On the strategic management of an events portfolio to extend tourists' length of stay: A LASSO approach

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Abstract

Tourism destinations are increasingly recognising the potential for additional benefits to be captured by managing their events as a strategic portfolio. By identifying and exploiting relatedness between key event variables, otherwise inaccessible benefits can be cross-leveraged from the portfolio as a whole. Developing a methodology for putting such a strategy into practice has, however, thus far eluded researchers. Indeed, the empirical research has thus far focused almost entirely on single events, considered in isolation. The purpose of this study is, therefore, to propose and test a parsimonious method for determining relatedness in the determinants of length of stay across a portfolio of events. This involves using sparse regression, based on the LASSO approach, using data from an event portfolio in Madeira. The LASSO method can be considered particularly advantageous because it produces results that are easily interpretable by event managers and are thus able to inform marketing strategies. The results from Madeira illustrate this by identifying four areas of close relatedness that could be cross-leveraged through the co-ordinated strategic marketing of the portfolio at the destination level. The approach uses readily obtainable data and, as such, represents a practical tool for event portfolio management that can readily be applied elsewhere.

Keywords: event; length of stay; portfolio, sparse regression; strategy; synergy

Declarations

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1. Introduction

Events have long been viewed as key components of a destination's tourism offer, and destinations worldwide have invested heavily in events with the aim of strengthening their competitive position (Hernández-Mogollón et al., 2018). This trend has been especially evident in established destinations operating in traditional sand-sun-and-sea markets, where market competition can be particularly intense (Brida et al., 2013). Expectations about the potential of events to leverage a wide range of benefits have grown markedly in recent times (Kelly & Fairley, 2018; Pereira et al., 2015). In response to such demands, event stakeholders have begun to recognise that additional benefits can be leveraged by managing events together as a strategic portfolio (Antchak & Pernecky, 2017; Ziakas, 2020; Ziakas & Getz, 2021). Many destinations have responded by investing in large-scale events, often with the addition of a variety of smaller-scale events to occupy empty slots in the calendar (Wang & Jin, 2019).

There remains, however, a lack of research that demonstrates how destinations should best develop their event portfolio in a strategic manner (Ziakas, 2019, 2020). Ideally, a destination would wish to develop and manage their events in such a way as to create maximum benefits for the portfolio as a whole (Chalip & Costa, 2005; Pereira et al., 2015; Ziakas, 2020). Destination managers are thus under growing pressure to deliver results and achieve sophisticated outcomes by hosting events, while at the same time lacking practical guidance about how to achieve those results and outcomes.

The purpose of this paper is to demonstrate an approach that could help destination managers address this challenge. Using data collected from multiple events taking place at different times of the year in Madeira, Portugal, it applies a sparse regression approach to identify the most influential determinants of attendees' length of stay (LOS) in the destination. This enables common determinants to be identified, which can then be used to cross-leverage benefits through further strategic management of the event portfolio. The approach can be considered to be a parsimonious one in that it can assist in managing the events making up an overall strategic portfolio in such a way as to meet the multiple goals set for the portfolio, while at the same time making efficient use of the destination's scarce resources.

2. Literature review

This section begins with a review of the contribution of events to destination objectives, focusing particularly on how synergistic benefits may be cross leveraged by adopting a portfolio approach to events management. It will then present a review of previous studies tourist LOS and conclude by examining various methods available to analyse its determinants.

2.1. Events and event portfolios

Events are expected to generate a multitude of benefits, ranging from encouraging increased positive word-of-mouth and repeat visitation (Dowell et al., 2019; Newland & Yoo, 2020; Ziakas, 2014), to positive media exposure and enhanced destination brand image (Hernández-Mogollón et al., 2018; Piva et al., 2017). Elsewhere, the focus has been on commercial development, urban regeneration and greater export competitiveness (Azzali, 2017; Richards & Palmer, 2010). The growth of high-order

drivers of competitiveness, such as social capital and collaborative networks, has frequently been an objective (Misener & Mason, 2006; Pereira et al., 2015). Events have also been used to combat poverty following a crisis (Raya, 2012) and to address social exclusion (Misener & Mason, 2006; Ziakas & Costa, 2011). As such, events are expected to serve as flexible instruments to address a wide variety of market segments, and to adapt effectively to changing patterns of visitor demand and destination resources (Ziakas, 2019). Their success in meeting these objectives has traditionally been measured by simple indicators such as visitor numbers, repeat visitation rates and LOS in the destination (Kelly & Fairley, 2018).

Developing an event portfolio involves taking a strategic and coordinated approach to their management. By doing so, synergistic benefits can be cross leveraged between the events using techniques such as events programming, collaboration (for example, using joint-marketing campaigns, bundling or co-branding), inter-organisational networking and the exchange of best practices (Almeida et al., 2019; Antchak & Pernecky, 2017; O'Brien & Chalip, 2008). The focus then is not the benefits that can be obtained from any one event, but the overall benefits associated with the entire event portfolio (Ziakas & Getz, 2021). The greater the degree of relatedness between the various characteristics of the events in the portfolio, the greater will be the synergies available (Ziakas, 2020).

An event portfolio is thus widely regarded as a versatile strategic management tool (Dredge & Whitford, 2011; Ziakas, 2020) that can address a wide range of policy objectives (Chalip & Costa, 2005). It can be conceptualised as a 'leverageable resource' capable of transforming opportunities into quantifiable short-term benefits and longer-term advantages for the host destination (Chalip, 2004; Ziakas & Getz, 2021). Examples include exploiting opportunities to develop higher-order capabilities through the expansion of information-sharing, dialogue and communication among stakeholders (Ziakas, 2020). The use of participatory planning, as well as portfolio design, governance and coordination, and the establishment of a collaborative management approach, can also be noted (Ziakas & Getz, 2021). The adoption an asset-based development agenda and an action-oriented attitude are further relevant in this regard (Misener & Schulenkorf, 2016; Ziakas, 2019, 2020; Ziakas & Costa, 2010). From this perspective, events are seen as opportunities for intervention rather than as interventions in themselves.

In contrast to the enthusiasm that is frequently expressed in the literature, many studies have noted the difficulties in operationalising these cross-leveraging strategies (Ziakas, 2019, 2020; Ziakas & Costa, 2011). The obstacles seem formidable. Indeed, it has been noted that decision-makers tend to operate on an tactical rather than a strategic basis, making decisions in an ad-hoc and opportunistic way that is grounded on well-established business models but often "lacking a coherent vision and strategy" (Ziakas, 2019, p.124). They also tend to focus on higher-order objectives and operate in a reactive manner (Ziakas, 2013, 2019). Managing an event portfolio requires, however, that events managers adapt their own practices (such as embracing of strategic thinking, forward planning and formalising management processes) as well as to collaborate effectively with other destination stakeholders (Ziakas & Getz, 2021).

Decision-makers presently have little guidance, therefore, to assist them to embrace the portfolio approach to events management. At present, learning can only take place by examining the performance of events on a case-by-case basis (Kelly & Fairley, 2018;

Ziakas, 2019). Ziakas (2020) explains this omission in terms of the fragmentation of the events industry and on the multiplicity of theoretical approaches that have been used to analyse the determinants of event performance. Little is therefore known about how to cross-leverage the synergies associated with an events portfolio (Ziakas, 2020; Ziakas & Costa, 2011). Even well-established events portfolios in cities such as Edinburgh, Gold Coast and Auckland have thus far failed to identify and employ a clear and systematic cross-leveraging strategy (Ziakas, 2019).

2.2. Length of stay

Length of stay is widely considered to be a critical variable in managing destinations because it is closely linked to many other variables of interest, including levels of expenditure, occupancy rates, satisfaction, positive word-of-mouth, loyalty and attachment, and the number of activities pursued (Pérez-Cabañero et al., 2017; Soler et al., 2018). The LOS decision is usually made by the tourist when planning their holiday, although in some cases a decision to extend the LOS will be made during the holiday. Destination managers therefore need to have a good knowledge of the determinants of this decision and how they can best be influenced (Wang et al., 2012).

This literature on the determinants of tourists' LOS has recently been thoroughly reviewed (Hateftabar, 2021) and it is not the intention of this paper to replicate this work. It can be noted, however, that a wide array of potential determinants of LOS have been investigated empirically. First, it has been found that foreign tourists tend to stay longer than domestic tourists (Soler et al., 2018; Barros & Machado, 2010; Pérez-Cabañero et al., 2017; Wang et al., 2012). Second, some studies highlight a positive relationship between age and LOS (Alén et al., 2014; Barros & Machado, 2010; Barros, Butler, & Correira, 2010), older people tending to have more free time to enable them to stay longer in the destination. Marital status was also found to be a determinant of LOS by Salmasi et al. (2012), while Barros and Machado (2010) found that males were likely to stay longer. Family lifecycle stage, proxied by variables such as household composition and employment status, was also found to be relevant (Alén et al., 2014). Higher levels of income are linked to longer holidays (Gokovali et al., 2007). Motivation is considered as a determinant of LOS (Prebensen et al., 2015; Rodríguez et al., 2018; Thrane, 2012) and trip purpose has also been found to have a significant impact on LOS (Santos et al., 2015), with tourists visiting friends and relatives staying longer (Alén et al., 2014; Menezes & Moniz, 2011). Various travel characteristic such as accommodation type and the number of travel companions (Salmasi et al., 2012) have also been studied.

With regard specifically to the impact of events on LOS, much less is known. Studies such as Prebensen et al. (2015) found that higher levels of satisfaction with the destination and the activities enjoyed while staying there had a positive impact on LOS, but such studies have not focused on the relationship between event portfolios and LOS. In particular, the potential for events to encourage tourists to plan to stay longer in the destination has not yet been the subject of substantial empirical research.

2.3. Methods for analysing the determinants of length of stay

It is also important to acknowledge the debate in the literature regarding the methods that can be used to analyse the determinants of LOS. It is not within the scope of this

paper to provide a full review but it can be noted that such methods have included not only traditional approaches, such as ordinary least squares (OLS), including the Heckman model, binomial logit models, multinomial logit models and ordered logit models (e.g., Lee et al., 2014; Mortazavi & Cialani, 2016; Scholtz et al., 2015; Thrane & Farstad, 2012), count data models (e.g., Brida et al., 2013; Brida et al., 2014) and survival analysis (e.g., Gémar et al., 2016; Wang et al., 2012; Yi et al., 2011). Thrane (2012) argued, however, that the benefits of using complex models such as survival analysis are overshadowed by the lack of theoretical support for the results and the difficulties in interpreting them. It can be argued that OLS tends to produce results that are qualitatively similar to those provided by survival analysis and count data models (Mortazavi & Cialani, 2016; Rodríguez et al., 2018). Prebensen et al. (2015) advocate using count data models because OLS violates certain assumptions relating to the dependent variable. More recently, newer approaches such as latent class modelling (Alegre et al., 2011) and conditional quantile regression (Belloni & Chernozhukov, 2011) have also been used.

Applying any of these techniques is most difficult when theoretical guidance is unavailable to assist in variable selection (Rodríguez et al., 2018). Many researchers have, in such cases, relied on 'scientific judgment', guided by previous studies, to select the variables of interest (Raya. 2012; Wang et al., 2011). This implies, however, that variable selection is effectively exogenous to the process of analysis, so any resulting model can only be efficient if the researchers happen to have chosen the most effective set of variables from the wide array of candidates (Sant'Anna et al., 2020). Lack of data availability has often served as a constraint on variable choice (Alegre et al., 2011). Given the increasing availability of big data, however, studies are increasingly able to draw candidate variables from a large pool. Such variables will not necessarily have a strong theoretical basis, however, which can not only decrease the predictive power of the model (Sant'Anna et al., 2020) but also reduce its interpretability for policy-making purposes.

The least absolute shrinkage and selection operator (LASSO) technique, meanwhile, has the major advantage of enabling researchers to select variables based on a data-driven procedure (Chu et al., 2020; Fishburn et al., 2019; Konzen & Ziegelmann, 2016; Panagiotidis et al., 2018). As such, LASSO offers a number of advantages. First, there is good evidence that individuals take account of the costs of acquiring and processing information, and use 'rational inattention' to screen out less-salient variables (Abel et al., 2013; Luo & Young, 2016). The LASSO method mimics such human behaviour by selecting just the most salient variables of interest (Zou, 2006). Second, bounded rationality suggests that people often prefer to make suboptimal decisions (Grüne-Yanoff et al., 2014). In the absence of full information and with limited resources, they may favour a satisficing approach involving the use of heuristics. Such 'rules of thumb' can, however, be greatly over-simplified, and this may lead to choices that are more efficient to make but suboptimal in their outcomes. Grüne-Yanoff et al., (2014) also argue that such an approach offers a sense of 'empowerment' and instils confidence in the decision-makers to challenge complexity in a pragmatic way.

3. Madeira's event portfolio

Madeira is a small-island archipelago in the North Atlantic Ocean and is one of the two autonomous regions of Portugal. Its main industry is tourism, with approximately 1.5

million tourists visiting annually, representing around five times the resident population (Discover Madeira, 2021). Madeira has a long history of tourism, possessing a warm year-round climate, attractive fauna, flora and natural landscapes, historic and cultural value, and an ample stock of high-quality tourist accommodation (Almeida & Garrod, 2018). Initially regarded as a luxury destination for wealthy visitors from Europe, Madeira is best known as a traditional sun-sand-and-sea resort (Almeida & Garrod, 2018). In recent years, Madeira has also become a popular port of call for cruise liners, bringing around half a million stop-over visitors to Madeira annually (Madeira Island Direct, 2021).

Madeira has a well-established event portfolio. As elsewhere (Ziakas, 2019), it emerged in a largely unplanned way to address mainly touristic and economic objectives. These events, styled as 'festivals', blend popular traditions with tourism-related additions. Faced with strong competition from other traditional tourism destinations, and recognising the need to move away from relying on its replicable attractions such as climate, nature and luxury, the destination has more recently taken a portfolio approach to managing its events, mainly by adding smaller events into the schedule to plug existing holes and create a year-round calendar of events (Almeida et al., 2019).

This essentially informal event portfolio has been shaped by Madeira's existing resources and competitive strengths, based on a 'top-down' coordination by the Regional Directorate for Tourism (DRT), which is the destination management organisation (DMO), with the primary aim of attracting overseas tourists. As such, the portfolio is strategically aligned with the authorities' vision for the sector and is strongly anchored to its authentic cultural traditions. Strong connections to the region's cultural assets and agricultural traditions are also evident, which adds authenticity to the offer (Almeida et al., 2019).

4. Methodology

This study is based on the analysis of data collected at seven events taking place in Madeira between February 2019 and January 2020. For further details, see Almeida and Garrod (2018) and Almeida et al. (2019). Events taking place both in the high season and the low season were thus sampled. The surveys were administered mainly in hotels in order to capture data from event attendees who were visiting Madeira as tourists. However, a sizeable number of questionnaires were collected from tourists leaving the airport. A stratified random sample of hotels was employed to avoid establishment-specific bias according to location. Where the establishment's owner/manager agreed to be involved, staff at the reception desk assumed the responsibility for distributing the questionnaires. Those surveys undertaken at the airport were administered on a randomised, mall-intercept basis.

The survey was based on a two-page self-administered questionnaire designed primarily to gather information on attendee satisfaction on behalf of the DMO. Data on LOS were also collected, along with a number of travel-related, motivational and behavioural variables. The selection was based on the empirical findings of a literature review.

Most of the data were collected using nominal variables, with some use of binary variables (e.g. use of sources of information, accommodation type). For each variable, a value of 1 was assigned to the reference category. Monthly income and age were both

collected as categorical variables (using income and age ranges respectively). Length of stay, income, expenditure, number of events attended, and the distance travelled between the hotel and the event main stage, were all treated as continuous variables.

With regard to the variables employed in this study, problems of coefficient inconsistency may arise if endogenous variables are added to the model. The researcher must, therefore, carefully select the subset of variables to be included in the model based on guidance from the literature and sound economic/behavioural reasoning. In this regard, once the researcher has confirmed that the standard considerations in terms of variable selection are met, LASSO offers the opportunity to operate a variable-selection algorithm, based on the identification of patterns, driven by statistical considerations. LASSO allows an exploratory data-driven approach (i.e., a 'fact-finding exercise'), that exempts the researcher from having to make non-trivial decisions about which variables to keep or exclude from the analysis, thereby helping to mitigate the biasing effect of the pre-selection of key variable.

Indeed, the LASSO method allows the researcher to perform variable selection and regularisation simultaneously (Detmer et al., 2020; Lehman & Archer, 2019; Zhang et al., 2019). Based on inference procedures, LASSO permits the jointly estimation of coefficients and standard errors of various covariates of interest and the identification of a subset of relevant control variables that appear in the model used to test inference. Specifically, LASSO sets some regression coefficients to zero in order to select just a few non-zero coefficients. As such, the method is appropriate to handle uncertainty about which variables to select as the most efficient ones and eliminate irrelevant ones, based on a data-driven method (Rich et al., 2020).

The LASSO approach proceeds in two steps. First, a selection method is employed to identify a sub-set of variables of interest. Second, inferential methods, based on the OLS method, are then used to interpret the covariates thus identified. The statistical package, STATA, offers three algorithms to perform inference: double-selection LASSO; partialling-out LASSO; and cross-fit partialling-out LASSO, also known as double machine learning. For further details see STATA (2019). Cross-fit partialling-out was selected for this study. While being the most computationally intensive method (Wang et al., 2011), it employs a weaker definition of sparsity: "that the number of nonzero coefficients in the true model is small relative to the number of observations […] and that the coefficients are large enough relative to error variance to be selected by the lasso" (STATA, 2019, p.8). As recommended by STATA (2019), while the final model used cross-fitting partialling-out, the covariates were selected based on the plug-in method, to avoid adding 'noise' to the model through variable selection.

This study thus employs a big-data econometric model to pre-select variables from a wide range of potential candidates. The method is not, however, completely 'automatic' and devoid of theoretical considerations. Firstly, a list of the 'usual suspects' of explanatory variables is identified a priori according to the extant literature. A 'fact-finding exercise' is then conducted, based on a data-driven approach, to formulate a general research question (Coad & Srhoj, 2020). Such an approach is well-suited to avoiding what is sometimes known as HARKing the results (i.e., 'hypothesizing after the results are known', see Kerr, 1998). This involves formulating hypotheses after running a large number of estimations to identify significant coefficients. Coad and

Srhoj (2020), refer to this a post-hoc theorizing and argue that it can be detrimental to scientific progress because it is based on the "misinterpreting and overtheorizing of statistically significant results" (p.546). Some studies, after a lengthy review of the literature, are unable to avoid "sharking", i.e. secretly HARKing (Coad & Srhoj, 2020; Hollenbeck & Wright, 2017). This is likely to result in module misspecification.

Secondly, LASSO is not entirely automatic because the number of variables selected can be fined-tuned based on manipulation by hand of the penalty factor. In addition, results must be interpreted, and the significance of excluded variables acknowledged. The LASSO procedure is thus implemented in a semi-supervised way. Indeed, the results still need to be interpreted before firm conclusions are drawn. As mentioned by Coad and Srhoj (2020, p.556), LASSO output "requires much effort for interpretation" to identify the most "theoretically interesting significant results". Indeed, it must be remembered that "AI and machine learning are tools to augment human decision-making" and autonomous robots can never adequately replace human decision-making (Brynjolfsson & McAfee, 2014)."

5. Results

5.1. Descriptive analysis

In total, 3,200 questionnaires were obtained. Table 1 sets out the main descriptive features of the data, from which the following can be noted. The sample was evenly balanced by gender. Just over 22% of the respondents had travelled with the main purpose of attending the event itself. There were, however, considerable differences between events in this regard: the percentage of attendees travelling specifically to attend the event ranged from 2.5% (Wine Festival) to around 42% (Flower Festival). For intentional attendees of the Flower Festival, the duration of stay was quite similar to the overall average but lower than the average for the 'casual segment' attending the event by chance (7.97 vs. 8.65; t=3.491; sig=0.000). For the total sample, the average LOS was around nine days (standard deviation: 8.96) and around 47% of the respondents stayed for seven or eight days. Respondents were, on average, 55.9 years old. About 34% of the total sample was over 65 and just over 27% were in the 55-64 age cohort. Therefore, around 60% of the respondents were aged 45 and more. Visitors were mainly from the United Kingdom (27%), Germany (23%), and Portugal (14%) and France (13%). Almost two thirds had travelled with their spouse and 11% alone. The average visitor considered their overall experience to be positive (average of 6.1 on a seven-point Likert scale). A large share of visitors was repeating both their visit to the island (46%) and to the event (16%). Around 20% of the tourists held at least an undergraduate degree. Just under 72% were married. Around 16% of the respondents earned between €2500 and €3,500 per month, while less than 6% had a monthly income over €10,000. It may therefore be concluded that events attendees are older that the average tourist to Madeira, but that the sample generally reflects the wider trend provided in studies of events in other destinations.

5.2. LASSO analysis

The study considered 72 variables as potential determinants of LOS, including 20 socio-demographic related variables and 40 travel-related variables. Using the cross-validation (CV) method, the algorithm selected 33 from a total of 66 controls, while the adaptive

method selected 38. The Wald statistic (along with p-value) indicates that the covariates of interests are significant. While cross-validation is well-established as a method in the machine-learning literature, the method tends to over-select variables beyond those that are strictly essential (STATA, 2019). Indeed, based on the plug-in method, the algorithm selected just 19 variables. The results suggest that the determinant variables tend to be socio-demographic, with some evidence of country-of-origin effects. Brida et al. (2013) reached a similar conclusion regarding the importance of the socio-demographic dimension.

5.3. Cross-validation analysis

Given that the plug-in method excluded several variables of theoretical interest, a choice between either the CV or adaptive method seemed to be most appropriate, depending on further examination of the statistical proprieties of each method. As the CV function appeared somewhat flat near the optimal λ (See STATA, 2019), which implies that nearby values of λ would produce similar out-of-sample MSEs, the decision was taken to select different (larger) values of λ for both the CV and adaptive methods. As a result, the number of variables selected was reduced from 33 to 27 and from 38 to 26 respectively. The model using the adaptive method contained the same socio-demographic variables, but some travel-related variables were removed (see Table 2).

The CV method performed better than the adaptive method in terms of out-of-sample prediction, so this was selected for further analysis. Based on the CV method, travel arrangements (first visit, type of accommodation, daily price, travelling with children), sources of information (information at a tourism fair) and a number of destination attributes (climate, accommodation facilities, taking part in activities), among others that were identified by both methods, were selected as variables of interest. Several event-related variables were also identified as having non-zero coefficient variables: previous attendance, participation in the main event, motivation to attend and the number of events attended. These variables are of prime importance in identifying commonalities that can be leveraged through the portfolio. The results obtained to this point provided support to the conclusions of previous studies, as noted in the literature review, in terms of the relevance of key variables.

The purpose of inferential LASSO analysis is to estimate the relationship between a manageable few covariates of interest and the dependent variable. Based on the information retained in the first stage, the impact of the 33 variables selected was therefore estimated. Many of the socio-demographic variables, but by no means all of them, were not, however, statistically significant (see Table 3). This included variables such as civil status and academic background, which reflected the findings of previous studies (Brida et al., 2013; Soler et al., 2018). Examining the other variables of interest, the point estimate for the effect of income on LOS was negative, meaning that LOS should be expected to fall by 0.4 days for each increase of around €1,000 in terms of monthly income. Many studies report a positive relationship between income and LOS. However, findings by Soler et al. (2018), Brida et al. (2013), Fleischer et al. (2011) and Nicolau and Más (2009) point in the opposite direction, providing some support for the findings of the present study A possible reason, indicated by Nicolas and Más (2009), is that tourists with higher incomes may prefer to take shorter but higher-quality holidays.

5.4. Nationality

In terms of nationality, being a Portuguese national resulted in a 3.9-days reduction in terms of LOS in comparison to the British reference group. Being French resulted in a 1.4-day reduction and being Spanish national a 2.2-day reduction. Raya (2012), Nicolau and Más (2002) and Alegre et al (2011) also identified the influence of nationality on LOS. The impact of nationality reflects a series of factors such as flights availability, probably the key issue to explain the Portuguese and Spanish nationals' behaviour in terms of LOS in view of the availability of a significant number of daily/weekly flights between Madeira and mainland Portugal. Previous studies (e.g. Soler et al., 2018) have also found that domestic visitors tend to book shorter stays.

5.5. Age

In line with previous studies, older visitors tended to stay longer (Alén et al., 2014; Brida et al., 2013; Mortazavi & Cialani, 2016). On average, each additional 10 years of age lead to 0.31 more days of stay. This could possibly be explained by previous research which shows that attributes such as pleasant climate and personal safety appeal especially to seniors (e.g., Barros et al. 2010; Nicolau & Más, 2009). Indeed, Madeira is well-known for its mild climate. However, in the present study, the variable 'climate' is not statistically significant. It can nevertheless be suggested that issues such as the availability of free time and higher levels of discretionary income compared to other groups may be the key reason behind this result. Previous research shows that regions excelling in attributes such as mild weather conditions, security, low prices, easily accessible cultural attractions, natural areas and places of historical/artistic interest, are attractive for elderly people. Chen (2009), Jang and Wu (2006), and Prayag (2012), for example, all note this tendency. With regard to older people, issues such ease of transport and mobility in urban areas, secure urban environments, access to shopping areas and medical coverage are highly praised owing to the prevalence of age-related constraints in that segment in particular. Further research is therefore needed to explain the attraction of elderly people to Madeira's event portfolio, and other possible reasons must be called upon to explain this effect. For example, the programme content may appeal more to older, more culturally oriented visitors.

5.6. First-time or repeat visit

Among the travel-related variables, being a first-time visitor resulted in shorter stays, which is in accordance with previous studies (e.g. Alegre et al., 2011). First-time visitors stayed on average for 7.8 days, while repeat visitors stayed on average 9.3 days (t=7.834; sig=0.000). Only two variables were found to impact LOS positively, those being price/quality considerations and opportunities to partake in activities. Respondents staying for reasons other than a holiday break, business or visiting friends and/or relatives also tended stay for a few extra days.

5.7. Event-related variables

In terms of event-related variables, those travelling mainly to attend the event take shorter stays. Greater participation in the event (proxied by the number of sub-events and activities attended) also leads to a higher propensity to leaving early. Attendees who exhibited a high degree of involvement are, therefore, more prone to opt for shorter

stays. Previous attendance, on the other hand, leads to longer stays, as does participating in the main event.

5.8. Travel arrangements

With regard to travel arrangements, a positive impact of 'other lodging' was noted. Staying at a local lodging establishment (a non-traditional type of accommodation) was associated with longer stays, possibly because guests faced lower budgetary constraints. These results are in line with Soler et al. (2018), Alegre and Pou (2006), Alegre et al. (2011), and Raya (2012), in that cheaper accommodation leads to more extended holidays. In line with Soler et al. (2018), the study also identified a positive association between opting for cheaper accommodation and greater LOS. The available evidence suggests that low-income individuals are more inclined to stay in cheaper accommodation, which may explain this result. This suggests that budgetary constraints are vital considerations when deciding the duration of stay: people will stay in cheaper accommodation in order to stay longer. From the policy-making point of view this might be consider undesirable because it may result in less revenue per tourist being captured locally. It might be the case, however, that such tourists may make up for this through further expenditures in other (non-lodging) activities during their more extended stay.

5.8. Hotel location

Another variable of interest regards hotel location. Accessibility, proxied by the distance calculated between the hotel and the city centre, are worth consideration because of the large number of older attendees at the events. Based on the data, each extra kilometre to be travelled resulted in a decrease of 0.25 days in terms of LOS. Respondents opting for hotels located in the periphery (a proxy, no doubt, for greater budget constraints or a signal that expresses visitors' preference to take time in rural areas outside the main city), report a decrease of 0.34 days for each additional minute of walking distance. Cost reasons and attempts to avoid the heavier traffic in the city centre area are plausible reasons to explain this result. Whatever the reason, the greater the distance between the hotel location and the city centre, the shorter the duration of stay.

5.9. Degree of participation

Visitors travelling with the sole purpose of taking part in the event reported shorter stays (8.01 vs. 9.06; t=4,076; sig=0.000). Such individuals might be said to be concerned primarily with attending and enjoying the event. Budgetary considerations and time availability issues must also be examined, however, in this context. The data indicate that nearly 64% of the respondents travelling to attend (22% of the total sample) were repeat visits, which enabled them to concentrate and indulge in enjoying the main event and other activities without having to worry about other aspects of the visit.

The higher the number of sub-events attended, the shorter was the duration of stay. The results indicated a significant degree of correlation between these variables (σ=-0.046; sig=0.009). However, the impact of this was disproportionately high among visitors travelling specifically to attend an event, which is only a subset of the overall sample. In the same vein, respondents reporting a high degree of involvement by taking part in other sub-events than the main one, shortened the number of days in the region by 0.5

day for each extra sub-event attended. Visitors reporting previous attendance, however, opted to stay 1.2 days more than the sample average.

5.10. Cross-fit partialling-out

The final step was to employ the cross-fit partialling (double-machine-learning) estimation method to undertake inferential analysis. This enabled the researchers to interpret the covariates and identify commonalities between the events that could then be cross-leveraged by managing them as a strategic portfolio. The results, which are shown in Table 4, suggest four promising avenues for possible further investigation, based on the variables revealed to be important in all or most events.

First, in relation to the country of origin of event visitors, the model suggests that being a Portuguese national has a statistically significant impact on LOS at six of the seven events. Attempts to market any of Madeira's events to visitors from mainland Portugal would likely, therefore, pay dividends across the whole portfolio. Second, destination managers may wish to pay greater attention to older visitors. Age emerged as a statistically significant determinant of LOS at five of the seven events, impacting positively LOS. Encouraging more older visitors could, therefore, be a viable strategy to increase LOS associated with visits to the destination to attend any of the events. Third, previous attendance of any of the events in Madeira's portfolio, emerged from the analysis as a significant determinant of LOS at six of the seven events. DMOs may therefore wish to encourage repeat visitation (either the same event or another in the portfolio) in order to enhance LOS. Fourth, the study identified a tendency for visitors staying in local lodging to remain longer in the destination. Given that this effect is statistically significant at five of the seven events, an efficient strategy for destination managers could be target potential event attendees who prefer to stay in such accommodation. This could serve to increase the LOS across the whole portfolio.

6. Conclusions

This study has undertaken an empirical analysis with the use of the LASSO method in order to identify the most relevant variables impacting upon LOS. Length of stay in this study was explained as a function of socio-demographic, travel related and motivation-centred variables. The results highlight some significant commonalities which could, if acted upon, allow synergies to be cross-leveraged from the various events in the portfolio.

The first was that there was a consistent relationship across six of the seven events between Portugal as the country of origin and LOS. Destination managers could therefore use strategic marketing to target Portuguese nationals to visit Madeira to attend events, which could increase attendance at any of the events in the portfolio. The problem with this strategy, as previously noted, is that this impact is a negative one, in that Portuguese visitors tend to have shorter stays. With excellent air travel linkages with the mainland, visitors can arrive only a few hours before the main event and travel back to the mainland as soon as it is concluded. Portuguese visitor may also be more heavily constrained by budgetary considerations, owing to the much lower salaries (comparatively to the EU average) paid to the average Portuguese national. It can be argued, however, that neither the increased availability of inbound and outbound flights nor budget constraints can, in and of themselves, explain why so many Portuguese

nationals stay for so little time. Short stays are not amenable to visitors exploring a wide range of attractions, which implies with fewer spending opportunities and reduced economic impact (Barros & Machado, 2010; Prebensen et al., 2015). Madeira's DMO has recently launched a promotional campaign focused at the Portuguese market to encourage Portuguese nationals to discover Madeira and its 'tropical' attractions, and to encourage them to stay longer. With Portuguese visitors comprising only 14% of tourists to Madeira, however, attempts to increase visits in this way will doubtless need to be supplemented by other measures to increase LOS.

Destination marketers may wish to pay greater attention to older visitors in their efforts to attract visitors to attend the events in their portfolio. Age had a statistically significant positive impact on LOS at five out of the seven events. This result is consistent with studies such as Raya (2012), and Nicolau and Mas (2004). Many European destinations have been attempting to ease their growing dependence on the senior citizen market but in the case of Madeira's event portfolio, this would seem a promising target market. As noted above, each additional 10 years of age leads to the average visitor staying in the destination for 0.31 more days. Older visitors are generally wealthier and benefit from more free time (Soler et al., 2018). As such, they can take their holidays when the events are being hosted, stay for longer and visit in the low season. This study suggests, however, that such visitors are more sensitive to comfort and accessibility issues.

Issues such as the lack of information about the events, along with the shortage in seating capacity and resting areas, both of which were identified in the blank space for free-form comments and suggestions, must be promptly addressed to ensure that the needs of older attendees are met. This could induce them to give positive word of mouth and perhaps make a repeat visit. Experience in handling such issues can be cross-leveraged from one event to the others, provided that the organisers can find a way to work together effectively. Madeira is well-placed in having a DMO to encourage and supervise such collaboration.

A second potential avenue for investigation relates to the visitors' attendance at previous events in Madeira. Previous attendance is a significant positive determinant of LOS at six of the seven events. The DMO may therefore wish to encourage existing attendees to make further visits rather than to try to widen the pool and attract first-time attendees. This result echoes that of previous studies (e.g. Alegre et al. 2011). Repeat visitors reported staying 2.8 days longer than first-time visitors. They also reported significantly higher levels of satisfaction (6.25 vs. 6.09; t=-3.123; sig=0.002) and a significantly greater willingness to recommend (92.9% vs. 81.3%; χ=41.752; sig=0.000). Even so, repeat visitors were also more likely to make harsh or negative observations on both event and destination related aspects (8.8% vs. 5.7%; χ=7.271; sig=0.007). Such visitors are, indeed, significantly more likely to take the opportunity to express their opinion (24.2% vs. 17.9%; χ=11.307; sig=0.001), which suggests that they may be not be offering positive word of mouth or, even worse, be giving negative word of mouth.

The results of the study therefore suggest that swift action is needed to tackle and to address the issues reported by visitors. Once the problems have been resolved, it is also strongly advisable to maintain an effective social-media presence aimed at emphasising the destination's responsiveness and high standards of customer care. Photos, videos and stories should be shared to emphasise the capability to answer visitor's needs. This

is an approach that would benefit from the sharing of lessons from one event to the next and, indeed, from the events sector to the broader tourism sector. As noted above, Madeira is well-placed to achieve this due to the presence of a strong DMO to encourage and monitor this cross-leveraging process.

A third potential strategy is to encourage attendees to become ambassadors and influencers based on their sharing their experiences online. This is most effective if they can be induced to share stories, photos, reviews and lively posts. Again, the DMO will need to take a key co-ordinating role in this. Ensuring that guests have good public WiFi access to share their experiences in real time may enhance these efforts. Bloggers and YouTubers similarly can be encouraged to collaborate with the DMO. The purpose is to cultivate a loyal tourist segment characterised by repeated attendance (Brida et al., 2014). One of the most effective ways to promote a destination it to stimulate visitors' intention to return again and again.

A fourth potential strategy relates to the tendency for visitors staying in local lodging to stay longer in the destination. This was found to be statistically significant at five of the seven events. Any further attempt to develop this segment would, however, have to be very cautiously undertaken, however, as it is likely to put increased pressure on the hotel sector and the industry as a whole, adding to the general downward pressure on prices. Data on the number of employees per visitor indicates that the hotel sector creates a further 0.049 full-time equivalent jobs per additional visitor, while the local lodging sector only creates 0.0021 jobs per additional visitor (based on data from the Madeira Statistical Office).

The results of this study are consistent with previous research and from in-situ observations of the event visitors. While the determinants of LOS have been widely studied, it is still unclear which should be given the highest priority. This study applied a methodology that allows the selection of the most efficient covariates based on the assumption of sparsity. Further analysis using traditional methods then permitted the identification of four promising areas of intervention that could cross-leverage synergies between the events. Further research should incorporate other aspects that may be of relevance in determining LOS in the context of an event portfolio. For example, given the tendency for repeat visitors to stay longer in the destination, this could include place attachment.

The limitations of the methodology employed in this study must be acknowledged. The LASSO algorithm is driven by statistical rather than theoretical guidelines (Coad & Srhoj, 2020), and LASSO may omit covariates that have small coefficients in favour of ones that are correlated with the error term but are not in the true model (STATA, 2021). However, LASSO offers the opportunity to operate a variable-selection mechanism algorithm, based on the identification of patterns and driven by statistical considerations, which is increasingly acknowledged by researchers interested in the analysis of big data sets. It has the additional advantage of producing easily interpretable outcomes, which most alternatives methods do not. LASSO facilitates an exploratory data-driven approach (or 'fact-finding exercise') that releases the researcher from having to make non-trivial decisions about which variables to keep or exclude from the analysis, mitigating to a certain extent the effect of the 'pre-selection' of key variables.

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Table 1: Basic statistics

Socio-demographic	**Min**	**Max**	**% of total**
Age (years): Average= 54.9	20	75	
15 to 24	0	1	3.9
25 to 34	0	1	10.7
35 to 44	0	1	9.8
45 to 54	0	1	15.8
55 to 64	0	1	27.5
65 or over	0	1	32.4
Monthly income (€): Average = 2,990	500	10,000	
Nationality:			
Portuguese	0	1	13.8
German	0	1	23.2
British	0	1	27.0
Other	0	1	36.1
Civil Status:			
Single	0	1	16.69
Married	0	1	68.56
Divorced	0	1	5.28
Other	0	1	9.47
Academic background:			
Secondary	0	1	28.09
Tertiary	0	1	53.47
Travel arrangements			
First visit	0	1	53.60
Travelling with children	0	1	7.20
Local lodging	0	1	14.30
Motivations			
Travelling to attend	0	1	22.25
Previous knowledge	0	1	63.22
Previous participation	0	1	16.28
General motivations	14	98	74.14
Satisfaction			
Event	1	7	6.12
Holiday	1	7	6.52
Recommendation	0	1	83.20

Table 2: Variable selection

Variables selected	CV method	CV[1] method	Adaptive method	Adaptive[1] method	Plug-in method
Socio-demographic					
Age	X	x	X	x	x
Gender	X	x	X	x	x
Income	X	x	X	x	x
Country of origin					
Germany	X	x	X	x	x
Portugal	X	x	X	x	x
France	X	x	X	x	x
United Kingdom	X	x	X	x	x
Scandinavia	X	x	X	x	x
Spain	X	x	X	x	x
Netherlands	X	x	X	x	x
Civil status					
Single	X	x	X	x	x
Married	X	x	X	x	x
Divorced	X	x	X	x	x
Academic background					
Academic:0	X	x	X	x	x
Academic:1	X	x	X	x	x
Academic:2	X	x	X	x	x
Academic:3	X	X	X	x	x
Motivations and travel arrangements					
FirstVisit	X	X	x	x	
OtherLodging	X	X	x	x	
OtherLodging	X	X	x	x	
DailyPrice	X	X	x	x	
Kmbycar	X		x		
MinbyFoot					x
TravellingwithChildren	X		x		
InfoTourismFair	X		x		
InfoTv			x		
InfoFamilyFriends			x		
Climate	X		x		
AccommodationQuality	X		x	x	
TakePartActivitiesd	X		x	x	
PriceQuality			x		
Gastronomy			x		
LearningCultures			x		
OtherReason	X	X	x	x	
Behaviours and event-related variables					
PreviousAssistance	X	x	x		
ParticipationMainEvent	X	x	x	x	
MotivationtoAttend	X	x	x	x	
Expenditure	X	x	X	x	x
NEventsAttended	X	x	x	x	
_cons	X	x	X	x	x

Table 3: Inference analysis

Variables selected	Coef.	P>z
Age	**.3171356**	**0.000**
Gender	-.065259	0.687
Income	**-.402803**	**0.000**
Country of origin		
Germany	**.673549**	**0.015**
Portugal	**-3.900008**	**0.000**
France	**-1.285208**	**0.000**
United Kingdom	-.0547987	0.854
Scandinavia	-.5859549	0.126
Spain	**-2.29953**	**0.000**
Netherlands	.4730594	0.460
Civil status		
Civil:single	.3028453	0.246
Civil:married	.1434824	0.644
Civil:divorced	-.1689698	0.717
Academic background		
Academic:0	.1701568	0.502
Academic:1	.880035	0.261
Academic:2	.2556915	0.269
Academic:3	**.3691919**	**0.068**
Motivations and travel arrangements		
FirstVisit	**-.6816854**	**0.000**
OtherLodginga	**5.719334**	**0.000**
OtherLodgingb	**1.221241**	**0.000**
DailyPrice	**-.0037012**	**0.051**
Kmbycar	**-.0169723**	**0.099**
MinbyFoot	**-.196307**	**0.000**
TravellingwithChildren	**-.4528002**	**0.068**
InfoTourismFair	.5429022	0.389
InfoTV	.4052628	0.239
InfoFamilyFriends	.2400243	0.328
Climate	.0889405	0.258
AccommodationQuality	-.0668141	0.445
TakePartActivitiesd	.0900305	0.140
PriceQuality	**.1533043**	**0.018**
Gastronomy	**-.141969**	**0.040**
LearningCultures	-.0992556	0.136
OtherReason	.474567	0.121
Behaviours and event-related variables		
PreviousAssistance	**1.985442**	**0.000**
ParticipationMainEvent	**.6392648**	**0.003**
MotivationtoAttend	**-1.100012**	**0.000**
Expenditure	**.6529359**	**0.000**
NEventsAttended	**-.1935354**	**0.013**
_cons		
Number of observations	3,192	
Number of controls	3	
Number of selected	3	
Wald chi2(39)	638.43	0

Table 4: Identification of commonalities

	Event 1		Event 2		Event 3		Event 4		Event 5		Event 6		Event 7		
	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	
Income	-0.033	0.818	0.076	0.406	0.062	0.596	0.077	0.633	-0.339	0.002	-0.076	0.711	-1.164	0.006	2.000
Age	0.652	0.000	0.054	0.569	0.452	0.000	0.325	0.037	0.506	0.000	0.762	0.000	-0.079	0.826	5.000
First Visit	-1.056	0.020	-0.315	0.229	-1.350	0.000	0.367	0.484	-0.550	0.163	-0.516	0.473	3.529	0.003	3.000
Daily Price	-0.011	0.018	-0.003	0.347	0.004	0.319	0.013	0.020	-0.004	0.322	-0.007	0.395	-0.009	0.658	2.000
Portugal	-4.556	0.000	-2.798	0.000	-4.224	0.000	-1.284	0.098	-3.973	0.000	-2.395	0.021	11.256	0.000	7.000
Number of events attended	0.565	0.055	-0.010	0.908	0.310	0.187	-0.513	0.047	0.936	0.000	-0.108	0.784	-0.453	0.524	3.000
Previous Assistance	2.778	0.000	1.774	0.000	1.471	0.007	2.345	0.002	1.859	0.000	3.957	0.000	-2.844	0.055	7.000
Main Event	-0.311	0.590	0.912	0.002	0.231	0.630	0.183	0.782	-0.712	0.237	0.743	0.390	-0.298	0.850	1.000
Motivation to attend	-1.268	0.070	-0.462	0.067	-0.896	0.364	0.870	0.552	-0.879	0.013	-0.993	0.286	2.398	0.315	3.000
Gastronomy	-0.179	0.198	-0.114	0.092	-0.042	0.664	0.197	0.266	-0.135	0.171	-0.531	0.013	-0.633	0.166	2.000
Ratio Price/Quality	-0.051	0.702	-0.035	0.610	0.047	0.629	-0.369	0.029	0.103	0.297	0.287	0.179	0.550	0.216	1.000
Local Lodgment	-0.900	0.474	2.432	0.005	6.163	0.053	4.057	0.001	2.532	0.000	21.118	0.000	4.790	0.003	6.000
_cons	8.023	0.000	7.751	0.000	6.443	0.000	5.607	0.000	8.024	0.000	7.322	0.000	21.137	0.000	
Number of obs	437		669		413		318		730		469		159		
F(12, 146)	10.930		11.800		11.760		4.660		14.700		13.600		12.230		
Prob > F	0.000		0.000		0.000		0.000		0.000		0.000		0.000		
R-squared	0.236		0.178		0.261		0.155		0.198		0.264		0.501		
Adj R-squared	0.215		0.163		0.239		0.122		0.184		0.244		0.460		
Root MSE	3.991		2.845		3.141		3.876		4.164		6.730		5.919		