Explaining cruisers' shore expenditure through a latent class tobit model: evidence from the Canary Islands

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Abstract

This study analyzes the expenditure patterns of cruise ship passengers during stopovers in the Canary Islands, which is a key variable for evaluating the economic impact of this type of tourism from the point of view of local key stakeholders and residents. Information on cruisers' expenditure was collected in each port of call by survey responses for six cruise seasons, during the period 2001-2015. Through a latent class model in a framework of censured regression, three distinct groups of passengers were identified. This approach fills a gap in the empirical tourism literature in order to achieve more accurate results to deal with cruise travelers' heterogeneity. Moreover, the identification of these homogeneous groups is important so as to better design policies that allow for higher tourism economic impact on shore. Our findings suggest that it would be ideal to attract more Class 1 cruise passengers.

Keywords: Cruisers' expenditure during stopovers; economic impacts on shore; Canary Islands; latent class tobit model

INTRODUCTION

The cruise business is one of the fastest growing economic segments in tourism over the last decade. Indeed, high rates of economic growth prevail, despite the recent international crisis and vessel accidents related to the industry. Since its emergence in the Canary Islands, just over twenty years ago, cruise passenger numbers and cruise services deployed in Canarian ports have over time increased. The archipelago itself has shown an increase in cruise passengers from 1.5 to almost 2 million in less than five years, representing more than 25% of this type of tourism in Spain.

The cruise industry benefits its destinations because it generates economic growth, investment, jobs, taxes, positive externalities and economies of scale (Dwyer and Forsyth, 1998). Whether a ship brings a profit or a loss to the city depends on the money spent by the passengers, by the crews and by the shipping companies (Tattara, 2014). However, we cannot forget that cruise ships also generate important negative externalities, due to an increase in air pollution[1] and waste.

Although the economic contribution of the cruise industry to destination economies has been widely researched in different areas (BREA, 2014; CLIA, 2018), the real economic impact on local economies has rarely been analyzed (Paoli *et al.* 2017). These studies assessing the economic impact of the cruise industry on destinations usually do it through the evaluation of cruise ship tourists' expenditure on shore. As our literature survey shows, the previous empirical studies which have analyzed cruise ship passenger spending patterns have used a variety of econometric models, but neither of them has considered simultaneously the heterogeneity of cruise passengers and the fact that a significant percentage of them do not incur in expenditure.

The purpose of this paper is threefold. First, it aims to better understand the determinants (drivers) of the cruise passenger expenditure patterns during their stopovers in the Canary Island ports. The total cruise passenger expenditure could be analyzed in the theoretical framework of Engel's curve. Thus, according to the economic literature, the determinants of tourist spending levels include several explanatory variables which, following Wang *et al.* (2006), Brida and Scuderi (2013) or Marrocu *et al.* (2015), can be grouped into four broad categories: economic constraints (income), socio-demographic attributes (age, education, gender, country of residence, occupation), trip-related characteristics (destination, party size, previous travel experiences) and psychographic factors (satisfaction about the trip).

The second objective is to ascertain whether the drivers identified (demographic features, education level, country of residence, and so on) also let us identify a set of homogeneous groups of cruisers, with regard to their expenditure patterns. This identification is important when designing policies that facilitate the success of the stopover, in terms of increasing its potential for achieving or maintaining a higher expenditure on shore. Several papers have studied the segmentation of cruise passengers using multivariate factorial analysis taking into account the visitors' preferences, motivations, satisfaction and probability of returning to a cruise destination (see Andriotis and Agiomirgianakis, 2010 or Brida *et al.*, 2014). While these papers have clustered cruise passengers based on some of their characteristics, in the present one we try to identify more than one type of cruise passengers sharing the same parameters of a regression model that explains their onshore spending patterns. For this reason, we have applied a latent class model to estimate, simultaneously, the number of clusters, the cruise passengers' expenditure function for each tourist segment and the probability of belonging to each class. This will also enable us to calculate the effect of any

explanatory variable on the expected level of total expenditure for each distinct group of cruise ship passengers.

Finally, the third target is to evaluate the effect of the financial crisis on the cruise passenger expenditure levels in the Canary Islands. Since 2008, the European cruise market has expanded by a 44% proving how resilient the cruise industry's behavior has been to economic downturns. In this context, it could be interesting to check whether the cruise passenger expenditure levels in the stopover have enjoyed the same resilience that the cruise industry showed after the 2008 crisis.

To sum up, the present article is a step towards an improved understanding in the empirical literature concerning the expenditure patterns of cruise ship passengers a key variable for evaluating the economic impact from the point of view of local key stakeholders and residents. Regarding methodological issues, the paper is relevant due to the fact that it is the first time a latent class model in a framework of censured regression has been used to analyze expenditure patterns of cruise ship passengers and its determinants. This approach is an improvement in the methodology since it fills a gap in the literature, and it is necessary to achieve more accurate results by applying an appropriate model to deal with cruise traveler's heterogeneity. Finally, the stopover cruise passenger expenditure's resilience to the international crisis in the Canary Islands has been analyzed to shed light on whether cruise tourism could be an interesting element to ameliorate the negative effects of the economic downturns.

Based on programmed cruise itineraries, the geographical scope of this study includes every Canary Island, with the exception of the island of El Hierro, during the period 2001-2015. The paper is structured as follows. In Section 2 we provide a brief but

comprehensive review of the studies of cruise passenger expenditure at port using econometric techniques. Section 3 presents the methodological issues, and Section 4 describes the cruise activity in the Canary Islands; and the questionnaire's design and the relevant data which is extracted from them. Results, discussion and policy implications are presented in Section 5. Finally, Section 6 presents the most relevant conclusions and directions for future research.

LITERATURE REVIEW

The literature studying the determinants of individual tourist expenditure is vast and it has been previously revised by other authors such as Xiao and Smith (2006), Brida and Scuderi (2013) or Mayer and Vogt (2016). In this section we focus on those studies which have analyzed cruise ship passenger spending patterns relying on econometric estimation.

This literature is in an early stage, as can be readily deduced by the fact that the first paper was published in 2000. Studies can be differentiated by those analyzing different expenditure categories, such as Brida *et al*. (2012a, b and 2015) and Risso (2012) and those studying the total expenditure, such as those that appear in Table 1. We are scrutinizing the latter more deeply, since this study pertains to this second group.

(INSERT TABLE 1 ABOUT HERE)

Table 1 provides an overview of the papers using econometric techniques to explain the influence of certain contextual variables on per capita expenditure. In order to do that, all the studies involve the collection of data from cruise passengers. This collection is usually made through face-to-face interviews carried out during the time that passengers

spend offshore and through a questionnaire which has been designed ad hoc by the authors (Henthorne, 2000; Lynch, 2004; Cuellar-Río and Kido-Cruz, 2008; Parola *et al*., 2014; Gargano and Grasso, 2016; Marksel *et al*., 2017; Di Vaio *et al*., 2018). However, there are also studies, six of the thirteen, which have taken advantages from a data base collected by others (Brida and Risso, 2010; Brida *et al*., 2014, 2015, 2018; Bellani *et al*., 2017; the present study).

Seven out of the thirteen studies have included more than one port (Brida and Risso, 2010; Brida *et al*., 2014, 2015, 2018; Parola *et al*., 2014; Bellani *et al*., 2017; the present study), but only one has included ports from different countries (Parola *et al*., 2014) in a single voyage. With regard to the period analyzed, most articles have considered only one season. Relatively few studies, only three out of thirteen, have analyzed more than one (Henthorne, 2000; Bellani *et al*., 2017; the present study). Finally, and regarding the respondents who were asked (population) most articles have considered only cruise passengers; relatively few studies, only four out of thirteen, have also included cruise crews, (Brida *et al*., 2015; Gargano and Grasso, 2016; Bellani *et al*., 2017; Marksel *et al*., 2017).

Regarding the model followed, our literature review shows articles that use a regression model estimated by ordinary least squares (Henthorne, 2000; Lynch, 2004; Cuellar-Río and Kido-Cruz, 2008; Di Vaio *et al*., 2018), tobit and OLS models (Brida and Risso, 2010); tobit and Heckman models (Brida *et al*., 2014); Heckman models (Bellani *et al*., 2017); least squares dummy variable regression (Parola *et al*., 2014); two-step stratified approach (Brida *et al*., 2015); OLS model and finite mixture models (Gargano and Grasso, 2016), and two-stage regression with Lasso and Random Forest (Brida *et al*.,

2018). From the methodology point of view, this paper contributes to the cruise literature, because it is the first one to use a latent class tobit model.

With regard to the sampling strategy, the studies are divided between those that employ the random sample (Henthorne, 2000; Lynch, 2004; Cuellar-Río and Kido-Cruz, 2008; Brida and Risso, 2010; Marksel *et al.*, 2017), and those that follow a two-step stratified approach; this is where first, cruise vessels were selected randomly through systematic sampling, and second, cruise passengers from travel groups were chosen to ensure equiprobability (Brida *et al.*, 2014, 2015, 2018; Gargano and Grasso, 2016; Bellani *et al.*, 2017). Then again, Parola *et al.* (2014) and Di Vaio *et al.* (2018) follow an accidental sample method for defining the sample. In this way adult tourists were asked to join the research, and after each port visit they replied to questions on the visited destination. The sampling strategy followed in this study is explained in Section 4.2.

Finally, and with respect to the main independent variables, there are several that have been used, such as age (Henthorne, 2000; Lynch, 2004; Brida and Risso, 2010; Brida *et al.*, 2014, 2015, 2018; Parola *et al.*, 2014; Gargano and Grasso, 2016; Marksel *et al.*, 2017; Bellani *et al.*, 2017; Di Vaio *et al.*, 2018); gender (Henthorne, 2000; Lynch, 2004; Brida and Risso, 2010; Brida *et al.*, 2014, 2015, 2018; Marksel *et al.*, 2017; Bellani *et al.*, 2017; Di Vaio *et al.*, 2018); education level (Cuellar-Río and Kido-Cruz, 2008; Brida and Risso, 2010; Parola *et al.*, 2014); income (Lynch, 2004; Cuellar-Río and Kido-Cruz, 2008; Brida and Risso, 2010; Parola *et al.*, 2014); occupation (Brida *et al.*, 2014, 2018; Parola *et al.*, 2014; Gargano and Grasso, 2016; Bellani *et al.*, 2017); civil status (Brida and Risso, 2010; Parola *et al.*, 2014; Di Vaio *et al.*, 2018); nationality (Brida and Risso, 2010; Parola *et al.*, 2014; Brida *et al.*, 2015; Gargano and Grasso, 2016; Marksel *et al.*, 2017); satisfaction (Henthorne, 2000; Cuellar-Río and Kido-Cruz,

2008; Brida *et al.*, 2014, 2018; Gargano and Grasso, 2016; Marksel *et al.*, 2017; Bellani *et al.*, 2017; Di Vaio *et al.*, 2018); port of call (Brida *et al.*, 2014, 2015, 2018; Parola *et al.*, 2014; Bellani *et al.*, 2017); hours offshore (Henthorne, 2000; Lynch, 2004; Brida and Risso, 2010; Parola *et al.*, 2014; Gargano and Grasso, 2016; Marksel *et al.*, 2017; Di Vaio *et al.*, 2018).

METHODOLOGY

Taking into account the heterogeneity of the cruise passengers' consumption, the main focus of this study is the splitting of tourists into separate groups. For that purpose, we will follow Gargano and Grasso's research (2016), and a latent class model[2] will be employed; this will allow us to distinguish among two or more homogeneous segments of cruise passengers, while letting us determine the influence of certain explanatory variables on tourists' expense in each class or segment.

However, unlike Gargano and Grasso (2016) where "95 per cent of visitors in the port of Messina spend at least 1 euro", we will take into account that a significant percentage of cruise passengers do not incur expenses of any kind; this is something that has been highlighted in several previous studies about cruise passengers' behavior. It is known that, because of the existence in the sample of a high proportion of null observations in the dependent variable, it is necessary to estimate censored models. In fact, in our sample, the distribution of the total tourist expenditure includes around 15% of zeros. Consequently, the latent class model will be applied in a framework of censured regression (Brown *et al.*, 2015), and the most common econometric alternative used in such cases would be the tobit regression (Tobin, 1958).

In the rest of this section, the methodology used to estimate the relationship between the total expenditure incurred by cruise passengers and certain explanatory variables is briefly presented.

The tobit model was the basic analytical tool chosen for this paper, since the most common alternative of ordinary least squares (OLS) regression, not recognizing the censored nature of the distribution of cruise passengers' expenditure, would lead to biased and inconsistent estimates. This tobit model also considers that the decision to make a positive spending and the level of expenditure are generated by the same probability mechanism.

Thus, the tobit model involves expressing the relationship of a non-negative dependent variable (y_i) and a group of explanatory variables which determine the behavior of individual i, via a latent and not directly observable variable (y_i^*). Therefore, in this study, y_i^* represents the expenditure that cruise passengers would like to undertake, while y_i measures their observed expenditure. Accordingly, the expression of the tobit model is:

$$y_i^* = x_i\beta + \varepsilon_i \tag{1}$$

$$\begin{cases} y_i = y_i^* & \text{if } y_i^* > 0 \\ y_i = 0 & \text{if } y_i^* \leq 0 \end{cases} \tag{2}$$

Where x_i is a set of explanatory variables, concerning both socio-demographic characteristics of individuals as well as certain trip related characteristics, β is the vector of parameters to be estimated and ε_i is the identically distributed and random disturbance; i.e., $\varepsilon_i \sim N(0, \sigma^2)$. This implies that the latent variable, y_i^*, also follows a normal distribution, $y_i^* \sim N(x_i\beta, \sigma^2)$.

As it has been mentioned before, in this paper we use a finite mixture or a latent class version of the tobit model. This approach considers that the observed data is drawn from a mixture of underlying populations. Firstly, this procedure attempts to split the sample into two or more populations, and then for each of these classes it estimates their behavior following separate tobit models. Hence, cruise passengers are supposed to belong to a latent class $j \in \{1,2,\ldots,J\}$ with probability p_{ij}. This probability is based on a logit specification that, in this paper, we allowed to be a function of observed cruise passengers' characteristics z_i with associated vector of coefficients γ_j:

$$p_{ij} = \frac{\exp(z_i\gamma_j)}{\sum_{j=1}^{J} \exp(z_i\gamma_j)} \qquad j = 1,2,\ldots,J$$

where $0 < p_{ij} < 1$; $\sum_{j=1}^{J} p_{ij} = 1$ and the parameters are subject to the identification constraints, $\sum_{j=1}^{J} \gamma_j = 0$.

The z_i variables or separating variables are individual characteristics that sharpen the prior probabilities, and can be included to identify any regularity in classifying the sample by means of the estimated coefficients of latent class probability functions (Greene 2008). However, the number of classes J is a parameter that is not observable by the research and cannot be estimated either. In practice, to solve this problem, diverse statistical tests as the Akaike information criterion (AIC) or the Bayesian information criterion (BIC), can be used.

It should be noted that both the parameters of the logit model determining class membership and those in the multiple tobit equations are jointly estimated for maximum

likelihood (Deb and Trivedi, 2002). The density function for the cruise passengers' expenditure (y_i) can be modelled using a latent regression:

$$y_i^* | (class = j) = x_i \beta_j + \varepsilon_{i|j}, \text{ with } \varepsilon_{i|j} \sim N(0, \sigma_j^2), \text{ where } y_i = y_i^* \text{ if } y_i^* > 0 \text{ and } y_i = 0$$

otherwise.

By adopting the general framework of the tobit model, the implied density function for the observed y_i will be:

$$f(y_i^* | \left(class = j, x_i, \beta_j, \sigma_j \right) = \left[\Phi \left(\frac{x_i \beta_j}{\sigma_j} \right) \right]^{1-d_i} \left[\frac{1}{\sigma_j} \phi \left(\frac{y_i - x_i \beta_j}{\sigma_j} \right) \right]^{d_i}$$

where d_i equals 1 if y_i is greater than zero, and 0 otherwise, and $\Phi(\cdot)$ is the standard normal cumulative distribution function and $\phi(\cdot)$ is the standard normal density.

In this case, the estimation of this model implies the maximization of the overall likelihood function, which can be written as the sum of the likelihood functions at each point of the sample weighed by the probability of belonging to each class:

$$\log L \left[\left(\beta_j, \sigma_j, \gamma_j \right), j = 1,2, \dots, J \right] = \sum_{i=1}^{N} \log \left[\sum_{j=1}^{J} p_{ij} \left(\gamma_j, z_i \right) f(y_i^* | \left(class = j, x_i, \beta_j, \sigma_j \right) \right]$$

THE CRUISE ACTIVITY IN CANARY ISLAND

The Canary Islands are one of Spain's seventeen autonomous communities and one of the outermost regions of the European Union. Located in the Atlantic Ocean, this collection of islands is at 115 kilometers distance from the northwest African coast, and 1,739 kilometers southwest of the country's capital. The archipelago consists of seven islands, as shown in Figure 1, each with its own characteristics. As the seven Canary

Islands are diverse, they have a huge potential to offer an array of leisure and tourist services.

(INSERT FIGURE 1 ABOUT HERE)

Tourist activity began, timidly, at the beginning of the 60s. Since then, the Canarian Archipelago has specialized in mass tourism, modality that has consolidated the Islands as a major world tourist destination, with activity levels similar to those in the Balearics and much higher than those in Hawaii, Cancun, Cyprus, Jamaica or Bali (Domínguez Mújica, 2008). As a consequence, tourism is a sector of great relevance to the economy of the islands and largely responsible for employment, consumption and standard of living (31.4% of GDP and 35.9% of direct jobs in 2015, Exceltur and Gobierno de Canarias, 2015).

New types of tourism trying to enhance the traveler's experience have appeared within the tourist offer of the Islands, and one of which is cruise tourism. Interest in the promotion of this kind of tourism is clearly shown by the institutional support from the Government of the Canary Islands and the port authorities of both Canarian provinces.

The beginning of cruise tourism in the Canary Islands occurred approximately in 2000, almost a decade after the rest of Europe, although it had already been consolidated as a traditional tourism destination beforehand. However, since then there has been sustained growth that confirms the consolidation of this sector in the islands. This is shown in Table 2, which provides an overview of the main cruise figures and their evolution from 1997 to 2015.

(INSERT TABLE 2 ABOUT HERE)

Growth could be attributed to two of their main advantages when compared with alternative destinations: being within Europe and enjoying very good weather in the winter season. This is in addition to their strategic location, short distances from flight departure points, quality in land services and infrastructure improvement. Moreover, as a Spanish autonomous region, it is governed by European Union law. The latter means several advantages, especially for European citizens (the largest source market); for example, its currency is the euro, and all European residents have a right to free healthcare within the Canary Islands public health system.

Last but not least, and as stated before, it should be noted that the archipelago as a destination for cruise tourism has been promoted from the very beginning through the firm Cruises in the Atlantic Islands[3]. It has received support from the Government of the Canary Islands through Promotur[4] whose latest strategy to promote the archipelago as a destination for cruise tourism is mainly aimed at encouraging cruise passengers to enjoy the attractions of the islands during their stopovers; consequently, they should spend more money at the destinations.

Canary ports

The Autonomous Community of the Canary Islands is divided in two provinces, Las Palmas and Santa Cruz de Tenerife. The main ports of The Canary Islands are managed by two different Port Authorities[5] as shown in Figure 2, where ports involved in cruise traffic are represented by red points. The Port Authority of Las Palmas controls three ports that receive cruise ships: Las Palmas (Gran Canaria), Arrecife (Lanzarote) and

Rosario Port (Fuerteventura). Santa Cruz de Tenerife Port Authority manages four ports involved in cruise traffic: Santa Cruz de Tenerife, Santa Cruz de La Palma, San Sebastián de La Gomera and La Estaca (El Hierro).

(INSERT FIGURE 2 ABOUT HERE)

The Port Authority of Santa Cruz de Tenerife closed the year 2015 with 506 cruise ship calls and 933,417 cruise ship travelers, whereas for the same year the Port Authority of Las Palmas registered 548 cruise ship calls and 1,252,052 cruise ship travelers.

In addition, it should be noted that the steady growth in vessel scales and cruise passengers in all Canarian ports could also be attributed to the improvement of harbor infrastructure, and to the increase of vessels with hub operations in both main ports. Indeed, according to EDEI (2011), the overall perception for passenger infrastructure offered by the Canarian ports is considered positive by cruise operators navigating in this area, and further expansion of cruise operations could be expected as the number of cruise vessels and the hosting of new hub services increase over time.

Questionnaire design

Since 2001, and in order to improve the attention to cruise passengers, both Canarian Port Authorities with the collaboration of the autonomous government have commissioned several market studies on cruise tourism in the Canary Islands[6]. Data used in the empirical part of this paper comes from these studies. Currently, there are six studies which were performed in the following cruise seasons: 2001-2002, 2003-

2004, 2004-2005, 2008-2009, 2011-2012 and 2014-2015. Table 3 shows the characteristics of each study and clearly shows that their sample sizes are rather similar.

(INSERT TABLE 3 ABOUT HERE)

The population of each study involved passengers who disembarked from arriving cruise ships in, at least, one of the Canarian ports. Face-to-face interviews were carried out during the time of the high cruise season, from December to May.

The sampling strategy followed in those studies was a two-step stratified approach. In the first phase, cruise vessels in each port were selected from a list of the ships expected to arrive during the season, through systematic sampling attending the following criteria:

- This is the ship's last port call before the end of the cruise, or it is one of the later stops. This criterion let us obtain better information from the tourist due to the fact that when interviewed he/she has visited a higher number of islands.

- This port is not the cruise's homeport. This criterion avoids selecting a bad moment to interviewed cruiser's passenger[7].

- Finally, it should be noted that a ship was never selected more than one time in the same trip. This criterion ensures the same passenger was never interviewed twice in different ports during the same voyage.

In the second stage, a convenience random sample of cruise passengers, who belong to the previously selected ships, was followed. Potential respondents were approached and invited to take part in a face-to-face survey before they returned to the cruise ship.

The questionnaire, available in Spanish, English and German, was carried out by previously trained assistants and was comprised of five sections. The first section tries to characterize the trip through questions such as whether the cruise passengers had been in the Canary Islands before, if they were travelling with someone or alone, how many stops they had made until this moment in this cruise and so on. The second section asks about the cruise's pre-trip issues, such as the way they knew about and contracted the cruise package, motivations for taking a cruise, how early the booking was made and so on. It also asks about the trip itself, such as the main reason for choosing it, how they bought the cruise trip and cruise experiences before this. The third section asks about the tourist's experience in this cruise trip. The respondents had to evaluate how satisfied they were with the different factors that were decisive for choosing to cruise around the Canary Islands. In the fourth section, cruiser passengers were asked to indicate their satisfaction with regard to this stopover (with the island and port services) through questions where the tourists had to assess different factors regarding the city. This section also contains questions about the cruiser's expenditure behavior. Finally, in the fifth section, tourists were asked to indicate their future intentions to come back for a land vacation and/or if they would recommend the island to relatives and friends. The questionnaire ends collecting socio-demographic variables such as age, gender, civil status, level of education, occupation and nationality.

The relevant data

Table 4 provides an overview of the cruise ships' passenger profiles, showing major sociodemographic and behavioral dimensions.

Cruise tourists allocated travel spending across the cruise fare, onboard and shore expenses, and airfare. Focusing on the shore expenses, cruisers spent €52.10 per

stopover on average but, as Table 4 shows, the maximum and minimum figures revealed important variations with a range from €0 to €1,191.

According to Larssen *et al.* (2013) seemingly cruise passengers are less profitable for local tourism outlets when compared to land based tourist due to the fact that "… no matter how we measured, cruise passengers' expenditures are lower than the expenditures of other tourists…". In the Canary Island case we found the same result for season 2008-2009, where the average cruise passengers' expenditure was €6.81 lower than their land based counterpart, but the opposite was true in the latter two seasons 2011-2012 and 2014-2015 where the average cruise passengers' expenditure was €5.85 and €4.4 higher, respectively[8].

For all the estimations the dependent variable used is the total real expenditure of the cruise passengers at a port of call, at 2016 prices. The average cruise passenger's expenditure by stopover, calculated over the six seasons analyzed, showed differences among the islands: it was €70.98 in Tenerife, €56.19 in Gran Canaria, €51.20 in Lanzarote, €41.24 in Fuerteventura, €38.59 in La Palma and €27.05 in La Gomera. All these monetary variables have been deflated to 2016 prices, using the Retail Price Index for the Canary Islands

(INSERT TABLE 4 ABOUT HERE)

The explanatory variables included in the best fit model consider sociodemographic characteristics, such as the age of the cruise travelers and the age squared/100 to capture possible non-linear effects, gender, level of education, occupational status (as a proxy of income following, for example, Brida *et al.*, 2014) and country of residence; variables

regarding trip-related characteristics such as group composition, port of call and cruise season; and finally a variable that measures the satisfaction achieved at the destination. Thus, we have included all broad categories identified in the literature: socio-demographic attributes, trip-related characteristics and psychographic factors except economic constraints (income) because this information is not available although, as we stated before, we have approximated it through the occupation status.

RESULTS, DISCUSSION AND POLICY IMPLICATION

In this section we present the results obtained by estimating the latent class tobit model, as explained in Section 3 above. Firstly, we have found that a model of three latent classes provides a good description of the cruise passengers' expenditure in the Canary Islands. In fact, Table 5 reports the value of the likelihood function, AIC and BIC for different latent class tobit models, where up to four classes are considered. As it can be seen, a model with three latent classes presents the lowest values of AIC and BIC and the highest value of the likelihood function, and is therefore the chosen specification.

(INSERT TABLE 5 ABOUT HERE)

Table 6 shows the results relating to the determinants of class membership. The positive coefficients are associated with the higher probabilities of being in that class, while in contrast the negative ones are associated with a lower probability of being in that class. The results reveal that younger tourists, those under forty, have a higher probability of belonging to Class 3 and a lower probability of belonging to Class 1. Moreover, travelling in a group (with a partner, with the family or with friends) and previous experience of cruise journeys are positively associated with being in Class 3, whereas visiting the Canary Islands for the first time may help classify travelers into Class 1.

In addition, we have included a macroeconomic variable to take into account the differences in purchasing power among the cruisers' countries of origin and the Canary Islands (Spain). Specifically, we have used the ratio of foreign and Spanish price levels of real consumption of households at PPP (see Feenstra *et al*., 2015). The results indicate that relative prices may help to classify travelers into Class 2/Class 3, when prices in the cruisers' country are higher/lower than in the Canary Islands; however, it does not have any significant influence for those belonging to Class 1.

(INSERT TABLE 6 ABOUT HERE)

Out of the total of 12,461 observations, 3,482 cases are assigned to Class 1 (27.95%), 8,308 cases are assigned to Class 2 (66.675%) and 671 to Class 3 (5.38%), as shown in Table 6. These class separations are calculated by conditional posterior probabilities using Bayes' theorem. This lets us allocate each cruise passenger to a particular class, the one which has the higher posterior class probability.

Table 6 also shows the estimated probability of making a positive expenditure in each class. As it can be seen, there is a clear difference between these probabilities, with Class 2 being the one with the highest number of zero expenses, followed by Class 3 and further away by Class 1. This reinforces the identification results of the three classes obtained by the information criteria

The results of the tobit estimation for modelling the cruise passenger expenditure are presented in Table 7, where the coefficients are reported by class. It can be appreciated that most of the explanatory variables are statistically significant. The predicted

expected value of cruise traveler expenditure, evaluated at sample mean of the explanatory variables, shows that the three classes identified correspond to *medium* (Class 1), *low* (Class 2) and *high* (Class 3) tourist spending. We calculate that the average predicted level of cruise passenger expenditure is €77.61, €23.24 and €182.53 for Class 1 to 3, respectively. As expected, these predicted averages are higher when zero expenditure observations are eliminated. It should be noticed that being the class with the highest probability of having a positive cruiser passenger expenditure (Class 1) does not correspond to the class with the higher average tourist expenditure (Class 3).

Within Class 1 and 3, the positive sign of the age coefficient suggests that older tourists tend to increase their levels of consumption, albeit at a decreasing rate according to the negative coefficient of the squared term. This result, regarding the first order term[9], is in line with previous evidence found by Henthorne (2000), Gargano and Grasso (2016) and Bellani *et al*. (2017), although in this latter case the variable was statistical significant only for some cruise's seasons. However, there are also other authors who found the opposite result such as Lynch (2004), Brida and Risso (2010), Parola *et al*., (2014) and Brida *et al*. (2015) and Di Vaio *et al*. (2018); also there are those who did not find a significant association between age and passengers' expenditures, such as Marksel *et al*. (2017).

The education level and deriving greater satisfaction in the destination have a direct positive incidence on total expenditure incurred by the cruise passengers belonging to all Classes. The influence of levels of satisfaction in expenditure found in this study is similar to the results regarding the analysis of in-port expenditure reported by Cuellar-Río and Kido-Cruz (2008) in Puerto de Santa Cruz (Mexico); by Brida *et al*. (2014)[10], Bellani *et al*. (2017) and Brida *et al*., (2018) in the Montevideo and Punta del Este ports

(Uruguay); by Parola *et al*. (2014) in several Mediterranean ports; by Gargano and Grasso (2016) in Koper port (Slovenia) and by Di Vaio *et al*. (2018) in Naples port (Italy). Therefore, we can conclude that the level of satisfaction is confirmed as being a critical predictor of cruiser passengers' expenses on shore.

Regarding the variable travelling in a group, our literature review does not show conclusive results. Parola *et al*. (2014) did not find a significant association between travelling in group and passengers' expenditures. However, other authors such as Brida *et al*. (2015, 2018) and Bellani *et al*. (2017) found the opposite result. In our case, travelling in a group seems to have a direct positive impact on total expenditure in the cases of Class 1 and 2; whereas it has the opposite effect in Class 3, although it is only statistically significant at 10% level.

Taking England as the reference for country of residence, it appears that cruise travelers from Italy, North America and other countries in Europe (France, Netherlands or Austria) show a greater tendency for tourist consumption when they are classified in Class 1. For Class 3, the same could be said regarding Spanish, Italian and other Europeans, but the opposite is true for German and rest of the world passengers when they belong to Class 2. Besides, other variables such as gender[11] or professional status proved non-significant in the tobit regressions. In that sense, the literature review shows that this last result is similar to the one found by Lynch (2004), Brida and Risso, (2010), Gargano and Grasso (2016) and Bellani *et al*. (2017) but differs from the one reported by Brida *et al*. (2015, 2018) and Marksel *et al*., (2017)

Furthermore, we highlight the importance that cruise seasons have on expenditure, as well as the port of call and the island visited. In particular, and taking as reference the

islands of Fuerteventura and La Gomera, the expenditure pattern of cruise passengers is greater in Lanzarote for Class 1 and 2, and it is always greater in Tenerife and Gran Canaria no matter the class.

The period under study is particularly interesting, due to the fact that it grouped the years pre and post the recent international financial crisis. Therefore, the effect of the financial crisis on the cruise passenger expenditure levels (on shore) in the Canary Islands could be evaluated. It should be noted that, since 1980 to the present, a period that encompasses a number of economic downturns as well as international crises, the average annualized growth of the cruise industry has remained positive in terms of numbers. In fact, according to CLIA[12] *"since the beginning of the economic crisis in 2008, the European cruise market has grown by 44%, proving the cruise industry's resilience"*. However, these good figures do not mean that the economic impact in the ports of call, measured through the passengers' expenditure in the stopover, have shown the same resilience.

There are several papers regarding the effect of the financial crisis on the port sector[13]. However, to the best of the authors' knowledge, this is the first study measuring whether and how the volatile economic climate generated by the latest financial crisis affected the cruise passengers' expenditure at the port of call. Therefore, especially noteworthy is the result concerning the cruise season, since it reflects the impact of the last great recession. It should be noted that the cruise season 2002/2003 has been taken as a reference category. Then, a positive/negative coefficient is associated with a higher/lower expenditure level compared to the reference season.

Thus, from these coefficients in Table 7 for Class 1 and 3, we can deduce that time has had a positive and significant impact on the passenger expenditure levels for the 2003/2004 and 2004/2005 seasons, but a negative and significant impact in the 2008/2009 season. It is also negative for the 2011/2012 and 2014/2015 seasons for Class 1 and 3 passengers, respectively; i.e., ceteris paribus, expenditure levels on shore increase and diminish in the time period studied in the case of Class 1 and 3 passengers. However, it can be observed that the coefficient estimated for the season 2008/2009 is the most negative; while the 2011/2012 season already appears as more moderate, showing clearly that the international financial crisis of 2008 affected the expenditure on shore of passengers belonging to Class 1. Conversely, for Class 2 coefficients Table 7 shows that time has had a positive and significant impact on the passenger expenditure levels in all the seasons; i.e., ceteris paribus, expenditure levels on shore increase in the time period studied in the case of Class 2 passengers.

(INSERT TABLE 7 ABOUT HERE)

Table 8 presents descriptive statistics of the characteristics of cruise passengers by class. The simple average of tourist expenditure is €88.40, €20.10 and €259.60 for Class 1, 2 and 3, respectively. Moreover, minimum and maximum values also show major differences. There are also paramount differences among classes, in terms of how the levels of expenditure are distributed. That is, total passenger expenditure in Class 1 and 2 is almost distributed among three categories, which represent 99.4% and 98.7% of the total expenditure, respectively; but these categories are not the same. In fact, they are the three higher/lower expenditure categories in the Class 1/Class 2 case, respectively. Furthermore, the most representative passenger expenditure category is €61-€100 in Class 1 and €0.50-€30 in Class 2. Besides, the total passenger expenditure is almost

evenly distributed among the other two categories in both classes; although in Class 1 both categories signify a positive expenditure, whereas in one Class 2 category the passengers spend nothing. Finally, Class 3 is characterized by having almost all cases concentrated in the highest passenger expenditure category (97.02%); although some null expenditure observations can also be found (2.98%). It should be noted that we have found no observations in Class 3 for €0.50-30, €31-€60 and €61-€100.

Last but not least, Table 8 shows that Class 1 and 3 incorporate a higher proportion of cruise passengers who have not been in the Canary Islands before. Moreover, Class 3 also presents a large number of passengers who are younger than forty years old. However, the passenger distribution regarding the income status is similar in all classes. The same could be said regarding some trip-related characteristics, such as whether the passenger has enjoyed previous cruises. It should be noted that in all classes the ranking in the group composition (if he/she is travelling with someone or alone) from the most to the least important segment is the same, whether it is with a partner, with the family, with friends or finally alone. Nevertheless, there are some little differences in the percentages among classes. That is to say, the proportion of cruise passengers who are cruising with a partner is higher in Class 2, whereas there are more passengers cruising with friends or with the family in Class 1 and 3. Furthermore, in Class 3 the number of cruise travelers whose country of residence has a lower retail price index than Spain is highlighted.

(INSERT TABLE 8 ABOUT HERE)

From the previous paragraph, it seems evident that Class 3 is clearly dominated by the cruise passengers' extreme expenditure at a port of call, whereas the other two present a

smaller dispersion in their behavior. That is to say, Class 1 corresponds to a medium expenditure level and Class 2 corresponds to a low expenditure level. The latter is clearly illustrated by Figure 3, which depicts the distributions of the total real expenditure for all classes.

(INSERT FIGURE 3 ABOUT HERE)

Finally, the marginal effects computed for each class are presented in Table 9. We have calculated three different types of marginal effects based on the posterior probabilities of belonging to each class. The first one refers to the probability of making a positive expenditure, the second one has to do with the overall expected value of tourist spending in euros, E[y], and the last one is related to the expected expenditure conditional on a positive value of such, E[y|y>0]. All effects are evaluated at the means of the explanatory variables for each class. The magnitudes for E[y] and E[y|y]>0, in absolute values, are higher in Class 3 in relation to Classes 1 and 2, except for a few variables such as age[14]. In Class 1 the marginal effects are very similar for E[y] and E[y|y>0]; however, within Class 2, the effects for E[y|y>0] are more than double those for E[y]. Also, for Class 3 the effects of E[y|y>0] are noticeably higher. These results reinforce the idea of heterogeneous behavior among cruise passengers.

Table 9 shows that there are several variables which behave equally in all classes, such as education level and destination satisfaction. Moreover, it should be noted that the marginal effect regarding the main Canarian ports (Tenerife and Gran Canaria) are always positive, no matter the class. For instance, the marginal effect E[y] of making a stopover in Tenerife, in relation to the islands of Fuerteventura and La Gomera, is a

higher expenditure of €21.6 for Class 1, €1.8 for Class 2 and €47.2 for Class 3, respectively.

In addition to the ports of call, the following list of variables shows those with the highest positive effects on tourist spending for Class 1: travelling with a group, deriving greater satisfaction at the destination and several countries of residence (North America, Italy and other European countries) in relation to England. For Class 2, not only successive cruise seasons have had a positive effect but also it is important to travel in a group. Finally, for Class 3 highlights the positive marginal effects of destination satisfaction and different countries of residence, such as Italy, Spain and other European countries.

We have tried to compare, as far as possible, these results with those inferred from other studies[15]. For example, we have obtained that passengers' expenditure for Class 1 will decrease by €1.91 for each additional year of age, while in Lynch (2002) that value reaches €1.72 euros (at 2016 prices). Also, our marginal effects as regards destination satisfaction ranges between €0.81 and €17.06, values which are in line with the empirical findings from €3.09 to €12.82 of Gargano and Grasso (2016), €5.84 of Di Vaio *et al*. (2012), and €17.76 of Parola *et al*. (2014). However, we have computed a marginal effect for travelling with a group equal to €8.93 (Class 1), a value lower than €17.62 that found by Bellani *et al*. (2018).

Regarding the marginal effect E[y|y>0] for the most critical period of the recent economic recession, the 2008-2009 cruise season, it should be pointed out that it represents a decrease of average expenditure per passenger of €24.5 for Class 1 and by €42.2 for Class 3, whereas for Class 2 this expenditure increases by €10.1 with regard to the 2002/2003 season.

(INSERT TABLE 9 ABOUT HERE)

CONCLUSIONS AND FUTURE RESEARCH

This study analyzes the expenditure patterns of cruise ship passengers during stopovers in the Canary archipelago, which is an essential variable to evaluate their economic impact from the point of view of local key stakeholders and residents. Regarding methodological issues, it contributes to the existing literature because it is the first time a latent class model in a framework of censured regression has been used to analyze expenditure patterns of cruise ship passengers and their determinants. Moreover, our work takes into account both the heterogeneity of cruise passengers and the fact that a significant percentage of them do not make any expenditure. As such, the present article represents a step towards an improved understanding in the empirical literature concerning expenditure patterns of cruise ship passengers.

In our empirical application to cruise ship stopovers in the Canary Islands, information on passenger spending was collected in each port of call by survey responses for six cruise seasons. The empirical evidence shows that a tobit model of three latent classes provides a good description of cruise passengers' expenditure. In particular, three homogeneous groups of cruisers were identified according to their expenditure patterns: medium (Class 1), low (Class 2) and high (Class 3) tourist spending. Of the 12,461 total observations, our model assigned 27.95% of observation to Class 1, 66.67% to Class 2 and 5.38% to Class 3. In addition, members of Class 1 were found to have the highest probability of spending, with Class 2 having the lowest.

By understanding the profile of the average tourist and the different determinants of tourist spending, as well as how much is spent, policymakers and local entrepreneurs can better address the formulation of appropriate marketing strategies. In this way, sellers and entrepreneurs may gain access to the information and incentives required to direct their efforts towards attracting the biggest spenders. From our empirical results, it is possible to provide some policy recommendations for enhancing the economic impacts of cruise tourism on shore.

According to our model, the optimal strategy would appear to be to attract more Class 1 cruise passengers. Concretely, it would seem ideal to target a segment of younger tourists among those over 40 years old that have no previous experience of cruise journeys, that have a high educational level, and that travel in a group coming from North America, Italy or other European countries. These results provide the foundation for designing incentive policies to capture such a segment of demand and can serve as a guide for marketing and communication campaigns in those countries. Likewise, it would also be important to promote the Canary Islands as a destination with tourist attractions for group activities.

Due to the fact that the cruisers' expenditure is always higher in the ports of Tenerife and Gran Canaria regardless of other circumstances, it would also be advisable to identify the factors determining this phenomenon at these two stopover points. Moreover, greater consumer satisfaction at the destination is found to have a direct positive influence on total expenditure, so that policies designed to increase passenger satisfaction should also result in higher expenditure in port. In this sense, activities such as the ones developed by *Promotur* that facilitate passengers' knowledge about the tourism options in the region, including an agenda with the most relevant events

happening on the islands, are highly welcome. Cooperation between the local governments and port authorities should therefore be strengthened in order to improve tourist information at cruise terminals.

We also find that the international financial crisis of 2008 affected the on-shore expenditure of passengers in different ways depending on which class they belong to. Thus, the crisis had a negative impact on the passenger expenditure levels of Classes 1 and 3, but a positive one on the Class 2 expenditure levels. The latter result implies that the good economic performance of the cruise industry through the economic downturns and international crises does not necessarily mean that the economic impact on the ports of call, measured through the passengers' expenditure in the stopover, have enjoyed the same resilience.

Finally, some words are in order about where future research on the issues raised in this paper could go. Firstly, we see no reason why the results of our study of cruise passengers' expenditure during stopover in the Canary Islands should not be applicable to other islands or countries. It would therefore be interesting to see to what extent our results are corroborated by studies using data from other countries or continents. Secondly, it would be interesting to expand the methodology used in this paper to the different components of tourist spending for cruise passengers.

NOTES

1. A detailed analysis about the methodological and empirical state of the art on external cost estimation from harbor emissions released by vessels is out of the scope of this article, but could be found in a recent review by Tichavska and Tovar (2017). For an estimation of exhaust pollutants, and the derived external cost, related to cruise and ferry operations by sea in Las Palmas Port see also Tichavska and Tovar (2015a, b).

2. Several latent class approaches have already been applied in other tourism studies, such as Van der Ark and Richards (2006), Alegre *et al*. (2011) or Wu *et al*. (2011).

3. Cruises Atlantic Islands is a marketing and promotional association created in 1994, and formed by the Port Authorities of Madeira, Cabo Verde, Las Palmas and Tenerife, to promote the islands as a cruise area in the Atlantic.

4. PROMOTUR TURISMO CANARIAS, S.A. (PROMOTUR) is a public company whose principal purposes include activities associated with promoting and fostering Canary Islands tourism, products and services, and reinforcing the tourism options in the region.

5. For a detailed analysis of the port management model in Spain, see Rodriguez-Álvarez and Tovar (2012) and Tovar and Wall (2014).

6. Each study has been carried out following the UNE-ISO 20252, which is the international quality standard in market, opinion and social research.

7. This is because in the beginning he/she has not still enjoyed the trip, and thus has no direct information about the destination. Then again, at the end it is not possible to do interviews due to the cruise ship's berthing.

8. Aguilo Perez and Juaneda Sampol (2000) have emphasized, in the context of mass tourism markets, the importance of breaking down the purchase of each individual into expenditure at the origin country and expenditure at the destination. As the Canarian Archipelago has specialized in mass tourism, the comparison has been made using the average daily expenditure made at the destination by the land based tourists, using the information provided by the Tourism Expenditure Survey conducted by the Canary Institute of Statistics of the Government of the Canary Islands.

9. To the best of our knowledge this is the first study including the age squared term.

10. Satisfaction factors influence only the decision on whether or not to purchase.

11. In the case of Class 2 the coefficient associate to gender shows that being male have a direct negative effect on total expenditure but this result is only statistically significant at 10% level.

12. https://www.cruiseexperts.org/media/2298/european-cruise-market-reaches-an-all-time-high.pdf

13. See, for example, Chang and Tovar (2014ab, 2017ab) and Wilmsmeier *et al*. (2013) regarding the effect of the financial crisis on Peru and Chile port terminals and Latin America and the Caribbean container port productivity, respectively.

14. The marginal effect of age takes into account both the linear and squared terms of the latent class tobit model.

15. Some caution is necessary in the comparison of these results, since the other studies have estimated OLS models. All values are in euros at 2016 prices.

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Table 1. Papers using econometric techniques to explain per capita cruise passenger's expenditure

Study	Data	Methodology	Independent Variables	Results/Observations
Henthorne (2000)	-Port: Jamaica (Jamaica) -Period: Collected annually during a 5-year period, -Years: 1993-1997. -1,500 questionnaires -Population = cruise passengers	OLS model EV =PCE OUE = 1500 TO	Age, Gender, Time spent shopping, Year of visit. Regarding experiences with vendors 3 factors extracted using PCA: Friendly, Aggressive and Believable.	-The longer visitors remain in the vicinity of a vendor's shop, the greater the likelihood of increased purchases. -Older travelers purchase more than their younger counterparts do. -The friendlier a vendor, the more likely that customers will purchase. -Vendors perceived as manipulative and aggressive achieve lower sales than their more "refined" counterparts.
Lynch (2004)	-Ports: Bar harbor (Maine, USA) -Period: August-October -Year= 2002 -1,080 questionnaires -Population = cruise passengers	OLS model EV =PCE OUE = 779 TO	Age, Distance to home, Gender, Income, Passenger's ship, Previous visit, Plans for return, Hours offshore.	-Plans for return and time spent in port are both important determinants in the level of passenger expenditures in port. -Passenger income has a significant impact on expenditures. -The ship and dates of passenger visits both have a significant impact on passenger spending in port. -While the gender of a passenger does not have a significant impact on expenditures in port, age proves to be significant (older passengers purchase less). -There is no evidence that previous visits to Bar Harbor significantly impact on the levels of expenditures of cruise passengers while in port.
Cuellar-Río & Kido-Cruz (2008)	-Port: Puerto de Santa Cruz (México) -Period: September-May -Year: 2005/2006. -365 questionnaires -Population = cruise passengers	OLS model EV =PCETE OUE = from 251 to 356 TO depending on the model)	Activities done, Buy tour, Buy tour in other ports, Education level, Expenditure on board, Income level, Satisfaction level.	-In opposition to conventional wisdom, on-board expenditure behavior was found to be positively related to in-port expenditure behavior. -The higher the level of satisfaction, the bigger the impact of on-board expenditure on in-port expenditure.
Brida & Risso (2010)	-Ports: Calderas, Puntarenas, Golfito, Moin and Limon (Costa Rica) -Period: October-November -Year= 2008 -1,121 questionnaires -Population = cruise passengers	OLS, Tobit models EV =PCET OUE = 893 TO EV =PCE OUE = 670 TO	Age, Civil status, Education level, Gender, Hours offshore, Income level, Nationality, Time outside the cruise ship.	-Different tourist profiles related to the expenditure levels are shown -Heavy spenders are distinguishable from the other segments, in terms of age (older passengers purchase less), hours spent out of the ship, nationality, levels of income and their spending pattern. -Tourists spending higher amounts of money while at the port are also those that stay off the ship for longer time periods. -Passengers' sex and the level of education are not significant.
Brida *et al.* (2014)	-Ports: Montevideo, Punta del Este (Uruguay)	Tobit Model: EV =PCE	Age, First time visitors, Gender, Inverse Mills ratio,	-The Heckit model suggests the presence of a decision process of purchasing that might be more 'instinctive' than is suggested by the

Study	Data	Methodology	Independent Variables	Results/Observations
	-Period: November-March -Year= 2011/2012 -N° questionnaires (NA.) -Population = cruise passengers	OUE = 3173 TO Heckman Model (UM and RM): <u>First stage</u>: EV =D OUE = 3173 TO <u>Second stage</u>: EV =PCE OUE = 2588 UO	Month, Occupation, Party size, Port of call, Residence, Satisfaction	findings of other papers on general tourism expenditure -The restrictions imposed on the RM seem to suggest that local tourist operators might be advised to increase the in place satisfaction, in order to promote the decision to spend. -Satisfaction factors only influence the decision of whether or not to purchase, whereas occupation as a proxy of income is considered only in the outcome stage
Parola *et al.* (2014)	-Ports: Casablanca (Morocco), Lisbon (Portugal), Malaga, Cadiz Valencia and Barcelona (Spain) -Period: April -Year= 2013 -127 questionnaires -Population = cruise passengers	LSDV regression model EV =PCE OUE = 748 TO	Age, Civil status, Country, Education level, First time cruising, Group composition, Hours offshore, Income level, Old (cruiser over 64), Occupation, Port destination dummy	-Young cruisers spend more during on shore visits, as well as those passengers coming from the country in which the port is located. -Cruisers' level of income and time spent out of the ship are confirmed to be critical predictors of tourists' expenses. -Some bias might originate from endogeneity between cruise expenditures and income levels (the introduction of instrumental variables in order to overcome this concern in future research is recommended).
Brida *et a.l* (2015)	-Ports: Montevideo, Punta del Este (Uruguay) -Period: November-March -Year: 2009/2010 -3348 questionnaires -Population = cruise passengers and crew (over 18)	Two-step stratified approach -Logit model EV = D OUE = 3448 TO -Tobit model EV =PCE OUE = 2802 UO	-Age, -Dislike prices, -Gender -Group size, -Montevideo port arrival, -Nationality -Number of visit, Cities visited: -Montevideo -Punta del Este, - Colonia	-The Logit model suggests that the most likely visitor to spend money is a crew member, a professional or an employer. The likelihood of spending increases if the tourist is in a big group and is visiting Punta del Este. -From the results of the Tobit model, we can conclude that the visitor profile which tends to spend the most is a man not resident in Argentina whose occupational status is professional.
Gargano & Grasso (2016)	-Port: Messina (Sicily, Italy) -Period: March-October -Year: 2014 -5500 questionnaires -Population = cruise passengers and crew	OLS model and Finite mixture (Latent class) models EV =PCE OUE = 5500 TO	Age, General satisfaction, Hours offshore, Nationality, Occupation, Previous holiday in Messina, Recommendation, Season	-Age, nationality and occupation influence expenditure, but gender and level of education do not. -Mixture regression models study if the visitors' expenditure depends on various factors (duration of visit, nationality, occupation, previous visit and satisfaction) in visitors with different levels of satisfaction. Three profiles in expenditure according to levels of satisfaction were identified.
Marksel *et al.* (2016)	-Port: Koper (Slovenia) -Period: September -Year: 2013	The Fisher exact test EV =PCE	Age, Frequency of cruise, train, Frequency of visit, Gender, Nationality, Time	-The results highlight that gender, nationality, experience regarding the transport services and motives for disembarkation have a statistically significant effect on cruise passenger expenditures.

Study	Data	Methodology	Independent Variables	Results/Observations
	-357 questionnaires -Population = cruise passengers and crew	OUE = 357 TO	spend at hinterland, Motives for disembark, Tourist experience with: ships' excursions, local providers' excursion, tourist information, taxi, Bus, shopping, food and drink and port facilities	- The significant association of age, travel-related characteristics (frequency of cruising, frequency of visits and time spent in the hinterland) on the passengers' expenditures could not be confirmed.
Bellani *et al.* (2017)	-Ports: Montevideo, Punta del Este (Uruguay) -Period: November-April -Years: 2010-2011, 2011-2012, 2012-2013, 2013-2014 y 2014-2015 -Nº questionnaires (NA.) -Population = cruise passengers and crew	Heckman Model <u>First stage:</u> EV =D OUE = NA. TO <u>Second stage:</u> EV =PCE OUE = NA UO	Age, First time visitors, Group composition, Crew member, Gender, Month, Occupation, Port of call, Residence, Satisfaction,	- Results from Heckman's selection models applied on surveys from 2010 to 2014 show that only a few characteristics determine the level of spending: the Brazilian nationality, travel in groups, visiting Montevideo and being satisfied with the trip. This pattern has not had significant variations in the period.
Brida *et al.* (2018)	-Ports: Montevideo, Punta del Este (Uruguay) -Period: November-March -Year= 2016/2017 -Nº questionnaires = 3117 -Population = cruise passengers	Two-Stage Regression with Lasso and Random Forest. <u>First stage:</u> EV =D OUE = 3117 TO <u>Second stage:</u> EV =PCE OUE = 1964 UO	-Satisfaction variables (variables of pleasure and displeasure), -Socio-Economic variables (residence, age, occupation) -Travel variables (month, number of previous visits, descending port, sites visited) -Context variables (number of group members -one, two and more than two- and group type -mixed, only women or only men-).	- The paper analyzes the distribution of conditional expenditure to a set of sociodemographic, travel, contextual and satisfaction variables applying non-linear regression techniques with Lasso penalty and nonparametric techniques such as Random Forest. -The empirical results show that the residence, the fact of not traveling alone, the port of landing and satisfaction are the main variables to explain total expenditure of cruisers in Uruguay.
Di Vaio *et al.* (2018)	-Port: Naples (Italy) -Period: October-December -Year= 2016 -Nº questionnaires = 812	OLS and Hierarchical regression EV =PCE	Age, Civil status, Company, Country, Education level, First time cruising, Frequency of cruise Gender, Hours offshore,	-The study highlight that the effect of cruisers' satisfaction with the terminal facilities and local transport services positively influences the expenditure of cruisers in the cruise destination; -The latter relationship is moderated by the dimensions of the ships;

Study	Data	Methodology	Independent Variables	Results/Observations
	-Population = self-organised cruisers	OUE = 812 TO	Old (cruiser over 63), Destination satisfaction, Super-size ship	-Age, cruise experience and time on land are confirmed to be critical predictors of cruiser's expenditures in the tourism destination.
Present study (2018)	-Ports: La Palmas, Arrecife, Rosario Port, Tenerife, S/C, La Palma, S/S La Gomera (Canary Islands, Spain). -Period: Collected annually -Years: 2001-2002, 2003-2004, 2004-2005, 2008-2009, 2011-2012, 2014-2015. -12,578 questionnaires -Population = cruise passengers	Latent class tobit model EV =PCE OUE = 12,461 TO and 10,606 UO	Age, Age squared, Gender, Education level, Occupation, Group composition, Residence, Port call, Destination satisfaction	-Three latent classes provide a good description of the cruise passengers' expenditure in the Canary Islands, and correspond to medium (Class 1), low (Class 2) and high (Class 3), tourist spending. -The determinants of class membership reveal that the separating variables were related to age, relative price index, travelling in a group, previous experience of cruise journeys and visiting the Canary Islands for the first time. -This identification is important, in order to better design policies that obtain a higher expenditure on shore.

Note: EV = Endogenous Variable; PCET = Per capita Expenditure board and port; PCE = Per capita Expenditure offshore; PCA = Principal Component Analysis, PCETE = Per capita Expenditure tour excluded; OUE =Observations used in the model estimation; TO = Total observations, UO= Uncensored observations; D= decision on whether or not to purchase; UM=Unrestricted Model; RM=Restricted Model; OLS = Ordinary Least Square; LSDV = Least square Dummy Variable, NA = Not available

Table 2. The evolution of cruise ship passengers and port calls in the Canary Islands

Year	Passenger			Port calls
	Total	**Call port**	**Home port**	
1997	146,117	139,893	6,224	231
1998	259,610	231,842	27,768	387
1999	304,389	268,989	35,400	559
2000	308,319	271,667	36,652	430
2001	396,488	355,586	40,902	512
2002	526,996	475,537	51,459	627
2003	658,991	584,176	74,815	702
2004	832,627	670,408	162,219	706
2005	903,360	699,950	203,410	731
2006	757,202	590,358	166,844	639
2007	942,105	775,588	166,517	733
2008	1,110,999	913,776	197,223	684
2009	1,200,281	1,009,489	190,792	730
2010	1,410,213	1,177,831	232,382	767
2011	1,594,664	1,251,157	343,507	862
2012	1,719,169	1,376,266	342,903	1,002
2013	1,627,352	1,217,209	410,143	982
2014	1,907,913	1,382,969	524,944	1,026
2015	2,185,469	1,627,086	558,383	1.048

Source: own elaboration

Table 3. Summary of the surveys of each study

Cruise Season	Canary Island cruise		Stopover with	
	Sample	**Sample error**	**min**	**max**
2001-2002	1,613	0.0244	0	402
2003-2004	2,389	0.0200	0	503
2004-2005	2,421	0.0199	0	464
2008-2009	2,031	0.0217	192	414
2011-2012	2,000	0.0219	188	414
2014-2015	2,124	0.0212	206	473
TOTAL	12,578			

Source: own elaboration

Table 4. Variables and descriptive statistics

Gender (%)		Port (%)		Number cruise (%)	
Male	48.1	Lanzarote	23.0	First time	37.0
Female	51.9	Tenerife	22.5	Second time	18.5
Age (%)		Gran Canaria	20.5	Third time	12.4
< 40 years	13.0	La Palma	20.1	Four or more	32.1
40-64 years	56.5	Fuerteventura	9.2	**Satisfaction (%)**	
>65 years	30.5	La Gomera	4.7	Low	2.8
Education level (%)		**Group composition (%)**		Medium-Low	7.2
Below elementary	6.5	With a partner	62.3	Medium-High	29.0
Elementary	20.0	With family	13.6	High	61.0
High-school	36.6	With friends	18.9	**Total expenditure (€)**	
University/college	36.9	Alone	5.1	**(2016 prices)**	
Country (%)		**Occupation status (%)**		*(total sample)*	
(residence)		Unemployed (low)	16.9	Mean	52.10
United Kingdom	43.5	Retired (low-medium)	46.8	Max	1,191
Germany	34.5	Employed (medium)	26.0	Min	0
Italy	4.4	Manager (high-medium)	7.8	*(only positive values)*	
USA and Canada	3.7	Entrepreneur (high)	2.6	Mean	61.22
Spain	2.0	**First time in Canary Island (%)**		Max	1,191
Other European countries	10.2	Yes	51.3	Min	1.0
Others	1.8	No	48.7		

Source: own elaboration

Table 5. Model selection criteria

Model	Log-likelihood	AIC	BIC
Tobit model	-13,463.26	26,974.52	27,152.85
2-Latent class tobit model	-10,227.49	20,566.98	20,983.08
3-Latent class tobit model	**-9,679.43**	**19,534.86**	**20,188.73**
4-Latent class tobit model	-12,711.81	25,621.62	26,357.22

Table 6. Estimates of the determinants of class membership

Explanatory variable	Class-1		Class-2		Class-3	
	Coefficient	t-Stat.	Coefficient	t-Stat.	Coefficient	t-Stat.
Socio-economic characteristics						
Age (< 40)	-0.8125***	-3.22	0.1788	1.44	0.6337***	3.97
Relative Price Index	0.1131	0.41	0.6171***	4.47	-0.7302***	-3.96
Trip-related characteristics						
Group composition (ref. alone)						
With a partner	-0.8219*	-1.69	-0.0332	-0.14	0.8551**	2.54
With the family	-0.6142	-1.20	-0.3323	-1.33	0.9465***	2.68
With friends	-0.4463	-0.89	-0.3045	-1.25	0.7508**	2.17
First visit Canary Islands (ref. No)	0.2773*	1.75	-0.2521***	-3.57	-0.0252	-0.23
Previous cruises	-0.0289**	-2.05	0.0098	1.57	0.0191**	2.06
Constant	1.0408	1.48	-0.4948	-1.44	-0.9060*	-1.91
Total observations	12,461					
Censored observations	14.88% (1,855)					
Proportion predicted in Class 1	27.95% (3,482)					
Proportion predicted in Class 2	66.67% (8,308)					
Proportion predicted in Class 3	5.38% (671)					
Pr(expenditure > 0) in Class 1	95.39 %					
Pr(expenditure > 0) in Class 2	78.78 %					
Pr(expenditure > 0) in Class 3	83.88 %					

Note. *, ** and *** indicate statistical significance at 10%, 5% and 1%, respectively.

Table 7. Estimated latent class tobit model for cruise passengers' expenditure during stopovers

Explanatory variable	Latent class 1 Coefficient	t-Stat.	Latent class 2 Coefficient	t-Stat.	Latent class 3 Coefficient	t-Stat.
Socio-economic characteristics						
Age (years)	0.0089*	1.89	-0.0013	-0.65	0.0605***	2.59
Age square/100	-0.0114***	-2.65	-0.0015	-0.81	-0.0642***	-2.93
Gender (ref. female)	-0.0177	-0.99	-0.0092*	-1.16	0.0076	0.06
Education (0= below elementary, 1= elementary, 2= High-school, 3= University/College)	0.0339***	3.36	0.0086*	1.87	0.1285*	1.79
Occupation status (0=low, 1=low-medium, 2=medium, 3=high).	-0.0002	-0.02	-0.0010	-0.22	0.0745	1.19
Country of residence (ref. England)						
Germany	-0.0038	0.17	-0.0284***	-2.89	-0.1712	-1.12
Spain	0.0574	0.95	0.0566*	1.91	0.8519***	2.81
North America	0.2091***	4.27	0.0113	0.51	0.4867	1.29
Italy	0.2046***	4.85	0.0207	1.01	0.5692**	2.37
Other European countries	0.1375***	4.26	0.0129	1.01	0.9468***	4.63
Rest of the world	0.0257	0.39	-0.1402***	-3.77	0.5107*	1.80
Trip-related characteristics						
Group composition (ref. alone)						
With a partner, family or friends	0.1128***	1.98	0.0577***	3.04	-0.6526*	-1.86
Port of call (ref. Fuerteventura and La Gomera)						
Tenerife	0.2732***	7.93	0.0552***	3.37	0.8851***	3.30
La Palma	-0.0411	-1.16	0.0098	0.60	0.1612	0.57
Gran Canaria	0.2473***	7.03	0.0360**	2.18	0.6325**	2.27
Lanzarote	0.1683***	5.02	0.0526***	3.39	-0.1601	-0.59
Cruise season						
2003/2004	0.1800***	5.48	0.1367***	8.26	0.8109***	4.02
2004/2005	0.0674**	1.99	0.1684***	9.88	0.4817**	2.41
2008/2009	-0.2594***	-6.36	0.1291***	6.09	-0.5026*	-1.74
2011/2012	-0.1085***	-2.82	0.1119***	5.95	0.0945	0.40
2014/2015	-0.0149	-0.38	0.2144***	11.30	-0.5847*	-1.74
Destination satisfaction (0=low, 1=low-medium, 2=medium, 3=high)	0.0696***	5.57	0.0242***	4.19	0.3198***	3.87
Constant	-0.0422	-0.27	0.0078	0.12	-1.4074*	-1.81
E(expenditure) (in €)	77.61		23.24		182.53	
E(expenditure/expenditure>0) (in €)	80.33		28.81		209.01	
Observations	12,461					

Note. *, ** and *** indicate statistical significance at 10%, 5% and 1%, respectively

Table 8. Characteristics of cruise passengers, by class

	Class 1 (3,482 cases)	Class 2 (8,308 cases)	Class 3 (671 cases)
Total expenditure (€ at 2016 prices)			
Mean	88.40	20.13	259.57
Std. Dev.	31.49	18.27	127.60
Min.	0	0	0
Max.	211	78	1,191
Total expenditure (%)			
0	0.20	22.00	2.98
0-30	0.35	49.30	0.00
31-60	18.95	27.41	0.00
61-100	49.05	1.29	0.00
>100	31.45	0.00	97.02
Socio-economic characteristics (%)			
Age ($\leq$ 40)	13.90	14.06	25.34
Age (> 65)	25.01	27.42	19.08
Low income status	1.87	2.43	2.83
Low-medium income status	14.76	15.58	12.52
Medium income status	34.20	34.26	34.43
High-medium income status	28.26	27.50	26.97
High income status	20.91	20.23	23.25
Relative Price Index			
Mean	1.21	1.19	1.18
Relative Price Index < 1 (%)	6.69	4.61	11.33
Trip-related characteristics (%)			
Group composition (ref. alone)			
With a partner	57.84	64.66	56.04
With the family	15.42	12.47	18.93
With friends	22.69	17.60	22.21
Previous cruises (Mean)	2.68	3.38	3.40
First visit Canary Islands (%)	59.39	47.29	58.87

Table 9. Marginal effects of the latent class tobit model

Latent class 1						
	Prob(y>0)/Class 1)		**E[y]**		**E[y/y>0]**	
	Partial effect	t	Partial effect	t	Partial effect	t
Age	-0.00094***	-3.67	-1.907***	-2.63	-0.355***	-4.54
Education	0.00849***	2.99	2.681***	3.32	3.200***	3.36
Germany	-0.00096	-0.17	-0.302	-0.17	-0.361	-0.17
Spain	0.01439	0.93	4.544	0.95	5.423	0.95
North America	0.05238***	3.50	16.540***	4.23	19.740***	4.28
Italy	0.05126***	3.79	16.185***	4.80	19.316***	4.87
Other European countries	0.03444***	3.65	10.876***	4.14	12.980***	4.25
Rest of the world	0.00645	0.38	2.036	0.39	2.430	0.39
With a partner, family or friends	0.02827*	1.86	8.928**	1.98	10.655**	1.98
Tenerife	0.06845***	5.01	21.613***	7.53	25.793***	7.95
La Palma	-0.0103	-1.14	-3.254	-1.15	-3.883	-1.16
Gran Canaria	0.06196***	4.76	19.564***	6.74	23.348***	7.04
Lanzarote	0.04217***	4.02	13.316***	4.88	15.892***	5.02
2003/2004	0.04510***	4.35	14.239***	5.22	16.994***	5.45
2004/2005	0.01689**	1.97	5.333**	1.96	6.365**	1.99
2008/2009	-0.06498***	-4.34	-20.518***	-6.34	-24.487***	-6.43
2011/2012	-0.02718**	-2.51	-8.581***	-2.84	-10.241***	-2.83
2014/2015	-0.00373	-0.37	-1.179	-0.38	-1.406	-0.38
Destination satisfaction	0.01742***	4.18	5.501***	5.43	6.565***	5.58

Latent class 2						
	Prob(y>0)/Class 2)		**E[y]**		**E[y/y>0]**	
	Partial effect	t	Partial effect	t	Partial effect	t
Age	-0.00359***	-8.57	-0.102***	-7.66	-0.238***	-8.67
Education	0.01017*	1.87	0.288*	1.88	0.674*	1.87
Germany	-0.03339***	-2.89	-0.945***	-2.84	-2.214***	-2.89
Spain	0.06662*	1.91	1.885*	1.91	4.418*	1.91
North America	0.01325	0.51	0.375	0.52	0.879	0.51
Italy	0.02442	1.01	0.691	1.02	1.621	1.01
Other European countries	0.01525	1.01	0.432	1.01	1.011	1.01
Rest of the world	-0.16492***	-3.77	-4.666***	-3.64	-10.937***	-3.77
With a partner, family or friends	0.06785***	3.04	1.920***	2.96	4.499***	3.03
Tenerife	0.06497***	3.36	1.838***	3.46	4.308***	3.40
La Palma	0.01161	0.60	0.329	0.61	0.770	0.60
Gran Canaria	0.04238**	2.18	1.199**	2.22	2.810**	2.19
Lanzarote	0.06191***	3.38	1.752***	3.41	4.106***	3.41
2003/2004	0.16086***	8.25	4.551***	7.47	10.668***	8.41
2004/2005	0.19815***	9.84	5.606***	8.12	13.141***	9.94
2008/2009	0.15194***	6.09	4.299***	5.23	10.076***	6.02
2011/2012	0.13174***	5.94	3.727***	5.30	8.737***	5.93
2014/2015	0.25222***	11.15	7.136***	8.66	16.727***	11.28
Destination satisfaction	0.02853***	4.19	0.807***	4.15	1.892***	3.81

Note. *, ** and *** indicate statistical significance at 10%, 5% and 1%, respectively.

Table 9. Marginal effects of the latent class tobit model (Cont.)

Latent class 3						
	Prob(y>0)/Class 3)		**E[y]**		**E[y/y>0]**	
	Partial effect	t	Partial effect	t	Partial effect	t
Age	-0.00084	-1.26	-0.314	-1.30	-0.494	-1.29
Education	0.01840*	1.77	6.856*	1.74	10.781*	1.78
Germany	-0.02451	-1.12	-9.131	-1.10	-14.357	-1.12
Spain	0.12197***	2.81	45.446***	2.61	71.460***	2.78
North America	0.06969	1.28	25.967	1.28	40.831	1.29
Italy	0.08149**	2.31	30.365**	2.34	47.746**	2.38
Other European countries	0.13556***	4.37	50.509***	4.14	79.421***	4.59
Rest of the world	0.07312*	1.78	27.243*	1.76	42.838*	1.79
With a partner, family or friends	-0.09343*	-1.86	-34.811*	-1.80	-54.737*	-1.85
Tenerife	0.12671***	3.22	47.213***	3.06	74.239***	3.29
La Palma	0.02308	0.57	8.598	0.57	13.52	0.57
Gran Canaria	0.09055**	2.23	33.741**	2.20	53.054**	2.28
Lanzarote	-0.02291	-0.59	-8.536	-0.58	-13.423	-0.59
2003/2004	0.11610***	3.81	43.261***	3.79	68.024***	4.03
2004/2005	0.06898**	2.38	25.701**	2.31	40.412**	2.39
2008/2009	-0.07196*	-1.74	-26.813*	-1.70	-42.162*	-1.74
2011/2012	0.01354	0.41	5.044	0.40	7.931	0.40
2014/2015	-0.08370*	-1.75	-31.189*	-1.66	-49.041*	-1.74
Destination satisfaction	0.04579***	3.84	17.061***	3.39	26.827***	3.81

Note. *, ** and *** indicate statistical significance at 10%, 5% and 1%, respectively.
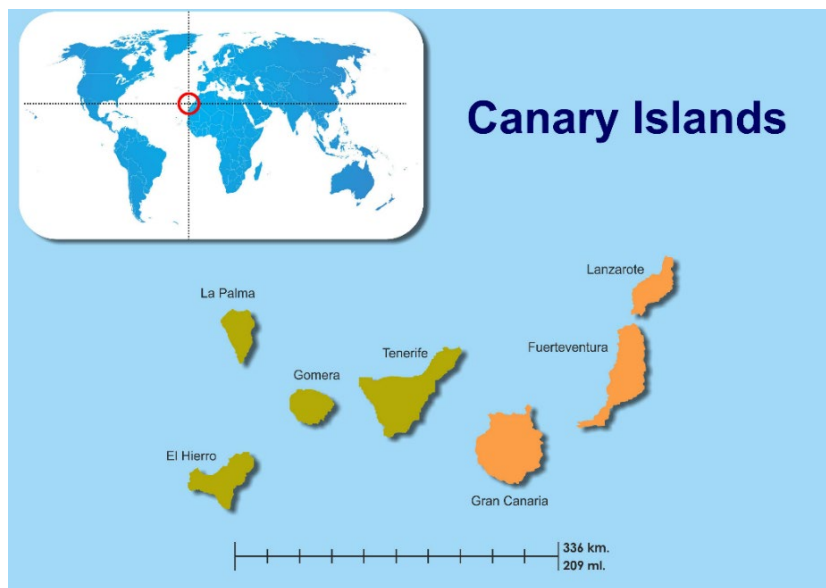
Figure 1. The Canary Islands' Location

Figure 2. The Canaries and the Main Ports

Figure 3. Distribution of cruise passengers' expenditure during stopovers according to latent class model (in euros at 2016 prices)