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Evaluating the effect of air transport resident subsidies on non-residents tourists' expenditure☆

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ABSTRACT

Several countries around the world have implemented policies to subsidize passengers who live on islands and travel domestically by air transport. This paper analyzes the effect of an exogenous change in the percentage of air transport resident subsidies in Spain on non-residents tourists' expenditure per day and overnight stays in corresponding regions. Drawing on monthly data from the period 2015–2019, a difference-in-difference estimator is applied, in addition to several robustness checks and placebo tests. We found a negative causal relationship between raising the subsidy percentage and non-residents tourists' expenditure per day on affected routes (routes between the mainland and islands). In fact, estimations show a reduction of between 9.6 and 12.2 per cent of non-residents tourists' expenditure per day on the Canary Islands.

1. Introduction

Air transportation is essential in modern societies, as it plays an important role in fostering development. Specifically, air transport facilitates economic integration, generates trade, promotes tourism, and creates employment opportunities. Moreover, it facilitates both integration into the global economy and vital connectivity at national, regional, and international level (Irigoyen et al., 2018). The relationship between air transportation and economic growth in regional territories is well established in the literature (see, for example, Brueckner, 2003; Green, 2007; Bel and Fageda, 2008; Percoco, 2010; Sheard, 2014; Bilotkach, 2015; Albalate and Fageda, 2016; Fageda, 2017 or Alderighi and Gaggero, 2017).

Furthermore, given the characteristics of remote areas, air transportation is even more important: it is the only available mode connecting the whole territory or even within the territory in the case of islands (taking into account that, in both cases, maritime transportation is only a credible competition for short-haul distances). Specifically, in peripheral locations, routes may be characterized by hight fixed cost of operations and a likely low demand, being a plausible reason because airlines may provide no service, or at least they offer less frequent and more expensive services (see Bitzan and Junkwood, 2006; Fageda, 2013). Furthermore, governments may be interested in fostering air services to islands to spur tourism, promote national cohesion (Williams, 2010) or seek equity for those who live on the periphery.

A common way to deal with this problem has been to subsidize the population living in these areas or to apply price discounts on specific routes. This is the case, for example, in Spain (that provides the biggest subsidies), Ecuador, Portugal and Scotland (Fageda et al., 2018). Sometimes, this is accompanied by the imposition of public service obligations (PSO) in the European Union (EU) or Essential Air Services (EAS) in the United States, which may put limits on the frequency of service, aircraft size, the service schedule, and, on occasions, the maximum permitted fare for some or all seats. However, as noted by Fageda et al. (2018), there are varied policies around the world to support air services in remote regions apart from PSO or EAS. Specially, they distinguish four categories of policies: route-based policies; passenger-based policies; airline-based policies; and airport-based policies. Note that these categories are not mutually exclusive, i.e., some countries choose to combine them.

The relevant question that we seek to analyze is whether some of these policies affect national inbound tourism (i.e., tourists from Mainland Spain), given that governments want to spur tourism and frequently it is a justification of protecting air services. For example, if resident subsidies cause higher airline prices (Fageda et al., 2017; AIReF, 2020), non-resident passengers might be 'excluded' from the market,

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and the tourism sector will be damaged. That is, in a non-competitive market, prices for resident passengers do not reduce in the amount of the subsidy, so prices without subsidy (prices for non-resident passengers) become higher in the new situation. This effect might be a negative consequence on the economic activity of the islands because of their dependence on tourism, that is damaged because of the higher prices for non-resident passengers.

Furthermore, Gundelfinger-Casar and Coto-Millán (2018) have highlighted the fact that besides per capita income, airline ticket prices determine inbound domestic tourism flows. In Spain, the weight of domestic tourism in 2019 was significant for the Canary Islands (12.76%), as it was for other European regions like Madeira for example (12.94%); but far from Sardinia (48.98%), the Azores (44.90%) or Corsica (70.60%). Nevertheless, the number of total nights spent in the Canary Islands (96,113,149) were, approximately, six times greater than that of Sardinia, nine times that of Corsica, 12 times that of Madeira and 41 times that of Azores; and this was mainly because of foreign tourism. Finally, for the whole of Spain, the percentage rises to 36.34%.[1]

Moreover, as highlighted by Álvarez-Arvelo et al. (2020) most remote regions are heavily dependent on air transport (McElroy and Parry, 2010) and its contribution to economic growth and tourism on small islands has frequently been highlighted (Brau et al., 2007; Scheyvens and Momsen, 2008; Croes 2013; Pratt, 2015; Bojanic and Lo, 2016) . The literature has focused on air transport activity (Wu et al., 2020), but some economic impacts may be more significant in tourism-based economies (Bråthen and Halpern, 2012), so it is interesting to investigate the effects beyond air transport markets.

The aim of our work is to evaluate how an exogenous change in resident subsidies (specifically, a rise in its percentage of ad valorem subsidy, which took place in July 2018) affects total expenditure per day, expenditure at destination per day and overnight stays of national inbound tourism, in two regions: the Canary Islands and the Balearic Islands. As far as we know this is the first time that this effect has been analyzed.

We draw on a large sample of individuals who travel within Spain (including individuals who travel on routes both affected and unaffected by the discounts) for the period 2015–2019. Our estimation strategy includes both Ordinary Least Squares (OLS) and Quantile Regression (QR) in order to obtain the causal effect of interest through the difference-in-differences estimator.

Our results show that the subsidy increase from 50% to 75% in 2018 has reduced total tourists' expenditure per day (and expenditure at destination per day) on routes from mainland Spain to the Canary Islands (but not in the Balearic Islands). Moreover, there was no effect on the overnight stays of tourists after the shock (the change in percentage of subsidy to residents) in either region.

2. Literature review

Resident state grants consist of subsidies that are given to passengers who entitle them because they are residents, and they vary from specific (a fixed amount of money per ticket that is independent of its price) to ad valorem ones (dependent on the ticket price and implemented as a percentage), with variants in the administrative procedures.[2] Valido et al. (2014) show theoretically that non-resident passengers may be 'expelled' from the market when carriers have market power if the proportion of resident passengers is high enough. Moreover, the willingness to pay of passengers is a key variable in the selection of the most desirable situation between both types of subsidies.

These kinds of subsidies are employed by a number of countries around the world. In Europe, Spain invests most resources on subsidies, making it an exception within general European legislation on state aid rules. Other examples in Europe are Scotland, Portugal, France and Italy, or in the rest of the world Ecuador or Canada (see Fageda et al., 2018 for a brief explanation of each case). Countries vary on the mechanism applied: for example, a discount is offered in Scotland and Spain; whereas there are flat rates or specific maximum fares in Ecuador, France, Italy, and Portugal.

Few studies have sought to empirically assess on ticket price the effects of air transport subsidies for resident passengers. Calzada and Fageda (2012) show that routes benefiting from price discounts are priced more highly than other domestic routes (and enjoy greater demand). Fageda et al. (2012) compare prices on domestic flights from Gran Canaria (subsidized) with international flights from Gran Canaria (unsubsidized), finding that prices are higher on domestic routes. Fageda et al. (2016) study the impact on prices of the regulatory changes during the period 2003–2013 (i.e. changes in the percentage of discount) on residents' flight subsidies implemented in Spain. They do not find price differences between routes affected and not afected by the discounts. Fageda et al. (2017) compares different polices in different European countries with islands, and they use two complementary strategies (instrumental variables and matching procedures). They did find higher prices in routes where only island residents enjoy subsidies but not effect where everyone are entitled to the subsidies (i.e. no discrimination between resident and not resident). Moreover, PSO do not seem to be effective in reducing prices and flat rates induce higher prices than market fare discounts.

Recently, Fageda et al. (2019) compare different policies in order to estimate the impacts on prices and frequencies. In the case of subsidies for resident passengers, they found low fares (for island residents) and frequencies. However, the amount of public resources should be taken into account, which is higher than the whole PSO programme in Europe (with more routes affected).

Previous literature point to a negative effect that affects the motivation of the paper: higher prices for non-resident passengers that lead to the possible exclusion of them from the market. Thus, the tourism sector will be damaged. To our knowledge, the effect of resident subsidies in the tourism sector is an unexplored effect, and the only attempts are the theoretical work of Álvarez-Arvelo et al. (2020) and the empirical work of Jiménez et al. (2022). The former study the effects of subsidies (ad-valorem) for resident passengers on the tourism industry through a theoretical model, exploring how a packaging strategy, that acts as hidden price discrimination, benefits transport and local tourism firms. This strategy could offset the negative effects on the tourism industry because of higher airfares. The latter also analyzes the effect of an external shock (raising the percentage of the subsidy) but in outbound tourists, i.e., the effects in the expenditure at destination per day and the overnight stays of passengers who enjoy resident subsidies. Their results show how air transport subsidies change the behaviour of tourists.

Finally, extensive literature exists on public expenditure and its determinants, which have been widely studied both from the macro and micro perspective (see for example Wang and Davidson, 2010 for a detailed classification of different types of tourism demand studies from both perspectives). However, given the aim of our work and the data used, we are only interested in determinants in tourism demand at the individual level. There have been a number of attempts to review micro data analysis and papers (see, for example, Brida and Scuderi, 2013; Wang and Davidson, 2010; Marcussen, 2011; or Disegna and Osti 2016),

[1] See Eurostat, "nights spent at tourist accommodation establishments", here: https://ec.europa.eu/eurostat/databrowser/view/TOUR_OCC_NIN2$DEFAULTVIEW/default/table.

[2] There are also other tax policies on tourism in different contexts. In a general context, see for example Gooroochurn and Sinclair (2005), that study types, objectives, principles, and effects of tourism taxation; or Gago et al. (2009), that focus on specific or general taxation for tourism activities. Specific topics have been also analyzed: for example, Tol (2007) or recently Zhang and Zhang (2018) for carbon tax, or Forsyth and Dwyer (2002) for market power.

where we may compare methods or variables used in the literature, for example.[3]

Based on the aim of this paper and the data available, we follow these studies in order to choose the model definition and selected determinants of tourists' expenditure, which are specified in section 4.

3. Subsidy schemes in Spain

Currently, in Spain, passengers who are resident in islands (Canary Islands or Balearic Islands) and in Ceuta and Melilla, enjoy an air transport subsidy when they travel to mainland Spain and also on interisland air routes (they are also entitled when they travel by boat). The form of the subsidy is ad valorem, and it is now established at a 75 per cent discount on the ticket price, but with some limitations. Concerning the maximum amount of subsidy per passenger, the discounted rate cannot be higher than the basic rate, which is defined as the lowest fully flexible fare for a roundtrip flight, recorded by each airline in accordance with the procedures established by the Spanish Ministry of Transport, Mobility and Urban Agenda (see Fageda et al., 2016 or Valido et al., 2014 for an extensive explanation about the subsidy).

The 75% discount is therefore applied to the standard rate charged by the airlines in scheduled services, including baggage and other services, taxes and fees, with the exception of infrastructure and security fees. We have to take into account that the regulation imposes a priori a maximum limitation of the eligible rate, but on an amount established by companies without restrictions on each route, so that even business or similar rates can be fully subsidized if they are lower than the basic registered. There are no limitations on the number of eligible tickets per person per year, or any other requirement, beyond the place of residence (AIReF 2020). Finally, the discount on the price is immediately in the purchase process (the passenger facilitates the necessary data and resident justification to the airline), and the airline will obtain the money from the government later.

The first application of the subsidy dates from 1961 for the Canary Islands, and territorial equity has always been the main objective. The subsidy has always been an ad-valorem grant although, there have been modifications in the legislation over the decades (with the addition of other territories or modes, through modifying various aspects of the conditions that merit the subsidy, and details concerning the maximum amount available, the way to gain accreditation, and so on).

For connections with the rest of the country, the percentage have reached a 75% since July 2018, but the first legislation concerning resident subsidies date from 1961 (12%), and the percentage has progressively increased (to 33%,from 1962 to February 2005; to 38%,in force from February to December 2005; to 45%, 2006); to 50%, from January 2007 to June 2017).

Recently, in the context of the Spanish 2017–2020 Stability Programme Update, a government commission has undertaken a "Spending Review", i.e., an analysis of public expenditure. One aspect of this Review included an in-depth analysis of resident subsidies (AIReF, 2020). In fact, the aim of the study was to evaluate the effects of the increase from 50 to 75% in the amount of subsidy for resident passengers through a detailed analysis of a flight database from 2009 to 2019 (generating a sample of 2 million), but also with data on subsidized tickets during the same period (10 million).

For 2021 the Spanish Government foresees a total expenditure of around €650 million on this budget item (see Ministerio de Hacienda, 2021). Moreover, annual total spending on resident subsidies multiplied by 2.2 between July 2016 and July 2019; rising from €324 million to €730 million (AIReF, 2020).

Some interesting conclusions reached by AIReF are: the cost of tickets for non-residents has increased on flights between the islands and mainland Spain, with a significant part that is due to the subsidy increase and the higher percentage of residents the higher the increase (as Valido et al., 2014 and de Rus and Socorro, 2022 stated theoretically). Moreover, there has been an increase in the average percentage of residents on flights in all segments due to an increase in resident demand and a slowdown in the growth of non-resident passengers, and prices in the Canary Islands inter-island market have remained stable for the last ten years, but prices on other routes have fallen by more than 30%. In the case of the Balearic inter-island market, a decrease in prices has been observed in the last decade, but the rise to a 75% subsidy has not increased prices.

4. Data and descriptive statistics

Data are extracted from the Residents Travel Survey, and it is collected by the Spanish National Statistics Institute (INE in its Spanish initials). The survey is defined as "a continuous survey whose main objective is to provide monthly, quarterly and annual estimates of the number of trips made by the population resident in Spain and its main characteristics (destination, duration, purpose, accommodation, means of transport, expenditure, socio-demographic characteristics of the travellers, etc.)".

These statistics replaces the Spanish Touristic Movements Statistics (called *FAMILITUR*) and supply results from February 2015 onwards. The survey is continuous on a quarterly basis, and it is addressed is to people who have been residents in family dwellings in the Spanish territory for 15 years or more. Around 8,000 surveys are carried out each month in Spain, which include telephone questionnaires and in some cases personal interviews.[4]

The database contains monthly information from February 2015 to September 2019 (i.e. 56 months). The change in the percentage of the subsidy that we seek to analyze took place in July 2018 (month 42 out of 56). Specific considerations to be taken into account include: first, our main aim is to estimate the effects of subsidy change on non-residents. For this reason, we exclude foreign travelers because no information about their origin is included in the survey; second, we only consider those travelers moved by plane (excluding those by train, ship, cars, etc.); third, only routes between the Canary Islands and Balearic Islands to/from Mainland Spain are considered as treated routes (i.e., we exclude inter and intra archipelago routes); fourth, people who do not spend are not considered (in our case, 611 out of more than 8 thousand); and fifth, residents in the Canary Islands and Balearic Islands are excluded.

We follow Brida and Scuderi (2013) to decide what covariates affect tourists' expenditure and their relationship with the endogenous variables. We use the classical approach of explaining the level of expenditure as a function of a set of individual characteristics (and the difference in difference variables that we explain later).

1. Total expenditure without transport costs$_{zit}$: this is the total expenditure incurred by the person z at route i in month t, but without considering the transport costs. This dependent variable tries to isolate the effects on tourism without the sector where the intervention has been made. Because it is influenced by number of people as well as by length of stay, we finally use expenditure per person per day.
2. Expenditure at destination$_{zit}$: this is the total expenditure incurred by person z at route i in month t at destination. This dependent variable includes expenditure in bars and restaurants,

[3] We may also distinguish two groups in the tourists' expenditure literature: studies focused on market segmentation (Legohérel and Wong, 2006 or Lew and Ng, 2012) or studies that models the individual expenditure of each tourist (see for instance Brida and Scuderi, 2013).

[4] Database can be found here: https://www.ine.es/dyngs/INEbase/en/operacion.htm?c=Estadistica_C&cid=1254736176990&menu=ultiDatos&idp=1254735576863).

cultural amenities and others. It is equal to total expenditure without transport and accommodation cost. This variable allows us to estimate losses for the destination because of the policy. We also use this variable per person per day.

3. Overnight stays $_{zit}$: the total number of nights spent at destination by *z* in month *t*. This is also a dependent variable.
4. Gender $_z$: a binary variable that takes value 1 if the person is a woman. Usually, it is not significant.
5. Age $_z$: age of the surveyed person. This is the most frequently used variable and it is directly related to tourists' expenditure. We also consider the quadratic of this variable at estimations, in order to control for the potential non-linearity of this effect.
6. Income $_z$: another frequent variable, usually positive and significant. In the database, this variable is ordinal (from 1 to 6) and it summarizes monthly family income. We include as categorical variable (several binary variables using one of them as a reference). Specifically, the variable is categorized as: 1, below 999 euros; 2, 1,000–1,499€; 3, 1,500–2,499€; 4, 2,500–3,499€; 5, 3,500–4,999€; 6, over 5,000€.
7. Employed $_z$: also frequently used but not always significant (approximately 50%). We use a binary variable that takes value 1 if traveler *z* is employed; 0 in all other cases (unemployed, retiree, etc.).
8. Education $_z$: This is a typical categorical variable but is often not significant. It controls for the level of education of traveler *z*. In our case it ranges from 1 (elementary) to 4 (higher education).
9. Market housing $_z$: This consists of a binary variable that takes value 1 if traveler *z* uses a market residence to stay (i.e., hotels, apartments, etc., instead of a family or friend's home). This variable is not used very frequently buy is very often significant.
10. Low Cost traveler $_z$: a binary variable that takes value 1 if traveler *z* flies to destination with a Low Cost Carrier. We may test whether cheaper air fares generate a perception of saving money for tourists and for this reason they are encouraged to spend more money at their destinations (Eugenio-Martin and Inchausti-Sintes, 2016).[5]
11. Business motivation $_z$: a binary variable that takes value 1 if traveler *z* flies to destination with a business motivation. This variable tries to control for potential different expenditures between tourists (leisure vs. business).

All these variables are not highly correlated, so there is not multicollinearity problems. Moreover, we include the binary variables for the difference-in-difference estimations:

11. Treated Route $_i$: a binary variable that takes value 1 if the route *i* is a treated route, i.e., it is affected by the subsidy. In our case we have five different types of treated routes and we only consider two: routes from/to Canary Islands-Mainland Spain; routes from/to Balearic Islands-Mainland Spain; routes intra Canary Islands (not considered); routes intra Balearic Islands (not considered); routes from/to Canary Islands-Balearic Islands (not considered). The control group (when this variable takes value 0) includes those routes that connect different mainland regions.
12. After (75% period)$_t$: binary variable that takes value 1 for all routes after the change in residents' subsidy (July 2018).
13. Difference-in-difference variables $_{it}$: binary variable that takes value 1 if the route *i* is a treated route and month *t* is after the shock took place. This is our relevant variable (hereinafter, DiD). As for the treated route, we split this into two effects: the DiD for the Canary Islands and the DiD for the Balearics.

Table 1 shows descriptive statistics for both treated and control routes. Statistical significance for *t*-test between treated and control routes are in the last column.

In general, both routes show different average descriptives for each variable (see *t-test*). Travelers on treated routes spend more money per day than on control routes (excluding transport costs), although the expenditure at destination per day is lower on the Islands-Mainland routes than on intra-Mainland routes. Overnight stays, age of travelers, women, Low Cost travelers and market housing are covariates that show higher values on treated routes than on control routes. On the other hand, income, employed and education are lower on treated routes than on control ones.[6]

As explained in the introduction, we seek to explore how the change in subsidy affects three variables: total expenditure per day, expenditure at destination per day and overnight stays. Tables 2–7 includes the average value for each these variables at the Canary (a) and Balearic Islands (b), regarding control group. Differences between treated vs. control or after vs. before are included in last column and row, respectively. Finally, the double difference (a simple average difference-in-difference) is shown in the last cell. If it is positive, the endogenous variable was greater on control routes than on treated ones.

Tables 2a and 2b give us the same conclusion: average tourists' expenditure per day decreases less on control routes than on treated routes after the change in subsidy.

The average expenditure at destination per day is included in Tables 3a and 3b Like previous outcomes, the double difference is positive. But in this case, the most striking outcome in the after-before difference is for the Canary Islands. In this case, average expenditure at destination per day fell by 5.65% after the change in subsidy, and also decreased by 2.85% at control routes; opposite results on the Balearic Islands.

Finally, changes in average overnight stays are considered in Tables 4a and 4b In this case, mixed results are found. While the double difference is negative in the case of the Canary Islands, it is positive in the Balearic Islands. If we only consider the after-before difference, both treated routes and control routes increase.

Nevertheless, we have to bear in mind that all these statistics are merely descriptives. We have to control for all the potential variables that affect all these endogenous ones.

Another question about descriptives is how endogenous variables behave in treatment and control groups. In fact, the trends in both groups should be the same without intervention (i.e., the "before" period, in our case from February 2015 to June 2018). It is a necessary assumption of the difference-in-differences estimator.

Figs. 1–3 represents the monthly average total expenditure per day, monthly average expenditure at destination per day and monthly average overnight stays for each treated route (on the Canary Islands and Balearic Islands) and control routes, respectively. In this case, the latter is an average of all control routes considered.

It can be seen that, in all cases, these outcomes follow similar patterns before the intervention, but after that they progress differently over time. However, a more detailed analysis will be undertaken in section 5.

Despite these descriptive outcomes, a multivariate analysis is needed, not only to control for other variables that affect this traveler's behavior, but also to identify the causal relationship between these

[5] In the Resident Travel Survey, the following definition is given to passengers in order to answer the question: "Low-cost air company: airline offering flights at very competitive prices, not offering as included or selling most of the services that can be offered as complementary to the air transport service (food and drinks on board, booking seats, luggage …). Some examples of low-cost air companies are: Ryanair, Easyjet, Iberia Express, Vueling, Airberlin, Transavia, Etihad, Jet2, Norwegian, Brussels Airline, Germania Express, Air Malta, Volotea, SunEspress, Monarch, Wizz Air, …."

[6] Correlation matrix shows no statistical significance relationship among covariates considered. See Table 9 at Annex 1.

Table 1
Descriptive statistics.

Covariate	Obs	Mean	Median	Std. Dev.	Min	Max	*t*-test
Treated routes							
Total expenditure per day	4078	67.036	50.54	51.006	0	695.93	***
Expenditure at destination per day	4078	30.593	22.402	24.364	0	275.62	***
Overnight stays	4078	7.137	7	5.106	1	65	***
Treated route (Canary Islands)	4078	.515	1	.5	0	1	–
After (75% period)	4078	.3	0	.458	0	1	–
Treated route (Balearic Islands)	4078	.485	0	.5	0	1	–
Gender	4078	.541	1	.498	0	1	***
Age	4078	47.99	47	15.153	16	85	**
Income	4078	3.461	3	1.3	1	6	***
Employed	4078	.656	1	.475	0	1	***
Low Cost traveler	4078	.681	1	.466	0	1	***
Market housing	4078	.769	1	.422	0	1	***
Education	4078	3.405	4	.869	1	4	***
Control routes							
Total expenditure per day	3820	92.589	72.352	66.528	3.495	666.78	
Expenditure at destination per day	3820	46.485	42.07	31.249	0	348.06	
Overnight stays	3820	4.584	3	5.686	1	98	
After (75% period)	3820	.299	0	.458	0	1	
Gender	3820	.495	0	.5	0	1	
Age	3820	47.276	46	14.282	16	85	
Income	3820	3.731	4	1.392	1	6	
Employed	3820	.742	1	.437	0	1	
Low Cost traveler	3820	.635	1	.482	0	1	
Market housing	3820	.709	1	.454	0	1	
Education	3820	3.55	4	.793	1	4	

Source: Own elaboration. Obs.: Observations. Std. Dev.: Standard Deviation. Min: minimum. Max: maximum. *t*-test compares treated versus control routes. $^*p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 2
Average tourists' expenditure per day (€) on the Canary Islands (a) and Balearic Islands (b).

a			
	B: Before	A: After	Difference (A-B/B)*100
T: Treated routes (Mainland from/ to Canary Islands)	68.87	63.92	−7.19
C: Control routes	95.52	94.02	−1.57
Difference (C-T/C)*100	−27.90	−32.01	**9.73**
b			
	B: Before	A: After	Difference (A-B/B)*100
T: Treated routes (Mainland from/ to Balearic Islands)	73.52	68.29	−7.11
C: Control routes	95.52	94.02	−1.57
Difference (C-T/C)*100	−23.03	−27.37	**9.88**

Source: own elaboration.

Table 3
Average expenditure at destination per day(€) on the Canary Islands (a) and Balearic Islands (b).

3.a			
	B: Before	A: After	Difference (A-B/B)*100
T: Treated routes (Mainland from/ to Canary Islands)	27.28	25.74	−5.65
C: Control routes	46.68	45.35	−2.85
Difference (C-T/C)*100	−41.56	−43.24	**4.48**
3.b			
	B: Before	A: After	Difference (A-B/B)*100
T: Treated routes (Mainland from/ to Balearic Islands)	33.94	33.55	−1.15
C: Control routes	46.68	45.35	−2.85
Difference (C-T/C)*100	−27.29	−26.02	**−2.97**

Source: own elaboration.

changes and the modification of the residents' subsidy. The next section will explain our empirical strategy: the difference-in-difference estimations.

5. Results

The difference-in-differences estimator is applied to obtain the causal effect of interest: does the increase of subsidy affect tourists' expenditure per day and overnight stays of those non-resident travelers? Moreover, unobserved differences between treated and control observations are controlled, so are common shocks through the variables 'treated routes' before and after the change in policy (from 50 to 75% of residents' subsidy). In particular, the following regression is run on our sample:

$$Y_{it} = \beta_0 + \beta_1 Treated_i + \beta_2 After_t + \beta_3 Treated_i * After_t + X_{it} + \alpha_i + \delta_t + u_{it} \quad \text{[eq. 1]}$$

where Y_{it} is the outcome of interest described in section 4 (total expenditure per day; expenditure at destination per day or overnight stays); $Treated_i$ takes value 1 if the person (i) has traveled from mainland Spain to the Canary or Balearic Islands (and viceversa) and 0 otherwise (in our case, intra-mainland Spain routes); $After_t$ takes value 1 for the months in which the policy took place (after July 2018) and 0 before; $Treated_i * After_t$ is the interaction of both previous binary variables. Therefore, it takes value 1 for the travelers on treated routes during the period in which the subsidy is 75%, and 0 in all other cases (it will be called DiD); X_{it} are all control variables considered (see previous sections); α_i represents individual fixed effects (route); δ_t represents time fixed effects (month and year); and u_{it} is the error term.

The coefficient of interest is β_3, which tells us how endogenous variables changed on treated routes after the shock compared to control routes. Thus, it gives the average treatment effect of the treated routes.

First we estimate equation [1] where the difference-in-difference

Table 4a
Overnight stays. Canary Islands (a) and Balearic Islands (b).

4.a			
	B: Before	A: After	Difference (A-B/B)*100
T: Treated routes (Mainland from/to Canary Islands)	7.35	7.91	7.62
C: Control routes	4.47	4.79	7.16
Difference (C-T/C)*100	64.43	65.14	**−1.17**
4.b			
	B: Before	A: After	Difference (A-B/B)*100
T: Treated routes (Mainland from/to Balearic Islands)	6.23	6.52	4.65
C: Control routes	4.47	4.79	7.16
Difference (C-T/C)*100	39.37	36.12	**5.76**

Source: own elaboration.

coefficient include both archipelagos jointly (see Table 10 at annex 1). However, due to differences in covariates between Canary and Balearic Islands routes, we consider them separately in our analysis (see Table 5 below). So, the final equation is:

$$Y_{it} = \beta_0 + \beta_1 Treated\ (Canary\ Islands)_i + \beta_2 Treated\ (Balearic\ Islands)_i + \beta_3 After_t + \beta_4 Treated(Canary\ Islands)_i * After_t + \beta_5 Treated(Balearic\ Islands)_i * After_t + X_{it} + \alpha_i + \delta_t + u_{it} \quad \text{[eq. 2]}$$

Where β_4 and β_5 are DiD variables, our coefficients of interest. We estimate several models for this pooled dataset. First, three endogenous variables Y_{it} are considered: total expenditure per day; expenditure at destination per day, and overnight stays. Second, each model is estimated with and without fixed effects (α_i and δ_t in equation [2]). Third, OLS estimations and QR are implemented. As highlighted by Brida and Scuderi (2013), QR is an alternative (or complement) to OLS in order to assess local behaviour at specific portions of the empirical distribution with location measures reference instead of mean values.

Table 5 includes all these results.

The explanatory capacity of the OLS models ranges from 0.25 to 0.60 and the F-tests were accepted at 1% in all cases. Statistical significance and sign of coefficients remain after considering the fixed effect of each model (the even estimates in Table 5). All covariates show expected signs.

The results in the explanatory variables are nearly all as expected.

Table 5
Difference-in-difference estimations.

	OLS. TE [1]	OLS. TE [2]	OLS. ED [3]	OLS. ED [4]	QR. TE [5]	QR. TE [6]	QR. ED [7]	QR. ED [8]	OLS. Overnights [9]	OLS. Overnights [10]
Treated (Canary Islands)	−0.1767***	0.1273***	−0.3384***	0.0177	−0.1009***	0.0560	−0.2812***	−0.0566	0.5111***	0.2188
	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)	(0.15)	(0.02)	(0.16)	(0.06)	(0.13)
After	0.0535***	0.0115	0.0342	0.0732***	0.0772***	0.0037	0.0597**	0.0701*	0.0016	−0.0055
	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)
DiD (Canary Islands)	**−0.0438**	**−0.0457**	**−0.0966*****	**−0.0996*****	**−0.0862****	**−0.0730***	**−0.1020****	**−0.1222*****	**0.0252**	**0.0260**
	(0.03)	**(0.03)**	**(0.03)**	**(0.03)**	**(0.04)**	**(0.04)**	**(0.04)**	**(0.04)**	**(0.03)**	**(0.03)**
Treated (Balearic Islands)	−0.1598***	−0.0350	−0.2226***	−0.1078***	−0.1259***	−0.0873	−0.1820***	−0.2027	0.3152***	0.0882
	(0.03)	(0.02)	(0.04)	(0.02)	(0.02)	(0.16)	(0.02)	(0.17)	(0.06)	(0.13)
DiD (Balearic Islands)	**0.0342**	**0.0230**	**0.0208**	**0.0182**	**−0.0015**	**−0.0294**	**−0.0253**	**−0.0620**	**−0.0273**	**−0.0241**
	(0.04)	**(0.04)**	**(0.03)**	**(0.03)**	**(0.04)**	**(0.04)**	**(0.04)**	**(0.04)**	**(0.05)**	**(0.04)**
Business motivation	0.5935***	0.5000***	0.4859***	0.3766***	0.6523***	0.5416***	0.5106***	0.3834***	−0.6363***	−0.4561***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.02)
Gender (1 = Woman)	−0.0497***	−0.0510***	−0.0500***	−0.0466**	−0.0668***	−0.0583***	−0.0707***	−0.0505***	0.0394*	0.0353***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Age	0.0035	0.0035	0.0088**	0.0090**	0.0055	0.0057	0.0092**	0.0080**	−0.0091*	−0.0098***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Employed	0.1534***	0.1671***	0.1459***	0.1649***	0.1029***	0.1205***	0.1181***	0.1635***	−0.1196***	−0.1457***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.04)	(0.02)
Low Cost traveler	−0.0756***	−0.0558***	−0.0317	−0.0075	−0.0901***	−0.0513***	−0.0525***	−0.0314*	0.0179	−0.0118
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.01)
Market housing	0.9632***	0.9837***	0.1532***	0.1742***	0.9601***	0.9755***	0.1471***	0.1718***	−0.1596***	−0.2144***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Education	0.1315***	0.1255***	0.1518***	0.1427***	0.1267***	0.1219***	0.1496***	0.1341***	−0.0748***	−0.0610***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
Income (binary variables)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Route effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	7898	7898	7645	7645	7898	7898	7645	7645	7898	7898
R^2 (or Pseudo R^2 for QR)	0.56	0.60	0.38	0.43	0.38	0.42	0.25	0.29	0.43	0.53

Note: Other variables included and not shown: quadratic age and binary variables for marital status. Standard errors in parentheses. $^*p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Note 2: TE: Tourists' expenditure per day (excepting airline expenditure); ED: Tourists' expenditure at destination per day.

Table 6
Parallel trend estimations.

	TE [1	TE + Controls [2	ED [3	ED + Controls [4	Overnights [5	Overnights + Controls [6]
Treated Canary Islands-Before [A]	0.3848	3.7299***	0.4929	3.0747***	−0.4237	1.9784***
	(0.27)	(0.05)	(0.34)	(0.03)	(0.34)	(0.05)
Treated Canary Islands-Before*Trend [B]	−0.0090	0.0078***	−0.0146*	0.0016	0.0112	−0.0045***
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
Treated Balearic Islands-Before [C]	0.4378	3.7813***	0.6249*	3.2187***	−0.6426*	1.7656***
	(0.28)	(0.04)	(0.34)	(0.05)	(0.35)	(0.07)
Treated Balearic Islands-Before*Trend [D]	−0.0077	0.0067***	−0.0121	0.0023	0.0098	−0.0041**
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
Control-Before [E]	0.6050**	4.1075***	0.7874**	3.5606***	−0.9460***	1.2143***
	(0.27)	(0.07)	(0.34)	(0.05)	(0.36)	(0.08)
Control-Before*Trend [F]	−0.0103	0.0043**	−0.0120	0.0024*	0.0127	−0.0012
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
Control-After [G]	0.6809**	4.5986***	0.8004**	3.8928***	−0.9777***	0.8850**
	(0.29)	(0.34)	(0.31)	(0.24)	(0.30)	(0.34)
Control-After*Trend [H]	−0.0107*	−0.0071	−0.0104*	−0.0052	0.0124**	0.0061
	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
Test [B] = [F]	F (1,142) = 0.35	F (1,148)1.65	F (1,142) = 2.72	F (1,147) = 0.19	F (1,142) = 0.7	F (1,148) = 1.73
Test [D] = [F]	F (1,142) = 1.90	F (1,148) = 1.00	F (1,142) = 0.00	F (1,147) = 0.00	F (1,142) = 1.00	F (1,148) = 1.17
Test [F] = [H]	F (1,142) = 0.00	F (1,148) = 2.52	F (1,142) = 0.03	F (1,147) = 2.44	F (1,142) = 0.00	F (1,148) = 0.98
Observations	8235	9181	7964	8853	8235	9181
R^2	0.98	0.82	0.97	0.83	0.88	0.64

Note 2: TE: Tourists' Expenditure per day (excepting airline expenditure); ED: Tourists' Expenditure at Destination per day. Standard errors in parentheses. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

Three facts relating to these estimates stand out. First, the increase in the subsidy to 75% did not lead to changes in tourists' expenditure per day in the Balearic Islands (nor total tourists' expenditure nor expenditure at destination). Second, travelers did not change their overnight stays after the shock, neither in the Canary Islands nor in the Balearics Islands. Finally, the difference-in-difference shows that tourists reduced their expenditure per day on routes from mainland Spain to the Canary Islands.

Specifically, total expenditure per day was reduced by 7.3–8.6 per cent (in QR regressions, although OLS show low statistical significance), while expenditure at destination per day experienced an even greater effect: it diminished by 9.6–12.2 per cent. The pooled estimates at Table 10 show similar outcomes, although the non-effect of the Balearic Islands reduces the significance of the overall results.

6. Parallel trends

In this section, we have to test whether the outcome variables of interest (average tourists' expenditure per day, average tourists' expenditure at destination per day and average overnight stays) follow parallel trends in treated and control groups. The reason is the assumption of the difference-in-differences estimator: with no treatment (i.e., before the exogenous change in the subsidy when it was 50%), trends in the treated and control groups are the same. Previous Figs. 1–3 represent these trends, and they suggest this behaviour, i.e., previous outcomes follow similar patterns before the subsidy changed, but evolving differently over time after this intervention.

Furthermore, we follow Galiani et al. (2005) and test the previous assumption (trends for treatment and control group are not different before the intervention). For this test of parallel trends, only the pre-treatment period for treated routes is considered. In contrast, the observations of the control group are considered for the whole period. We estimate a model that includes interactions between each group and trend variable, and no constant is included (i.e. the fully saturated model), and we test the equality of the relevant coefficients.

Two tests are performed for average tourists' expenditure per day, average tourists' expenditure at destination per day and average overnight stays (with and without controls) and for the different samples. First, the trends of the treatment and control group are the same in the pre-treatment period (that is, the null hypothesis cannot be rejected in any case). Second, we found the same result for control routes before and after the intervention (see Table 6). Both tests imply that the outcomes of the treatment and control groups had identical trends before the exogenous change in the subsidy, so our difference-in-difference identification strategy is validated.

7. Robustness checks

In this section we perform two different standard placebo tests already used in the literature. They allow us to ensure that the effects found are due to the change in the subsidy, and not for other reasons or missing variables. The first test is performed in the period before the exogenous change in order to check whether the effects on expenditures per day or overnights stays can be detected before the intervention. The second one repeats the estimations of interest, but in this case the control group and two regions that act as treated regions formed the sample (i.e., we substitute the Canary Islands and Balearic Islands for other regions).

7.1. Placebo test in the period before the change in subsidy

In this case we performed the test in the sample of treated and control routes in the pre-treatment period only, i.e., from February 2015 to June 2018. We estimate equation [2] again, supposing that the shock was at month 30 out of 42. The results are presented in Table 7. As can be seen, no DiD coefficient shows statistical significance. It can be concluded that travelers on treated routes do not behave differently from those on control routes before the treatment starts.

7.2. Placebo test for treated group

In this second placebo test, we consider only the control routes in our estimations. Two of these regions are going to be the artificial treatment group in the placebo test. Specifically we use, for example, Galicia and Catalonia as the Canary Islands and Balearic Islands, respectively. The period of treatment used is the real one (from July 2018 to September 2019).

The estimation results of equation [2] are presented in Table 8. No significant impact of this shock on expenditure per day or overnight stays can be found in these placebo analyses, so we can confirm that the results obtained for treated and control groups really represent the causal effect of the increase of the subsidy from 50 to 75 per cent.

Table 7
Placebo test. Difference-in-difference estimations for PRE-TREATMENT period (Before).

	TE [1]	TE + Controls [2]	QR_TE [3]	QR_TE + Controls [4]	ED [5]	ED + Controls [6]	QR_ED [7]	QR_ED + Controls [8]	Overnights [9]	Overnights + Controls [10]
Treated (Canary Islands)	−0.2005***	0.1159***	−0.1257***	0.0811	−0.3356***	−0.0298	−0.2808***	0.0128	0.5218***	0.2270
	(0.04)	(0.03)	(0.03)	(0.18)	(0.03)	(0.02)	(0.03)	(0.20)	(0.06)	(0.15)
Fake After	0.0484	−0.0214	0.0810***	−0.0143	0.0324	0.0500	0.0755**	0.0621	−0.0499	−0.0641
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.05)	(0.03)	(0.05)	(0.03)	(0.04)
DiD (Canary Islands at fake period)	**0.0387**	**0.0447**	**0.0018**	**0.0108**	**−0.0443**	**−0.0476**	**−0.0904***	**−0.0390**	**−0.0089**	**−0.0327**
	(0.04)	**(0.05)**	**(0.04)**	**(0.04)**	**(0.04)**	**(0.04)**	**(0.05)**	**(0.05)**	**(0.04)**	**(0.04)**
Treated (Balearic Islands)	−0.1838***	0.0086	−0.1429***	−0.0508	−0.2335***	0.1989***	−0.1911***	−0.0934	0.3196***	0.0090
	(0.04)	(0.02)	(0.03)	(0.19)	(0.04)	(0.02)	(0.03)	(0.21)	(0.07)	(0.14)
DiD (Balearic Islands at fake period)	**0.0602**	**0.0498**	**0.0098**	**0.0043**	**0.0175**	**0.0003**	**−0.0183**	**−0.0202**	**−0.0052**	**−0.0205**
	(0.04)	**(0.04)**	**(0.05)**	**(0.05)**	**(0.04)**	**(0.04)**	**(0.05)**	**(0.05)**	**(0.05)**	**(0.04)**
Business motivation	0.5601***	0.4708***	0.6028***	0.5044***	0.4518***	0.3461***	0.4438***	0.3329***	−0.6042***	−0.4179***
	(0.03)	(0.04)	(0.02)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)
Gender	−0.0543***	−0.0512**	−0.0804***	−0.0616***	−0.0530***	−0.0463**	−0.0892***	−0.0619***	0.0416	0.0369**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)
Age	0.0055	0.0054	0.0059	0.0065	0.0117**	0.0121***	0.0092*	0.0125**	−0.0078	−0.0080**
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Employed	0.1715***	0.1843***	0.1369***	0.1494***	0.1682***	0.1832***	0.1444***	0.1892***	−0.1553***	−0.1790***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)
Low Cost traveler	−0.0734***	−0.0541***	−0.0893***	−0.0417**	−0.0296	−0.0063	−0.0743***	−0.0318	0.0274	0.0002
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)
Market housing	0.9794***	0.9977***	0.9684***	0.9840***	0.1780***	0.1974***	0.1585***	0.1947***	−0.1537***	−0.2054***
	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)
Education	0.1217***	0.1142***	0.1231***	0.1137***	0.1367***	0.1274***	0.1359***	0.1202***	−0.0752***	−0.0601***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
Income (binary variables)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Route effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	5531	5531	5531	5531	5358	5358	5358	5358	5531	5531
R^2 (or Pseudo R^2 for QR)	0.55	0.59	0.38	0.42	0.37	0.44	0.25	0.29	0.43	0.54

Note: Other variables included and not showed: quadratic age and binary variables for marital status. Standard errors in parentheses. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.
Note 2: TE: Tourists' expenditure per day (excepting airline expenditure); ED: Tourists' expenditure at destination per day.

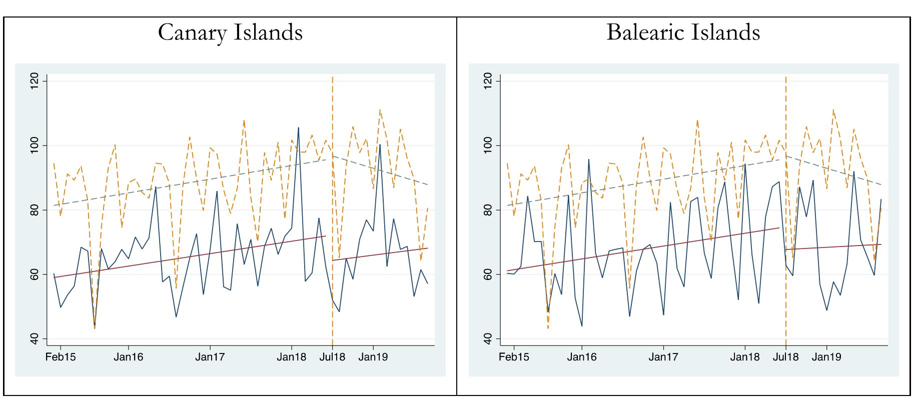

Fig. 1. Average tourists' expenditure per day. Islands versus average control group
Note: Dashed lines correspond to control routes. Lines are fitted values per period. The vertical line represents the shock (50–75%). Own elaboration.

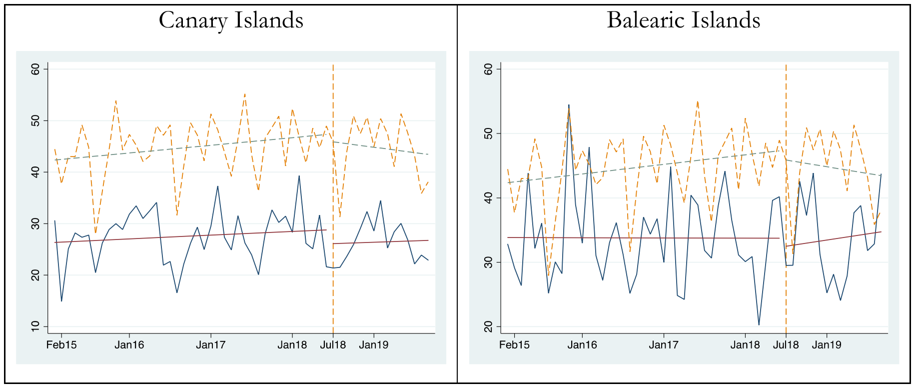

Fig. 2. Average tourists' expenditure at destination per day. Islands versus average control group
Note: Dashed lines correspond to control routes. Lines are fitted values per period. The vertical line represents the shock (50–75%). Own elaboration.

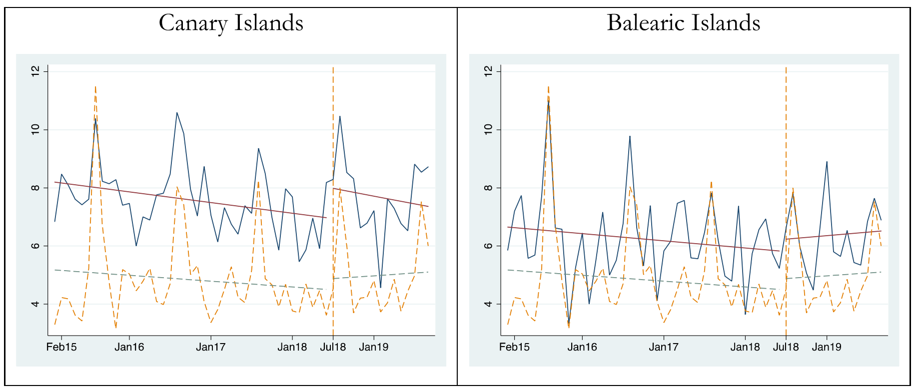

Fig. 3. Average overnight stays. Islands versus average control group
Note: Dashed lines correspond to control routes. Lines are fitted values per period. The vertical line represents the shock (50–75%). Own elaboration.

8. Policy recommendations, limitations and conclusions

Markets failures and/or equity reasons support interventions in (transport) markets. In the latter case, examples applied in some countries (as in Spain, Ecuador, Portugal or Scotland) are resident subsidies, whose economics effects have been analyzed in recent decades. However the economic effects in related markets (like tourism) are (almost) unexplored ones that deserve more attention.

The aim of this paper is to fill this gap and study the effects of these kinds of subsidies in the tourism sector. Specifically, we evaluate the effects on tourists' expenditure of the last change in the percentage of the subsidy given to residents in the Canary Islands and Balearic Islands in Spain through a difference-in-difference estimator. Our estimation strategy includes both OLS and QR, using a large sample of individuals who travel within Spain (including individuals who travel on routes both affected and unaffected by the discounts) for the period 2015–2019.

Why is it relevant? Because tourism is particularly important in Spain: in 2018, it amounted to 11.7% of GDP and 12.8% of employment. For example, the tourism sector accounted for 35.0% of GDP (€6,099 million), and 343,899 jobs, representing 40.4% of employment at Canary Islands (Exceltur and Gobierno de Canarias, 2019).

Given that the literature has shown a clear increase in the relative prices of routes affected by the subsidy, it may affect the touristic sector through a decrease in tourists' expenditure per day (without considering transport cost), because they are non-resident passengers, so they have to pay higher prices for transport. Moreover, we also study the effects on expenditure at destination per day (that is, tourists' expenditure, without considering transport or accommodation costs), so we can get an idea of the domestic losses.

The results yield several conclusions. First, no tourists' expenditure effect is found in the Balearic Islands. Second, the most remote region of Spain, the Canary Islands, shows a negative effect on non-residents tourists' expenditure that ranges from 7.3 to 8.6 per cent on total tourists' expenditure per day (excluding transport costs). In the case of expenditure at destination per day, there was a greater effect equal to a reduction of 9.6–12.2 per cent. Using total monthly touristic data, these coefficients imply a reduction of € 1.8 million per month and higher than € 23.6 million per year at destination. Finally, overnight stays remain stable after the policy change in both regions.

Differences in results in the two regions studied in this paper could be explained by several reasons. For example, apart from distance or different seasonability, we highlight the different levels of airline and intermodal competition, the tourist profile or differences in airfares from the same origin (maybe related to distance or level or competition, for example). Each issue deserves further research.

These results, although not transferable, give us an idea of the undesirable effects of such a policy, i.e., unintentional effects, which affects non-beneficiaries of the policy, and may act against the intended beneficiaries (resident passengers and, in the end, the Canary Islands, a touristic region).

The efficient use of public funds is important, even more in times like today (considering that touristic regions were most affected by the pandemic). Because of this, the evaluation of the use of public funds also becomes more necessary. Resident subsidies are based on the equity principle, and are given to residents who live in isolated, non-vertebrated and, in some cases, remotes territories. For this reason, we are not justifying the aim of the policy, but their possible effects beyond transport markets.

For example, different ways of applying the policy (e.g. a specific

Table 8
Placebo test. Difference-in-difference estimations using other regions as treated.

	TE [1]	TE + Controls [2]	QR_TE [3]	QR_TE + Controls [4]	ED [5]	ED + Controls [6]	QR_ED [7]	QR_ED + Controls [8]	Overnights [9]	Overnights + Controls [10]
Treated (Fake Canary Islands)	−0.0604	1.0887***	−0.0058	0.3862*	−0.0769	−0.1034	0.0107	0.2955	0.0336	−0.6023**
	(0.06)	(0.03)	(0.04)	(0.22)	(0.07)	(0.08)	(0.05)	(0.24)	(0.06)	(0.27)
After	0.0509**	0.0468	0.0554**	0.0222	0.0275	0.0505	0.0605**	0.0557	0.0035	−0.0095
	(0.02)	(0.03)	(0.03)	(0.05)	(0.03)	(0.04)	(0.03)	(0.05)	(0.04)	(0.05)
DiD (Fake Canary Islands)	**0.0276**	**0.0244**	**0.0394**	**0.0399**	**0.0402**	**0.0641**	**−0.0313**	**−0.0078**	**−0.0334**	**−0.0444**
	(0.03)	**(0.03)**	**(0.08)**	**(0.08)**	**(0.07)**	**(0.06)**	**(0.08)**	**(0.09)**	**(0.06)**	**(0.08)**
Treated (Fake Balearic Islands)	−0.0821**	0.1277**	−0.1156***	0.3382**	−0.1118**	0.1164*	−0.1126***	0.5192***	0.0294	−0.4744**
	(0.04)	(0.06)	(0.03)	(0.15)	(0.05)	(0.06)	(0.04)	(0.16)	(0.06)	(0.21)
DiD (Fake Balearic Islands)	**−0.0399**	**−0.0398**	**−0.0237**	**−0.0161**	**−0.0267**	**−0.0186**	**−0.0255**	**−0.0645**	**0.0155**	**0.0189**
	(0.05)	**(0.04)**	**(0.07)**	**(0.06)**	**(0.04)**	**(0.04)**	**(0.07)**	**(0.07)**	**(0.06)**	**(0.07)**
Business motivation	0.5133***	0.4261***	0.5062***	0.3969***	0.3209***	0.2331***	0.3002***	0.2102***	−0.4803***	−0.3479***
	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)
Gender	−0.0443*	−0.0384*	−0.0535**	−0.0469**	−0.0362	−0.0273	−0.0200	−0.0195	0.0342	0.0309
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)
Age	0.0128**	0.0121**	0.0173***	0.0195***	0.0148**	0.0142**	0.0243***	0.0151***	−0.0160**	−0.0146***
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Employed	0.2044***	0.1993***	0.2069***	0.2120***	0.2385***	0.2389***	0.2731***	0.3028***	−0.2033***	−0.1969***
	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.07)	(0.04)
Low Cost traveler	−0.1013***	−0.0593**	−0.1290***	−0.0841***	−0.1027***	−0.0609*	−0.1220***	−0.0580**	0.1276***	0.0244
	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
Market housing	0.9016***	0.9391***	0.8863***	0.9325***	0.1987***	0.2279***	0.1389***	0.2196***	−0.2342***	−0.2939***
	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Education	0.1254***	0.1215***	0.1392***	0.1491***	0.1421***	0.1314***	0.1468***	0.1427***	−0.0993***	−0.0908***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Income (binary variables)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Route effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	3820	3820	3820	3820	3696	3696	3696	3696	3820	3820
R^2 (or Pseudo R^2 for QR)	0.62	0.67	0.43	0.47	0.35	0.43	0.22	0.27	0.39	0.51

Note: Other variables included and not showed: quadratic age and binary variables for marital status. Standard errors in parentheses. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.
Note 2: TE: Tourists' expenditure per day (excepting airline expenditure); ED: Tourists' expenditure at destination per day.

subsidy instead of an ad-valorem subsidy) or other subsidy criteria (e.g. route criterion) might be policies without the undesirable effects like those found in this paper.

Moreover, some routes are high density, where competition between airlines is possible, and that competition could be enough in order to offer services with a right service and affordable prices with no need of this kind of distortions. Furthermore, we have to highlight the fact that if there are dense routes, it implies that the policy has a higher cost. For this reason, it is reasonable to encourage competition on routes where it may be possible and restrict markets intervention on the other routes where any kind of competition were impossible.

These solutions, already highlighted in the literature, are also proposed by de Rus et al. (2020); and de Rus and Socorro (2022) to mitigate problems with the subsidy. This study theoretically proves the undesirable effects found in AIReF (2020) with Spanish data (for example, the cost of increase in tickets for non-residents, the majority due to the subsidy increase and the higher percentage of residents the higher the increase). Moreover, they recommend establishing the amount of the specific subsidy according to each route (considering the particular characteristics of each one, market conditions and the period of time, and its need for regular revision), and that any Cost-Benefit Analysis that evaluates the effects of the subsidy must be carried out route by route, by taking into account its characteristics and the period of time.

Finally, justifying the use (or not) of the resident subsidies is not the aim of the paper. A proper cost-benefit analysis should be done in order to show whether the policy is beneficial considering all the benefits and costs. This research should compare the total benefit that the island residents have with the new policy (and other potential benefits) with the costs of this policy (including some deterioration in tourism). If the cost-benefit analysis shows that policy benefits offset policy costs, it would be desirable. Then, tourism sector (governments and business) should find ways to encourage tourism to offset the cost of the policy. This is an issue that deserves further research.

Limitations and future research on this topic are linked to data and survey design. First, it would be desirable to use panel data instead of several cross section. Second, the design of the survey does not allow to estimate other variables of interest such as frequency. Third, it could be interesting to have data of non-travellers, allowing data to be extracted on at least two stages in the tourism process: whether or not they travel in each period and how much they decide to spend. For this reason, it would be desirable to have better databases and surveys from public agencies to evaluate the real effects of this policy.

Contribution statement

Conceptualization: Juan Luis Jiménez, Jorge Valido and Alfonso Pellicer; Methodology: Juan Luis Jiménez and Jorge Valido; Formal analysis and investigation: Juan Luis Jiménez; Writing - original draft preparation: Juan Luis Jiménez and Jorge Valido; Writing - review and editing: Juan Luis Jiménez and Jorge Valido; Funding acquisition: None; Resources: Juan Luis Jiménez and Alfonso Pellicer; Supervision: Juan Luis Jiménez and Jorge Valido.

Data availability

Data will be made available on request.

Annex 1

Table 9
Correlation matrix

	(ln) Total expenditure per day	Business motivation	Gender (1 = Woman)	Age	Employed	Low Cost traveler	Market housing
(ln) Total expenditure per day							
Business motivation	0.51						
Gender (1 = Woman)	−0.14	−0.25					
Age	−0.15	−0.10	−0.006				
Employed	0.30	0.34	−0.12	−0.40			
Low Cost traveler	−0.14	−0.20	0.07	−0.04	−0.08		
Market housing	0.55	0.24	−0.09	0.02	0.06	−0.08	
Education	0.27	0.24	−0.06	−0.31	0.42	−0.07	0.01

Table 10
Difference-in-difference estimations. Treated routes considered (Both Canary and Balearic Islands)

	OLS. TE [1]	OLS. TE [2]	OLS. ED [3]	OLS. ED [4]	QR. TE [5]	QR. TE [6]	QR. ED [7]	QR. ED [8]	OLS. Overnights [9]	OLS. Overnights [10]
Treated (Canary and Balearic Islands)	−0.1678***	0.1147***	−0.2793***	0.0350	−0.1171***	0.0365	−0.2284***	−0.0760	0.4116***	0.2280*
	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)	(0.15)	(0.02)	(0.16)	(0.06)	(0.13)
After	0.0534***	0.0109	0.0341	0.0717***	0.0752***	0.0027	0.0546**	0.0694*	0.0017	−0.0051
	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.04)	(0.02)	(0.04)	(0.03)	(0.03)
DiD (Canary and Balearic Islands)	−0.0068	−0.0128	−0.0420	−0.0433	−0.0531*	−0.0522*	−0.0745**	−0.1068***	0.0020	0.0020
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)
Business motivation	0.5955***	0.4992***	0.4945***	0.3751***	0.6528***	0.5460***	0.5232***	0.3828***	−0.6510***	−0.4555***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.02)
Gender (1 = Woman)	−0.0495***	−0.0510***	−0.0494**	−0.0466**	−0.0643***	−0.0564***	−0.0708***	−0.0494***	0.0387*	0.0353***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)
Age	0.0032	0.0034	0.0078**	0.0088**	0.0042	0.0065*	0.0070*	0.0076*	−0.0078	−0.0098***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Employed	0.1534***	0.1675***	0.1448***	0.1657***	0.1042***	0.1226***	0.1221***	0.1632***	−0.1172***	−0.1460***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.02)
Low Cost traveler	−0.0730***	−0.0557***	−0.0228	−0.0074	−0.0948***	−0.0547***	−0.0418**	−0.0284	0.0054	−0.0118
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.01)
Market housing	0.9609***	0.9834***	0.1453***	0.1736***	0.9620***	0.9726***	0.1424***	0.1760***	−0.1487***	−0.2142***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)
Education	0.1319***	0.1254***	0.1541***	0.1425***	0.1260***	0.1228***	0.1454***	0.1346***	−0.0783***	−0.0609***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
Income (binary variables)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Route effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	7898	7898	7645	7645	7898	7898	7645	7645	7898	7898
R^2 (or Pseudo R^2 for QR)	0.56	0.60	0.37	0.43	0.38	0.42	0.25	0.30	0.42	0.53

Note: Other variables included and not shown: quadratic age and binary variables for marital status. Standard errors in parentheses. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.
Note 2: TE: Tourists' expenditure per day (excepting airline expenditure); ED: Tourists' expenditure at destination per day.

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