | -32.41% | -18.02% | 0.00% | 100.00% | 4.17% | 91.67% | 20.83% |
| %MA Cash Total | 3.17% | 14.17% | 15.29% | -35.29% | -28.83% | 0.00% | 100.00% | 2.08% | 85.42% | 14.58% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 3.24% | 14.27% | 15.85% | -32.87% | -28.01% | 0 | 23 | 0 | 16 | 1 |
| XO2 | 3.17% | 14.19% | 15.28% | -32.47% | -28.66% | 0 | 23 | 1 | 17 | 1 |
| % XO Cash | 3.21% | 14.23% | 15.56% | -32.67% | -28.33% | 0.00% | 100.00% | 2.17% | 71.74% | 4.35% |
| EOM XO1 | 3.84% | 14.42% | 19.84% | -31.61% | -26.35% | 0 | 23 | 2 | 18 | 2 |
| EOMXO2 | 3.89% | 14.38% | 20.18% | -31.26% | -26.74% | 0 | 23 | 3 | 18 | 1 |
| % EOM XO Cash | 3.87% | 14.40% | 20.01% | -31.44% | -26.54% | 0.00% | 100.00% | 10.87% | 78.26% | 6.52% |
| % All XOs Cash | 3.54% | 14.31% | 17.79% | -32.05% | -27.44% | 0.00% | 100.00% | 6.52% | 75.00% | 5.43% |

| HSBC JAPAN INDEX ACC | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
|---|---|---|---|---|---|
| Buy and Hold | 6.39% | 20.33% | 30.70% | -41.89% | -9.34% |

| Trend-Following Average by Strategy To Gilts | | | | | | No of Outperformances by Strategy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 2.49% | 14.09% | 11.01% | -34.16% | -35.72% | 0 | 12 | 0 | 11 | 1 |
| MA2 | 2.63% | 13.94% | 12.00% | -33.73% | -35.94% | 0 | 12 | 0 | 10 | 1 |
| % MA Gilt | 2.56% | 14.02% | 11.51% | -33.95% | -35.83% | 0.00% | 100.00% | 0.00% | 87.50% | 8.33% |
| EOM MA | 4.91% | 15.30% | 26.18% | -28.44% | -20.25% | 1 | 12 | 4 | 12 | 2 |
| | | | | | | | | | | |
| %EOMMAGilt | 4.91% | 15.30% | 26.18% | -28.44% | -20.25% | 8.33% | 100.00% | 33.33% | 100.00% | 16.67% |
| % MA Gilt total * | 3.70% | 14.70% | 18.60% | -31.30% | -27.99% | 4.17% | 100.00% | 16.67% | 95.83% | 12.50% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 3.86% | 14.85% | 19.46% | -31.38% | -27.27% | 1 | 23 | 5 | 18 | 1 |
| XO2 | 3.85% | 14.85% | 19.45% | -31.35% | -27.28% | 1 | 23 | 5 | 18 | 1 |
| % XO Gilt | 3.86% | 14.85% | 19.46% | -31.36% | -27.27% | 4.35% | 100.00% | 21.74% | 78.26% | 4.35% |
| EOM XO | 4.71% | 15.03% | 25.01% | -30.07% | -26.08% | 2 | 23 | 7 | 21 | 1 |
| | | | | | | | | | | |
| %EOM XO Gilt | 4.71% | 15.03% | 25.01% | -30.07% | -26.08% | 8.70% | 100.00% | 30.43% | 91.30% | 4.35% |
| % XO Gilt Total* | 4.28% | 14.94% | 22.24% | -30.73% | -26.67% | 6.52% | 100.00% | 26.09% | 84.78% | 4.35% |

* Gilt total % includes daily gilt 1 and EOM gilt values to have equal daily/EOM split

| HSBC EUR.INDEX AC. | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
|---|---|---|---|---|---|
| Buy and Hold | 9.18% | 19.85% | 43.55% | -45.96% | -17.62% |

| Trend-Following Average by Strategy To Cash | | | | | | No of Outperformances by Strategy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 5.28% | 12.69% | 31.32% | -26.52% | -35.25% | 0 | 12 | 3 | 12 | 1 |
| MA2 | 5.35% | 12.20% | 31.93% | -26.25% | -33.64% | 0 | 12 | 3 | 12 | 1 |
| % MA Cash | 5.31% | 12.45% | 31.63% | -26.38% | -34.45% | 0.00% | 100.00% | 25.00% | 100.00% | 8.33% |
| EOMMA1 | 6.71% | 13.44% | 39.84% | -28.82% | -40.03% | 0 | 12 | 5 | 12 | 1 |
| EOMMA2 | 6.18% | 13.37% | 36.28% | -30.29% | -41.41% | 0 | 12 | 3 | 12 | 0 |
| %EOMMACash | 6.45% | 13.40% | 38.06% | -29.56% | -40.72% | 0.00% | 100.00% | 33.33% | 100.00% | 4.17% |
| %MA Cash Total | 5.88% | 12.93% | 34.84% | -27.97% | -37.58% | 0.00% | 100.00% | 29.17% | 100.00% | 6.25% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 5.71% | 13.65% | 32.77% | -32.24% | -52.86% | 0 | 23 | 3 | 22 | 0 |
| XO2 | 5.67% | 13.58% | 32.57% | -32.50% | -53.07% | 0 | 23 | 2 | 22 | 2 |
| % XO Cash | 5.69% | 13.62% | 32.67% | -32.37% | -52.97% | 0.00% | 100.00% | 10.87% | 95.65% | 4.35% |
| EOM XO1 | 6.12% | 13.92% | 35.22% | -32.72% | -52.45% | 0 | 23 | 4 | 22 | 1 |
| EOMXO2 | 5.95% | 13.89% | 34.07% | -33.31% | -53.08% | 0 | 23 | 4 | 22 | 1 |
| % EOM XO Cash | 6.04% | 13.90% | 34.64% | -33.02% | -52.76% | 0.00% | 100.00% | 17.39% | 95.65% | 4.35% |
| % All XOs Cash | 5.86% | 13.76% | 33.66% | -32.69% | -52.87% | 0.00% | 100.00% | 14.13% | 95.65% | 4.35% |

| HSBC EUR.INDEX AC. | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
|---|---|---|---|---|---|
| Buy and Hold | 9.18% | 19.85% | 43.55% | -45.96% | -17.62% |

| Trend-Following Average by Strategy To Gilts | | | | | | No of Outperformances by Strategy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 6.39% | 12.91% | 38.24% | -26.07% | -29.65% | 2 | 12 | 5 | 12 | 1 |
| MA2 | 6.51% | 12.80% | 39.19% | -25.56% | -30.46% | 1 | 12 | 6 | 12 | 1 |
| % MA Gilt | 6.45% | 12.86% | 38.72% | -25.81% | -30.05% | 12.50% | 100.00% | 45.83% | 100.00% | 8.33% |
| EOM MA | 7.86% | 13.92% | 46.62% | -26.55% | -40.56% | 4 | 12 | 8 | 12 | 0 |
| | | | | | | | | | | |
| %EOMMAGilt | 7.86% | 13.92% | 46.62% | -26.55% | -40.56% | 33.33% | 100.00% | 66.67% | 100.00% | 0.00% |
| % MA Gilt total * | 7.13% | 13.42% | 42.43% | -26.31% | -35.10% | 25.00% | 100.00% | 54.17% | 100.00% | 4.17% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 6.86% | 14.16% | 39.55% | -30.82% | -48.37% | 1 | 23 | 10 | 23 | 2 |
| XO2 | 6.87% | 14.16% | 39.59% | -30.86% | -48.51% | 1 | 23 | 10 | 23 | 2 |
| % XO Gilt | 6.87% | 14.16% | 39.57% | -30.84% | -48.44% | 4.35% | 100.00% | 43.48% | 100.00% | 8.70% |
| EOM XO | 7.23% | 14.45% | 41.45% | -32.45% | -48.79% | 2 | 23 | 11 | 22 | 1 |
| | | | | | | | | | | |
| %EOM XO Gilt | 7.23% | 14.45% | 41.45% | -32.45% | -48.79% | 8.70% | 100.00% | 47.83% | 95.65% | 4.35% |
| % XO Gilt Total* | 7.04% | 14.31% | 40.50% | -31.63% | -48.58% | 6.52% | 100.00% | 45.65% | 97.83% | 6.52% |

* Gilt total % includes daily gilt 1 and EOM gilt values to have equal daily/EOM split

| HSBC PACIFIC INDEX ACC | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Buy and Hold | 11.21% | 18.35% | 55.26% | -50.10% | -22.53% | | | | | |
| **Trend-Following Average by Strategy To Cash** | | | | | | **No of Outperformances by Strategy** | | | | |
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 8.68% | 12.41% | 56.51% | -26.32% | -34.09% | 0 | 12 | 5 | 12 | 2 |
| MA2 | 8.23% | 12.03% | 54.20% | -25.60% | -33.45% | 0 | 12 | 5 | 12 | 1 |
| % MA Cash | 8.45% | 12.22% | 55.35% | -25.96% | -33.77% | 0.00% | 100.00% | 41.67% | 100.00% | 12.50% |
| EOMMA1 | 8.45% | 13.14% | 52.31% | -29.18% | -28.46% | 0 | 12 | 6 | 12 | 4 |
| EOMMA2 | 7.92% | 13.11% | 48.75% | -30.76% | -30.01% | 0 | 12 | 6 | 12 | 2 |
| %EOMMACash | 8.18% | 13.12% | 50.53% | -29.97% | -29.23% | 0.00% | 100.00% | 50.00% | 100.00% | 25.00% |
| %MA Cash Total | 8.32% | 12.67% | 52.94% | -27.97% | -31.50% | 0.00% | 100.00% | 45.83% | 100.00% | 18.75% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 6.84% | 13.35% | 41.41% | -30.54% | -33.31% | 0 | 23 | 2 | 23 | 2 |
| XO2 | 6.73% | 13.30% | 40.73% | -30.59% | -33.36% | 0 | 23 | 3 | 23 | 3 |
| % XO Cash | 6.78% | 13.32% | 41.07% | -30.56% | -33.34% | 0.00% | 100.00% | 10.87% | 100.00% | 10.87% |
| EOM XO1 | 6.87% | 13.60% | 41.23% | -30.69% | -30.01% | 0 | 23 | 4 | 23 | 6 |
| EOMXO2 | 6.58% | 13.57% | 39.28% | -31.18% | -30.52% | 0 | 23 | 3 | 23 | 6 |
| % EOM XO Cash | 6.73% | 13.58% | 40.25% | -30.94% | -30.26% | 0.00% | 100.00% | 15.22% | 100.00% | 26.09% |
| % All XOs Cash | 6.76% | 13.45% | 40.66% | -30.75% | -31.80% | 0.00% | 100.00% | 13.04% | 100.00% | 18.48% |

| HSBC PACIFIC INDEX ACC | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Buy and Hold | 11.21% | 18.35% | 55.26% | -50.10% | -22.53% | | | | | |
| **Trend-Following Average by Strategy To Gilts** | | | | | | **No of Outperformances by Strategy** | | | | |
| Moving Averages | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| MA1 | 9.27% | 12.71% | 59.01% | -23.48% | -32.33% | 1 | 12 | 9 | 12 | 1 |
| MA2 | 9.14% | 12.63% | 58.30% | -24.24% | -31.94% | 1 | 12 | 9 | 12 | 1 |
| % MA Gilt | 9.21% | 12.67% | 58.66% | -23.86% | -32.14% | 8.33% | 100.00% | 75.00% | 100.00% | 8.33% |
| EOM MA | 9.36% | 13.68% | 56.77% | -28.29% | -29.50% | 2 | 12 | 7 | 12 | 2 |
| | | | | | | | | | | |
| %EOMMAGilt | 9.36% | 13.68% | 56.77% | -28.29% | -29.50% | 16.67% | 100.00% | 58.33% | 100.00% | 16.67% |
| % MA Gilt total * | 9.32% | 13.19% | 57.89% | -25.89% | -30.92% | 12.50% | 100.00% | 66.67% | 100.00% | 12.50% |
| Crossovers | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew | Ann Rtn | Ann Vol | Ann SR | Max DD | Skew |
| XO1 | 7.96% | 13.86% | 47.59% | -29.34% | -31.74% | 1 | 23 | 7 | 23 | 3 |
| XO2 | 7.97% | 13.85% | 47.62% | -29.34% | -31.74% | 1 | 23 | 7 | 23 | 3 |
| % XO Gilt | 7.97% | 13.85% | 47.61% | -29.34% | -31.74% | 4.35% | 100.00% | 30.43% | 100.00% | 13.04% |
| EOM XO | 8.13% | 14.12% | 48.18% | -30.54% | -29.21% | 3 | 23 | 7 | 23 | 6 |
| | | | | | | | | | | |
| %EOM XO Gilt | 8.13% | 14.12% | 48.18% | -30.54% | -29.21% | 13.04% | 100.00% | 30.43% | 100.00% | 26.09% |
| % XO Gilt Total* | 8.05% | 13.99% | 47.88% | -29.94% | -30.47% | 8.70% | 100.00% | 30.43% | 100.00% | 19.57% |

* Gilt total % includes daily gilt 1 and EOM gilt values to have equal daily/EOM split

# Table 3.3: 15-Year Returns by Market

| Annualised Return | Year 15 |
|---|---|
| HSBC FTSE 100 INDEX AC. RETAIL | 7.02% |

Positive Returns
Outperforms Buy and Hold
Highest 10 Positive Return
Highest Outperforms Buy and Hold

| Cash Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Cash 1 | -1.73% | -0.33% | 0.60% | 2.93% | 3.13% | 5.29% | 5.83% | 4.38% | 5.14% | 4.92% | 4.29% | 4.18% |
| MA - Cash 2 | -0.57% | -0.02% | 0.62% | 2.13% | 3.21% | 5.75% | 5.24% | 4.24% | 4.96% | 4.78% | 4.70% | 4.02% |
| EOM MA - Cash 1 | 3.37% | 2.63% | 3.50% | 3.07% | 5.11% | 7.33% | 7.63% | 5.34% | 6.31% | 6.48% | 6.68% | 6.89% |
| EOM MA - Cash 2 | 2.72% | 1.14% | 2.17% | 1.77% | 4.20% | 6.47% | 7.02% | 5.11% | 5.99% | 6.36% | 6.44% | 6.64% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | -0.08% | -2.01% | 1.56% | 4.37% | 4.45% | 7.04% | 5.19% | 4.46% | 6.36% | 6.91% | 5.86% | 5.54% | 6.07% | 5.70% | 5.37% | 6.06% | 4.96% | 5.60% | 5.72% | 5.41% | 5.53% | 5.73% | 4.78% |
| XO - Cash 2 | -0.44% | -2.78% | 1.63% | 4.31% | 4.53% | 6.90% | 5.38% | 4.72% | 6.36% | 6.89% | 5.84% | 5.48% | 6.05% | 5.87% | 5.39% | 6.23% | 5.21% | 5.53% | 5.77% | 5.58% | 5.52% | 5.57% | 4.77% |
| EOM XO - Cash 1 | 1.55% | 3.73% | 3.41% | 5.19% | 6.05% | 6.55% | 6.12% | 5.75% | 6.48% | 6.19% | 5.69% | 5.72% | 6.18% | 6.06% | 5.99% | 6.99% | 5.26% | 5.63% | 5.61% | 5.69% | 5.94% | 5.77% | 5.21% |
| EOM XO - Cash 2 | 0.38% | 2.54% | 2.47% | 4.89% | 6.42% | 6.58% | 5.98% | 5.69% | 6.74% | 6.08% | 5.60% | 5.68% | 6.24% | 6.07% | 6.04% | 7.07% | 5.03% | 5.69% | 5.45% | 5.63% | 5.83% | 5.67% | 5.10% |

| Gilt Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Gilt 1 | -2.36% | -0.29% | -0.84% | 2.51% | 3.94% | 6.78% | 6.30% | 5.16% | 5.95% | 5.17% | 4.87% | 4.50% |
| MA - Gilt 2 | -1.35% | -0.22% | -0.14% | 2.68% | 4.05% | 7.12% | 6.17% | 5.10% | 6.00% | 5.24% | 5.33% | 4.48% |
| EOM MA - Gilt | 3.12% | 0.60% | 2.86% | 4.80% | 6.60% | 9.13% | 8.69% | 6.21% | 7.20% | 7.76% | 7.66% | 7.26% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Gilt 1 | -1.60% | -3.24% | 4.12% | 6.86% | 6.89% | 9.11% | 6.57% | 6.53% | 7.85% | 7.41% | 6.48% | 6.39% | 7.28% | 7.01% | 6.00% | 7.26% | 6.12% | 6.29% | 6.56% | 5.98% | 6.09% | 6.14% | 5.25% |
| XO - Gilt 2 | -1.33% | -3.15% | 4.12% | 6.87% | 6.89% | 9.05% | 6.54% | 6.53% | 7.85% | 7.41% | 6.48% | 6.39% | 7.28% | 7.01% | 6.00% | 7.26% | 6.12% | 6.29% | 6.56% | 5.98% | 6.09% | 6.14% | 5.25% |
| EOM XO - Gilt | -0.54% | 4.59% | 5.92% | 7.45% | 8.02% | 8.12% | 7.68% | 7.36% | 8.10% | 7.02% | 6.13% | 6.16% | 7.14% | 7.13% | 6.72% | 8.26% | 5.72% | 6.56% | 5.99% | 5.82% | 6.25% | 6.39% | 5.47% |

| Annualised Return | Year 15 |
|---|---|
| HSBC TRKR.FTSE 250 IDX. AC.RE | 11.88% |

Positive Returns
Outperforms Buy and Hold
Highest 10 Positive Return
Highest Outperforms Buy and Hold

| Cash Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Cash 1 | 5.15% | 7.13% | 6.09% | 8.21% | 9.00% | 10.10% | 10.00% | 11.31% | 9.88% | 10.05% | 10.09% | 9.05% |
| MA - Cash 2 | 5.69% | 5.42% | 5.73% | 7.61% | 8.66% | 10.00% | 10.32% | 10.88% | 9.32% | 10.28% | 9.92% | 9.50% |
| EOM MA - Cash 1 | 6.29% | 6.33% | 7.00% | 7.01% | 11.10% | 11.47% | 11.96% | 11.04% | 11.02% | 11.43% | 11.84% | 11.08% |
| EOM MA - Cash 2 | 5.37% | 4.88% | 5.52% | 5.64% | 10.47% | 11.13% | 11.82% | 11.18% | 11.23% | 11.35% | 11.66% | 11.02% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 5.56% | 4.13% | 7.55% | 9.75% | 9.31% | 11.30% | 11.89% | 12.30% | 12.48% | 13.17% | 12.63% | 10.35% | 9.57% | 7.81% | 10.32% | 9.68% | 8.99% | 9.38% | 9.82% | 9.87% | 9.57% | 10.73% | 9.97% |
| XO - Cash 2 | 5.40% | 4.69% | 6.97% | 9.62% | 8.94% | 11.36% | 12.75% | 12.13% | 12.47% | 13.06% | 12.32% | 10.16% | 9.44% | 7.89% | 10.21% | 9.62% | 8.99% | 9.32% | 9.78% | 9.75% | 9.51% | 10.82% | 10.07% |
| EOM XO - Cash 1 | 6.83% | 10.04% | 6.07% | 10.88% | 11.27% | 12.25% | 12.15% | 12.66% | 13.31% | 12.73% | 11.24% | 9.74% | 9.51% | 8.40% | 10.31% | 9.98% | 9.51% | 9.78% | 10.01% | 10.28% | 9.48% | 10.53% | 10.02% |
| EOM XO - Cash 2 | 5.17% | 8.25% | 5.23% | 10.65% | 11.42% | 12.27% | 12.29% | 12.64% | 13.22% | 12.48% | 11.23% | 9.82% | 9.47% | 8.28% | 10.37% | 9.92% | 9.72% | 9.89% | 9.94% | 10.26% | 9.29% | 10.48% | 9.80% |

| Gilt Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Gilt 1 | 4.23% | 5.17% | 4.41% | 8.25% | 10.13% | 11.19% | 11.88% | 12.92% | 10.47% | 11.13% | 10.92% | 9.91% |
| MA - Gilt 2 | 4.24% | 4.63% | 4.46% | 7.86% | 9.58% | 11.27% | 12.11% | 12.49% | 10.19% | 11.00% | 10.72% | 9.93% |
| EOM MA - Gilt | 4.68% | 3.58% | 7.38% | 7.96% | 13.14% | 13.06% | 13.33% | 12.20% | 11.79% | 11.84% | 12.30% | 11.70% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Gilt 1 | 4.41% | 4.61% | 9.10% | 11.98% | 11.43% | 13.46% | 14.32% | 13.99% | 13.89% | 15.04% | 13.55% | 11.36% | 10.71% | 8.86% | 11.27% | 10.32% | 9.57% | 10.15% | 10.55% | 10.16% | 9.10% | 10.51% | 9.57% |
| XO - Gilt 2 | 3.99% | 4.71% | 9.10% | 11.98% | 11.43% | 13.46% | 14.44% | 13.95% | 13.87% | 15.04% | 13.55% | 11.36% | 10.71% | 8.86% | 11.27% | 10.32% | 9.57% | 10.15% | 10.55% | 10.16% | 9.10% | 10.51% | 9.57% |
| EOM XO - Gilt | 5.74% | 10.95% | 8.05% | 13.19% | 13.47% | 14.51% | 13.83% | 14.10% | 14.56% | 14.19% | 12.32% | 11.17% | 10.46% | 9.21% | 11.28% | 10.83% | 10.08% | 10.82% | 10.71% | 10.35% | 8.96% | 9.81% | 9.62% |

| Annualised Return | Year 15 |
|---|---|
| HSBC AMER.INDEX AC. | 9.20% |

Positive Returns
Outperforms Buy and Hold
Highest 10 Positive Return
Highest Outperforms Buy and Hold

| Cash Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Cash 1 | 3.00% | 4.89% | 1.91% | 2.87% | 4.28% | 5.14% | 6.04% | 4.53% | 5.24% | 5.45% | 4.88% | 4.39% |
| MA - Cash 2 | 3.44% | 1.42% | 0.61% | 3.03% | 3.73% | 5.75% | 5.73% | 5.09% | 5.11% | 5.55% | 4.73% | 4.46% |
| EOM MA - Cash 1 | 3.86% | 4.41% | 3.96% | 3.72% | 4.50% | 5.34% | 6.21% | 6.65% | 6.81% | 6.93% | 6.84% | 8.25% |
| EOM MA - Cash 2 | 1.99% | 3.25% | 2.95% | 2.55% | 3.58% | 4.86% | 5.81% | 6.31% | 6.32% | 6.81% | 6.60% | 8.40% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 3.47% | -1.35% | 1.73% | 1.71% | 0.58% | 7.31% | 6.87% | 5.26% | 7.56% | 6.72% | 7.85% | 7.33% | 6.77% | 7.34% | 8.24% | 7.26% | 8.30% | 8.70% | 8.81% | 8.13% | 8.34% | 8.39% | 8.70% |
| XO - Cash 2 | 1.74% | -1.30% | 2.53% | 1.65% | 0.70% | 7.35% | 6.91% | 5.12% | 7.54% | 6.66% | 7.69% | 7.68% | 6.64% | 7.25% | 8.30% | 7.19% | 8.26% | 8.64% | 8.85% | 7.99% | 8.34% | 8.45% | 8.66% |
| EOM XO - Cash 1 | 4.28% | 4.61% | 3.46% | 3.19% | 6.06% | 7.94% | 6.41% | 6.46% | 7.64% | 6.88% | 6.85% | 7.55% | 7.88% | 7.12% | 8.27% | 8.65% | 7.83% | 8.68% | 8.41% | 8.63% | 8.71% | 8.64% | 7.74% |
| EOM XO - Cash 2 | 3.25% | 3.63% | 2.36% | 3.04% | 5.94% | 7.79% | 5.95% | 6.42% | 8.11% | 7.18% | 6.84% | 7.45% | 7.79% | 6.96% | 8.36% | 8.46% | 7.75% | 8.75% | 8.33% | 8.70% | 8.54% | 8.54% | 7.66% |

| Gilt Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Gilt 1 | 2.14% | 0.47% | -0.59% | 4.75% | 4.28% | 6.42% | 7.09% | 5.60% | 5.41% | 5.74% | 4.44% | 4.12% |
| MA - Gilt 2 | 2.20% | 0.92% | -0.37% | 4.07% | 4.91% | 6.81% | 6.51% | 5.67% | 5.70% | 5.94% | 4.70% | 4.29% |
| EOM MA - Gilt | 1.64% | 2.79% | 4.23% | 4.23% | 4.82% | 6.83% | 7.13% | 7.43% | 7.11% | 7.41% | 6.82% | 8.29% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Gilt 1 | 1.01% | -0.67% | 4.29% | 2.65% | 2.03% | 8.78% | 7.91% | 6.45% | 8.51% | 7.06% | 8.21% | 8.54% | 6.77% | 7.20% | 8.48% | 7.29% | 8.05% | 8.85% | 8.87% | 7.61% | 7.82% | 8.08% | 8.59% |
| XO - Gilt 2 | 0.83% | -0.75% | 4.24% | 2.65% | 2.02% | 8.78% | 7.90% | 6.45% | 8.51% | 7.06% | 8.21% | 8.54% | 6.77% | 7.20% | 8.48% | 7.29% | 8.05% | 8.85% | 8.87% | 7.61% | 7.82% | 8.08% | 8.59% |
| EOM XO - Gilt | 3.18% | 6.17% | 4.35% | 3.85% | 7.16% | 9.12% | 7.15% | 7.60% | 9.03% | 7.60% | 7.41% | 8.13% | 7.94% | 6.91% | 8.64% | 8.18% | 7.15% | 9.00% | 7.86% | 8.22% | 8.05% | 8.34% | 7.70% |

| Annualised Return | Year 15 |
|---|---|
| HSBC JAPAN INDEX ACC | 6.39% |

Positive Returns
Outperforms Buy and Hold
Highest 10 Positive Return
Highest Outperforms Buy and Hold

| Cash Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Cash 1 | 1.25% | 4.29% | 2.34% | 0.63% | 1.28% | 2.99% | 1.08% | -0.09% | -0.83% | 1.95% | 2.17% | 3.63% |
| MA - Cash 2 | 3.25% | 3.02% | 3.23% | 2.31% | 2.84% | 3.96% | 1.75% | -0.52% | 0.03% | 0.30% | 1.86% | 3.23% |
| EOM MA - Cash 1 | 4.20% | 5.14% | 5.65% | 4.73% | 4.72% | 3.29% | 5.40% | 4.17% | 4.20% | 4.11% | 3.78% | 4.79% |
| EOM MA - Cash 2 | 3.78% | 4.97% | 4.82% | 4.57% | 4.82% | 2.79% | 5.17% | 4.03% | 4.23% | 4.28% | 3.92% | 4.89% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | -0.44% | 2.80% | 0.11% | 1.82% | 1.00% | 1.00% | 2.06% | 2.67% | 2.71% | 4.82% | 4.26% | 2.66% | 4.03% | 4.24% | 4.43% | 2.92% | 4.06% | 5.58% | 5.31% | 5.44% | 3.67% | 5.06% | 4.38% |
| XO - Cash 2 | -1.24% | 2.74% | 0.67% | 2.18% | 0.96% | 0.90% | 2.26% | 2.26% | 2.55% | 4.24% | 4.25% | 2.75% | 3.74% | 4.40% | 4.25% | 3.00% | 3.79% | 5.72% | 5.44% | 5.29% | 3.58% | 5.03% | 4.17% |
| EOM XO - Cash 1 | 4.36% | 2.71% | 3.42% | 3.11% | 3.23% | 3.38% | 3.64% | 1.30% | 4.26% | 4.05% | 3.77% | 2.99% | 3.09% | 4.12% | 4.42% | 3.85% | 3.80% | 6.35% | 6.02% | 5.25% | 3.15% | 4.76% | 3.25% |
| EOM XO - Cash 2 | 4.61% | 1.08% | 3.66% | 2.64% | 3.60% | 3.49% | 3.57% | 1.66% | 4.36% | 4.08% | 3.84% | 3.16% | 3.34% | 4.67% | 4.67% | 3.99% | 4.11% | 6.11% | 6.08% | 5.57% | 3.15% | 5.00% | 3.15% |

| Gilt Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Gilt 1 | 2.08% | 2.30% | 2.89% | 3.07% | 3.06% | 4.34% | 2.78% | 1.05% | 0.53% | 1.44% | 2.56% | 3.73% |
| MA - Gilt 2 | 2.77% | 2.48% | 2.99% | 3.02% | 3.88% | 5.26% | 2.55% | 0.91% | 0.65% | 0.88% | 2.29% | 3.84% |
| EOM MA - Gilt | 2.70% | 3.76% | 6.01% | 5.79% | 6.30% | 4.00% | 6.42% | 4.94% | 4.44% | 5.06% | 4.28% | 5.17% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Gilt 1 | -2.24% | 2.76% | 1.47% | 4.29% | 1.67% | 1.29% | 3.16% | 3.41% | 3.03% | 5.07% | 4.41% | 2.71% | 4.22% | 5.69% | 5.30% | 4.15% | 5.01% | 6.63% | 6.32% | 5.94% | 4.29% | 5.70% | 4.40% |
| XO - Gilt 2 | -2.33% | 2.86% | 1.47% | 4.29% | 1.67% | 1.29% | 3.17% | 3.41% | 3.03% | 5.07% | 4.41% | 2.66% | 4.22% | 5.69% | 5.30% | 4.15% | 5.01% | 6.63% | 6.32% | 5.94% | 4.29% | 5.70% | 4.40% |
| EOM XO - Gilt | 3.98% | 2.64% | 5.99% | 3.78% | 3.52% | 3.61% | 4.86% | 1.88% | 4.60% | 4.83% | 4.99% | 3.85% | 4.32% | 5.89% | 6.08% | 4.81% | 5.26% | 7.02% | 6.92% | 6.26% | 3.94% | 5.79% | 3.58% |

| Annualised Return | Year 15 |
|---|---|
| HSBC EUR.INDEX AC. | 9.18% |

Positive Returns
Outperforms Buy and Hold
Highest 10 Positive Return
Highest Outperforms Buy and Hold

| Cash Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Cash 1 | 3.04% | -0.59% | 5.45% | 4.19% | 5.69% | 5.59% | 7.19% | 8.13% | 7.24% | 5.90% | 5.42% | 6.10% |
| MA - Cash 2 | 1.20% | 1.49% | 6.08% | 3.71% | 6.24% | 5.36% | 7.15% | 8.63% | 7.31% | 5.51% | 5.10% | 6.43% |
| EOM MA - Cash 1 | 6.89% | 7.99% | 6.20% | 3.47% | 4.93% | 6.83% | 7.52% | 7.86% | 6.78% | 6.70% | 7.36% | 8.02% |
| EOM MA - Cash 2 | 6.70% | 7.01% | 4.95% | 2.16% | 3.93% | 6.31% | 6.98% | 7.45% | 6.68% | 6.59% | 7.39% | 8.05% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 2.61% | 2.87% | 3.01% | 4.55% | 3.78% | 5.88% | 7.16% | 7.68% | 5.93% | 6.73% | 8.14% | 6.32% | 6.70% | 6.48% | 6.12% | 6.36% | 5.48% | 7.23% | 6.28% | 5.53% | 5.64% | 4.83% | 5.93% |
| XO - Cash 2 | 2.72% | 3.37% | 2.59% | 4.43% | 3.50% | 6.02% | 6.74% | 7.27% | 5.81% | 6.56% | 7.95% | 6.60% | 6.81% | 6.42% | 6.31% | 6.58% | 5.53% | 7.18% | 6.14% | 5.46% | 5.78% | 5.04% | 5.68% |
| EOM XO - Cash 1 | 5.24% | 5.47% | 0.75% | 6.51% | 7.70% | 5.68% | 7.96% | 6.45% | 5.91% | 6.07% | 7.71% | 6.40% | 6.43% | 6.89% | 7.02% | 6.74% | 6.30% | 7.63% | 6.06% | 5.47% | 6.16% | 5.25% | 5.03% |
| EOM XO - Cash 2 | 3.77% | 4.33% | -0.15% | 6.45% | 8.16% | 5.67% | 7.41% | 6.05% | 5.53% | 5.89% | 7.63% | 6.47% | 6.64% | 7.13% | 7.09% | 6.93% | 6.40% | 7.93% | 6.00% | 5.30% | 6.03% | 5.25% | 4.94% |

| Gilt Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Gilt 1 | 1.25% | 0.59% | 5.84% | 4.76% | 8.42% | 7.71% | 9.57% | 10.18% | 8.66% | 6.81% | 5.88% | 7.03% |
| MA - Gilt 2 | 1.28% | 2.01% | 5.97% | 5.08% | 8.62% | 7.03% | 9.14% | 10.20% | 8.75% | 6.73% | 5.85% | 7.44% |
| EOM MA - Gilt | 5.97% | 6.24% | 7.04% | 4.66% | 7.34% | 9.31% | 9.61% | 10.00% | 8.35% | 8.24% | 8.41% | 9.20% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Gilt 1 | 2.33% | 3.50% | 5.25% | 7.09% | 4.92% | 8.43% | 8.73% | 9.39% | 7.82% | 7.59% | 9.10% | 7.68% | 8.02% | 7.06% | 7.32% | 7.95% | 6.52% | 8.40% | 7.17% | 6.25% | 5.91% | 5.28% | 6.17% |
| XO - Gilt 2 | 2.34% | 3.63% | 5.25% | 7.09% | 4.92% | 8.43% | 8.72% | 9.39% | 7.82% | 7.59% | 9.10% | 7.68% | 8.02% | 7.06% | 7.32% | 7.95% | 6.52% | 8.40% | 7.17% | 6.25% | 5.91% | 5.28% | 6.17% |
| EOM XO - Gilt | 3.67% | 8.35% | 2.62% | 8.93% | 9.01% | 7.17% | 9.98% | 8.26% | 6.90% | 6.52% | 9.23% | 7.63% | 7.63% | 8.09% | 7.94% | 8.18% | 7.32% | 9.10% | 6.96% | 5.69% | 6.27% | 5.57% | 5.15% |

| Annualised Return | Year 15 |
|---|---|
| BLACKROCK EMRG.MKTS | 12.01% |

Positive Returns
Outperforms Buy and Hold
Highest 10 Positive Return
Highest Outperforms Buy and Hold

| Cash Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Cash 1 | 9.08% | 8.63% | 12.74% | 11.60% | 10.65% | 10.99% | 10.05% | 11.52% | 11.32% | 9.19% | 8.50% | 8.68% |
| MA - Cash 2 | 8.46% | 6.57% | 8.92% | 10.12% | 10.56% | 11.42% | 9.40% | 11.15% | 10.99% | 8.90% | 9.04% | 8.81% |
| EOM MA - Cash 1 | 10.34% | 11.50% | 6.96% | 7.77% | 12.14% | 11.61% | 11.78% | 11.64% | 10.56% | 10.99% | 9.75% | 9.52% |
| EOM MA - Cash 2 | 9.46% | 10.82% | 5.78% | 5.91% | 11.54% | 10.54% | 10.68% | 11.17% | 10.23% | 10.71% | 9.46% | 9.32% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 6.12% | 9.14% | 8.52% | 7.19% | 11.45% | 8.08% | 11.08% | 9.74% | 9.36% | 10.83% | 8.52% | 9.27% | 6.37% | 5.04% | 7.27% | 5.42% | 5.81% | 5.73% | 4.38% | 1.79% | 2.55% | 1.05% | 2.25% |
| XO - Cash 2 | 5.02% | 8.81% | 7.30% | 6.35% | 11.03% | 7.84% | 11.13% | 9.80% | 9.59% | 11.14% | 8.98% | 8.90% | 6.17% | 4.84% | 7.24% | 5.32% | 5.68% | 5.92% | 4.40% | 1.86% | 2.77% | 0.82% | 2.26% |
| EOM XO - Cash 1 | 8.48% | 7.57% | 8.25% | 8.60% | 11.39% | 9.84% | 10.88% | 11.86% | 9.57% | 9.91% | 6.41% | 6.71% | 5.80% | 4.50% | 5.98% | 4.79% | 4.73% | 5.89% | 4.19% | 3.09% | 2.61% | 1.31% | 3.44% |
| EOM XO - Cash 2 | 7.41% | 5.11% | 7.02% | 8.13% | 11.43% | 9.94% | 10.27% | 11.31% | 9.56% | 9.51% | 6.06% | 6.50% | 5.97% | 4.53% | 5.92% | 4.58% | 4.56% | 6.20% | 3.94% | 2.81% | 2.59% | 1.32% | 3.37% |

| Gilt Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Gilt 1 | 7.06% | 6.59% | 9.04% | 10.73% | 12.28% | 12.94% | 10.96% | 12.72% | 12.63% | 10.16% | 10.02% | 9.79% |
| MA - Gilt 2 | 7.82% | 6.33% | 8.60% | 10.66% | 11.93% | 12.99% | 10.87% | 12.47% | 12.69% | 10.01% | 10.14% | 9.76% |
| EOM MA - Gilt | 8.74% | 9.92% | 7.17% | 8.24% | 13.62% | 13.47% | 12.61% | 12.79% | 11.99% | 12.59% | 11.27% | 11.21% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Gilt 1 | 4.53% | 8.65% | 9.62% | 8.57% | 13.25% | 10.01% | 12.58% | 11.27% | 10.93% | 12.41% | 9.88% | 10.13% | 7.22% | 6.67% | 8.28% | 6.71% | 7.53% | 6.87% | 5.84% | 3.18% | 3.96% | 1.63% | 3.23% |
| XO - Gilt 2 | 4.42% | 8.68% | 9.63% | 8.57% | 13.25% | 10.01% | 12.57% | 11.27% | 10.93% | 12.42% | 9.88% | 10.13% | 7.22% | 6.67% | 8.28% | 6.71% | 7.53% | 6.87% | 5.84% | 3.18% | 3.96% | 1.63% | 3.23% |
| EOM XO - Gilt | 7.49% | 7.79% | 9.88% | 10.25% | 13.43% | 11.76% | 12.17% | 13.40% | 10.64% | 10.64% | 6.89% | 7.28% | 7.36% | 6.82% | 7.10% | 6.23% | 6.23% | 7.38% | 5.39% | 4.39% | 3.33% | 2.28% | 4.01% |

| Annualised Return | Year 15 |
|---|---|
| HSBC PACIFIC INDEX ACC | 11.21% |

Positive Returns
Outperforms Buy and Hold
Highest 10 Positive Return
Highest Outperforms Buy and Hold

| Cash Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Cash 1 | 7.19% | 7.51% | 8.83% | 9.87% | 8.18% | 10.26% | 9.59% | 9.61% | 8.13% | 8.33% | 8.48% | 8.14% |
| MA - Cash 2 | 4.89% | 7.27% | 7.73% | 7.82% | 9.14% | 9.77% | 9.49% | 9.37% | 8.03% | 7.98% | 8.85% | 8.39% |
| EOM MA - Cash 1 | 8.76% | 8.14% | 4.85% | 5.90% | 9.30% | 9.48% | 9.36% | 10.26% | 9.50% | 8.97% | 9.17% | 7.69% |
| EOM MA - Cash 2 | 7.53% | 7.50% | 3.91% | 4.70% | 8.60% | 9.09% | 8.98% | 9.96% | 9.34% | 8.93% | 9.00% | 7.53% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 6.96% | 8.25% | 5.62% | 6.54% | 10.28% | 7.62% | 8.68% | 8.54% | 7.52% | 7.34% | 8.14% | 8.71% | 7.48% | 6.34% | 7.32% | 4.83% | 5.45% | 7.32% | 4.47% | 5.36% | 4.85% | 5.62% | 4.09% |
| XO - Cash 2 | 6.59% | 7.34% | 5.11% | 6.69% | 10.29% | 7.35% | 8.64% | 8.67% | 7.45% | 7.26% | 8.27% | 8.56% | 7.50% | 6.33% | 7.35% | 4.84% | 5.38% | 7.03% | 4.32% | 5.66% | 4.65% | 5.38% | 4.05% |
| EOM XO - Cash 1 | 4.86% | 8.05% | 7.60% | 8.50% | 10.46% | 7.67% | 9.44% | 8.90% | 9.07% | 7.79% | 7.75% | 7.09% | 6.06% | 6.34% | 5.99% | 4.89% | 5.16% | 6.34% | 5.49% | 6.05% | 4.54% | 5.88% | 4.15% |
| EOM XO - Cash 2 | 4.20% | 6.64% | 6.65% | 7.87% | 10.21% | 7.43% | 9.11% | 8.50% | 8.90% | 7.37% | 7.69% | 6.90% | 6.02% | 6.37% | 5.87% | 4.92% | 5.07% | 6.15% | 5.51% | 5.98% | 4.43% | 5.74% | 3.94% |

| Gilt Strategies | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| MA - Gilt 1 | 4.84% | 7.18% | 6.93% | 9.67% | 10.05% | 11.33% | 10.81% | 10.51% | 9.92% | 10.14% | 10.46% | 9.39% |
| MA - Gilt 2 | 4.23% | 6.76% | 7.46% | 8.85% | 10.47% | 11.48% | 10.71% | 10.24% | 10.15% | 9.84% | 10.15% | 9.41% |
| EOM MA - Gilt | 6.98% | 6.45% | 5.68% | 7.06% | 10.67% | 11.71% | 11.10% | 11.77% | 10.66% | 10.53% | 10.91% | 8.83% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Gilt 1 | 5.69% | 7.52% | 7.10% | 8.87% | 12.96% | 9.38% | 9.77% | 10.80% | 9.37% | 7.42% | 8.88% | 9.52% | 8.72% | 7.57% | 8.32% | 6.10% | 6.89% | 7.75% | 5.40% | 7.02% | 6.03% | 6.76% | 5.32% |
| XO - Gilt 2 | 5.66% | 7.58% | 7.10% | 8.87% | 12.96% | 9.38% | 9.87% | 10.80% | 9.37% | 7.42% | 8.88% | 9.52% | 8.72% | 7.57% | 8.32% | 6.10% | 6.89% | 7.75% | 5.40% | 7.02% | 6.03% | 6.76% | 5.32% |
| EOM XO - Gilt | 4.46% | 9.54% | 9.60% | 10.92% | 12.31% | 9.03% | 11.60% | 11.22% | 9.93% | 7.27% | 7.78% | 8.18% | 7.92% | 8.03% | 7.31% | 6.59% | 6.32% | 7.31% | 6.63% | 7.42% | 5.59% | 6.90% | 5.08% |

# Table 3.4: 15-Year Returns by Market: 5 Duration Averages

| Annualised Return | Year 15 |
|---|---|
| HSBC FTSE 100 INDEX AC. | 7.02% |

| Cash Strategies | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 -100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
| MA - Cash 1 | 0.92% | 2.32% | 3.56% | 4.31% | 4.75% | 5.11% | 4.91% | 4.58% | 4.19% |
| MA - Cash 2 | 1.07% | 2.34% | 3.39% | 4.11% | 4.68% | 5.00% | 4.79% | 4.54% | 3.92% |
| EOM MA - Cash 1 | 3.53% | 4.33% | 5.33% | 5.69% | 6.34% | 6.62% | 6.49% | 6.34% | 3.08% |
| EOM MA - Cash 2 | 2.40% | 3.15% | 4.33% | 4.91% | 5.76% | 6.19% | 6.18% | 6.11% | 3.79% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 - | 100/250 - | 100/300 - | 150/300 - | 200/300 - | 100/350 - | 150/350 - | 200/350 - | 100-400 - | 150/400 - | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | Range |
| XO - Cash 1 | 1.66% | 3.08% | 4.52% | 5.10% | 5.50% | 5.99% | 5.76% | 5.82% | 6.15% | 6.02% | 5.71% | 5.75% | 5.63% | 5.54% | 5.54% | 5.55% | 5.44% | 5.60% | 5.43% | 4.49% |
| XO - Cash 2 | 1.45% | 2.92% | 4.55% | 5.17% | 5.58% | 6.05% | 5.84% | 5.86% | 6.12% | 6.02% | 5.72% | 5.80% | 5.75% | 5.65% | 5.63% | 5.67% | 5.52% | 5.59% | 5.44% | 4.67% |
| EOM XO - Cash 1 | 3.99% | 4.98% | 5.46% | 5.93% | 6.19% | 6.22% | 6.04% | 5.96% | 6.05% | 5.97% | 5.93% | 6.19% | 6.09% | 5.98% | 5.90% | 5.84% | 5.63% | 5.73% | 5.64% | 2.23% |
| EOM XO - Cash 2 | 3.34% | 4.58% | 5.27% | 5.91% | 6.28% | 6.21% | 6.02% | 5.96% | 6.07% | 5.93% | 5.93% | 6.22% | 6.09% | 5.98% | 5.86% | 5.77% | 5.53% | 5.65% | 5.54% | 2.94% |

| Gilt Strategies | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 -100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
| MA - Gilt 1 | 0.59% | 2.42% | 3.74% | 4.94% | 5.62% | 5.87% | 5.49% | 5.13% | 5.28% |
| MA - Gilt 2 | 1.01% | 2.70% | 3.98% | 5.02% | 5.69% | 5.93% | 5.57% | 5.23% | 4.92% |
| EOM MA - Gilt | 3.60% | 4.80% | 6.42% | 7.09% | 7.57% | 7.80% | 7.50% | 7.22% | 4.20% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 - | 100/250 - | 100/300 - | 150/300 - | 200/300 - | 100/350 - | 150/350 - | 200/350 - | 100-400 - | 150/400 - | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | Range |
| XO - Gilt 1 | 2.61% | 4.75% | 6.71% | 7.19% | 7.39% | 7.49% | 6.97% | 6.93% | 7.08% | 6.91% | 6.63% | 6.79% | 6.73% | 6.54% | 6.44% | 6.44% | 6.21% | 6.21% | 6.00% | 4.89% |
| XO - Gilt 2 | 2.68% | 4.76% | 6.69% | 7.17% | 7.37% | 7.47% | 6.96% | 6.93% | 7.08% | 6.91% | 6.63% | 6.79% | 6.73% | 6.54% | 6.44% | 6.44% | 6.21% | 6.21% | 6.00% | 4.79% |
| EOM XO - Gilt | 5.09% | 6.82% | 7.44% | 7.73% | 7.86% | 7.66% | 7.26% | 6.95% | 6.91% | 6.71% | 6.65% | 7.08% | 6.99% | 6.88% | 6.65% | 6.47% | 6.07% | 6.20% | 5.98% | 2.77% |

| Annualised Return | Year 15 |
|---|---|
| HSBC TRKR.FTSE 250 IDX. AC.R | 11.88% |

**Cash Strategies**

| Moving Average: | 5 -100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 7.12% | 8.11% | 8.68% | 9.72% | 10.06% | 10.27% | 10.27% | 10.08% | 3.15% |
| MA - Cash 2 | 6.62% | 7.48% | 8.46% | 9.49% | 9.84% | 10.16% | 10.15% | 9.98% | 3.54% |
| EOM MA - Cash 1 | 7.54% | 8.58% | 9.71% | 10.52% | 11.32% | 11.38% | 11.46% | 11.28% | 3.91% |
| EOM MA - Cash 2 | 6.38% | 7.53% | 8.92% | 10.05% | 11.17% | 11.34% | 11.45% | 11.29% | 5.07% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100-400 | 150/400 - | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | Range |
| XO - Cash 1 | 7.26% | 8.41% | 9.96% | 10.91% | 11.46% | 12.23% | 12.49% | 12.19% | 11.64% | 10.71% | 10.13% | 9.54% | 9.27% | 9.24% | 9.64% | 9.55% | 9.53% | 9.87% | 9.99% | 5.24% |
| XO - Cash 2 | 7.12% | 8.32% | 9.93% | 10.96% | 11.53% | 12.35% | 12.55% | 12.03% | 11.49% | 10.57% | 10.01% | 9.46% | 9.23% | 9.21% | 9.58% | 9.49% | 9.47% | 9.83% | 9.98% | 5.42% |
| EOM XO - Cash 1 | 9.02% | 10.10% | 10.53% | 11.84% | 12.33% | 12.62% | 12.42% | 11.94% | 11.31% | 10.32% | 9.84% | 9.59% | 9.54% | 9.60% | 9.92% | 9.91% | 9.81% | 10.02% | 10.07% | 3.60% |
| EOM XO - Cash 2 | 8.14% | 9.56% | 10.37% | 11.85% | 12.37% | 12.58% | 12.37% | 11.88% | 11.24% | 10.26% | 9.84% | 9.57% | 9.55% | 9.64% | 9.97% | 9.95% | 9.82% | 9.97% | 9.95% | 4.43% |

**Gilt Strategies**

| Moving Average: | 5 -100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
|---|---|---|---|---|---|---|---|---|---|
| MA - Gilt 1 | 6.44% | 7.83% | 9.17% | 10.87% | 11.32% | 11.52% | 11.47% | 11.07% | 5.08% |
| MA - Gilt 2 | 6.15% | 7.56% | 9.06% | 10.66% | 11.13% | 11.41% | 11.30% | 10.87% | 5.26% |
| EOM MA - Gilt | 7.35% | 9.02% | 10.97% | 11.94% | 12.70% | 12.44% | 12.29% | 11.96% | 5.36% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100-400 | 150/400 - | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | Range |
| XO - Gilt 1 | 8.31% | 10.12% | 12.06% | 13.04% | 13.42% | 14.14% | 14.16% | 13.57% | 12.91% | 11.91% | 11.15% | 10.50% | 10.15% | 10.03% | 10.37% | 10.15% | 9.91% | 10.09% | 9.98% | 5.85% |
| XO - Gilt 2 | 8.24% | 10.14% | 12.08% | 13.05% | 13.43% | 14.15% | 14.17% | 13.56% | 12.91% | 11.91% | 11.15% | 10.50% | 10.15% | 10.03% | 10.37% | 10.15% | 9.91% | 10.09% | 9.98% | 5.93% |
| EOM XO - Gilt | 10.28% | 12.03% | 12.61% | 13.82% | 14.09% | 14.24% | 13.80% | 13.27% | 12.54% | 11.47% | 10.88% | 10.59% | 10.37% | 10.44% | 10.74% | 10.56% | 10.18% | 10.13% | 9.89% | 4.35% |

| Annualised Return | Year 15 |
|---|---|
| HSBC AMER.INDEX AC. | 9.20% |

Cash Strategies

| Moving Average: | 5 -100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 3.39% | 3.82% | 4.05% | 4.57% | 5.04% | 5.28% | 5.23% | 4.90% | 1.89% |
| MA - Cash 2 | 2.45% | 2.91% | 3.77% | 4.67% | 5.08% | 5.45% | 5.24% | 4.99% | 3.00% |
| EOM MA - Cash 1 | 4.09% | 4.39% | 4.75% | 5.28% | 5.90% | 6.39% | 6.69% | 7.10% | 3.01% |
| EOM MA - Cash 2 | 2.86% | 3.44% | 3.95% | 4.62% | 5.38% | 6.02% | 6.37% | 6.89% | 4.02% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100-400 | 150/400 - | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | Range |
| XO - Cash 1 | 1.23% | 1.99% | 3.64% | 4.34% | 5.51% | 6.74% | 6.85% | 6.95% | 7.25% | 7.20% | 7.50% | 7.39% | 7.58% | 7.97% | 8.26% | 8.24% | 8.46% | 8.48% | 8.48% | 7.25% |
| XO - Cash 2 | 1.06% | 2.19% | 3.83% | 4.35% | 5.53% | 6.72% | 6.79% | 6.94% | 7.24% | 7.18% | 7.51% | 7.41% | 7.53% | 7.93% | 8.25% | 8.18% | 8.41% | 8.45% | 8.46% | 7.39% |
| EOM XO - Cash 1 | 4.32% | 5.05% | 5.41% | 6.01% | 6.90% | 7.07% | 6.85% | 7.08% | 7.36% | 7.26% | 7.54% | 7.90% | 7.95% | 8.11% | 8.37% | 8.44% | 8.45% | 8.61% | 8.42% | 4.29% |
| EOM XO - Cash 2 | 3.64% | 4.55% | 5.02% | 5.83% | 6.84% | 7.09% | 6.90% | 7.20% | 7.47% | 7.24% | 7.48% | 7.80% | 7.86% | 8.06% | 8.33% | 8.40% | 8.41% | 8.57% | 8.35% | 4.93% |

Gilt Strategies

| Moving Average: | 5 -100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
|---|---|---|---|---|---|---|---|---|---|
| MA - Gilt 1 | 2.21% | 3.07% | 4.39% | 5.63% | 5.76% | 6.05% | 5.65% | 5.06% | 3.84% |
| MA - Gilt 2 | 2.34% | 3.27% | 4.38% | 5.59% | 5.92% | 6.13% | 5.70% | 5.26% | 3.78% |
| EOM MA - Gilt | 3.54% | 4.58% | 5.45% | 6.09% | 6.66% | 7.18% | 7.18% | 7.41% | 3.87% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100-400 | 150/400 - | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | Range |
| XO - Gilt 1 | 1.86% | 3.42% | 5.13% | 5.56% | 6.74% | 7.74% | 7.63% | 7.75% | 7.82% | 7.56% | 7.84% | 7.66% | 7.56% | 7.97% | 8.31% | 8.13% | 8.24% | 8.25% | 8.19% | 6.44% |
| XO - Gilt 2 | 1.80% | 3.39% | 5.12% | 5.56% | 6.73% | 7.74% | 7.63% | 7.75% | 7.82% | 7.56% | 7.84% | 7.66% | 7.56% | 7.97% | 8.31% | 8.13% | 8.24% | 8.25% | 8.19% | 6.51% |
| EOM XO - Gilt | 4.94% | 6.13% | 6.33% | 6.98% | 8.01% | 8.10% | 7.76% | 7.95% | 8.02% | 7.60% | 7.81% | 7.96% | 7.77% | 7.98% | 8.17% | 8.08% | 8.06% | 8.29% | 8.03% | 3.35% |

| Annualised Return | Year 15 |
|---|---|
| HSBC JAPAN INDEX ACC | 6.39% |

| Cash Strategies | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5-100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
| MA - Cash 1 | 1.96% | 2.31% | 1.66% | 1.18% | 0.89% | 1.02% | 0.86% | 1.37% | 1.45% |
| MA - Cash 2 | 2.93% | 3.07% | 2.82% | 2.07% | 1.61% | 1.10% | 0.68% | 0.98% | 2.39% |
| EOM MA - Cash 1 | 4.89% | 4.71% | 4.76% | 4.46% | 4.36% | 4.23% | 4.33% | 4.21% | 0.68% |
| EOM MA - Cash 2 | 4.59% | 4.39% | 4.43% | 4.28% | 4.21% | 4.10% | 4.33% | 4.27% | 0.49% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 - | 100/250 - | 100/300 - | 150/300 - | 200/300 - | 100/350 - | 150/350 - | 200/350 - | 100-400 - | 150/400 - | Range |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | |
| XO - Cash 1 | 1.06% | 1.35% | 1.20% | 1.71% | 1.89% | 2.65% | 3.31% | 3.43% | 3.70% | 4.00% | 3.92% | 3.66% | 3.94% | 4.25% | 4.46% | 4.66% | 4.81% | 5.01% | 4.77% | 3.95% |
| XO - Cash 2 | 1.06% | 1.49% | 1.39% | 1.71% | 1.78% | 2.44% | 3.11% | 3.21% | 3.51% | 3.88% | 3.88% | 3.63% | 3.84% | 4.23% | 4.44% | 4.65% | 4.76% | 5.01% | 4.70% | 3.95% |
| EOM XO - Cash 1 | 3.37% | 3.17% | 3.36% | 2.93% | 3.16% | 3.33% | 3.40% | 3.27% | 3.63% | 3.61% | 3.68% | 3.69% | 3.86% | 4.51% | 4.89% | 5.05% | 4.91% | 5.11% | 4.49% | 2.17% |
| EOM XO - Cash 2 | 3.12% | 2.90% | 3.39% | 2.99% | 3.34% | 3.43% | 3.50% | 3.42% | 3.75% | 3.82% | 3.93% | 3.96% | 4.16% | 4.71% | 4.99% | 5.17% | 5.00% | 5.18% | 4.59% | 2.29% |

| Gilt Strategies | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5-100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
| MA - Gilt 1 | 2.68% | 3.13% | 3.23% | 2.86% | 2.35% | 2.03% | 1.67% | 1.86% | 1.55% |
| MA - Gilt 2 | 3.03% | 3.53% | 3.54% | 3.12% | 2.65% | 2.05% | 1.45% | 1.71% | 2.09% |
| EOM MA - Gilt | 4.91% | 5.17% | 5.70% | 5.49% | 5.22% | 4.97% | 5.03% | 4.78% | 0.92% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 - | 100/250 - | 100/300 - | 150/300 - | 200/300 - | 100/350 - | 150/350 - | 200/350 - | 100-400 - | 150/400 - | Range |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | |
| XO - Gilt 1 | 1.59% | 2.30% | 2.38% | 2.76% | 2.51% | 3.19% | 3.82% | 3.73% | 3.89% | 4.42% | 4.47% | 4.41% | 4.87% | 5.36% | 5.48% | 5.61% | 5.64% | 5.78% | 5.33% | 4.18% |
| XO - Gilt 2 | 1.59% | 2.32% | 2.38% | 2.77% | 2.51% | 3.20% | 3.82% | 3.72% | 3.88% | 4.41% | 4.46% | 4.40% | 4.87% | 5.36% | 5.48% | 5.61% | 5.64% | 5.78% | 5.33% | 4.18% |
| EOM XO - Gilt | 3.98% | 3.91% | 4.35% | 3.53% | 3.69% | 3.96% | 4.23% | 4.03% | 4.52% | 4.78% | 5.03% | 4.99% | 5.27% | 5.81% | 6.02% | 6.05% | 5.88% | 5.99% | 5.30% | 2.52% |

| Annualised Return | Year 15 |
|---|---|
| HSBC EUR.INDEX AC. | 9.18% |

**Cash Strategies**

| Moving Average: | 5 -100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 3.56% | 4.06% | 5.62% | 6.16% | 6.77% | 6.81% | 6.77% | 6.56% | 3.25% |
| MA - Cash 2 | 3.74% | 4.57% | 5.71% | 6.22% | 6.94% | 6.79% | 6.74% | 6.59% | 3.19% |
| EOM MA - Cash 1 | 5.90% | 5.88% | 5.79% | 6.12% | 6.79% | 7.14% | 7.24% | 7.34% | 1.55% |
| EOM MA - Cash 2 | 4.95% | 4.87% | 4.87% | 5.37% | 6.27% | 6.80% | 7.02% | 7.23% | 2.36% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100-400 | 150/400 - | Range |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | |
| XO - Cash 1 | 3.36% | 4.02% | 4.88% | 5.81% | 6.08% | 6.68% | 7.13% | 6.96% | 6.76% | 6.87% | 6.75% | 6.40% | 6.23% | 6.34% | 6.29% | 6.18% | 6.03% | 5.90% | 5.64% | 3.76% |
| XO - Cash 2 | 3.32% | 3.98% | 4.65% | 5.59% | 5.87% | 6.48% | 6.87% | 6.84% | 6.75% | 6.87% | 6.82% | 6.54% | 6.33% | 6.40% | 6.35% | 6.18% | 6.02% | 5.92% | 5.62% | 3.55% |
| EOM XO - Cash 1 | 5.13% | 5.22% | 5.72% | 6.86% | 6.74% | 6.41% | 6.82% | 6.51% | 6.50% | 6.70% | 6.89% | 6.70% | 6.68% | 6.92% | 6.75% | 6.44% | 6.32% | 6.11% | 5.59% | 1.78% |
| EOM XO - Cash 2 | 4.51% | 4.89% | 5.51% | 6.75% | 6.56% | 6.11% | 6.50% | 6.31% | 6.43% | 6.75% | 6.99% | 6.85% | 6.84% | 7.10% | 6.87% | 6.51% | 6.33% | 6.10% | 5.50% | 2.58% |

**Gilt Strategies**

| Moving Average: | 5 -100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
|---|---|---|---|---|---|---|---|---|---|
| MA - Gilt 1 | 4.17% | 5.46% | 7.26% | 8.13% | 8.91% | 8.59% | 8.22% | 7.71% | 4.74% |
| MA - Gilt 2 | 4.59% | 5.74% | 7.17% | 8.01% | 8.75% | 8.37% | 8.13% | 7.79% | 4.15% |
| EOM MA - Gilt | 6.25% | 6.92% | 7.59% | 8.18% | 8.92% | 9.10% | 8.92% | 8.84% | 2.85% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100-400 | 150/400 - | Range |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | |
| XO - Gilt 1 | 4.62% | 5.84% | 6.88% | 7.71% | 7.86% | 8.39% | 8.53% | 8.32% | 8.04% | 7.89% | 7.84% | 7.60% | 7.37% | 7.45% | 7.47% | 7.26% | 6.85% | 6.60% | 6.16% | 3.91% |
| XO - Gilt 2 | 4.65% | 5.86% | 6.88% | 7.71% | 7.86% | 8.39% | 8.52% | 8.32% | 8.04% | 7.89% | 7.84% | 7.60% | 7.37% | 7.45% | 7.47% | 7.26% | 6.85% | 6.60% | 6.16% | 3.88% |
| EOM XO - Gilt | 6.52% | 7.22% | 7.54% | 8.67% | 8.26% | 7.77% | 8.18% | 7.71% | 7.58% | 7.82% | 8.10% | 7.89% | 7.83% | 8.13% | 7.90% | 7.45% | 7.07% | 6.72% | 5.93% | 2.74% |

| Annualised Return | Year 15 |
|---|---|
| BLACKROCK EMRG.MKTS. | 12.01% |

Cash Strategies

| Moving Average: | 5 -100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 10.54% | 10.92% | 11.20% | 10.96% | 10.91% | 10.61% | 10.12% | 9.84% | 1.36% |
| MA - Cash 2 | 8.93% | 9.52% | 10.08% | 10.53% | 10.70% | 10.37% | 9.89% | 9.78% | 1.78% |
| EOM MA - Cash 1 | 9.74% | 10.00% | 10.05% | 10.99% | 11.55% | 11.32% | 10.94% | 10.49% | 1.81% |
| EOM MA - Cash 2 | 8.70% | 8.92% | 8.89% | 9.97% | 10.83% | 10.66% | 10.45% | 10.18% | 2.13% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100-400 | 150/400 - | Range |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | |
| XO - Cash 1 | 8.49% | 8.88% | 9.27% | 9.51% | 9.94% | 9.82% | 9.90% | 9.54% | 8.87% | 8.01% | 7.29% | 6.67% | 5.98% | 5.85% | 5.72% | 4.63% | 4.05% | 3.10% | 2.40% | 7.54% |
| XO - Cash 2 | 7.70% | 8.26% | 8.73% | 9.23% | 9.88% | 9.90% | 10.13% | 9.68% | 8.96% | 8.00% | 7.22% | 6.49% | 5.85% | 5.80% | 5.71% | 4.64% | 4.13% | 3.15% | 2.42% | 7.71% |
| EOM XO - Cash 1 | 8.86% | 9.13% | 9.79% | 10.51% | 10.71% | 10.41% | 9.73% | 8.89% | 7.68% | 6.67% | 5.88% | 5.56% | 5.16% | 5.18% | 5.12% | 4.54% | 4.10% | 3.42% | 2.93% | 7.78% |
| EOM XO - Cash 2 | 7.82% | 8.32% | 9.36% | 10.21% | 10.50% | 10.12% | 9.34% | 8.59% | 7.52% | 6.51% | 5.80% | 5.50% | 5.11% | 5.16% | 5.04% | 4.42% | 4.02% | 3.37% | 2.81% | 7.70% |

Gilt Strategies

| Moving Average: | 5 -100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
|---|---|---|---|---|---|---|---|---|---|
| MA - Gilt 1 | 9.14% | 10.31% | 11.19% | 11.92% | 12.30% | 11.88% | 11.30% | 11.06% | 3.17% |
| MA - Gilt 2 | 9.07% | 10.10% | 11.01% | 11.78% | 12.19% | 11.81% | 11.23% | 11.01% | 3.12% |
| EOM MA - Gilt | 9.54% | 10.48% | 11.02% | 12.15% | 12.89% | 12.69% | 12.25% | 11.97% | 3.36% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100-400 | 150/400 - | Range |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | |
| XO - Gilt 1 | 8.92% | 10.02% | 10.81% | 11.14% | 11.61% | 11.44% | 11.41% | 10.92% | 10.11% | 9.26% | 8.44% | 7.80% | 7.28% | 7.21% | 7.05% | 6.03% | 5.48% | 4.30% | 3.57% | 8.04% |
| XO - Gilt 2 | 8.91% | 10.03% | 10.81% | 11.13% | 11.61% | 11.44% | 11.41% | 10.93% | 10.12% | 9.27% | 8.44% | 7.80% | 7.28% | 7.21% | 7.05% | 6.03% | 5.48% | 4.30% | 3.57% | 8.04% |
| EOM XO - Gilt | 9.77% | 10.62% | 11.50% | 12.20% | 12.28% | 11.72% | 10.75% | 9.77% | 8.56% | 7.80% | 7.09% | 6.96% | 6.75% | 6.75% | 6.46% | 5.92% | 5.34% | 4.55% | 3.88% | 8.40% |

| Annualised Return | Year 15 |
|---|---|
| HSBC PACIFIC INDEX ACC | 11.21% |

| Cash Strategies | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 -100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
| MA - Cash 1 | 8.32% | 8.93% | 9.35% | 9.50% | 9.15% | 9.18% | 8.83% | 8.54% | 1.19% |
| MA - Cash 2 | 7.37% | 8.35% | 8.79% | 9.12% | 9.16% | 8.93% | 8.74% | 8.52% | 1.79% |
| EOM MA - Cash 1 | 7.39% | 7.53% | 7.78% | 8.86% | 9.58% | 9.51% | 9.45% | 9.11% | 2.19% |
| EOM MA - Cash 2 | 6.45% | 6.76% | 7.05% | 8.26% | 9.19% | 9.26% | 9.24% | 8.95% | 2.81% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100-400 | 150/400 - | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | Range |
| XO - Cash 1 | 7.53% | 7.66% | 7.75% | 8.33% | 8.53% | 7.94% | 8.05% | 8.05% | 7.84% | 7.60% | 7.60% | 6.94% | 6.29% | 6.25% | 5.88% | 5.49% | 5.49% | 5.52% | 4.88% | 3.65% |
| XO - Cash 2 | 7.21% | 7.36% | 7.62% | 8.33% | 8.48% | 7.87% | 8.06% | 8.04% | 7.81% | 7.58% | 7.60% | 6.92% | 6.28% | 6.18% | 5.78% | 5.44% | 5.41% | 5.41% | 4.81% | 3.67% |
| EOM XO - Cash 1 | 7.89% | 8.45% | 8.73% | 8.99% | 9.11% | 8.57% | 8.59% | 8.12% | 7.55% | 7.01% | 6.65% | 6.07% | 5.69% | 5.74% | 5.57% | 5.59% | 5.52% | 5.66% | 5.22% | 3.89% |
| EOM XO - Cash 2 | 7.11% | 7.76% | 8.25% | 8.62% | 8.83% | 8.26% | 8.31% | 7.87% | 7.38% | 6.87% | 6.57% | 6.02% | 5.65% | 5.67% | 5.50% | 5.52% | 5.43% | 5.56% | 5.12% | 3.71% |

| Gilt Strategies | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Moving Average: | 5 -100 | 10-150 | 25-200 | 50-250 | 100-300 | 150-350 | 200-400 | 250-450 | Range |
| MA - Gilt 1 | 7.74% | 9.03% | 9.76% | 10.47% | 10.52% | 10.54% | 10.37% | 10.08% | 2.81% |
| MA - Gilt 2 | 7.55% | 9.00% | 9.79% | 10.35% | 10.61% | 10.48% | 10.22% | 9.96% | 3.06% |
| EOM MA - Gilt | 7.37% | 8.32% | 9.25% | 10.46% | 11.18% | 11.15% | 10.99% | 10.54% | 3.81% |

| Moving Average 1: | 5/10- | 10/20- | 25/50 - | 25/100 - | 50/100 - | 50/150 - | 5/200 - | 20/200 - | 50/200 - | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100-400 | 150/400 - | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 50/100 | 50/150 | 5/200 | 20/200 | 50/200 | 100/200 | 100/250 | 100/300 | 150/300 | 200/300 | 100/350 | 150/350 | 200/350 | 100/400 | 150/450 | 200/400 | 250/400 | 200/450 | 250/450 | Range |
| XO - Gilt 1 | 8.43% | 9.17% | 9.62% | 10.36% | 10.46% | 9.35% | 9.25% | 9.20% | 8.78% | 8.42% | 8.60% | 8.05% | 7.52% | 7.32% | 6.89% | 6.63% | 6.62% | 6.59% | 6.10% | 4.35% |
| XO - Gilt 2 | 8.43% | 9.18% | 9.64% | 10.38% | 10.48% | 9.37% | 9.27% | 9.20% | 8.78% | 8.42% | 8.60% | 8.05% | 7.52% | 7.32% | 6.89% | 6.63% | 6.62% | 6.59% | 6.10% | 4.37% |
| EOM XO - Gilt | 9.37% | 10.28% | 10.69% | 11.01% | 10.82% | 9.81% | 9.56% | 8.88% | 8.22% | 7.84% | 7.84% | 7.61% | 7.24% | 7.11% | 6.83% | 6.86% | 6.66% | 6.77% | 6.32% | 4.69% |

# Table 3.5: Range of Duration Returns by Market

**HSBC FTSE 100 INDEX AC. RETAIL**

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash MA Range | 5.10% | 2.96% | 2.90% | 1.30% | 1.98% | 2.04% | 2.39% | 1.10% | 1.35% | 1.71% | 2.38% | 2.87% |

Average 2.34%

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Cash XO Range | 1.99% | 6.51% | 1.85% | 0.88% | 1.97% | 0.49% | 0.93% | 1.29% | 0.38% | 0.83% | 0.26% | 0.24% | 0.20% | 0.37% | 0.67% | 1.01% | 0.30% | 0.15% | 0.32% | 0.27% | 0.43% | 0.20% | 0.43% |

Average 0.96%

**Gilt Strategies**

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gilt MA Range | 5.48% | 0.90% | 3.70% | 2.28% | 2.67% | 2.35% | 2.52% | 1.11% | 1.25% | 2.58% | 2.79% | 2.78% |

Average 2.53%

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Gilt XO Range | 1.06% | 7.83% | 1.81% | 0.59% | 1.13% | 0.99% | 1.14% | 0.84% | 0.25% | 0.39% | 0.35% | 0.23% | 0.15% | 0.12% | 0.72% | 1.00% | 0.40% | 0.27% | 0.57% | 0.16% | 0.16% | 0.24% | 0.22% |

Average 0.90%

**HSBC TRKR.FTSE 250 IDX. AC.RETAIL**

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash MA Range | 1.14% | 2.25% | 1.48% | 2.57% | 2.44% | 1.47% | 1.96% | 0.43% | 1.91% | 1.38% | 1.92% | 2.03% |

Average 1.75%

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Cash XO Range | 1.66% | 5.91% | 2.32% | 1.27% | 2.48% | 0.96% | 0.87% | 0.53% | 0.84% | 0.69% | 1.40% | 0.61% | 0.13% | 0.59% | 0.16% | 0.37% | 0.73% | 0.57% | 0.24% | 0.54% | 0.28% | 0.34% | 0.27% |

Average 1.03%

**Gilt Strategies**

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gilt MA Range | 0.45% | 1.59% | 2.97% | 0.39% | 3.56% | 1.87% | 1.46% | 0.73% | 1.60% | 0.84% | 1.58% | 1.79% |

Average 1.57%

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Gilt XO Range | 1.75% | 6.33% | 1.05% | 1.21% | 2.04% | 1.05% | 0.61% | 0.15% | 0.69% | 0.86% | 1.24% | 0.20% | 0.26% | 0.35% | 0.01% | 0.51% | 0.51% | 0.67% | 0.16% | 0.19% | 0.15% | 0.70% | 0.05% |

Average 0.90%

**HSBC EUR.INDEX AC.**

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash MA Range | 5.69% | 8.58% | 1.25% | 2.03% | 2.31% | 1.47% | 0.54% | 1.18% | 0.63% | 1.18% | 2.29% | 1.95% |

Average 2.43%

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Cash XO Range | 2.62% | 2.60% | 3.16% | 2.08% | 4.66% | 0.35% | 1.23% | 1.63% | 0.40% | 0.85% | 0.51% | 0.29% | 0.38% | 0.70% | 0.97% | 0.57% | 0.92% | 0.75% | 0.28% | 0.23% | 0.52% | 0.42% | 1.00% |

Average 1.18%

**Gilt Strategies**

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gilt MA Range | 4.72% | 5.66% | 1.20% | 0.42% | 1.28% | 2.29% | 0.46% | 0.20% | 0.40% | 1.51% | 2.56% | 2.17% |

Average 1.90%

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Gilt XO Range | 1.34% | 4.85% | 2.63% | 1.85% | 4.08% | 1.26% | 1.25% | 1.13% | 0.92% | 1.07% | 0.13% | 0.05% | 0.39% | 1.03% | 0.62% | 0.24% | 0.81% | 0.70% | 0.21% | 0.56% | 0.36% | 0.28% | 1.02% |

Average 1.16%

**HSBC AMER.INDEX AC.**

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash MA Range | 1.87% | 3.47% | 3.35% | 1.18% | 0.91% | 0.89% | 0.48% | 2.12% | 1.69% | 1.48% | 2.11% | 4.01% |

**Average 1.96%**

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Cash XO Range | 2.54% | 5.96% | 1.73% | 1.54% | 5.47% | 0.64% | 0.96% | 1.34% | 0.57% | 0.52% | 1.01% | 0.35% | 1.25% | 0.37% | 0.12% | 1.46% | 0.55% | 0.11% | 0.53% | 0.71% | 0.37% | 0.25% | 1.04% |

**Average 1.28%**

Gilt Strategies

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gilt MA Range | 0.56% | 2.33% | 4.82% | 0.69% | 0.62% | 0.40% | 0.62% | 1.83% | 1.70% | 1.67% | 2.38% | 4.18% |

**Average 1.82%**

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Gilt XO Range | 2.35% | 6.92% | 0.11% | 1.20% | 5.14% | 0.34% | 0.75% | 1.15% | 0.52% | 0.53% | 0.80% | 0.40% | 1.16% | 0.29% | 0.17% | 0.89% | 0.90% | 0.15% | 1.01% | 0.61% | 0.23% | 0.27% | 0.89% |

**Average 1.17%**

**HSBC JAPAN INDEX ACC**

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash MA Range | 2.95% | 2.12% | 3.31% | 4.10% | 3.54% | 1.17% | 4.32% | 4.70% | 5.06% | 3.98% | 2.06% | 1.66% |

**Average 3.25%**

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Cash XO Range | 5.84% | 1.71% | 3.55% | 1.29% | 2.64% | 2.59% | 1.58% | 1.37% | 1.81% | 0.77% | 0.49% | 0.49% | 0.94% | 0.54% | 0.42% | 1.07% | 0.32% | 0.77% | 0.77% | 0.31% | 0.52% | 0.31% | 1.23% |

**Average 1.36%**

Gilt Strategies

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gilt MA Range | 0.69% | 1.46% | 3.12% | 2.77% | 3.24% | 1.26% | 3.87% | 4.03% | 3.91% | 4.19% | 1.99% | 1.44% |

**Average 2.67%**

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Gilt XO Range | 6.31% | 0.21% | 4.52% | 0.51% | 1.85% | 2.32% | 1.70% | 1.54% | 1.57% | 0.24% | 0.58% | 1.19% | 0.10% | 0.19% | 0.78% | 0.66% | 0.24% | 0.39% | 0.59% | 0.33% | 0.35% | 0.09% | 0.82% |

**Average 1.18%**

**BLACKROCK EMRG.MKTS. AC.**

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash MA Range | 1.87% | 4.93% | 6.96% | 5.68% | 1.58% | 1.08% | 2.38% | 0.50% | 1.09% | 2.09% | 1.25% | 0.84% |

**Average 2.52%**

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Cash XO Range | 3.46% | 4.02% | 1.51% | 2.25% | 0.43% | 2.10% | 0.86% | 2.13% | 0.23% | 1.63% | 2.92% | 2.77% | 0.57% | 0.54% | 1.35% | 0.83% | 1.25% | 0.48% | 0.45% | 1.30% | 0.22% | 0.50% | 1.19% |

**Average 1.43%**

Gilt Strategies

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gilt MA Range | 1.68% | 3.59% | 1.86% | 2.49% | 1.68% | 0.53% | 1.74% | 0.33% | 0.70% | 2.59% | 1.25% | 1.44% |

**Average 1.66%**

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Gilt XO Range | 3.07% | 0.89% | 0.27% | 1.68% | 0.18% | 1.75% | 0.41% | 2.12% | 0.29% | 1.78% | 2.99% | 2.85% | 0.14% | 0.15% | 1.18% | 0.48% | 1.30% | 0.50% | 0.45% | 1.21% | 0.63% | 0.64% | 0.78% |

**Average 1.12%**

**HSBC PACIFIC INDEX ACC**

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash MA Range | 3.87% | 0.88% | 4.92% | 5.18% | 1.12% | 1.17% | 0.61% | 0.89% | 1.46% | 0.99% | 0.69% | 0.86% |

Average 1.89%

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Cash XO Range | 2.76% | 1.61% | 2.49% | 1.96% | 0.25% | 0.32% | 0.80% | 0.39% | 1.63% | 0.53% | 0.58% | 1.81% | 1.48% | 0.04% | 1.48% | 0.08% | 0.39% | 1.18% | 1.19% | 0.69% | 0.43% | 0.50% | 0.21% |

Average 0.99%

Gilt Strategies

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gilt MA Range | 2.75% | 0.73% | 1.79% | 2.61% | 0.62% | 0.38% | 0.40% | 1.53% | 0.74% | 0.69% | 0.75% | 0.58% |

Average 1.13%

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| Gilt XO Range | 1.23% | 2.02% | 2.51% | 2.05% | 0.66% | 0.35% | 1.83% | 0.41% | 0.56% | 0.15% | 1.10% | 1.34% | 0.80% | 0.46% | 1.00% | 0.49% | 0.56% | 0.43% | 1.23% | 0.41% | 0.44% | 0.14% | 0.24% |

Average 0.89%

# Table 3.6: Total Cumulative Outperformances by Year for all Strategies

| | 2016-17 | 2015-17 | 2014-17 | 2013-17 | 2012-17 | 2011-17 | 2010-17 | 2009-17 | 2008-17 | 2007-17 | 2002-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total > | 34 | 88 | 241 | 177 | 130 | 85 | 71 | 44 | 302 | 360 | 130 |
| Total > = | 1078 | 90 | 243 | 178 | 131 | 85 | 71 | 44 | 302 | 360 | 130 |

Table 3.6: This table shows the number of outperformances across all strategies, durations and across all markets for each year ending in 2017. The years before a trough had the highest number of overall cumulative outperformances, such as 2007 and 2008 – 2017. While years in the trough or just after had the lowest number of outperformances with only 44 and 71 from 2009 and 2010-2017.

# Table 3.7: Underlying Market Statistics Over 15 Years

15-Year Annualised Return

| | |
|---|---|
| BLACKROCK EMRG.MKTS. AC. | 12.01% |
| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | 11.88% |
| HSBC PACIFIC INDEX ACC | 11.21% |
| HSBC AMER.INDEX AC. | 9.20% |
| HSBC EUR.INDEX AC. | 9.18% |
| HSBC FTSE 100 INDEX AC. RETAIL | 7.02% |
| HSBC JAPAN INDEX ACC | 6.39% |

15-Year Volatility

| | |
|---|---|
| HSBC JAPAN INDEX ACC | 20.33% |
| HSBC EUR.INDEX AC. | 19.85% |
| BLACKROCK EMRG.MKTS. AC. | 19.71% |
| HSBC AMER.INDEX AC. | 18.61% |
| HSBC PACIFIC INDEX ACC | 18.35% |
| HSBC FTSE 100 INDEX AC. RETAIL | 17.63% |
| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | 16.87% |

15-Year Sharpe Ratio

| | |
|---|---|
| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | 62.00% |
| BLACKROCK EMRG.MKTS. AC. | 56.26% |
| HSBC PACIFIC INDEX ACC | 55.26% |
| HSBC AMER.INDEX AC. | 45.27% |
| HSBC EUR.INDEX AC. | 43.55% |
| HSBC FTSE 100 INDEX AC. RETAIL | 35.74% |
| HSBC JAPAN INDEX ACC | 30.70% |

15-Year Max Drawdown

| | |
|---|---|
| BLACKROCK EMRG.MKTS. AC. | -0.5509 |
| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | -0.5236 |
| HSBC PACIFIC INDEX ACC | -0.5010 |
| HSBC EUR.INDEX AC. | -0.4596 |
| HSBC FTSE 100 INDEX AC. RETAIL | -0.4574 |
| HSBC JAPAN INDEX ACC | -0.4189 |
| HSBC AMER.INDEX AC. | -0.3703 |

Outperformances Total =>*

| | |
|---|---|
| BLACKROCK EMRG.MKTS. AC. | 600 |
| HSBC FTSE 100 INDEX AC. RETAIL | 431 |
| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | 410 |
| HSBC PACIFIC INDEX ACC | 378 |
| HSBC EUR.INDEX AC. | 318 |
| HSBC AMER.INDEX AC. | 304 |
| HSBC JAPAN INDEX ACC | 267 |

Outperformances Total >*

| | |
|---|---|
| BLACKROCK EMRG.MKTS. AC. | 473 |
| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | 316 |
| HSBC FTSE 100 INDEX AC. RETAIL | 289 |
| HSBC PACIFIC INDEX ACC | 200 |
| HSBC EUR.INDEX AC. | 158 |
| HSBC AMER.INDEX AC. | 129 |
| HSBC JAPAN INDEX ACC | 97 |

* Summary across ALL cumulative time periods from 1 year to 10 years and 15 years.

Table 3.7: The top four charts show the underlying market statistics compared to each other. The markets for which trend-following strategies trading into cash outperformed the buy and hold (FTSE 100, FTSE250, Emerging Markets) are in light yellow.

The two outperformance charts on the bottom of the table aggregate all the trend-following strategies cumulative outperformances for each market from 1 year to 10 years and 15 years. The chart on the left includes both the number of outperformances and those strategies whose returns were equal to the buy and hold. The chart on the right only includes the number of outperformances.

In a strong upward market, a successful trend following strategy would be invested in equities and therefore have an equivalent return. In shorter time periods, this outcome is more probable as there is less opportunity for drawdowns within the underlying market and consequently less deviation from the buy and hold.

# Table 3.8: Strategy Volatilities by Market

| HSBC FTSE 100 INDEX AC. RETAIL | |
|---|---|
| 15-Year Heat Map | |
| Annualised Volatility B&H | 17.63% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 11.46% | 11.17% | 11.24% | 10.65% | 10.57% | 10.50% | 10.75% | 10.70% | 10.89% | 10.98% | 11.08% | 11.09% |
| MA - Cash 2 | 9.40% | 9.89% | 10.64% | 10.29% | 10.28% | 10.37% | 10.58% | 10.62% | 10.79% | 10.81% | 10.85% | 10.93% |
| MA - Gilt 1 | 10.39% | 10.84% | 11.45% | 11.08% | 11.01% | 11.11% | 11.25% | 11.30% | 11.51% | 11.50% | 11.58% | 11.59% |
| MA - Gilt 2 | 10.10% | 10.60% | 11.30% | 10.98% | 10.95% | 11.07% | 11.22% | 11.29% | 11.47% | 11.49% | 11.52% | 11.59% |
| EOM MA - Cash 1 | 11.65% | 12.22% | 12.18% | 11.45% | 11.45% | 11.20% | 11.26% | 11.77% | 11.89% | 11.78% | 11.83% | 11.93% |
| EOM MA - Cash 2 | 11.54% | 12.13% | 12.04% | 11.36% | 11.40% | 11.15% | 11.22% | 11.73% | 11.87% | 11.77% | 11.82% | 11.91% |
| EOM MA - Gilt | 12.34% | 12.87% | 12.63% | 11.99% | 11.98% | 11.77% | 11.86% | 12.36% | 12.46% | 12.41% | 12.44% | 12.50% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 11.12% | 11.42% | 11.71% | 10.91% | 11.15% | 10.84% | 10.73% | 10.99% | 10.97% | 11.32% | 11.78% | 11.93% | 12.08% | 12.28% | 12.14% | 12.24% | 12.33% | 12.14% | 12.36% | 12.29% | 12.50% | 12.34% | 12.40% |
| XO - Cash 2 | 10.41% | 11.17% | 11.63% | 10.82% | 11.07% | 10.81% | 10.69% | 10.96% | 10.97% | 11.31% | 11.77% | 11.92% | 12.08% | 12.26% | 12.14% | 12.23% | 12.32% | 12.13% | 12.36% | 12.28% | 12.48% | 12.33% | 12.40% |
| XO - Gilt 1 | 11.21% | 11.93% | 12.28% | 11.46% | 11.71% | 11.48% | 11.35% | 11.58% | 11.62% | 12.00% | 12.43% | 12.57% | 12.72% | 12.89% | 12.75% | 12.84% | 12.94% | 12.75% | 12.96% | 12.94% | 13.10% | 12.98% | 13.03% |
| XO - Gilt 2 | 11.18% | 11.92% | 12.28% | 11.46% | 11.71% | 11.48% | 11.35% | 11.58% | 11.62% | 12.00% | 12.43% | 12.57% | 12.72% | 12.89% | 12.75% | 12.84% | 12.94% | 12.75% | 12.96% | 12.94% | 13.10% | 12.98% | 13.03% |
| EOM XO - Cash 1 | 12.89% | 11.68% | 11.86% | 11.65% | 11.61% | 11.38% | 11.73% | 11.62% | 11.36% | 11.24% | 12.13% | 12.14% | 12.20% | 12.37% | 12.24% | 12.27% | 12.38% | 12.30% | 12.31% | 12.38% | 12.45% | 12.42% | 12.48% |
| EOM XO - Cash 2 | 12.77% | 11.52% | 11.77% | 11.58% | 11.53% | 11.35% | 11.68% | 11.57% | 11.33% | 11.23% | 12.12% | 12.13% | 12.19% | 12.36% | 12.22% | 12.26% | 12.36% | 12.29% | 12.30% | 12.37% | 12.44% | 12.41% | 12.47% |
| EOM XO - Gilt | 13.42% | 12.22% | 12.40% | 12.18% | 12.12% | 12.00% | 12.28% | 12.20% | 11.99% | 11.98% | 12.75% | 12.76% | 12.80% | 12.96% | 12.82% | 12.86% | 12.99% | 12.91% | 12.92% | 13.02% | 13.07% | 13.02% | 13.10% |

| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | |
|---|---|
| 15-Year Heat Map | |
| Annualised Volatility B&H | 16.87% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 11.54% | 11.31% | 11.23% | 11.05% | 11.32% | 11.30% | 11.58% | 11.74% | 11.66% | 11.76% | 11.90% | 12.02% |
| MA - Cash 2 | 10.01% | 10.50% | 10.73% | 10.74% | 11.10% | 11.21% | 11.48% | 11.67% | 11.61% | 11.71% | 11.87% | 11.92% |
| MA - Gilt 1 | 10.95% | 11.30% | 11.49% | 11.49% | 11.79% | 11.84% | 12.07% | 12.25% | 12.22% | 12.31% | 12.44% | 12.48% |
| MA - Gilt 2 | 10.66% | 11.13% | 11.41% | 11.41% | 11.75% | 11.83% | 12.04% | 12.23% | 12.21% | 12.30% | 12.43% | 12.47% |
| EOM MA - Cash 1 | 12.69% | 12.44% | 11.85% | 11.48% | 11.56% | 11.47% | 12.12% | 12.37% | 12.11% | 12.26% | 12.32% | 12.51% |
| EOM MA - Cash 2 | 12.58% | 12.34% | 11.70% | 11.33% | 11.46% | 11.44% | 12.10% | 12.35% | 12.09% | 12.26% | 12.31% | 12.49% |
| EOM MA - Gilt 1 | 13.17% | 12.95% | 12.39% | 12.00% | 12.07% | 12.05% | 12.61% | 12.87% | 12.64% | 12.79% | 12.82% | 12.98% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 11.42% | 11.29% | 11.75% | 11.50% | 11.82% | 11.78% | 11.64% | 11.71% | 11.85% | 11.53% | 11.58% | 11.88% | 11.92% | 12.14% | 12.11% | 12.14% | 12.23% | 12.38% | 12.33% | 12.24% | 12.62% | 12.83% | 12.82% |
| XO - Cash 2 | 10.54% | 11.10% | 11.66% | 11.48% | 11.77% | 11.77% | 11.33% | 11.68% | 11.84% | 11.51% | 11.57% | 11.87% | 11.92% | 12.11% | 12.11% | 12.13% | 12.22% | 12.38% | 12.33% | 12.24% | 12.62% | 12.83% | 12.81% |
| XO - Gilt 1 | 11.30% | 11.81% | 12.27% | 12.10% | 12.39% | 12.38% | 11.94% | 12.27% | 12.44% | 12.20% | 12.24% | 12.50% | 12.56% | 12.75% | 12.70% | 12.74% | 12.84% | 12.94% | 12.90% | 12.85% | 13.20% | 13.35% | 13.36% |
| XO - Gilt 2 | 11.23% | 11.80% | 12.27% | 12.10% | 12.39% | 12.38% | 11.92% | 12.27% | 12.44% | 12.20% | 12.24% | 12.50% | 12.56% | 12.75% | 12.70% | 12.74% | 12.84% | 12.94% | 12.90% | 12.85% | 13.20% | 13.35% | 13.36% |
| EOM XO - Cash 1 | 12.82% | 11.44% | 12.13% | 12.08% | 12.07% | 11.86% | 12.04% | 12.02% | 11.95% | 11.63% | 11.66% | 11.90% | 11.98% | 12.31% | 12.21% | 12.29% | 12.22% | 12.54% | 12.34% | 12.28% | 12.69% | 12.79% | 12.84% |
| EOM XO - Cash 2 | 12.68% | 11.27% | 12.04% | 12.03% | 12.05% | 11.85% | 12.00% | 12.01% | 11.94% | 11.62% | 11.65% | 11.89% | 11.95% | 12.28% | 12.20% | 12.26% | 12.21% | 12.52% | 12.32% | 12.27% | 12.68% | 12.79% | 12.84% |
| EOM XO - Gilt | 13.27% | 12.03% | 12.63% | 12.59% | 12.65% | 12.47% | 12.56% | 12.59% | 12.55% | 12.29% | 12.32% | 12.53% | 12.59% | 12.90% | 12.77% | 12.85% | 12.84% | 13.05% | 12.89% | 12.90% | 13.26% | 13.33% | 13.37% |

| HSBC AMER.INDEX AC. | |
|---|---|
| 15-Year Heat Map | |
| Annualised Volatility B&H | 18.61% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 12.57% | 12.35% | 12.02% | 12.09% | 11.94% | 11.94% | 11.76% | 11.83% | 12.13% | 12.28% | 12.48% | 12.55% |
| MA - Cash 2 | 10.41% | 11.02% | 11.23% | 11.42% | 11.43% | 11.57% | 11.50% | 11.64% | 11.91% | 12.14% | 12.40% | 12.45% |
| MA - Gilt 1 | 11.57% | 11.91% | 12.08% | 12.25% | 12.09% | 12.21% | 12.11% | 12.24% | 12.54% | 12.71% | 12.92% | 12.95% |
| MA - Gilt 2 | 11.10% | 11.68% | 11.90% | 12.07% | 11.98% | 12.13% | 12.06% | 12.20% | 12.44% | 12.64% | 12.89% | 12.91% |
| EOM MA - Cash 1 | 12.79% | 13.07% | 13.47% | 12.24% | 12.02% | 12.46% | 12.79% | 13.07% | 13.24% | 13.53% | 13.57% | 13.18% |
| EOM MA - Cash 2 | 12.58% | 12.97% | 13.36% | 12.15% | 11.95% | 12.40% | 12.74% | 13.03% | 13.20% | 13.50% | 13.54% | 13.17% |
| EOM MA - Gilt 1 | 13.32% | 13.63% | 13.93% | 12.82% | 12.60% | 12.94% | 13.28% | 13.53% | 13.69% | 13.95% | 13.98% | 13.61% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 12.02% | 12.41% | 13.20% | 12.86% | 12.86% | 11.64% | 11.97% | 12.55% | 12.00% | 11.95% | 12.23% | 12.50% | 12.59% | 12.73% | 13.01% | 12.99% | 12.95% | 13.18% | 13.20% | 13.16% | 13.25% | 13.33% | 13.25% |
| XO - Cash 2 | 11.41% | 12.13% | 13.07% | 12.78% | 12.81% | 11.62% | 11.86% | 12.51% | 11.98% | 11.93% | 12.22% | 12.47% | 12.58% | 12.72% | 13.01% | 12.98% | 12.95% | 13.18% | 13.19% | 13.16% | 13.25% | 13.33% | 13.25% |
| XO - Gilt 1 | 12.16% | 12.78% | 13.63% | 13.34% | 13.35% | 12.25% | 12.42% | 13.06% | 12.58% | 12.61% | 12.84% | 13.03% | 13.14% | 13.25% | 13.49% | 13.47% | 13.43% | 13.61% | 13.63% | 13.58% | 13.71% | 13.76% | 13.68% |
| XO - Gilt 2 | 12.13% | 12.78% | 13.63% | 13.34% | 13.35% | 12.25% | 12.41% | 13.06% | 12.58% | 12.61% | 12.84% | 13.03% | 13.14% | 13.25% | 13.49% | 13.47% | 13.43% | 13.61% | 13.63% | 13.58% | 13.71% | 13.76% | 13.68% |
| EOM XO - Cash 1 | 13.26% | 12.74% | 13.78% | 13.48% | 13.35% | 11.65% | 12.79% | 12.52% | 12.42% | 12.18% | 12.25% | 12.51% | 12.68% | 12.84% | 13.13% | 12.97% | 12.97% | 13.25% | 13.21% | 13.28% | 13.26% | 13.30% | 13.24% |
| EOM XO - Cash 2 | 13.17% | 12.62% | 13.68% | 13.40% | 13.27% | 11.60% | 12.75% | 12.49% | 12.37% | 12.16% | 12.22% | 12.48% | 12.68% | 12.83% | 13.13% | 12.96% | 12.96% | 13.24% | 13.20% | 13.28% | 13.26% | 13.29% | 13.24% |
| EOM XO - Gilt | 13.80% | 13.32% | 14.24% | 13.96% | 13.82% | 12.25% | 13.30% | 13.04% | 12.94% | 12.81% | 12.82% | 13.04% | 13.21% | 13.34% | 13.58% | 13.44% | 13.44% | 13.66% | 13.62% | 13.71% | 13.71% | 13.73% | 13.68% |

| HSBC JAPAN INDEX ACC | |
|---|---|
| 15-Year Heat Map | |
| Annualised Volatility B&H | 20.33% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 13.52% | 13.63% | 13.38% | 13.40% | 13.56% | 13.67% | 13.70% | 13.81% | 13.81% | 14.38% | 14.76% | 14.99% |
| MA - Cash 2 | 11.54% | 12.45% | 12.57% | 12.71% | 13.16% | 13.26% | 13.39% | 13.49% | 13.53% | 14.16% | 14.56% | 14.85% |
| MA - Gilt 1 | 12.77% | 13.36% | 13.38% | 13.57% | 13.93% | 14.00% | 14.13% | 14.23% | 14.23% | 14.85% | 15.21% | 15.47% |
| MA - Gilt 2 | 12.18% | 13.10% | 13.21% | 13.36% | 13.86% | 13.90% | 14.04% | 14.12% | 14.16% | 14.80% | 15.15% | 15.41% |
| EOM MA - Cash 1 | 15.33% | 15.25% | 14.42% | 14.22% | 13.89% | 14.49% | 14.41% | 14.49% | 14.72% | 15.34% | 15.45% | 15.33% |
| EOM MA - Cash 2 | 15.11% | 15.05% | 14.16% | 14.13% | 13.83% | 14.46% | 14.38% | 14.46% | 14.69% | 15.32% | 15.43% | 15.32% |
| EOM MA - Gilt 1 | 15.67% | 15.64% | 14.80% | 14.76% | 14.47% | 15.06% | 14.98% | 15.10% | 15.32% | 15.89% | 15.99% | 15.89% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 13.39% | 13.69% | 14.09% | 14.02% | 14.50% | 14.41% | 13.96% | 14.30% | 14.32% | 14.23% | 14.04% | 14.40% | 14.21% | 14.08% | 14.63% | 14.43% | 14.29% | 14.89% | 14.62% | 14.48% | 14.33% | 14.43% | 14.41% |
| XO - Cash 2 | 12.64% | 13.35% | 13.98% | 13.97% | 14.43% | 14.40% | 13.84% | 14.26% | 14.30% | 14.21% | 14.03% | 14.36% | 14.18% | 14.03% | 14.60% | 14.42% | 14.28% | 14.88% | 14.61% | 14.47% | 14.32% | 14.43% | 14.41% |
| XO - Gilt 1 | 13.29% | 14.00% | 14.67% | 14.63% | 15.04% | 15.03% | 14.49% | 14.90% | 14.95% | 14.89% | 14.74% | 15.04% | 14.86% | 14.74% | 15.29% | 15.10% | 14.97% | 15.50% | 15.24% | 15.11% | 14.98% | 15.07% | 15.05% |
| XO - Gilt 2 | 13.27% | 13.99% | 14.67% | 14.63% | 15.04% | 15.03% | 14.48% | 14.90% | 14.95% | 14.89% | 14.74% | 15.04% | 14.86% | 14.74% | 15.29% | 15.10% | 14.97% | 15.50% | 15.24% | 15.11% | 14.98% | 15.07% | 15.05% |
| EOM XO - Cash 1 | 15.26% | 14.18% | 14.99% | 14.36% | 14.40% | 14.36% | 14.44% | 14.36% | 14.68% | 14.21% | 13.80% | 14.51% | 14.41% | 13.89% | 14.58% | 14.35% | 14.27% | 14.64% | 14.49% | 14.47% | 14.23% | 14.46% | 14.35% |
| EOM XO - Cash 2 | 15.19% | 13.87% | 14.86% | 14.32% | 14.35% | 14.33% | 14.40% | 14.31% | 14.65% | 14.18% | 13.78% | 14.49% | 14.37% | 13.84% | 14.57% | 14.33% | 14.23% | 14.62% | 14.48% | 14.43% | 14.23% | 14.43% | 14.35% |
| EOM XO - Gilt | 15.74% | 14.58% | 15.45% | 14.93% | 14.95% | 14.98% | 15.01% | 14.96% | 15.28% | 14.87% | 14.53% | 15.17% | 15.07% | 14.54% | 15.24% | 15.00% | 14.93% | 15.23% | 15.14% | 15.07% | 14.90% | 15.05% | 14.98% |

| HSBC EUR.INDEX AC. | |
|---|---|
| 15-Year Heat Map | |
| Annualised Volatility B&H | 19.85% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 13.16% | 13.00% | 12.86% | 12.77% | 12.33% | 12.27% | 12.46% | 12.19% | 12.52% | 12.75% | 12.90% | 13.10% |
| MA - Cash 2 | 10.87% | 11.58% | 12.35% | 12.37% | 11.98% | 12.08% | 12.32% | 12.08% | 12.37% | 12.67% | 12.74% | 12.99% |
| MA - Gilt 1 | 11.98% | 12.48% | 13.12% | 13.09% | 12.61% | 12.75% | 12.95% | 12.71% | 13.02% | 13.29% | 13.38% | 13.58% |
| MA - Gilt 2 | 11.49% | 12.17% | 12.96% | 12.97% | 12.54% | 12.70% | 12.91% | 12.68% | 13.00% | 13.26% | 13.33% | 13.56% |
| EOM MA - Cash 1 | 14.15% | 14.64% | 13.36% | 13.31% | 12.58% | 12.81% | 13.21% | 12.64% | 13.42% | 13.61% | 13.64% | 13.85% |
| EOM MA - Cash 2 | 14.05% | 14.55% | 13.23% | 13.18% | 12.50% | 12.77% | 13.18% | 12.61% | 13.40% | 13.58% | 13.62% | 13.83% |
| EOM MA - Gilt 1 | 14.59% | 15.05% | 13.75% | 13.73% | 13.13% | 13.34% | 13.69% | 13.22% | 13.95% | 14.11% | 14.14% | 14.32% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 13.03% | 13.17% | 13.03% | 12.97% | 13.09% | 12.76% | 12.71% | 12.92% | 13.16% | 13.02% | 13.40% | 13.48% | 13.95% | 14.12% | 13.80% | 14.13% | 14.48% | 13.91% | 14.28% | 14.60% | 14.69% | 14.61% | 14.72% |
| XO - Cash 2 | 12.24% | 12.74% | 12.95% | 12.91% | 13.06% | 12.74% | 12.66% | 12.88% | 13.11% | 12.99% | 13.38% | 13.46% | 13.93% | 14.11% | 13.79% | 14.11% | 14.48% | 13.91% | 14.28% | 14.60% | 14.69% | 14.60% | 14.70% |
| XO - Gilt 1 | 12.98% | 13.43% | 13.60% | 13.49% | 13.61% | 13.33% | 13.22% | 13.42% | 13.67% | 13.62% | 13.99% | 14.12% | 14.52% | 14.69% | 14.41% | 14.68% | 14.99% | 14.49% | 14.81% | 15.11% | 15.21% | 15.11% | 15.21% |
| XO - Gilt 2 | 12.91% | 13.42% | 13.60% | 13.49% | 13.61% | 13.33% | 13.22% | 13.42% | 13.67% | 13.62% | 13.99% | 14.12% | 14.52% | 14.69% | 14.41% | 14.68% | 14.99% | 14.49% | 14.81% | 15.11% | 15.21% | 15.11% | 15.21% |
| EOM XO - Cash 1 | 14.11% | 13.32% | 13.49% | 13.43% | 13.53% | 13.37% | 12.96% | 13.55% | 13.42% | 13.63% | 13.73% | 13.60% | 14.10% | 14.25% | 13.85% | 14.15% | 14.62% | 13.80% | 14.53% | 14.59% | 14.64% | 14.68% | 14.82% |
| EOM XO - Cash 2 | 14.00% | 13.14% | 13.42% | 13.40% | 13.48% | 13.34% | 12.93% | 13.52% | 13.40% | 13.62% | 13.71% | 13.57% | 14.08% | 14.22% | 13.83% | 14.14% | 14.62% | 13.78% | 14.52% | 14.58% | 14.62% | 14.67% | 14.82% |
| EOM XO - Gilt | 14.62% | 13.83% | 13.99% | 13.92% | 14.00% | 13.91% | 13.48% | 14.03% | 13.98% | 14.21% | 14.34% | 14.23% | 14.66% | 14.78% | 14.43% | 14.69% | 15.11% | 14.35% | 15.03% | 15.11% | 15.15% | 15.18% | 15.32% |

| HSBC PACIFIC INDEX ACC | |
|---|---|
| 15-Year Heat Map | |
| Annualised Volatility B&H | 18.35% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 13.16% | 12.06% | 11.84% | 11.91% | 12.01% | 11.97% | 12.24% | 12.58% | 12.92% | 13.09% | 13.01% | 13.10% |
| MA - Cash 2 | 10.47% | 11.08% | 11.28% | 11.54% | 11.81% | 11.88% | 12.09% | 12.49% | 12.84% | 12.96% | 12.91% | 13.05% |
| MA - Gilt 1 | 11.44% | 11.89% | 12.16% | 12.29% | 12.50% | 12.53% | 12.68% | 13.06% | 13.37% | 13.54% | 13.48% | 13.58% |
| MA - Gilt 2 | 11.11% | 11.75% | 11.95% | 12.20% | 12.44% | 12.53% | 12.67% | 13.05% | 13.36% | 13.49% | 13.45% | 13.57% |
| EOM MA - Cash 1 | 13.50% | 13.52% | 12.51% | 13.18% | 12.24% | 12.91% | 12.97% | 13.35% | 13.33% | 13.35% | 13.24% | 13.56% |
| EOM MA - Cash 2 | 13.68% | 13.40% | 12.39% | 13.10% | 12.18% | 12.84% | 12.95% | 13.34% | 13.32% | 13.35% | 13.24% | 13.56% |
| EOM MA - Gilt 1 | 14.23% | 13.99% | 13.12% | 13.65% | 12.84% | 13.40% | 13.49% | 13.84% | 13.84% | 13.88% | 13.80% | 14.07% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 11.98% | 12.27% | 11.92% | 12.44% | 12.88% | 12.85% | 12.52% | 12.72% | 12.82% | 13.02% | 13.28% | 13.49% | 13.79% | 13.97% | 13.56% | 13.82% | 14.07% | 13.76% | 13.93% | 14.15% | 14.67% | 14.33% | 14.87% |
| XO - Cash 2 | 11.45% | 12.00% | 11.85% | 12.39% | 12.82% | 12.83% | 12.48% | 12.71% | 12.80% | 13.01% | 13.28% | 13.47% | 13.73% | 13.94% | 13.55% | 13.82% | 14.06% | 13.72% | 13.92% | 14.13% | 14.67% | 14.32% | 14.87% |
| XO - Gilt 1 | 12.18% | 12.69% | 12.54% | 12.99% | 13.32% | 13.42% | 13.07% | 13.26% | 13.37% | 13.60% | 13.82% | 13.99% | 14.26% | 14.46% | 14.06% | 14.36% | 14.57% | 14.24% | 14.44% | 14.66% | 15.16% | 14.83% | 15.37% |
| XO - Gilt 2 | 12.17% | 12.69% | 12.54% | 12.99% | 13.32% | 13.42% | 13.06% | 13.26% | 13.37% | 13.60% | 13.82% | 13.99% | 14.26% | 14.46% | 14.06% | 14.36% | 14.57% | 14.24% | 14.44% | 14.66% | 15.16% | 14.83% | 15.37% |
| EOM XO - Cash 1 | 13.24% | 11.91% | 12.47% | 13.12% | 13.29% | 13.10% | 12.75% | 12.84% | 12.80% | 13.14% | 13.59% | 13.43% | 13.73% | 14.11% | 13.76% | 14.01% | 14.07% | 13.80% | 14.12% | 14.44% | 15.36% | 14.41% | 15.21% |
| EOM XO - Cash 2 | 13.15% | 11.77% | 12.38% | 13.05% | 13.25% | 13.08% | 12.73% | 12.82% | 12.79% | 13.13% | 13.58% | 13.42% | 13.73% | 14.10% | 13.75% | 13.99% | 14.06% | 13.78% | 14.11% | 14.44% | 15.36% | 14.41% | 15.20% |
| EOM XO - Gilt | 13.72% | 12.59% | 13.04% | 13.57% | 13.75% | 13.65% | 13.30% | 13.38% | 13.40% | 13.75% | 14.11% | 13.99% | 14.28% | 14.59% | 14.28% | 14.51% | 14.58% | 14.32% | 14.62% | 14.95% | 15.84% | 14.92% | 15.66% |

| BLACKROCK EMRG.MKTS. AC. | |
|---|---|
| 15-Year Heat Map | |
| Annualised Volatility B&H | 19.71% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 13.56% | 13.18% | 13.12% | 12.94% | 13.18% | 13.21% | 13.48% | 13.67% | 13.75% | 13.76% | 13.65% | 13.62% |
| MA - Cash 2 | 11.49% | 12.10% | 12.68% | 12.55% | 12.96% | 13.05% | 13.38% | 13.59% | 13.71% | 13.65% | 13.59% | 13.54% |
| MA - Gilt 1 | 12.51% | 12.91% | 13.37% | 13.29% | 13.59% | 13.70% | 13.95% | 14.14% | 14.24% | 14.21% | 14.20% | 14.17% |
| MA - Gilt 2 | 12.06% | 12.72% | 13.28% | 13.17% | 13.57% | 13.67% | 13.94% | 14.13% | 14.24% | 14.19% | 14.18% | 14.15% |
| EOM MA - Cash 1 | 14.99% | 14.80% | 14.04% | 13.88% | 13.24% | 13.79% | 13.77% | 14.28% | 14.02% | 13.90% | 13.95% | 13.84% |
| EOM MA - Cash 2 | 14.87% | 14.69% | 13.85% | 13.76% | 13.17% | 13.73% | 13.71% | 14.26% | 14.01% | 13.89% | 13.94% | 13.83% |
| EOM MA - Gilt 1 | 15.35% | 15.20% | 14.47% | 14.41% | 13.81% | 14.29% | 14.26% | 14.76% | 14.57% | 14.48% | 14.52% | 14.43% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 13.00% | 13.56% | 13.69% | 13.76% | 13.98% | 13.86% | 13.59% | 13.94% | 13.68% | 13.67% | 13.95% | 14.00% | 14.09% | 14.28% | 14.08% | 14.39% | 14.85% | 14.18% | 14.71% | 15.26% | 16.07% | 15.51% | 16.10% |
| XO - Cash 2 | 12.37% | 13.35% | 13.55% | 13.71% | 13.95% | 13.83% | 13.54% | 13.91% | 13.67% | 13.63% | 13.93% | 13.97% | 14.08% | 14.27% | 14.07% | 14.38% | 14.84% | 14.16% | 14.71% | 15.25% | 16.06% | 15.48% | 16.09% |
| XO - Gilt 1 | 13.04% | 13.96% | 14.13% | 14.24% | 14.48% | 14.42% | 14.10% | 14.45% | 14.24% | 14.23% | 14.49% | 14.52% | 14.68% | 14.83% | 14.63% | 14.96% | 15.36% | 14.74% | 15.26% | 15.77% | 16.54% | 16.02% | 16.61% |
| XO - Gilt 2 | 13.01% | 13.96% | 14.12% | 14.24% | 14.48% | 14.42% | 14.10% | 14.45% | 14.24% | 14.23% | 14.49% | 14.52% | 14.68% | 14.83% | 14.63% | 14.96% | 15.36% | 14.74% | 15.26% | 15.77% | 16.54% | 16.02% | 16.61% |
| EOM XO - Cash 1 | 13.50% | 13.40% | 13.71% | 14.05% | 13.85% | 14.03% | 13.66% | 14.08% | 13.77% | 13.78% | 14.13% | 14.32% | 14.24% | 14.84% | 14.28% | 14.95% | 15.04% | 14.57% | 15.01% | 16.15% | 15.93% | 15.81% | 16.14% |
| EOM XO - Cash 2 | 13.35% | 13.24% | 13.63% | 13.99% | 13.79% | 13.99% | 13.64% | 14.05% | 13.74% | 13.77% | 14.11% | 14.31% | 14.21% | 14.83% | 14.28% | 14.93% | 15.03% | 14.56% | 14.99% | 16.13% | 15.92% | 15.79% | 16.12% |
| EOM XO - Gilt | 13.99% | 13.96% | 14.25% | 14.51% | 14.33% | 14.58% | 14.22% | 14.60% | 14.32% | 14.36% | 14.70% | 14.87% | 14.79% | 15.36% | 14.83% | 15.46% | 15.55% | 15.12% | 15.51% | 16.59% | 16.41% | 16.34% | 16.64% |

# Table 3.9: Strategy Maximum Drawdowns by Market

| HSBC FTSE 100 INDEX AC. RETAIL | |
|---|---|
| **15-Year Heat Map** | |
| Annualised Drawdown | -45.74% |

| | |
|---|---|
| Largest | -51.80% |
| Smallest | -15.01% |

| | |
|---|---|
| Range | 36.79% |
| Average | -23.31% |

Return Correlation

| | |
|---|---|
| MA Corr | 77.09% |
| XO Corr | 74.57% |

Volatility Correlation

| | |
|---|---|
| MA Corr | 10.48% |
| XO Corr | 37.57% |

Overall Averages

| | |
|---|---|
| MA | -23.61% |
| XO | -23.16% |
| Cash | -23.52% |
| Gilt | -23.04% |
| Daily | -23.59% |
| EOM | -22.95% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | -34.82% | -25.60% | -30.08% | -21.54% | -24.86% | -20.47% | -19.49% | -25.84% | -19.85% | -23.08% | -26.02% | -23.60% | -34.82% | -19.49% | 15.33% | -24.60% |
| MA - Cash 2 | -25.10% | -24.96% | -29.18% | -23.94% | -19.65% | -18.74% | -22.27% | -21.88% | -19.28% | -21.24% | -22.83% | -23.59% | -29.18% | -18.74% | 10.43% | -22.72% |
| MA - Gilt 1 | -40.54% | -29.38% | -32.73% | -19.71% | -20.85% | -18.45% | -20.26% | -24.47% | -21.08% | -19.35% | -22.26% | -24.69% | -40.54% | -18.45% | 22.09% | -24.48% |
| MA - Gilt 2 | -34.52% | -31.39% | -31.86% | -19.66% | -19.72% | -15.01% | -21.34% | -24.10% | -21.69% | -18.56% | -21.94% | -24.63% | -34.52% | -15.01% | 19.51% | -23.70% |
| EOM MA - Cash 1 | -22.95% | -27.93% | -28.25% | -35.68% | -23.61% | -22.89% | -18.94% | -23.74% | -19.00% | -17.52% | -17.52% | -17.52% | -35.68% | -17.52% | 18.16% | -22.96% |
| EOM MA - Cash 2 | -22.60% | -31.13% | -30.71% | -37.12% | -27.19% | -24.26% | -19.71% | -24.77% | -20.29% | -17.52% | -17.52% | -17.52% | -37.12% | -17.52% | 19.60% | -24.19% |
| EOM MA - Gilt 1 | -22.49% | -31.49% | -26.00% | -29.01% | -22.81% | -24.11% | -19.33% | -23.43% | -19.89% | -17.52% | -17.52% | -17.52% | -31.49% | -17.52% | 13.97% | -22.59% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 | | | | |
| XO - Cash 1 | -27.75% | -43.63% | -33.48% | -28.63% | -40.77% | -18.45% | -21.70% | -28.75% | -22.93% | -23.68% | -19.80% | -19.73% | -18.06% | -19.24% | -22.49% | -18.06% | -20.89% | -19.38% | -19.79% | -18.93% | -20.11% | -18.06% | -20.11% | -43.63% | -18.06% | 25.57% | -23.67% |
| XO - Cash 2 | -31.27% | -51.23% | -33.27% | -31.64% | -37.95% | -20.17% | -20.25% | -29.18% | -23.14% | -22.97% | -19.58% | -20.60% | -18.06% | -18.06% | -22.97% | -18.06% | -19.53% | -18.91% | -19.39% | -18.06% | -20.11% | -18.57% | -20.29% | -51.23% | -18.06% | 33.17% | -24.06% |
| XO - Gilt 1 | -35.29% | -51.80% | -28.48% | -27.38% | -32.88% | -18.14% | -17.61% | -25.65% | -17.21% | -21.94% | -20.09% | -20.67% | -18.51% | -19.99% | -21.63% | -18.06% | -19.10% | -20.19% | -19.10% | -18.06% | -20.11% | -18.06% | -20.11% | -51.80% | -17.21% | 34.59% | -23.05% |
| XO - Gilt 2 | -33.64% | -51.08% | -28.48% | -27.38% | -32.88% | -18.78% | -17.58% | -25.65% | -17.21% | -21.94% | -20.09% | -20.67% | -18.51% | -19.99% | -21.63% | -18.06% | -19.10% | -20.19% | -19.10% | -18.06% | -20.11% | -18.06% | -20.11% | -51.08% | -17.21% | 33.87% | -22.97% |
| EOM XO - Cash 1 | -31.64% | -21.86% | -39.26% | -28.96% | -27.68% | -24.17% | -26.08% | -26.08% | -22.62% | -19.46% | -24.20% | -22.55% | -18.06% | -18.06% | -18.06% | -18.06% | -19.21% | -19.21% | -19.21% | -18.06% | -20.11% | -18.06% | -24.16% | -39.26% | -18.06% | 21.20% | -22.82% |
| EOM XO - Cash 2 | -35.95% | -23.43% | -40.66% | -27.74% | -26.05% | -23.96% | -27.46% | -27.46% | -22.38% | -20.27% | -24.40% | -23.94% | -18.06% | -18.06% | -18.93% | -18.06% | -19.41% | -19.43% | -19.41% | -18.06% | -20.11% | -18.06% | -25.18% | -40.66% | -18.06% | 22.60% | -23.33% |
| EOM XO - Gilt | -36.39% | -20.44% | -31.37% | -22.96% | -28.83% | -25.54% | -24.73% | -24.73% | -20.17% | -18.53% | -24.40% | -24.55% | -18.89% | -18.62% | -19.44% | -18.89% | -18.62% | -19.28% | -18.62% | -18.06% | -20.11% | -18.06% | -20.32% | -36.39% | -18.06% | 18.32% | -22.24% |

| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | |
|---|---|
| **15-Year Heat Map** | |
| Annualised Drawdown | -52.36% |

| | |
|---|---|
| Largest | -48.43% |
| Smallest | -15.80% |

| | |
|---|---|
| Range | 32.64% |
| Average | -24.94% |

Return Correlation

| | |
|---|---|
| MA Corr | 81.95% |
| XO Corr | 64.64% |

Volatility Correlation

| | |
|---|---|
| MA Corr | 19.14% |
| XO Corr | 22.10% |

Overall Averages

| | |
|---|---|
| MA | -26.29% |
| XO | -24.24% |
| Cash | -25.46% |
| Gilt | -24.26% |
| Daily | -25.25% |
| EOM | -24.54% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | -40.82% | -29.06% | -31.96% | -29.04% | -25.88% | -25.53% | -28.99% | -26.98% | -27.31% | -26.74% | -25.04% | -26.44% | -40.82% | -25.04% | 15.78% | -28.65% |
| MA - Cash 2 | -28.88% | -25.75% | -32.02% | -26.48% | -27.33% | -24.23% | -25.84% | -28.63% | -29.60% | -24.46% | -24.30% | -24.47% | -32.02% | -24.23% | 7.79% | -26.83% |
| MA - Gilt 1 | -39.11% | -25.59% | -36.64% | -22.64% | -23.39% | -24.32% | -24.07% | -22.95% | -28.33% | -22.83% | -21.52% | -22.44% | -39.11% | -21.52% | 17.60% | -26.15% |
| MA - Gilt 2 | -37.13% | -26.60% | -34.13% | -22.50% | -23.46% | -23.18% | -22.73% | -24.53% | -29.45% | -22.76% | -21.08% | -22.44% | -37.13% | -21.08% | 16.05% | -25.83% |
| EOM MA - Cash 1 | -40.60% | -35.23% | -29.10% | -30.99% | -23.21% | -20.37% | -20.37% | -22.57% | -22.57% | -22.57% | -20.33% | -20.33% | -40.60% | -20.33% | 20.27% | -25.69% |
| EOM MA - Cash 2 | -42.05% | -39.25% | -28.77% | -32.74% | -23.42% | -21.11% | -21.11% | -23.11% | -23.11% | -23.11% | -20.49% | -20.33% | -42.05% | -20.33% | 21.72% | -26.55% |
| EOM MA - Gilt 1 | -40.77% | -39.02% | -23.29% | -23.83% | -19.42% | -20.58% | -20.58% | -21.31% | -21.31% | -21.31% | -20.33% | -20.33% | -40.77% | -19.42% | 21.34% | -24.34% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 | | | | |
| XO - Cash 1 | -28.80% | -48.43% | -25.82% | -22.72% | -29.39% | -20.16% | -29.13% | -24.43% | -23.46% | -23.40% | -21.28% | -26.44% | -21.69% | -25.72% | -22.83% | -21.69% | -24.25% | -26.50% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -48.43% | -20.16% | 28.27% | -25.31% |
| XO - Cash 2 | -26.01% | -43.87% | -27.23% | -23.02% | -29.44% | -20.41% | -22.80% | -24.14% | -24.03% | -22.99% | -22.11% | -26.11% | -21.69% | -24.98% | -23.23% | -21.69% | -24.69% | -27.00% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -43.87% | -20.41% | 23.46% | -24.84% |
| XO - Gilt 1 | -31.07% | -43.10% | -20.53% | -19.44% | -24.02% | -19.47% | -21.16% | -19.81% | -20.76% | -21.63% | -20.54% | -25.50% | -21.69% | -25.71% | -21.82% | -22.72% | -23.19% | -28.15% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -43.10% | -19.44% | 23.66% | -23.75% |
| XO - Gilt 2 | -30.72% | -42.47% | -20.53% | -19.44% | -24.02% | -19.47% | -21.66% | -19.81% | -20.76% | -21.63% | -20.54% | -25.50% | -21.69% | -25.71% | -21.82% | -22.72% | -23.19% | -28.15% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -42.47% | -19.44% | 23.03% | -23.73% |
| EOM XO - Cash 1 | -28.72% | -18.08% | -41.96% | -27.28% | -24.19% | -21.42% | -21.38% | -21.42% | -21.42% | -27.06% | -26.62% | -23.48% | -21.69% | -23.19% | -23.48% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -41.96% | -18.08% | 23.88% | -24.21% |
| EOM XO - Cash 2 | -31.07% | -18.53% | -42.94% | -26.16% | -24.05% | -21.42% | -20.49% | -21.42% | -21.42% | -27.87% | -27.17% | -24.05% | -21.69% | -23.19% | -24.05% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -42.94% | -18.53% | 24.41% | -24.39% |
| EOM XO - Gilt | -28.89% | -15.80% | -32.46% | -23.30% | -24.24% | -20.33% | -20.33% | -20.33% | -20.33% | -28.46% | -27.11% | -23.85% | -21.69% | -23.19% | -23.85% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -23.19% | -32.46% | -15.80% | 16.66% | -23.46% |

| HSBC AMER.INDEX AC. | |
|---|---|
| **15-Year Heat Map** | |
| Annualised Drawdown | -37.03% |

| | |
|---|---|
| Largest | -54.75% |
| Smallest | -15.19% |

| | |
|---|---|
| Range | 39.56% |
| Average | -26.03% |

Return Correlation

| | |
|---|---|
| MA Corr | 41.74% |
| XO Corr | 87.76% |

Volatility Correlation

| | |
|---|---|
| MA Corr | 10.87% |
| XO Corr | -9.70% |

Overall Averages

| | |
|---|---|
| MA | -27.31% |
| XO | -25.36% |
| Cash | -25.65% |
| Gilt | -26.54% |
| Daily | -26.56% |
| EOM | -25.33% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | -32.40% | -18.24% | -26.27% | -23.79% | -25.51% | -27.41% | -24.05% | -27.74% | -25.72% | -22.47% | -24.40% | -27.19% | -32.40% | -18.24% | 14.16% | -25.43% |
| MA - Cash 2 | -18.99% | -24.28% | -30.17% | -24.97% | -30.13% | -25.61% | -23.77% | -25.32% | -27.48% | -28.65% | -25.49% | -26.36% | -30.17% | -18.99% | 11.18% | -25.93% |
| MA - Gilt 1 | -22.72% | -36.07% | -34.64% | -23.84% | -28.01% | -25.42% | -24.47% | -27.18% | -27.73% | -29.36% | -33.16% | -35.10% | -36.07% | -22.72% | 13.35% | -28.97% |
| MA - Gilt 2 | -21.20% | -33.72% | -34.45% | -25.07% | -24.66% | -23.61% | -24.19% | -24.69% | -26.27% | -29.64% | -31.21% | -33.96% | -34.45% | -21.20% | 13.25% | -27.72% |
| EOM MA - Cash 1 | -24.59% | -21.13% | -23.25% | -37.62% | -34.11% | -32.71% | -23.27% | -25.79% | -26.47% | -25.17% | -23.74% | -19.78% | -37.62% | -19.78% | 17.85% | -26.47% |
| EOM MA - Cash 2 | -29.41% | -22.40% | -28.77% | -42.75% | -37.78% | -34.67% | -24.85% | -27.82% | -28.15% | -25.91% | -24.77% | -19.78% | -42.75% | -19.78% | 22.97% | -28.92% |
| EOM MA - Gilt 1 | -31.24% | -23.06% | -28.53% | -37.75% | -35.75% | -29.49% | -21.03% | -24.80% | -27.51% | -25.20% | -28.59% | -19.78% | -37.75% | -19.78% | 17.97% | -27.73% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 | | | | |
| XO - Cash 1 | -22.03% | -54.75% | -38.06% | -53.75% | -53.19% | -21.07% | -20.31% | -37.75% | -19.17% | -22.50% | -20.49% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -21.76% | -19.78% | -19.78% | -54.75% | -19.17% | 35.58% | -26.19% |
| XO - Cash 2 | -25.47% | -53.72% | -37.28% | -52.92% | -52.51% | -21.80% | -21.73% | -36.54% | -19.17% | -22.50% | -20.66% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -20.81% | -21.67% | -19.78% | -19.78% | -53.72% | -19.17% | 34.55% | -26.28% |
| XO - Gilt 1 | -35.82% | -54.03% | -33.45% | -48.74% | -49.59% | -18.47% | -21.79% | -30.50% | -19.17% | -24.01% | -23.95% | -20.34% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -23.43% | -25.26% | -19.78% | -19.78% | -54.03% | -18.47% | 35.56% | -26.37% |
| XO - Gilt 2 | -35.84% | -54.30% | -33.45% | -48.74% | -49.67% | -18.47% | -22.39% | -30.50% | -19.17% | -24.01% | -23.95% | -20.34% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -23.43% | -25.26% | -19.78% | -19.78% | -54.30% | -18.47% | 35.83% | -26.41% |
| EOM XO - Cash 1 | -24.22% | -21.23% | -50.01% | -40.89% | -38.71% | -15.19% | -27.93% | -23.39% | -22.86% | -22.87% | -21.16% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -50.01% | -15.19% | 34.82% | -23.73% |
| EOM XO - Cash 2 | -29.15% | -21.97% | -53.28% | -40.16% | -37.35% | -15.19% | -30.53% | -23.36% | -23.64% | -23.28% | -21.58% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -19.78% | -53.28% | -15.19% | 38.09% | -24.21% |
| EOM XO - Gilt | -34.54% | -22.06% | -46.76% | -38.00% | -34.32% | -15.39% | -26.66% | -22.11% | -26.35% | -26.42% | -23.77% | -19.78% | -19.78% | -21.63% | -19.78% | -19.78% | -19.78% | -19.78% | -20.38% | -19.78% | -22.75% | -19.78% | -19.78% | -46.76% | -15.39% | 31.37% | -24.31% |

| HSBC JAPAN INDEX ACC | |
|---|---|
| **15-Year Heat Map** | |
| Annualised Drawdown | -41.89% |

| | |
|---|---|
| Largest | -57.54% |
| Smallest | -20.02% |

| | |
|---|---|
| Range | 37.53% |
| Average | -32.38% |

Return Correlation

| | |
|---|---|
| MA Corr | 76.82% |
| XO Corr | 71.96% |

Volatility Correlation

| | |
|---|---|
| MA Corr | 17.73% |
| XO Corr | 17.15% |

Overall Averages

| | |
|---|---|
| MA | -33.93% |
| XO | -31.57% |
| Cash | -33.16% |
| Gilt | -31.34% |
| Daily | -33.40% |
| EOM | -31.02% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | -35.46% | -21.74% | -34.95% | -38.61% | -41.36% | -32.20% | -44.38% | -52.58% | -56.33% | -35.16% | -39.05% | -33.79% | -56.33% | -21.74% | 34.59% | -38.80% |
| MA - Cash 2 | -29.26% | -27.32% | -32.44% | -32.67% | -32.35% | -32.01% | -41.08% | -54.92% | -52.79% | -40.13% | -40.77% | -34.76% | -54.92% | -27.32% | 27.60% | -37.54% |
| MA - Gilt 1 | -36.41% | -33.99% | -33.49% | -28.77% | -31.13% | -26.85% | -33.09% | -41.19% | -46.73% | -35.53% | -35.95% | -26.75% | -46.73% | -26.75% | 19.99% | -34.16% |
| MA - Gilt 2 | -31.69% | -30.33% | -34.55% | -31.16% | -28.16% | -22.85% | -34.01% | -44.44% | -48.03% | -37.25% | -35.88% | -26.47% | -48.03% | -22.85% | 25.19% | -33.73% |
| EOM MA - Cash 1 | -25.69% | -24.16% | -20.71% | -28.89% | -37.77% | -42.85% | -33.43% | -38.41% | -38.92% | -33.05% | -34.51% | -28.51% | -42.85% | -20.71% | 22.14% | -32.24% |
| EOM MA - Cash 2 | -27.15% | -22.43% | -21.15% | -29.00% | -36.94% | -44.24% | -36.20% | -40.93% | -40.05% | -32.05% | -33.21% | -27.57% | -44.24% | -21.15% | 23.09% | -32.58% |
| EOM MA - Gilt 1 | -28.60% | -28.21% | -23.32% | -27.87% | -29.51% | -33.41% | -25.47% | -30.48% | -35.18% | -25.54% | -28.62% | -25.13% | -35.18% | -23.32% | 11.85% | -28.44% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 | | | | |
| XO - Cash 1 | -43.33% | -29.02% | -46.93% | -45.57% | -57.54% | -46.15% | -39.36% | -49.86% | -44.33% | -34.13% | -30.19% | -33.78% | -26.11% | -24.01% | -23.33% | -25.21% | -20.02% | -22.15% | -20.02% | -20.02% | -26.06% | -20.38% | -28.49% | -57.54% | -20.02% | 37.53% | -32.87% |
| XO - Cash 2 | -33.77% | -28.23% | -42.54% | -44.20% | -56.86% | -47.13% | -38.99% | -52.21% | -43.67% | -35.87% | -29.61% | -33.90% | -26.64% | -24.31% | -25.74% | -24.12% | -20.02% | -21.34% | -20.02% | -20.02% | -26.70% | -20.42% | -30.56% | -56.86% | -20.02% | 36.85% | -32.47% |
| XO - Gilt 1 | -43.36% | -30.32% | -47.14% | -32.94% | -53.51% | -42.97% | -32.01% | -45.29% | -38.28% | -31.49% | -29.90% | -35.68% | -31.06% | -29.10% | -24.74% | -23.64% | -20.25% | -20.09% | -20.02% | -20.02% | -24.79% | -20.02% | -25.17% | -53.51% | -20.02% | 33.49% | -31.38% |
| XO - Gilt 2 | -42.96% | -30.32% | -47.14% | -32.94% | -53.51% | -42.97% | -31.61% | -45.29% | -38.28% | -31.49% | -29.90% | -35.68% | -31.06% | -29.10% | -24.74% | -23.64% | -20.25% | -20.09% | -20.02% | -20.02% | -24.79% | -20.02% | -25.17% | -53.51% | -20.02% | 33.49% | -31.35% |
| EOM XO - Cash 1 | -31.90% | -25.34% | -44.93% | -43.87% | -44.30% | -35.82% | -42.90% | -57.48% | -33.70% | -36.82% | -28.42% | -32.78% | -25.94% | -20.46% | -24.66% | -21.52% | -21.86% | -20.02% | -20.02% | -21.09% | -33.00% | -23.44% | -36.90% | -57.48% | -20.02% | 37.47% | -31.61% |
| EOM XO - Cash 2 | -29.62% | -29.10% | -43.63% | -43.79% | -42.60% | -36.66% | -43.65% | -55.20% | -33.70% | -36.19% | -28.84% | -31.63% | -25.65% | -20.02% | -23.96% | -21.84% | -20.02% | -20.02% | -20.02% | -20.02% | -32.83% | -22.31% | -37.78% | -55.20% | -20.02% | 35.19% | -31.26% |
| EOM XO - Gilt | -32.46% | -28.21% | -42.00% | -36.59% | -39.94% | -33.67% | -36.93% | -53.86% | -31.41% | -35.94% | -28.68% | -33.85% | -30.48% | -22.31% | -23.64% | -23.64% | -20.30% | -20.02% | -20.02% | -20.02% | -27.11% | -20.56% | -30.04% | -53.86% | -20.02% | 33.85% | -30.07% |

| HSBC EUR.INDEX AC. | |
|---|---|
| **15-Year Heat Map** | |
| Annualised Drawdown | -45.96% |

| | |
|---|---|
| Largest | -56.56% |
| Smallest | -15.54% |

| | |
|---|---|
| Range | 41.02% |
| Average | -30.42% |

Return Correlation

| | |
|---|---|
| MA Corr | 70.15% |
| XO Corr | 54.86% |

Volatility Correlation

| | |
|---|---|
| MA Corr | 0.56% |
| XO Corr | 4.90% |

Overall Averages

| | |
|---|---|
| MA | -27.15% |
| XO | -32.13% |
| Cash | -31.07% |
| Gilt | -29.55% |
| Daily | -29.72% |
| EOM | -31.36% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | -26.24% | -45.09% | -20.12% | -29.05% | -25.89% | -25.53% | -21.35% | -19.64% | -23.59% | -25.12% | -28.89% | -27.69% | -45.09% | -19.64% | 25.44% | -26.52% |
| MA - Cash 2 | -37.95% | -33.20% | -17.88% | -33.05% | -22.91% | -23.41% | -20.16% | -18.33% | -21.08% | -28.06% | -33.13% | -25.87% | -37.95% | -17.88% | 20.07% | -26.25% |
| MA - Gilt 1 | -41.01% | -34.92% | -18.73% | -31.74% | -15.97% | -20.89% | -18.84% | -19.63% | -21.16% | -27.73% | -30.67% | -31.55% | -41.01% | -15.97% | 25.04% | -26.07% |
| MA - Gilt 2 | -40.42% | -28.89% | -19.17% | -32.79% | -15.54% | -21.13% | -19.79% | -20.90% | -21.33% | -28.60% | -29.83% | -28.28% | -40.42% | -15.54% | 24.88% | -25.56% |
| EOM MA - Cash 1 | -23.76% | -22.28% | -25.00% | -36.86% | -35.70% | -25.28% | -28.70% | -21.59% | -35.41% | -35.04% | -29.99% | -26.29% | -36.86% | -21.59% | 15.27% | -28.82% |
| EOM MA - Cash 2 | -27.46% | -25.40% | -27.77% | -43.14% | -38.12% | -26.73% | -29.13% | -21.43% | -36.04% | -34.00% | -28.02% | -26.29% | -43.14% | -21.43% | 21.72% | -30.29% |
| EOM MA - Gilt 1 | -28.29% | -25.29% | -21.04% | -32.55% | -28.02% | -23.73% | -21.91% | -20.64% | -34.83% | -29.72% | -26.29% | -26.29% | -34.83% | -20.64% | 14.20% | -26.55% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 | | | | |
| XO - Cash 1 | -25.69% | -24.76% | -40.66% | -33.96% | -47.53% | -39.53% | -31.79% | -24.27% | -37.79% | -28.75% | -26.77% | -31.61% | -30.82% | -33.34% | -30.82% | -30.82% | -32.43% | -30.82% | -30.82% | -30.82% | -34.82% | -32.09% | -30.82% | -47.53% | -24.27% | 23.26% | -32.24% |
| XO - Cash 2 | -27.87% | -24.69% | -45.30% | -33.05% | -47.32% | -39.26% | -32.36% | -25.95% | -39.76% | -29.16% | -27.41% | -30.08% | -30.82% | -32.80% | -30.82% | -30.82% | -32.12% | -30.82% | -30.82% | -30.82% | -33.67% | -31.08% | -30.82% | -47.32% | -24.69% | 22.63% | -32.50% |
| XO - Gilt 1 | -34.16% | -24.54% | -35.06% | -27.01% | -45.22% | -34.89% | -26.63% | -21.31% | -34.73% | -26.31% | -26.29% | -30.39% | -31.14% | -33.90% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -45.22% | -21.31% | 23.92% | -30.82% |
| XO - Gilt 2 | -35.19% | -24.34% | -35.06% | -27.01% | -45.22% | -34.89% | -26.63% | -21.31% | -34.73% | -26.31% | -26.29% | -30.39% | -31.14% | -33.90% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -45.22% | -21.31% | 23.92% | -30.86% |
| EOM XO - Cash 1 | -34.95% | -24.34% | -52.55% | -35.62% | -28.07% | -33.17% | -27.68% | -33.71% | -35.10% | -34.15% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -32.18% | -33.88% | -30.82% | -31.46% | -32.36% | -30.82% | -30.82% | -36.91% | -52.55% | -24.34% | 28.21% | -32.72% |
| EOM XO - Cash 2 | -37.23% | -26.76% | -56.56% | -34.95% | -27.07% | -34.15% | -29.70% | -34.04% | -37.65% | -34.99% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -32.23% | -32.56% | -30.82% | -31.36% | -32.77% | -30.82% | -30.82% | -37.54% | -56.56% | -26.76% | 29.81% | -33.31% |
| EOM XO - Gilt | -41.12% | -25.40% | -49.40% | -29.53% | -29.82% | -31.35% | -25.36% | -30.59% | -35.01% | -35.70% | -30.82% | -31.32% | -33.84% | -31.43% | -30.82% | -33.27% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -30.82% | -36.61% | -49.40% | -25.36% | 24.05% | -32.45% |

| BLACKROCK EMRG.MKTS. AC. | |
|---|---|
| **15-Year Heat Map** | |
| Annualised Drawdown | -55.09% |

| | |
|---|---|
| Largest | -68.29% |
| Smallest | -19.91% |

| | |
|---|---|
| Range | 48.38% |
| Average | -35.13% |

Return Correlation

| | |
|---|---|
| MA Corr | 58.60% |
| XO Corr | 81.75% |

Volatility Correlation

| | |
|---|---|
| MA Corr | -24.45% |
| XO Corr | -79.48% |

Overall Averages

| | |
|---|---|
| MA | -30.00% |
| XO | -37.80% |
| Cash | -36.32% |
| Gilt | -33.54% |
| Daily | -34.77% |
| EOM | -35.61% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | -43.79% | -22.97% | -26.27% | -25.30% | -29.72% | -28.45% | -31.22% | -24.89% | -25.13% | -33.70% | -37.88% | -40.15% | -43.79% | -22.97% | 20.81% | -30.79% |
| MA - Cash 2 | -24.67% | -23.70% | -36.48% | -26.30% | -31.94% | -21.36% | -32.98% | -27.53% | -24.10% | -30.79% | -33.18% | -39.98% | -39.98% | -21.36% | 18.63% | -29.42% |
| MA - Gilt 1 | -32.84% | -24.21% | -39.79% | -26.14% | -28.35% | -21.76% | -26.63% | -26.15% | -24.38% | -30.49% | -34.79% | -37.55% | -39.79% | -21.76% | 18.03% | -29.42% |
| MA - Gilt 2 | -30.00% | -26.36% | -38.01% | -22.81% | -29.05% | -21.13% | -27.87% | -25.62% | -24.38% | -29.82% | -33.69% | -39.03% | -39.03% | -21.13% | 17.90% | -28.98% |
| EOM MA - Cash 1 | -37.12% | -32.28% | -40.25% | -42.53% | -21.80% | -27.71% | -24.32% | -31.77% | -26.30% | -24.10% | -26.86% | -25.61% | -42.53% | -21.80% | 20.73% | -30.05% |
| EOM MA - Cash 2 | -39.35% | -34.47% | -40.91% | -45.54% | -23.67% | -31.19% | -29.23% | -33.36% | -27.52% | -24.10% | -27.31% | -26.66% | -45.54% | -23.67% | 21.87% | -31.94% |
| EOM MA - Gilt 1 | -39.42% | -37.90% | -38.07% | -39.36% | -19.91% | -25.03% | -24.60% | -31.24% | -25.24% | -24.10% | -24.10% | -24.10% | -39.42% | -19.91% | 19.51% | -29.42% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 | | | | |
| XO - Cash 1 | -20.37% | -27.52% | -34.37% | -44.19% | -31.61% | -36.89% | -27.45% | -36.34% | -34.56% | -26.30% | -31.30% | -24.10% | -31.87% | -39.52% | -35.11% | -42.01% | -39.15% | -43.41% | -42.01% | -61.85% | -62.35% | -67.18% | -62.87% | -67.18% | -20.37% | 46.81% | -39.23% |
| XO - Cash 2 | -21.56% | -29.32% | -35.69% | -44.54% | -32.64% | -36.79% | -27.72% | -36.59% | -34.96% | -25.49% | -29.49% | -24.10% | -31.80% | -40.46% | -34.69% | -42.09% | -38.95% | -43.44% | -41.69% | -61.29% | -61.68% | -68.29% | -63.55% | -68.29% | -21.56% | 46.73% | -39.43% |
| XO - Gilt 1 | -23.98% | -28.01% | -27.66% | -33.79% | -29.31% | -35.20% | -26.43% | -33.05% | -32.46% | -24.10% | -24.47% | -24.10% | -29.76% | -32.51% | -31.92% | -37.28% | -34.83% | -40.48% | -34.83% | -53.01% | -55.44% | -65.28% | -59.44% | -65.28% | -23.98% | 41.29% | -35.54% |
| XO - Gilt 2 | -24.01% | -28.01% | -27.66% | -33.79% | -29.31% | -35.20% | -26.55% | -33.05% | -32.46% | -24.10% | -24.47% | -24.10% | -29.76% | -32.51% | -31.92% | -37.28% | -34.83% | -40.48% | -34.83% | -53.01% | -55.44% | -65.28% | -59.44% | -65.28% | -24.01% | 41.27% | -35.54% |
| EOM XO - Cash 1 | -31.82% | -26.06% | -27.61% | -32.95% | -28.87% | -30.60% | -26.90% | -24.10% | -34.53% | -34.16% | -36.04% | -35.08% | -35.78% | -43.35% | -41.17% | -41.50% | -45.02% | -40.85% | -45.88% | -57.15% | -59.70% | -62.50% | -56.52% | -62.50% | -24.10% | 38.40% | -39.05% |
| EOM XO - Cash 2 | -36.01% | -29.48% | -30.89% | -32.65% | -27.75% | -29.50% | -29.51% | -24.10% | -33.90% | -34.69% | -36.98% | -36.67% | -36.04% | -42.39% | -41.05% | -41.24% | -45.50% | -38.99% | -46.13% | -57.82% | -59.41% | -62.02% | -57.88% | -62.02% | -24.10% | 37.91% | -39.59% |
| EOM XO - Gilt | -37.72% | -21.13% | -22.19% | -32.02% | -30.51% | -32.57% | -25.52% | -24.10% | -33.83% | -33.89% | -34.72% | -35.41% | -32.13% | -34.83% | -37.37% | -34.83% | -34.83% | -36.44% | -37.84% | -55.09% | -55.09% | -55.60% | -55.09% | -55.60% | -21.13% | 34.46% | -36.21% |

| HSBC PACIFIC INDEX ACC | |
|---|---|
| **15-Year Heat Map** | |
| Annualised Drawdown | -50.10% |

| | |
|---|---|
| Largest | -50.05% |
| Smallest | -17.77% |

| | |
|---|---|
| Range | 32.28% |
| Average | -29.13% |

Return Correlation

| | |
|---|---|
| MA Corr | 41.00% |
| XO Corr | 51.75% |

Volatility Correlation

| | |
|---|---|
| MA Corr | -37.72% |
| XO Corr | -67.57% |

Overall Averages

| | |
|---|---|
| MA | -26.84% |
| XO | -30.32% |
| Cash | -29.80% |
| Gilt | -28.23% |
| Daily | -28.22% |
| EOM | -30.33% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | -32.34% | -20.90% | -24.97% | -18.23% | -31.62% | -18.60% | -22.94% | -31.23% | -30.63% | -30.18% | -26.28% | -27.91% | -32.34% | -18.23% | 14.11% | -26.32% |
| MA - Cash 2 | -28.62% | -20.69% | -22.08% | -20.51% | -31.11% | -20.07% | -22.72% | -28.56% | -29.01% | -33.82% | -24.08% | -25.96% | -33.82% | -20.07% | 13.75% | -25.60% |
| MA - Gilt 1 | -29.58% | -17.77% | -23.03% | -21.04% | -25.66% | -21.42% | -21.88% | -27.64% | -22.55% | -23.43% | -24.49% | -23.33% | -29.58% | -17.77% | 11.81% | -23.48% |
| MA - Gilt 2 | -31.56% | -21.37% | -21.63% | -20.66% | -25.95% | -21.31% | -22.63% | -28.10% | -22.55% | -27.19% | -24.58% | -23.33% | -31.56% | -20.66% | 10.90% | -24.24% |
| EOM MA - Cash 1 | -36.56% | -31.99% | -26.40% | -43.56% | -24.85% | -25.52% | -26.11% | -26.70% | -30.61% | -25.99% | -23.16% | -28.72% | -43.56% | -23.16% | 20.40% | -29.18% |
| EOM MA - Cash 2 | -42.21% | -33.19% | -28.02% | -46.34% | -27.64% | -27.64% | -27.02% | -27.44% | -31.13% | -25.79% | -23.16% | -29.53% | -46.34% | -23.16% | 23.18% | -30.76% |
| EOM MA - Gilt 1 | -40.31% | -30.17% | -23.71% | -38.32% | -26.27% | -26.27% | -26.27% | -26.73% | -26.73% | -23.16% | -23.16% | -28.45% | -40.31% | -23.16% | 17.15% | -28.29% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 | Largest | Smallest | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 | | | | |
| XO - Cash 1 | -23.49% | -26.01% | -25.51% | -29.38% | -33.05% | -30.41% | -26.78% | -26.74% | -25.76% | -28.02% | -31.72% | -27.47% | -28.76% | -27.47% | -29.60% | -34.05% | -31.95% | -30.22% | -32.64% | -30.41% | -43.39% | -33.33% | -46.17% | -46.17% | -23.49% | 22.68% | -30.54% |
| XO - Cash 2 | -21.89% | -30.42% | -26.32% | -28.22% | -32.24% | -29.50% | -27.20% | -26.57% | -26.94% | -28.38% | -31.28% | -27.97% | -28.23% | -27.47% | -29.73% | -34.21% | -31.90% | -30.52% | -32.69% | -28.98% | -43.48% | -33.33% | -46.17% | -46.17% | -21.89% | 24.29% | -30.59% |
| XO - Gilt 1 | -20.60% | -29.41% | -24.53% | -23.71% | -28.04% | -32.21% | -25.90% | -22.41% | -23.41% | -29.25% | -30.22% | -29.10% | -27.47% | -27.47% | -29.34% | -31.62% | -30.05% | -28.95% | -30.99% | -27.47% | -43.27% | -33.33% | -46.17% | -46.17% | -20.60% | 25.58% | -29.34% |
| XO - Gilt 2 | -20.60% | -29.41% | -24.53% | -23.71% | -28.04% | -32.21% | -25.90% | -22.41% | -23.41% | -29.25% | -30.22% | -29.10% | -27.47% | -27.47% | -29.34% | -31.62% | -30.05% | -28.95% | -30.99% | -27.47% | -43.27% | -33.33% | -46.17% | -46.17% | -20.60% | 25.58% | -29.34% |
| EOM XO - Cash 1 | -35.13% | -20.04% | -30.35% | -31.23% | -30.46% | -30.54% | -26.11% | -26.11% | -21.75% | -27.47% | -28.75% | -27.47% | -30.54% | -27.47% | -29.71% | -33.41% | -27.68% | -27.47% | -27.47% | -33.33% | -50.05% | -33.33% | -50.05% | -50.05% | -20.04% | 30.01% | -30.69% |
| EOM XO - Cash 2 | -36.00% | -21.88% | -34.06% | -34.20% | -29.40% | -29.77% | -27.02% | -27.02% | -21.75% | -27.61% | -29.99% | -27.47% | -30.44% | -27.47% | -30.10% | -33.31% | -27.90% | -27.51% | -27.47% | -33.33% | -50.05% | -33.33% | -50.05% | -50.05% | -21.75% | 28.29% | -31.18% |
| EOM XO - Gilt | -38.39% | -20.43% | -23.86% | -28.31% | -32.11% | -32.62% | -26.27% | -26.27% | -21.75% | -29.75% | -30.65% | -27.47% | -27.47% | -27.47% | -29.64% | -30.81% | -27.47% | -27.47% | -27.47% | -33.33% | -50.05% | -33.33% | -50.05% | -50.05% | -20.43% | 29.62% | -30.54% |

# Table 3.10: Sharpe Ratios by Market

| HSBC FTSE 100 INDEX AC. RETAIL | |
|---|---|
| 15-Year Heat Map | |
| Annualised Sharpe Ratio | 35.74% |

| | |
|---|---|
| Low | -35.87% |
| High | 63.31% |

| | |
|---|---|
| Range | 99.18% |
| Average | 30.38% |

Return Correlation

| | |
|---|---|
| MA Corr | 99.72% |
| XO Corr | 99.64% |

Volatility Correlation

| | |
|---|---|
| MA Corr | 36.06% |
| XO Corr | 14.17% |

Overall Averages

| | |
|---|---|
| MA | 24.38% |
| XO | 33.51% |
| Cash | 28.61% |
| Gilt | 32.75% |
| Daily | 27.19% |
| EOM | 34.64% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Low | High | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | -24.70% | -13.45% | -5.31% | 14.51% | 16.29% | 35.43% | 39.49% | 27.11% | 33.25% | 31.29% | 25.87% | 24.90% | -24.70% | 39.49% | 64.19% | 17.06% |
| MA - Cash 2 | -20.40% | -13.54% | -6.04% | 7.34% | 17.19% | 39.84% | 34.85% | 26.05% | 31.99% | 30.39% | 29.64% | 23.73% | -20.40% | 39.84% | 60.24% | 16.75% |
| MA - Gilt 1 | -34.42% | -13.89% | -17.14% | 10.86% | 22.93% | 46.27% | 42.00% | 32.67% | 38.52% | 32.39% | 29.84% | 26.84% | -34.42% | 46.27% | 80.69% | 18.07% |
| MA - Gilt 2 | -25.86% | -13.71% | -11.56% | 12.28% | 24.00% | 49.16% | 41.05% | 32.20% | 39.05% | 32.95% | 33.56% | 26.69% | -25.86% | 49.16% | 75.02% | 19.98% |
| EOM MA - Cash 1 | 17.77% | 11.84% | 18.51% | 15.40% | 31.95% | 50.42% | 52.64% | 33.18% | 40.46% | 42.06% | 43.38% | 44.72% | 11.84% | 52.64% | 40.80% | 33.53% |
| EOM MA - Cash 2 | 12.53% | 0.21% | 8.20% | 4.65% | 24.69% | 43.69% | 47.85% | 31.46% | 38.01% | 41.13% | 41.61% | 42.86% | 0.21% | 47.85% | 47.65% | 28.07% |
| EOM MA - Gilt 1 | 15.57% | -3.10% | 13.56% | 28.65% | 42.43% | 62.20% | 58.53% | 38.64% | 45.57% | 49.76% | 48.95% | 45.90% | -3.10% | 62.20% | 65.30% | 37.22% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | -11.40% | -27.32% | 3.21% | 26.73% | 27.05% | 49.37% | 34.08% | 27.35% | 43.24% | 46.70% | 37.21% | 34.49% | 38.18% | 35.01% | 32.77% | 37.75% | 29.42% | 34.54% | 34.99% | 32.87% | 33.34% | 35.10% | 28.00% |
| XO - Cash 2 | -16.21% | -34.99% | 3.72% | 26.38% | 27.85% | 48.27% | 35.75% | 29.64% | 43.32% | 46.56% | 37.07% | 34.01% | 38.01% | 36.28% | 32.91% | 39.03% | 31.34% | 34.04% | 35.40% | 34.10% | 33.30% | 33.96% | 27.95% |
| XO - Gilt 1 | -24.38% | -35.87% | 23.14% | 45.85% | 45.36% | 63.31% | 43.88% | 42.88% | 53.04% | 48.48% | 40.44% | 39.52% | 45.51% | 43.18% | 36.34% | 45.04% | 36.83% | 38.38% | 39.86% | 35.87% | 36.35% | 36.91% | 30.56% |
| XO - Gilt 2 | -22.10% | -35.09% | 23.14% | 45.91% | 45.36% | 62.88% | 43.60% | 42.88% | 53.04% | 48.48% | 40.44% | 39.52% | 45.51% | 43.18% | 36.34% | 45.04% | 36.83% | 38.38% | 39.86% | 35.87% | 36.35% | 36.91% | 30.56% |
| EOM XO - Cash 1 | 3.96% | 20.59% | 17.99% | 32.25% | 39.06% | 43.61% | 39.39% | 36.69% | 43.11% | 41.09% | 35.21% | 35.41% | 38.73% | 37.49% | 37.24% | 44.56% | 31.60% | 34.45% | 34.32% | 34.73% | 36.48% | 35.29% | 31.03% |
| EOM XO - Cash 2 | -4.87% | 11.07% | 10.56% | 30.03% | 42.23% | 43.99% | 38.37% | 36.32% | 45.32% | 40.23% | 34.53% | 35.12% | 39.23% | 37.62% | 37.67% | 45.17% | 29.91% | 34.92% | 33.09% | 34.29% | 35.70% | 34.54% | 30.28% |
| EOM XO - Gilt | -10.63% | 26.77% | 36.42% | 48.23% | 52.62% | 53.75% | 49.61% | 47.51% | 53.66% | 45.60% | 37.26% | 37.45% | 44.27% | 43.82% | 41.33% | 51.99% | 33.94% | 39.99% | 35.92% | 34.57% | 37.49% | 38.53% | 32.00% |

| Moving Average 1: | Low | High | Range | Average |
|---|---|---|---|---|
| Moving Average 2: | | | | |
| XO - Cash 1 | -27.32% | 49.37% | 76.69% | 28.81% |
| XO - Cash 2 | -34.99% | 48.27% | 83.26% | 28.60% |
| XO - Gilt 1 | -35.87% | 63.31% | 99.18% | 35.24% |
| XO - Gilt 2 | -35.09% | 62.88% | 97.97% | 35.34% |
| EOM XO - Cash 1 | 3.96% | 44.56% | 40.59% | 34.10% |
| EOM XO - Cash 2 | -4.87% | 45.32% | 50.19% | 32.84% |
| EOM XO - Gilt | -10.63% | 53.75% | 64.39% | 39.66% |

| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | |
|---|---|
| 15-Year Heat Map | |
| Annualised Sharpe Ratio | 62.00% |

| | |
|---|---|
| Low | 18.75% |
| High | 102.23% |

| | |
|---|---|
| Range | 83.47% |
| Average | 66.77% |

Return Correlation

| | |
|---|---|
| MA Corr | 99.38% |
| XO Corr | 99.17% |

Volatility Correlation

| | |
|---|---|
| MA Corr | 33.08% |
| XO Corr | -3.58% |

Overall Averages

| | |
|---|---|
| MA | 62.37% |
| XO | 69.07% |
| Cash | 65.56% |
| Gilt | 68.39% |
| Daily | 65.75% |
| EOM | 68.14% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Low | High | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 32.11% | 48.46% | 40.38% | 58.13% | 63.26% | 71.88% | 69.69% | 78.63% | 68.40% | 69.16% | 68.82% | 60.58% | 32.11% | 78.63% | 46.52% | 60.79% |
| MA - Cash 2 | 40.35% | 36.56% | 38.63% | 54.45% | 61.54% | 71.62% | 72.64% | 75.80% | 64.39% | 71.16% | 67.70% | 64.31% | 36.56% | 75.80% | 39.24% | 59.93% |
| MA - Gilt 1 | 25.54% | 32.77% | 26.28% | 56.61% | 69.58% | 77.16% | 80.85% | 87.21% | 70.03% | 74.33% | 72.15% | 64.89% | 25.54% | 87.21% | 61.67% | 61.45% |
| MA - Gilt 2 | 26.02% | 28.59% | 26.82% | 53.87% | 65.71% | 77.86% | 82.69% | 84.30% | 68.09% | 73.43% | 70.77% | 65.03% | 26.02% | 84.30% | 58.28% | 60.27% |
| EOM MA - Cash 1 | 38.50% | 39.32% | 45.79% | 46.97% | 78.11% | 81.38% | 81.16% | 73.35% | 74.50% | 76.64% | 79.25% | 72.91% | 38.50% | 81.38% | 42.88% | 65.66% |
| EOM MA - Cash 2 | 32.06% | 28.82% | 34.75% | 36.50% | 73.91% | 79.04% | 80.32% | 74.42% | 76.11% | 76.10% | 78.06% | 72.58% | 28.82% | 80.32% | 51.50% | 61.89% |
| EOM MA - Gilt 1 | 26.42% | 18.75% | 47.09% | 52.56% | 89.90% | 89.36% | 87.82% | 78.74% | 77.15% | 76.78% | 79.70% | 74.90% | 18.75% | 89.90% | 71.14% | 66.60% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 35.62% | 24.28% | 50.28% | 68.18% | 63.33% | 78.33% | 83.50% | 86.10% | 86.57% | 93.71% | 89.36% | 70.77% | 64.84% | 50.99% | 69.43% | 64.64% | 59.34% | 61.54% | 64.87% | 65.61% | 61.94% | 69.07% | 63.89% |
| XO - Cash 2 | 36.28% | 29.11% | 46.18% | 67.28% | 60.77% | 78.81% | 92.02% | 85.04% | 86.51% | 93.01% | 87.19% | 69.45% | 63.87% | 51.70% | 68.71% | 64.25% | 59.35% | 61.08% | 64.57% | 64.75% | 61.53% | 69.66% | 64.65% |
| XO - Gilt 1 | 26.51% | 27.49% | 59.96% | 81.40% | 75.96% | 90.06% | 99.08% | 94.49% | 92.71% | 102.23% | 91.67% | 74.96% | 70.13% | 56.49% | 73.33% | 66.60% | 61.10% | 64.65% | 67.57% | 65.05% | 56.65% | 65.47% | 59.23% |
| XO - Gilt 2 | 23.16% | 28.23% | 59.96% | 81.40% | 75.96% | 90.06% | 100.10% | 94.23% | 92.57% | 102.23% | 91.67% | 74.96% | 70.13% | 56.49% | 73.33% | 66.60% | 61.10% | 64.65% | 67.57% | 65.05% | 56.65% | 65.47% | 59.23% |
| EOM XO - Cash 1 | 42.10% | 70.68% | 38.09% | 73.71% | 76.51% | 84.75% | 83.03% | 86.75% | 91.89% | 89.74% | 78.60% | 66.20% | 64.10% | 54.74% | 68.92% | 66.19% | 63.08% | 63.74% | 66.19% | 68.43% | 61.06% | 67.90% | 64.13% |
| EOM XO - Cash 2 | 30.52% | 57.53% | 31.91% | 72.24% | 77.72% | 84.96% | 84.20% | 86.69% | 91.23% | 88.00% | 78.54% | 66.86% | 63.95% | 54.00% | 69.42% | 65.89% | 64.67% | 64.54% | 65.78% | 68.27% | 59.76% | 67.54% | 62.70% |
| EOM XO - Gilt | 33.67% | 74.42% | 51.22% | 86.98% | 88.47% | 96.63% | 91.52% | 93.09% | 96.52% | 95.71% | 82.52% | 73.42% | 68.21% | 58.37% | 73.03% | 69.63% | 64.60% | 68.72% | 68.65% | 66.15% | 55.49% | 60.93% | 59.54% |

| Moving Average 1: | Low | High | Range | Average |
|---|---|---|---|---|
| Moving Average 2: | | | | |
| XO - Cash 1 | 24.28% | 93.71% | [illegible]4% | 66.36% |
| XO - Cash 2 | 29.11% | 93.01% | [illegible]0% | 66.34% |
| XO - Gilt 1 | 26.51% | 102.23% | 75.72% | 70.56% |
| XO - Gilt 2 | 23.16% | 102.23% | 79.06% | 70.47% |
| EOM XO - Cash 1 | 38.09% | 91.89% | 53.80% | 69.15% |
| EOM XO - Cash 2 | 30.52% | 91.23% | 60.71% | 67.69% |
| EOM XO - Gilt | 33.67% | 96.63% | 62.97% | 72.93% |

| HSBC AMER.INDEX AC. | |
|---|---|
| **15-Year Heat Map** | |
| Annualised Sharpe Ratio | 45.27% |

| | |
|---|---|
| Low | -19.28% |
| High | 60.18% |

| | |
|---|---|
| Range | 79.46% |
| Average | 35.97% |

Return Correlation

| | |
|---|---|
| MA Corr | 99.62% |
| XO Corr | 99.65% |

Volatility Correlation

| | |
|---|---|
| MA Corr | 43.19% |
| XO Corr | 5.99% |

Overall Averages

| | |
|---|---|
| MA | 27.08% |
| XO | 40.62% |
| Cash | 35.84% |
| Gilt | 36.16% |
| Daily | 33.53% |
| EOM | 39.23% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Low | High | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 14.64% | 28.84% | 6.16% | 13.72% | 24.73% | 31.33% | 38.63% | 26.77% | 31.77% | 33.12% | 28.60% | 24.95% | 0.06162 | 0.38634 | 0.32472 | 0.25271 |
| MA - Cash 2 | 19.20% | 1.45% | -5.26% | 15.14% | 20.81% | 36.80% | 36.84% | 31.50% | 31.19% | 34.11% | 27.58% | 25.55% | -0.05256 | 0.36838 | 0.42094 | 0.22909 |
| MA - Gilt 1 | 7.84% | -5.45% | -13.68% | 27.97% | 24.59% | 40.54% | 45.72% | 34.32% | 32.41% | 34.51% | 24.92% | 22.58% | -13.68% | 0.45716 | 0.59398 | 0.23021 |
| MA - Gilt 2 | 8.16% | -2.07% | -12.28% | 22.94% | 29.50% | 43.59% | 41.56% | 34.93% | 34.68% | 36.06% | 26.79% | 23.83% | -0.12285 | 0.43588 | 0.55872 | 0.23973 |
| EOM MA - Cash 1 | 20.85% | 24.56% | 21.15% | 20.20% | 26.30% | 32.06% | 37.74% | 40.23% | 40.99% | 41.25% | 40.55% | 50.97% | 0.20199 | 0.50967 | 0.30769 | 0.3307 |
| EOM MA - Cash 2 | 7.08% | 16.38% | 14.12% | 11.17% | 19.29% | 28.55% | 35.01% | 37.98% | 37.73% | 40.46% | 39.03% | 52.03% | 0.07075 | 0.5203 | 0.44954 | 0.28236 |
| EOM MA - Gilt 1 | 4.86% | 13.07% | 22.67% | 23.51% | 28.01% | 41.78% | 43.10% | 44.54% | 42.05% | 43.51% | 39.65% | 50.03% | 0.04863 | 0.5003 | 0.45167 | 0.33065 |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 | Low | High | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 | | | | |
| XO - Cash 1 | 18.39% | -18.98% | 5.48% | 5.08% | -3.26% | 48.77% | 44.43% | 31.29% | 49.54% | 43.41% | 51.01% | 46.45% | 42.14% | 45.85% | 51.33% | 44.69% | 51.99% | 54.02% | 54.67% | 50.19% | 51.34% | 51.46% | 53.78% | -0.18979 | 0.54673 | 0.73653 | 0.37959 |
| XO - Cash 2 | 4.43% | -19.28% | 11.16% | 4.64% | -2.43% | 49.17% | 45.10% | 30.36% | 49.47% | 42.98% | 49.89% | 49.01% | 41.23% | 45.28% | 51.75% | 44.17% | 51.67% | 53.56% | 54.98% | 49.23% | 51.31% | 51.82% | 53.50% | -0.19282 | 0.5498 | 0.74261 | 0.37521 |
| XO - Gilt 1 | -0.80% | -12.80% | 23.30% | 12.05% | 7.68% | 57.73% | 50.79% | 38.92% | 54.61% | 44.20% | 51.68% | 53.31% | 40.97% | 43.67% | 51.56% | 43.77% | 48.93% | 53.64% | 53.74% | 45.63% | 46.72% | 48.24% | 51.75% | -0.12797 | 0.57728 | 0.70524 | 0.39534 |
| XO - Gilt 2 | -2.28% | -13.46% | 22.97% | 12.05% | 7.60% | 57.73% | 50.80% | 38.92% | 54.61% | 44.20% | 51.68% | 53.31% | 40.97% | 43.67% | 51.56% | 43.77% | 48.93% | 53.64% | 53.74% | 45.63% | 46.72% | 48.24% | 51.75% | -0.1346 | 0.57728 | 0.71188 | 0.39423 |
| EOM XO - Cash 1 | 23.49% | 26.32% | 17.62% | 15.85% | 35.65% | 53.63% | 39.17% | 40.07% | 48.90% | 43.99% | 43.58% | 47.96% | 49.85% | 44.08% | 51.25% | 54.28% | 48.63% | 53.64% | 51.94% | 53.19% | 53.76% | 53.23% | 47.31% | 0.15848 | 0.54278 | 0.3843 | 0.43366 |
| EOM XO - Cash 2 | 16.29% | 19.24% | 10.10% | 14.78% | 34.98% | 52.63% | 35.99% | 39.86% | 52.42% | 46.28% | 43.60% | 47.31% | 49.18% | 42.96% | 51.85% | 53.01% | 48.14% | 54.14% | 51.42% | 53.66% | 52.66% | 52.55% | 46.81% | 0.10099 | 0.54135 | 0.44036 | 0.42168 |
| EOM XO - Gilt | 15.69% | 36.50% | 23.33% | 20.19% | 42.14% | 60.18% | 43.22% | 46.90% | 57.03% | 47.47% | 46.16% | 50.53% | 48.75% | 41.47% | 52.41% | 49.78% | 42.89% | 54.49% | 47.16% | 49.30% | 48.19% | 50.06% | 45.98% | 0.1569 | 0.60183 | 0.44492 | 0.4434 |

| HSBC JAPAN INDEX ACC | |
|---|---|
| **15-Year Heat Map** | |
| Annualised Sharpe Ratio | 30.70% |

| | |
|---|---|
| Low | -24.10% |
| High | 38.77% |

| | |
|---|---|
| Range | 62.87% |
| Average | 18.09% |

Return Correlation

| | |
|---|---|
| MA Corr | 99.89% |
| XO Corr | 99.80% |

Volatility Correlation

| | |
|---|---|
| MA Corr | 34.14% |
| XO Corr | 56.39% |

Overall Averages

| | |
|---|---|
| MA | 15.77% |
| XO | 19.30% |
| Cash | 16.93% |
| Gilt | 19.63% |
| Daily | 14.68% |
| EOM | 22.63% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Low | High | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 2.25% | 23.30% | 9.84% | -2.24% | 2.51% | 14.44% | 1.22% | -6.79% | -11.96% | 7.58% | 9.21% | 18.42% | -11.96% | 23.30% | 35.26% | 5.65% |
| MA - Cash 2 | 16.89% | 14.76% | 16.32% | 9.46% | 13.41% | 21.31% | 5.73% | -10.40% | -6.40% | -3.65% | 7.08% | 15.93% | -10.40% | 21.31% | 31.71% | 8.37% |
| MA - Gilt 1 | 7.78% | 9.57% | 13.72% | 14.95% | 14.90% | 23.43% | 13.00% | 1.55% | -1.98% | 4.56% | 11.77% | 18.92% | -1.98% | 23.43% | 25.41% | 11.01% |
| MA - Gilt 2 | 12.93% | 10.78% | 14.42% | 14.65% | 20.43% | 29.57% | 11.47% | 0.46% | -1.27% | 0.90% | 10.09% | 19.61% | -1.27% | 29.57% | 30.84% | 12.00% |
| EOM MA - Cash 1 | 21.76% | 27.51% | 31.47% | 25.80% | 25.98% | 16.37% | 29.90% | 22.02% | 22.04% | 21.21% | 19.23% | 25.34% | 16.37% | 31.47% | 15.11% | 24.05% |
| EOM MA - Cash 2 | 19.28% | 26.63% | 26.41% | 24.83% | 26.71% | 13.10% | 28.46% | 21.09% | 22.28% | 22.28% | 20.06% | 25.98% | 13.10% | 28.46% | 15.36% | 23.09% |
| EOM MA - Gilt 1 | 12.71% | 19.06% | 33.26% | 31.98% | 35.51% | 20.65% | 35.53% | 26.42% | 23.26% | 26.59% | 22.03% | 27.21% | 12.71% | 35.53% | 22.82% | 26.18% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 | Low | High | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 | | | | |
| XO - Cash 1 | -9.95% | 13.09% | -5.02% | 6.52% | 1.43% | 1.37% | 8.15% | 12.30% | 12.58% | 26.39% | 22.86% | 12.27% | 21.21% | 22.69% | 23.58% | 13.97% | 21.36% | 30.52% | 29.14% | 30.06% | 18.83% | 27.74% | 23.38% | -9.95% | 30.52% | 40.47% | 15.85% |
| XO - Cash 2 | -17.47% | 12.68% | -1.30% | 8.99% | 1.07% | 0.65% | 9.44% | 9.60% | 11.48% | 22.60% | 22.78% | 12.82% | 19.38% | 23.77% | 22.44% | 14.48% | 19.65% | 31.36% | 29.95% | 29.17% | 18.26% | 27.54% | 22.07% | -17.47% | 31.36% | 48.83% | 15.28% |
| XO - Gilt 1 | -23.42% | 12.87% | 4.65% | 22.70% | 6.14% | 3.72% | 15.51% | 17.08% | 14.68% | 27.40% | 23.40% | 12.67% | 22.10% | 31.38% | 28.42% | 21.56% | 26.96% | 36.09% | 34.61% | 32.44% | 22.49% | 31.06% | 23.14% | -23.42% | 36.09% | 59.51% | 19.46% |
| XO - Gilt 2 | -24.10% | 13.50% | 4.65% | 22.70% | 6.14% | 3.72% | 15.57% | 17.08% | 14.68% | 27.40% | 23.40% | 12.38% | 22.10% | 31.38% | 28.42% | 21.56% | 26.96% | 36.09% | 34.61% | 32.44% | 22.49% | 31.06% | 23.14% | -24.10% | 36.09% | 60.19% | 19.45% |
| EOM XO - Cash 1 | 22.81% | 12.56% | 17.14% | 15.19% | 15.95% | 16.97% | 18.62% | 3.27% | 22.48% | 21.37% | 19.71% | 14.42% | 15.06% | 22.02% | 23.54% | 19.99% | 19.69% | 35.58% | 33.73% | 28.90% | 15.48% | 25.77% | 16.07% | 3.27% | 35.58% | 32.31% | 19.84% |
| EOM XO - Cash 2 | 24.30% | 1.40% | 18.63% | 12.13% | 18.38% | 17.67% | 18.18% | 5.65% | 23.12% | 21.55% | 20.17% | 15.48% | 16.70% | 25.68% | 25.13% | 20.90% | 21.76% | 34.12% | 34.10% | 30.93% | 15.49% | 27.32% | 15.44% | 1.40% | 34.12% | 32.72% | 20.18% |
| EOM XO - Gilt | 20.32% | 12.17% | 32.39% | 19.38% | 17.74% | 18.28% | 26.02% | 7.40% | 24.23% | 25.92% | 27.20% | 19.75% | 22.64% | 32.81% | 33.15% | 25.69% | 28.50% | 38.77% | 38.29% | 34.48% | 20.37% | 31.60% | 18.12% | 7.40% | 38.77% | 31.36% | 25.01% |

| HSBC EUR.INDEX AC. | |
|---|---|
| **15-Year Heat Map** | |
| Annualised Sharpe Ratio | 43.55% |

| | |
|---|---|
| Low | -11.81% |
| High | 66.06% |

| | |
|---|---|
| Range | 77.86% |
| Average | 36.86% |

Return Correlation

| | |
|---|---|
| MA Corr | 99.57% |
| XO Corr | 99.54% |

Volatility Correlation

| | |
|---|---|
| MA Corr | 26.70% |
| XO Corr | 6.95% |

Overall Averages

| | |
|---|---|
| MA | 37.63% |
| XO | 36.46% |
| Cash | 34.06% |
| Gilt | 40.59% |
| Daily | 35.80% |
| EOM | 38.29% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 14.86% | -11.81% | 32.21% | 23.23% | 34.81% | 34.21% | 45.51% | 53.15% | 45.72% | 35.58% | 31.98% | 36.38% |
| MA - Cash 2 | -0.58% | 2.51% | 37.65% | 19.98% | 39.71% | 32.80% | 45.57% | 57.22% | 46.63% | 32.97% | 29.87% | 38.89% |
| MA - Gilt 1 | 0.90% | -3.73% | 34.53% | 27.06% | 53.85% | 48.43% | 60.70% | 65.79% | 54.20% | 40.92% | 34.43% | 41.82% |
| MA - Gilt 2 | 0.72% | 7.01% | 35.71% | 29.45% | 55.51% | 43.74% | 57.90% | 66.06% | 54.88% | 40.45% | 34.27% | 44.55% |
| EOM MA - Cash 1 | 39.76% | 45.68% | 36.60% | 17.85% | 28.87% | 42.12% | 45.95% | 49.81% | 40.45% | 39.51% | 43.85% | 47.69% |
| EOM MA - Cash 2 | 38.74% | 39.80% | 28.22% | 8.51% | 21.57% | 38.54% | 42.34% | 46.97% | 39.82% | 38.85% | 44.08% | 47.94% |
| EOM MA - Gilt 1 | 33.26% | 34.38% | 41.47% | 25.73% | 44.85% | 57.57% | 58.35% | 62.54% | 49.53% | 48.45% | 49.41% | 53.89% |

| Low | High | Range | Average |
|---|---|---|---|
| -11.81% | 53.15% | 64.96% | 31.32% |
| -0.58% | 57.22% | 57.80% | 31.93% |
| -3.73% | 65.79% | 69.52% | 38.24% |
| 0.72% | 66.06% | 65.33% | 39.19% |
| 17.85% | 49.81% | 31.96% | 39.84% |
| 8.51% | 47.94% | 39.43% | 36.28% |
| 25.73% | 62.54% | 36.81% | 46.62% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 11.76% | 13.63% | 14.62% | 25.67% | 20.10% | 35.44% | 44.70% | 47.75% | 35.09% | 40.96% | 49.60% | 37.22% | 38.92% | 37.24% | 35.39% | 36.46% | 30.34% | 42.43% | 35.67% | 30.53% | 31.09% | 26.15% | 32.89% |
| XO - Cash 2 | 12.55% | 17.31% | 11.63% | 24.85% | 18.10% | 36.51% | 41.77% | 45.05% | 34.38% | 39.84% | 48.42% | 39.17% | 39.66% | 36.88% | 36.66% | 37.85% | 30.67% | 42.11% | 34.81% | 30.12% | 31.99% | 27.43% | 31.37% |
| XO - Gilt 1 | 9.70% | 17.97% | 29.83% | 42.37% | 27.62% | 51.76% | 54.06% | 57.85% | 46.81% | 45.41% | 54.20% | 44.85% | 46.11% | 39.90% | 42.04% | 45.35% | 36.11% | 48.54% | 40.38% | 34.34% | 32.19% | 28.51% | 33.77% |
| XO - Gilt 2 | 9.74% | 18.90% | 29.83% | 42.37% | 27.62% | 51.76% | 54.03% | 57.85% | 46.81% | 45.41% | 54.20% | 44.85% | 46.11% | 39.90% | 42.04% | 45.35% | 36.11% | 48.54% | 40.38% | 34.34% | 32.19% | 28.51% | 33.77% |
| EOM XO - Cash 1 | 29.18% | 31.71% | -1.30% | 38.58% | 46.32% | 33.07% | 49.63% | 37.98% | 34.54% | 35.33% | 45.96% | 37.58% | 36.91% | 39.63% | 41.20% | 38.82% | 35.28% | 45.25% | 33.92% | 30.18% | 34.42% | 28.73% | 27.20% |
| EOM XO - Cash 2 | 19.61% | 23.98% | -7.84% | 38.23% | 49.53% | 33.09% | 45.91% | 35.33% | 31.99% | 34.10% | 45.46% | 38.11% | 38.33% | 41.15% | 41.70% | 40.07% | 35.94% | 47.24% | 33.56% | 29.11% | 33.64% | 28.68% | 26.62% |
| EOM XO - Gilt | 18.79% | 49.86% | 11.93% | 53.36% | 53.58% | 42.07% | 61.46% | 48.77% | 40.13% | 37.34% | 53.99% | 44.29% | 43.46% | 45.98% | 45.83% | 46.74% | 40.78% | 53.24% | 38.74% | 30.94% | 34.43% | 30.14% | 27.56% |

| Low | High | Range | Average |
|---|---|---|---|
| 11.76% | 49.60% | 37.85% | 32.77% |
| 11.63% | 48.42% | 36.79% | 32.57% |
| 9.70% | 57.85% | 48.15% | 39.55% |
| 9.74% | 57.85% | 48.11% | 39.59% |
| -1.30% | 49.63% | 50.93% | 35.22% |
| -7.84% | 49.53% | 57.36% | 34.07% |
| 11.93% | 61.46% | 49.52% | 41.45% |

| BLACKROCK EMRG.MKTS. AC. | |
|---|---|
| **15-Year Heat Map** | |
| Annualised Sharpe Ratio | 56.26% |

| | |
|---|---|
| Low | 1.20% |
| High | 83.10% |

| | |
|---|---|
| Range | 81.89% |
| Average | 48.60% |

Return Correlation

| | |
|---|---|
| MA Corr | 98.15% |
| XO Corr | 99.86% |

Volatility Correlation

| | |
|---|---|
| MA Corr | 9.07% |
| XO Corr | -65.20% |

Overall Averages

| | |
|---|---|
| MA | 62.03% |
| XO | 41.60% |
| Cash | 46.26% |
| Gilt | 51.72% |
| Daily | 49.29% |
| EOM | 47.68% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 55.40% | 53.52% | 81.05% | 74.37% | 67.00% | 69.15% | 61.93% | 70.67% | 69.08% | 55.45% | 51.30% | 52.55% |
| MA - Cash 2 | 58.29% | 41.89% | 57.16% | 66.01% | 67.32% | 72.67% | 57.99% | 68.60% | 67.13% | 53.91% | 54.98% | 53.62% |
| MA - Gilt 1 | 44.46% | 40.17% | 55.66% | 67.07% | 75.79% | 79.41% | 65.98% | 76.03% | 75.07% | 60.17% | 59.31% | 58.00% |
| MA - Gilt 2 | 51.33% | 38.74% | 53.02% | 67.11% | 73.68% | 79.91% | 65.50% | 74.57% | 75.45% | 59.26% | 60.11% | 57.89% |
| EOM MA - Cash 1 | 58.79% | 66.22% | 40.45% | 45.96% | 76.55% | 70.70% | 71.86% | 68.97% | 63.24% | 66.38% | 58.41% | 57.33% |
| EOM MA - Cash 2 | 53.99% | 62.54% | 33.06% | 34.06% | 72.97% | 64.15% | 65.13% | 66.16% | 61.25% | 64.65% | 56.59% | 56.07% |
| EOM MA - Gilt 1 | 48.59% | 55.79% | 40.97% | 47.73% | 83.10% | 79.89% | 74.88% | 73.89% | 69.91% | 73.88% | 65.81% | 65.78% |

| Low | High | Range | Average |
|---|---|---|---|
| 51.30% | 81.05% | 29.75% | 63.46% |
| 41.89% | 72.67% | 30.78% | 59.96% |
| 40.17% | 79.41% | 39.23% | 63.09% |
| 38.74% | 79.91% | 41.16% | 63.05% |
| 40.45% | 76.55% | 36.10% | 62.07% |
| 33.06% | 72.97% | 39.90% | 57.55% |
| 40.97% | 83.10% | 42.13% | 65.02% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 36.74% | 55.74% | 51.32% | 42.49% | 68.96% | 48.04% | 68.17% | 58.37% | 56.79% | 66.26% | 50.60% | 55.25% | 36.53% | 27.74% | 42.36% | 30.03% | 32.01% | 32.28% | 23.24% | 7.04% | 11.94% | 2.61% | 10.21% |
| XO - Cash 2 | 29.82% | 54.17% | 43.62% | 37.04% | 66.42% | 46.54% | 68.66% | 58.89% | 58.33% | 68.40% | 53.59% | 52.98% | 35.27% | 26.46% | 42.15% | 29.42% | 31.21% | 33.55% | 23.32% | 7.48% | 13.21% | 1.20% | 10.26% |
| XO - Gilt 1 | 25.48% | 51.41% | 57.04% | 50.19% | 77.77% | 58.56% | 75.37% | 66.11% | 64.76% | 73.81% | 57.56% | 59.01% | 40.91% | 37.30% | 47.46% | 37.31% | 41.58% | 38.68% | 31.69% | 15.60% | 20.06% | 6.53% | 15.93% |
| XO - Gilt 2 | 24.71% | 51.63% | 57.14% | 50.19% | 77.77% | 58.56% | 75.32% | 66.11% | 64.76% | 73.90% | 57.56% | 59.01% | 40.91% | 37.30% | 47.46% | 37.31% | 41.58% | 38.68% | 31.69% | 15.60% | 20.06% | 6.53% | 15.93% |
| EOM XO - Cash 1 | 51.60% | 45.78% | 49.55% | 50.85% | 69.06% | 58.71% | 66.61% | 71.08% | 57.87% | 59.99% | 36.75% | 38.33% | 32.65% | 23.90% | 33.75% | 25.64% | 25.15% | 32.84% | 21.89% | 15.09% | 12.29% | 4.45% | 17.13% |
| EOM XO - Cash 2 | 44.84% | 29.35% | 41.60% | 48.00% | 69.54% | 59.48% | 62.80% | 67.82% | 57.89% | 57.49% | 34.51% | 37.06% | 33.79% | 24.07% | 33.42% | 24.35% | 24.17% | 34.79% | 20.36% | 13.46% | 12.14% | 4.51% | 16.72% |
| EOM XO - Gilt | 43.95% | 45.94% | 58.33% | 59.76% | 79.47% | 68.53% | 72.38% | 78.07% | 62.72% | 62.60% | 38.82% | 40.94% | 41.57% | 37.41% | 39.90% | 33.79% | 33.68% | 41.07% | 28.78% | 22.41% | 16.49% | 10.43% | 20.27% |

| Low | High | Range | Average |
|---|---|---|---|
| 2.61% | 68.96% | 66.35% | 39.77% |
| 1.20% | 68.66% | 67.46% | 38.78% |
| 6.53% | 77.77% | 71.24% | 45.66% |
| 6.53% | 77.77% | 71.24% | 45.64% |
| 4.45% | 71.08% | 66.63% | 39.17% |
| 4.51% | 69.54% | 65.03% | 37.05% |
| 10.43% | 79.47% | 69.04% | 45.10% |

| HSBC PACIFIC INDEX ACC | |
|---|---|
| **15-Year Heat Map** | |
| Annualised Sharpe Ratio | 55.26% |

| | |
|---|---|
| Low | 20.24% |
| High | 81.45% |

| | |
|---|---|
| Range | 61.21% |
| Average | 47.63% |

Return Correlation

| | |
|---|---|
| MA Corr | 98.13% |
| XO Corr | 99.19% |

Volatility Correlation

| | |
|---|---|
| MA Corr | 11.43% |
| XO Corr | -50.05% |

Overall Averages

| | |
|---|---|
| MA | 55.12% |
| XO | 43.72% |
| Cash | 44.87% |
| Gilt | 51.31% |
| Daily | 48.68% |
| EOM | 46.23% |

| Moving Average: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Low | High | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA - Cash 1 | 46.41% | 49.05% | 59.65% | 67.14% | 54.16% | 69.66% | 63.60% | 62.39% | 50.90% | 51.78% | 52.99% | 50.42% | 46.41% | 69.66% | 23.25% | 56.51% |
| MA - Cash 2 | 31.98% | 50.35% | 53.34% | 53.14% | 62.15% | 66.49% | 63.51% | 61.00% | 50.46% | 49.71% | 55.88% | 52.33% | 31.98% | 66.49% | 34.50% | 54.20% |
| MA - Gilt 1 | 29.82% | 47.08% | 44.44% | 63.97% | 65.77% | 74.54% | 70.24% | 66.60% | 61.49% | 62.31% | 64.57% | 57.30% | 29.82% | 74.54% | 44.71% | 59.01% |
| MA - Gilt 2 | 25.28% | 44.21% | 49.02% | 58.39% | 68.99% | 75.57% | 69.60% | 64.82% | 63.04% | 60.52% | 62.72% | 57.45% | 25.28% | 75.57% | 50.29% | 58.30% |
| EOM MA - Cash 1 | 53.42% | 49.31% | 28.34% | 34.86% | 61.49% | 60.19% | 59.19% | 63.75% | 58.85% | 55.23% | 56.93% | 46.18% | 28.34% | 63.75% | 35.41% | 52.31% |
| EOM MA - Cash 2 | 44.88% | 45.34% | 21.48% | 26.59% | 56.65% | 57.75% | 56.64% | 61.85% | 57.83% | 54.99% | 55.84% | 45.16% | 21.48% | 61.85% | 40.36% | 48.75% |
| EOM MA - Gilt 1 | 40.19% | 37.24% | 33.42% | 41.86% | 68.62% | 73.02% | 68.74% | 71.47% | 64.55% | 63.59% | 66.24% | 52.30% | 33.42% | 73.02% | 39.60% | 56.77% |

| Moving Average 1: | 5 | 10 | 25 | 25 | 50 | 50 | 5 | 20 | 50 | 100 | 100 | 100 | 150 | 200 | 100 | 150 | 200 | 100 | 150 | 200 | 250 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moving Average 2: | 10 | 20 | 50 | 100 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 300 | 300 | 300 | 350 | 350 | 350 | 400 | 400 | 400 | 400 | 450 | 450 |
| XO - Cash 1 | 45.11% | 53.81% | 35.08% | 40.87% | 65.81% | 47.54% | 56.01% | 54.38% | 46.95% | 45.19% | 49.93% | 53.17% | 44.30% | 36.54% | 43.78% | 26.82% | 30.61% | 43.35% | 24.31% | 29.93% | 26.21% | 31.39% | 21.35% |
| XO - Cash 2 | 43.77% | 47.94% | 31.28% | 42.07% | 66.10% | 45.69% | 55.89% | 55.33% | 46.46% | 44.60% | 50.79% | 52.23% | 44.58% | 36.51% | 43.99% | 26.85% | 30.13% | 41.50% | 23.30% | 31.88% | 24.93% | 29.88% | 21.08% |
| XO - Gilt 1 | 35.11% | 47.26% | 44.66% | 55.79% | 81.45% | 57.76% | 61.60% | 67.68% | 57.83% | 44.37% | 53.28% | 56.87% | 51.04% | 43.48% | 49.04% | 34.42% | 39.02% | 45.03% | 29.89% | 39.66% | 32.96% | 37.81% | 28.48% |
| XO - Gilt 2 | 34.89% | 47.67% | 44.66% | 55.79% | 81.45% | 57.76% | 62.26% | 67.68% | 57.83% | 44.37% | 53.28% | 56.87% | 51.04% | 43.48% | 49.04% | 34.42% | 39.02% | 45.03% | 29.89% | 39.66% | 32.96% | 37.81% | 28.48% |
| EOM XO - Cash 1 | 27.55% | 53.52% | 48.47% | 52.82% | 65.31% | 47.22% | 60.53% | 56.44% | 57.81% | 47.92% | 46.57% | 42.53% | 35.04% | 36.30% | 34.55% | 27.02% | 28.71% | 36.86% | 30.83% | 33.96% | 23.80% | 32.94% | 21.52% |
| EOM XO - Cash 2 | 23.05% | 43.26% | 41.84% | 48.71% | 63.81% | 45.63% | 58.28% | 53.79% | 56.66% | 45.08% | 46.16% | 41.27% | 34.82% | 36.54% | 33.78% | 27.21% | 28.11% | 35.59% | 30.93% | 33.57% | 23.14% | 32.06% | 20.24% |
| EOM XO - Gilt | 24.39% | 61.83% | 60.56% | 67.24% | 75.23% | 54.73% | 72.78% | 69.89% | 61.45% | 43.03% | 45.52% | 48.34% | 46.02% | 46.05% | 42.21% | 37.28% | 35.50% | 42.14% | 37.37% | 41.64% | 29.67% | 38.51% | 26.83% |

| Low | High | Range | Average |
|---|---|---|---|
| 21.35% | 65.81% | 44.46% | 41.41% |
| 21.08% | 66.10% | 45.02% | 40.73% |
| 28.48% | 81.45% | 52.97% | 47.59% |
| 28.48% | 81.45% | 52.97% | 47.62% |
| 21.52% | 65.31% | 43.80% | 41.23% |
| 20.24% | 63.81% | 43.57% | 39.28% |
| 24.39% | 75.23% | 50.84% | 48.18% |

# Table 3.11: Cumulative Number of Outperformances by Strategy and Duration

**Total By strategy for All Years**

| | Total > | Total = > | % > | % = > |
|---|---|---|---|---|
| MA | 41 | 86 | 4.44% | 9.31% |
| MA 2 | 21 | 66 | 2.27% | 7.14% |
| EOM MA | 51 | 101 | 5.52% | 10.93% |
| EOM MA 2 | 33 | 83 | 3.57% | 8.98% |
| MA-gilt | 90 | 135 | 9.74% | 14.61% |
| MA-gilt 2 | 87 | 132 | 9.42% | 14.29% |
| EOM MA-gilt | 204 | 260 | 22.08% | 28.14% |
| Total MA | 527 | 863 | 8.15% | 13.34% |
| MAXO | 70 | 174 | 3.95% | 9.82% |
| MAXO2 | 67 | 171 | 3.78% | 9.66% |
| EOM MAXO | 77 | 183 | 4.35% | 10.33% |
| EOM MAXO2 | 66 | 172 | 3.73% | 9.71% |
| MAXO-gilt | 269 | 373 | 15.19% | 21.06% |
| MAXO-gilt2 | 269 | 373 | 15.19% | 21.06% |
| EOM MAXO-gilt | 317 | 423 | 17.90% | 23.88% |
| Total XO | 1135 | 1869 | 9.16% | 15.08% |

These tables show the number of times that the strategy or duration outperformed or if including 2016 had a return which was equal to the buy and hold. There were 12 moving average durations studied and 23 crossover durations studied across 11 different cumulative periods and 7 markets. The results by strategy show that version 1, trading at the end of the month and using gilts performed better than version 2, daily trading and moving into cash. Although overall moving averages trading into gilts had the highest percentage of outperformance, with so few across all the markets and years, the absolute number of successful durations favoured crossovers.

**Total Number of Outperformances or Strategies Equal to Buy and Hold Across all Markets for all years**

| MA: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | 7 | 17 | 32 | 34 | 76 | 124 | 139 | 117 | 86 | 83 | 69 | 79 | 863 |
| Percentage | 1.3% | 3.2% | 5.9% | 6.3% | 14.1% | 23.0% | 25.8% | 21.7% | 16.0% | 15.4% | 12.8% | 14.7% | 13.3% |

| MA1: | 25 | 25 | 50 | 50 | 50 | 100 | 100 | 100 | 100 | 150 | 150 | 5 | 20 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 250 | 5 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA2: | 50 | 100 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 300 | 350 | 200 | 200 | 200 | 400 | 300 | 350 | 400 | 450 | 400 | 450 | 10 | 20 | Total |
| Number | 20 | 72 | 139 | 151 | 137 | 97 | 84 | 84 | 108 | 76 | 76 | 143 | 148 | 141 | 77 | 73 | 33 | 50 | 61 | 37 | 26 | 7 | 26 | 1866 |
| Percentage | 3.7% | 13.4% | 25.8% | 28.0% | 25.4% | 18.0% | 15.6% | 15.6% | 20.0% | 14.1% | 14.1% | 26.5% | 27.5% | 26.2% | 14.3% | 13.5% | 6.1% | 9.3% | 11.3% | 6.9% | 4.8% | 1.3% | 4.8% | 15.1% |

**Total Number of Outperformances Across 15 Years**

| MA: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 1 | 0 | 4 | 11 | 9 | 9 | 3 | 2 | 2 | 2 |

| MA1: | 25 | 25 | 50 | 50 | 50 | 100 | 100 | 100 | 100 | 150 | 150 | 5 | 20 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 250 | 5 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA2: | 50 | 100 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 300 | 350 | 200 | 200 | 200 | 400 | 300 | 350 | 400 | 450 | 400 | 450 | 10 | 20 |
| | 0 | 4 | 8 | 9 | 10 | 6 | 0 | 0 | 3 | 3 | 4 | 13 | 12 | 12 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

These tables show the number of times each duration outperforms the buy-and-hold on a cumulative basis over 1-10 and 15 years. There are 7 strategies tested for each duration: daily and monthly trading for moving averages and crossovers into gilts and cash. These numbers can therefore be compared directly unlike the strategy results which have a larger number of crossover durations v. moving average durations.

# Table 3.12: Cumulative Number of Outperformances by Market by Strategy and Duration

**FTSE 100 Cumulative Summary of Outperforming Strategies by Year**

| | | | | | | | | | | | | | 1-15 Years | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cumulatively | # duration | 1996-201 | 2002-17 | 2016-17 | 2015-17 | 2014-17 | 2013-17 | 2012-17 | 2011-17 | 2010-17 | 2009-17 | 2008-17 | 2007-17 | Total > | Total = > | % => | 10 year txn # |
| MA | 12 | 0 | 0 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 5.30% | 2346 |
| MA 2 | 12 | 0 | 0 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 5.30% | 1745 |
| EOM MA | 12 | 6 | 2 | 0(8) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 9 | 17 | 12.88% | 378 |
| EOM MA 2 | 12 | 6 | 0 | 0(8) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 10 | 7.58% | 374 |
| MA-gilt | 12 | 3 | 0 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 8 | 6.06% | 3717 |
| MA-gilt 2 | 12 | 3 | 1 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 10 | 7.58% | 3411 |
| EOM MA-gilt | 12 | 8 | 6 | 0(8) | 2 | 4 | 3 | 3 | 1 | 1 | 1 | 6 | 7 | 34 | 42 | 31.82% | 748 |
| MAXO | 23 | 13 | 1 | 0(13) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 16 | 6.32% | 792 |
| MAXO2 | 23 | 13 | 0 | 0(13) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 15 | 5.93% | 792 |
| EOM MAXO | 23 | 13 | 0 | 2(14) | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 1 | 7 | 21 | 8.30% | 398 |
| EOM MAXO2 | 23 | 13 | 1 | 2(14) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 7 | 21 | 8.30% | 398 |
| MAXO-gilt | 23 | 19 | 5 | 0(13) | 6 | 11 | 10 | 8 | 2 | 4 | 2 | 10 | 12 | 70 | 83 | 32.81% | 1511 |
| MAXO-gilt2 | 23 | 19 | 5 | 0(13) | 6 | 11 | 10 | 8 | 2 | 4 | 2 | 10 | 12 | 70 | 83 | 32.81% | 1509 |
| EOM MAXO-gilt | 23 | 21 | 10 | 0(14) | 5 | 10 | 10 | 9 | 2 | 5 | 3 | 11 | 16 | 81 | 95 | 37.55% | 781 |
| Total > | 245 | 137 | 31 | 4 | 19 | 39 | 34 | 28 | 7 | 14 | 8 | 47 | 58 | 289 | | | |
| Total > = | 245 | 137 | 31 | 150 | 19 | 39 | 34 | 28 | 7 | 14 | 8 | 47 | 58 | | 435 | | |
| B&H Annualised Rtn | | 0.058 | 0.0702 | 0.1388 | 0.1455 | 0.0679 | 0.0704 | 0.0901 | 0.0932 | 0.0856 | 0.0909 | 0.0674 | 0.0507 | | | | |
| B&H Annual Vol of rtn | | 0.1851 | 0.17626 | 0.1113 | 0.1502 | 0.1475 | 0.1378 | 0.1347 | 0.1448 | 0.1516 | 0.1544 | 0.188 | 0.1901 | | | | |

This table shows the number of times each strategy outperforms the buy-and-hold on a cumulative basis. There are 12 different MA durations and 23 different XO pairs. The percentage of times each strategy outperforms or is equal to the buy and hold is listed in the final column. The strategies with the highest number of outperformances are highlighted in yellow.

**FTSE 100 Cumulative Summary of Outperforming Durations**

| MA: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Sum (84) | % >= | B/H Return Total | An Rtn | An Vol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2002-17** | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 1 | 1 | 1 | 1 | 9 | 10.71% | 176.75% | 7.02% | 0.17626 |
| **2016-17*** | 0 | 0 | 0 | 0 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 52 | 61.90% | 13.88% | 13.88% | 0.11134 |
| **2015-17** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 2.38% | 31.22% | 14.55% | 0.15018 |
| **2014-17** | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 1 | 0 | 0 | 6 | 7.14% | 21.77% | 6.79% | 0.14745 |
| **2013-17** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 3 | 3.57% | 31.29% | 7.04% | 0.13784 |
| **2012-17** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 3 | 3.57% | 53.93% | 9.01% | 0.13471 |
| **2011-17** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1.19% | 70.64% | 9.32% | 0.14478 |
| **2010-17** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1.19% | 77.71% | 8.56% | 0.15165 |
| **2009-17** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1.19% | 100.54% | 9.09% | 0.15437 |
| **2008-17** | 0 | 0 | 0 | 0 | 1 | 4 | 2 | 0 | 0 | 1 | 1 | 1 | 10 | 11.90% | 79.85% | 6.74% | 0.18798 |
| **2007-17** | 0 | 0 | 0 | 0 | 1 | 4 | 2 | 0 | 1 | 1 | 1 | 3 | 13 | 15.48% | 64.00% | 5.07% | 0.19005 |
| Sum (77) | 0 | 0 | 0 | 0 | 6 | 26 | 18 | 7 | 9 | 13 | 10 | 12 | 101 | | | | |
| %>= | 0.00% | 0.00% | 0.00% | 0.00% | 7.79% | 33.77% | 23.38% | 9.09% | 11.69% | 16.88% | 12.99% | 15.58% | 10.00% | | | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | |

| MA1: | 25 | 25 | 50 | 50 | 50 | 100 | 100 | 100 | 100 | 150 | 150 | 5 | 20 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 250 | 5 | 10 | Sum | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA2: | 50 | 100 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 300 | 350 | 200 | 200 | 200 | 400 | 300 | 350 | 400 | 450 | 400 | 450 | 10 | 20 | (total 161 | % >= |
| **2002-17** | 0 | 1 | 1 | 4 | 3 | 0 | 0 | 0 | 0 | 3 | 4 | 1 | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 13.66% |
| **2016-17*** | 0 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 0 | 7 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 98 | 60.87% |
| **2015-17** | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 | 0 | 2 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 10.56% |
| **2014-17** | 3 | 4 | 3 | 3 | 2 | 0 | 0 | 0 | 1 | 3 | 3 | 1 | 3 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 20.50% |
| **2013-17** | 3 | 2 | 3 | 3 | 2 | 0 | 0 | 0 | 1 | 3 | 3 | 1 | 3 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 19.25% |
| **2012-17** | 0 | 1 | 3 | 3 | 2 | 0 | 0 | 0 | 1 | 3 | 3 | 1 | 3 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 15.53% |
| **2011-17** | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 3.73% |
| **2010-17** | 1 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 8.07% |
| **2009-17** | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 4.35% |
| **2008-17** | 0 | 3 | 5 | 7 | 3 | 0 | 0 | 1 | 1 | 3 | 3 | 1 | 3 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 22.98% |
| **2007-17** | 1 | 3 | 3 | 6 | 3 | 0 | 0 | 1 | 1 | 3 | 5 | 1 | 3 | 3 | 2 | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 1 | 45 | 27.95% |
| Sum (77) | 8 | 23 | 31 | 40 | 22 | 7 | 7 | 9 | 13 | 28 | 34 | 13 | 25 | 21 | 12 | 30 | 0 | 0 | 3 | 5 | 2 | 0 | 1 | 334 | |
| %>= | 10.39% | 29.87% | 40.26% | 51.95% | 28.57% | 9.09% | 9.09% | 11.69% | 16.88% | 36.36% | 44.16% | 16.88% | 32.47% | 27.27% | 15.58% | 38.96% | 0.00% | 0.00% | 3.90% | 6.49% | 2.60% | 0.00% | 1.30% | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | | | | | | | | | |

This table shows the number of times each duration outperforms the buy-and-hold on a cumulative basis. There are 7 strategies tested for each duration. * For the first year, results equivalent to the buy and hold are also included.

**FTSE 250 Cumulative Summary of Outperforming Strategies by Year**

| | | | | | | | | | | | | 1-15 Years | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cumulatively | # duratio | 2002-17 | 2016-17 | 2015-17 | 2014-17 | 2013-17 | 2012-17 | 2011-17 | 2010-17 | 2009-17 | 2008-17 | 2007-17 | Total > | Total = > | % = > | 10 year txn # |
| MA | 12 | 0 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 5.30% | 2089 |
| MA 2 | 12 | 0 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 5.30% | 1627 |
| EOM MA | 12 | 1 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 5 | 12 | 9.09% | 369 |
| EOM MA 2 | 12 | 0 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 9 | 6.82% | 369 |
| MA-gilt | 12 | 1 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4 | 11 | 8.33% | 3344 |
| MA-gilt 2 | 12 | 2 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 5 | 12 | 9.09% | 3142 |
| EOM MA-gilt | 12 | 5 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 8 | 17 | 24 | 18.18% | 733 |
| MAXO | 23 | 5 | 6(9) | 3 | 1 | 1 | 2 | 0 | 0 | 0 | 1 | 6 | 25 | 34 | 13.44% | 736 |
| MAXO2 | 23 | 5 | 6(9) | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 7 | 24 | 33 | 13.04% | 736 |
| EOM MAXO | 23 | 5 | 3(9) | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 5 | 7 | 24 | 33 | 13.04% | 362 |
| EOM MAXO2 | 23 | 5 | 3(9) | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 3 | 7 | 23 | 32 | 12.65% | 362 |
| MAXO-gilt | 23 | 7 | 0(9) | 8 | 7 | 7 | 7 | 1 | 1 | 1 | 9 | 13 | 61 | 70 | 27.67% | 1399 |
| MAXO-gilt2 | 23 | 7 | 0(9) | 8 | 7 | 7 | 7 | 1 | 1 | 1 | 9 | 13 | 61 | 70 | 27.67% | 1391 |
| EOM MAXO-gilt | 23 | 8 | 0(9) | 7 | 6 | 7 | 7 | 1 | 1 | 2 | 9 | 17 | 65 | 74 | 29.25% | 713 |
| Total > | 245 | 51 | 18 | 33 | 24 | 25 | 24 | 3 | 3 | 4 | 43 | 88 | 316 | | | |
| Total > = | 245 | 51 | 130 | 33 | 24 | 25 | 24 | 3 | 3 | 4 | 43 | 88 | | 428 | | |
| B&H Annualised Rtn | | 0.1188 | 0.1326 | 0.1064 | 0.0991 | 0.0993 | 0.1395 | 0.1371 | 0.1279 | 0.1335 | 0.1107 | 0.0806 | | | | |
| B&H Annual Vol of rtn | | 0.1687 | 0.1058 | 0.1491 | 0.1435 | 0.1374 | 0.1353 | 0.1439 | 0.1483 | 0.1523 | 0.1821 | 0.1874 | | | | |

This table shows the number of times each strategy outperforms the buy-and-hold on a cumulative basis. There are 12 different MA durations and 23 different XO pairs. The percentage of times each strategy outperforms or is equal to the buy and hold is listed in the final column. The strategies with the highest number of outperformances are highlighted in yellow.

**FTSE 250 Cumulative Summary of Outperforming Durations**

| MA: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Sum (84) | % >= | B/H Return Total | An Rtn | An Vol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2002-17 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 3 | 0 | 0 | 1 | 0 | 9 | 10.71% | 438.45% | 11.88% | 0.16867 |
| 2016-17* | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 49 | 58.33% | 13.26% | 13.26% | 0.10583 |
| 2015-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 22.42% | 10.64% | 0.14905 |
| 2014-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 32.77% | 9.91% | 0.14348 |
| 2013-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 46.02% | 9.99% | 0.13743 |
| 2012-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 92.11% | 13.95% | 0.13534 |
| 2011-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 116.18% | 13.71% | 0.14394 |
| 2010-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 132.17% | 12.79% | 0.14825 |
| 2009-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 172.58% | 13.35% | 0.1523 |
| 2008-17 | 0 | 0 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 6 | 7.14% | 157.16% | 11.07% | 0.18213 |
| 2007-17 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 3 | 1 | 1 | 3 | 2 | 18 | 21.43% | 117.08% | 8.06% | 0.18735 |
| Sum (77) | 0 | 0 | 0 | 0 | 6 | 12 | 14 | 13 | 8 | 8 | 11 | 10 | 82 | | | | |
| %>= | 0.00% | 0.00% | 0.00% | 0.00% | 7.79% | 15.58% | 18.18% | 16.88% | 10.39% | 10.39% | 14.29% | 12.99% | 10.00% | | | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | |

| MA1: | 25 | 25 | 50 | 50 | 50 | 100 | 100 | 100 | 100 | 150 | 150 | 5 | 20 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 250 | 5 | 10 | Sum | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA2: | 50 | 100 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 300 | 350 | 200 | 200 | 200 | 400 | 300 | 350 | 400 | 450 | 400 | 450 | 10 | 20 | (total 161 | % >= |
| 2002-17 | 0 | 3 | 1 | 5 | 7 | 5 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 26.09% |
| 2016-17* | 0 | 0 | 0 | 7 | 7 | 7 | 7 | 7 | 7 | 0 | 2 | 7 | 7 | 7 | 2 | 2 | 2 | 4 | 4 | 2 | 0 | 0 | 0 | 81 | 50.31% |
| 2015-17 | 0 | 0 | 0 | 1 | 5 | 5 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 7 | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 33 | 20.50% |
| 2014-17 | 0 | 0 | 0 | 3 | 3 | 1 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 5 | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 24 | 14.91% |
| 2013-17 | 0 | 1 | 0 | 3 | 3 | 1 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 5 | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 25 | 15.53% |
| 2012-17 | 0 | 1 | 0 | 3 | 3 | 1 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 5 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 24 | 14.91% |
| 2011-17 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1.86% |
| 2010-17 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1.86% |
| 2009-17 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2.48% |
| 2008-17 | 0 | 4 | 5 | 5 | 5 | 2 | 0 | 1 | 1 | 0 | 0 | 3 | 3 | 6 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 37 | 22.98% |
| 2007-17 | 0 | 3 | 5 | 7 | 7 | 7 | 3 | 3 | 1 | 3 | 1 | 4 | 7 | 7 | 1 | 0 | 1 | 3 | 6 | 0 | 0 | 0 | 1 | 70 | 43.48% |
| Sum (77) | 0 | 12 | 11 | 35 | 43 | 29 | 13 | 23 | 21 | 3 | 3 | 21 | 24 | 55 | 11 | 2 | 3 | 15 | 19 | 2 | 0 | 0 | 1 | 346 | |
| %>= | 0.00% | 15.58% | 14.29% | 45.45% | 55.84% | 37.66% | 16.88% | 29.87% | 27.27% | 3.90% | 3.90% | 27.27% | 31.17% | 71.43% | 14.29% | 2.60% | 3.90% | 19.48% | 24.68% | 2.60% | 0.00% | 0.00% | 1.30% | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | | | | | | | | | |

This table shows the number of times each duration outperforms the buy-and-hold on a cumulative basis. There are 7 strategies tested for each duration. * For the first year, results equivalent to the buy and hold are also included.

**America Cumulative Summary of Outperforming Strategies by Year**

| Cumulatively | # duratio | 2002-17 | 2016-17 | 2015-17 | 2014-17 | 2013-17 | 2012-17 | 2011-17 | 2010-17 | 2009-17 | 2008-17 | 2007-17 | 1-15 Years Total > | 1-15 Years Total = > | 1-15 Years % > | 10 year txn # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | 12 | 0 | 1(6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 5.30% | 2358 |
| MA 2 | 12 | 0 | 0(6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 4.55% | 1698 |
| EOM MA | 12 | 0 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 8 | 6.06% | 388 |
| EOM MA 2 | 12 | 0 | 0(7) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 9 | 6.82% | 386 |
| MA-gilt | 12 | 0 | 0(6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 4.55% | 3642 |
| MA-gilt 2 | 12 | 0 | 0(6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 4.55% | 3286 |
| EOM MA-gilt | 12 | 0 | 0(7) | 0(1) | 0(1) | 0(1) | 0(1) | 0 | 0 | 0 | 3 | 1 | 4 | 15 | 11.36% | 782 |
| MAXO | 23 | 0 | 0(18) | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 6 | 4 | 14 | 32 | 12.65% | 732 |
| MAXO2 | 23 | 0 | 0(18) | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 6 | 4 | 14 | 32 | 12.65% | 732 |
| EOM MAXO | 23 | 0 | 2(18) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 3 | 12 | 30 | 11.86% | 362 |
| EOM MAXO2 | 23 | 0 | 1(18) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 3 | 11 | 29 | 11.46% | 362 |
| MAXO-gilt | 23 | 0 | 0(18) | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 11 | 8 | 23 | 41 | 16.21% | 1402 |
| MAXO-gilt2 | 23 | 0 | 0(18) | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 11 | 8 | 23 | 41 | 16.21% | 1387 |
| EOM MAXO-gilt | 23 | 0 | 0(18) | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 12 | 8 | 24 | 42 | 16.60% | 712 |
| Total > | 245 | 0 | 4 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 65 | 40 | 129 | 129 | | |
| Total > = | 245 | 0 | 175 | 6 | 6 | 6 | 6 | 0 | 0 | 0 | 65 | 40 | 264 | 304 | | |
| B&H Annualised Rtn | | 0.092 | 0.1835 | 0.2389 | 0.183 | 0.1792 | 0.1839 | 0.1858 | 0.1762 | 0.1662 | 0.132 | 0.1161 | | | | |
| B&H Annual Vol of rtn | | 0.1861 | 0.1261 | 0.1545 | 0.1564 | 0.1447 | 0.1425 | 0.1473 | 0.1517 | 0.1554 | 0.196 | 0.1973 | | | | |

This table shows the number of times each strategy outperforms the buy-and-hold on a cumulative basis. There are 12 different MA durations and 23 different XO pairs. The percentage of times each strategy outperforms or is equal to the buy and hold is listed in the final column. The strategies with the highest number of outperformances are highlighted in yellow.

**America Cumulative Summary of Outperforming Durations**

| MA: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Sum (84) | % >= | B/H Return Total | An Rtn | An Vol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2002-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 274.60% | 9.20% | 0.1861 |
| **2016-17*** | 1 | 0 | 0 | 0 | 0 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 46 | 54.76% | 18.35% | 18.35% | 0.12615 |
| **2015-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1.19% | 53.48% | 23.89% | 0.15454 |
| **2014-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1.19% | 65.57% | 18.30% | 0.15644 |
| **2013-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1.19% | 93.36% | 17.92% | 0.14472 |
| **2012-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1.19% | 132.59% | 18.39% | 0.14253 |
| **2011-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 178.02% | 18.58% | 0.14734 |
| **2010-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 211.45% | 17.62% | 0.15166 |
| **2009-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 242.14% | 16.62% | 0.15537 |
| **2008-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 5 | 5.95% | 205.24% | 13.20% | 0.19597 |
| **2007-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2.38% | 200.00% | 11.61% | 0.19727 |
| Sum (77) | 1 | 0 | 0 | 0 | 0 | 3 | 7 | 7 | 7 | 8 | 8 | 16 | 57 | | | | |
| %>= | 1.30% | 0.00% | 0.00% | 0.00% | 0.00% | 3.90% | 9.09% | 9.09% | 9.09% | 10.39% | 10.39% | 20.78% | 10.00% | | | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | |

| MA1: | 25 | 25 | 50 | 50 | 50 | 100 | 100 | 100 | 100 | 150 | 150 | 5 | 20 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 250 | 5 | 10 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA2: | 50 | 100 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 300 | 350 | 200 | 200 | 200 | 400 | 300 | 350 | 400 | 450 | 400 | 450 | 10 | 20 | (total 161 | % >= |
| **2002-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% |
| **2016-17*** | 0 | 1 | 2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 0 | 0 | 129 | 80.12% |
| **2015-17** | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 3.11% |
| **2014-17** | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 3.11% |
| **2013-17** | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 3.11% |
| **2012-17** | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 3.11% |
| **2011-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% |
| **2010-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% |
| **2009-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% |
| **2008-17** | 0 | 0 | 1 | 7 | 2 | 0 | 3 | 5 | 7 | 1 | 1 | 0 | 1 | 0 | 7 | 0 | 2 | 7 | 5 | 7 | 4 | 0 | 0 | 60 | 37.27% |
| **2007-17** | 0 | 0 | 0 | 5 | 3 | 0 | 3 | 5 | 5 | 1 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 7 | 4 | 0 | 0 | 38 | 23.60% |
| Sum (77) | 0 | 1 | 3 | 19 | 12 | 7 | 29 | 17 | 19 | 13 | 8 | 7 | 8 | 7 | 19 | 7 | 9 | 14 | 12 | 21 | 15 | 0 | 0 | 247 | |
| %>= | 0.00% | 1.30% | 3.90% | 24.68% | 15.58% | 9.09% | 37.66% | 22.08% | 24.68% | 16.88% | 10.39% | 9.09% | 10.39% | 9.09% | 24.68% | 9.09% | 11.69% | 18.18% | 15.58% | 27.27% | 19.48% | 0.00% | 0.00% | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | | | | | | | | | |

This table shows the number of times each duration outperforms the buy-and-hold on a cumulative basis. There are 7 strategies tested for each duration. * For the first year, results equivalent to the buy and hold are also included.

**Japan Cumulative Summary of Outperforming Strategies by Year**

| | | | | | | | | | | | | | 1-15 Years | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cumulatively | # duratio | 2002-17 | 2016-17 | 2015-17 | 2014-17 | 2013-17 | 2012-17 | 2011-17 | 2010-17 | 2009-17 | 2008-17 | 2007-17 | Total > | Total = > | % > | 10 year txn # |
| MA | 12 | 0 | 0(6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 4.55% | 2711 |
| MA 2 | 12 | 0 | 0(6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 7 | 5.30% | 1878 |
| EOM MA | 12 | 0 | 0(6) | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 9 | 6.82% | 393 |
| EOM MA 2 | 12 | 0 | 0(6) | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 8 | 6.06% | 392 |
| MA-gilt | 12 | 0 | 0(6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 7 | 5.30% | 4095 |
| MA-gilt 2 | 12 | 0 | 0(6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 8 | 6.06% | 3645 |
| EOM MA-gilt | 12 | 1 | 0(6) | 0(1) | 2(1) | 1 | 0 | 0 | 0 | 0 | 1 | 4 | 9 | 17 | 12.88% | 793 |
| MAXO | 23 | 0 | 0(18) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 7.11% | 806 |
| MAXO2 | 23 | 0 | 0(18) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 7.11% | 806 |
| EOM MAXO | 23 | 0 | 1(18) | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 25 | 9.88% | 432 |
| EOM MAXO2 | 23 | 0 | 1(18) | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 22 | 8.70% | 432 |
| MAXO-gilt | 23 | 1 | 0(18) | 1 | 3 | 3 | 0 | 0 | 0 | 1 | 2 | 4 | 15 | 33 | 13.04% | 1563 |
| MAXO-gilt2 | 23 | 1 | 0(18) | 1 | 3 | 3 | 0 | 0 | 0 | 1 | 2 | 4 | 15 | 33 | 13.04% | 1549 |
| EOM MAXO-gilt | 23 | 2 | 0(18) | 3 | 7 | 7 | 0 | 3 | 1 | 2 | 5 | 8 | 38 | 56 | 22.13% | 880 |
| Total > | 245 | 5 | 2 | 9 | 17 | 20 | 0 | 4 | 1 | 4 | 11 | 24 | 97 | | | |
| Total > = | 245 | 5 | 170 | 10 | 18 | 20 | 0 | 4 | 1 | 4 | 11 | 24 | | 267 | | |
| B&H Annualised Rtn | | 0.0639 | 0.1701 | 0.1996 | 0.1654 | 0.131 | 0.1567 | 0.1199 | 0.1024 | 0.0874 | 0.0777 | 0.0619 | | | | |
| B&H Annual Vol of rtn | | 0.2033 | 0.1255 | 0.1955 | 0.1886 | 0.1789 | 0.1827 | 0.179 | 0.1832 | 0.1819 | 0.2052 | 0.2088 | | | | |

This table shows the number of times each strategy outperforms the buy-and-hold on a cumulative basis. There are 12 different MA durations and 23 different XO pairs. The percentage of times each strategy outperforms or is equal to the buy and hold is listed in the final column. The strategies with the highest number of outperformances are highlighted in yellow.

**Japan Cumulative Summary of Outperforming Durations**

| MA: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Sum (84) | % >= | B/H Return Total | An Rtn | An Vol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2002-17 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1.19% | 153.21% | 6.39% | 0.20326 |
| 2016-17* | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 7 | 7 | 7 | 7 | 42 | 50.00% | 17.01% | 17.10% | 0.12547 |
| 2015-17 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 2.38% | 43.90% | 19.96% | 0.1955 |
| 2014-17 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 4 | 4.76% | 58.28% | 16.54% | 0.18856 |
| 2013-17 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 4 | 4.76% | 63.62% | 13.10% | 0.1789 |
| 2012-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 107.04% | 15.67% | 0.18267 |
| 2011-17 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1.19% | 97.25% | 11.99% | 0.17902 |
| 2010-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 97.82% | 10.24% | 0.18316 |
| 2009-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 95.47% | 8.74% | 0.18195 |
| 2008-17 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 2.38% | 96.06% | 7.77% | 0.2052 |
| 2007-17 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 7 | 8.33% | 82.33% | 6.19% | 0.20882 |
| Sum (77) | 0 | 0 | 5 | 1 | 2 | 0 | 16 | 7 | 7 | 8 | 7 | 10 | 63 | | | | |
| %>= | 0.00% | 0.00% | 6.49% | 1.30% | 2.60% | 0.00% | 20.78% | 9.09% | 9.09% | 10.39% | 9.09% | 12.99% | 10.00% | | | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | |

| MA1: | 25 | 25 | 50 | 50 | 50 | 100 | 100 | 100 | 100 | 150 | 150 | 5 | 20 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 250 | 5 | 10 | Sum | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA2: | 50 | 100 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 300 | 350 | 200 | 200 | 200 | 400 | 300 | 350 | 400 | 450 | 400 | 450 | 10 | 20 | (total 161 | % >= |
| 2002-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2.48% |
| 2016-17* | 0 | 0 | 2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 0 | 0 | 128 | 79.50% |
| 2015-17 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 3.11% |
| 2014-17 | 1 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 14 | 8.70% |
| 2013-17 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 5 | 1 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 17 | 10.56% |
| 2012-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% |
| 2011-17 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1.86% |
| 2010-17 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.62% |
| 2009-17 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2.48% |
| 2008-17 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 5.59% |
| 2007-17 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4 | 0 | 0 | 0 | 0 | 1 | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 17 | 10.56% |
| Sum (77) | 7 | 0 | 2 | 7 | 7 | 11 | 11 | 11 | 22 | 8 | 7 | 13 | 7 | 15 | 14 | 13 | 7 | 12 | 13 | 7 | 7 | 1 | 0 | 202 | |
| %>= | 9.09% | 0.00% | 2.60% | 9.09% | 9.09% | 14.29% | 14.29% | 14.29% | 28.57% | 10.39% | 9.09% | 16.88% | 9.09% | 19.48% | 18.18% | 16.88% | 9.09% | 15.58% | 16.88% | 9.09% | 9.09% | 1.30% | 0.00% | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | | | | | | | | | |

This table shows the number of times each duration outperforms the buy-and-hold on a cumulative basis. There are 7 strategies tested for each duration. * For the first year, results equivalent to the buy and hold are also included.

**Europe Cumulative Summary of Outperforming Strategies by Year**

| | | | | | | | | | | | | | 1-15 Years | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cumulatively | # duratio | 2002-17 | 2016-17 | 2015-17 | 2014-17 | 2013-17 | 2012-17 | 2011-17 | 2010-17 | 2009-17 | 2008-17 | 2007-17 | Total > | Total = > | % > | 10 year txn # |
| MA | 12 | 0 | 0(6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 4.55% | 2311 |
| MA 2 | 12 | 0 | 0(6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 9 | 6.82% | 1636 |
| EOM MA | 12 | 0 | 0(7) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 9 | 6.82% | 385 |
| EOM MA 2 | 12 | 0 | 0(7) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 6.06% | 384 |
| MA-gilt | 12 | 2 | 0(6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 12 | 18 | 13.64% | 3587 |
| MA-gilt 2 | 12 | 1 | 0(6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 9 | 15 | 11.36% | 3241 |
| EOM MA-gilt | 12 | 4 | 0(7) | 0 | 1 | 1 | 0 | 2 | 3 | 2 | 6 | 6 | 25 | 32 | 24.24% | 763 |
| MAXO | 23 | 0 | 1(16) | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 20 | 7.91% | 777 |
| MAXO2 | 23 | 0 | 1(16) | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 20 | 7.91% | 777 |
| EOM MAXO | 23 | 0 | 0(17) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 3 | 20 | 7.91% | 417 |
| EOM MAXO2 | 23 | 0 | 0(17) | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 5 | 22 | 8.70% | 417 |
| MAXO-gilt | 23 | 1 | 0(16) | 7 | 3 | 3 | 1 | 0 | 1 | 0 | 5 | 5 | 26 | 42 | 16.60% | 1499 |
| MAXO-gilt2 | 23 | 1 | 0(16) | 7 | 3 | 3 | 1 | 0 | 1 | 0 | 5 | 5 | 26 | 42 | 16.60% | 1487 |
| EOM MAXO-gilt | 23 | 2 | 0(17) | 6 | 5 | 4 | 1 | 2 | 3 | 3 | 6 | 6 | 38 | 55 | 21.74% | 819 |
| Total > | 245 | 11 | 2 | 22 | 17 | 14 | 4 | 4 | 8 | 5 | 35 | 36 | 158 | | | |
| Total > = | 245 | 11 | 162 | 22 | 17 | 14 | 4 | 4 | 8 | 5 | 35 | 36 | | 318 | | |
| B&H Annualised Rtn | | 0.0918 | 0.2589 | 0.2072 | 0.1353 | 0.1227 | 0.1521 | 0.1292 | 0.109 | 0.0973 | 0.0754 | 0.0627 | | | | |
| B&H Annual Vol of rtn | | 0.1985 | 0.1361 | 0.155 | 0.1544 | 0.1463 | 0.1489 | 0.1724 | 0.1814 | 0.1859 | 0.2129 | 0.2123 | | | | |

This table shows the number of times each strategy outperforms the buy-and-hold on a cumulative basis. There are 12 different MA durations and 23 different XO pairs. The percentage of times each strategy outperforms or is equal to the buy and hold is listed in the final column. The strategies with the highest number of outperformances are highlighted in yellow.

**Europe Cumulative Summary of Outperforming Durations**

| | | | | | | | | | | | | | | | B/H Return | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Sum (84) | % >= | Total | An Rtn | An Vol |
| 2002-17 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 1 | 6 | 7.14% | 273.36% | 9.18% | 0.19855 |
| 2016-17* | 0 | 0 | 0 | 0 | 0 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 45 | 53.57% | 25.89% | 25.89% | 0.1361 |
| 2015-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 45.74% | 20.72% | 0.15501 |
| 2014-17 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3.57% | 46.34% | 13.53% | 0.15445 |
| 2013-17 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1.19% | 58.85% | 12.27% | 0.14626 |
| 2012-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 102.96% | 15.21% | 0.14894 |
| 2011-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 2.38% | 107.34% | 12.92% | 0.17235 |
| 2010-17 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 3.57% | 106.32% | 10.90% | 0.18143 |
| 2009-17 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 2.38% | 110.14% | 9.73% | 0.18586 |
| 2008-17 | 0 | 0 | 2 | 0 | 3 | 2 | 3 | 4 | 0 | 0 | 1 | 1 | 16 | 19.05% | 92.37% | 7.54% | 0.21293 |
| 2007-17 | 0 | 1 | 4 | 0 | 3 | 2 | 3 | 4 | 0 | 0 | 0 | 1 | 18 | 21.43% | 83.77% | 6.27% | 0.21231 |
| Sum (77) | 0 | 5 | 6 | 0 | 8 | 9 | 15 | 20 | 8 | 7 | 8 | 10 | 96 | | | | |
| %>= | 0.00% | 6.49% | 7.79% | 0.00% | 10.39% | 11.69% | 19.48% | 25.97% | 10.39% | 9.09% | 10.39% | 12.99% | 10.00% | | | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | |

| MA1: | 25 | 25 | 50 | 50 | 50 | 100 | 100 | 100 | 100 | 150 | 150 | 5 | 20 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 250 | 5 | 10 | Sum | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA2: | 50 | 100 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 300 | 350 | 200 | 200 | 200 | 400 | 300 | 350 | 400 | 450 | 400 | 450 | 10 | 20 | (total 161 | % >= |
| 2002-17 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2.48% |
| 2016-17* | 0 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 2 | 7 | 0 | 0 | 0 | 0 | 117 | 72.67% |
| 2015-17 | 0 | 0 | 0 | 0 | 0 | 5 | 3 | 3 | 3 | 3 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 13.66% |
| 2014-17 | 0 | 0 | 2 | 5 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 8.70% |
| 2013-17 | 0 | 0 | 2 | 5 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 8.07% |
| 2012-17 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2.48% |
| 2011-17 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1.24% |
| 2010-17 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 3.11% |
| 2009-17 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1.86% |
| 2008-17 | 0 | 3 | 3 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 19 | 11.80% |
| 2007-17 | 0 | 3 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 18 | 11.18% |
| Sum (77) | 0 | 12 | 24 | 21 | 13 | 19 | 10 | 10 | 19 | 10 | 10 | 17 | 17 | 7 | 7 | 7 | 7 | 2 | 7 | 0 | 0 | 0 | 2 | 221 | |
| %>= | 0.00% | 15.58% | 31.17% | 27.27% | 16.88% | 24.68% | 12.99% | 12.99% | 24.68% | 12.99% | 12.99% | 22.08% | 22.08% | 9.09% | 9.09% | 9.09% | 9.09% | 2.60% | 9.09% | 0.00% | 0.00% | 0.00% | 2.60% | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | | | | | | | | | |

This table shows the number of times each duration outperforms the buy-and-hold on a cumulative basis. There are 7 strategies tested for each duration. * For the first year, results equivalent to the buy and hold are also included.

**Pacific Cumulative Summary of Outperforming Strategies by Year**

| | | | | | | | | | | | | 1-15 Years | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cumulatively | # duratio | 2002-17 | 2016-17 | 2015-17 | 2014-17 | 2013-17 | 2012-17 | 2011-17 | 2010-17 | 2009-17 | 2008-17 | 2007-17 | Total > | Total = > | % > | 10 year txn # |
| MA | 12 | 0 | 0(7) | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 7 | 14 | 10.61% | 1996 |
| MA 2 | 12 | 0 | 0(7) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 6.82% | 1541 |
| EOM MA | 12 | 0 | 0(8) | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 11 | 8.33% | 384 |
| EOM MA 2 | 12 | 0 | 0(8) | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 10 | 7.58% | 382 |
| MA-gilt | 12 | 1 | 0(7) | 0 | 6 | 4 | 2 | 2 | 0 | 0 | 4 | 6 | 25 | 32 | 24.24% | 3193 |
| MA-gilt 2 | 12 | 1 | 0(7) | 0 | 6 | 4 | 1 | 3 | 0 | 0 | 4 | 5 | 24 | 31 | 23.48% | 2983 |
| EOM MA-gilt | 12 | 2 | 0(8) | 0 | 6 | 7 | 6 | 5 | 3 | 1 | 7 | 7 | 44 | 52 | 39.39% | 754 |
| MAXO | 23 | 0 | 1(18) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 24 | 9.49% | 739 |
| MAXO2 | 23 | 0 | 1(18) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 23 | 9.09% | 739 |
| EOM MAXO | 23 | 0 | 0(18) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 21 | 8.30% | 433 |
| EOM MAXO2 | 23 | 0 | 0(18) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 20 | 7.91% | 433 |
| MAXO-gilt | 23 | 1 | 0(18) | 0 | 7 | 6 | 0 | 2 | 2 | 1 | 3 | 4 | 26 | 44 | 17.39% | 1431 |
| MAXO-gilt2 | 23 | 1 | 0(18) | 0 | 7 | 6 | 0 | 2 | 2 | 1 | 3 | 4 | 26 | 44 | 17.39% | 1425 |
| EOM MAXO-gilt | 23 | 3 | 0(18) | 0 | 4 | 3 | 2 | 2 | 2 | 0 | 5 | 4 | 25 | 43 | 17.00% | 846 |
| Total > | 245 | 9 | 2 | 0 | 50 | 30 | 11 | 16 | 10 | 3 | 30 | 39 | 200 | | | |
| Total > = | 245 | 9 | 180 | 0 | 50 | 30 | 11 | 16 | 10 | 3 | 30 | 39 | | 378 | | |
| B&H Annualised Rtn | | 0.1121 | 0.2357 | 0.2933 | 0.1125 | 0.1095 | 0.1085 | 0.0931 | 0.0924 | 0.1051 | 0.1016 | 0.0811 | | | | |
| B&H Annual Vol of rtn | | 0.1835 | 0.1228 | 0.1488 | 0.1456 | 0.1339 | 0.1335 | 0.1463 | 0.1505 | 0.1554 | 0.1908 | 0.1969 | | | | |

This table shows the number of times each strategy outperforms the buy-and-hold on a cumulative basis. There are 12 different MA durations and 23 different XO pairs. The percentage of times each strategy outperforms or is equal to the buy and hold is listed in the final column. The strategies with the highest number of outperformances are highlighted in yellow.

**Pacific Cumulative Summary of Outperforming Durations**

| | | | | | | | | | | | | | | | B/H Return | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Sum (84) | % >= | Total | An Rtn | An Vol |
| 2002-17 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 4 | 4.76% | 392.26% | 11.21% | 0.18347 |
| 2016-17* | 0 | 0 | 0 | 0 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 52 | 61.90% | 23.57% | 23.57% | 0.12281 |
| 2015-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 67.27% | 29.33% | 0.1488 |
| 2014-17 | 0 | 2 | 0 | 2 | 2 | 5 | 6 | 4 | 4 | 3 | 0 | 0 | 28 | 33.33% | 37.70% | 11.25% | 0.14556 |
| 2013-17 | 0 | 0 | 0 | 2 | 1 | 3 | 3 | 1 | 2 | 3 | 0 | 0 | 15 | 17.86% | 51.53% | 10.95% | 0.1339 |
| 2012-17 | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 0 | 0 | 9 | 10.71% | 67.34% | 10.85% | 0.1335 |
| 2011-17 | 0 | 0 | 0 | 1 | 2 | 2 | 1 | 0 | 0 | 3 | 1 | 0 | 10 | 11.90% | 70.55% | 9.31% | 0.14633 |
| 2010-17 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 4.76% | 85.65% | 9.24% | 0.15052 |
| 2009-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1.19% | 122.44% | 10.51% | 0.15542 |
| 2008-17 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 0 | 15 | 17.86% | 138.86% | 10.16% | 0.19078 |
| 2007-17 | 0 | 0 | 1 | 3 | 3 | 4 | 3 | 3 | 1 | 2 | 1 | 0 | 21 | 25.00% | 118.11% | 8.11% | 0.19695 |
| Sum (77) | 1 | 2 | 1 | 10 | 16 | 29 | 24 | 20 | 16 | 23 | 10 | 7 | 159 | | | | |
| %>= | 1.30% | 2.60% | 1.30% | 12.99% | 20.78% | 37.66% | 31.17% | 25.97% | 20.78% | 29.87% | 12.99% | 9.09% | 10.00% | | | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | |

| MA1: | 25 | 25 | 50 | 50 | 50 | 100 | 100 | 100 | 100 | 150 | 150 | 5 | 20 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 250 | 5 | 10 | Sum | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA2: | 50 | 100 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 300 | 350 | 200 | 200 | 200 | 400 | 300 | 350 | 400 | 450 | 400 | 450 | 10 | 20 | (total 161 | % >= |
| 2002-17 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 3.11% |
| 2016-17* | 0 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 2 | 0 | 0 | 0 | 128 | 79.50% |
| 2015-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% |
| 2014-17 | 0 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 22 | 13.66% |
| 2013-17 | 0 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 15 | 9.32% |
| 2012-17 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1.24% |
| 2011-17 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 3.73% |
| 2010-17 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 3.73% |
| 2009-17 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1.24% |
| 2008-17 | 0 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 15 | 9.32% |
| 2007-17 | 0 | 0 | 7 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 18 | 11.18% |
| Sum (77) | 0 | 19 | 36 | 12 | 9 | 9 | 7 | 7 | 7 | 7 | 7 | 21 | 20 | 7 | 7 | 7 | 7 | 7 | 7 | 2 | 0 | 4 | 10 | 219 | |
| %>= | 0.00% | 24.68% | 46.75% | 15.58% | 11.69% | 11.69% | 9.09% | 9.09% | 9.09% | 9.09% | 9.09% | 27.27% | 25.97% | 9.09% | 9.09% | 9.09% | 9.09% | 9.09% | 9.09% | 2.60% | 0.00% | 5.19% | 12.99% | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | | | | | | | | | |

This table shows the number of times each duration outperforms the buy-and-hold on a cumulative basis. There are 7 strategies tested for each duration. * For the first year, results equivalent to the buy and hold are also included.

**Emerging Markets Cumulative Summary of Outperforming Strategies by Year**

| | | | | | | | | | | | | | | 1-15 Years | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cumulatively | # duratio | 1996-201 | 2002-17 | 2016-17 | 2015-17 | 2014-17 | 2013-17 | 2012-17 | 2011-17 | 2010-17 | 2009-17 | 2008-17 | 2007-17 | Total > | Total = > | % > | 10 year txn # |
| MA | 12 | 11 | 1 | 0(6) | 0 | 6 | 3 | 4 | 4 | 2 | 1 | 5 | 7 | 33 | 39 | 29.55% | 2016 |
| MA 2 | 12 | 11 | 0 | 0(6) | 0 | 4 | 0 | 1 | 1 | 1 | 0 | 3 | 5 | 15 | 21 | 15.91% | 1577 |
| EOM MA | 12 | 10 | 1 | 0(7) | 0 | 7 | 3 | 6 | 3 | 0 | 0 | 4 | 4 | 28 | 35 | 26.52% | 396 |
| EOM MA 2 | 12 | 8 | 0 | 0(7) | 0 | 7 | 3 | 6 | 2 | 0 | 0 | 3 | 1 | 22 | 29 | 21.97% | 396 |
| MA-gilt | 12 | 12 | 4 | 0(6) | 0 | 7 | 4 | 5 | 6 | 6 | 2 | 6 | 7 | 47 | 53 | 40.15% | 3303 |
| MA-gilt 2 | 12 | 12 | 3 | 0(6) | 0 | 8 | 3 | 5 | 6 | 4 | 3 | 6 | 6 | 44 | 50 | 37.88% | 3125 |
| EOM MA-gilt | 12 | 11 | 5 | 0(7) | 0 | 12 | 9 | 8 | 10 | 7 | 4 | 8 | 8 | 71 | 78 | 59.09% | 784 |
| MAXO | 23 | 7 | 0 | 0(12) | 0 | 5 | 3 | 2 | 1 | 0 | 0 | 3 | 4 | 18 | 30 | 11.86% | 785 |
| MAXO2 | 23 | 7 | 0 | 0(12) | 0 | 5 | 2 | 2 | 1 | 0 | 0 | 4 | 4 | 18 | 30 | 11.86% | 785 |
| EOM MAXO | 23 | 5 | 0 | 1(12) | 0 | 4 | 2 | 2 | 2 | 1 | 1 | 3 | 5 | 21 | 33 | 13.04% | 443 |
| EOM MAXO2 | 23 | 4 | 0 | 1(12) | 0 | 4 | 2 | 2 | 0 | 0 | 0 | 2 | 3 | 14 | 26 | 10.28% | 443 |
| MAXO-gilt | 23 | 8 | 3 | 0(12) | 0 | 7 | 5 | 5 | 5 | 5 | 3 | 8 | 7 | 48 | 60 | 23.72% | 1517 |
| MAXO-gilt2 | 23 | 8 | 3 | 0(12) | 0 | 7 | 5 | 5 | 5 | 5 | 3 | 8 | 7 | 48 | 60 | 23.72% | 1515 |
| EOM MAXO-gilt | 23 | 10 | 3 | 0(12) | 0 | 6 | 5 | 5 | 5 | 4 | 3 | 8 | 7 | 46 | 58 | 22.92% | 868 |
| Total > | 245 | 124 | 23 | 2 | 0 | 89 | 49 | 58 | 51 | 35 | 20 | 71 | 75 | 473 | | | |
| Total > = | 245 | 124 | 23 | 129 | 0 | 89 | 49 | 58 | 51 | 35 | 20 | 71 | 75 | | 600 | | |
| B&H Annualised Rtn | | 0.064 | 12.01% | 0.2655 | 0.3028 | 0.1028 | 0.1083 | 0.0869 | 0.0653 | 0.0628 | 0.0791 | 0.076 | 0.0661 | | | | |
| B&H Annual Vol of rtn | | 0.2091 | 0.19714 | 0.1447 | 0.1624 | 0.162 | 0.1516 | 0.1487 | 0.154 | 0.1551 | 0.159 | 0.2064 | 0.2085 | | | | |

This table shows the number of times each strategy outperforms the buy-and-hold on a cumulative basis. There are 12 different MA durations and 23 different XO pairs. The percentage of times each strategy outperforms or is equal to the buy and hold is listed in the final column. The strategies with the highest number of outperformances are highlighted in yellow.

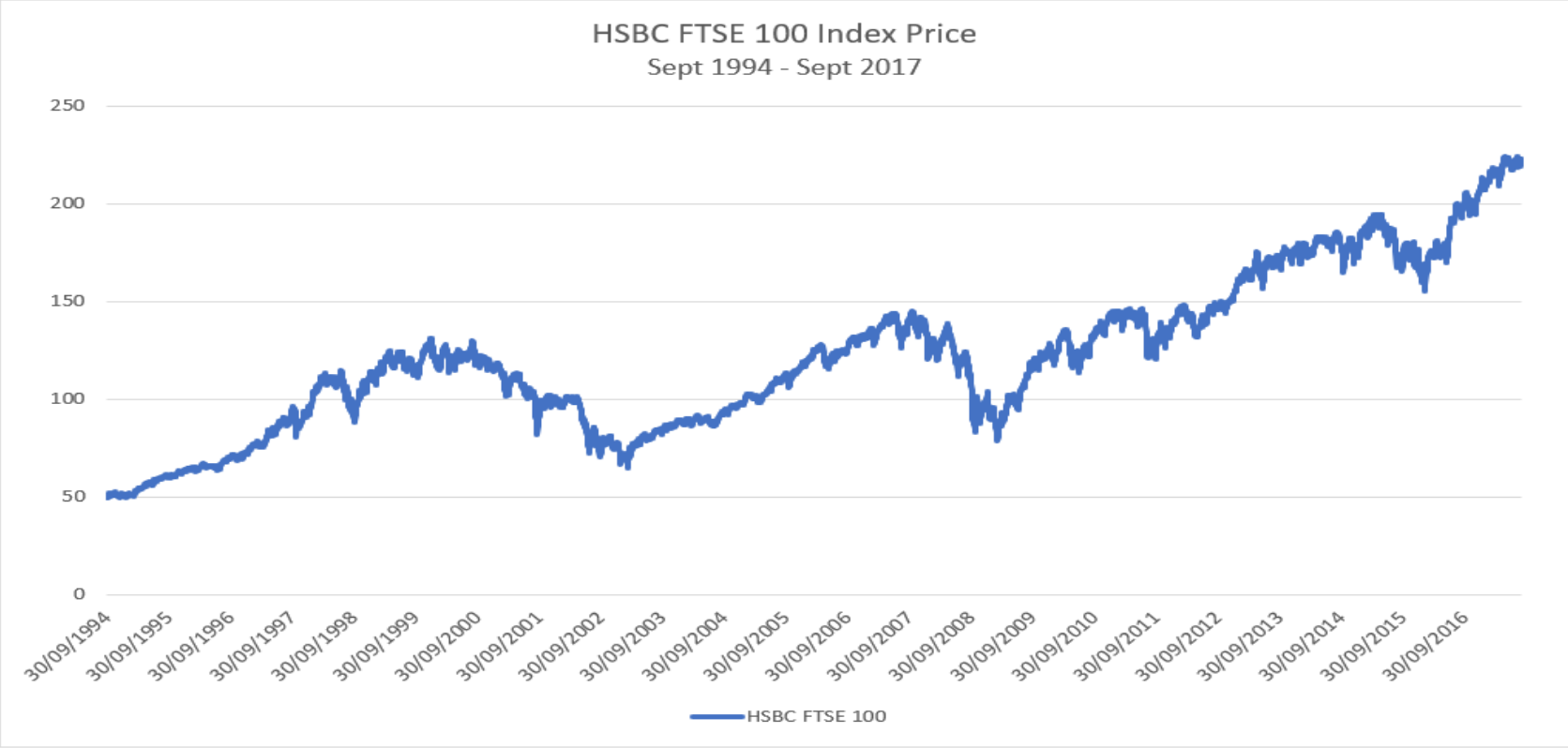
**Emerging Markets Cumulative Summary of Outperforming Durations**

| MA: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Sum (84) | % >= | B/H Return Total | An Rtn | An Vol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2002-17** | 0 | 0 | 1 | 0 | 3 | 3 | 1 | 3 | 2 | 1 | 0 | 0 | 14 | 16.67% | 267.63% | 6.40% | 0.20914 |
| **2016-17*** | 0 | 0 | 0 | 0 | 0 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 45 | 53.57% | 26.55% | 26.55% | 0.14467 |
| **2015-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% | 69.73% | 30.28% | 0.16243 |
| **2014-17** | 3 | 3 | 7 | 4 | 5 | 7 | 7 | 7 | 4 | 1 | 2 | 1 | 51 | 60.71% | 34.13% | 10.28% | 0.16204 |
| **2013-17** | 0 | 0 | 2 | 2 | 1 | 5 | 6 | 5 | 1 | 1 | 1 | 1 | 25 | 29.76% | 50.90% | 10.83% | 0.15162 |
| **2012-17** | 2 | 2 | 3 | 3 | 5 | 5 | 7 | 6 | 1 | 1 | 0 | 0 | 35 | 41.67% | 51.68% | 8.69% | 0.14875 |
| **2011-17** | 0 | 3 | 2 | 4 | 5 | 4 | 6 | 3 | 2 | 1 | 1 | 1 | 32 | 38.10% | 46.14% | 6.53% | 0.15402 |
| **2010-17** | 0 | 0 | 2 | 4 | 4 | 3 | 2 | 0 | 2 | 1 | 1 | 1 | 20 | 23.81% | 53.17% | 6.28% | 0.15513 |
| **2009-17** | 0 | 0 | 1 | 0 | 2 | 2 | 0 | 0 | 2 | 1 | 1 | 1 | 10 | 11.90% | 83.88% | 7.91% | 0.15903 |
| **2008-17** | 0 | 0 | 1 | 3 | 6 | 7 | 4 | 6 | 5 | 1 | 1 | 1 | 35 | 41.67% | 93.37% | 7.60% | 0.20636 |
| **2007-17** | 0 | 2 | 1 | 3 | 7 | 6 | 5 | 6 | 5 | 1 | 1 | 1 | 38 | 45.24% | 89.65% | 6.61% | 0.20854 |
| Sum (77) | 5 | 10 | 20 | 23 | 38 | 45 | 45 | 43 | 31 | 16 | 15 | 14 | 305 | | | | |
| %>= | 6.49% | 12.99% | 25.97% | 29.87% | 49.35% | 58.44% | 58.44% | 55.84% | 40.26% | 20.78% | 19.48% | 18.18% | 10.00% | | | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | |

| MA1: | 25 | 25 | 50 | 50 | 50 | 100 | 100 | 100 | 100 | 150 | 150 | 5 | 20 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 250 | 5 | 10 | Sum | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA2: | 50 | 100 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 300 | 350 | 200 | 200 | 200 | 400 | 300 | 350 | 400 | 450 | 400 | 450 | 10 | 20 | (total 161 | % >= |
| **2002-17** | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 5.59% |
| **2016-17*** | 0 | 0 | 0 | 0 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 86 | 53.42% |
| **2015-17** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% |
| **2014-17** | 0 | 1 | 3 | 7 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 23.60% |
| **2013-17** | 1 | 1 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 14.91% |
| **2012-17** | 1 | 1 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 14.29% |
| **2011-17** | 1 | 1 | 3 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 11.80% |
| **2010-17** | 1 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 15 | 9.32% |
| **2009-17** | 0 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 6.21% |
| **2008-17** | 1 | 1 | 7 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 6 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 36 | 22.36% |
| **2007-17** | 0 | 0 | 7 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 6 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 37 | 22.98% |
| Sum (77) | 5 | 5 | 32 | 17 | 31 | 15 | 7 | 7 | 7 | 7 | 7 | 51 | 47 | 29 | 7 | 7 | 0 | 0 | 0 | 0 | 2 | 2 | 12 | 297 | |
| %>= | 6.49% | 6.49% | 41.56% | 22.08% | 40.26% | 19.48% | 9.09% | 9.09% | 9.09% | 9.09% | 9.09% | 66.23% | 61.04% | 37.66% | 9.09% | 9.09% | 0.00% | 0.00% | 0.00% | 0.00% | 2.60% | 2.60% | 15.58% | | |
| 10 Yr Txn # | | | | | | | | | | | | | | | | | | | | | | | | | |

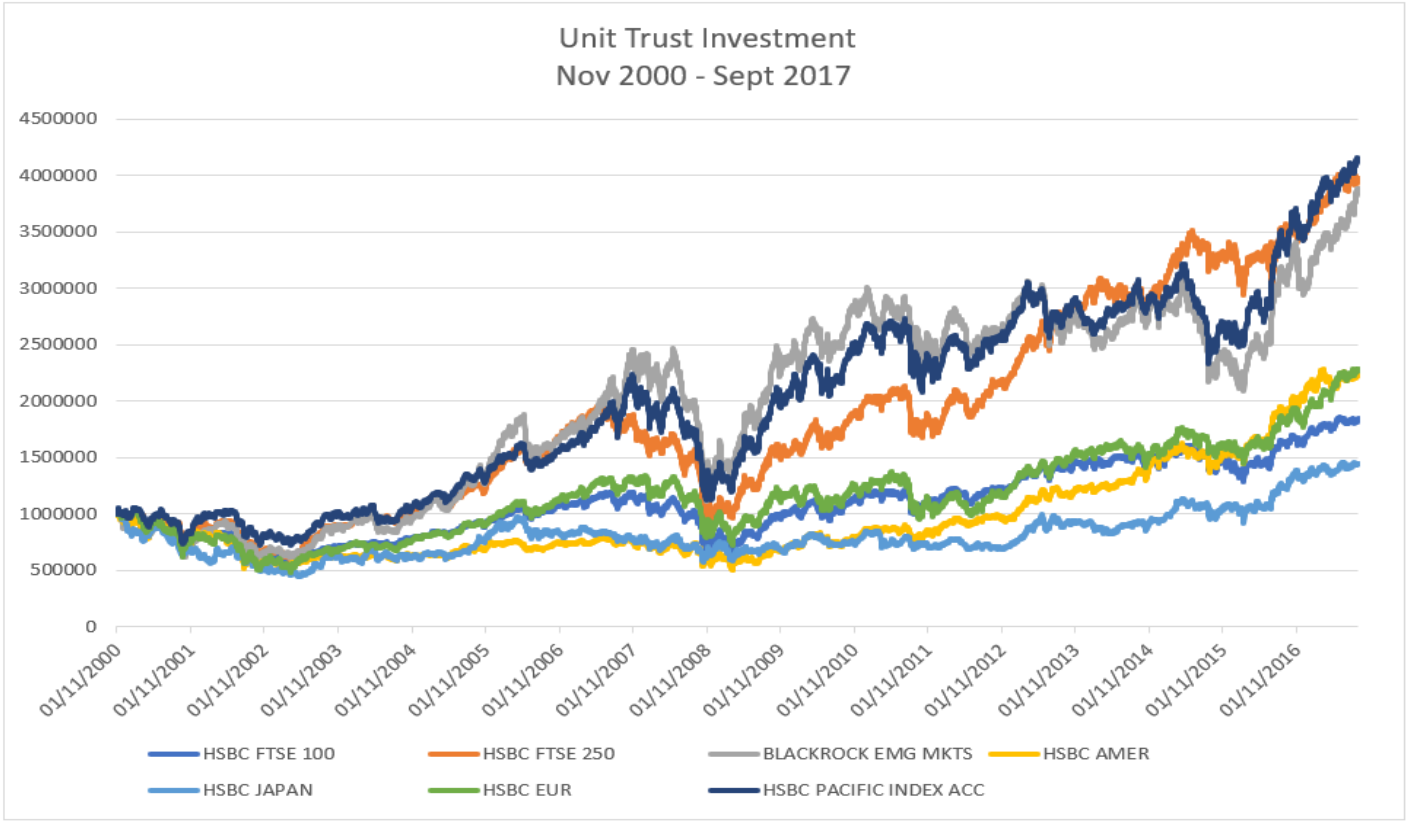
This table shows the number of times each duration outperforms the buy-and-hold on a cumulative basis. There are 7 strategies tested for each duration. * For the first year, results equivalent to the buy and hold are also included.

# Graph 3.1: HSBC FTSE 100 Index Price




Graph 3.1: The prices for the HSBC FTSE 100 Index unit trust over 23 years shows the upward trajectory from 1994-2000 and the downward trend from 2000-2002. This allowed all moving averages and crossovers time to exit the equity market before the trough in 2002. A trend-following investment which started around the bottom of the market in 2002 would have had a delayed re-entry into the market without the advantage of exiting the equity market on the way down. The state of the underlying market when commencing a study will have an impact on the ability of a timing strategy to outperform a buy and hold.

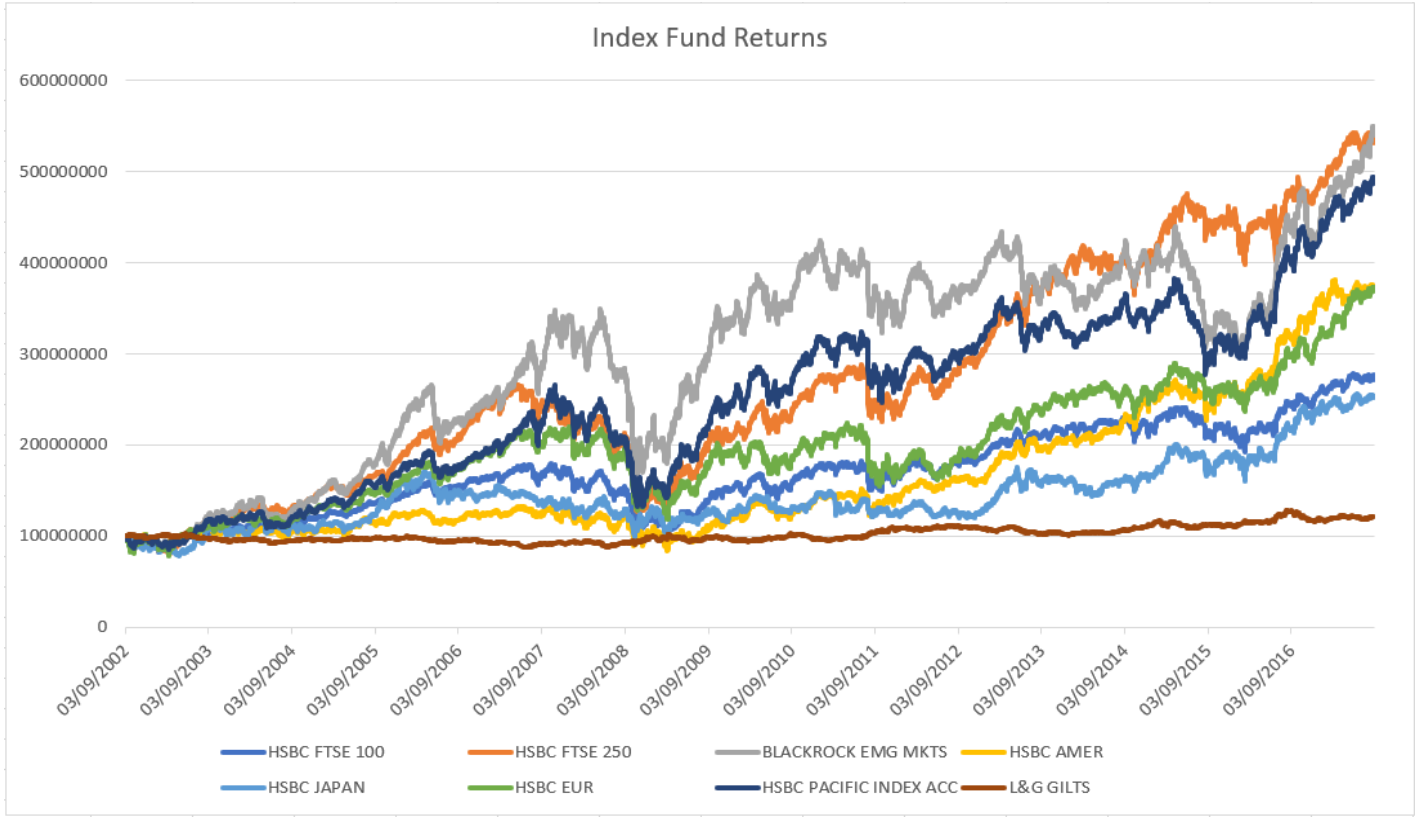
# Graph 3.2: Unit Trust Investments from Nov 2000 – Sept 2017




| | Annualised Return |
|---|---|
| HSBC PACIFIC INDEX ACC | 8.82% |
| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | 8.55% |
| BLACKROCK EMRG.MKTS. AC. | 8.38% |
| HSBC EUR.INDEX AC. | 5.04% |
| HSBC AMER.INDEX AC. | 4.91% |
| HSBC FTSE 100 INDEX AC. RETAIL | 3.71% |
| HSBC JAPAN INDEX ACC | 2.20% |

Graph 3.2: Many of the unit trusts used in this research only launched in Nov 2000. This graph shows the value of a buy and hold investment into each of these unit trusts from the Nov 1, 2000. There was a long, sustained drop in values from 2000 until the rebound in 2002. Due to the 450-day initialisation period required for the longest durations studied, the earliest a trend-following strategy could re-invest would have been from the 2002 trough depending on the length of the trend-following duration.

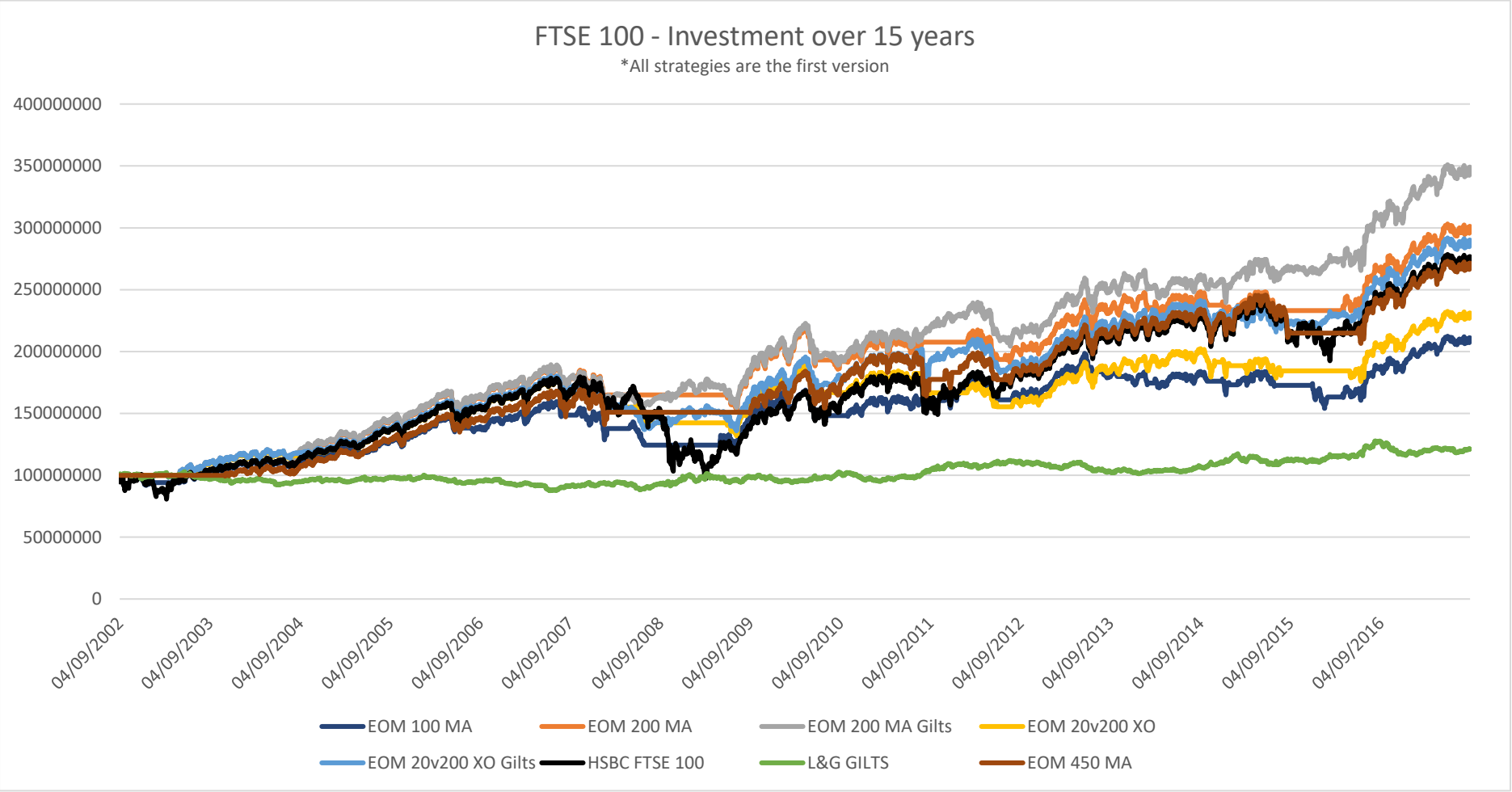
# Graph 3.3: 15 Year Buy and Hold for All Markets (Sept 2002-Sept 2017)



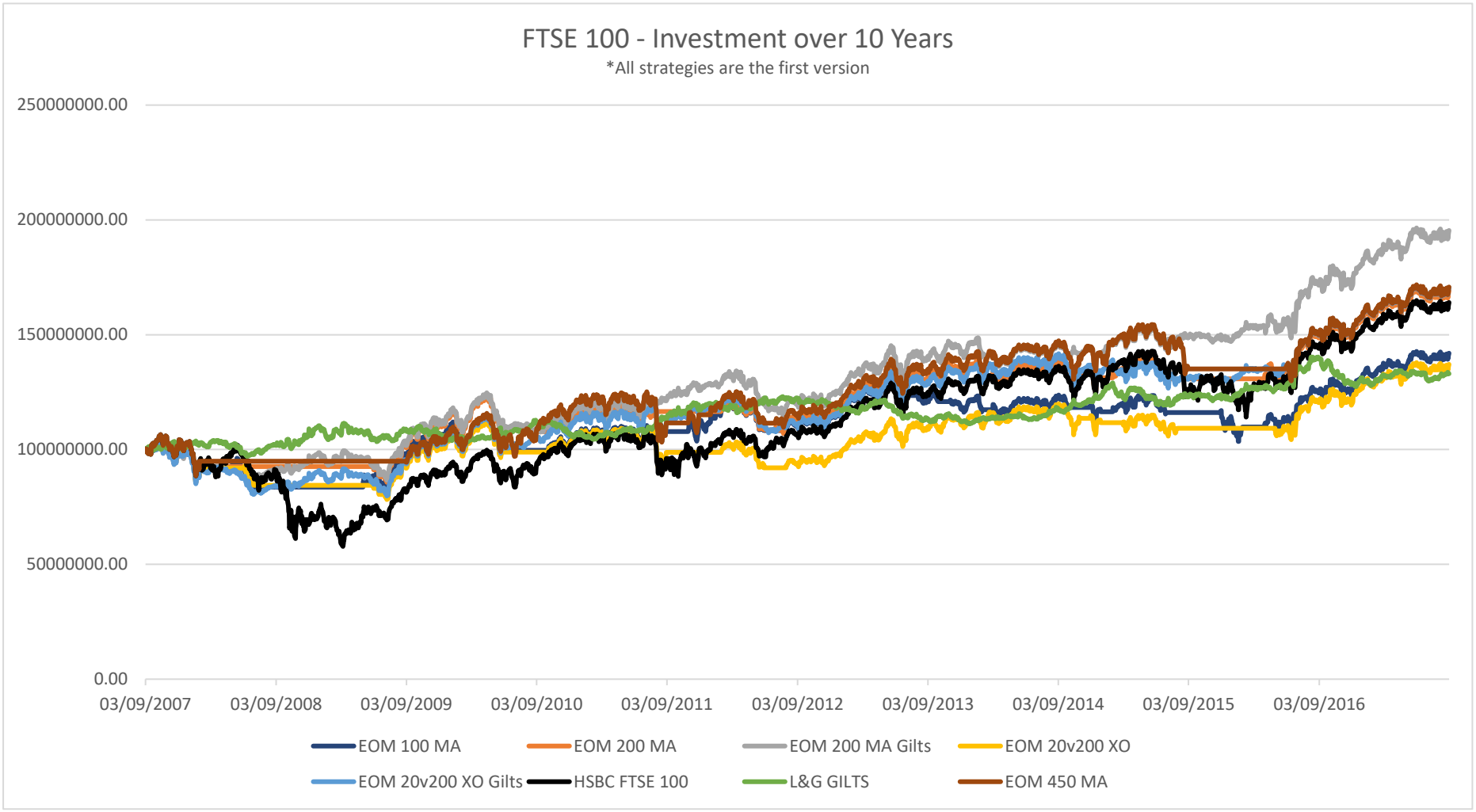

| 15-Year Annualised Return | |
|---|---|
| BLACKROCK EMRG.MKTS. AC. | 12.01% |
| HSBC TRKR.FTSE 250 IDX. AC.RETAIL | 11.88% |
| HSBC PACIFIC INDEX ACC | 11.21% |
| HSBC AMER.INDEX AC. | 9.20% |
| HSBC EUR.INDEX AC. | 9.18% |
| HSBC FTSE 100 INDEX AC. RETAIL | 7.02% |
| HSBC JAPAN INDEX ACC | 6.39% |

Graph 3.3: This graph shows the cumulative returns for each fund over 15 years. The volatility for the returns' ranged from 0.17-0.20 while the maximum drawdown ranged from -0.37 for HSBC America which had a volatility of 0.186 to -0.55 to Blackrock Emerging Markets which had a volatility of 0.197.

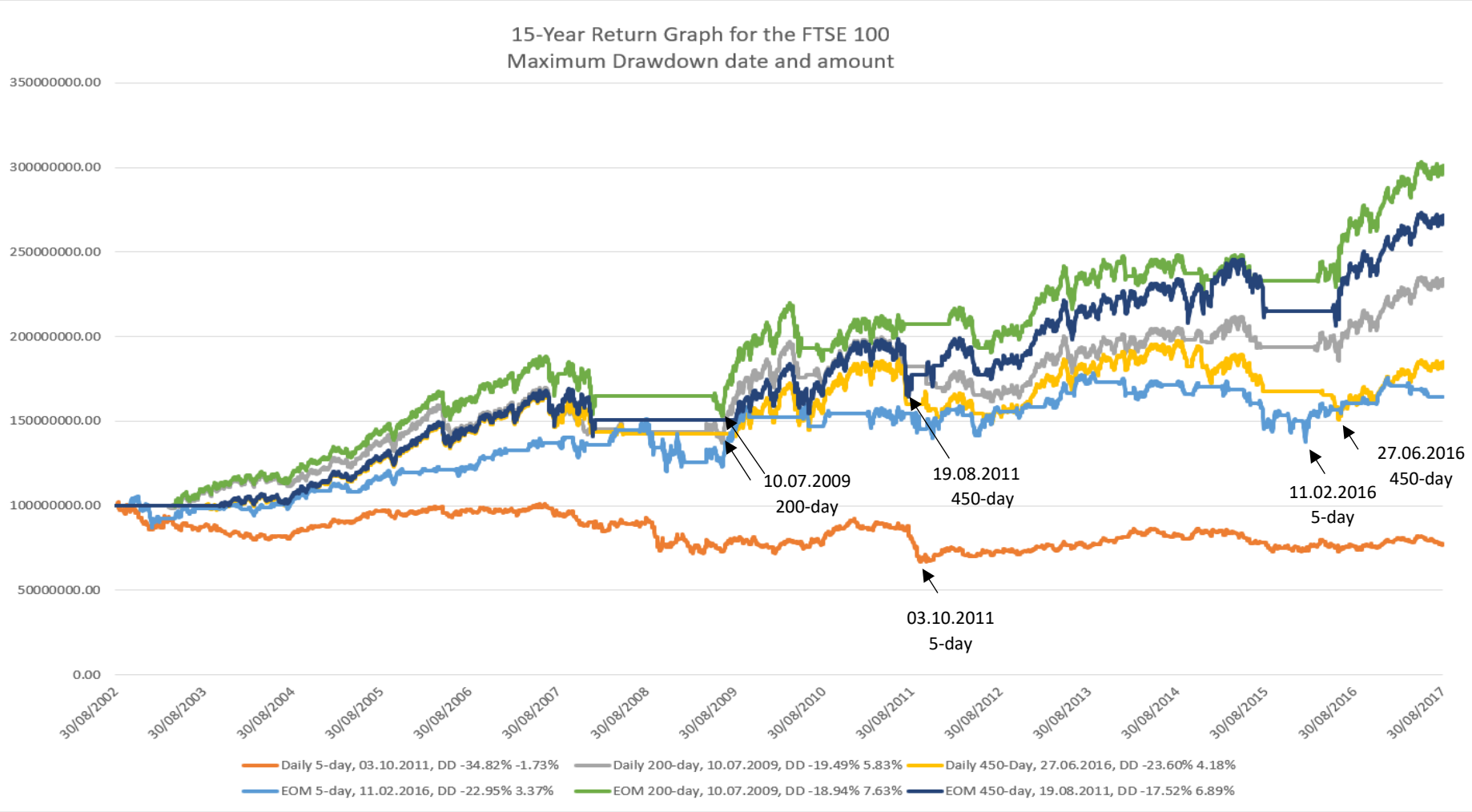
## Graph 3.4: FTSE 100 Strategy Returns over 15 Years (Sept 2002-Sept 2017)



## Graph 3.5: FTSE 100 Strategy Returns over 10 Years (Sept 2007-Sept 2017)



# Graph 3.6: FTSE 100 15-Year Returns with Maximum Drawdowns



# 4 Trend Following within a Portfolio

## 4.1 Introduction

An in-depth study in Chapter 2 into the FTSE 100 over 21 years found that most trend-following strategies using unit trusts were able to outperform the underlying passive buy and hold index and that the use of a trend-following strategy not only increased returns and risk-adjusted returns but also decreased volatility and maximum drawdown. Chapter 3 extended this discussion to consider unit trusts for international markets over a 15-year period for which fund prices were available after an initiation period for the longest duration trend-following strategy of 450 days. There was a surprising reduction in the number of strategies which were able to outperform. This underperformance illustrated the strengths and weaknesses of trend-following strategies. The ability to reduce volatility and maximum drawdowns over time persisted, but over the period studied, the ability to outperform in terms of returns depended purely on where within the market cycle the investment started, the movement of the underlying asset, and the presence of large drawdowns. Throughout both chapters the unique inclusion of gilts as the alternative asset instead of cash when out of equity markets was found to contribute to returns and risk-adjusted returns while still providing protection from risk in the form of reduced volatilities and maximum drawdowns.

The aim of this chapter was to combine the international unit trusts reviewed in the previous chapters together to create a diversified equity portfolio of unit trusts with an overlay of trend-following strategies for a UK-based investor. As the previous results have found reductions in volatility and maximum drawdown which would benefit a risk averse investor concerned with sequence risk, this portfolio was not only compared to a 100% equity buy and hold portfolio, but also to portfolios invested in 60% equities and 40% cash or gilts.

The objective of this chapter was to see if creating a portfolio of international unit trusts with a trend-following overlay would provide protection from loss above that offered by diversification alone while also providing returns or risk-adjusted returns. There were two different asset allocations tested for the equity portion of the

portfolios. The first was an equally weighted allocation as used by Faber (2007) and Clare, Seaton, Smith and Thomas (2016a) which was calculated over 15 years. The second was a typical asset allocation which would be recommended to UK retail investor, similar to that published by Morningstar, which was calculated over 5 years.[1] Both versions of the portfolios only reviewed the equity portion of a larger investment strategy, allowing for the rest of the diversification within the portfolio allocation to remain constant or to be modified as preferred due to an investor's risk tolerance.

The specific research questions explored in this chapter were:

- Does combining the optimum trend-following strategies, for each of the markets investigated in chapters 2 and 3, into a portfolio provide better returns, risk-adjusted returns, volatilities, and maximum drawdowns when compared to either a 100% equity portfolio or the popular mixed portfolio allocation containing 60% equity with either a 40% cash or 40% gilt allocation?
- Does the use of gilts instead of cash when out of equities continue to support the use of trend-following strategies as part of a portfolio?
- How did trend-following strategies perform over the coronavirus crisis of 2020?

The rest of this chapter is as follows: 4.2 a review of literature on diversification, asset allocation, the issue of increasing international equity correlations and how trend-following strategies fit in within this; 4.3 a review of the 15-year results for a 100% equity allocation, a 60/40 allocation and the added benefits of a trend-following portfolio; 4.4 the performance of trend following through the 2020 coronavirus crisis; and 4.5 summary and conclusion.

[1] The selected UK allocation is similar to the yearly equity allocation selected by Morningstar. Only 5 years was used due to the availability of the suggested allocation.

## 4.2 Literature Review

### 4.2.1 Diversification

The benefits of diversification have been apparent since Markowitz (1952) found that non-correlated assets reduce overall risk and stabilise a portfolio allowing for a higher expected return. In doing so, he is credited with creating the basis of modern portfolio theory. Only a few months later, Roy (1952) also published an article independently which created a similar mean-variance portfolio trade-off equation with an emphasis on an individual's personal preference to avoid what they would consider a "disaster". Markowitz very generously stated in 1999, "I am often called the father of modern portfolio theory (MPT), but Roy can claim an equal share of this honor." (Rubinstein, 2002)

Since this time, diversification has been an integral component of investment management. All modern portfolios are based upon the theory of diversification and the consensus is that over the long-term the best investment option is to buy and hold a well-diversified portfolio. Markowitz (1952) Given the strength of equity markets and transaction costs, such a passive investment would seem to be the most sensible option. Siegel in his book, Stocks for the Long Run (2020), found that over 210 years a broadly diversified buy and hold portfolio of stocks averaged a real return of 6.6% per year.

Dimson, Marsh and Staunton (2004) calculated the real returns of US equities from 1900-2002, 103 years, and found the annualised return to be 6.3%, which they mention is 'close to Siegel's constant, $s$ = 6.75%.' But they also found that the US was one of the better performing markets of the 16 that they studied. The US had relatively higher historical mean returns, comparatively lower volatilities and independent returns from one year to the next. They also believed that future returns were unlikely to be as high as they have been in the past, but that equities still offered a risk premium compared to bonds and cash. Given the potential domestic stock market volatility from any one country, Dimson *et al.* (2004) concluded that over the long term, rewards from equity were worth pursuing as part of a globally diversified portfolio. "If investors fail to diversify efficiently and cost-effectively, they can expect to erode the reward for equity risk exposure."

### 4.2.2 Lack of Diversification and Home Bias

Even though the benefits of diversification are well known and acknowledged, most individual investors do not hold a portfolio of well-diversified assets. A study by Goetzmann and Kumar (2008) reviewed the investments of over 60,000 individual investors at an US brokerage house from 1991-1996 and found that on average investors held under-diversified portfolios. From the beginning of the study in 1991 until the end of the study in 1996, the average number of shares held per investment portfolio went from 4.28 to only 6.32. Although the number of shares increased, the correlation of the portfolio was still higher than what would have been expected from a randomly generated portfolio. They divided the ability to diversify into two different aspects. The first they described as passive diversification or the reduction of risk through the purchase of more than one security. The second was to have diversification skill or the ability to choose uncorrelated stocks. The investors they studied showed passive diversification but not diversification skill.

For most individual portfolios being under-diversified in their stock selection meant lower returns and Sharpe ratios (Goetzmann and Kumar, 2008). The least diversified investors had a Sharpe ratio which was 2.04% less annually than the most diversified investors. They found that diversification increased based on age, experience, income, and financial sophistication which had a direct impact on their profitability. Goetzmann and Kumar (2008) concluded that most investors would have improved the returns and performance of their portfolios if they would have instead invested into a passive index fund.

French and Poterba (1991) were the first to observe home bias in investors. They studied investors from 1975 – 1989 in the US, UK, Japan, France, Germany, and Canada and found that all held predominantly domestic assets. By the end of 1989, the percentage of international stocks held in the equity portion of Japanese investors' portfolios was only 1.9%, with US equity portfolios holding 6.2% and British portfolios holding 18%. French and Poterba (1991) discussed possible constraints due to institutional barriers such as taxes, transaction costs, or government policy and decided that none of these issues were significant barriers to investment. Instead, they concluded that the lack of diversity was mainly due to

investor preferences. They noted that different investor groups appeared to have different return expectations across markets and theorised that investors may perceive foreign investments to have an increased risk.

Home bias continues to be an ongoing issue for both individual investors and actively managed funds. Research by Vanguard's Scott, Balsamo, McShane and Tasopoulos (2017) found that investors in the US, UK, Canada, Australia and Japan as of December 31, 2014, all had significant home biases in their asset allocation compared to what the allocation would have been through a market-cap weighting. The worst of which was for Australian investors who had a 65% gap between the 2% global market capitalization for Australia and the 67% overweighting by investors in domestic assets. This was followed by Canada with a gap of 56% (59% allocation to domestic equities and a 3% market cap) and Japan with a gap of 48% (55% allocated domestically and a global market cap of 7%). The US had an overweighting of domestic assets by 79% and a global market cap of 50% which led to a gap of 29%. The UK had the smallest gap of the markets studied of 19% with a market cap of 7% and an overweight of 26% to domestic equities. Scott et al. (2017) believed that for some investors home bias was a conscious decision due to return expectations or risk mitigation but for others this decision may have been unintended. In both instances there were several potential factors which they cited which to contribute to home bias. These included future return expectations, preference for the familiar, corporate governance practices, liability hedging, the belief that multinational companies provide international exposure, and currency risk.

Home bias was also found amongst 699 actively managed equity funds across 15 European countries by Maier and Scholz (2019). All 15 European countries and on average more than 90% of the funds studied were found to have home bias. They also found that this home bias was stable over time and on average overweighted domestic stocks by about 16 percentage points. The countries with the largest overweight in domestic stocks were France (overweighting by 30 percentage points), the UK (24 percentage points) and Germany (21 percentage points). They concluded that the issue of home bias was more likely related to behavioural reasons than informational advantages connected to domestic equity.

Did this lack of diversification also have an impact on markets or on equity funds? Swedroe (2019) states that although active investors claimed that distortions in the market prices were caused by passive investing, it may have been that the "active decisions of investors (influenced by a home country bias) leads them to overweight, not market-cap weight their home country. And because of the large size of the U.S. market relative to all other markets, that bias can lead to distortions in markets." White and Haghani (2019) suggested that such a home bias leads to a supply and demand problem for larger markets. This could be resolved by either rising prices or by new issuance both of which they concluded leads to higher valuations and lower expected returns for larger markets such as the U.S. "If there were less home bias and more passive investing in line with global market-value proportions, US equity investors would likely enjoy lower relative valuations and higher expected returns." (White and Haghani, 2019)

Although it is common knowledge that diversification offers the 'only free lunch'. A lack of diversification within equities (Goetzmann and Kumar (2008), home bias (Scott *et al*., 2017; White and Haghani, 2019), and the implied differentials with expected returns (French and Poterba, 1991) have been well established. The lack of diversification through selecting correlated stocks has been found to have a negative impact on performance (Goetzmann and Kumar, 2008) while home bias is thought to increase valuations and reduce future expected returns for large markets (White and Haghani, 2019). As a note of caution to aid the avoidance of home country bias Swedroe (2019) remarks, "remember that behavioural biases have a tendency to destroy investment returns."

### 4.2.3 Asset Allocation

Investment policy decisions which drive asset allocation are considered the dominant factor of portfolio returns. Brinson, Hood and Beebower (1986) and a follow up study by Brinson, Singer and Beebower (1991) researched the impact of investment policy, market timing, and stock selection on US corporate pension plans. Brinson *et al.* (1986) found that 93.6% of the average portfolio's return was based on investment policy i.e., the asset allocation between equity, bonds, and cash. Timing and stock selection were both found to be insignificant. They found that the

average percentages of stocks, bonds and cash was approximately 60% for stocks and 40% for bonds and cash.

Brinson *et al.* (1991) noted that from 1977-1987 the average asset class weights did not shift significantly in any year between equity, bonds, cash and other. Essentially, most of the returns were determined and driven by the percentage of the portfolio's equity and that on aggregate did not alter much over time.

Although asset allocation explained most of the returns, Hood (2006) later clarified that other factors such as cost, manager selection, and stock selection still had a residual impact on returns. As the original results were based on aggregate portfolio results, there were still large variations between individual portfolios. For example, the original Brinson *et al.* (1986) article stated that 10-year annualised returns based on stock selection had a range from 3.6% to -2.9% with a standard deviation of 1.36%. The large range in individual portfolio returns would therefore have been due to stock selection, manager selection and cost. It was when analysing aggregate returns that it became apparent that overall returns were predominantly determined by asset allocation.

One caveat to the Brinson *et al.* (1986 and 1991) research is that they did not consider international investments in their studies. This is mainly because during the period studied, Brinson *et al.* (1991) noted that none of the 82 pension plans studied held any non-US bonds and only two held non-US equity demonstrating a strong home bias. Given that Goetzmann and Kumar (2008) found that those investing in international funds were typically more diversified and had higher returns, the inclusion of international equity in their study might have influenced the outcome by Brinson *et al.* (1991) that stock selection did not have much impact on overall returns. Instead, the Brinson *et al.* (1986 and 1991) conclusion could have been due to home bias and the possible correlation within US equity shares compared to an investment into international equity. Regardless of the study's home bias, Brinson *et al.* (1986 and 1991) still displayed the importance of the percentage of equity allocation as the driver of a portfolio's returns.

Scott *et al.* (2017) found that most of the return variability (the level of divergence of actual returns from policy returns) for the US, Canada, UK, Australia, and Japan was determined by the underlying static asset allocation in a broadly

diversified portfolio. Scott *et al.* (2017) also found that around 80 - 90% of this variability could be explained over time by asset allocation, an amount slightly less but similar to the results from Brinson *et al.* (1986). Scott *et al.* (2017) considers "asset allocation key in managing the range, or variability (experienced volatility), of a portfolio's returns *over time*." They also found that the average actively manged fund had lower returns and higher volatility than a passive index policy portfolio. But, confirming Hood's clarification (2006), they found that there were funds which were able to outperform. These funds typically had lower costs and larger average assets.

The overall asset allocation between equities, bonds and cash has been found to be the main determinant of returns and volatility (Brinson *et al.* 1986, 1991, Scott *et al.* 2017). It is possible for active funds to outperform, but the average active fund had both lower returns and higher volatility than its passive counterpart (Hood, 2006). Once the equity allocation has been decided, the addition of international assets would be expected to add further diversification and reduce domestic volatility.

### 4.2.4 International Equity Correlations

Over time, the ease with which it is possible to invest in international equities has increased with financial innovation. There are now readily available, well-diversified, selections of unit trusts and ETFs with ever-decreasing fees. An investor following the recommended suggestions by Malkiel (2012) and Seigel (2020) for portfolio creation would therefore easily be able to hold an internationally diverse portfolio with the amount of equity desired for their attitude to risk and to drive their return. But would they be diverse enough? Have international equities around the world become more correlated? And does this negate any benefits of diversification?

Most of the time, if markets are moving upwards, an increased international correlation would be welcome for investors as all shares would move upward together. Unfortunately, Longin and Solnik (2001) found that international equity markets appear to become more correlated when markets trend downward, and less correlated when markets are trending upward. They studied the correlation in returns

across the US/UK, US /French, US/German, and US/Japanese markets from Jan 1959 to Dec 1996 and found across all 4 combinations that the correlations between markets were influenced by both the direction and size of returns.

Ang and Bekaert (2002) also found an increase in correlation during bear markets and a decrease in correlation in bull markets through the study of US, UK and German equities. They found that international markets do not have constant correlation across regimes and asserted that during 'bad regimes' for which international equities did not provide the benefits of diversification, then international investing may not be beneficial for investors. They instead suggested international diversification when considering a US-based investor who rebalanced based on regime switches to a home-bias, bonds or to a risk-free asset when necessary. Diversifying when equity markets were rising and de-risking to US-equities or bonds when markets were falling.

Amira, Taamouti, and Tsafack (2011) found that there was also a relationship between the level of volatility and the correlations between international equities, and that the increase in correlation related to the direction of the market had more impact than market volatility.

Historically, overall average cross-market correlations were able to add a diversifying effect. More recently financial engineering, the globalisation of both markets and corporations, and global quantitative easing have greatly increased market correlations from 10-15% in 1970 to about 45% since the 2008 financial crisis (Straatman, 2013). Scott, Stockton, and Donaldson (2019) found that the correlations between US and non-US stock returns have increased even further to 0.80 as of September 30, 2018, after having increased dramatically between 1994 and 2000. They noted that "despite globalisation, factors unique to a country's markets and economy will prevent perfect correlation between the equity markets of any two countries." International diversification will continue to offer benefits in terms of both return and reductions in volatility, but the diversification effect available from investing in international assets appear to diminish especially in times of market distress.

### 4.2.5 Other Sources of Diversification

It has become apparent that in extreme bear market conditions many assets which were considered uncorrelated become highly correlated. During the 2008 financial crisis, equity markets across the world fell together. It would be of interest to find alternative investments which have non-correlated returns to provide diversification in any type of market. Investing based on asset allocation alone may end up providing "passive diversification" in times of market distress instead of showing actual "diversification skill" as defined by Goetzmann and Kumar (2008).

For example, a typical asset allocation might hold US equity, international equity and private equity which would all be impacted similarly by underlying economic factors. Podkaminer (2013) explored investing through risk factors, such as inflation, currency, and volatility, instead of asset allocation. These factors would not only have a similar impact on different types of equity, but also to some extent on corporate bond returns. Instead dividing investments based on fundamental risk factors such as GDP growth, inflation, volatility, value, duration, size, etc. could allow for further diversification than would be found through normal asset allocation. The difficulties with factor investing are that they are not proxies for every type of factor and it is complicated for investors.

Idzorek and Kowara (2013) studied both factor and asset allocation strategies and found that there did not appear to be a gain in efficiency from using one or the other. By using different time periods, it was possible to show that neither one provides superior returns to the other, but factor investing also required a large amount of leverage too extreme for most institutional investors. (Idzorek and Kowara, 2013)

In the search for 'alternative' investment strategies, McMillan (2012) discussed different investments which could provide some diversification and non-correlated return streams. Amongst the investment strategies suggested to help add diversification were absolute return strategies, managed futures, illiquid market strategies, and tactical strategies such as trend-following. These different strategies provide differing levels of 'alternative' non-correlated returns and some suggestions, such as illiquid market types, are particularly unsuitable for individual or unsophisticated investors. In either case, true diversification across different market

conditions would require uncorrelated assets or uncorrelated portfolio strategies to be selected. To make this accessible and comfortable to the average investor, secure asset classes would need to be selected and a strategy which would be both relatively simple to understand and implement while still providing uncorrelated returns, such as a trend-following strategy.

### 4.2.6 Trend-Following Strategies

A trend-following strategy is a form of tactical trading which could provide additional diversification compared to asset allocation alone. Chapters 2 and 3 found that trend following provided returns which were uncorrelated during sustained market falls but were invested in equities during the majority of bull markets.

Using a trend-following overlay on top of 5 diverse asset classes formed into an equally weighted portfolio (the S&P 500, an international developed markets index, a commodity index, a real estate index, and US 10-year T-bills over 30 years), Faber (2007) found that the 10-month moving average trend-following strategy was able to produce equity-like returns with bond-like volatility and drawdowns.

Clare *et al.* (2016a) tested several different combinations of trend-following, risk-parity, momentum, volatility-adjusted momentum, and flexible asset allocation strategies on developed, emerging market, government bonds, commodities, and country-level real estate asset allocations. They found that trend-following improved returns, Sharpe Ratios, drawdown, and volatility, and that using individual country indexes further improved performance.

This chapter further investigated trend-following in a similar way to Faber (2007) and Clare *et al.* (2016a) and found comparable results. Moving average (MA) and crossover (XO) trend-following portfolios appeared to provide better risk-adjusted returns, volatilities, and maximum drawdowns. Different equity markets responded differently to different trend-following strategies, but when combined into an equally weighted, equity-only portfolio, the risk-adjusted returns, volatility, and maximum drawdown statistics were greatly improved similarly across all strategies.

The addition of gilts when not investing in equities increased returns but this effect may be short lived if quantitative easing is reduced in the future.

## 4.3 Methodology

Following the method of Faber (2007) and Clare *et al.* (2013, 2016a), this chapter investigated moving averages and crossovers within a portfolio of international equity markets. The funds chosen were therefore the HSBC FTSE 100 index, HSBC FTSE 250 index, HSBC America index, HSBC European index, HSBC Japan index, HSBC Pacific-ex Japan index, and Blackrock Emerging Markets index[2]. These were selected because they had the longest amount of historical data for a well-known fund provider of passive index tracking unit trusts with a clean share class. The addition of the HSBC 250 did bias the overall allocation towards the UK, but as this thesis was concerned with a UK-based investor it was important to consider not only the larger companies that would be represented within the FTSE 100 but also medium sized companies which would have little representation across the other international equity markets.

In the same method as was used in Chapters 2 and 3, when gilts were used as the alternative investment to equities, the UK government bond fund used was the Legal & General All Stocks Gilt Index unit trust. When cash was used as the alternative, it was not invested in a cash proxy like Faber (2007) and Clare *et al.* (2013, 2016a) who invested in US Treasury bills. The cash did not accrue any interest or fees and remained at the same amount as when the equity was sold.

Two different asset allocations were used. The first was an equally weighted portfolio like those tested by Faber (2007) and Clare *et al.* (2016a) over 15 years using the same data set as was used in Chapter 3. This allocation was also used to consider the out of sample performance of trend-following strategies throughout the coronavirus crisis over 2020. The second allocation was a typical yearly UK based equity asset allocation similar to that which would be recommended by Morningstar. This was tested over 5 years as that was the extent of the yearly allocation which was

[2] The Blackrock Emerging Market Index is an active not passive fund. This was used because there were no other emerging market unit trust funds which dated back to 2000.

available. This was also then compared to the 5-year results for the equally weighted portfolio. Only the equity portion of the allocation was studied to allow for the rest of the allocation to be considered by the individual investor based upon their own risk tolerance.

Due to the vast number of potential findings across all strategies and durations, the portfolios reviewed will concentrated on a 200-day end of month moving average and a 50 v 150-day end of month crossover trading into both cash and gilts over 15 years. The 200-day moving average was selected as it is the one most frequently used by practitioners and academics alike such as Mills (1997), Ellis and Parbery (2005), Faber (2007), ap Gwilym *et al.* (2010), and Clare *et al.* (2013, 2016a) and had the highest number of strategies outperform of the moving average durations studied in Chapter 3 over 1-10 years and 15 years. The 50 v 150-day crossover was the crossover duration with the highest number of outperformances as shown originally in Table 3.11 and reproduced in Table 4.1. Although there was obviously repetition in the data underlying the results over 1-10 cumulative years and 15 years, from the discussion in chapter 3 it was also clear that trend-following strategies had vastly different fortunes when compared to the buy and hold depending on the start date. To capture different underlying market movements, these durations were tested in Chapter 3 over the combination of 1-10 years as well as 15 years was used to determine the durations which were most successful at outperforming the buy and hold in terms of returns as well as being mindful of the experience the investor would have had throughout the investment instead of just the strategies which were successful over the longest 15-year period. This would have been important for investors who may have invested for only a portion of the period instead of for the full 15 years.

When calculating the returns for the portfolios, each market's investment signals and returns were first calculated separately. All market investments started with £1,000,000. Each market was allocated a percentage of the total portfolio return on a daily basis throughout the investment. If one of the equity markets sold into cash, that cash was kept within that market's return and was continued to be given the same daily weight throughout. Each market's end of day values, daily returns and cash were not mixed between assets. The end of day values and the daily returns for the portfolio were calculated based on the allocation assigned to each market within

the portfolio. If this was for the equally weighted portfolio, each market's daily returns were added together and divided by 7, the number of equity unit trusts which were studied. If the UK-based allocation was instead used, the market's daily return was given an allocation as shown in Table 4.4 and divided by the overall equity allocation to create a full equity portfolio.

### 4.3.1 Comparator Statistics

The main comparative statistics used to determine the performance of the strategies were annualised return, annualised volatility, annualised Sharpe Ratio (SR), annualised Sortino ratio, and maximum drawdown. Most of these statistics were previously used in Chapter 2 and 3. Further information about each of these calculations can be found in Chapter 2. The Sortino ratio was the only new statistic to be reviewed in this chapter.

The Sortino ratio is similar to the more popular Sharpe ratio. Although it is not as well known, it is a more appropriate measure of risk-adjusted return for those seeking to minimise the downside of their investment. Instead of dividing the excess return by the standard deviation of the whole return series, the upside and well as the downside as is done when calculating the Sharpe ratio, the Sortino ratio is constructed to capture only downside volatility. Clare *et al.* (2016a) and others calculate the Sortino ratio by dividing the average excess return by the standard deviation of negative returns. Although this provides a more useful measurement than a Sharpe ratio, this measure only includes the negative returns in the standard deviation calculation and compares each individual negative return to the average of all the negative returns. It also prevents positive returns from having any impact on the equation.

The Sortino ratio used in this chapter used the same numerator as was used in the Sharpe Ratio. The risk-free daily returns (the 3-month UK Treasury Bill) were subtracted from the daily returns, but the average was divided by a target downside deviation as per Rollinger and Hoffman (2013) instead of by the standard deviation of negative returns to provide a more relative measure of risk-adjusted returns.

Sortino Ratio: $\left(\frac{Avg(R_p - T)}{TDD}\right) * \sqrt{252}$

Where:

- $R_p$ = daily actual portfolio return
- T= daily target rate of return
- TDD = target downside deviation

The target downside deviation measures the difference of each return from a selected target return, in this case again the 3-month UK Treasury Bill. It also considered returns which were higher than the target rate of return. These returns were given a value of 0 therefore rewarding incidences of higher positive returns. As Rollinger and Hoffman (2013) state, "Throwing away the zero underperformance data points removes the ratio's sensitivity to frequency of underperformance."

TDD: $\sqrt{\left(\frac{\sum(Min(0, R_p - T))^2}{N}\right)}$

Where:

- N = total number of returns

Therefore, the denominator in the Sharpe ratio equation, the target downside deviation, was the square root of the sum of the negative excess returns squared and divided by the total number of observations (including days of outperformance).

The rest of this chapter reviewed the results of these statistics as part of an equally weighted portfolio over 15 years and over 5 years with both equally weighted and typical UK asset allocations. A further extension over 2020 was also considered to review trend-following strategies' performance over the coronavirus crisis by market and as part of an equally weighted portfolio.

## 4.4 Results

The detailed results for the 200-day moving average and the 50 vs 150-day crossover to both cash and gilts for each market over 15 years are available on Table 4.2. These two strategies were chosen as they were the strategies with the highest number of outperformances for a moving average and crossover over 1-10 and 15 years across the unit trusts studied in Chapter 3. These results were discussed at depth in Chapter 3. A few comments for these specific strategies are that the only trend-following strategies trading into cash when out of equities which outperformed the buy-and-hold were the 200-day moving average for the FTSE 100 and both the 200-day moving average and the 50 v 150-day crossover for the FTSE 250 over the 15 years. In all cases moving to gilts instead of cash increased the average return of the trend-following strategies, with either the MA-gilt or XO-gilt strategy outperforming the buy-and-hold for all markets except for the American and Pacific unit trusts. All the trend-following strategies had reduced volatility and maximum drawdowns compared to the buy-and-hold and in most cases, there were also improvements to both Sharpe and Sortino ratios. The majority of the trend-following strategies over this 15-year period may not have outperformed but they did have a definite impact on the amount of risk experienced for an investor into each of these funds.

Based on the results in Chapter 2 and 3, trend-following strategies would be particularly useful for an investor concerned about risk who would also be suggested to naturally diversify following the principles of modern portfolio theory and common sense. The results therefore review a portfolio of international funds with a trend-following overlay benchmarked against a 100% equity unit trust portfolio and 60% equity and 40% cash/gilt portfolios.

### 4.4.1 15 Year Results

#### 4.4.1.1 Benchmark Equity Portfolio

The equally weighted buy and hold portfolio displayed the benefits of diversification in Table 4.3 when compared to the individual equity markets as shown in Table 4.2. The portfolio had higher returns than four out of the seven

markets and had lower volatility than any of the individual markets. The returns for the individual markets ranged from 6.39% for Japan to 12.01% for emerging markets. If investing with a home bias in either Japan which had a return of only 6.39%, the UK with the FTSE 100 which had a return of 7.02%, Europe which had a return of 9.18% or even in the US with a return of 9.20%, the return would have been less than the return from the equally weighted buy and hold portfolio which had a return of 9.83%. The volatility of the portfolio was 15.44% which was less than the volatility from any of the individual markets which ranged from 16.87% for the FTSE 250 to 20.32% for Japan. The portfolio maximum drawdown was -44.19%, which was smaller than all but two of the markets, America (-37.03%) and Japan (-41.89%), with the largest drawdown across all markets from the emerging markets with a maximum drawdown of -55.09%. Although investing in other equity markets displayed the benefits of diversification such as reduced volatility during this 15-year period, the large maximum drawdowns were still evident as international equities became more correlated through the 2008-2009 bear market causing some of the benefits of diversification to fade. The addition of less- or non-correlated assets such as cash or gilts to the portfolio would increase the portfolio's diversification.

#### 4.4.1.2 Benchmark 60/40 Equity Portfolio

A traditional portfolio allocation used by many investors is a split between 60% invested into equity and 40% invested into domestic bonds (Clare *et al.* 2016a). In this study the 60% equity was provided through the benchmark equally weighted buy and hold portfolio and the other 40% was invested into either cash or UK government bonds to add diversification benefits. The results of these portfolios and their comparison to the 100% equity portfolio are shown in Tables 4.3 and 4.4. The reduction in equity led to an expected reduction in terms of returns, but also a similar percentage of improvement to both volatility and maximum drawdowns. The 60/40 cash portfolio reduced returns by 26.46% (from 9.83% to 7.23%), but also reduced volatility by 27.56% (from 15.44% to 11.18%). While the 60/40 gilts portfolio only reduced returns by 24.34% (to 7.44%), there was also a further reduction in volatility by 29.49% (to 10.88%).

As the reduction in volatility was greater than the reduction in returns, the risk-adjusted returns were less profoundly impacted than the absolute returns, especially when 40% of the portfolio was invested in gilts instead of cash due to increased returns from gilts and the slightly lower volatility. The Sharpe and Sortino ratios were reduced by 9.11% and 9.67% respectively for the 60/40 cash portfolio and only by 4.02% and 4.48% for the 60/40 gilt portfolio. The maximum drawdowns for both the 60/40 cash and gilts portfolios were smaller than they were for any individual market with improvements of 23.41% (to -33.85%) and 23.02% (to -34.02%) respectively. This illustrates the benefits of diversification by including non-correlated cash or less correlated gilts with equities within a portfolio and offers an appealing risk/return trade-off. The analysis in chapter 2 showed the addition of a trend-following strategy overlay amongst the individual markets offered downside risk protection. The use of a trend-following strategy on a portfolio would be expected to have similar further advantages for risk reduction above and beyond that from diversification alone.

#### 4.4.1.3 Trend-Following Equity Portfolio

When utilising the same 200 day moving average or 50/150-day crossover trend-following strategy for each market, like Faber (2007) and Clare *et al*. (2016a), the portfolios had further significant improvements compared to the 100% equity buy and hold and the 60/40 portfolios. Although only the 200-day moving average to gilts portfolio outperformed in terms of returns compared to the 100% equity buy and hold benchmark, they all had returns which outperformed when compared to the 60/40 portfolios. (Table 4.3) In a comparison between the 60/40 cash portfolio which had a return of 7.23% to the trend-following portfolios which traded into cash when out of equities, there was a 23.50% increase in terms of returns for the 200-day moving average portfolio which traded into cash with a return of 8.93% and an 11.76% increase in returns for the 50/150-day crossover portfolio when using cash with a return of 8.08%. (Table 4.4) The use of gilts in the trend-following strategies over this period added additional returns compared to cash as the 200-day moving average portfolio using gilts had a return of 10.22% and the 50/150-day crossover

portfolio using gilts had a return of 9.69%. Both outperformed the 60/40 equity/gilt portfolio which had a return of 7.44% by 37.43% and 30.36% respectively.

All four trend-following strategies offered lower volatilities not only against the 100% equity portfolio, but also compared to the 60/40 portfolios and the individual markets with trend following. The trend-following strategies offered significant reductions of 33.58% - 36.59% compared to the 100% equity benchmark with little difference between the different strategies. The 200-day and 50/150-day portfolios using cash in the trend-following strategies had volatilities of 9.82% and 9.79%. Comparing cash portfolios, the 200 and 50v150-day trend-following strategies reduced volatility by 12.18% and 12.46% respectively compared to the 60/40 cash portfolio which had a volatility of 11.18%. The trend-following portfolios which traded into gilts had slightly higher volatilities than the trend-following portfolios which used cash with volatilities of 10.20% (200-day) and 10.25% (50v150-day). This offered a reduction in volatility of 6.29% (200-day) and 5.81% (50v150-day) compared to the 60/40 gilt portfolio which had a volatility of 10.88%.

It is therefore not surprising that this drastic reduction in volatility and improvement in returns resulted in higher risk-adjusted returns when compared to the 60/40 portfolios, but all of the trend-following strategies also had risk-adjusted returns which outperformed the 100% equity benchmark. The 200-day and 50v150-day trend-following strategies trading into cash had Sharpe ratios of 70.57% and 63.05% and Sortino ratios of 98.5% and 87.28% compared to the 60/40 cash portfolio which had a Sharpe ratio of 49.68% and a Sortino ratio of 68.87%. This was a dramatic 42.04% and 26.90% increase in Sharpe ratio and a 43.02% and 26.73% improvement in Sortino ratios for the 200-day and 50v150-day trend-following strategies using cash against the 60/40 cash portfolio. The improvement against the 100% equity benchmark which had a Sharpe ratio of 54.66% and a Sharpe ratio of 76.24% for the trend-following strategies using cash was still a substantial 29.11% and 15.35% increase in Sharpe ratio and a 29.19% and 14.47% increase in Sortino ratios for the 200-day and 50v150-day trend-following strategies respectively compared to the 100% equity benchmark.

Risk-adjusted returns for trend-following strategies using gilts when not invested in equities were even greater than those for the cash trend-following

strategies. Although the volatilities were slightly higher for the gilt trend-following portfolios, the higher returns appeared to more than make up for the difference. The 200-day and 50 v 150-day gilt portfolios had Sharpe ratios of 79.50% and 74.64% and Sortino ratios of 111.41% and 103.7%. This was a dramatic increase against the 60/40 gilt benchmark which had a Sharpe ratio of 52.47% and a Sortino ratio of 72.83%. There was a substantial increase of 51.52% and 42.26% for the Sharpe ratios respectively and an increase of 52.97% and 42.39% for the Sortino ratios against the 60/40 gilt portfolio.

Some of the largest improvements which the trend-following strategies provided were for maximum drawdowns. The 200-day and 150-day cash trend-following strategies had maximum drawdowns of -17.41% and -19.5% compared to -44.19% for the 100% equity portfolio, and -33.85% for the 60/40 cash portfolio. This was a 48.55% and 42.37% improvement to the 60/40 cash portfolio and 60.59% and 55.86% improvement to the 100% equity buy and hold. The trend-following portfolio using gilts offered a similar improvement as the 200-day and 50v150-day portfolios had maximum drawdowns of -16.83% and 21.70% respectively versus the 60/40 gilt benchmark of -34.02%, a reduction of 50.53% and 36.20% respectively against the 60/40 gilt benchmark and 61.92% and 50.89% against the 100% equity benchmark. These improvements are significant for an investor's experience of their investment and of material importance when an investor is drawing down from their investment account.

The 200-day moving average strategies had better overall statistics than the 50 v 150-day crossover. The 200-day moving average had higher returns, Sharpe, and Sortino ratios while also having better maximum drawdowns and similar volatilities. When both trend-following strategies traded into gilts instead of cash when not in equities, the average return, Sharpe, and Sortino ratios were boosted while also having similar drawdowns and volatilities as trading into cash. The extra return which gilts provided over this period was enough to minimise maximum drawdown and boost the risk-adjusted returns even though gilts also slightly raised the volatility. The performance of gilts over this period was improved by interventions such as quantitative easing. Although this was a benefit to these trend-following strategies during this period, this may not necessarily continue in the future. Overall, the difference between the trend-following strategies was minimal

compared to the difference between these strategies and the 100% equity buy and hold or the 60/40 cash and gilt benchmark portfolios.

Using trend-following for individual markets was found to reduce volatility compared to the buy and hold of each underlying market in Chapters 2 and 3 and this continued to be the case when combined within a portfolio. Diversification alone did not appear to reduce volatility or maximum drawdowns as much as trend-following. The benchmark 100% equally weighted equity portfolio had a higher amount of volatility and larger maximum drawdowns (Table 4.3) than any of the individual markets when using trend-following even in isolation (Table 4.2). Combining the equity buy and hold markets with a 40% cash or gilt diversifier brought the portfolio's volatility down more than the use of trend-following on any of the individual markets, but reduced returns and risk adjusted returns for the portfolios and the 60/40 portfolios still had larger maximum drawdowns than the individual trend-following markets.

Creating a trend-following portfolio with an equally weighted equity asset allocation and using the same trend-following strategies as used for the individual markets greatly reduced volatility and maximum drawdowns compared to the individual markets with or without trend following, and both the 100% equity and 60/40 portfolios. The trend-following 100% equity portfolios also provided higher risk-adjusted returns when compared to most of the individual markets using trend following with the same strategy and against the 100% equity and 60/40 portfolios. The improvements in volatility and maximum drawdown for the trend-following portfolios compared to the individual markets using trend-following were similar to that when creating portfolios with markets without trend-following showing the power of diversification. The trend-following portfolios had the benefits of both diversification and the downside risk protection from trend following allowing these portfolios to have improved Sharpe and Sortino ratios, volatilities and maximum drawdowns compared to the individual markets, the 100% equity portfolio and the 60/40 portfolios.

If an investor were invested in a traditional 60/40 portfolio and was looking to continue to invest based on the amount of risk that they were happy to experience, as measured through volatility and maximum drawdown, an investment into any of

these trend-following portfolios would have offered them an improvement in both statistics. The trend-following strategies studied here over this 15-year period offered a lower amount of volatility, significantly better drawdowns than even the already risk-reduced 60/40 portfolios provided while also having higher returns, Sharpe, and Sortino ratios. Even when compared to a 100% equity portfolio, all the trend-following strategies were able to provide significantly better volatilities, maximum drawdowns, and risk-adjusted returns. This outperformance occurred even though this 15-year period was not one of the most opportune for trend-following strategies. One can imagine that in the 21 years studied in Chapter 2 or even the shorter 9 or 10 years from 2007 or 2008 - 2017, this outperformance would be even greater across all statistics.

### 4.4.2 5-Year Portfolio Results

Having reviewed the performance of trend-following portfolios with an equally weighted equity asset allocation over the whole 15-year period available, in the interests of this chapter being relevant to a UK-based retail investor, the performance of a more typical asset allocation similar to that which was selected by Morningstar and would have been recommended to a UK individual investor was also studied. This allocation is shown in the top half of Table 4.6 and reallocated to 100% of the portfolio in the second half of the table. Although containing a clear UK home bias, it would have been prudent to consider the impacts of trend-following on such a portfolio as it was one which is readily used by individual investors within the UK. Only 5 years were studied due to the availability of the recommended allocation. For comparison purposes, the 5-year equally weighted portfolio was also reviewed.

#### 4.4.2.1 Benchmark Equity Portfolio Allocation Comparison

When comparing the UK allocation to the equally weighted allocation, the results show that the equally weighted portfolio (results in Table 4.7) outperformed the UK based allocation (Table 4.8) in terms of returns and risk-adjusted returns but with almost identical volatilities and maximum drawdowns for the 100% equity

benchmark portfolio and the two 60/40 portfolios. The only difference between the two portfolio allocations was the asset allocation weightings within the equity portion of the portfolios. Therefore, the underlying equity asset selection was shown to be the driver of the improvement in returns between the equally weighted portfolio and the UK based portfolio similar to the findings by Brinson *et al.* (1986) and Scott *et al.* (2017).

The creation of the 60/40 portfolios with lower or non-correlated gilt and cash assets had the expected reduction in absolute returns and risk adjusted returns, and improvements in volatility and maximum drawdown from the 100% equity portfolio. Over this 5-year period, the diversification between equity and cash or gilts was more responsible for the reduction in volatility and maximum drawdown for both allocations than the makeup of the equity within the portfolios as these statistics were nearly identical for both allocations. This could be due to equity markets during this time being highly correlated over these 5 years as shown in Table 4.9. Almost all of the equity markets had correlations of over 90% with the exception of the emerging markets and the Pacific indexes. The lowest correlations for these two markets were with the FTSE 250 with a 51% correlation between the FTSE 250 and the emerging markets and 73.6% between the Pacific and the FTSE 250. The rest of the correlations with the other markets across the Pacific index were over 80% and for the emerging market index over 65%.

Graph 4.2 shows the 5-year buy and hold returns for the individual equity markets. The markets moved together for the majority of this time and in an upwards direction. The drop in 2015 is visible across all markets but impacted the emerging markets and the Pacific indexes most severely explaining the lower correlation from these markets to the other equity markets.

Although highly correlated, the individual equity portfolio returns over the 5-year period varied and ranged from 8.69% for the emerging markets to 18.39% for the American index as shown on Table 4.10. It is obvious that a portfolio with an allocation that had a higher percentage of the American index would have a much higher return than one which instead had a higher percentage of the emerging markets index. The range of returns for the individual markets was much larger than the range for volatilities which went from 13.35% for the Pacific to 18.26% for

Japan. The act of combining the equity markets into a 100% equity portfolio allowed both asset allocations to have lower overall volatilities through the benefits of diversification, but as the two different portfolios had similar volatilities (11.13% and 11.15%) and maximum drawdowns (-18.60%, -18.10%) the selection of the equity assets within the equity allocation itself did not have as much of an impact as combining them with an asset with much lower level of volatility. The inclusion of cash or gilts further reduced the volatility to around 7.4% for both allocations and would have been the primary driver for the change in portfolio volatility instead of the market split of the equity allocation within it.

The difference in the results between the two equity portfolio allocations for the benchmark buy and hold and their 60/40 portfolios appeared to mainly be in returns and risk-adjusted returns with the equally weighted portfolio outperforming the more typical UK allocation. Although the volatility was reduced through diversification, the selection of the equity allocation within the portfolio had little impact on volatility. The high correlation between markets and the relatively shorter 5-year period may help to explain the similar volatility and maximum drawdown statistics across the two asset allocations.

#### 4.4.2.2 Trend-Following Equity Portfolio

The 5-year cumulative period, from 2012 to 2017, had an identical number of outperformances, 130, as there were in the 15-year period studied from 2002 to 2017 as shown in Table 4.5 (and reproduced from Table 2.6). One could therefore expect a similar pattern to the 5-year statistics for the equally weighted asset allocation portfolio in Table 4.7 as to the 15-year statistics in Table 4.3. For the most part, the pattern of over and under performance across the statistics was similar for both the equally weighted portfolio and the UK based portfolio (Table 4.8) when using a trend-following strategy over the 5 years as it was for the 15 years.

Over the 5-year period, all four trend-following strategies for both allocations had lower returns than the 100% equity portfolios, but also lower volatilities, improved maximum drawdowns, and higher risk-adjusted returns compared to the 100% equity benchmark. The trend-following portfolios again had returns and risk-adjusted returns which were higher than the 60/40 cash and gilt portfolios, but with a

slightly higher amount of volatility and improved maximum drawdowns for all but the 50v150 cash equally weighted portfolio.

The volatilities and maximum drawdowns for the 5-year trend-following portfolios across both asset allocations were not as relatively low as they were for the 15-year results. In the 15-year results the trend-following strategies had much reduced volatilities compared to the individual markets using trend-following, the 100% equity benchmark and the 60/40 portfolios. In the 5-year results, the trend-following portfolios all had reduced volatilities compared to the 100% equity portfolio, and the individual equity markets using trend-following (Table 4.10), but not against the 60/40 portfolios. This may be because the 5 years studied was a relatively short period of time and trend-following has been found to work best when reviewed over the course of whole business cycles as noted by Faber (2007). The strong, predominantly upward markets shown in Graph 4.2 over this period make it difficult for trend-following strategies to add significant value across all the equity markets.

The decrease in volatility compared to the 100% equity portfolios and the increase in return compared to the 60/40 portfolios led the trend-following portfolios to still have much improved Sharpe and Sortino ratios. The equally weighted trend-following portfolios had Sharpe ratios of 117.62% and 118.67% for the cash and 126.21% and 127.63% for the gilt 200 and 50v150-day trend-following portfolios respectively compared to the 108.52% and 113.79% for the 60/40 cash and gilt portfolios and the 111.04% from the 100% equity portfolio. The trend following strategies showed even greater improvements in Sortino ratios. The cash 200-day and 50v150-day trend-following strategies had Sortino ratios of 170.48% and 171.13% while the gilt versions had ratios of 182.67% and 183.77%. This was a large increase compared to the 60/40 cash and gilt benchmarks which had Sortino ratios of 156.10% and 164.75% respectively and the 100% equity portfolio which had a Sortino ratio of 160.09%.

Although using an equally weighted asset allocation for the equity portion of the portfolio could be considered a relatively impartial way to review trend-following strategies versus the buy and hold (although it still had a UK bias with the use of unit trusts for the FTSE 100 and FTSE 250), it is worth comparing it to a more

typical UK based allocation that might have been recommended by investment houses or used by individual investors. UK based allocation had a similar pattern of results as the equally weighted allocation, but as was found through the results of the underlying portfolios without trend-following, the returns and risk adjusted returns were slightly less than that from the equally weighted trend-following portfolios. The UK based allocation also had volatilities which were slightly higher than the equally weighted allocation, but there was not much difference between them.

The only statistic which was improved using the UK allocation was the maximum drawdown from -11.7% to -12.37% for the equally weighted trend-following portfolio to -10.51 to -11.70% for the UK trend-following portfolio allocation. In both instances this was a large improvement from the 100% equity buy and hold portfolio which had a maximum drawdown of -18.10%. All of the UK allocation trend-following strategies had lower drawdowns than the 100% equity benchmarks and the 60/40 portfolios across both allocations, the equally weighted trend-following portfolios, and the individual markets using trend-following themselves. Without the trend-following overlay, the UK based allocation had lower maximum drawdowns compared to the equally weighted allocation across all the portfolios, but the difference between the two was largest between the trend-following portfolios. This most likely due to the fact that the FTSE 100 had almost double the allocation it would have had in the equally weighted portfolio and over the 5 years the trend-following strategy for the FTSE 100 had the lowest maximum drawdown of only -10.71%.

Trend-following strategies can only ever perform as well as the underlying equity markets in terms of returns and therefore as well as the underlying equity allocation. This allocation within equities and the decision to include other assets had a direct impact on the value of the returns. Regardless of equity allocation, the trend-following portfolios themselves continued to provide a reduction in volatility and maximum drawdown through the benefits of diversification when compared to most of the individual markets with or without using trend-following and downside risk protection when compared to the 100% equity portfolio. Over these 5-years, the trend-following strategies had volatilities which were about halfway between the

benchmark and the 60/40 portfolios due to the shorter 5-year period, but overall had higher returns and risk-adjusted returns, and improved maximum drawdowns.

### 4.4.3 Coronavirus Crisis 2020 Extension

The effects of the coronavirus pandemic were felt throughout the world as the virus reached every corner of the globe. As the impacts of the rapidly spreading disease first became apparent in China and in Europe, borders closed, and economies shut down taking their equity markets down with them. As the virus originated in China, the Pacific market was the first to have a significant drop in values through the month of February with other markets following suit as the virus spread. The sudden, sharp, and dramatic drop across all equity markets as shown in Graph 4.3 reached its lowest point at the end of March. Realising the economic hardship that required lockdowns would cause businesses and individuals, governments and central banks issued stimulus packages, quantitative easing and furlough packages at record speed causing markets to quickly rebound from the month of April.

Although the individual markets suffered large maximum drawdowns over the course of the year, with the exceptionally large government and central bank intervention most of the markets recovered to post large returns by the end of the year, if not record-breaking highs in the case of the American market (Table 4.11). The markets with the largest returns were the emerging markets with a return over the year of 19.44%, followed by the Pacific with a return of 16.88% and the American index with a return of 13.99%. The only market with negative returns was the UK with both the FTSE 100 and FTSE 250 indexes having returns of -11.39% and -5.26% respectively. This may have been due to both the continued uncertainty over Brexit throughout 2020 and the relatively high number of covid cases.

Markets were highly correlated in both their fall and in their rebound (Table 4.12) with most equity market correlations for the year around or over 90% except for with the UK. The FTSE 100 and FTSE 250 still had strong positive correlations of 40-60% with the other equity markets but were over 90% correlated to each other. At the height of the panic and subsequent sell off in March, all assets lost value and became correlated in their fall including gilts and gold. Although cash “became king” for a few weeks, bonds regained their footing and as yields fell values

increased. The correlation to gilts across all equity markets was negative throughout the year with unusually high negative correlations of over -60% with the UK markets. As gilts are UK government bonds, it would make sense for the UK equity and UK government bond markets to have a higher correlation, positive or negative, than with other international markets.

#### 4.4.3.1 Trend-Following Results over 2020

The speed at which the drop in market values and the subsequent rebound occurred took many by surprise, including the trend-following strategies which were created to reduce maximum drawdown and volatility. The statistics from the individual markets shown in Table 4.11 and Graphs 4.4-4.7 reflect the difficulty of applying trend-following strategies. The drop in values was signalled by both trend-following strategies studied, but the 200-day moving average was able to register the drop more quickly as it compared only one day's value, at the end of month, to the longer 200-day average. The 50 v 150-day crossover was unable to signal an exit from equities until the 50-day average was low enough to drop below the 150-day average. As the strategies only trade once a month, unfortunately, this did not occur for the 50 v 150-day crossover until the beginning of April when the underlying markets were all rebounding.

#### 4.4.3.2 200-Day Moving Average

The 200-day moving average first recognised the drop in values in the Pacific from the beginning of February and signalled to be out of all other markets from the end of February/beginning of March as shown in Graphs 4.4 when moving into cash and Graph 4.5 when moving into gilts. In the cash version of the graph, it is much easier to see the trade decisions as cash did not provide any return and so instead the value when out of equities was reflected as a flat line. Although the 200-day moving average was more agile than the 50 v 150-day crossover at exiting the troubled markets, it still performed poorly because of the delay in returning to equity markets. The problem for the 200-day moving average was that the current daily price had to be over the remarkably high and recent past 200-day's average, approximately 10

months, before the strategy would signal to go back into equity markets. Only the passage of time or a large rise in values would allow the 200-day average to drop below the end of month's daily price. Unfortunately, this was not signalled until June for the American and Japanese indexes, July for the European, Pacific, and emerging markets, and not until December for the FTSE 100 and FTSE 250. The continued uncertainty and waves of the virus meant that there was a further signal to exit Japanese markets in August and re-enter in September, selling at a lower price than at which the strategy ended up rebuying.

For the 200-day moving average, only the gilts version of the trend-following strategy for the FTSE 100 and the Pacific index outperformed the buy and hold in terms of returns (Table 4.11). Although, the gilts strategy still ended the year for the FTSE 100 with a negative return of -9.82%. The returns were also negative for the FTSE 250 (-9.22%), Japan (-1.52%) and Europe (-7.03%), whose buy and hold versions had returns of -5.26%, 10.45% and 8.78% respectively. None of the cash versions outperformed the buy and hold due to the fundamental mathematical issue of the 200-day average being so much higher than the value after the drop and the ensuing end of month prices. This delayed market repurchases for most markets until they were higher than the price at which they sold.

As the 200-day moving average was able to exit markets quickly, it was still able to significantly reduce volatility and maximum drawdowns compared to the buy and hold across all markets. This is still an important factor for investors, and their nerves, who may have been wary of the volatility which they would have experienced and/or if they were also taking income from their accounts. In minimising these extreme losses, it would have reduced the sequence of returns risk and maintained a minimum value for their investments. Even though the 200-day moving average was able to reduce volatility, the low returns meant that only the Pacific and the emerging markets showed improved Sharpe and Sortino ratios than the buy and hold for both cash and gilts versions.

#### 4.4.3.3 50 v 150-Day Crossover

Unfortunately, the 50 v 150-day crossover completely mistimed the exit and delayed the re-entry into equity markets. The 50-day average was constructed from

almost 2 months of prices. This was relatively high compared to the prices for the previous 150-days. It therefore took until April for the 50-day average to include enough of the prices at the bottom of the market to counteract the previous highs and to signal to be out of equity markets. This was also just as the markets were reacting to the stimulus packages by governments and central banks, and the reduction in case numbers as the lockdowns were in effect, spring was arriving, and it appeared that an end may be only months away.

The delay in exiting equity markets was also mirrored with a further delay in market re-entry. The markets signalled to invest in the same order as the 200-day moving average, but only one month later for all markets except the UK. The 50 v 150-day crossover recommended to re-enter the American and Japanese indexes in July; Europe, the Pacific and emerging markets in August; and the FTSE 100 and FTSE 250 in September – three months earlier than the 200-day moving average. It then also signalled the FTSE 100 index to be out again from November until at least the end of the year.

This poor timing caused the 50v150-day crossover to end the year with negative returns, negative Sharpe and Sortino ratios, and an underperformance against the buy and hold across all markets in regard to these statistics. As the strategy was so slow in exiting equity markets, it exited after market values had reached their maximum drawdown, and therefore had the same maximum drawdowns as the buy and hold. The only statistic in which it was able to outperform was volatility, but that was mainly because the strategy spent most of the year in safer alternative cash or gilt assets.

#### 4.4.3.4 Portfolios

The statistics for the equally weighted equity buy and hold, and 60/40 cash and gilt portfolio benchmarks as well as the 200-day moving average and 50 v 150-day crossover trend-following strategies portfolios trading into both cash and gilts through 2020 are available in Table 4.13. All the benchmark portfolios had higher returns, Sharpe and Sortino ratios compared to the trend-following strategies. The 200-day moving average portfolio was able to register the improvement in volatility and maximum drawdown found throughout each of the individual market statistics.

Although not providing a return high enough for the Sharpe and Sortino ratios to outperform the 60/40 cash and gilt portfolios, the reduction in volatility was much less for the 200-day moving average portfolio to cash than the 60/40 portfolios and for the 200-day moving average portfolio to gilts was relatively close. The 200-day moving average portfolios using both cash and gilts had maximum drawdowns which were less than either of the 60/40 cash or gilt benchmark portfolios. The 50 v 150-day crossover portfolios trading to both cash and gilts continued to underperform with large negative returns and risk-adjusted returns, and with the same maximum drawdown as the underlying 100% equity benchmark portfolio.

Trend-following strategies rely on trends, established over time, to be able to perform. The emergence of the coronavirus had an impact similar to a sudden declaration of war or natural disaster, but yet one which was systematic across all markets and impossible to diversify out of in the short term, especially as all equity markets were so highly correlated over the year. The response by governments to provide fiscal support to economies created a dramatic welcome recovery to business and individuals especially in developed countries. The impact on trend-following strategies to these market movements was that the drop in values was so swift and great, that most trend-following strategies of different durations would have registered the fall and signalled to come out of equity markets, but all would have had long delays in being able to recognise prices rebounding over the longer averages. In fact, the best returns would have been from an investment in gilts alone or the 60/40 gilt portfolio which also had the highest risk-adjusted returns and relatively low volatilities and maximum drawdowns.

The universally established 200-day moving average was adept at signalling when to come out of equity markets, but a more flexible or a shorter signal would have been helpful in establishing when to return to equity markets. Investment managers who were by decree only able to follow the strict 200-day moving average set out before them, struggled with poor, but positive performance and would still be able to point to the virtues of lower volatilities and reductions in maximum drawdowns. Although this did not outperform for the return and risk-adjusted return statistics, this might still have been more appealing and provided a safety net for those most risk averse who might have otherwise sold and continued to be in cash. The return to equity in 2021 reflected across all 200-day moving averages could

have provided strong returns as markets continued to rebound with the hope of the eventual end or at least management of the coronavirus.

## 4.5 Conclusion

This chapter aimed to answer three main research questions. Does combining the optimum trend-following strategies, for each of the markets investigated in chapters 2 and 3, into a portfolio provide better returns, risk-adjusted returns, volatilities, and maximum drawdowns when compared to either a 100% equity portfolio or the popular mixed portfolio allocation containing 60% equity with either a 40% cash or 40% gilt allocation? Does the use of gilts instead of cash when out of equities continue to support the use of trend-following strategies as part of a portfolio? And how did trend-following strategies perform over the coronavirus crisis of 2020?

Firstly, when reviewing the 7 international equity unit trusts trend-following results individually over 15-years, certain trend-following strategies performed better than others. However, when combined as part of a diversified equally weighted portfolio over 15 years, the differences between the 200-day moving average and the 50/150-day crossover were minimal. Over the 15-years, the trend-following portfolios increased risk-adjusted returns in terms of Sharpe and Sortino ratios, reduced volatility, and improved maximum drawdowns when compared to the 100% equity portfolios.

The benefits of diversification found when creating a 100% equity buy and hold portfolio were decreased volatility compared to the individual markets and reduced dependency on any one market's returns. The effect of even a 40% allocation to cash or gilts compared to the 100% equity buy and hold portfolios lead to an increased amount of diversification and a further reduction in volatility and maximum drawdowns, but also reductions in returns and risk-adjusted returns. The buy and hold portfolio and the trend-following portfolios both experienced reduced volatilities and better maximum drawdowns when combined displaying the effects of diversification. Trend-following over 15-years created even further reduction in volatility and maximum drawdown than the inclusion of the 40% of cash or bonds to the portfolios. Over 5 years this reduction in volatility was not as great as the 60/40

portfolios due to the shorter period studied, but the trend-following portfolios still further reduced the volatility and maximum drawdown compared to the benefits of diversification within the 100% equity portfolio alone. The trend-following portfolios were also found to have higher returns than the 60/40 portfolios and better risk-adjusted returns than both the 60/40 portfolios and the 100% equity buy and hold portfolios. Trend-following strategies provided better risk-adjusted returns, volatilities, and drawdowns over both the 15 years and 5 years studied.

The underlying asset allocation within equities and the split to equities and other less correlated assets is still the main driver of returns and the foundation of the trend-following portfolio. In a bull market, trend-following portfolios can only ever achieve the highest returns that the underlying buy and hold equity markets do when they are compared to the buy and hold of the same assets. Over business cycles or in bear markets, a trend-following strategy may outperform the underlying buy and hold portfolio by exiting down markets and re-joining when the markets are on the way back up. Over the 15 and 5 years studied here or through 2020, the timing did not contribute to the trend-following strategies' returns in this way. Even though these periods and their start dates were not opportune for trend-following returns, the benefits of trend-following were still apparent although comparing a 100% equity trend-following portfolio to a 100% equity buy and hold benchmark portfolio is not comparing like for like.

Secondly, the use of gilts as the alternative investment instead of cash when the strategy is not in the equity index, increased average returns and risk-adjusted returns and reduced maximum drawdowns as compared to the portfolio which instead moved to cash. The trend-following portfolio over 15 years, all had higher returns, Sharpe and Sortino ratios, with lower volatilities and much lower maximum drawdowns than compared to the 100% equity portfolio as well as both portfolios with 60% equity and 40% cash or gilts. The 200-day moving average portfolio to gilts also had a return which outperformed both 60/40 portfolios and the 100% equity portfolio. Over 5 years, the results for the trend-following portfolios had volatilities that were slightly higher than the 60/40 portfolios, but they were lower than the 100% equity portfolio. They also had higher returns than the 60/40 portfolios but did not have returns which outperformed the 100% equity portfolio. The increased returns with only slightly raised volatilities compared to the 60/40

portfolios led the trend-following strategies with gilts to have superior risk-adjusted returns in both Sharpe and Sortino ratios and improved maximum drawdowns for both the equally weighted equity portfolio and the UK-based asset allocation when compared to the 100% equity portfolio and both 60/40 portfolios. This was no doubt due partly to the recent exceptional performance of gilt markets due to government intervention and quantitative easing.

Finally, all the studied trend-following strategies through the coronavirus crisis in 2020 had delays to both the exit and re-entry into equity markets and mistimed the start of the equity rebounds. However, they still provided reductions in volatilities and maximum drawdowns, but the losses in returns were so great that the Sharpe and Sortino ratios were less than the 100% or 60/40 benchmark portfolios. The ability to move out of sustained downturns needs to be observed over entire market cycles, but in this case, the losses and rebounds happened so quickly due to both the sudden lockdowns and sudden announcements of government support for economies that the markets moved more quickly than the selected trends could react. This could have been due to the fact that the information was disseminated quickly and in these instances the markets were incredibly efficient and impossible to time.

The specific contributions of this chapter were first, the demonstration of the benefits of using unit trust trend-following strategies combined into portfolios. Although the strategies individually did not have many risk-adjusted returns which outperformed the buy and hold, when combined within a portfolio they were able to provide significant reductions in volatilities and maximum drawdowns as was to be expected, but also provided improvements in risk-adjusted returns over both 15 and 5 years with both an equally weighted asset allocation and a UK-biased allocation. This demonstrates not only the impact of diversification but also the ability of trend-following to provide further benefits above diversification alone.

The use of gilts within the trend-following strategies over both the 15 and 5 years studied continued to provide extra returns, allowing the 200-day moving average portfolio to outperform the 100% equity buy and hold portfolio in returns as well as risk-adjusted returns, volatility, and large reductions in maximum drawdowns of more than half. This chapter therefore provides the contribution that the use of government bonds instead of just cash can provide further returns when

compared to cash as well as a greater reduction in risk compared to equity. Other types of assets such as money market funds, investment grade bonds or gold could also be studied as alternatives when out of equity markets instead of cash.

Another unique contribution was the study of trend-following portfolios of unit trusts over the coronavirus crisis throughout 2020. As this was so recent, there had not yet been many studies which have covered this period. This study provided a unique test of how trend following strategies perform where market corrections are short lived. The results in this study show that while many trend-following signals were able to catch the fall in markets reasonably quickly (given the extent of the fall in prices) and take the investment out of equity, none of the strategies were able to time the re-entry into equity markets in a timely manner due to the speed of recovery of most markets. This reveals a fundamental problem with using trend-following in relation to particular types of market correction. Further research is needed on whether to use different trend-following signals to exit and re-enter the equity markets. In particular, whether to use shorter signals to re-enter. This research could investigate whether a volatility-based switch in signals may produce better outcomes, or to review further types of trend-following signals. It should be noted that the trend-following strategies studied in this chapter had higher returns than a portfolio that switched completely to cash which some may have moved to, and also had reductions in volatilities compared to the all-equity or 60/40 benchmarks. In summary, trend following provided useful signals to time an exit from equity markets, but the re-entry signals need further research.

The last contribution of this chapter was the confirmation of previous trend-following research as Faber (2007) demonstrated that trend-following could provide equity-like returns with bond-like risk. Trend-following portfolios in this chapter were found to have equity-like risk-adjusted returns with 60/40 portfolio like risk. Through the reductions in risk, volatility and maximum drawdowns makes these portfolios similar to a 60/40 portfolio in terms of risk management, but typically with higher returns. For an investor who would be interested in risk management and concerned about sequence risk, the use of a trend-following overlay over the 15 and 5-years studied achieved lower volatility and maximum drawdowns with higher risk-adjusted returns from investing in a 100% equity portfolio with a trend-following overlay than with a 60% equity and 40% bond or cash portfolio. Of course, trend-

following strategies, like all strategies, are never going to be completely accurate. They could still miss a sudden large drop in values such as in 2020 and therefore when 100% invested in equities could still pose a larger amount of risk than an individual would feel comfortable. If a higher amount of return was required, it may be possible to consider the risk and return trade off and move up a level of risk when using a trend-following strategy while continuing to achieve lower volatility while still maintaining the awareness of the overall percentage of equity with which an investor would feel comfortable.

# Table 4.1: Number of Outperformances by Duration

**Total Number of Outperformances or Strategies Equal to Buy and Hold Across all Markets for all years**

| MA: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | 7 | 17 | 32 | 34 | 76 | 124 | 139 | 117 | 86 | 83 | 69 | 79 | 863 |
| Percentage | 1.3% | 3.2% | 5.9% | 6.3% | 14.1% | 23.0% | 25.8% | 21.7% | 16.0% | 15.4% | 12.8% | 14.7% | 13.3% |

| MA1: | 25 | 25 | 50 | 50 | 50 | 100 | 100 | 100 | 100 | 150 | 150 | 5 | 20 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 250 | 5 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA2: | 50 | 100 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 300 | 350 | 200 | 200 | 200 | 400 | 300 | 350 | 400 | 450 | 400 | 450 | 10 | 20 | Total |
| Number | 20 | 72 | 139 | 151 | 137 | 97 | 84 | 84 | 108 | 76 | 76 | 143 | 148 | 141 | 77 | 73 | 33 | 50 | 61 | 37 | 26 | 7 | 26 | 1866 |
| Percentage | 3.7% | 13.4% | 25.8% | 28.0% | 25.4% | 18.0% | 15.6% | 15.6% | 20.0% | 14.1% | 14.1% | 26.5% | 27.5% | 26.2% | 14.3% | 13.5% | 6.1% | 9.3% | 11.3% | 6.9% | 4.8% | 1.3% | 4.8% | 15.1% |

**Total Number of Outperformances Across 15 Years**

| MA: | 5 | 10 | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 1 | 0 | 4 | 11 | 9 | 9 | 3 | 2 | 2 | 2 |

| MA1: | 25 | 25 | 50 | 50 | 50 | 100 | 100 | 100 | 100 | 150 | 150 | 5 | 20 | 100 | 150 | 200 | 200 | 200 | 200 | 250 | 250 | 5 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA2: | 50 | 100 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 300 | 350 | 200 | 200 | 200 | 400 | 300 | 350 | 400 | 450 | 400 | 450 | 10 | 20 |
| | 0 | 4 | 8 | 9 | 10 | 6 | 0 | 0 | 3 | 3 | 4 | 13 | 12 | 12 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

These tables show the number of times each duration outperforms the buy-and-hold on a cumulative basis over 1-10 and 15 years. There are 7 strategies tested for each duration: daily and monthly trading for moving averages and crossovers into gilts and cash. These numbers can therefore be compared directly unlike the strategy results which have a larger number of crossover durations v. moving average durations.

# Table 4.2: 15-Year Results by Market

| 15 Years | HSBC FTSE 100 INDEX AC. RETAIL | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
|---|---|---|---|---|---|
| Annualised Rtn | 7.02% | 7.63% | 8.69% | 6.55% | 8.12% |
| Annualised Sharpe Ratio | 0.3574 | 0.5264 | 0.5853 | 0.4361 | 0.5375 |
| Annualised Sortino Ratio | 0.5019 | 0.7736 | 0.6628 | 0.6075 | 0.7500 |
| Annual Vol of rtn | 17.62% | 11.26% | 11.86% | 11.38% | 12.00% |
| Max Drawdown | -45.74% | -18.94% | -19.33% | -24.17% | -25.54% |
| | HSBC TRKR.FTSE 250 IDX. AC.RETAIL | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 11.88% | 11.96% | 13.33% | 12.25% | 14.51% |
| Annualised Sharpe Ratio | 0.6200 | 0.8116 | 0.8782 | 0.8475 | 0.9663 |
| Annualised Sortino Ratio | 0.8505 | 1.1573 | 1.1419 | 1.1687 | 1.3359 |
| Annual Vol of rtn | 16.87% | 12.12% | 12.61% | 11.86% | 12.47% |
| Max Drawdown | -52.36% | -20.37% | -20.58% | -21.42% | -20.33% |
| | HSBC AMER.INDEX AC. | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 9.20% | 6.21% | 7.13% | 7.94% | 9.12% |
| Annualised Sharpe Ratio | 0.4527 | 0.3774 | 0.4310 | 0.5363 | 0.6018 |
| Annualised Sortino Ratio | 0.6484 | 0.5362 | 0.6107 | 0.7839 | 0.8751 |
| Annual Vol of rtn | 18.61% | 12.79% | 13.28% | 11.65% | 12.25% |
| Max Drawdown | -37.03% | -23.27% | -21.03% | -15.19% | -15.39% |
| | HSBC JAPAN INDEX ACC | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 6.39% | 5.40% | 6.42% | 3.38% | 3.61% |
| Annualised Sharpe Ratio | 0.3070 | 0.2990 | 0.3553 | 0.1697 | 0.1828 |
| Annualised Sortino Ratio | 0.4367 | 0.4278 | 0.5056 | 0.2396 | 0.2570 |
| Annual Vol of rtn | 20.32% | 14.41% | 14.98% | 14.36% | 14.98% |
| Max Drawdown | -41.89% | -33.43% | -25.47% | -35.82% | -33.67% |
| | HSBC EUR.INDEX AC. | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 9.18% | 7.52% | 9.61% | 5.68% | 7.17% |
| Annualised Sharpe Ratio | 0.4355 | 0.4595 | 0.5835 | 0.3307 | 0.4207 |
| Annualised Sortino Ratio | 0.6150 | 0.6460 | 0.8219 | 0.4554 | 0.5804 |
| Annual Vol of rtn | 19.85% | 13.21% | 13.69% | 13.37% | 13.91% |
| Max Drawdown | -45.96% | -28.70% | -21.91% | -33.17% | -31.35% |
| | HSBC PACIFIC INDEX ACC | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 11.21% | 9.36% | 11.10% | 7.67% | 9.03% |
| Annualised Sharpe Ratio | 0.5526 | 0.5919 | 0.6874 | 0.4722 | 0.5473 |
| Annualised Sortino Ratio | 0.7802 | 0.8320 | 0.9669 | 0.6598 | 0.7651 |
| Annual Vol of rtn | 18.34% | 12.97% | 13.48% | 13.10% | 13.65% |
| Max Drawdown | -50.10% | -26.11% | -26.27% | -30.54% | -32.62% |
| | BLACKROCK EMRG.MKTS. AC. | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 12.01% | 11.78% | 12.61% | 9.84% | 11.76% |
| Annualised Sharpe Ratio | 0.5626 | 0.7186 | 0.7488 | 0.5871 | 0.6853 |
| Annualised Sortino Ratio | 0.7844 | 1.0230 | 1.0629 | 0.8267 | 0.9652 |
| Annual Vol of rtn | 19.71% | 13.77% | 14.26% | 14.03% | 14.58% |
| Max Drawdown | -55.09% | -24.32% | -24.60% | -30.60% | -32.57% |

Table 4.2: 15-year Results by Market for the buy and hold and the MA/XO trend-following strategies for each market with an investment to cash or gilts when not invested in the index. Column 1 represents the buy-and-hold performance of the underlying market unit trust. Columns 2- 5 represent the corresponding statistics for the 200-day end of month MA trading to cash and to gilts, and then the 50v150-day end of month XO trading to cash and to gilts. The strategies invested from Sept 2002 – Sept 2017.

# Table 4.3: Equally Weighted Portfolio Results Over 15 Years

**15 Year Equally Weighted Equity Portfolios: FTSE 100, FTSE 250, Emerging Markets, America, Japan, Europe and Pacific**

| | Benchmark | 60% Benchmark + 40% Cash | 60% Benchmark + 40% Gilts | L&G Gilts |
|---|---|---|---|---|
| Annualised Rtn | 9.83% | 7.23% | 7.44% | 1.28% |
| Annualised Sharpe Ratio | 54.66% | 49.68% | 52.47% | -5.80% |
| Annualised Sortino Ratio | 76.24% | 68.87% | 72.83% | -7.90% |
| Annual Vol of rtn | 15.44% | 11.18% | 10.88% | 6.41% |
| Max Drawdown | -44.19% | -33.85% | -34.02% | -14.79% |
| | EOM 200 Day MA Cash | EOM 200 Day MA to Gilts | EOM 50v150 XO Cash | EOM 50v150 Day XO Gilts |
| Annualised Rtn | 8.93% | 10.22% | 8.08% | 9.69% |
| Annualised Sharpe Ratio | 70.57% | 79.50% | 63.05% | 74.64% |
| Annualised Sortino Ratio | 98.50% | 111.41% | 87.28% | 103.70% |
| Annual Vol of rtn | 9.82% | 10.20% | 9.79% | 10.25% |
| Max Drawdown | -17.41% | -16.83% | -19.50% | -21.70% |

Table 4.3: All four of the selected trend-following strategies had higher Sharpe ratios, Sortino ratios, lower volatility, and smaller maximum drawdowns than the benchmark buy and hold and the 60/40 equity/cash or gilts portfolios. The 200 day moving averages had higher return and risk adjusted return statistics with comparable volatility and smaller maximum drawdown statistics than the 50v150 day crossover. With the inclusion of gilts, annualised return as well as a risk adjusted returns (Sharpe and Sortino ratios) were higher with a relatively small increase in volatility and comparable drawdowns. Although the trend-following strategies moving to cash underperformed against the benchmark in terms of returns (except the 200-day to gilts), when compared to the 60/40 equity/cash or gilt portfolios all the trend-following strategies had large improvements for all the statistics.

# Table 4.4: Percentage of Over or Underperformance Compared to the Benchmark

**15 Year Equally Weighted Portfolios % difference**

| | 60/40 C from B&H | 60/40 G from B&H |
|---|---|---|
| Annualised Rtn | -26.46% | -24.34% |
| Annualised Sharpe Ratio | -9.11% | -4.02% |
| Annualised Sortino Ratio | -9.67% | -4.48% |
| Annual Vol of rtn | -27.56% | -29.49% |
| Max Drawdown | -23.41% | -23.02% |

| | 200 MA to cash 60/40 | 200 MA to gilts 60/40 | 50/150 to cash 60/40 | 50/150 to gilts 60/40 | 200 MA to B&H | 200 MA to B&H | 50/150 to B&H | 50/150 to B&H |
|---|---|---|---|---|---|---|---|---|
| Annualised Rtn | 23.50% | 37.43% | 11.76% | 30.36% | -9.18% | 3.99% | -17.82% | -1.37% |
| Annualised Sharpe Ratio | 42.04% | 51.52% | 26.90% | 42.26% | 29.11% | 45.44% | 15.35% | 36.55% |
| Annualised Sortino Ratio | 43.02% | 52.97% | 26.73% | 42.39% | 29.19% | 46.12% | 14.47% | 36.02% |
| Annual Vol of rtn | -12.18% | -6.29% | -12.46% | -5.81% | -36.38% | -33.92% | -36.59% | -33.58% |
| Max Drawdown | -48.55% | -50.53% | -42.37% | -36.20% | -60.59% | -61.92% | -55.86% | -50.89% |

Table 4.4: The percentage of over or underperformance in the top row compares the performance of the 60/40 cash and gilt portfolios to the 100% equity buy and hold portfolio. The bottom row compares the performance of the trend-following strategies first to the similar cash or gilts 60/40 cash and gilt benchmark portfolio and the 100% equity buy and hold portfolio.

# Table 4.5: Total Cumulative Outperformances by Year for all Strategies

| | 2016-17 | 2015-17 | 2014-17 | 2013-17 | 2012-17 | 2011-17 | 2010-17 | 2009-17 | 2008-17 | 2007-17 | 2002-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total > | 34 | 88 | 241 | 177 | 130 | 85 | 71 | 44 | 302 | 360 | 130 |
| Total > = | 1078 | 90 | 243 | 178 | 131 | 85 | 71 | 44 | 302 | 360 | 130 |

Table 4.5: (Reproduced from Table 3.6) This table shows the number of outperformances across all strategies, durations and across all markets for each year ending in 2017. The years before a trough had the highest number of overall cumulative outperformances, such as 2007 and 2008 – 2017. While years in the trough or just after had the lowest number of outperformances with only 44 and 71 from 2009 and 2010-2017.

# Table 4.6: Typical Asset Allocation Over 5 Years

**Suggested Equity Allocation**

| Asset Allocation | 1.9.2012 - 1.7.2013 | 1.7.2013- 1.7.2014 | 1.7.2014 - 1.7.2015 | 1.7.2015-1.8.2016 | 1.8.2016 - 1.9.2017 |
|---|---|---|---|---|---|
| HSBC FTSE 100 | 26 | 25 | 20 | 20 | 20 |
| HSBC FTSE 250 | 12 | 13 | 19 | 19 | 19 |
| BLACKROCK EMG MKTS | 7 | 9 | 9 | 12 | 13 |
| HSBC AMER | 20 | 17 | 15 | 13 | 13 |
| HSBC JAPAN | 6 | 6 | 6 | 8 | 10 |
| HSBC EUR | 15 | 12 | 15 | 14 | 13 |
| HSBC PACIFIC INDEX ACC | 4 | 7 | 8 | 6 | 6 |
| Total Equity Allocation | 90 | 89 | 92 | 92 | 94 |

**All Equity Allocation**

| Asset Allocation | 1.9.2012 - 1.7.2013 | 1.7.2013- 1.7.2014 | 1.7.2014 - 1.7.2015 | 1.7.2015-1.8.2016 | 1.8.2016 - 1.9.2017 |
|---|---|---|---|---|---|
| HSBC FTSE 100 | 29% | 28% | 22% | 22% | 21% |
| HSBC FTSE 250 | 13% | 15% | 21% | 21% | 20% |
| BLACKROCK EMG MKTS | 8% | 10% | 10% | 13% | 14% |
| HSBC AMER | 22% | 19% | 16% | 14% | 14% |
| HSBC JAPAN | 7% | 7% | 7% | 9% | 11% |
| HSBC EUR | 17% | 13% | 16% | 15% | 14% |
| HSBC PACIFIC INDEX ACC | 4% | 8% | 9% | 7% | 6% |
| Total Equity Allocation | 1 | 1 | 1 | 1 | 1 |

Table 4.6: The top half of this table shows a typical UK based asset allocation used by UK investors similar to that which would have been recommended by Morningstar. The second half of the table was adjusted to allow the equity component to be equal to 100% of the allocation.

# Table 4.7: 5-Year Equally Weighted Equity Portfolio Performance

**5 Year Equally Weighted Equity Portfolios: FTSE 100, FTSE 250, Emerging Markets, America, Japan, Europe and Pacific**

| | Benchmark | 60% Benchmark + 40% Cash | 60% Benchmark + 40% Gilts | L&G Gilts |
|---|---|---|---|---|
| Annualised Rtn | 13.31% | 8.75% | 9.25% | 1.71% |
| Annualised Sharpe Ratio | 111.04% | 108.52% | 113.79% | 23.70% |
| Annualised Sortino Ratio | 160.09% | 156.10% | 164.75% | 33.51% |
| Annual Vol of rtn | 11.15% | 7.43% | 7.47% | 6.43% |
| Max Drawdown | -18.60% | -12.83% | -12.31% | -9.21% |
| | EOM 200 Day MA Cash | EOM 200 Day MA to Gilts | EOM 50v150 XO Cash | EOM 50v150 Day XO Gilts |
| Annualised Rtn | 11.38% | 12.36% | 11.10% | 12.06% |
| Annualised Sharpe Ratio | 117.62% | 126.21% | 118.67% | 127.63% |
| Annualised Sortino Ratio | 170.48% | 182.67% | 171.13% | 183.77% |
| Annual Vol of rtn | 8.92% | 8.98% | 8.61% | 8.67% |
| Max Drawdown | -11.99% | -11.77% | -12.37% | -11.70% |

Table 4.7: Over 5 years, the buy and hold 100% equity portfolio had the highest return, but the risk-adjusted returns, volatility and drawdown were better with any of the trend following strategies. The trend-following portfolios had similar volatilities and maximum drawdowns to the 60/40 cash and gilt portfolios, but with much higher returns. The use of gilts in the trend-following portfolios increased the returns and risk adjusted returns while adding only a slight amount of volatility and further minimising maximum drawdowns.

# Table 4.8: Asset Allocation Comparison Portfolio Results Over 5 Years

**5 Year Typical UK Equity Allocation Portfolios: FTSE 100, FTSE 250, Emerging Markets, America, Japan, Europe and Pacific**

| | Benchmark | 60% Benchmark + 40% Cash | 60% Benchmark + 40% Gilts | L&G Gilts |
|---|---|---|---|---|
| Annualised Rtn | 12.52% | 8.19% | 8.70% | 1.71% |
| Annualised Sharpe Ratio | 105.15% | 101.71% | 108.78% | 23.70% |
| Annualised Sortino Ratio | 149.58% | 144.14% | 154.67% | 33.51% |
| Annual Vol of rtn | 11.13% | 7.44% | 7.37% | 6.43% |
| Max Drawdown | -18.10% | -12.53% | -12.02% | -9.21% |
| | EOM 200 Day MA Cash | EOM 200 Day MA to Gilts | EOM 50v150 XO Cash | EOM 50v150 Day XO Gilts |
| Annualised Rtn | 10.88% | 11.88% | 10.81% | 11.92% |
| Annualised Sharpe Ratio | 112.21% | 120.83% | 114.16% | 123.66% |
| Annualised Sortino Ratio | 160.74% | 172.67% | 162.30% | 175.57% |
| Annual Vol of rtn | 8.97% | 9.05% | 8.74% | 8.86% |
| Max Drawdown | -11.70% | -10.51% | -10.79% | -10.42% |

Table 4.8: Over 5 years, the buy and hold 100% equity portfolio again had a higher return with a UK based equity asset allocation, but the risk-adjusted returns, volatility and drawdown were better with a trend-following strategy. The trend-following strategies again provided similar volatilities and better maximum drawdowns than the 60/40 cash and gilt portfolios, but with much higher returns and risk adjusted returns. Interestingly, the equally weighted portfolio in Table 4.7 outperformed the typical UK asset allocation in almost every measure. The volatilities and maximum drawdowns were similar amongst both asset allocations, with the difference between the two being the returns and risk adjusted returns. This confirms the findings that asset allocation drives returns while a trend-following strategy's main contribution was to reduce risk through the reduction of both volatility and maximum drawdown.

# Table 4.9: 5-Year Equity Asset Correlations

| Equity Correlations | HSBC FTSE 100 | HSBC FTSE 250 | BLACKROCK EM | HSBC AMER | HSBC JAPAN | HSBC EUR | HSBC PACIFIC | L&G GILTS |
|---|---|---|---|---|---|---|---|---|
| HSBC FTSE 100 | 100.0% | 91.7% | 77.0% | 91.7% | 92.2% | 98.0% | 90.6% | 64.2% |
| HSBC FTSE 250 | 91.7% | 100.0% | 51.0% | 93.1% | 92.3% | 94.9% | 73.6% | 69.1% |
| BLACKROCK EMG MKTS | 77.0% | 51.0% | 100.0% | 65.3% | 68.2% | 72.1% | 93.5% | 54.2% |
| HSBC AMER | 91.7% | 93.1% | 65.3% | 100.0% | 97.8% | 94.3% | 86.1% | 83.9% |
| HSBC JAPAN | 92.2% | 92.3% | 68.2% | 97.8% | 100.0% | 94.3% | 87.3% | 79.8% |
| HSBC EUR | 98.0% | 94.9% | 72.1% | 94.3% | 94.3% | 100.0% | 88.8% | 68.3% |
| HSBC PACIFIC | 90.6% | 73.6% | 93.5% | 86.1% | 87.3% | 88.8% | 100.0% | 70.2% |
| L&G GILTS | 64.2% | 69.1% | 54.2% | 83.9% | 79.8% | 68.3% | 70.2% | 100.0% |

Table 4.9: The equity correlations over the 5 years from 2012-2017 were over 90% correlated across most of the equity markets except for the emerging markets and the Pacific indexes. The correlations of the equity markets to gilts were also positive but depending on the market ranged from 54% to 84%.

# Table 4.10: 5-Year Individual Equity Portfolio Results

| 5 Years | HSBC FTSE 100 INDEX AC. RETAIL | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
|---|---|---|---|---|---|
| Annualised Rtn | 9.01% | 8.55% | 10.24% | 8.24% | 9.92% |
| Annualised Sharpe Ratio | 0.6624 | 0.7670 | 0.8826 | 0.7282 | 0.8388 |
| Annualised Sortino Ratio | 0.9275 | 1.0829 | 1.2401 | 1.0208 | 1.1799 |
| Annual Vol of rtn | 13.47% | 10.66% | 10.99% | 10.87% | 11.26% |
| Max Drawdown | -20.11% | -10.71% | -10.71% | -11.66% | -11.32% |
| | HSBC TRKR.FTSE 250 IDX. AC.RETAIL | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 13.95% | 9.63% | 10.95% | 12.93% | 15.47% |
| Annualised Sharpe Ratio | 0.9765 | 0.7648 | 0.8465 | 1.0204 | 1.1733 |
| Annualised Sortino Ratio | 1.3392 | 1.0281 | 1.1410 | 1.3964 | 1.6124 |
| Annual Vol of rtn | 13.53% | 12.17% | 12.39% | 11.90% | 12.21% |
| Max Drawdown | -16.49% | -20.37% | -20.58% | -16.82% | -14.67% |
| | HSBC AMER.INDEX AC. | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 18.39% | 14.18% | 13.56% | 17.72% | 17.34% |
| Annualised Sharpe Ratio | 1.1929 | 1.0013 | 0.9581 | 1.2367 | 1.2061 |
| Annualised Sortino Ratio | 1.8257 | 1.5279 | 1.4528 | 1.9067 | 1.8543 |
| Annual Vol of rtn | 14.25% | 13.36% | 13.43% | 13.18% | 13.26% |
| Max Drawdown | -16.47% | -18.47% | -16.17% | -13.99% | -15.39% |
| | HSBC JAPAN INDEX ACC | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 15.67% | 14.61% | 14.52% | 10.47% | 9.70% |
| Annualised Sharpe Ratio | 0.8435 | 0.8936 | 0.8814 | 0.6791 | 0.6281 |
| Annualised Sortino Ratio | 1.2378 | 1.3385 | 1.3186 | 0.9949 | 0.9177 |
| Annual Vol of rtn | 18.26% | 15.77% | 15.93% | 15.44% | 15.68% |
| Max Drawdown | -19.64% | -16.90% | -17.17% | -26.24% | -26.55% |
| | HSBC EUR.INDEX AC. | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 15.21% | 12.35% | 14.28% | 12.82% | 14.79% |
| Annualised Sharpe Ratio | 0.9713 | 0.9173 | 1.0289 | 0.9781 | 1.0883 |
| Annualised Sortino Ratio | 1.3949 | 1.3178 | 1.4754 | 1.3996 | 1.5554 |
| Annual Vol of rtn | 14.89% | 12.80% | 13.04% | 12.36% | 12.69% |
| Max Drawdown | -18.35% | -16.01% | -13.29% | -15.47% | -13.29% |
| | HSBC PACIFIC INDEX ACC | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 10.85% | 9.44% | 11.81% | 6.28% | 7.06% |
| Annualised Sharpe Ratio | 0.7879 | 0.8572 | 1.0182 | 0.5853 | 0.6297 |
| Annualised Sortino Ratio | 1.1502 | 1.2841 | 1.5180 | 0.8593 | 0.9195 |
| Annual Vol of rtn | 13.35% | 10.42% | 10.85% | 10.43% | 10.89% |
| Max Drawdown | -27.47% | -18.48% | -16.30% | -28.24% | -27.62% |
| | BLACKROCK EMRG.MKTS. AC. | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 8.69% | 10.26% | 10.81% | 7.52% | 8.49% |
| Annualised Sharpe Ratio | 0.5942 | 0.8596 | 0.8680 | 0.6498 | 0.7015 |
| Annualised Sortino Ratio | 0.8333 | 1.2342 | 1.2416 | 0.9245 | 0.9970 |
| Annual Vol of rtn | 14.87% | 11.35% | 11.86% | 11.26% | 11.75% |
| Max Drawdown | -32.65% | -18.64% | -18.64% | -21.63% | -22.50% |

Table 4.10: 5-year Results by Market for the buy and hold and the MA/XO trend-following strategies for each market with an investment to cash or gilts when not invested in the index. Column 1 represents the buy-and-hold performance of the underlying market unit trust. Columns 2- 5 represent the corresponding statistics for the 200-day end of month MA to cash and to gilt, and then the 50v150-day end of month XO to cash and to gilts. The strategies invested from Sept 2012 – Sept 2017.

The use of a trend-following strategy always reduced volatility and, in most cases, also reduced maximum drawdown.

# Table 4.11: Equity Markets During the Coronavirus Crisis of 2020

| 1 Year: 2020 | HSBC FTSE 100 INDEX AC. RETAIL | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
|---|---|---|---|---|---|
| Annualised Rtn | -11.39% | -11.68% | -9.82% | -30.03% | -30.62% |
| Annualised Sharpe Ratio | -0.0160 | -0.0745 | -0.0385 | -0.0842 | -0.0835 |
| Annualised Sortino Ratio | -0.0207 | -0.0860 | -0.0514 | -0.1003 | -0.1001 |
| Annual Vol of rtn | 1.84% | 0.62% | 0.92% | 1.49% | 1.53% |
| Max Drawdown | -34.86% | -15.25% | -19.33% | -34.86% | -34.86% |
| | HSBC TRKR.FTSE 250 IDX. AC.RETAIL | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | -5.26% | -9.22% | -8.74% | -21.66% | -23.70% |
| Annualised Sharpe Ratio | 0.0013 | -0.0562 | -0.0334 | -0.0400 | -0.0447 |
| Annualised Sortino Ratio | 0.0017 | -0.0695 | -0.0460 | -0.0510 | -0.0570 |
| Annual Vol of rtn | 2.17% | 0.63% | 0.93% | 1.88% | 1.90% |
| Max Drawdown | -43.34% | -14.03% | -18.64% | -43.34% | -43.34% |
| | HSBC AMER.INDEX AC. | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 13.99% | 4.98% | 10.66% | -8.17% | -6.89% |
| Annualised Sharpe Ratio | 0.0378 | 0.0222 | 0.0372 | -0.0160 | -0.0119 |
| Annualised Sortino Ratio | 0.0526 | 0.0308 | 0.0535 | -0.0207 | -0.0154 |
| Annual Vol of rtn | 1.67% | 1.06% | 1.22% | 1.42% | 1.45% |
| Max Drawdown | -26.29% | -16.44% | -18.26% | -26.29% | -26.29% |
| | HSBC JAPAN INDEX ACC | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 10.45% | -1.52% | -1.14% | -3.43% | -1.98% |
| Annualised Sharpe Ratio | 0.0346 | -0.0032 | 0.0005 | -0.0062 | -0.0010 |
| Annualised Sortino Ratio | 0.0506 | -0.0046 | 0.0008 | -0.0086 | -0.0014 |
| Annual Vol of rtn | 1.33% | 0.85% | 1.05% | 1.16% | 1.18% |
| Max Drawdown | -22.34% | -16.79% | -15.50% | -22.34% | -22.34% |
| | HSBC EUR.INDEX AC. | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 8.78% | -7.03% | -6.52% | -11.12% | -9.89% |
| Annualised Sharpe Ratio | 0.0275 | -0.0287 | -0.0192 | -0.0238 | -0.0197 |
| Annualised Sortino Ratio | 0.0357 | -0.0368 | -0.0261 | -0.0291 | -0.0242 |
| Annual Vol of rtn | 1.64% | 0.86% | 1.07% | 1.45% | 1.48% |
| Max Drawdown | -30.96% | -13.81% | -15.34% | -30.96% | -30.96% |
| | HSBC PACIFIC INDEX ACC | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 16.88% | 16.85% | 21.97% | -4.68% | -4.26% |
| Annualised Sharpe Ratio | 0.0493 | 0.0846 | 0.0821 | -0.0097 | -0.0079 |
| Annualised Sortino Ratio | 0.0675 | 0.1233 | 0.1242 | -0.0126 | -0.0102 |
| Annual Vol of rtn | 1.39% | 0.72% | 0.97% | 1.19% | 1.22% |
| Max Drawdown | -28.70% | -7.21% | -11.20% | -28.70% | -28.70% |
| | BLACKROCK EMRG.MKTS. AC. | EOM 200-Day MA Cash | EOM 200-Day MA Gilt | EOM 50v150 XO Cash | EOM 50v150 XO Gilt |
| Annualised Rtn | 19.44% | 13.94% | 16.18% | -5.15% | -3.90% |
| Annualised Sharpe Ratio | 0.0521 | 0.0585 | 0.0564 | -0.0096 | -0.0053 |
| Annualised Sortino Ratio | 0.0715 | 0.0842 | 0.0835 | -0.0122 | -0.0069 |
| Annual Vol of rtn | 1.50% | 0.91% | 1.11% | 1.29% | 1.31% |
| Max Drawdown | -24.53% | -11.09% | -15.34% | -24.64% | -24.53% |

Table 4.11: The 2020, 1-year results by market for the buy and hold and the MA/XO trend-following strategies for each market with an investment to cash or gilts when not invested in the index. Column 1 represents the buy-and-hold performance of the underlying market unit trust. Columns 2- 5 represent the corresponding statistics for the 200-day end of month MA to cash and to gilt, and then the 50v150-day end of month XO to cash and to gilts.

Although maximum drawdowns were large across all markets, the quick rebound after the drop in values in March and subsequent government support and intervention left most markets with large returns over the year except for the UK markets. The drop in values was so sudden and steep that the monthly trend-following signals were delayed in both exit and re-entry to equity markets with the 50v150 portfolios completely mistiming both.

# Table 4.12: Market Correlations Through 2020

| Equity Correlations | HSBC FTSE 100 | HSBC FTSE 250 | BLACKROCK EM | HSBC AMER | HSBC JAPAN | HSBC EUR | HSBC PACIFIC | L&G GILTS |
|---|---|---|---|---|---|---|---|---|
| HSBC FTSE 100 | 100.0% | 94.2% | 49.2% | 41.7% | 46.5% | 63.3% | 55.0% | -66.0% |
| HSBC FTSE 250 | 94.2% | 100.0% | 69.6% | 61.6% | 63.8% | 77.7% | 74.6% | -61.4% |
| BLACKROCK EMG MKTS | 49.2% | 69.6% | 100.0% | 94.9% | 92.1% | 95.2% | 98.9% | -15.2% |
| HSBC AMER | 41.7% | 61.6% | 94.9% | 100.0% | 91.8% | 93.5% | 93.2% | -4.9% |
| HSBC JAPAN | 46.5% | 63.8% | 92.1% | 91.8% | 100.0% | 89.8% | 93.3% | -10.0% |
| HSBC EUR | 63.3% | 77.7% | 95.2% | 93.5% | 89.8% | 100.0% | 95.1% | -22.0% |
| HSBC PACIFIC | 55.0% | 74.6% | 98.9% | 93.2% | 93.3% | 95.1% | 100.0% | -19.0% |
| L&G GILTS | -66.0% | -61.4% | -15.2% | -4.9% | -10.0% | -22.0% | -19.0% | 100.0% |

Table 4.12: The equity market correlations throughout this time were relatively high across all equity markets as the sharp and sudden drop in equity values and subsequent rebound impacted all markets. The FTSE 100 and FTSE 250 were less correlated to the other equity markets, but very highly correlated with each other over this period most likely due to the continued uncertainty over Brexit. The correlation of the equity markets to gilts during 2020 was negative with an extremely high negative correlation to the UK markets.

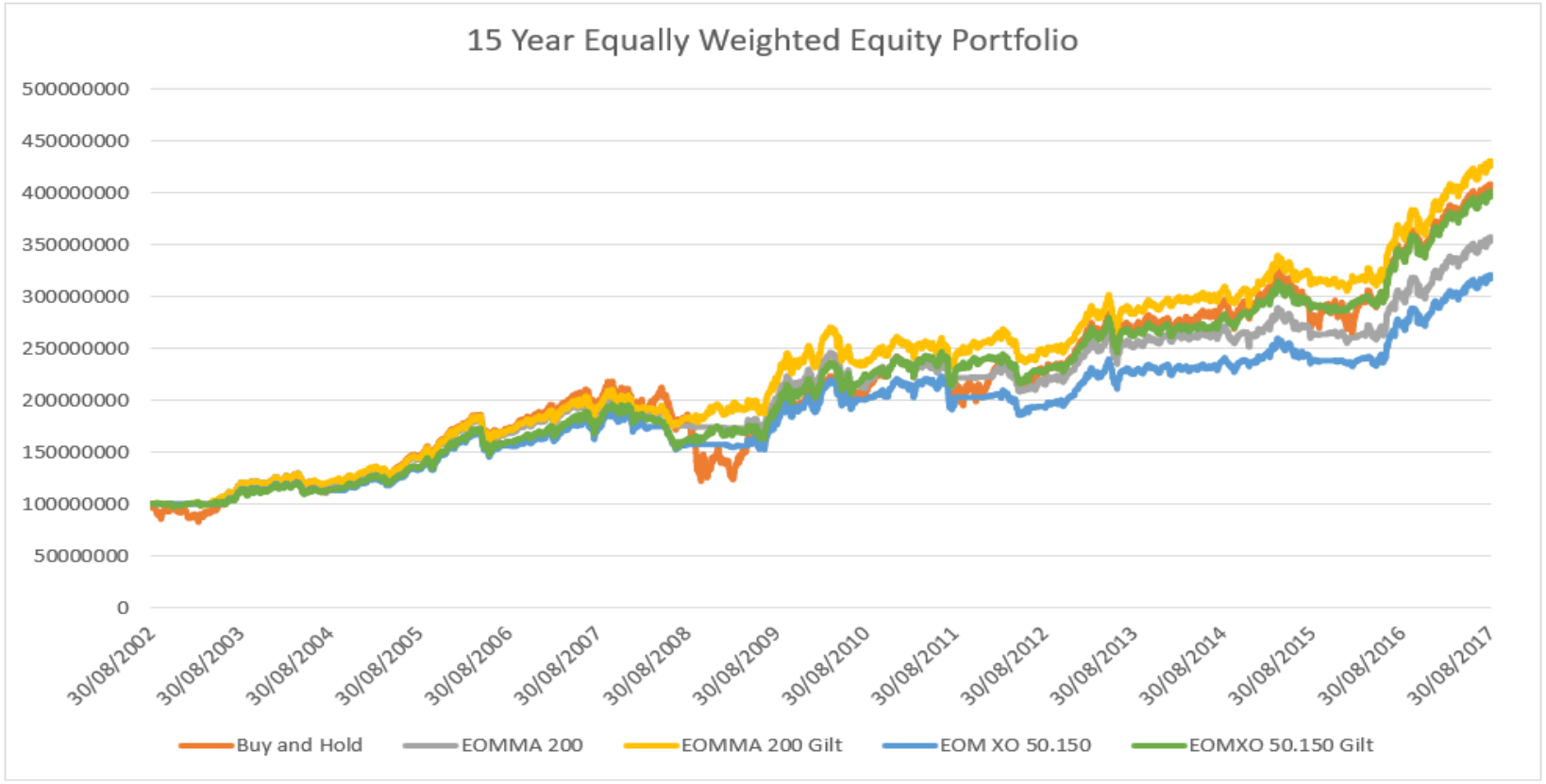
# Table 4.13: How Trend Following Fared During the Coronavirus Crisis of 2020

**2020: Equally Weighted Equity Portfolios: FTSE 100, FTSE 250, Emerging Markets, America, Japan, Europe and Pacific**

| | Benchmark | 60% Benchmark + 40% Cash | 60% Benchmark + 40% Gilts | L&G Gilts |
|---|---|---|---|---|
| Annualised Rtn | 7.55% | 4.53% | 7.80% | 8.16% |
| Annualised Sharpe Ratio | 2.65% | 2.46% | 3.99% | 4.34% |
| Annualised Sortino Ratio | 3.57% | 3.30% | 5.95% | 6.79% |
| Annual Vol of rtn | 1.39% | 0.79% | 0.78% | 0.74% |
| Max Drawdown | -27.80% | -16.88% | -17.69% | -11.20% |
| | EOM 200 Day MA Cash | EOM 200 Day MA to Gilts | EOM 50v150 XO Cash | EOM 50v150 Day XO Gilts |
| Annualised Rtn | 0.90% | 3.23% | -12.03% | -11.60% |
| Annualised Sharpe Ratio | 0.78% | 1.77% | -3.59% | -3.33% |
| Annualised Sortino Ratio | 1.01% | 2.55% | -4.44% | -4.14% |
| Annual Vol of rtn | 0.59% | 0.85% | 1.18% | 1.20% |
| Max Drawdown | -11.66% | -15.44% | -27.80% | -27.80% |

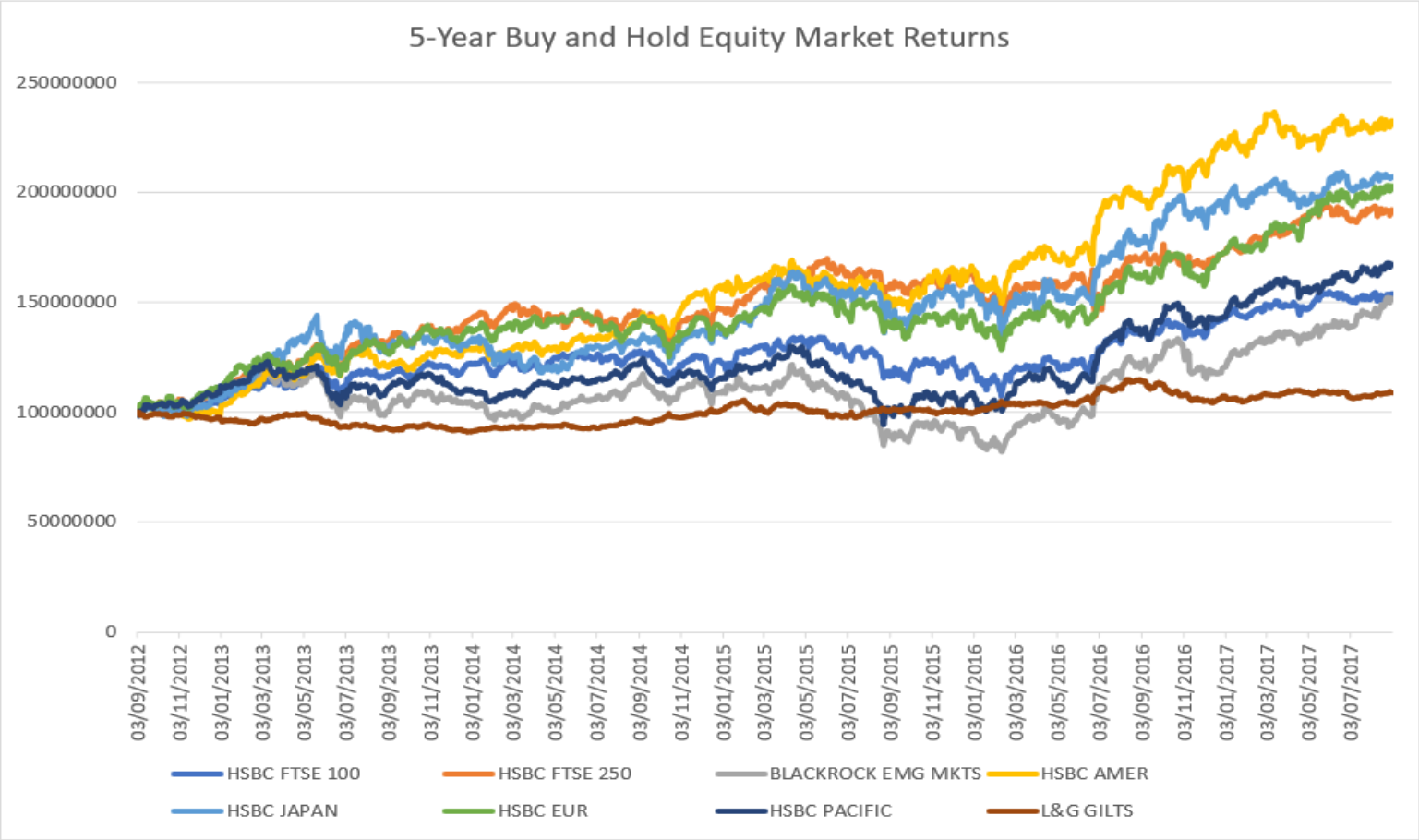
Table 4.13: The sharp and deep contraction across equity markets in response to the coronavirus in March 2020 was so sudden that monthly trend-following strategies struggled to react to the drop in values and was so deep that the trend-following strategies struggled to register when to re-enter equity markets. The 50v150-day crossover was too slow to react and hence had the same drawdowns as the benchmark itself. The 200-day moving average was able to exit some of the markets before the crash but missed most of the rebound by the relatively low continued valuations compared to the previous 200-day average.

## Graph 4.1: 15-Year Returns for an Equally Weighted Portfolio (Sept 2002-Sept 2017)



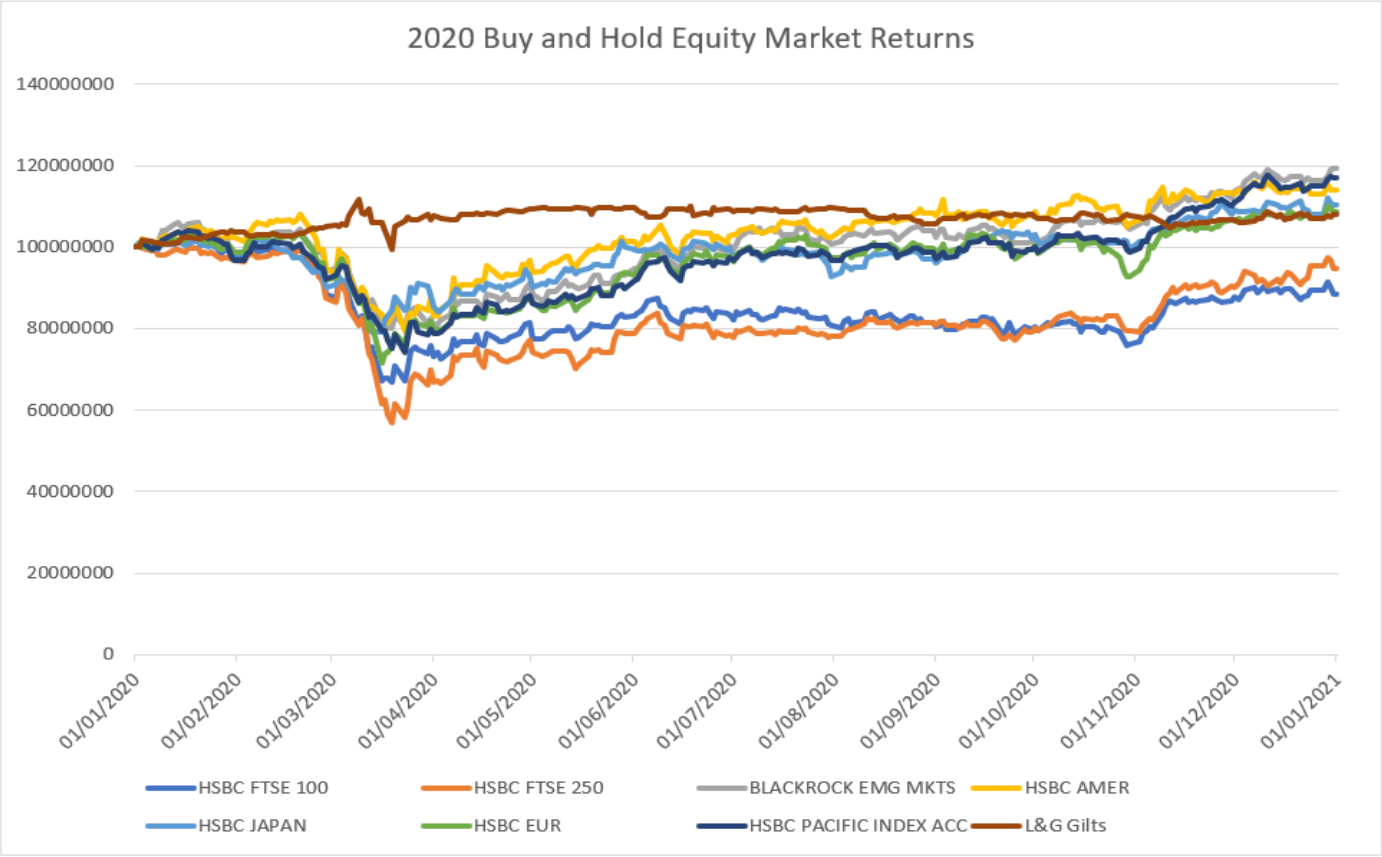

Graph 4.1: This graph shows the cumulative 15-year returns of the benchmark buy and hold portfolio as well as the alternative trend following portfolios. The portfolios with the highest returns were both of the trend following portfolios which traded into gilts when not in equities while the trend-following portfolios which traded into cash underperformed over the 15 years. All trend following portfolios had better Sharpe ratios, Sortino ratios, volatilities, and maximum drawdowns.

# Graph 4.2: Equity Market Returns Over 5 Years



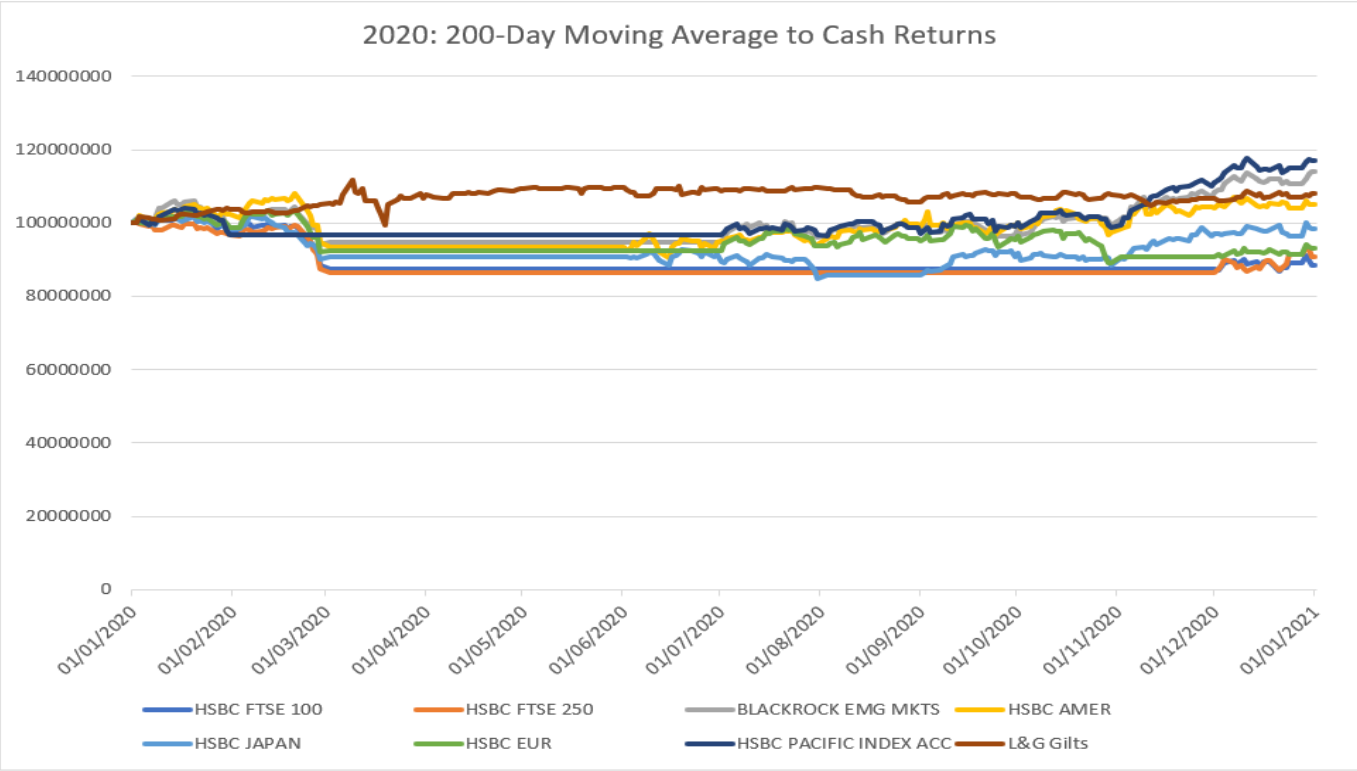

Graph 4.2: The cumulative 5-year returns of the individual buy and hold equity markets had a strong upward trend and were relatively correlated. The drop in values in 2015 impacted all markets but had the strongest effect on the emerging market and Pacific indexes.

# Graph 4.3: Equity Market Returns over the Coronavirus Crisis in 2020



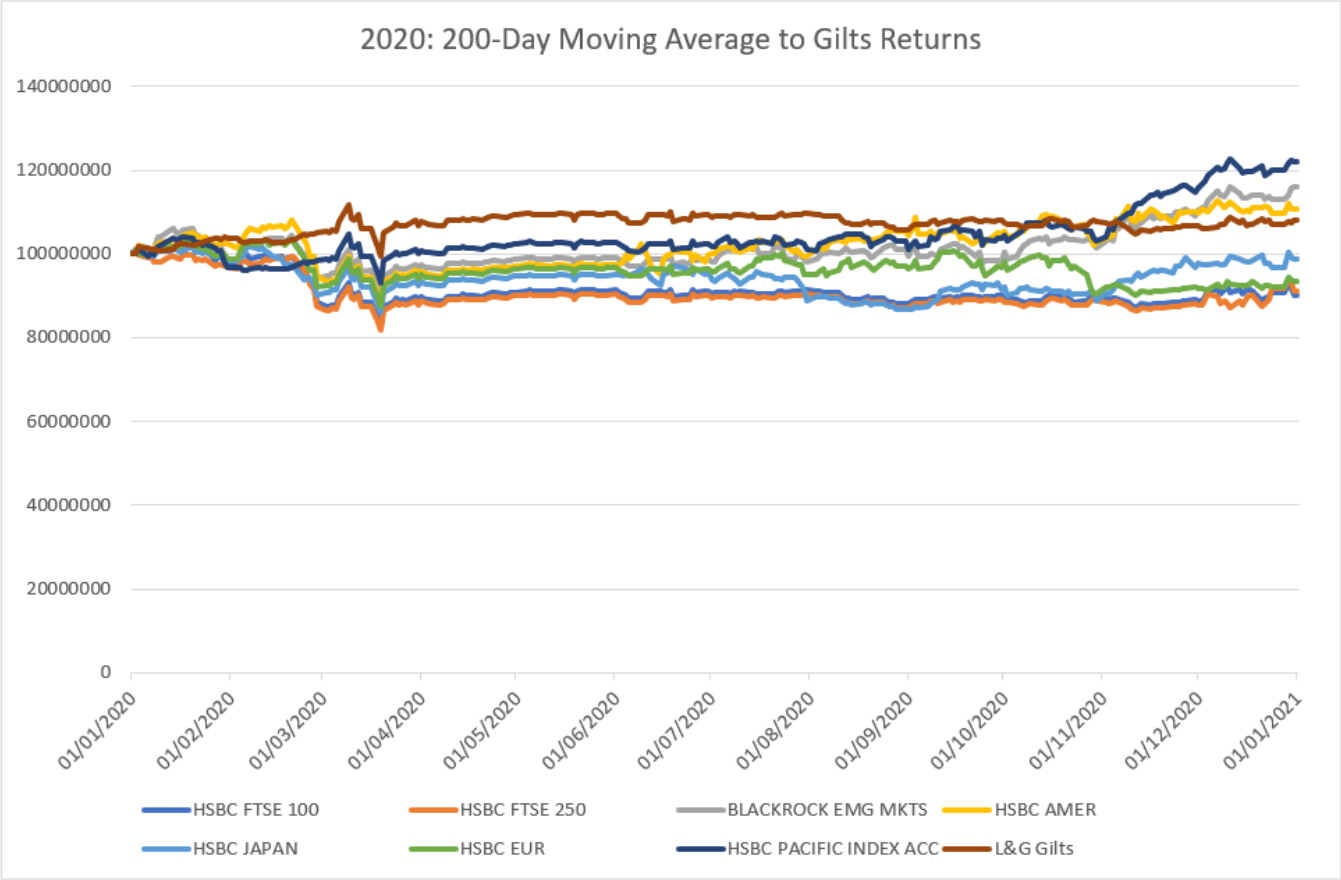

Graph 4.3: The coronavirus caused a sharp and dramatic drop in values in February and March of 2020. The impact was felt throughout all markets with correlations throughout the year relatively high across equity markets except for the UK. The FTSE 100 and FTSE 250 were highly correlated with each other, but less so with the other markets. This may have also been caused by the continued uncertainty throughout the year over Brexit.

# Graph 4.4: Coronavirus Crisis in 2020: 200-Day Moving Average to Cash



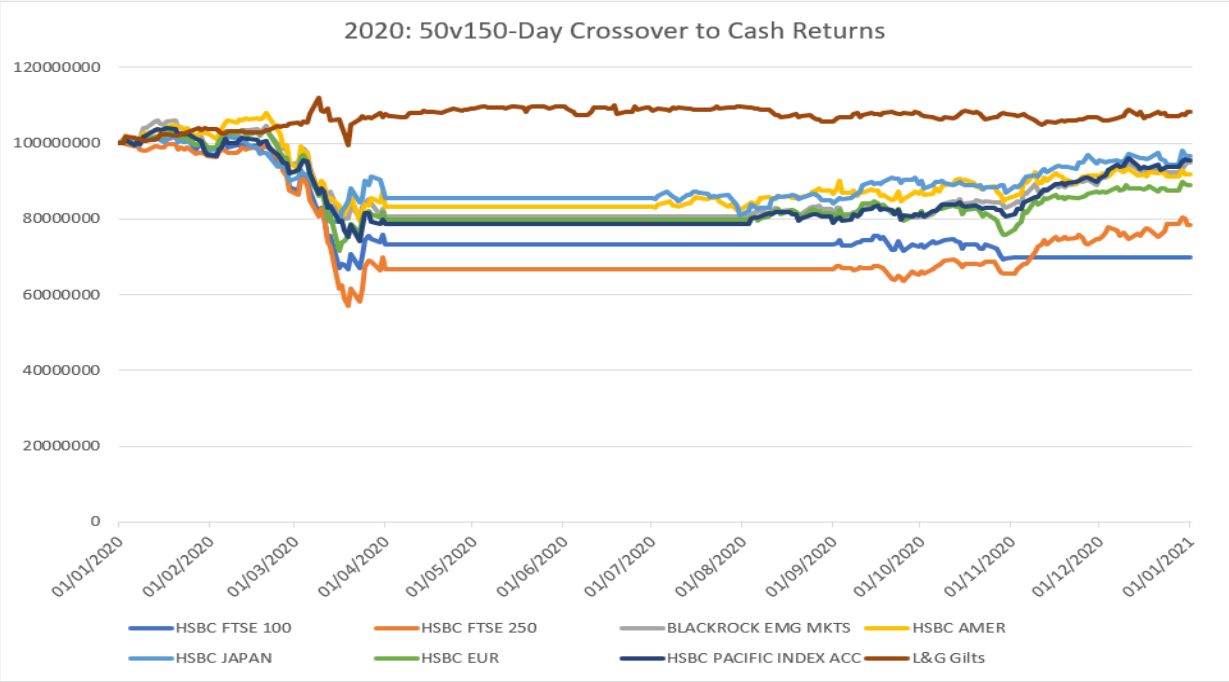

Graph 4.4: The 200-day moving average was able to exit across all markets relatively early on March 1, 2020. Unfortunately, the drop in values was so deep and sudden the comparison of the daily price to the previous 200-day average which would have included prices for the previous approximately 10 months would have been so high, it would have taken some time to register a buy signal. The American and Japanese indexes were the first to re-join equity markets in June, with the emerging markets, Europe, and Pacific re-joining in July. The 200-day MA signalled to be out of the Japanese index again for just the month of August while the UK market did not signal to re-join again until December. The Japanese, European, FTSE 100, and FTSE 250 indexes all ended the year with negative returns.

# Graph 4.5: Coronavirus Crisis in 2020: 200-Day Moving Average to Gilts



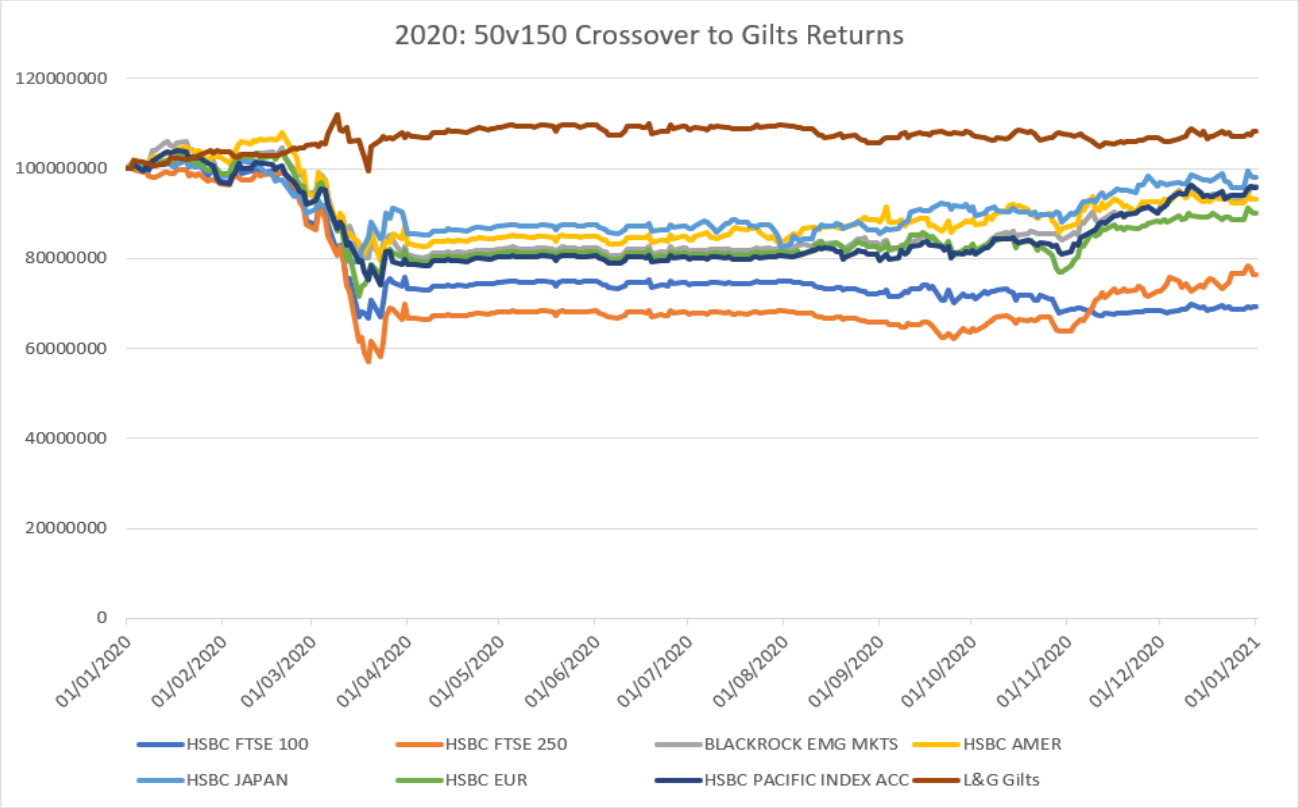

Graph 4.5: The 200-day moving average to gilts follows the same signals as when moving to cash. The only difference between the two strategies was the investment into gilts instead of cash when out of equity markets. This was able to provide a higher return than moving to cash alone, but also increased volatility and maximum drawdowns.

# Graph 4.6: Coronavirus Crisis in 2020: 50v150-Day Crossover to Cash




Graph 4.6: The larger duration of 50 days used in the crossover instead of the one day moving average comparison, caused the crossover to delay the exit across equity markets until April. This was after the worst of the drawdowns had already occurred and as the markets were rebounding. The markets were also further delayed in the re-enter to equities. The trend-following signals did not recommend re-joining for the American and Japanese indexes until July, for the European, Pacific and the emerging markets until August, and the FTSE 100 and FTSE 250 in September. The signal in November recommended selling the FTSE 100 and instead finished the year invested into cash. The overall impact was therefore that all of the markets using the 50 v 150 day crossover ended the year with negative returns.

# Graph 4.7: Coronavirus Crisis in 2020: 50v150-Day Crossover to Gilts




Graph 4.7: The signals for the 50v150 crossover to gilts were again the same as the signals to cash. The investment into gilts instead of cash when out of the equity markets improved returns, but slightly increased volatility. There was no impact to the maximum drawdown from cash to gilts as the 50v150-day crossover signals missed the exit out of equities. Instead, both cash and gilts had the large maximum drawdown that the benchmark 100% equity buy and hold experienced. Even with the improvement in gilts returns, all equity markets using this trend-following strategy finished the year with negative returns.

# 5 Conclusion

## 5.1 Motivation

Faber (2007), ap Gwilym, Clare, Seaton, and Thomas (2010) and Clare, Seaton, Smith and Thomas (2013, 2016a) found that trend-following strategies were able to provide excess returns and risk-adjusted returns while also reducing volatilities and maximum drawdowns. As equity market have been found to be more highly correlated when markets fall (Longin and Solnik, 2001; Ang and Bekaert, 2002; Amira, Taamouti, and Tsafack, 2011) and more especially since the 2008 financial crisis (Straatman, 2013) with a US, non-US correlation of 0.80 at of the end of Sept 2018 (Scott, Stockton, and Donaldson, 2019), a strategy such as trend-following could add an alternative source of risk control above asset allocation alone when it is most needed, as markets are falling (McMillan, 2012).

Furthermore, Clare, Seaton, Smith, and Thomas (2016b, 2017, 2021) found that although not empirically related, reductions in maximum drawdowns, such as those found through the use of trend following, had direct positive implications for reductions in sequence risk. Sequence risk is the risk associated with the order in which positive and negative returns occur and the significant detrimental impact this can have on the final values of an investment if negative values occur at the start of income drawdown.

To tactically modify asset allocations to avoid losses and reduce sequence such as a de-risking/"guide path" strategy that reduces equity allocation as retirement approaches could potentially be costly and lead to portfolio failure (Clare *et al.*, 2017). Bengen (1994), as well as Guyton and Klinger (2006), Frank, Mitchell and Blanchett (2011) and Clare *et al.* (2017, 2021) found that reductions in equity allocation when in or approaching retirement was detrimental to the value of the total investment and put the longevity of the portfolio at risk. Alternatively, the reduction in sequence risk found when using trend following could therefore have beneficial implications for an investor approaching or in retirement and taking an income from their investments (Clare *et al.*, 2017, 2021).

This study therefore investigates the benefits of trend-following applied to equity investments.

## 5.2 Aims and Gaps in Previous Literature

The aim of this thesis was to extend the previous trend-following research to unit trusts as they are well-known, relatively inexpensive, easily available and are regularly used by retail investors within investment accounts. Although trend-following has been found to be profitable and to reduce risk across asset classes such as commodities, equity markets, bond markets, and currencies, these studies were typically implemented through indices (Faber, 2007; Clare *et al.* 2013, 2016a, Hurst, 2017). There was a gap in previous research as little, if any, studies had utilised unit trusts as the equity investment. This was an important extension of this work due to the popularity of unit trusts but also because of their idiosyncrasies. Unlike other assets, they are only created and redeemed once a day, which creates a lag when completing transactions, and they are highly utilised by retail investors. The higher level of inexperienced, retail investors could impact the level of behavioural biases to a larger extent with unit trusts compared to other investments such as ETFs or not be as apparent as would be seen in indices. One aim of this research was therefore to investigate whether the benefits of trend-following found in previous studies could be obtained from using a retail investor vehicle such as a unit trust.

There has also been a gap in the literature around the choice of the alternative asset when the trend-following strategy signals to exit equity markets. Previous studies typically invest into a cash-like proxy such as the 3-month US Treasury Bill (Faber, 2007; ap Gwilym *et al.*, 2010; Clare *et al.* 2013, 2016a). The use of UK government bonds (gilts) was studied as it provided a reduction in risk to equities, but a potential increase in returns when compared to cash.

Two further gaps in previous literature have been the review of trend-following over shorter time periods. Most previous studies examine the effects of trend following over long investment periods. Trend-following strategies examined over periods from 20-60 years have been studied by Faber (2007), ap Gwilym *et al.* (2010), Clare *et al*.(2013, 2016a) and even over 100 years by Hurst *et al*. (2017). The

practical problem with this is that retail investors are increasingly focused on shorter time horizons. Faber (2007) found that trend-following strategies are most effective over whole business cycles and that in over 40% of the individual years he studied they underperformed. The review of the experience for an investor would therefore be useful.

The final gap in literature was that there had been no study investigating the application of trend-following to a sudden market correction followed by a quick recovery. This was the experience of most equity markets in early-mid 2020 caused by the coronavirus pandemic. This study examines how trend-following performed during this particular type of equity market disruption.

## 5.3 Objectives and Research Questions

The objectives of the thesis were to first, in Chapter 2, review the implications of trend-following for a unit trust based investment with a passive FTSE 100 unit trust over the maximum period of 21 years as well as discrete one-year periods over 10 years. This was investigated using 12 different moving durations from 5 to 450 days and 23 average crossover combinations on a daily and monthly basis, using both cash and UK government bonds (gilts) as alternative assets when out of equities, as well as with two different slightly varied versions of each due to the delay in trading unit trusts.

The objectives of Chapter 3 were to complete a similar review over seven different international equity market index tracking unit trusts over the maximum 15 years as well as over 1-10 years cumulatively to review the differences in start dates on the results of the strategies using the same methods as were used in Chapter 2. In both of these chapters, the search for an optimum strategy was completed to first infer a useful strategy for a retail investor to pursue and to investigate if one strategy and duration would be optimum across all markets.

The objectives of Chapter 4 were to compare a combined trend-following portfolio across all seven markets to a 100% equity portfolio, and both 60% equity/40% cash and 60% equity/40% gilt buy and hold portfolios to examine if the

trend-following portfolio was able to provide an improvement on returns, risk-adjusted returns, volatilities and maximum drawdowns compared to diversification provided through the buy and hold portfolios. This was studied through the use of a 200-day moving average and a 50/150-day crossover as they had the highest number of outperforms for each in the previous chapters and when trading into both cash and gilts. The final objective was to investigate how trend-following portfolios performed throughout the market turmoil in 2020.

The research questions explored through each chapter are as follows:

Chapter 2:

1. Is it possible to create a simple trend-following strategy that provides superior returns, risk-adjusted returns, volatilities, or maximum drawdowns using the HSBC FTSE 100 unit trust over a period of 21 years?
2. Is there an optimum trend-following strategy or range of strategies which outperforms the buy and hold strategy when examining 12 moving averages and 23 different crossovers with the duration lengths of 5-450 days either trading daily or monthly?
3. Would the use of gilts instead of cash when out of equities help or hinder a trend-following strategy?
4. Are the results from trend-following strategies consistent from year-to-year?

Chapter 3:

1. Do trend-following strategies applied to a range of international stock market indices for the FTSE 250, US, Europe, Japan, Pacific and emerging markets outperform the buy and hold for each market in terms of returns, risk-adjusted returns, volatility, and maximum drawdown over 1-10 years and 15 years cumulatively?
2. Does the inclusion of UK government bonds, gilts, into the strategy instead of cash as the alternative asset when exiting equities provide any support for trend-following strategies in international markets as they

may not have the relationship to international equities as they would for the UK market?

3. Are there different optimum strategies for different markets?

Chapter 4:

1. Does combining the optimum trend-following strategies, for each of the markets investigated in chapters 2 and 3, into a portfolio provide better returns, risk-adjusted returns, volatilities, and maximum drawdowns when compared to either a 100% equity portfolio or the popular mixed portfolio allocation containing 60% equity with either a 40% cash or 40% gilt allocation?
2. Does the use of gilts instead of cash when out of equities continue to support the use of trend-following strategies as part of a portfolio?
3. How did trend-following strategies perform over the coronavirus crisis of 2020?

## 5.4 Important Findings and Contributions

### Chapter 2

The results over 21 years in Chapter 2 for the FTSE 100 unit trust confirmed results from previous studies for indices. (Faber, 2007; ap Gwilym et al.,2010; Clare et al., 2013; and Hurst et al., 2017) Most of the trend-following strategies when using unit trusts had higher returns and Sharpe ratios while also having lower volatilities and smaller maximum drawdowns. Strategies which either traded at the end of the month with moving averages or traded either daily or monthly crossovers with a medium duration had the highest returns and risk-adjusted returns. The study of strategies trading into cash suggested that trend-following strategies were worth further consideration, and the addition of UK government bonds improved returns and risk-adjusted returns and had a similar reduction in volatility and maximum drawdown as the trend-following strategies which instead moved to cash. Similar to Faber (2007), trend-following strategies were not found to be consistent on a yearly basis. As many investors receive semi-annual updates or can review their investments daily online, this inconsistency of performance in terms of returns over short investment periods could be concerning.

The contributions of this chapter were to extend the study of trend following to unit trusts to examine the practical implications for retail investors. The performance of the 200-day moving average was found to be adequate, but other moving averages and crossovers provided higher returns and Sharpe ratios, such as the 450-day moving average. The addition of UK government bonds as the 'safe haven' asset when not invested in equities improved performance further and suggests investigation of alternative safe-haven assets (other than cash) is worth investigating further.

**Chapter 3**

The results of Chapter 3 found that trend following using unit trusts for international markets for different cumulative periods continued to improve volatility, Sharpe ratios, and maximum drawdowns, but the success of the trend following strategies in terms of returns varied greatly based upon the period reviewed and the durations chosen for the length of the trend-following strategy. The underlying market conditions at the start of the period reviewed had a large impact on the ability of a trend-following strategy to outperform the underlying equity benchmark buy and hold. If the period studied started invested in equities with market values rising, the trend-following strategy would have comparative statistics equal to the buy and hold. If a downturn followed, the trend-following strategy would be able to outperform as it would exit before the trough and re-enter as markets recovered. Alternatively, if the period started at the bottom of a market correction, such as in 2009 or 2016, the trend-following strategy would have a delayed entry based upon the length of the duration selected and would therefore typically underperform the buy and hold strategy.

There were also some underlying market characteristics which were found to be beneficial to trend following and therefore different markets had different optimum strategies. For example, markets with minimum volatilities, large maximum drawdowns and relatively high returns were opportune for the performance of trend following. Some markets, such as the US, did not have any trend following strategies outperform over the 15 years studied even after the addition of gilts. These markets typically had small maximum drawdowns and usually demonstrated that slower strategies such as longer durations or crossovers

which kept them in equity markets for most of the period worked the best. For other markets, such as the emerging markets and Pacific, it was found that shorter durations and quicker trend-following strategies such as moving averages instead of crossovers tended to be the best performing combinations.

The duration chosen was the most defining factor for the success of a strategy. A duration which was too short for the market led to whipsawing, while a duration too long would lead to both a delay in exit and re-entry causing the strategy to completely miss any large reductions in market values and re-invest after the rebound. Over the 15-year period, the 200-day moving average strategy was not found to be the optimal across all markets, but if using a mid-duration strategy, trading once a month, and to gilts, the difference between crossovers and moving averages can be minimised.

The addition of gilts increased both the returns and reduced volatility, but the uplift to returns allowed most risk adjusted returns to also be improved with higher percentages of outperformance for strategies using gilts. This displayed the benefits of including UK government bonds into the strategy as an alternative asset instead of cash even when used with international equity markets.

The main contributions of this chapter were the confirmation that unit trusts across international unit trusts over this 15 and 1-10 year period could continue to reduce volatility and maximum drawdowns while increasing risk-adjusted returns in a similar way as would be expected from indices. The inclusion of gilts to the strategies even when investing in (non-UK) international equity markets was unique to this thesis and found to provide higher returns and risk-adjusted returns when compared to a trend-following strategy trading to cash and reduced volatility compared to the underlying equity buy and hold. The final contribution is the discovery that although a 200-day moving average trading at the end of the month can provide reductions in risk and a suitable risk-adjusted return, a moderate strategy which was modified slightly shorter or longer or to a crossover could be more appropriate depending on the market. A one-size fits all solution in the 200-day moving average is useful, but given the differences in the underlying markets themselves, different strategies would be optimal for different markets.

## Chapter 4

The results of Chapter 4 found that even though there were remarkable differences in the trend-following strategies' returns on an individual market level, combing the strategies into a diversified trend-following portfolio increased risk-adjusted returns and reduced volatilities and maximum drawdowns compared to the individual equity markets and a 100% equity buy and hold portfolio of the same assets over the 5 and 15 years studied. The two trend-following strategies studied, the 200-day moving average and the 50v150-day crossover, had higher returns and risk-adjusted than the 60% equity 40% cash or gilts portfolios and also improved volatilities and maximum drawdowns.

The addition of gilts again provided extra returns which increased the trend-following strategies' returns and risk-adjusted returns when compared to moving into cash, while also reducing maximum drawdowns compared to both the 100% equity buy and hold portfolio and both 60/40 portfolios. The strategies which traded into gilts also had the highest risk-adjusted returns in both Sharpe and Sortino ratios than all three buy and hold portfolios.

Finally, the trend-following strategies were not able to perform well over the market disruption in 2020. Although, trend following originally appeared to be successful as most strategies were able to exit the falling market value adeptly. However, the sharp rebound due to government and central bank support was too quick for the monthly trend-following strategies to contend with. In fact, a buy and hold strategy would have outperformed any trend-following based strategy for the US market as the market reached all-time highs by the end of the year. The 200-day moving average was able to minimise volatility and maximum drawdown but was poor at signalling when to return to equity markets. The 50v150-day crossover was simply too slow and exited after the markets had begun to rebound ending the year with negative returns and with maximum drawdowns the same as the buy and hold portfolio.

The specific contribution of Chapter 4 was to study the benefits of unit trust trend-following portfolios which were diversified across a number of different international equity markets. The results showed higher risk-adjusted returns with reduced volatilities and maximum drawdowns for the trend-following portfolio

compared to the 100% equity buy and hold portfolio, suggesting that the use of trend following provides benefits above diversification alone. Not many previous studies, if any, have directly compared a trend-following portfolio directly to a 60% equity and 40% cash or gilt portfolio. The results were interesting in that the trend-following portfolio was able to provide returns similar to the 100% equity portfolio but risk similar to the 60/40 buy and hold portfolio. The further contribution of the benefits of the use of gilts as compared to cash when out of equities opens up other alternative assets for consideration. The final contribution is the review of trend-following portfolios over the 2020 market disruption caused by the coronavirus. Although the strategies were not able to perform well over these market conditions, the underperformance in terms of returns highlighted the need for further research into the re-entry into markets under such extreme conditions.

## 5.5 Implications

Trend following has been found over long periods to deliver improved returns and risk-adjusted returns with large reductions in risk as shown through reduced volatilities and maximum drawdowns when compared to a buy and hold benchmark of the same underlying asset (Faber, 2007; ap Gwilym *et al.*, 2010; Clare *et al.*, 2013; 2016a; Hurst *et al.*, 2017). This thesis confirmed those results and found that even under shorter time frames most middle length trend-following strategies were able to reduce volatilities and maximum drawdowns and increase risk adjusted returns. The study also shows that trend-following portfolios are able to deliver further reductions in risk beyond what can be achieved by diversification alone. Over certain periods, the markets may be out of equilibrium due to behavioural biases in which case trend following may be able to protect investment values from losses due to irrational investors and irrational behaviour.

Markets may also be out of equilibrium due to a market-wide shock, such as during 2008, which could have been caused by rational investors working on new levels of price discovery. This could have been equally addressed by trend following as the strategy itself is not concerned about the theory behind the market movements but would still be able to a signal to exit equities as markets fell. As trend following would be uncorrelated to other equity markets and strategies during these times, it

could be able to provide additional diversification from other strategies when it was most needed. Trend following may therefore be able to protect from market-wide, systemic risk, movements in market values that impact the economy as a whole, which could not have been removed from diversification alone.

Although the 200-day moving average through this thesis was found to provide consistent risk reduction benefits across all of the periods studied and also increased risk-adjusted returns when compared to the buy and hold, it was not the optimal investment strategy for every market. This study demonstrates the importance of considering the characteristics of the underlying market when selecting the appropriate trend-following strategy and duration. Some markets such as the US and Japan were found to require slower trend-following strategies such as longer durations and crossovers, while other such as the Pacific and the emerging markets had better returns with strategies which reacted more quickly such as shorter durations and moving averages. Mills (1997) argued that moving average trading rules were only able to outperform in driftless, inefficient markets while Ellis and Parbery (2005) found the opposite, that moving averages performed poorly in markets that were characterised by no clear trend. This thesis found that trend-following strategies were best able to perform when the underlying markets had little volatility, high returns, and large maximum drawdowns as per Ellis and Parbery (2005). It may be that trend following was best able to perform in markets that were less efficient such as the emerging markets and least able to outperform in more efficient markets such as the US (Mills, 1997). Either way, a one-size fits all approach may not be appropriate for the same reason that different markets are able to provide additional diversification benefits when combined. They have different market characteristics and move differently based on different stimulus.

The start date of an investment is important for sequence risk but also for a trend-following strategy. Although the delay in entry for a trend-following investor who starts at the bottom of a market trough is not likely to experience further losses, it does reduce the trend-following strategies' ability to outperform and will therefore have returns which will underperform when compared to a benchmark buy and hold. If the investor is one who was looking for strong returns from their investment or expecting at a strong bull market, trend following may not be the investment strategy for them. On the other hand, if an investor believes that market values are high and is

expecting a correction, or if an investor is in or near retirement and taking income from their pension, risk averse, or concerned about or expecting a downturn in future market movements, the use of trend-following can help with the reduction of volatility and maximum drawdowns and therefore also reduce sequence risk as found by Clare *et al.* 2016b, 2017, 2021 and across all periods studied in this thesis. This reduction in maximum drawdowns and the direct benefit on sequence risk reduces the potential of a pension shortfall and can have a very real financial and social impact on an investor in or nearing retirement.

The evidence that using government bonds as the alternative asset when out of equity markets can help to enhance returns and further reduce risk due to the negative correlation which has existed between equities and bond markets (Baele, 2010). The use of government bonds in a trend following strategy has the direct implication of improved returns and risk-adjusted returns when compared to the moving to cash while the trend-following strategy which trades to gilts will also still be able to provide large reductions in risk with reduced volatilities and maximum drawdowns.

When investing based on risk such as volatility or maximum drawdown, a 100% equity trend-following strategy appears to have a similar risk measure as the 60/40 portfolios with much higher returns. As trend following at times of market distress can have as little as 0% equity, it could be possible for an investor to consider increasing their equity to alternative asset ratio when using trend following to have the same amount of volatility, smaller maximum drawdowns, and higher returns. It is important to keep in mind that investors should not invest in a higher equity content than they would feel comfortable as determined through their capacity for loss, risk tolerance, and required return. No strategy is perfect, and it is possible that a trend-following strategy could miss a sudden and sharp contraction. Therefore, a 100% trend-following portfolio may not be the recommended strategy due to the high equity content the majority of the time. When comparing portfolios based on maximum equity content over the periods studied, the trend-following portfolio typically underperformed in terms of returns but continued to offer a more cautious approach with smaller volatilities, maximum drawdowns, and better risk-adjusted returns similar to reducing the equity content and replacing it with a less risky asset, but with higher returns than the less-risky asset. Trend-following portfolios were

able to provide 100% equity-like risk-adjusted returns but with 60/40 portfolio-like risk.

Although trend following over long periods and whole business cycles, has been found to outperform, due to its inconsistency over shorter periods and the potential inability to effectively judge when to return to equity markets, it may require further research into alternative re-investment signals. As trend following strategies themselves can only ever perform as well as the underlying investment in bull markets. The only way for a trend-following strategy to have a chance to outperform an underlying equity buy and hold is if the underlying investment has a significant drawdown for which it can exit. The delay to re-investment by trend-following strategies at the relative bottom of a market can causes the strategy to miss out on any quick rebounds and to always be behind in terms of returns.

## 5.6 Limitations

There are limitations to these results as shown through the drastically different results from the 21-year results in Chapter 2, the 15-year results in Chapter 3 and the 2020 results also in Chapter 3. These results were all dependent upon the period studied, the underlying market characteristics, and how the specific durations were able to time the underlying market movements. These results were considered ex post and cannot necessarily be used to infer that ex ante the same results would occur.

All of the investments reviewed did not incur either regular investments into or withdrawals out of the strategies. This would most certainly have impacted the returns and the final values of the both the trend-following strategies and underlying benchmark buy and hold investments. This would be an important consideration for a retail investor and especially in the case of an investor who is taking an income from their pension would further show the impact of sequence risk on their portfolio values and longevity.

The ability to choose a specific duration and strategy from history data can be used to inform a decision but cannot be guaranteed to be the best decision for future markets. It is in that respect impossible to find an optimum strategy and duration

combination which will be the optimum at all periods as this will change over time, and market conditions and remain elusive.

This thesis only reviewed UK government bonds as the alternative 'safe-haven' asset. It did not review other types of bonds such as investment grade bonds, or money market funds which might have yielded different results. Investigating other alternative investments could be an area for future research.

## 5.7 Future Work

Gilts throughout this period provided extra return due to generally falling yields (rising prices) which was partly a consequence of quantitative easing practiced by most central banks post 2008.. Although gilts are likely to continue to provide a reduction in risk compared to equities, they may not continue to provide the level of return in the future which was provided throughout the period studied. It could therefore be beneficial to look at other alternative asset solutions such as other non-correlated assets which could add further diversification and could be used either individually or as a basket of alternative investments. Some suggestions for further research could be money market funds, investment grade bonds, and gold or natural resources.

Future work could consider additional regular investments into or withdrawals out of the trend-following strategies and underlying buy and hold equity investments. As this work reviewed the practical application of trend following, a more sophisticated investigation into the implications of regular inflows or outflows of funds could have a direct impact on final values, sequence risk and pension longevity.

As trend-following strategies sometimes struggle to re-enter markets at optimal times after a sharp market contraction, further work could be carried out to try to modify this approach to be more adaptive and to identify the strong upward trend more quickly. The Achilles heel of trend following is the constraints of the mathematical comparison of the current day's (or days' for crossovers) price compared to what was a higher average before the market correction. It therefore is only the passage of time or a large increase in prices that would create a

reinvestment signal. One possible area of future research would be to combine several different durations of trend following strategies, so there would be a step-based approach to exiting and returning to an investment. This would further diversify the investment instead of an all or nothing approach and could help reduce the impact of erroneous signals.

Another avenue of further research could be to investigate other ways to signal the re-entry into equities for example using different signals to exit and re-enter markets such as moving to a quicker, shorter signal when a trend appears to change. This could potentially be identified through volatility signals or by using another type of dynamic trend following strategy to identify turning points such as one discussed by Garg, Goulding, Harvey and Mazzoleni (2020).

Although trend following can underperform at times in terms of returns, the downside risk protection of trend following can still be of benefit to investors. These further suggestions could identify additional steps or methods of diversification which could possibly increase returns and response times for equity market reinvestment. Trend following could also be used as a risk reduction component on its own or as part of a larger strategy to achieve an investor's financial objectives.

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