Maritime Policy & Management

The flagship journal of international shipping and port research

ISSN: 0308-8839 (Print) 1464-5254 (Online) Journal homepage: http://www.tandfonline.com/loi/tmpm20

Do maritime passengers' subsidies in Europe affect prices?

Juan Luis Jiménez, Jorge Valido & Naykel Morán

To cite this article: Juan Luis Jiménez, Jorge Valido & Naykel Morán (2018): Do maritime passengers' subsidies in Europe affect prices?, Maritime Policy & Management, DOI: 10.1080/03088839.2018.1441558

To link to this article: https://doi.org/10.1080/03088839.2018.1441558

Published online: 24 Feb 2018.

MARITIME POLICY & MANAGEMENT, 2018
https://doi.org/10.1080/03088839.2018.1441558

ARTICLE

Do maritime passengers' subsidies in Europe affect prices?

Juan Luis Jiménez [a], Jorge Valido [b] and Naykel Morán

[a]Departamento de Análisis Económico Aplicado, Universidad de Las Palmas de Gran Canaria, Spain; [b]Departamento de Ciencias Sociales, Universidad Europea de Canarias, Inocencio García 1, La Orotava, Spain

ABSTRACT
Some European governments subsidize their residents when they travel at sea. This paper seeks to analyze the impact on prices of maritime passengers' subsidies in Europe. Following a review of the scarce academic literature on this topic and the subsidy scheme in Europe, a sample of firms' prices and other characteristics of 40 European routes for 2016 are analyzed. Both an estimation of a price equation and a matching approach are applied and reach the same conclusion: prices per kilometer are around 40 per cent higher on those subsidized routes due to subsidies. This outcome reduces the potential subsidy gain to consumers.

KEYWORDS
Maritime; subsidies; Europe

1. Introduction

Maritime transport is an important factor in the economic development of islands, jointly with air transport. The role of these transport modes in people mobility leads governments to implement policies to subsidize passengers in order to compensate travel cost. Usually, these subsidies consist in a percentage of discount in the price or a fixed quantity of discount in price. Moreover, passengers enjoy them because they have the residence in a given geographical area.[1]

Subsidies for trips between islands and/or trips between the mainland and islands are very common practice around the world, and especially in Europe. There are three main objectives for this legal practice: to improve internal cohesion; to reduce the transport costs of consumers located in remote regions, especially those affected by 'double-insularity'; and to improve external trade.[2]

In the transport sector, transport authorities usually chose the ad-valorem form of the resident subsidy. However, a broad field of study analyzes the efficient form of the subsidy (or tax). Under imperfect competition, it depends of the characteristics of the market. On the one hand, some papers in the literature conclude that *ad valorem* taxes are better in social terms than specific taxes (see, for example, Suits and Musgrave 1953; Skeath and Trandel 1994; for monopoly and in the last case also extended to oligopoly; Cheung 1998; or Schröder, 2004, for monopolistic competition; or Delipalla and Keen 1992; and Denicolò and Matteuzzi 2000; for oligopoly).

On the other hand, other papers show that specific taxes may be more welfare enhancing (see, for example, Hamilton 1999; for monopsony; Grazzini 2006; or Blackorby and Murty 2007; for general equilibrium; Anderson, De Palma, and Kreider 2001a; Anderson, De Palma, and Kreider 2001b; Hamilton 2009; Wang and Zhao 2009; for differentiated or multiproduct oligopolies; Pirttilä 2002; in the presence of externalities; Kind, Koethenbuerger, and Schjelderup 2009; in two-sided markets; or Goerke 2011; Kotsogiannis and Serfes 2014; under uncertainty conditions).

CONTACT Juan Luis Jiménez juanluis.jimenez@ulpgc.es Facultad de Economía, Universidad de Las Palmas de Gran Canaria, Empresa y Turismo. Despacho D. 2-12. Las Palmas de Gran Canaria 35017, Spain

Moreover, we have to take into account that the ranking of the two types of instruments may be reversed in the case of subsidies (Collie 2006; Brander and Spencer 1984).

Although there are a number of economic implications for this kind of subsidy, the literature on transport sector has not focused on its corresponding importance. Most academic paper concerned with subsidies studied them in a general sense.[3]

Specific to maritime transport sector,[4] works on this topic study subsidies in different regions in a more descriptive way. For example, the seminal paper by Roueche (1981) analyzes the cases of Norway, Scotland, United States and Canada in order to focus on two issues: determination of the appropriate level of the subsidy and the operation and management of the ferry system. He concludes by emphasizing the importance of individual assessment of each particular case and the need for those two issues to be separated. Begg (1996) studies the ferry service on the Isle of Mull in Scotland. Waters, Evans, and Caravan (1996) analyze cost and revenue comparisons for 19 short distance coastal routes in Columbia. Hauge (2001) studies ferry crossings along the northern and western coast of Norway in order to improve services through the design of the tendering process. Brathen et al. (2004) analyzes efficiency on tendering for ferry services in Norway. Bennett (2006) takes into account European Union legislation to discuss the advantages and disadvantages of competitive tendering, focusing on Scottish islands. Odeck (2008) also analyzes efficiency on ferries operating on road networks, using the stochastic frontier approach. Chlomoudis et al. (2011) analyze specification and implementation of Public Service Obligation (hereafter, PSO) for island regions. Baird and Wilmsmeier (2011) study public procurement and tendering based on four European cases: Denmark, Greece, Sweden and Norway. Angelopoulos et al. (2013) assess PSO routes in Greece in order to study passenger transport services cost (both air and waterborne). Finally, the report of Rehmatulla and Tibbles (2014) studies public procurement and tendering of ferry services in the North Sea Region taking into account subsidies and PSO, among other factors.

More extensive is the air transport market literature in specifically those that analyzed Public Service Obligations.[5] Thus subsidies are usually linked to PSO, which puts limits on the analysis of particular characteristics, such as frequency of service, seats, schedule for the service, or, on occasion, the maximum permitted fare for some or all seats.[6] In air transport markets, several studies have analyzed the design and effects of PSO in different European countries (Williams and Pagliari 2004; Lian 2010; Lian and Ronnevik 2011; Di Francesco and Pagliari 2012; Merkert and O'Fee 2013; Calzada and Fageda 2014). Other studies have examined the efficiency of operators under PSO (Santana 2009; Merkert and Williams 2013; Pita, Adler, and Antunes 2014; Pita et al. 2013).

On the other hand, there are papers that have studied the price discount established for residents beyond the PSO declarations. Cabrera, Betancor, and Jiménez (2011), for example, have carried out a comparative study of subsidies for residents in Europe's outermost regions (they also analyzed PSO declarations in these regions). Calzada and Fageda (2012) have employed data from Spanish routes during the period 2001–2009 and have estimated through the two-stage least squares estimator the demand, price and frequency. They find greater demand and prices on granted routes with price discounts and lower prices and higher frequencies on routes regulated by price caps and frequency floors. Fageda, Jiménez, and Díaz (2012) compares flights from Gran Canaria (the Canary Islands, Spain) with domestic (and without international) subsidies, finding through a two-stage least squares estimation that nonresident passengers pay higher prices than international passengers, after controlling for market structure, demand and variables related to airline characteristics, such as low-cost, number of destinations, distance, and similar variables.

The theoretical paper by Valido et al. (2014) compares the varying effects of two different ways to apply subsidies to residents in the air transport market (*ad-valorem* and specific subsidies) in a context of market power. They show that if the proportion of resident passengers is high enough, nonresident passengers may be expelled from the market. They also analyze preferences in social terms between both types of subsidies, *ad-valorem* or specific, and show that it depends of passengers' willingness to pay. Finally, they apply the model to the Canary Island case, and conclude that the *ad-valorem* subsidy is not the most effective or efficient for this market.

Although this scheme seems to benefit consumers through lowering the prices of maritime transportation between islands or among mainland-island routes, it could have other non-desirable effects, such as price rises by firms in this market, as papers by Fageda, Jiménez, and Díaz (2012) or Calzada and Fageda (2012) found for the air transport market.

For this reason, the main aims of this paper are twofold: first, following this brief revision of the academic literature, we explain how resident subsidies work in Europe. And second, we try to study the real effect of these subsidies on final prices. Specifically, we focus on the subsidies given to passengers for residence reasons in order to analyze whether this kind of subsidy works for its purpose or, in contrast, resident subsidies are not effective in containing prices.[7] In fact, as far as we know, this is the first time that an empirical analysis of a resident subsidies scheme on maritime transport in Europe has been applied.

Following the methodology of studies of air transport on fare discounts (Calzada and Fageda 2012; or Fageda, Jiménez, and Díaz 2012 among others), we draw on our own cross-sectional database on prices and route characteristics for maritime European routes to analyze this effect. We estimate a route-level pricing equation using as explanatory factors variables related to route characteristics, market structure on routes and a number of demand shifters. A matching analysis is also implemented, in order to test the previous outcome reached. Our results state that prices per kilometer are between 37 and 43% higher on those subsidized routes due to resident discounts.

Following this introduction, the next section explains how subsidies on maritime passengers work in Europe. Section 3 details all variables included in the database and a descriptive analysis. Section 4 explains the empirical strategy employed and the outcomes. Section 5 concludes this paper by summarizing how subsidies increase final prices in Europe.

2. Subsidy schemes in Europe

Transport subsidies in Europe are a common practice not only in Europe, but around the world. Many countries offer various subsidies to beneficiaries for different reasons. Although there are many examples of this policy, it is often unclear as to whether it constitutes state aid or not. According to the European Commission website[8]: ‘State aid is defined as an advantage in any form whatsoever conferred on a selective basis to undertakings by national public authorities. Therefore, subsidies granted to individuals or general measures open to all enterprises are not covered by this prohibition and do not constitute State aid (examples include general taxation measures or employment legislation).’[9] It initially seems that resident subsidies given to passengers are entirely legal because it is given to *passengers*, but as the European Commission states: ‘the intervention gives the recipient an advantage on a selective basis, for example to specific companies or industry sectors, or to companies located in specific regions;’ making the subsidies a legally grey area.

Further, the European Commission states: ‘Despite the general prohibition of State aid, in some circumstances government interventions are necessary for a well-functioning and equitable economy. Therefore, the Treaty leaves room for a number of policy objectives for which State aid can be considered compatible. The legislation stipulates these exemptions. The laws are regularly reviewed to improve their efficiency and to respond to the European Councils’ calls for less but better targeted State aid to boost the European economy. The Commission adopts new legislation, which is adopted in close cooperation with the Member States.’

This is the case for resident subsidies to passengers with residence in the outermost regions[10] for territorial equity reasons. Moreover, there are a number of case examples outside of these regions (e.g. the Balearic Islands and the autonomous cities of Ceuta and Melilla in Spain, or the islands of Sicily and Sardinia in Italy).

Table 1. Subsidies on European ferry services.

Location	Subsidized services provided
Greece	All ferry operators are privately owned and the government subsidizes services that are otherwise not provided in the market. Surcharges applied to market services cross-subsidize routes that are economically not viable (Chlomoudis et al. 2007; Baird and Wilmsmeier 2011; Gratsos 2014).
Denmark	Since 2005, many ferry companies have been split into two: one public entity, often owned at municipal level, which owns the ferry and berth facilities, and another private company, which runs the service. The government, in accordance with "net cost" contracts, grants the subsidies (Baird and Wilmsmeier 2011).
France	The services between Corsica and the mainland are subsidized on the principle of territorial continuity. However, the subsidies granted to the public company Société Nationale Maritime Corse- Méditerranée (SNCM) were declared illegal by the EU due to a breach of competition rules, as noted above.
Spain	Resident maritime passengers from the Canary Islands (Outermost Region), Balearic Islands and the autonomous cities of Ceuta and Melilla are entitled to subsidies in order to guarantee territorial continuity. Both National and Regional Governments finance inter-island routes and routes between islands and the mainland.
Italy	The services between Sardinia and the mainland are subsidized (in form of PSO and special rates for Sardinian residents). There are also discounts to Sicilian residents.
Sweden	The major subsidized ferry service connects the island of Gotland in the Baltic Sea with the Swedish mainland; the service is tendered by the Swedish National Public Transport Agency (Baird and Wilmsmeier 2011).
Norway	Most of the ferries are owned and operated by private firms. However, like almost all other forms of public transport, many services operate at a loss and therefore require subsidy (Baird and Wilmsmeier 2011).
Scotland	According to the Scottish Government,[11] the subsidies given to maritime transport covers the following: Clyde and Hebrides Ferry Services (CHFS) contract; Northern Isles Ferry Services contract; Northern Isles Lift-On Lift-Off Freight Services contract; Gourock-Dunoon Ferry Service contract.

Source: Martino and Brambilla (2016) and own elaboration

In contrast, there are some cases where subsidies were prohibited by the European Commission, for example the subsidies granted to the public company Société Nationale Maritime Corse-Méditerranée (Corsica-Marseille route) in France because it was considered State Aid.[12] Table 1 summarizes a selection of subsidies in European maritime passengers' markets.

As noted above, the aim of this paper is to analyze the effects on prices of resident subsidies, by comparing different routes from different countries. As we explain in the next section, routes with subsidies are from Spain and Italy in our database, because these are the routes that enjoy direct passenger subsidies for residence reasons.

3. Data

Our database contains 53 observations collected in 2016 from 40 European maritime routes for 13 European countries (see routes included in Annex 1). The database includes both inter-island trips and routes with origin or destination on an island. We have to highlight that there is no public sources of information about prices by firms on routes, so we have collect data from each website, as papers by Fageda, Jiménez, and Díaz (2012) and Fageda, Jiménez, and Valido (2016; 2017) have developed. Although it is not an extensive analysis due to the difficult to collect data, this cross-section analysis is a first step to analyze this market.

There are two kinds of routes: those where passengers may be entitled to the maritime resident subsidy and those where passenger are not. This structure of the data will allow us to employ an empirical strategy based on how the treated route (subsidized) prices are different from the control group prices (those routes not affected by subsidies).

The variables included in the database are:

(1) *Ln Priceperkm*$_{if}$: is the natural logarithm of the price per kilometer corresponding to route *i* by firm *f*. This is the dependent variable in our model. This variable is constructed as the lowest mean round trip price charged by maritime transport offering services for one passenger. Information has been obtained manually from maritime websites between January 26th and 16 February 2016.

We follow these homogeneous rules in the data collection of prices, which have been collected from firms' websites one month before travelling, for an adult without vehicle.

Samples were taken in the original currencies of each country and converted to Euros using the official exchange rates provided by the European Central Bank in order to control for currency fluctuation. With this procedure, we can obtain data in homogeneous conditions for all the routes in our sample and exploit the variability of data across routes. To explain the corresponding price for each route we take as explanatory variables the following:

(2) *Ln Competitors$_i$*: logarithm of number of competitors on the route *i*. Source: own elaboration through companies' websites. This variable seeks to measure the influence of competitive intensity on the prices charged by shipping lines. The expected sign of the coefficient is ambiguous. On the one hand, this variable allows us to measure the influence of the intensity of competition on prices charged by firms. Competition could reduce prices charged by firms, so the sign of the coefficient associated with this variable should be negative. On the other hand, this variable may also work as a proxy for the profitability of operating on the route as it may be correlated with levels of demand on the route or omitted factors that influence such profitability, so the expected sign of the coefficient could be positive.

This variable may be showing an endogenous relationship with the explained variable. So, we have implemented instrumental variables in the estimation of Equation (1) through the following instruments:

2.a. *Population$_{it}$*: the logarithm of the average population at origin and destination of the route *i* during year *t*. Source: Eurostat.

2.b. *Unemployment$_{it}$*: the logarithm of the average rate of unemployment between origin and destination on route *i* in year *t*. Source: Eurostat.

(3) *Ln distance$_i$*: logarithm of the number of kilometers between origin and destination on route *i*. Route length is a major determinant of any mode of transport cost and its coefficient is expected to be positive. Source. Own elaboration.

(4) *Ln averagespeed$_{if}$*: logarithm of the average speed (kilometers per minutes) on route *i* for firm *f*. We expected a negative relationship with price per kilometer, because consumers are more prone to pay higher prices for faster modes. Source. Own elaboration.

(5) *International route$_i$*: binary variable that takes value 1 if route *i* joins two cities from different countries. This variable seeks to control for potential differences on wages, tourism, etc., which are not controlled for by other covariates. Source. Own elaboration.

(6) *Ln Frequency$_{if}$*: how many times a firm *f* offers a route *i* per week. Frequency refers to supply so we expect a negative coefficient for this variable. Source. Own elaboration.

(7) *Alternative mode competitor$_i$*: a binary variable that takes value 1 if there is at least one alternative mode competitor on route *i* (train or plane). Source: own elaboration.

(8) *Subsidized route$_i$*: binary variable that takes value 1 if route *i* benefited from direct public subsidies for residents using the maritime transport mode between the two cities considered. In our database, Spanish and Italian ports established this kind of public aid for maritime transport, and it accounts for 19 out of 53 observations. Source. Own elaboration.

As Fageda, Jiménez, and Valido (2016) reveal, discounts given to residents may have varying effects on prices (without discounts). On the one hand, they may increase prices since these discounts make the residents demand less elastic and, as a consequence, firms (train, rail or maritime) can set higher mark-ups. Second, the discount should increase the amount of traffic on the route (by residents). Unfortunately, we have not been able to control for this effect in our price equation, as we do not have data on demand. Overall, the subsidy may have an effect both on demand and supply, so that the expected effect on passenger behavior is not clear a priori. However, discounts usually benefit certain types of consumers (residents) and consequently split demand into two different types of consumers. Ideally detailed information on demand provides better results, but our proxy in this case is the binary variable on subsidized routes.

Table 2. Descriptive statistics and t-test.

Variable	Average		Standard deviation		Minimum		Maximum	
	N-S	S	N-S	S	N-S	S	N-S	S
Price per km	0.25(*)	0.36	0.20	0.34	0.02	0.08	0.91	1.60
Competitors	1.5	1.37	1.26	0.68	0	0	4	2
Average population	777,988	763,007	548,679	764,904	100,096	52,291	2,885,936	2,794,412
Average unemployment	9.10(***)	26.6	4.42	5.65	3.9	17.3	20	32.75
Distance	279.13	273.04	255.12	413.71	13.5	6.89	816.8	1434.21
Average speed	1.57	0.58	5.74	0.16	0.36	0.27	34.01	0.84
Frequency	13.22	10.58	12.61	15.42	1	1	52	63
International	0.71	0	-	-	0	0	1	0
Alternative mode competitor	0.18(**)	0.47	-	-	0	0	2	1

Source: Own elaboration. N-S denotes Nonsubsidized routes. S denotes Subsidized routes.
(***), (**), (*) indicates significance of t-test between N-S and S variables. 1, 5 and 10%, respectively.

On the other hand, firms may be forced to incorporate the subsidy into the price (without discount) if they are operating in a competitive context. In fact, the subsidy may increase the number of firms offering trips on the route given the increased demand. This effect can in part be captured by the variable 'number of competitors,' although a panel data structure would be needed to provide a better estimation of this specific effect.

Table 2 includes some descriptive statistics from the database. We split each covariate on both subsidized (treated) and nonsubsidized routes (control group).

Previous descriptives show that both types of routes are similar in their main covariates, except for three variables in which a t-test analysis shows statistical differences between the two samples. The first is the endogenous variable, average price per kilometer, which is higher on subsidized routes (0.36) than on nonsubsidized (0.25); subsidized routes show higher unemployment rates; and finally, 18% of nonsubsidized routes have an alternative competitor mode, whilst this percentage reaches 47% on subsidized routes.

Despite these results, a causal analysis is needed in order to establish and explain the differences in prices between subsidized and nonsubsidized routes. This is the purpose of the next section.

4. Empirical strategy and results

In order to estimate what factors affect firm's final prices on maritime routes, our empirical strategy consists of the use of both unobservable and observable covariates analysis. For this reason, we first implement an instrumental variables ordinary least squares estimation to analyze the effects of these types of subsidy programs on final prices. However, we also implement a matching estimator, in order to solve some of the problems produced by the previous methodology.

Estimations based on unobservable covariate analysis is supported by the estimation of the following pricing equation for the route i by firm f:

$$\begin{aligned} Ln\ \mathrm{Priceperkm_{if}} &= \beta_0 + \beta_1 Subsidizedroute_i + \beta_2 LnCompetitors_i \\ &+ \beta_3 Ln\mathrm{Distance_i} + \beta_4 LnAveragespeed_{if} + \beta_5 LnFrequency_{if} \\ &+ \beta_6 LnAlternativecompetitors_i + + \beta_7 International_i + \varepsilon_{if} \end{aligned} \tag{1}$$

Table 3 shows the results of the estimation of the pricing equation. We estimate three models, by adding covariates. Due to the simultaneous determination of competition, the estimation is made using the Two-Stage Least Square estimator.

The overall explanatory power of the model is reasonably good with an R^2 that ranges from 0.61 to 0.63. The instrument suitability tests and the Hansen J test of the possible endogeneity of

Table 3. Price (per km) equation. Instrumental variables estimation.

Covariates	Model 1	Model 2	Model 3
Subsidized route	0.37 (0.13)***	0.43 (0.14)***	0.53 (0.15)***
Ln Competitors	−0.09 (0.62)	−0.08 (0.71)	−0.09 (0.69)
Ln Distance	−0.53 (0.08)***	−0.45 (0.12)***	−0.49 (0.13)***
Ln Average speed	0.37 (0.11)***	0.35 (0.12)***	0.59 (0.20)***
Ln Frequency		0.11 (0.08)	0.09 (0.08)
Ln Alternative competitors			−1.76 (0.95)*
International route			0.17 (0.25)
Constant	1.23 (0.31)***	0.58 (0.58)	0.86 (0.61)
Observations	54	53	53
R^2 (centered)	0.61	0.63	0.63
Underidentification test/Hansen J statistic	2.627/5.853**	1.875/6.208**	1.819/n.r.

*** 1%, ** 5%, *10% significance test. Standard errors among brackets. n.r: not reported.
Number of competitors has been estimated using average population and average unemployment rate as instruments.

the instruments, show a high correlation between the variables instrumented and the instruments and indicate the exogeneity of the instruments.

These results raise three key questions. First, and in line with our expectations and the academic literature, the coefficient associated with distance is negative and has 1% significance and, moreover, the faster the firm, the more expensive the price per kilometer.

Second, although the instruments work well, the number of competitors shows no statistical significance. Nevertheless, another variable in our model that analyzes competition is the existence of alternative competitors, which is negatively correlated with prices per kilometer, as the coefficient of this variable shows in Model (3). This implies the positive effects of alternative modes of transport on competition.

Finally, the most relevant outcome is the positive coefficient of the binary variable that controls subsidized routes. This outcome implies that prices per kilometer are between 37 and 43% higher on those subsidized routes. This key outcome was also found in air transport markets by Fageda, Jiménez, and Díaz (2012) or by Calzada and Fageda (2012).

Academic literature has been referred to as unconfoundedness, exogeneity, ignorability or selection on observables when regression models have been used. However, comparisons made between treated and control groups remove any self-selection bias. Adjusting treatments and control groups for differences in covariates, or pretreatment variables, is the key to obtaining causal inference of effects, as matching analysis seeks to do (see Rubin 1974; or Rosenbaum and Rubin 1983).

Let Y_1 represent the outcome (here, price per kilometer) in the case of a unit (a route) exposed to treatment (subsidies). By analogy, Y_0 is the outcome if the unit is not exposed to treatment ($D = 0$).

Our interest is defined by the difference between Y_1 and Y_0. In our specific case, we are interested in estimating the average effect on prices per kilometer of routes affected by subsidies, which can be defined as:

$$E(Y_1 - Y_0 | D = 1)$$

A set of observable characteristics (Z) affects both treatment status and potential outcomes. Using the untestable conditional independence assumption and a requirement for identification, the Average Treatment effect on the Treated (hereafter, ATT) can be identified as:

$$\begin{aligned} \mathrm{ATT} &= \mathrm{E}(\mathrm{Y}_1 - \mathrm{Y}_0 | D = 1) = \mathrm{E}(\mathrm{E}(\mathrm{Y}_1 - \mathrm{Y}_0 | D = 1, Z)) \\ &= \mathrm{E}(\mathrm{E}(\mathrm{Y}_1 | D = 1, Z) - \mathrm{E}(\mathrm{Y}_0 | D = 0, \mathrm{Z}) | D = 1) \end{aligned}$$

The use of matching estimator pairs up treatment routes (subsidized) with control routes (nonsubsidized) that have similar observed attributes. This is one of the main advantages of matching analysis in contrast with the former empirical approach. The main hypothesis is whether any unobserved variable exists that we have not included in instrumental variable

Table 4. ATT estimation on prices. Kernel matching. Bootstrapped standard errors.

	In levels, original data	In logs
Subsidized route	0.162**	0.593*
Impact/Mean	53.6%	59.3%

*** 1%, ** 5%, *10% significance test.
Covariates used: competitors, alternative competitors, distance, average population.

regression that affects final prices. In our case, we have calculated the average treatment effect on the treated by using the Kernel Matching method.[13]

Table 4 summarizes matching estimator outcome. In all estimations we have included as exogenous variables the following: number of competitors, alternative competitors, distance and average population. The estimation has been done using the bootstrap option, and we also present the data in levels and in logs.

Both matchings show statistical significance and a positive coefficient. In fact, using the average price per kilometer these results imply that prices on subsidized routes are 53.6 or 59.3% higher than on control group routes.

Although the level of this outcome should be considered with caution, due to the lack of demand control variables and cross-section structure, a primer outcome on the effects of subsidies on prices is reached. Both analyses, unobservable and observable covariate analysis, show that prices are higher on subsidized routes than nonsubsidized routes, as in Calzada and Fageda (2012) or Fageda, Jiménez, and Díaz (2012) for the air transport sector.

For this reason, firms could have set higher mark-ups because the discount made the demand of residents less elastic. Nevertheless, we have to take into account that the possible inclusion of demand variable extract the effect of the increase of passenger and price increasing associated to it.

A clear implication of this result is that island residents have not taken advantage of the discounts, at least not as much as politically intended, because of higher prices (assuming that the aim of resident subsidies is to benefit resident passengers without damaging nonresident passengers). For this reason, nonresidents are harmed by the discount policy as prices without the discount are higher.

5. Conclusions

Transport subsidies are common practice, even in the field of maritime transport. Moreover, there are countries that commonly apply subsidies for passenger who live in specific territories and the academic research found this kind of subsidy not capable to contain prices. For this reason, this paper analyzes the economic effects on prices of these kinds of subsidies.

Although some papers have been published on air transport markets about subsidies given to passengers for resident condition, in maritime transport this analysis does not exist in our knowledge. Therefore, as far as we know this is the first attempt to explain the effect of resident subsidies on price. We use two different techniques in order to undertake this analysis: unobservable (instrumental variables ordinary least squares estimation) and observable covariate analysis (matching).

Both analyses find the same conclusion about the effects of subsidies on prices: routes that enjoy resident subsidies have higher prices than others without these kinds of subsidies. For this reason, we can conclude that firms set higher mark-ups on routes with resident subsidies. The reason lies in the elasticity of resident passengers, who are less elastic in supply and demand terms because of the subsidy.

Therefore, as firms increase prices on routes with resident subsidies, we can conclude that these work as a subsidy to them (and are, at least in part, shared with resident passengers). This also affects nonresident passengers because they suffer higher prices and some of them could even be expelled from the market because of this policy.

In fact, the discount policy may not be effective in reducing the costs of insularity and long distance travel to/from the mainland for residents. This is a serious problem for one of the major justifications of the policy: to promote the mobility at national level of residents on islands.

Finally, we have to take into account the fact that subsidies involve public resources aimed at protecting island residents. Other policies with a lower impact on the government budget could be implemented to protect passenger residents on islands. Some alternatives include applying a price-cap or favorable tax treatment for specific routes, providing a specific subsidy that does not depend on ticket price, or another kind of subsidy. All of these have to take into account European legislation on competition policy.

However, this study is a proposed first step to further research that could evaluate these alternative policies. Future papers are needed in order to analyze this market by using panel data analysis and to include demand factors by route. These two factors would lead to better estimations of price effects.

Notes

1. Transport authorities may provide also subsidies to ferry companies (i.e. subsidy per itinerary) apart from subsidies directly to resident. In these cases, all passengers (not only residents) are benefited from the subsidy. This analysis will be a good subject for further research, and whether the possible effects of the subsidy will be the same.
2. For example, Article 349 of the Treaty on the Functioning of the European Union allows for the special situation of the outermost regions to be taken into account when defining EU policies (Solbes-Mira 2011): "Taking account of the structural social and economic situation of Guadeloupe, French Guiana, Martinique, Réunion, Saint-Barthélemy, Saint-Martin, the Azores, Madeira and the Canary Islands, which is compounded by their remoteness, insularity, small size, difficult topography and climate, economic dependence on a few products, the permanence and combination of which severely restrain their development, the Council, on a proposal from the Commission and after consulting the European Parliament, shall adopt specific measures aimed, in particular, at laying down the conditions of application of the Treaties to those regions, including common policies".
3. For example, see the seminal paper of Mohring (1972) or Pucher, Markstedt, and Hirschman (1983) for urban bus transportation.
4. In this paper, we focus on subsidies given to resident passenger who travel by ferries, so maritime literature focus on it. Recent papers about cruise markets are: Sanz-Blas, Carvajal-Trujillo, and Buzova (2017), Chen, Lijesen, and Nijkamp (2017) or Lee and Lee (2017).
5. For a general perspective, see Nolan, Ritchie, and Rowcroft (2005), who analyzes the social welfare implications for various types of regulations (direct subsidies, protected route packages, and revenue guarantees).
6. For example, for the Canary Islands in Spain, there are 13 routes affected, which include regulations on frequency, schedule, capacity and operation timetable (Resolution of 21 July 2006 of the Sub-Secretariat, about the publication of the Council of Ministers Agreement of the 2 June 2006 (available at http://www.fomento.gob.es/NR/rdonlyres/50376DAE-D44B-453C-B5BE-A6706646B2C6/110159/RESO_2162006.pdf).
7. In a recent paper, Fageda, Jiménez, and Valido (2017) show that this kind of policy has not worked for European routes in air transport markets. They compare routes with and without resident subsidy and/or PSO through data extracted from five different countries.
8. http://ec.europa.eu/competition/state_aid/overview/index_en.html.
9. Moreover, it adds: 'To be State aid, a measure needs to have these features: There has been an intervention by the State or through State resources which can take a variety of forms (e.g. grants, interest and tax reliefs, guarantees, government holdings of all or part of a company, or providing goods and services on preferential terms, etc.); the intervention gives the recipient an advantage on a selective basis, for example to specific companies or industry sectors, or to companies located in specific regions; competition has been or may be distorted; the intervention is likely to affect trade between Member States.'
10. Currently, there are nine Outermost Regions in the European Union: Guadeloupe, French Guiana, Martinique, La Réunion, Mayotte (French overseas departments); Saint-Martin (French overseas

community); Madeira and Azores (Portuguese autonomous regions) and Canary Islands (Spanish autonomous community).
11. http://www.gov.scot/Publications/2014/10/2706/16.
12. 2013/435/EU: Commission Decision of 2 May 2013 on State aid SA.22843 (2012/C) (ex 2012/NN) implemented by France in favor of Société Nationale Maritime Corse-Méditerranée (available at http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013D0435).
13. Four of the most widely matching methods are the Nearest Neighbor, Radius, Stratification and Kernel. None of these are a priori superior to the others. See Becker and Ichino (2002) for a further explanation.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Juan Luis Jiménez http://orcid.org/0000-0002-3808-2588
Jorge Valido http://orcid.org/0000-0002-0815-4739

References

Anderson, S. P., A. De Palma, and B. Kreider. 2001a. "The Efficiency of Indirect Taxes under Imperfect Competition." *Journal of Public Economics* 81 (2): 231–251. doi:10.1016/S0047-2727(00)00085-2.

Anderson, S. P., A. De Palma, and B. Kreider. 2001b. "Tax Incidence in Differentiated Product Oligopoly." *Journal of Public Economics* 81 (2): 173–192. doi:10.1016/S0047-2727(00)00079-7.

Angelopoulos, J., C. Chlomoudis, P. Christofas, and S. Papadimitriou. 2013. "Cost Assessment of Sea and Air Transport PSO Services: The Case of Greece." *International Journal of Maritime, Trade & Economic Issues* 1 (2): 3–49.

Baird, A. J., and G. Wilmsmeier. 2011. "Public Tendering of Ferry Services in Europe." *European Transport* 49: 90–111.

Becker, S., and A. Ichino. 2002. "Estimation of Average Treatment Effects Based on Propensity Scores." *The Stata Journal* 2 (4): 358–377.

Begg, H. M. 1996. "The Impact of Improved Ferry Services on an Island Economy: The Case of Mull." *World Transport Policy and Practice* 2 (4): 8–12. doi:10.1108/13527619610129485.

Bennett, P. 2006. "Competing for the Island Lifeline: European Law, State Aid and Regional Public Services." *Regional Studies* 40 (8): 953–966. doi:10.1080/00343400600983959.

Blackorby, C., and S. Murty. 2007. "Unit versus Ad Valorem Taxes: Monopoly in General Equilibrium." *Journal of Public Economics* 91 (3–4): 817–822. doi:10.1016/j.jpubeco.2006.10.003.

Brander, J. A., and B. J. Spencer. 1984. "Trade Warfare: Tariffs and Cartels." *Journal of International Economics* 16 (3–4): 227–242. doi:10.1016/S0022-1996(84)80002-1.

Brathen, S., A. Hervik, J. Odeck, and O. Sunde 2004. "Competitive Tendering versus Subsidy Schemes in Public Transport Services: Comparing Efficiency in the Provision of Ferry Services." Proceedings of the European transport conference (ETC). Strasbourg, France, October 4–6.

Cabrera, M., O. Betancor, and J. L. Jiménez. 2011. "Subsidies to Air Transport Passengers: Efficiency of the European Policy Practice." In: Proceedings of the *7th International Forum on Air Transport in Remoter Regions*. Newquay, UK.

Calzada, J., and X. Fageda. 2012. "Discount and Public Service Obligation in the Airline Market: Lesson from Spain." *Review of Industrial Organization* 40 (4): 291–312. doi:10.1007/s11151-011-9331-7.

Calzada, J., and X. Fageda. 2014. "Competition and Public Service Obligations in European Aviation Markets." *Transportation Research Part A: Policy and Practice* 70: 104–116. doi:10.1016/j.tra.2014.10.009.

Chen, J. M., M. G. Lijesen, and P. Nijkamp. 2017. "Interpretation of Cruise Industry in a Two-Sided Market Context: An Exploration on Japan." *Maritime Policy & Management* 44 (6): 790–801. doi:10.1080/03088839.2017.1335898.

Cheung, F. K. 1998. "Excise Taxes on a Non-Uniform Pricing Monopoly: Ad Valorem and Unit Taxes Compared." *The Canadian Journal of Economics* 31 (5): 1192–1203. doi:10.2307/136466.

Chlomoudis, C. I., P. Kostagiolas, S. Papadimitriou, and E. S. Tzannatos. 2011. "A European Perspective on Public Service Obligations for Island Transport Services." *Maritime Economics and Logistics* 13 (3): 342–354. doi:10.1057/mel.2011.9.

Chlomoudis, C. I., P. L. Pallis, S. Papadimitriou, and E. S. Tzannatos. 2007. "The Liberalisation of Maritime Transport and the Island Regions in EU. Evidence from Greece." *European Transport* 37: 1–15.

Collie, D. R. 2006. "Tariffs and Subsidies under Asymmetric Oligopoly: Ad Valorem versus Specific Instruments." *The Manchester School* 74 (3): 314–333. doi:10.1111/j.1467-9957.2006.00495.x.
Delipalla, S., and M. Keen. 1992. "The Comparison between Ad Valorem and Specific Taxation under Imperfect Competition." *Journal of Public Economics* 49 (3): 351–367. doi:10.1016/0047-2727(92)90073-O.
Denicolò, V., and M. Matteuzzi. 2000. "Specific and Ad Valorem Taxation in Asymmetric Cournot Oligopolies." *International Tax Public Finance* 7 (3): 335–342. doi:10.1023/A:1008709914537.
Di Francesco, A., and R. Pagliari. 2012. "The Potential Impact of Removing Public Service Obligation Regulations on Air Fares between the Italian Mainland and the Island of Sardinia." *Journal of Transport Geography* 24: 332–339. doi:10.1016/j.jtrangeo.2012.03.012.
Fageda, X., J. L. Jiménez, and C. Díaz. 2012. "Fare Differences between Domestic and International Air Markets on Routes from Gran Canaria." *Journal of Air Transport Management* 25: 8–10. doi:10.1016/j.jairtraman.2012.03.001.
Fageda, X., J. L. Jiménez, and J. Valido. 2016. "Does an Increase in Subsidies Lead to Changes Air Fares? Empirical Evidence from Spain." *Transportation Research-A: Policy and Practice* 94: 235–242. doi:10.1016/j.tra.2016.09.018.
Fageda, X., J. L. Jiménez, and J. Valido. 2017. "An Empirical Evaluation of the Effects of European Public Policies on Island Airfares." *Transportation Research-A: Policy and Practice* 106: 288–299. doi:10.1016/j.tra.2017.09.018.
Goerke, L. 2011. "Commodity Tax Structure under Uncertainty in a Perfectly Competitive Market." *Journal of Economics* 103 (3): 203–219. doi:10.1007/s00712-011-0197-9.
Gratsos, G. A. 2014. "Greek Shipping and the Maritime Economy." In E.U. CCMI Seminar on Maritime Industrial Sectors, Athens, May 12.
Grazzini, L. 2006. "A Note on Ad Valorem and per Unit Taxation in an Oligopoly Model." *Journal of Economics* 89 (1): 59–74. doi:10.2007/s00712-006-0201-y.
Hamilton, S. F. 1999. "The Comparative Efficiency of Ad Valorem and Specific Taxes under Monopoly and Monopsony." *Economic Letters* 63 (2): 235–238. doi:10.1016/S0165-1765(99)00018-X.
Hamilton, S. F. 2009. "Excise Taxes with Multiproduct Transactions." *American Economic Review* 99 (1): 458–471. doi:10.1257/aer.99.1.458.
Hauge, O. 2001. "Experimental Tendering. An Analysis of Experiences from the Road/Ferry Sector in Norway." 6th conference on Competition and Ownership in Land Passenger Transport (Thredbo 6), Cape Town, South Africa.
Kind, H. J., M. Koethenbuerger, and G. Schjelderup. 2009. "On Revenue and Welfare Dominance of Ad Valorem Taxes in Two-Sided Markets." *Economic Letters* 104 (2): 86–88. doi:10.1016/j.econlet.2009.04.010.
Kotsogiannis, C., and K. Serfes. 2014. "The Comparison of Ad Valorem and Specific Taxation under Uncertainty." *Journal of Public Economic Theory* 16 (1): 48–68. doi:10.1111/jpet.12059.
Lee, G., and M. K. Lee. 2017. "Estimation of the Shore Excursion Expenditure Function during Cruise Tourism in Korea." *Maritime Policy & Management* 44 (4): 524–535. doi:10.1080/03088839.2017.1298866.
Lian, J. 2010. "Network Dependency and Airline Competition. Consequences for Remote Areas in Norway." *Journal of Air Transport Management* 16 (3): 137–143. doi:10.1016/j.jairtraman.2009.07.007.
Lian, J., and J. Ronnevik. 2011. "Airport Competition. Regional Airports Losing Ground to Main Airports." *Journal of Transport Geography* 19 (1): 85–92. doi:10.1016/j.jtrangeo.2009.12.004.
Martino, A., and M. Brambilla. 2016. *Research for TRAN Committee - the EU Maritime Transport System: Focus on Ferries (Provisional Draft)*. Directorate General for Internal Policies, Policy Department B: Structural and Cohesion Policies, Transport and Tourism (European Parliament). Brussels
Merkert, R., and B. O'Fee. 2013. "Efficient Procurement of Public Air Services. Lessons Learned from European Transport Authorities Perspectives." *Transport Policy* 29: 118–125. doi:10.1016/j.tranpol.2013.04.008.
Merkert, R., and G. Williams. 2013. "Determinants of European PSO Airline Efficiency: Evidence from a Semi-Parametric Approach." *Journal of Air Transport Management* 29: 11–16. doi:10.1016/j.jairtraman.2012.12.002.
Mohring, H. 1972. "Optimization and Scale Economies in Urban Bus Transportation." *The American Economic Review* 62 (4): 591–604.
Nolan, J., P. Ritchie, and J. Rowcroft. 2005. "Small Market Air Service and Regional Policy." *Journal of Transport Economics and Policy* 39 (3): 363–378.
Odeck, J. 2008. ""Efficiency Measurement of Ferries Serving Road Networks in Norway: A Stochastic Frontier Approach." *Maritime Economics & Logistics* 10: 409–428. doi:10.1057/mel.2008.14.
Pirttilä, J. 2002. "Specific versus Ad Valorem Taxation and Externalities." *Journal of Economics* 76 (2): 177–187. doi:10.1007/s007120200.
Pita, J. P., N. Adler, and A. P. Antunes. 2014. "Socially-Oriented Flight Scheduling and Fleet Assignment Model with an Application to Norway." *Transportation Research Part B: Methodological* 61: 17–32. doi:10.1016/j.trb.2013.12.006.
Pita, J. P., A. P. Antunes, C. Barnhart, and A. G. Menezes. 2013. "Setting Public Service Obligations in Low-Demand Air Transportation Networks: Application to the Azores." *Transportation Research Part A: Policy and Practice* 54: 35–48. doi:10.1016/j.tra.2013.07.003.

Pucher, J., A. Markstedt, and I. Hirschman. 1983. "Impacts of Subsidies on the Costs of Urban Public Transport." *Journal of Transport Economics and Policy* 17 (2): 155–176.
Rehmatulla, N., and L. Tibbles. 2014. *Effects of EU Policy Regulations on Ferry Operation: Sustainability Issues in Public Procurement of Ferry Services*. London, UK: UCL Energy Institute, University College London.
Rosenbaum, P., and D. Rubin. 1983. "The Central Role of the Propensity Score in Observational Studies for Causal Effects." *Biometrika* 70: 41–55. doi:10.2307/2335942.
Roueche, L. 1981. "Notes on Government Subsidisation of Ferry Transport." *Journal of Transport Economics and Policy* 15: 233–242.
Rubin, D. 1974. "Estimating Causal Effects of Treatments in Randomised and Non-Randomised Studies." *Journal of Educational Psychology* 66 (5): 688–701. doi:10.1037/h0037350.
Santana, I. 2009. "Do Public Service Obligations Hamper the Cost Competitiveness of Regional Airlines?" *Journal of Air Transport Management* 15: 344–349. doi:10.1016/j.jairtraman.2008.12.001.
Sanz-Blas, S., E. Carvajal-Trujillo, and D. Buzova. 2017. "Assessing Cruise Port of Call Performance: A Passenger-Based Approach Using PLS Modelling." *Maritime Policy & Management* 44 (8): 967–980. doi:10.1080/03088839.2017.1371346.
Schröder, P. J. H. 2004. "The Comparison between Ad Valorem and Unit Taxes under Monopolistic Competition." *Journal of Economics* 83 (3): 281–292. doi:10.1007/s00712-004-0096-y.
Skeath, S. E., and G. A. Trandel. 1994. "A Pareto Comparison of Ad Valorem and Unit Taxes in Noncompetitive Environments." *Journal of Public Economics* 55 (1): 53–71. doi:10.1016/0047-2727(94)90013-2.
Solbes-Mira, P. 2011. "Europe's Outermost Regions and the Single Market: The EU's Influence in the World." Report to the Member of the European Commission Michel Barnier.
Suits, D. B., and R. A. Musgrave. 1953. "Ad Valorem and Unit Taxes Compared." *The Quarterly Journal of Economics* 67 (4): 598–604. doi:10.2307/1883604.
Valido, J., M. P. Socorro, A. Hernández, and O. Betancor. 2014. "Air Transport Subsidies for Resident Passengers When Carriers Have Market Power." *Transportation Research Part E: Logistics and Transportation Review* 70: 388–399. doi:10.1016/j.tre.2014.08.001.
Wang, X. H., and J. Zhao. 2009. "On the Efficiency of Indirect Taxes in Differentiated Oligopolies with Asymmetric Costs." *Journal of Economics* 96 (3): 223–239. doi:10.1007/s00712-008-0046-7.
Waters II, W. G., J. Evans, and J. Caravan. 1996. "Subsidy Policy on Low Volume Ferry Routes: British Columbia's Coastal Services." *Transport Policy* 3 (3): 111–121. doi:10.1016/0967-070X(96)00013-3.
Williams, G., and R. Pagliari. 2004. "A Comparative Analysis of the Application and Use of Public Service Obligations in Air Transport within the EU." *Transport Policy* 11 (1): 55–66. doi:10.1016/S0967-070X(03)00040-4.

Annex 1

Table A1. List of routes included in the sample (Without subsidy).

Origin	Destiny	Country
Ballen	Kalundborg	Denmark
Dieppe (Francia)	New Haven (Inglaterra)	France/England
St. Malo (Francia)	Poole (inglaterra)	France/England
Calais (Francia)	Dover (Inglaterra)	France/England
Cherbourg (Francia)	Poole (inglaterra)	France/England
Aarhus	Odden	Denmark
Algeciras	Tanger Med.	Spain/Marroco
Ystad	Rønne	Sweden/Denmark
Cherbourg	Rosslare	France/Ireland
Oslo	Kiel	Norway/Germany
Katapola	Piraeus	Greece
Stockholm	Tallinn	Sweden/Estonia
Kapellskar	Paldiski	Sweden/Estonia
Nynashamn	Ventspils	Sweden/Latvia
Oban	Craignure	Scotland
Cavo	Portoferraio	Italy
Tallinn	St Petersburg	Latvia/Russia
Travemunde	Malmo	Germany/Sweden
Rostock	Trelleborg	Germany/Sweden
Pozzallo	Valletta	Italy/Malta
Tunis	Palermo	Tunesia/Italy
Dielette	Aurigny	France/England
Naantali	Langnas	Finland
Turku	Langnas	Finland
Barcelona	Livorno	Spain/Italy
Barcelona	Génova	Spain/Italy
Bar	Bari	Montenegro/Italy
Motril	Nador	Spain/Morocco
Almería	Nador	Spain/Morocco
Aberdeen	Kirkwall	United Kingdom
Stromstad	Sandefjord	Sweden/Norway
Horta	Sao Roque	Portuguese
Ventspils	Travemunde	Latvia/Germany
Ystad	Swinoujscie	Sweden/Poland
Trelleborg	Swinoujscie	Sweden/Poland
St Malo	Guernesey	France
Dielette	Guernesey	France
Eckero	Grisslehamn	Finland/Sweden
Ventotene	Casamicciola	Italy
Santander	Portsmouth	Spain/England
Marsella	Oran	France/Argelia

Table A2. List of routes included in the sample (With subsidy).

Origin	Destiny	Country
Gran Canaria (lp)	Tenerife (Sc)	Spain
Gran Canaria (Agaete)	Tenerife (Sc)	Spain
Gran canaria	Andalucia (Cadiz)	Spain
Gran canaria	Andalucia (Huelva)	Spain
Napoli	Palermo	Italy
Ibiza	Barcerlona	Spain
Los Cristianos	Santa Cruz de La Palma	Spain
Santa Cruz de Tenerife	Santa Cruz de La Palma	Spain
Ciutadella	Alcúdia	Spain
Mahón	Palma	Spain
Motril	Melilla	Spain
Almería	Melilla	Spain
La Graciosa	Órzola	Spain
La Gomera	Santa Cruz de La Palma	Spain
Valverde	Los Cristianos	Spain