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Estimating the impact of airport privatization on airline demand: A regression-based event study

Paula S. W. Rolim

Humberto F. A. J. Bettini

Alessandro V. M. Oliveira

Instituto Tecnológico de Aeronáutica
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Estimating the impact of airport privatization on airline demand:

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Paula S. W. Rolim[1]

Humberto F. A. J. Bettini[2]

Alessandro V. M. Oliveira[3]

Abstract

This paper develops an empirical model of passenger demand for routes of airports subject to either imminent or recent privatization. We investigate whether the privatization process produces a sequential impact over traffic. By employing a regression-based event methodology and controlling for fixed effects, price endogeneity and sample selection, we perform an econometric analysis of pre-privatization and post-privatization dynamic patterns of demand to infer the demand consequences of the major change in airport governance. We examine recent Brazilian airport privatization experience as a case. The main results suggest that privatization produced an overall increase in airline demand and that the airport notably recognized with the greatest demand potential and with the largest market penetration of a fast-growing low cost newcomer had the highest estimated *ceteris paribus* effect of privatization on demand.

Keywords: airports, privatization, demand, econometrics, endogeneity.

JEL Classification: L93, C5.

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[1] Center for Transport Economics, Aeronautics Institute of Technology, Brazil. E-mail: pswrolim@gmail.com.

[2] University of São Paulo, Brazil and Center for Transport Economics, Aeronautics Institute of Technology, Brazil. E-mail: humberto@sc.usp.br.

[3] Center for Transport Economics, Aeronautics Institute of Technology, Brazil. E-mail: alessandro@ita.br. The authors thank Fapesp, CAPES and CNPq for financial support. They also thank Anming Zhang, Branko Bubalo, Mia Mikic, Dan Wong, Sandro Cabral, Erico Santana, William Bendinelli, Reinaldo Crispiniano Garcia, Cláudio Jorge P. Alves, Carlos Müller, Fernando Capuano, Frederico Turolla, the anonymous reviewers, and the participants of the 10th Symposium on Transport Economics. All mistakes are ours.

Introduction

This paper develops an empirical model of passenger demand for routes of recently privatized airports aiming at inspecting if a privatization process producing a sequential impact on traffic. By employing a regression-based event methodology, we investigate whether the change in ownership and management control has any effect on the efficiency of both airports and airlines to generate additional demand. We perform an econometric analysis of pre-privatization and post-privatization dynamic patterns of demand to infer the demand consequences of the major change in governance and its anticipation by involved enterprises and all stakeholders.

Privatization is widely seen as a mechanism to promote competitiveness of a sector or a whole country by enhancing the efficiency of stated-owned enterprises (SOEs). In the air transport literature, some recent studies so far have suggested that airports operated by a majority private firm achieve higher efficiency than those operated by a majority public firm - for example, Oum, Yan and Yu (2008) and Oum, Adler and Yu (2006). However, the literature has not yet directly addressed the important issue of the impact of airport privatization on passenger demand. We argue that, in contrast to the state-owned enterprise, a privatized airport may be more effective not only in attracting new airlines but in producing route development strategies such as route support and risk sharing with existing airlines, which ultimately stimulates demand. We suspect that privatization produces effects not only through airport capacity expansion, the new regulatory framework and the potentially enhanced efficiency, but it also has a relevant impact in the short run. We suspect that privatization preparation, announcement, the transfer of management control, and the inevitable temporary effects of terminal and runway constructions and renovations may dictate these short run effects. By testing the effects on the dynamic pattern of passenger demand following the privatization of airports, we intend to fill the gap in the literature with respect to assessing its *ceteris paribus* impact on demand and also contribute to the scarce literature on the empirical modeling of airport privatization and its consequences. We consider the privatization timetable of Donaldson and Wagle (1995) to separate the short run from the long run effects in terms of sequential privatization stages.

To estimate the dynamic effects of demand following privatization, we develop an econometric model of passenger market demand by considering the Brazilian airline industry and its recent airport privatization experience. We consider the effects of the privatization package of 2011-2012 that included major airports São Paulo/Guarulhos (GRU), Brasília (BSB) and São Paulo/Viracopos (VCP) – respectively, the country's international gateway, the geographically centrally located domestic hub, and the only effective secondary airport in the country. From our regression-based event, we estimate a set of privatization-related coefficients and promote empirical tests of the sequential impact of privatization on demand. Our empirical model considers the endogeneity of price and therefore, makes use of an instrumental variables approach in a panel data framework. We also utilize a correction procedure for sample selectivity due to the fact that the short list of airports selected to be privatized is likely to be determined based on socio-economic criteria and airport performance indicators, and not randomly.

The present paper is organized in the following way: Section 1 presents a theoretical framework, with a literature review, the presentation of our conceptual model and investigation proposal. Section 2 presents the empirical model development. Section 3 contains our empirical modeling and presentation of estimation results. The final section contains the concluding remarks.

1. Theoretical framework

1.1. Literature review

One of the most commonly observed objectives of a privatization program is to enhance the efficiency of state-owned enterprises. Consequently, the air transportation literature has frequently discussed the relationship between airport ownership and performance. The conclusions over the relative performance of airport operators under alternative governance schemes are still not clear, however. For example, Oum, Yan and Yu (2008) estimate that there is an eighty percent probability that airports operated by a majority private firm achieve higher efficiency than those operated by a majority public firm. Those results are also found in Oum, Adler and Yu (2006). In contrast, Scotti et al. (2012) find that public airports are more efficient than private and mixed ones. As Megginson and Netter (2001) discuss, there are theoretical arguments for arguing that the impact of privatization ultimately depends on the degree of market failure. For example, if competition is naturally strong, than state enterprises may be forced to enhance productive efficiency, and the impact of ownership change of privatization may not be substantial. The authors survey several studies applied to many sectors of both transition and non-transition economies and conclude that the overall research supported the proposition that privately owned firms are more efficient and more profitable.

In addition to the relationship of airport ownership and efficiency, other subjects that have also been investigated by the literature were the link between privatization and profitability and the impacts and incentives of airport capacity expansion following privatization. Oum, Yan and Yu (2008) conclude that as privatized airports are more efficient, they are also more profitable. Noruzoliaee and Zhang (2015) suggest that increases in airport capacity depend on efficiency: a more efficient owner has more capital to invest in infrastructure and capacity expansion than a less efficient one. Zhang and Zhang (2003) discuss that airport capacity expansion is usually seen as improving the quality of service by reducing or eliminating airport congestion, which results from the heavy use of the existing airport. The authors conclude that given growing demand and lumpy capacity – i.e., capacity increase through large indivisible lumps, such as when a new runway is built - decisions over capacity expansion by private airports are suboptimal from a social point of view. Specifically, in their study, private airports tend to introduce capacity expansion later than comparable public airports.

As far as we are concerned, the literature has not yet directly addressed the issue of the impacts of airport privatization on passenger demand. There are indirect analyses linking privatization to demand through airport capacity expansion and efficiency – for example, Zhang and Zhang (2003) and Noruzoliaee and Zhang (2015) – but no study aimed at primarily inspecting this relation. In case privatization proves to be a successful demand-enhancement initiative, its effects must be accounted for in both the airport's and the airlines' demand forecasts and business plans. Additionally, the possibility of an increase in future demand of privatized airports should be explicitly considered in the asset valuation problem of the pre-privatization economic appraisal study. Given an expectation of future improved demand, airlines may regard the privatized airport as more attractive with respect to strengthening their flight frequency positions and even considering it as a possible hub or a focal airport. Megginson, Nash and Van Randenborgh (1994), and La Porta and López-de-Sillanes (1999) show that some demand increase is induced in the wake of privatization episodes - an actually standard effect that has been observed in a wide sample of firms, in an equally broad set of industries and countries[4]. Our econometric model aims at not only filling the gap in the airline literature regarding the demand impacts of privatization but also at providing estimates of its dynamic effects that may produce benefits to the air travel consumer over time.

An important issue for our empirical framework is related to the privatization timeline. The actual implementation of privatization typically depends on the model of privatization adopted by governments. According to Graham (2008) and Carney and Mew (2003), airport privatization can be categorized into five types: share flotation, trade sale, concession, project finance privatization, and management contract. Consider the privatization timetable of Donaldson and Wagle (1995), presented in Figure 1 – henceforth, DW95. Designed to assist the World Bank, and in particular, the International Finance Corporation (IFC), in analyzing privatizations in several sectors around the world, this general framework may be regarded being consistent with all privatization categories.

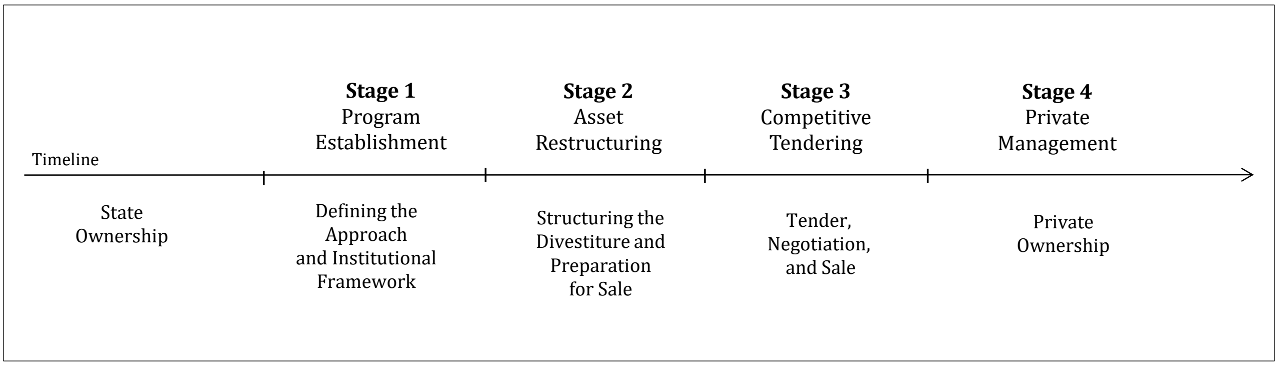

Figure 1 – Privatization Timeline – Adapted from Donaldson & Wagle (1995).

[4] Moreover, the authors provide evidence of an extra appeal commonly found with these destatization policies: in most of the cases, demand increase seems to be uncoupled from undesirable side effects such as unemployment and price increases, and it also comes without the need for extra investments, revealing that productivity gains can be explored by the private management.

1.2. Conceptual model

Our main objective here is to present a representation of the air passenger demand key drivers and their interactions. The resulting conceptual model is shown in the Figure 2.

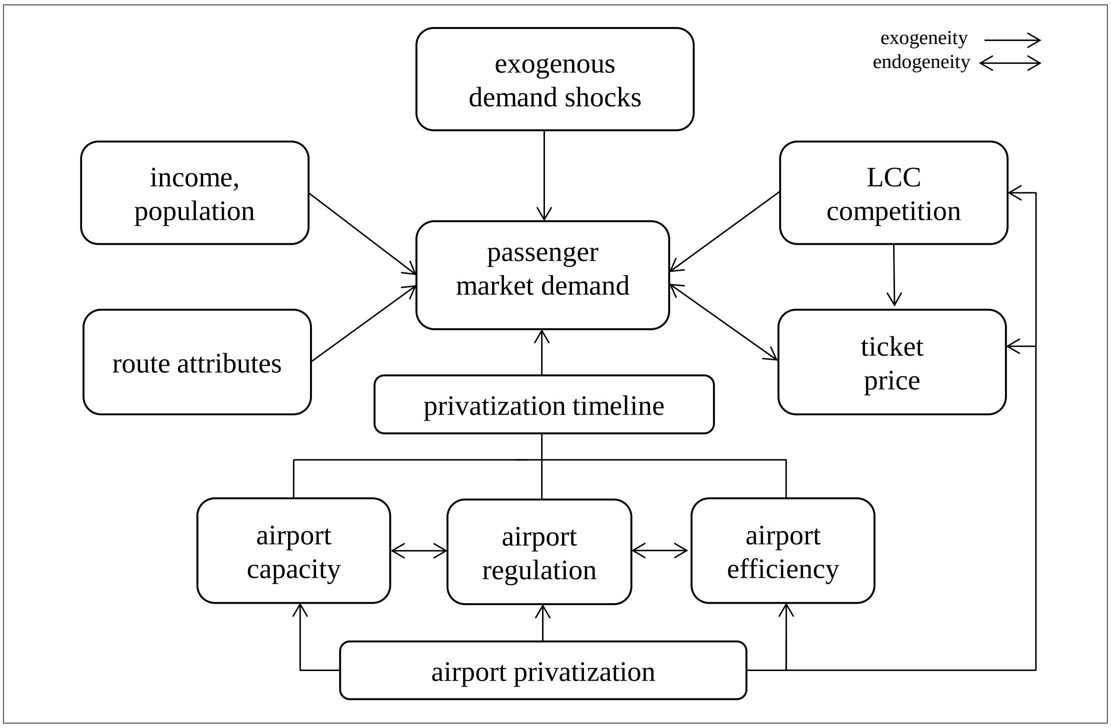

Figure 2 – Conceptual model of passenger market demand

As we can observe from Figure 2, passenger market demand is jointly determined with ticket price, as indicated by the bidirectional arrow (endogeneity). Key (exogenous) demand drivers are origin and destination population and average income, gravity terms that are explicitly modeled as regressors in our econometric framework. We also consider average route attributes - such as distance, flight time, intermodal competition, etc. - and other exogenous demand shocks, such as the seasonality, cultural and sports events, and touristic booms at both the origin and destination. All these idiosyncratic factors have their average effect accounted for in our approach by the use of route and time fixed effects in the panel data estimation. Consistent with the "Southwest Effect" in the US airline market[5], we consider the presence of low cost carrier (LCC) competition as an important demand shifter of airline demand as well as of price.

[5] The "Southwest Effect" is a term created by the US Department of Transportation to describe the significant impact on traffic and prices of the entry of LCC Southwest Airlines on domestic routes of the US airline industry.

Airport privatization enters our model as an element of investigation and hypothesis testing. In particular, we suspect that a process of change of ownership may have sequential effects on demand, inducing a combination of short run and long run impacts that will be observed according to the stage of privatization within the timeline window. We therefore have that, in Figure 2, airport privatization may produce impacts on passenger demand via its effects over airport capacity, regulation and efficiency, but acknowledge that these effects may be either moderated or accentuated by the sequence of events dictated by the privatization timeline. We suspect that early privatization stages, consisting of preparation, announcement, the tendering process and all arrangements previous to the transfer of management control will produce anticipated actions by airlines that may affect demand. Additionally, even after the transfer of full control of management, in case of capacity expansion, temporary effects of terminal and runway constructions may produce short run effects on demand. We think that the short run impact may materialize at least after Stage 2 of Figure 1, particularly because of the increased publicity permitted by the tendering process. We explicitly nominate airport capacity, airport regulation and airport efficiency as key drivers of the long run impact of privatization on passenger demand. By inserting bidirectional arrows, we consider that "airport efficiency" is not determined independently from "airport capacity" and "airport regulation"[6]. We think that the long run effects are more likely to materialize in the post-privatization period, namely, in Stages 3 and 4 of Figure 1. Additionally, we suspect that both the short and the long run effects of airport privatization may have positive effects on demand, but due to the above-mentioned temporary problems of terminal and runway constructions that were present in our case study. We also suspect that the magnitude of the short run effect may be lower than the magnitude of the long run effect but we acknowledge that it is an empirical matter to estimate and to distinguish which of these effects dominates.

By inspecting the above effects of privatization, we intend to fill the gap of the literature with respect to assessing the *ceteris paribus* impacts of privatization on demand. Additionally, we will consider the timetable of DW95 to examine the effects of the sequential steps of privatization - a methodological procedure that has not been empirically implemented yet. Our empirical model is discussed in Section 2.

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[6] Although we have the three concepts displayed side-by-side, this is not suggestive that they are in the same level of importance.

2. Empirical model development

2.1. Application

We develop an empirical model of passenger market demand by considering the Brazilian airline industry and its recent airport privatization cases. Brazil has experienced a sharp growth in demand for air transport, particularly during the late 2000s and early 2010s, as Table 1 indicates. In fact, the traffic more than trebled since 2000, with 175 million domestic passengers in 2013 against 53.9 million in 2000. The rapid growth and the nomination for being the official host of the 2014 World Cup and the 2016 Summer Olympic Games forced the authorities to perform major changes in the airport sector. The alternatives under consideration were either the public floatation of state-owned enterprise Infraero - which possessed 67 airports across the country - or full privatization of some key airports. After several months of discussions, a privatization plan was launched in May 31, 2011. The tender with an offer of a bid for a long-term contract included major airports São Paulo/Guarulhos - GRU, the country's international gateway and Latin American's biggest hub, Brasília - BSB, the most important and geographically centrally located domestic hub, and São Paulo/Viracopos - VCP, the only relevant and effective secondary airport operated by a low cost carrier in the country. Table 1 also presents the traffic evolution of each airport along with the other airports within the country.

In February 6, 2012, the auction of the three major airports raised a total of $14 billion[7]. The government granted concessions with contracts of 20 years (GRU), 25 years (BSB) and 30 years (VCP), in an ownership setup in which Infraero still holds a share of 49% stake. The actual dates of management control transfer from Infraero to the new owners were November 15, 2012 (GRU and VCP) and December 1, 2012 (BSB). Immediately after privatization, all airports went through intense constructions and capacity expansion to be ready for the enhanced international traffic expected for the 2014 World Cup. Major renovation projects of the three airports included the enlargement and refurbishment of runway, ramp and apron areas and the construction and implementation of new terminals, among others. However, many of the airport improvement projects suffered from implementation delays, with unfinished construction works causing problems associated with longer check-in lines, last-

[7] Source: "*Partners sought to operate three Brazilian airports*" (Aviation Week, June 1, 2011), "*Brazil Privatizes Airports, Raising $14 Billion*" (The Wall Street Journal, February, 7, 2012).

minute gate changes and flight delays in the months previous to the mega-event, with BSB being one of the airports that suffered most from the transitory effects of construction works[8].

Table 1 – Air travel evolution in Brazil[9]

Year	Total Domestic Brazil	International Gateway (GRU)	Domestic Hub (BSB)	Secondary Airport (VCP)	Other Airports
			Emplanements + Deplanements (Million Scheduled Pax)		
2000	53.9	6.1	4.7	0.6	32.0
2005	73.0	5.6	7.2	0.8	47.0
2010	135.7	15.4	14.1	4.9	69.9
2011	161.2	18.0	15.2	7.0	84.2
2012	174.3	20.2	16.1	8.4	88.5
2013	175.1	21.9	16.2	9.0	84.8
			Average year-over-year growth (%)		
2000-2005	6.2%	-1.8%	8.9%	5.8%	8.0%
2005-2010	13.2%	22.7%	14.3%	44.1%	8.2%
2010-2011	18.8%	16.4%	8.2%	43.6%	20.5%
2011-2012	8.1%	12.7%	5.8%	18.5%	5.1%
2012-2013	0.5%	8.0%	0.2%	8.2%	-4.2%

2.2. Data

Most data utilized in this research are publicly available from National Civil Aviation Agency (ANAC), Brazilian Institute of Geography and Statistics (IBGE) and Brazilian Central Bank. We consider a panel data of with monthly observations for all domestic routes in Brazil over 144 periods from January 2003 to December 2013[10].

2.3. Empirical model

We perform a regression-based event methodology to inspect the impact of airport privatization on passenger demand. In such a framework, time dummies consistent with notable events in the market are inserted in the model to capture the dynamic pattern of the dependent variable over time. When statistically significant, the estimated dynamics have the interpretation of a *ceteris paribus* effect on the dependent variable. For a recent example of the

[8] See "*Brazil airports won't be ready in time for World Cup as experts warn travellers to expect delays and chaotic scenes*" (The Daily Mail, April 8, 2014) and "*Within 50 days of the World Cup, Brasília airport is still under construction*" (dw.com, April, 25, 2014, translated from Portuguese)

[9] Source: National Civil Aviation Agency, Route Traffic Report, available at www.anac.gov.br.

[10] Routes with an average of less than thirty monthly passengers each way and that had less than five years of continuous scheduled traffic flow were discarded.

use of a similar methodology, see Oliveira, Lohmann and Costa (2015) and Escobari (2014). In the present case, we model the sequential time dummies to be consistent with the privatization timetable approach of Donaldson and Wagle (1995), DW95, and therefore, the stages of privatization of Figure 1. Our objective, therefore, is to estimate a set of privatization-related coefficients to promote empirical tests of the impact of privatization on demand. Equation (1) presents our model:

$$\ln \text{daily pax}_{\text{kt}} = \beta_1 \ln \text{gravity gdp per capita}_{kt} + \beta_2 \ln \text{gravity population}_{kt} + \beta_3 \text{yield}_{kt} + \beta_4 \text{LCC presence}_{kt} + \sum_{\alpha i} \delta_{\alpha i} \text{ privatization stage } i_{kt} + \gamma_k + \gamma_t + u_{kt} \quad (1)$$

where

- $daily\ pax_{kt}$ is the average number of daily revenue passengers on route (i.e. directional airport-pair) k and time t. Source: National Civil Aviation Agency, Traffic Report.
- $gravity\ gdp\ per\ capita_{kt}$ is the product of the gross domestic product (GDP) per capita of origin and destination cities of route k and time t. Source: Brazilian Institute of Geography and Statistics (IBGE). This metric has yearly periodicity and therefore, had to be interpolated to produce monthly series.
- $gravity\ population_{kt}$ is the product of the population of origin and destination cities of route k and time t. Source: Brazilian Institute of Geography and Statistics (IBGE). This metric has yearly periodicity and was interpolated to produce monthly series.
- $yield_{kt}$ is a proxy for the market average price per kilometer in market k and time t. Source: National Civil Aviation Agency, Yield Report.
- $LCC\ presence_{kt}$ is a dummy variable to account for the presence of low cost carrier Azul airlines at route k and time t. We defined "route presence" as being all periods in which the airline operated at least one scheduled flight on the route at time t.
- $privatization\ stage\ i_{kt}$ is a set of dummies to control for the stages of privatization at privatized airports. We therefore have dummies to control for privatization stage 1 (February 2008 – February 2010), stage 2 (March 2010 – April 2011), stage 3 (May 2011 – November 2012), and stage 4 (from December 2012 to the end of sample period). The base case of the dummies is the period previous to the establishment of the

privatization program. All periods were set according to the actual dates of privatization announcement, public auction and management control transfer, as presented in 2.1. In some specifications, we used as an alternative a single $privatization\, program_{kt}$ dummy variable set equal to 1 from the establishment of privatization (February 2008) to the end of the sample period. All privatization dummies were assigned with 1 only when one of the endpoint airports were actually one of the three privatized airports in the sample.

- $\delta_{\alpha i}$ are the investigated demand effects due to privatization at privatized airport α, $\alpha = \{GRU, BSB, VCP\}$, and at stage i, $i = \{1, 2, 3, 4\}$.
- β_1, β_2, β_3, and β_4 are unknown parameters.
- γ_k and γ_t are the route and time-specific fixed effects. The route-specific fixed effects aim to control for market demand unobservables related to airport-pair idiosyncrasies such as distance, whether it is a tourism-related route, etc. The time-specific fixed effects aim at controlling for common shifts across routes such as national-level historic events as the codeshare agreement between the two major carriers TAM and Varig between March 2003 and April 2005 and the period of massive flight delays and cancellations known as the “big blackout” from October 2006 to July 2007.
- u_{kt} is the disturbances term.

Note that our econometric model is intended to be consistent with the privatization timeline of Figure 1 - the DW95 framework. Additionally, it is designed to be an empirical counterpart of our conceptual model of Figure 2, as discussed earlier: we have passenger market demand as the regressand, which is endogenously determined with ticket price; we include the gravity terms of population and average income (gdp per capita) and the dummy of presence of LCC; and finally, we account for route-specific and time-specific effects in our fixed effects estimation to control for average route attributes and the average effect of other exogenous demand shocks across routes. The broad concepts of “airport efficiency”, “airport capacity” and “airport regulation” are not explicitly modeled in our demand framework but enter in a combined way through the privatization stage dummy variables[11].

[11] Note that, bu inserting time fixed effects, our econometric procedure is equivalent to a difference-in-differences estimator in which the effects of the privatized airports are compared with the remaining, non-privatized, airports.

A major issue of our empirical framework relates to to the privatization decision per se. The decision to privatize an airport is likely not to be exogenous to airline demand, as governments typically consider a broad range of factors when considering privatization and some of these motivations may be associated with many of the unobserved components of air travel generation. For example, the government might be more expected to privatize under-performing airports, or in other words, might be less willing to privatize airports that are clearly functioning efficiently according to some elected indicators such as traffic growth. In this case, airports with a recent record of lower-than-average growth - but good future growth perspectives - will be more likely selected. Ultimately, the privatized airports may see an increase in airline demand that is not a direct result of the privatization process, but caused by the selection of under-performing airports that are catching up[12]. As a consequence, any estimate of the impact of privatization using the $privatization\ stage\ i_t$ variables of (1) may be upwards biased. A classic way to circumvent the potential problem of biased estimation due to sample selection is to explicitly inserting such information in the estimating equation. This is accomplished by recurring to the two-step procedure of the Heckman correction, in which a selection decision equation is firstly estimated using a probit model and subsequently the observed factors that determine such selection are accounted for in the estimating equation. The framework makes use of the inverse Mills ratio term, which is plugged into the second-stage regression. See Alderighi, Gaggero & Piga (2015) for a recent example of implementation of the Heckit estimator to the airline industry. Our specification of the probit model has $privatization\ program_{kt}$ as the regressand and has the following explanatory variables:

- $ln\ gravity\ gdp\ per\ capita_{kt}$, $ln\ gravity\ population_{kt}$, and $ln\ yield_{kt}$, as defined above.
- $yoy\ gravity\ gdp\ per\ capita_{kt}$ calculated as the year-over-year percentage variation in $gravity\ gdp\ per\ capita_{kt}$. Source: Brazilian Institute of Geography and Statistics (IBGE). This metric captures the record of recent growth of the economies linked by route k at time t and may be regarded as a proxy for the growth perspectives of the related airports. The higher the values assumed by this variable the stronger the

[12] We thank an anonymous referee for that insight over the problem.

expectations of authorities of future enhanced organic traffic growth at the airports irrespective of privatization.

- $prop\ flights\ in\ congested\ hours$, measured as the proportion of daily scheduled flights of route k and time t that operate during congested hours[13]. A "congested hour" was defined as a full clock hour characterized by operations of flights (arrivals plus departures) in a higher amount than the official declared capacity. Sources: National Civil Aviation Agency, VRA Report and an airport capacity study of the Brazilian government (2010)[14].

Note that we do not include all the regressors of (1) in our first-stage probit model. Although this would be a reasonable procedure, it typically introduces severe multicollinearity in the second-stage model and most practitioners tend to impose exclusion restrictions.

Henceforth, we omit indexes k and t. Table 2 presents some descriptive statistics of the sample.

Table 2 - Descriptive statistics

Variable	Unity	Mean	Std. Dev.	Min	Max
daily pax	passengers	364.74	516.06	30.00	5888.23
gdp per capita (mean)	BRL in constant value	2367.79	876.73	496.65	5643.96
population (mean)	thoushand	6227.98	5336.37	290.31	17625.30
yield	BRL in constant value	0.5910	0.3510	0.0873	2.9961
LCC presence	dummy	0.1270	0.3329	0	1
yoy gravity gdp per capita	rate	0.7623	7.1271	-1	278
prop flights in congested hours	proportion	0.1006	0.2293	0	1
privatization program	dummy	0.1983	0.3987	0	1
privatization stage 1	dummy	0.0618	0.2408	0	1
privatization stage 2	dummy	0.0422	0.2011	0	1
privatization stage 3	dummy	0.0514	0.2208	0	1
privatization stage 4	dummy	0.0429	0.2026	0	1

[13] Note that this variable has the total number of actual flights as the denominator.

[14] "*Study of the Air Transport Sector in Brazil*" (text in Portuguese) - Brazilian Development Bank, Jan, 25, 2010, available at www.bndes.gov.br.

2.4. Estimation strategy

2.4.1. Heteroscedasticity and standard errors correction

We implemented tests of heteroscedasticity in the residuals. The first were the Pagan-Hall, White/Koenker and Breusch-Pagan/Godfrey/Cook-Weisberg heteroscedasticity tests, employing alternative specifications of levels, squares, cross products of regressors and also fitted values of the regressand. All these tests strongly rejected the null of homoscedastic disturbances.

2.4.2. Endogeneity and instrumental variables

Consistent with our conceptual framework, variable *ln yield* is jointly determined in a simultaneous equation model and is considered endogenous[15]. Additionally, as it is only a proxy for the average price per kilometer quoted to consumers, its correlation with the unobserved error term u_{kt} in Equation (1) is potentially strong and the estimation of (1) by Ordinary Least Squares (OLS) may lead to severely biased estimates. We, therefore, must employ an instrumental variables estimator[16].

Our identification strategy employed key exogenous cost shifters as instrumental variables. In particular, we utilized as instruments a set of proxies for the unit cost of airline inputs. The structural motivation for these instruments lies in that they are natural price drivers not directly related to the unobserved shocks of demand. To obtain the unit cost proxies, we utilized an unpublished monthly report of costs, expenses and operations disaggregated by aircraft type and airline kindly provided by the National Civil Aviation Agency. We then extracted unit costs of fuel, insurance, leasing, landing fees, navigation fees, maintenance and station by airline-aircraft type. We did not utilize labor costs (pilots and crew) as they are potentially correlated with demand – see Melo Filho et al. (2014). To calculate average airline-aircraft costs, we utilized each of the following metrics as denominators: available-seat kilometers (ASK), number of flights, flown hours and flown kilometers. With six numerators and four denominators, we were able to create a family of twenty-four unit cost instruments.

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[15] We conducted a Hausman endogeneity test and found that the differences between the instrumental variables estimates and the OLS estimates are large enough to suggest that the latter is inconsistent - ie. rejected the null of difference in coefficients not being systematic (χ^2 statistic = 116.7).

[16] For comparison purposes, we present the results of OLS estimation in the Appendix.

With aircraft-specific unit costs, we subsequently calculated route-specific costs by extracting a weighted average with weights being the flight frequencies of each airline-aircraft pair. With this procedure, we were able to produce instruments that had variation not only across time (months) but also across routes, making them potential candidates for effective instrumentation. We additionally used the unit cost transformation proposed by Brander & Zhang (1990, p. 575). We experimented with several combinations of unit costs (in logarithms) to instrument *ln yield*. The best results in terms of validity and relevance of instruments were the unit costs of fuel, maintenance, insurance and leasing[17].

2.4.3. Estimator

The estimation method employed was the two-step feasible efficient generalized method of moments estimator (2SGMM) with standard errors robust and efficient to arbitrary heteroscedasticity. The setup of the estimator employed a two-way fixed-effects procedure as discussed before. We also used a bootstrap procedure to correct the standard errors of the second-stage regression of the Heckit model to account for the presence of the estimated inverse Mills ratio among the regressors[18].

3. Results

Table 3 presents the estimation results of the empirical model of market passenger demand for the domestic routes of privatized and non-privatized airports in Brazil. The first three columns of Table 3 are representative of how "deep" we specified the dummies controlling for the privatization stages of the DW95 framework. Thus, in Column (1), we present results with only one common post-privatization dummy; in Column (2), results with airport-specific post-privatization dummies; and, in Column (3), results with stage-specific and airport-specific privatization dummies (with the period previous to the establishment of the privatization program being the base case). Columns (4) and (5) present robustness checks that we will discuss in next section. Column (6) presents the probit model of sample selection.

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[17] Extracted per available seat-kilometer, per kilometer, and per flown hour, respectively.

[18] With bootstrapping, controlling for autocorrelation in the second-step regression is not possible and actually unnecessary. Despite this, we also implemented a Cumby-Huizinga test of autocorrelation for several order specifications, already accounting for heteroscedasticity and endogeneity. These tests clearly indicated the presence of autocorrelation. We employed the procedure of Newey-West to adjust the standard error estimates of the non-bootstrapped model and results were robust to this correction.

Since our model is the demand function, it is important to first discuss the reasonability of the estimated result as a demand function of air transportation. It is possible to contrast our results with the results of the previous literature by considering the survey of Gillen, Morrison & Stewart (2007). Our estimated values of the price and income elasticities - related to, respectively, $yield$ and $gdp\ per\ capita$ - are close to the first quartile of the studies surveyed by the authors, which was estimated as -1.418 and 0.840, for price and income elasticity, respectively. Indeed, our estimates for price elasticity ranged from -1.5264 (Column 2) to -1.9349 (Column 3), whereas our estimates for income elasticity ranged from 0.3299 (Column 2) to 0.5507 (Column 3). With respect to the LCC competition variable - the LCC presence dummy - we have that our results are similar to other few studies that estimate the impacts of LCC on airline demand, such as Goolsbee & Syverson (2008) and Elwakil & Dresner (2013), which estimate that LCC presence is responsible for roughly 25% to 60% route traffic increase[19]. Our estimates point to a ceteris paribus increase of roughly 31% to 35%.

A core result of our estimations is that privatization produces an overall increase in demand. Indeed, the estimated coefficient of variable $privatization\ program$ in Column (1) of Table 3 is statistically significant at 1% level and indicates an increase in demand of approximately 30% after privatization. By inspecting Columns (2) and (3) of Table 3, it is possible to infer that this increase is mainly associated with GRU and VCP airports and mainly at Stages 3 and 4, that is, from the competitive tendering and with the transfer of management control.

[19] The estimates of Goolsbee & Syverson (2008, p. 1619) are imprecise however. Their point estimates suggest that passenger traffic rises on routes in which both an entry threat and actual entry by Southwest Airlines is observed.

Table 3 – Estimation results – Heckit model[20]

	(1) ln daily pax	(2) ln daily pax	(3) ln daily pax	(4) ln daily pax	(5) ln daily pax	(6) privatization program
ln gravity gdp per capita	0.3472***	0.3299***	0.5507***	0.4689***	0.7425***	1.3331***
	[0.124]	[0.087]	[0.135]	[0.127]	[0.146]	[0.022]
ln gravity population	2.0957***	2.7333***	3.2034***	2.8580***	3.1950***	0.0240***
	[0.240]	[0.164]	[0.258]	[0.198]	[0.259]	[0.008]
ln yield	-1.6747***	-1.5264***	-1.9349***	-2.0003***	-2.0707***	-1.1788***
	[0.256]	[0.163]	[0.270]	[0.251]	[0.277]	[0.022]
LCC presence	0.3449***	0.3174***	0.3332***	0.3548***		
	[0.017]	[0.014]	[0.016]	[0.018]		
privatization program	0.2882***					
	[0.027]					
yoy gravity gdp per capita (%)						-0.0363***
						[0.006]
prop flights in congested hours						1.0377***
						[0.040]
International Gateway (GRU)						
privatization program		0.4229***				
		[0.021]				
privatization - stage 1			0.3034***		0.2923***	
			[0.026]		[0.027]	
privatization - stage 2			0.3535***		0.3133***	
			[0.030]		[0.030]	
privatization - stage 3			0.4086***		0.3118***	
			[0.038]		[0.041]	
privatization - stage 4			0.5134***		0.4174***	
			[0.037]		[0.041]	
Domestic Hub (BSB)						
privatization program		0.0399**				
		[0.017]				
privatization - stage 1			0.0278		0.0208	
			[0.024]		[0.025]	
privatization - stage 2			0.0667***		0.0408*	
			[0.022]		[0.022]	
privatization - stage 3			-0.0034		-0.0699**	
			[0.028]		[0.031]	
privatization - stage 4			-0.1243***		-0.2353***	
			[0.041]		[0.046]	
Secondary Airport (VCP)						
privatization program		0.4346***				
		[0.028]				
privatization - stage 1			-0.3309***		-0.2478***	
			[0.084]		[0.082]	
privatization - stage 2			-0.0144		0.1809*	
			[0.102]		[0.095]	
privatization - stage 3			0.8382***		1.0565***	
			[0.033]		[0.039]	
privatization - stage 4			1.3024***		1.4683***	
			[0.074]		[0.081]	
inverse Mills ratio	0.4046***	0.3643***	0.5061***		0.5480***	
	[0.090]	[0.054]	[0.099]		[0.103]	
R-squared	0.8148	0.8277	0.8085	0.7860	0.7897	0.3689
Nr Observations	49,143	49,141	49,143	49,143	49,143	49,305
RMSE Statistic	0.4713	0.4545	0.4793	0.5066	0.5021	
F Statistic	749.47	804.82	683.71	618.83	636.21	
KP Statistic	156.17	249.89	149.35	186.81	142.12	
KP P-Value	0.0001	0.0001	0.0001	0.0001	0.0001	
Sargan Statistic	0.9287	2.7529	0.0139	3.0721	3.2617	
Sargan P-Value	0.3352	0.2525	0.9062	0.0796	0.0709	
Weak CD Statistic	80.912	97.042	84.469	98.831	79.725	
Weak KP Statistic	80.488	88.893	77.616	97.406	74.242	

[20] Columns (1)-(5) produced by the two-step feasible efficient generalized method of moments estimator (2SGMM); First-stage results produced with the probit model of Column (6); statistics robust to heteroscedasticity; standard errors of the estimated coefficients (in brackets) were bootstrapped to account for the two-stage nature of the Heckit method; R-squared and RMSE produced with the equivalent least-squares dummy variable model (LSDV); Column (6) produced by a maximum-likelihood probit model; standard errors in brackets; p-value representations: ***p<0.01, ** p<0.05, * p<0.10.

The results of Table 3 suggests that there were notable impacts on VCP's absolute demand after privatization since Stage 3 of the privatization process. We justify these results arguing that among the privatized airports, VCP is the one with the greatest demand potential, as it pertains to the segment of secondary airports, which is a market niche that was virtually unexplored in Brazil. Additionally, VCP's favorable location in the countryside of São Paulo state - one of the richest areas within the country besides being relatively close to São Paulo city – enhances the likelihood of profits of airline operations. It was no coincidence that Azul Airlines, the youngest low cost carrier in the market, has established its main operational basis and main hub at VCP since 2008. The carrier soon reached more than 90% of dominance at the airport since 2011[21]. We believe that privatization may have allowed a better airline-airport interaction toward more coordinated vertical relations. Our results point to a successful result of the privatization program in enhancing demand, at least in its first years and notably at the São Paulo city airports.

We challenged our instrumentation approach with tests of validity and relevance of the proposed set of instruments. First, the validity of the full set of over identifying conditions was analyzed by utilizing Sargan tests. Rejection of the null hypothesis implies that instruments are not satisfying the orthogonality conditions, one obvious reason being that they are not truly exogenous. For all considered specifications, the Sargan tests did not reject orthogonality - the p-values of the Sargan tests ranged from 0.2560 to 0.9273. Second, the relevance of the proposed set of instruments was challenged by underidentification tests. The test employs the Kleibergen-Paap rk LM statistic (KP). The tests led to the rejection of the null of underidentification - the p-values of the KP tests were very small, with KP statistics ranging from 148.04 to 247.70, soundly rejecting the null of not relevant instruments. Finally, we also tested for weak identification. Considering both the Cragg-Donald Wald F statistic and the Kleibergen-Paap rk Wald F statistic (Weak CD and Weak KP), we had enough evidence for rejecting the hypothesis of weak instruments - the statistics of the Weak CD and Weak KP ranged from 77.62 to 97.04, rejecting the null of weak instruments.

[21] Source: National Civil Aviation Agency, Traffic Report with own calculations.

Regarding the sample selection model - the probit estimation of Column 4 -, we have that, besides the variables already present in the demand model, the additional two variables inserted in the specification were statistically significant at 1%. First, a negative coefficient was estimated for variable $yoy\ gravity\ gdp\ per\ capita$, which is indicative that the government does consider the performance records of airports when selecting airports for privatization and prefers choosing underperformers in terms of recent traffic growth. Second, a positive coefficient was estimated for variable $prop\ flights\ in\ congested\ hours$, and thus is suggestive that, according to the government's view, airports with more noticeable bottlenecks are natural candidates for being selected for privatization. In all demand models - ie, Columns 1 to 3 -, the estimated coefficient of the inverse Mills ratio was positive and statistically significant, meaning that sample selection is clearly a problem to be addressed in our model; additionally, it has the intuitive interpretation that the unobservables of the privatization selection by the government are possibly positively correlated with the unobservables of airline demand.

4. Robustness checks

To check the validity and sensitivity of our results, we implemented three sets of robustness checks. First, we dropped some key variables of our empirical model and analyzed the changes in the estimates of the remaining variables; second, we employed alternative estimators in addition to the 2SGMM utilized so far; and thirdly, we relaxed our definition of routes to allow for possible airport substitution in multiple airport areas.

The results of the underspecified models are reported in Columns (4) and (5) of Table 3. Column (4) presents the results when all privatization dummies are dropped. No relevant change is observed, meaning that the results of estimated effects of our other key demand shifters are not driven by the insertion of the privatization variables. Column (5) presents the results of the same specification of column (3) but dropping *LCC presence*. By making this robustness check experiment, we aim at investigating whether the demand effects of such rivalry among carriers have any association with privatization. Note that most results remain unchanged when dropping *LCC presence*. Interesting to observe, however, that VCP's estimated effects increase notably and that in Stage 2, it becomes statistically significant at 10%, meaning that low cost entry is probably further induced by privatization and in particular, in that early stage.

With respect to the second set of robustness checks, we employed the alternative estimators Limited-Information Maximum Likelihood (LIML), in a crosschecking procedure recommended by Angrist and Pischke (2008). As discussed in Baum, Schaffer & Stillman (2007), LIML is known to perform better than IV/GMM in the presence of weak instruments, despite not providing any asymptotic efficiency gains. LIML produced very similar results, which are available in the Appendix. We also present the results when utilizing Ordinary Least Squares (OLS). As expected, the outcomes of OLS suggest the emergence of strong bias in the estimation. Most coefficients are underestimated when compared OLS to the results of 2SGMM and LIML. For example, when employ OLS, the coefficient of $ln\ yield$ is significantly decreased and is not statistically significant in most specifications. Additionally, the coefficient of $ln\ gravity\ gdp\ per\ capita$ is estimated by OLS with the wrong sign. And almost all privatization effects are significantly overestimated. From this experiment, we, therefore, recommend that practitioners should consider employing an instrumental variables estimator instead of OLS, aiming at producing more consistent estimates.

Our last robustness check is related to our definition of routes as airport-pairs. See Brueckner, Lee, & Singer (2014) for a discussion of the alternative route definition as "city-pairs" instead of "airport-pairs" and the associated methodological problems. In our dataset, São Paulo, Rio de Janeiro and Belo Horizonte are the only multiple airport areas, but we are aware that our results are potentially driven by the specific choice of route definition. Aiming at checking the robustness of our results, we implemented a model accounting for the degree of substitution between alternative airport-pairs in the same metropolitan area. To allow for route substitutability by air travel consumers, we utilized the logit with unobserved characteristics and aggregate data suggested by Berry (1994)[22]. In our framework, we employ the following derivation of the model developed by Huang and Rojas (2008): $\ln q_{jt} - \ln \tilde{q}_{0t} = \beta_0 + \beta_1 x_{jt} + \alpha p_{jt} + \varepsilon_{jt} + \Omega_t$, where q_{jt} is market quantity of the alternative j; $\tilde{q}_{0\mathrm{t}}$ is a guess for the size of the outside good; x_{jt} is the observable characteristic[23] of alternative j; p_{jt} is the price of alternative j; ξ_{jt} are the non-observable characteristics of alternative j; Ω_t is an additional error term, which is a function of the outside good; and α, β_0 and β_1 are unknown parameters. We treat the different airport-pairs of a given city-pair as the different alternatives available

[22] We defined the market size of the Berry-type logit to be equal to the population gravity term.

[23] Other variables may be included to account for the characteristics of the alternative.

to the air travel consumer. Additionally, we set $\tilde{q}_0 = gravity\ population * \left(\frac{1}{365}\right) - daily\ pax$, ie we consider a guess for the total market size to be one travel per year per capita and compute the guess for the size of the outside good accordingly. With respect to the specification of Ω_t, we consider $\ln gravity\ gdp\ per\ capita$ and $\ln gravity\ population$ as outside good shifters that are included in the right hand side of the estimating share equation. See Ishii, Jun and Van Dender (2009) for an alternative logit approach for modeling air passenger choices in multi-airport markets. With a logit setup, the cross-price elasticities between alternative airport-pairs are estimable from the parameters of the model and therefore elements of airport competition are directly incorporated into the air travel demand analysis. For our purposes, we are specifically interested in the results regarding the effects of privatization. All results regarding the privatization dummies were clearly robust to the change of demand model to a Berry-type logit framework as the one above described. We report the results in the Appendix.

Conclusion

The present paper developed an econometric model of passenger demand for routes of recently privatized airports. With a regression-based event methodology accounting for fixed effects, endogeneity of prices, and sample selectivity, we tested whether market demand presented a dynamic pattern across the identified stages of privatization for a set of privatized airports in Brazil. With the estimated set of privatization-related coefficients, we then tested the sequential impact of privatization on demand. As far as we are concerned, this was the first attempt in the literature to directly estimate the impacts of airport privatization on air transportation demand, contributing to the scarce empirical literature on airport ownership change and its consequences.

The main results were 1. privatization produces an overall increase in demand for the privatized airports, a phenomenon likely linked with the more flexible private management that could engage in route development strategies with existing and new airlines; 2. the airport widely recognized as possessing the greatest demand potential and with the largest market penetration by a fast-growing newcomer low cost carrier had the highest estimated *ceteris paribus* effects on demand due to privatization; and 3. LCC presence is positively correlated with privatization from its early stages, meaning that carriers anticipate the future effects of the new airport governance. The results suggest intense strategic activity by the LCC and its rivals, with new routes entry in the airport in which it could establish coordination with the new owners in a more effective way due to its relative higher size.

The evidence found in this article point that privatization seems to be a successful solution to airports of an emerging country marked by substantial bottlenecks, at least from the demand side perspective. But we understand at least one caveat is due: privatization requires a selected kind of understanding regarding what public policy should be, and how it should look like. It means that benefits of privatization may not be recognized by the incumbent political party(ies), or they may pose considerable degree of ideological dissonance with rooted guidance. In concrete terms, privatizing processes may well not be triggered, in spite of what empirical literature and practitioners may point as being the best policy tool. Also, it means that privatization-induced increases in demand may indeed be surprising to some actors, or an effect that is expected, but not aligned with ideological guidance. In sum, both political idiosyncrasies and methodological variations remind the practitioners and policy makers that there is no linear and easily assessed relationship between efficiency gains and privatization, and that the subject is ultimately due to empirical verification, as Tongzon and Heng (2004) support on their port-oriented study. In this sense, our ultimate contribution is to provide extra evidence to the debate - in particularly regarding the dynamic and evolving nature of the privatization process and its effects -, while keeping in mind industry- and national-specificities.

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Appendix

Table 4 – Robustness check: alternative estimator (Heckit with OLS in the second stage)[24]

	(1)	(2)	(3)	(4)	(5)
	ln daily pax	ln daily pax	ln daily pax	ln daily pax	ln daily pax
ln gravity gdp per capita	-0.3645***	-0.3152***	-0.2558***	-0.3570***	-0.1823***
	[0.028]	[0.030]	[0.026]	[0.028]	[0.028]
ln gravity population	0.5322***	1.3205***	1.3936***	1.3941***	1.2800***
	[0.036]	[0.054]	[0.040]	[0.038]	[0.041]
ln yield	-0.0252*	-0.0122	-0.0523***	-0.1029***	-0.0275*
	[0.014]	[0.015]	[0.014]	[0.015]	[0.014]
LCC presence	0.2476***	0.2227***	0.2278***	0.2364***	
	[0.009]	[0.008]	[0.010]	[0.009]	
privatization program	0.4483***				
	[0.007]				
International Gateway (GRU)					
privatization program		0.5879***			
		[0.011]			
privatization - stage 1			0.4397***		0.4404***
			[0.013]		[0.013]
privatization - stage 2			0.5359***		0.5196***
			[0.016]		[0.016]
privatization - stage 3			0.6394***		0.5876***
			[0.013]		[0.013]
privatization - stage 4			0.7732***		0.7235***
			[0.014]		[0.013]
Domestic Hub (BSB)					
privatization program		0.1787***			
		[0.008]			
privatization - stage 1			0.1885***		0.1926***
			[0.008]		[0.009]
privatization - stage 2			0.1702***		0.1584***
			[0.012]		[0.012]
privatization - stage 3			0.1749***		0.1400***
			[0.010]		[0.011]
privatization - stage 4			0.1435***		0.0847***
			[0.013]		[0.012]
Secondary Airport (VCP)					
privatization program		0.6126***			
		[0.016]			
privatization - stage 1			0.2024***		0.2889***
			[0.028]		[0.030]
privatization - stage 2			0.6708***		0.8424***
			[0.030]		[0.031]
privatization - stage 3			0.7707***		0.9107***
			[0.022]		[0.022]
privatization - stage 4			0.8912***		0.9746***
			[0.018]		[0.018]
inverse Mills ratio	-0.0948***	-0.0923***	-0.0685***	-0.1119***	-0.0780***
	[0.011]	[0.012]	[0.009]	[0.012]	[0.010]
R-squared	0.8769	0.8788	0.8813	0.8689	0.8793
Nr Observations	49,273	49,273	49,273	49,273	49,273
RMSE Statistic	0.3847	0.3817	0.3779	0.3970	0.3810
F Statistic	1401.9	1412.8	1378.5	1251.1	1403.1

[24] First-stage results produced with the probit model of Table 3, Column (6); second-stage results produced by the Ordinary Least Squares estimator (OLS); statistics robust to heteroscedasticity; standard errors of the estimated coefficients (in brackets) were bootstrapped to account for the two-stage nature of the Heckit method; R-squared and RMSE produced with the equivalent least-squares dummy variable model (LSDV); p-value representations: ***p<0.01, ** p<0.05, * p<0.10.

Table 5 – Robustness check: alternative estimator (Heckit with LIML in the second stage)[25]

	(1)	(2)	(3)	(4)	(5)
	ln daily pax	ln daily pax	ln daily pax	ln daily pax	ln daily pax
ln gravity gdp per capita	0.3541***	0.3438***	0.5512***	0.4909***	0.7542***
	[0.125]	[0.091]	[0.135]	[0.127]	[0.149]
ln gravity population	2.1056***	2.7551***	3.2038***	2.8870***	3.2329***
	[0.241]	[0.169]	[0.257]	[0.197]	[0.263]
ln yield	-1.6864***	-1.5521***	-1.9354***	-2.0397***	-2.1086***
	[0.256]	[0.169]	[0.268]	[0.249]	[0.281]
LCC presence	0.3450***	0.3198***	0.3332***	0.3561***	
	[0.017]	[0.015]	[0.016]	[0.018]	
privatization program	0.2874***				
	[0.026]				
International Gateway (GRU)					
privatization program		0.4208***			
		[0.021]			
privatization - stage 1			0.3034***		0.2884***
			[0.026]		[0.028]
privatization - stage 2			0.3535***		0.3078***
			[0.030]		[0.031]
privatization - stage 3			0.4086***		0.3053***
			[0.038]		[0.042]
privatization - stage 4			0.5134***		0.4107***
			[0.037]		[0.043]
Domestic Hub (BSB)					
privatization program		0.0380**			
		[0.017]			
privatization - stage 1			0.0278		0.0169
			[0.024]		[0.026]
privatization - stage 2			0.0667***		0.0384*
			[0.022]		[0.023]
privatization - stage 3			-0.0035		-0.0742**
			[0.028]		[0.031]
privatization - stage 4			-0.1244***		-0.2415***
			[0.041]		[0.046]
Secondary Airport (VCP)					
privatization program		0.4329***			
		[0.028]			
privatization - stage 1			-0.3309***		-0.2596***
			[0.084]		[0.083]
privatization - stage 2			-0.0143		0.1652*
			[0.102]		[0.096]
privatization - stage 3			0.8384***		1.0566***
			[0.033]		[0.041]
privatization - stage 4			1.3027***		1.4755***
			[0.074]		[0.083]
inverse Mills ratio	0.4090***	0.3758***	0.5064***	0.4929***	0.5564***
	[0.090]	[0.058]	[0.099]	[0.094]	[0.105]
R-squared	0.8150	0.8258	0.8073	0.7835	0.7863
Nr Observations	49,143	49,141	49,143	49,143	49,143
RMSE Statistic	0.4711	0.4571	0.4807	0.5096	0.5063
F Statistic	745.39	797.11	673.59	610.52	611.78
KP Statistic	156.17	249.89	149.35	186.81	142.12
KP P-Value	0.0001	0.0001	0.0001	0.0001	0.0001
Sargan Statistic	0.9227	2.7327	0.0148	3.0349	3.1445
Sargan P-Value	0.3368	0.2550	0.9032	0.0815	0.0762
Weak CD Statistic	80.912	97.042	84.469	98.831	79.725
Weak KP Statistic	80.488	88.893	77.616	97.406	74.242

[25] First-stage results produced with the probit model of Table 3, Column (6); second-stage results produced by the limited-information maximum likelihood estimator (LIML); statistics robust to heteroscedasticity; standard errors of the estimated coefficients (in brackets) were bootstrapped to account for the two-stage nature of the Heckit method; R-squared and RMSE produced with the equivalent least-squares dummy variable model (LSDV); p-value representations: ***p<0.01, ** p<0.05, * p<0.10.

Table 6 – Estimation results – Berry's (1994) logit model[26]

	(1)	(2)	(3)	(4)	(5)
	$\ln q_j/q_0$	$\ln q_j/q_0$	$\ln q_j/q_0$	$\ln q_j/q_0$	$\ln q_j/q_0$
ln gravity gdp per capita	0.3307***	0.3313***	0.5362***	0.4558***	0.7302***
	[0.125]	[0.088]	[0.136]	[0.128]	[0.147]
ln gravity population	1.6575***	2.3508***	2.7828***	2.4392***	2.7770***
	[0.242]	[0.166]	[0.260]	[0.199]	[0.260]
ln yield	-1.6588***	-1.5516***	-1.9224***	-1.9935***	-2.0616***
	[0.257]	[0.164]	[0.271]	[0.254]	[0.279]
LCC presence	0.3466***	0.3216***	0.3350***	0.3569***	
	[0.017]	[0.015]	[0.017]	[0.018]	
privatization program	0.2951***				
	[0.027]				
International Gateway (GRU)					
privatization program		0.4306***			
		[0.021]			
privatization - stage 1			0.3154***		0.3041***
			[0.026]		[0.027]
privatization - stage 2			0.3654***		0.3247***
			[0.030]		[0.030]
privatization - stage 3			0.4196***		0.3219***
			[0.038]		[0.041]
privatization - stage 4			0.5247***		0.4278***
			[0.037]		[0.042]
Domestic Hub (BSB)					
privatization program		0.0385**			
		[0.017]			
privatization - stage 1			0.0278		0.0204
			[0.025]		[0.025]
privatization - stage 2			0.0691***		0.0429*
			[0.022]		[0.022]
privatization - stage 3			0.0008		-0.0663**
			[0.028]		[0.031]
privatization - stage 4			-0.1219***		-0.2339***
			[0.042]		[0.046]
Secondary Airport (VCP)					
privatization program		0.4389***			
		[0.029]			
privatization - stage 1			-0.3255***		-0.2427***
			[0.085]		[0.083]
privatization - stage 2			-0.0017		0.1937**
			[0.103]		[0.096]
privatization - stage 3			0.8475***		1.0670***
			[0.033]		[0.040]
privatization - stage 4			1.3109***		1.4782***
			[0.075]		[0.081]
inverse Mills ratio	0.3991***	0.3709***	0.5018***	0.4746***	0.5447***
	[0.090]	[0.055]	[0.100]	[0.094]	[0.104]
R-squared	0.8062	0.8146	0.7964	0.7746	0.7805
Nr Observations	49,143	49,141	49,143	49,143	49,143
RMSE Statistic	0.4703	0.4599	0.4821	0.5072	0.5005
F Statistic	624.33	668.69	596.50	524.91	556.50
KP Statistic	156.17	249.89	149.35	186.81	142.12
KP P-Value	0.0001	0.0001	0.0001	0.0001	0.0001
Sargan Statistic	1.2343	2.9881	0.0560	3.6332	2.7928
Sargan P-Value	0.2666	0.2245	0.8129	0.0566	0.0947
Weak CD Statistic	80.912	97.042	84.469	98.831	79.725
Weak KP Statistic	80.488	88.893	77.616	97.406	74.242

[26] First-stage results produced with the probit model of Table 3, Column (6); results produced by the two-step feasible efficient generalized method of moments estimator (2SGMM); statistics robust to heteroscedasticity; standard errors of the estimated coefficients (in brackets) were bootstrapped to account for the two-stage nature of the Heckit method; R-squared and RMSE produced with the equivalent least-squares dummy variable model (LSDV); p-value representations: ***p<0.01, ** p<0.05, * p<0.10.