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Do non-stop flights boost exports?*

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Abstract

We study empirically the role of air service in boosting exports. We focus on the link between non-stop flights and outgoing trade of the Italian manufacturing sector in Europe using a panel of 12,000 half-yearly observations ranging from 1998 to 2010. The analysis shows that the supply of non-stop flights provided by Full-Service Carriers (FSCs) has a positive impact on the exports of Italian regions, whilst no significant evidence of this is found for Low-Cost Carriers. After taking the endogeneity of flight frequency into account, the estimates indicate that the elasticity of exports to FSC non-stop flights is about 10 percent.

JEL Classification: C23, F10, L20, L60, L93.

Keywords: airlines, export, full-service carriers, low-cost carriers, manufacturing.

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1 Introduction

Because of their role in reducing informal trade barriers, business and social networks are recognized as facilitators of international trade (Rauch, 2001). An important tool to build and maintain networks is communication, and in particular, face-to-face communication (Cristea, 2011). It is well acknowledged that personal interactions allow complex business relationships to be managed effectively (Saxenian, 1999), favor the transfer of tacit knowledge (Poole, 2010); and increase the trust in business partners (Storper and Venables, 2004). With markets turning more global, international networks increase their relevance, and business traveling, in parallel, is increasing its role in maintaining and reinforcing commercial relations.

Within Europe, traveling options mainly concern car, train and airplane. The latter is often preferred by businessmen apart from short-haul destinations. Thus, for mid-haul and long-haul destinations, air traveling often minimizes the generalized costs of travel, i.e. journey cost plus opportunity cost of time. This is particularly true in the presence of non-stop flights. Indeed, the existence of a non-stop flight allows businessmen to reach any continental destination within two or three hours and complete a business mission smoothly within a day, or considerably reduce the journey time component in case of a short stay. By trimming the time devoted to travel, non-stop flights favor face-to-face contacts, expand the knowledge of foreign markets, bring potential trading partners closer together, augment their reciprocal trust, thereby eventually increasing the likelihood of trade (Frankel, 1998; Rauch, 1999; Kulendran and Wilson, 2000; Frankel and Rose, 2002). The availability of a non-stop flight can also drive the decision of a businessman to visit a place or, more generally, the site choice among a set of possible destinations (Grosche et al. 2007).

In this work, we study empirically the role played by non-stop flights in boosting the exports of the Italian manufacturers in Europe. This continent is highly variegated as, covering an area slightly larger than the United States, it comprises several countries with a great diversity of language, legislation, culture, etc. While these differences can limit commercial flows among countries, the presence of air connections and, in particular, of non-stop flights may help to overcome these barriers and increase trade.

In the light of the mounting importance of the competition between Low-Cost Carriers (LCCs) versus Full-Service Carriers (FSCs), we investigate the differential impact on exports induced by these two types of airlines. The LCCs adopt a strictly cost-saving business model that involves a flight offer from usually a secondary airport, no frills, no cabin class differentiation, and low flight frequency (Mason, 2000). All these aspects make the use of LCCs particularly unsuitable to businessmen, suggesting that the offer of non-stop flights provided by FSCs should affect exports to a greater extent than that provided by LCCs.[1]

Our work contributes to the expanding literature on airline travel and international trade (Cristea, 2011; Poole 2010) by providing empirical evidence in favor of the positive effect of direct air connection on exports. Furthermore, to the best of our knowledge, we are the first to distinguish between FSCs and LCCs in the analysis.

To conduct our empirical investigation, we combine different sources of airline and trade variables. We collected data on non-stop flights and exports of the Italian regions to the main European countries observed half-yearly during the period 1998-2010, for a total of 12,000 observations.

The econometric analysis employs instrumental variable, panel data fixed-effect techniques to check for the robustness of the results dealing with spurious correlation and reverse causality.[2] Our findings confirm a positive effect of non-stop flights on exports.[3] Interestingly, a differentiated impact of FSCs and LCCs emerges from the analysis: in particular, we show that the supply of direct air connection provided by FSCs has a positive and significant impact on exports, whilst no significant evidence is found for LCCs.[4] Our estimates indicate that the elasticity of exports to FSC non-stop flights is about 10 percent.

The rest of the paper is organized as follows. Next, Section 2 reviews the related literature, and then Section 3 offers a snapshot of the air transport system and of the manufacturing sector in Italy. The data are described in Section 4, subsequently the econometric model (illustrated in Section 5) is presented. The results together with the robustness checks are reported in Sections 6 and 7. Finally, concluding remarks are made in Section 8.

2 Literature review

The branch of literature closest to our work analyzes the role of air travel as a channel to favor international trade. Some contributions identify a positive effect. In particular, Frankel (1997) focuses on the exports of high-tech capital goods from the United States. He argues that international (i.e. air) travel can affect the success of exports, as it implies a more committed and accurate pre-sale activity by the firm in the foreign country.

Poole (2010) underlines the importance of business and social networks in generating trade. She investigates how face-to-face communication generated by traveling for business reasons can facilitate international trade between countries. Using information related to passengers traveling abroad from the US during the period 1993-2003, she finds that a higher share of business travelers in total passenger travel purposes has a positive impact on exports. Further, she points out that this effect is stronger in the case of high-skilled travelers (i.e. those people in professional and managerial occupations), and in the case of differentiated products. Her results can be interpreted as follows: while substantial barriers that hinder trade continue to exist because of country differences in language, culture and legislation, business travelers who adopt more convenient options such as non-stop flights may develop their work-related networks and communicate more easily.

A different conclusion is reached by Head and Ries (2010), who investigate whether regular trade missions conducted by Canadian officers generate new business deals. After controlling for country-pair fixed effects, they find that trade missions have small, negative, and mainly insignificant effects.

Another stream of literature investigates the demand for air travel generated by business activities. Cristea (2011), using US data at state level over the period 1998-2003, finds that an increase in the volume of exports raises the demand for business class air travel. Moreover, her work highlights that export composition has a positive impact on air travel demand. Aguiléra (2003) identifies that the need to coordinate the planning and production processes with international customers is one of the main explanations of firm location in the neighborhood of an airport. Bel and Fageda (2008) find that air connectivity is a relevant factor driving foreign firms' location choices. Similarly, Brueckner (2003) argues that frequent service to a variety of destinations favors the location of new firms in the US metropolitan areas. In addition, Strauss-Khan and Vives (2009) show that headquarters tend to be located in US metropolitan areas with adequate airport facilities, and Williams and Balaz (2009) provide some evidence in favor of a positive impact of LCCs on the flows of knowledge and investments.

Other works that do not directly analyze the link between air travel and export volumes underline the role of infrastructure in the development, internationalization, and innovation of a country. Ashauer (1989), Morrison and Schwartz (1996) find that investment in infrastructure provides a significant return to manufacturers, and augments productivity growth. With respect to the airline industry, Rosenthal and Strange (2001), Brueckner (2003), Graham (2003), and Green (2007) reach the conclusion that a better airline accessibility of the site, measured by the supply of airline routes, increases firms' productivity and employment. Furthermore Ahn et al. (2001) and Bernard et al. (2011) show that improved access to airports contributes to reduce the costs of small and medium-sized enterprises by facilitating a direct connection to the export market.

3 The air transport system and the manufacturing sector in Italy

The peculiarities of Italy in terms of its air transport system, manufacturing activities, geographical morphology, and peripheral location relative to the European barycenter probably make this country a valid case to investigate the effects of non-stop flights on exports, for the following reasons.

[**INSERT TABLE 1 HERE**]

1. **Imperfect substitution with other means of transport.** The Italian peninsula is located in the Southern periphery of Europe. The Alps in the North and the surrounding Mediterranean Sea elsewhere create a barrier which may hamper the movement of people towards other countries. In Italy the high-speed train is only partially developed: it links a few of the main cities within the country, but is not well connected to the European network of high-speed trains. The highway

infrastructure is more capillary, but access to neighboring countries is convenient only for those border areas located in the North.

2. **Airports spread around the country.** Italy comprises 20 administrative regions, and as Table 1 above shows, in 2010 there were 41 Italian airports carrying international operations. So, on average, the country has about two international airports per region. The distribution of airports is evenly spread throughout the country: eight airports are located in North-West part of Italy, nine in the North-East, eight in the Center, eight in the South and seven in the Isles.

   The Italian airport system is characterized by: a lower average size of the major airports relative to other comparable European countries; a larger number of medium airports; and several small airports which do, however, offer international connections. These features lead to a quite homogeneous distribution of flight offer.[5]

   The proliferation of small and medium airports has been favored by local administrators who, seeking political consensus, have promoted the construction of new airports. Although, since the mid-1990s, some of the Italian airports have taken a step towards private ownership, most of them are still public.[6] The combined features of being diffused at the regional level and publicly owned mean that Italian airports can easily be influenced by regional policies.[7]

3. **Well-established manufacturing activities, scattered over the**

territory. The secondary sector represents about 12 percent of the Gross Domestic Product (GDP); the most noteworthy manufactured products include machine tools, textiles and clothing, motorized road vehicles, domestic appliances, arms, fertilizers, and petrochemicals. Industry is mainly composed by small and medium-sized enterprises, which account for roughly 8 percent of GDP. Despite their modest size, many Italian firms are export-oriented, producing and commercializing their output worldwide, particularly in Europe. Additionally, a well-established feature of the Italian manufacturing sector is the presence of industrial districts, which are located mainly in the North, but also in the Center and the South of the country. Therefore, just as we note a scattered distribution of airports on the territory, we also observe a similar dispersion of economic activities and export flows, especially for the manufacturing sector.

The first point suggests that air transport most likely represents the preferred means of travel from Italy around Europe. The last two points indicate that the distribution of international airports and the distribution of exporting manufacturers are both evenly spread around the country, and therefore justify the analysis based on regional data, as we detail in the next section.

4 The data

The data set used in this work combines these different data sources: the Official Airline Guide (OAG), the Italian National Institute of Statistics (Istat), and the European Institute of Statistics (Eurostat).

The OAG provides the bi-directional weekly frequency of non-stop flights by carriers operating on each route, thus making it possible to distinguish the flights supplied by FSCs from those supplied by LCCs. We define an airline as *low-cost* if it is a member of the European Low Fares Airline Association, and as *full-service* otherwise.[8] The OAG provides the statistics of flight frequency on a half-yearly basis in accordance with the winter schedule (November-March) and the summer schedule (April-October). We cover 24 European countries of export destination.[9]

The exclusion of non-European destinations is motivated by two main reasons. First, in relative terms, the overall journey time of an intercontinental non-stop flight is not much shorter than it is with stop-over(s). Therefore, the additional contribution to exports given by the presence of non-stop intercontinental flights is difficult to detect. Second, European flights are spread over the entire Italian peninsula, while intercontinental flights gravitate around the two regions which host the intercontinental airports of Rome-Fiumicino in Lazio and Milan-Malpensa in Lombardy. Clearly, this feature only allows a relationship to be identified between intercontinental trade and intercontinental flights for two regions, and hence it would not fit well with our panel data structure comprising 20 regions.

Trade data originate from Istat. For each Italian region the real value of its exports by country of destination is collected on a quarterly basis. The quarterly feature of these data allows a close relationship with the time framework of the OAG data, when we aggregate quarterly values to half-yearly ones. More precisely, the last quarter (Q4) of the current year and the first quarter (Q1) of the following year of the Istat data are matched with the same winter semester of the OAG data, whilst the second and third quarters (Q2 and Q3) of the Istat data are associated with the summer semester of the OAG data (see Figure 1).

[INSERT FIGURE 1 HERE]

From Eurostat, we collect quarterly data on the national GDP of European trading countries and on bilateral real exchange rates, which are aggregated to achieve the same time structure as the airline data.[10]

The series on the GDP of the Italian regions are provided by Associazione per lo sviluppo dell'industria nel Mezzogiorno (Svimez) on a yearly basis, and converted to the half-year framework.[11] More precisely, the regional GDP of each region has been evenly split among the four quarters and then aggregated in a similar fashion to the previous variables. A similar procedure was established for data on foreign residents provided by Istat on yearly basis. Daily prices on Brent Oil are collected from Datastream, and then aggregated. From Googlemaps we retrieve the region-trading country distance defined as the shortest travel path by car between the capitals of each pair.

All the economic variables are in constant prices, and the reference year is 2005, the middle of the sample period.[12]

By combining all the information from the above data sources, we obtain a balanced panel which comprises 20 Italian regions and 24 European countries observed half-yearly during the period 1998-2010, with a total of 12,000 observations. Table 2 reports the main descriptive statistics of the variables included in the database.

[**INSERT TABLE 2 HERE**]

5 Model

The empirical strategy used to study the impact of direct flights on exports draws upon the literature of international economics, and hinges on an export equation that links exports to the GDPs of the areas of origin and destination and to the exchange rate (Pozo, 1992; Obstfeld and Rogoff, 1996; Sauer and Bohara, 2001; Rose, 2000; Klaassen, 2004). We augment the original model by adding ethnic networks, travel cost components, flight frequencies, origin-destination fixed effects, and time fixed effects. The baseline equation takes the following form:

$$\begin{aligned}\log(Export_{rct}) &= \alpha_1 \log(Country\ GDP_{ct}) + \alpha_2 \log(Region\ GDP_{rt}) \\ &+\alpha_3 \log(Real\ exch\ rate_{ct}) + \alpha_4 \log(Foreign\ residents_{rct}) + \\ &+\alpha_5 Distance_{rc} * \log(Oil\ price_t) + \alpha_6 \log(FSC\ freq_{rct}) + \\ &+\alpha_7 \log(LCC\ freq_{rct}) + \rho_{rc} + \tau_t + \varepsilon_{rct},\end{aligned} \tag{1}$$

where:

- $\log(Export_{rct})$ denotes the natural logarithm of exports from region r to country c, in semester t of a given year.
- $\log(Country\ GDP_{ct})$ is the GDP of the country of export destination, in logarithms. The higher the GDP of the foreign country, the larger the demand for *all* imported products, and therefore also for Italian goods, all else being equal.
- $\log(Region\ GDP_{rt})$ is the natural logarithm of region r's gross domestic product. This variable relates to the exporting capacity of r, as larger regions are expected to have larger exporting capacity.
- $\log(Real\ exch\ rate_{ct})$ represents the natural logarithm of the real exchange rate between Italy and the trading partner. If foreign prices are higher relative to Italian prices, Italian goods become cheaper in the foreign country which, as a consequence, will import more from Italy, all else being equal.

- $\log(Foreign\ residents_{rct})$ is the natural logarithm of foreign residents in region r originating from country c. This variable is a proxy for ethnic networks at the regional level. The presence of foreigners is expected to affect positively both the flows of exports and the demand for international air travel services (Rauch and Trindade, 2002).

- $Distance_{rc}$ is the distance in thousand kilometers between the capital of region r and the capital of country c, and $\log(Oil\ price_t)$ is the logarithm of oil price. The product of these two variables takes into account the effect of transportation costs, as fluctuations in oil prices over the sample period affect both air travel and export volumes differentially over short versus long distances. The inclusion of this variable mitigates concerns of omitted variable bias.[13]

- $\log(FSC\ freq_{rct})$ and $\log(LCC\ freq_{rct})$ are, respectively, the natural logarithm of FSC and LCC bi-directional non-stop flight frequencies between region r and country c. As previously argued, non-stop flights help to establish contacts with foreign markets and therefore are expected to boost exports. The sign and the magnitude of α_6 and α_7 are useful to investigate which carrier type is more relevant as an export driver. We expect FSCs to be preferred by business travelers to a greater extent, and thus to play a more influential role in spurring exports compared with LCCs ($\alpha_6 > \alpha_7 \geq 0$).

- The parameter ρ_{rc} is the region-country fixed effects. It comprises all the time-invariant components that are region- and/or country-specific, such as the distance between the Italian region and the importing country, a common language or common border, landlocked or coastal status, etc.

- The parameter τ_t is the half-yearly period (i.e. season) fixed effects.

- Finally, ε_{rct} is the regression error, assumed random with zero mean.

Before presenting the results there are some critical points that need to be considered. First, equation (1) describes a log-log specification, which has the desirable property that the estimated coefficients can be interpreted as elasticities. This transformation relies on the assumption that variables are strictly positive. However, exports and flight frequencies can assume zero value if, for a specific origin-destination in a given semester, no trade flow or flight offer are observed. As explained in Santos Silva and Tenreyro (2006), the use of logarithms can produce inconsistent estimates, especially when the frequency of zeros on the dependent variable is relatively high. In our analysis such concern is negligible since exports are null in only 12 out of 12,000 observations.[14] As far as FSC and LCC frequencies are concerned, zero values appear more often, involving about two-thirds of the sample, so that a simple deletion of the null observations is not recommended. We tackle this issue by using a monotonic transformation, which adds 1 to these variables before taking the logarithm. Thus, the estimated coefficients should be interpreted more cautiously, since they only *approximately* represent elasticities.[15]

Second, as broadly pointed out in many related works, there is a severe risk of endogeneity bias. That is, even with the included fixed effects, the flight frequency measures, $\log(FSC\ freq)$ and $\log(LCC\ freq)$, could still be correlated with the error term due to possible reverse causation or omitted variable issues. For example, an increased volume of trade between an Italian region and a foreign country may spur airlines to provide additional non-stop flights, either by expanding the existing schedule or by starting new routes. Similarly, an unobserved change in an airline's costs (due, for instance, to a renewal of the contract for airport charges) may affect the airline's number of flights to and from that airport. To remove such endogeneity concerns, we instrument for the flight frequency variables, since ignoring their endogeneity could significantly bias our estimates.

Finally, the Dickey-Fuller Test for unit root in panel data is conducted using the methodology suggested by Levin et al. (2002). The null hypothesis that the dependent variable is not stationary is rejected at a high level of significance.

6 Baseline results

The Generalized Least Squares (GLS) fixed-effect estimates of equation (1) in the base version are reported in Table 3.

We cluster standard errors by four European macro-areas,[16] in order to allow the residuals of countries of the same macro-area to be correlated.

In other words, we take into account the fact that neighboring or nearby countries could be subject to similar business cycles as distant countries, and, hence, that they could possibly share a parallel trade pattern.

[**INSERT TABLE 3 HERE**]

Column 1 represents a basic gravity estimation, which is augmented by ethnic networks at regional levels, $\log(Foreign\ residents)$, and transportation cost barriers, $Distance * \log(Oil\ price)$, in column (2). The coefficient on the GDP of the country of export destination, $\log(Country\ GDP)$, is statistically significant and positively signed, in line with the prediction of the gravity model. A rise in trading partner's GDP positively affects the internal demand of the country and consequently also the demand for Italian goods, all else being equal.

Column 1 shows that this effect is almost proportional: the estimated coefficient of 1.03 on $\log(Country\ GDP)$ implies that a 1 percent increase of GDP of the country of export destination implies a 1.03 percent increase of Italian exports to that country. In all the next Columns 2 to 5 the estimated coefficient slightly falls below 1; these numbers are, however, similar to the findings in the empirical trade literature.[17]

The GDP of the Italian region, $\log(Region\ GDP)$, is found to be positive, albeit not statistically significant at conventional levels. One possible reason for this result may be that, once we control for region-country fixed effects, the average rate of GDP growth for region r is well captured by time fixed effects.[18]

The estimated coefficient on the real exchange rate, which proxies the relative price competitiveness of Italian regions, lies in the range 0.38-0.51, and is in line with the figures presented in previous works (e.g. Carlin et al., 2001; Chinn, 2006).

Ethnic networks at regional levels have the expected positive effects on exports, as a larger presence in region r of foreign residents originating from country c may increase the exports from r to c.[19]

The transport cost component, given by the product of distance with the logarithm of oil price, is correctly negatively signed and highly statistically significant.

When we include in the model the flight frequency variables, columns 3-5, the magnitude and significance of the remaining regressors is not affected. Although the multicollinearity between FSCs and LCCs is negligible, we first include $\log(FSC\ freq)$ and $\log(LCC\ freq)$ separately, and then together. Interestingly, the coefficient on FSC frequency is positive and statistically significant, whilst the coefficient on LCC frequency is of small magnitude and statistically insignificant. Although we have not controlled for endogeneity yet, this result provides preliminary evidence of our main finding in the present work: namely, that the presence of FSCs has a positive effect on exports, while the presence of LCCs does not seem to play a role in boosting exports.

7 Instrumental variable estimation

From a joint look at Columns 3-5 of Table 3, we observe, on the one hand, that LCC coefficients are close to zero and highly insignificant. On the other hand, the basic principles of economics imply that LCC and FSC frequencies should be negatively related: LCC and FSC flights are substitutes, especially for leisure travelers. An increase in on LCC offer induces FSCs to reduce their supply. This reasoning suggests that LCC frequency, or some related measures, might be valid candidates to instrument for FSC frequency. In other words we are claiming that, in those markets where LCCs exert a stronger competitive pressure, FSCs are more likely to reduce their presence. We thus instrument for FSC flight frequency with a 1/0 dummy to indicate whether, in a region-country pair, the presence of LCC is deemed relevant. To assess the presence of LCCs, we create a *quasi*-market-share for LCCs in r, calculated as the LCC frequency in the rc pair over the total flight frequencies linking r to all the countries of the sample but c.[20] The instrument *LCC dummy* is then defined if such an LCC market-share is above a given threshold. In the main analysis, we set the threshold level at 8 percent. Robustness checks are then performed to verify the consistency of results using different levels (see Figure **??**).

Our instrumental variable approach proceeds by excluding $\log(LCC\ freq)$ from the set of explanatory variables and instrumenting for $\log(FSC\ freq)$ with past semester values of *LCC dummy.* The choice of employing lagged values of the instruments is to consider the time spell that an airline takes to respond to the variation in the flight timetable of its competitors. This assumption seems reasonable as the airline schedule is usually set well in advance.

Each column of Table 4 reports the two-stage, fixed-effect estimates together with the first-stage estimates.

To test for the presence of endogeneity we apply the Hausman (1978) test between models (3) in Table 3 and model (3) in Table 4. The test produces a χ^2 value equal to 25.32, which is statistically significant at a critical value below 1 percent. We, hence, reject the null hypothesis of exogeneity.

To check for the weak instruments problem, Table 4 includes the F-statistic of the Cragg and Donald (1993) test. This test has been suggested by Stock and Yogo (2005) as a test for the presence of weak instruments (i.e. the equation is only weakly identified). In all the cases, the values of the F-statistic are significant at conventional levels and, more generally, are greater than the threshold of ten, proposed by Staiger and Stock (1997) as the rule-of-thumb to consider weak identification as a real concern. Thus, we can confidently reject the null hypothesis that instruments are weak. Finally, to examine instrument relevance, the bottom part of Table 4 shows the first-stage estimates together with the F-test for joint significance of excluded instruments. The diagnostic, statistically significant, presents further evidence in favor of instruments' relevance in all columns.

[INSERT TABLE 4 HERE]

With a closer look at the first-stage estimates, we observe that the instrument is negatively correlated with FSC frequency, as the competition argument suggests; furthermore, this relation is statistically significant in all cases. Foreign residents have a positive and statistically significant effect on flight frequency, as migrants have a clear influence on international travel demand. Further, note that controlling for ethnic networks strengthens the exogeneity of LCC as an instrument for FSC in the export regression, as migrants are more likely to use an LCC to fly home, and migrants also influence trade.

Although statistically insignificant, both region and country GDP are positively signed, which does not reject the idea that the stronger the economic activity in a region and/or in a country, the more frequent the air service. The positive, albeit insignificant, coefficient on Distance∗log(Oil price) in the first-stage estimates may be due to the possible substitution effect between car and air travel. As expected, the Real exchange rate variable does not significantly contribute to explain carrier behavior because of the bi-directional nature of flight flows.

As far as the two-stage estimates are concerned, no major differences appear on the gravity regressors with respect to Table 3. Shifting the discussion to the variable of interest, we observe that the coefficient on $\log(FSC\ freq)$ is positive and statistically significant across all the three specifications. Focusing on the estimates in column (3), which are obtained by including all the regressors of the model described in equation (1), the coefficient of 0.10 on log($FSC\ freq$) indicates that doubling the frequency of FSCs (for instance from one to two daily services to c) increases exports of the Italian region towards the country by 10 percent.

The results are not driven by this specific boundary, as different thresholds in the range lead to similar conclusions. Figure **??** depicts the point estimates of log($FSC\ freq$) for different thresholds used to define the LCC dummy; the grey area is delimited by plus/minus one-standard-deviation of the estimate on log($FSC\ freq$). The coefficient is quite stable in magnitude over the interval and remains significant below the conventional level of 10 percent in the entire range.

[**INSERT FIGURE 2 HERE**]

The magnitude of the coefficient on log($FSC\ freq$) reported in Table 4 is considerably larger than in the base line, non-instrumented estimate of Table 3. This finding contrasts with the expectation of a positive correlation between frequency of air service and factors determining export growth. One possible explanation of this downward bias may stem from the presence of slot-controlled airports located in export-intensive regions, and the way in which air carriers can increase capacity. As a matter of fact, airlines can respond to the increased demand for business travel in a region in other ways than adding more departure times; for example, they can supplement the number of seats by using larger aircraft on particular routes. This strategy is more likely on routes connecting slot-controlled airports. Such airports also tend to be located in trade-oriented areas, which may induce a negative correlation between flight frequency and trade.

8 Conclusion

In the view of the role of face-to-face contacts in facilitating trade, this paper has studied empirically the effect of non-stop flights on exports. The underlying idea is that a non-stop flight connection to the country of export destination favors in-person visits, consolidates the relation with the existing trading partners, brings potential buyers and sellers closer together, augments their reciprocal trust, and, hence, increases the likelihood of trading. In other words, non-stop flights reduce the 'distance' between trading partners and thereby constitute an important channel to boost exports.

We have tested this hypothesis for the Italian manufacturing sector using a panel of 480 pairs of Italian regions and the main European countries of export destination, sampled half-yearly during the period 1998-2010. We have matched the exports of each Italian region to each of the 24 European countries of the sample with the non-stop flight frequency, distinguishing between Full Service Carriers (FSCs) and Low-Cost Carriers (LCCs). Applying instrumental variable, panel data fixed-effect techniques, we found that the supply of non-stop flights provided by FSCs has a positive impact on exports, whilst no significant evidence is found in favor of LCC non-stop flights. The estimates indicate that the elasticity of exports to FSC non-stop flights is about 10 percent.

The present analysis suggests that, in those regions where manufacturing represents a key driver of the local economy, a policy intervention aiming at favoring the entry of FSCs should be implemented. Although state aid legislation may limit the policy intervention (i.e. it is not possible to discriminate among carriers types, for instance, by fixing different airport charges), airports designed to meet the specific needs of FSCs can be useful to reach this objective. In countries, such as Italy, where regional governments control and manage most of airport infrastructure, this policy might be more easy to implement.

Regarding data availability, it would be interesting to separate exports by sub-sectors within the manufacturing industry, and then test whether non-stop flights have the same impact in every sub-sector, or whether there are some sub-sectors which are more sensitive to the presence of non-stop flights. A deeper analysis could also be carried at product level (or for macro-categories of products) to test whether non-stop flights are more relevant in generating trade for differentiated goods than for homogeneous goods (Poole, 2010): we expect the former to be more dependent on communication than the latter (Rauch, 1999) and therefore more affected by the presence/absence of non-stop flights.

Finally, a similar approach to the present work to study the effect of non-stop flights on tourism flows would complete the picture. Symmetrically to the findings of this paper, LCCs are expected to be more relevant in boosting tourism than FSCs, as suggested by the recent literature (Williams and Balaz, 2009). If this expectation is confirmed, a national airport system could be designed to implement a regional development strategy, i.e. the specialization of some regions in manufacturing, and other regions in the tertiary sector (e.g. tourism).

The results of such lines of future research could give even more precise policy guidance on the topic that this work has just initiated.

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Notes

[1]In many cases, secondary airports are located in an area remote from the effective destination. For example, the main airport of Barcelona (El Prat) to/from where FSCs operate is less than 15 km from the city center, while the secondary airport (Girona), to/from where most of the LCCs operate, is located at about 90 km. Furthermore, LCC point-to-point strategy implies lower flight frequency combined with a larger set of destinations, thus it is not rare that, for several routes, LCCs do not set a daily service, but rather schedule three or four flights per week (for instance in 2005, the middle year of our sample, the median value of FSC frequency was ten versus four of the LCCs). Other factors that reduce the appeal of LCCs to businessmen are strict baggage restrictions and limited seat space, which can make the travel experience rather unpleasant and, more generally, hamper in-flight working.

[2]The existence of spurious correlation stems from both flight offer and exports being influenced by scale and proximity effects: as the gravity model literature suggests there are greater relationships in trade and flights between larger regions (Frankel, 1998; Grosche et al., 2007). Reverse causality issues can emerge since the transmission channel from air travel to exports may be bi-directional: a higher number of flights may spur exports, but also a larger volume of exports may induce airlines to increase the supply of flights (Poole, 2010).

[3]By measuring the frequency of non-stop flights linking a given Italian region to a certain European country, we aim to capture the additional boost to exports generated by non-stop flights with respect to the reference case (connecting flights).

[4]This result partially departs from Mason (2000, 2001), who finds that business people may also use LCCs, especially for short-haul journeys.

[5]The statistics do not allow to separate intercontinental (i.e. non-European) flights to be separated from continental (i.e., European) flights; however, if the intercontinental traffic generated by the two main Italian airports of Rome-Fiumicino and Milan-Malpensa were not considered, the number of Italian airports with comparable continental market shares enlarges. Moreover, if those statistics were weighted by the different population size and economic strength of the Italian regions, an even more homogeneous distribution of flight offer among Italian airports would emerge.

[6]Currently, private investors are the major shareholders of the airport system in Rome (97 percent) and Naples (70 percent), while they are partial shareholders of the airports of Turin (49 percent) and Venice (33 percent). Contrary to its main opponent Rome, Milan's airport system is still publicly-owned.

[7]Recently, the national regulatory authority, ENAC has provided some objectives in terms of air transport system strategy to comply with the Single European Sky Perfor-

mance Scheme Regulation (EC) No. 691/2010, which states that "The ENAC oversight philosophy is based on the principle of the minimum interference with the normal activity of Shareholders [..] ENAC is well aware that this is the first implementation of regulation 691/2010, and therefore the oversight policy and practices are to be considered as a 'first attempt', and could be changed during the period itself", ENAC (2011).

[8] The LCCs of our sample are Blue Air, EasyJet, Flybe, Jet2, Norwegian Air Shuttle, Ryanair, Sverigeflyg, Transavia.com, Vueling and Wizz Air. FSCs are those airlines not classified as LCCs; they comprise European national carriers (e.g. Alitalia, Lufthansa, British Airways) and regional carriers (e.g. Meridiana, Air Dolomiti, Brit Air, CityJet). Note that OAG data do not include charter airlines.

[9] These countries are: Albania, Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

[10] For a couple of countries (Turkey and Albania) time series stored in the Eurostat database do not cover the whole period of analysis. Missing information is collected from the Datastream database to complete the series.

[11] Similar results are obtained using official data from Istat, but we rely on theSvimez source because of the unavailability of data on regional GDP from Istat for the last year of the sample period.

[12] Exports and Oil prices have been deflated using the Italian import-export deflator provided by Istat. Country and regional GDP series have been directly retrieved in constant prices.

[13] We acknowledge the existence of other types of trade barriers, such as multilateral resistance, which is, however, somewhat harder to control, given the available data variation (Anderson and van Wincoop, 2003; Novy, forthcoming).

[14] Our results are robust to different specifications and, above all, to the exclusion of those 12 observations.

[15] As a robustness check, we have considered different shifting parameters, e.g. 0.1, 0.01, 0.001. In all the cases, the magnitude of the estimated coefficients and their standard errors have not been affected significantly, so that we rely on the initial transformation. This choice is also motivated by the following argument. The log-log specification implies that regressors enter multiplicatively in the underlying equation, and their coefficients are the exponents. By adding 1 to the initial flight variable, we set the no-direct air connection to be the reference case, and we measure the 'boosting' effect of non-stop flights on export flow by their multiplicative impact. First, when the shifted variable equals 1 (no-direct air connection), exports are not affected by the flight variables. Second, when the shifted variable equals 2 or more (i.e. there are non-stop connections), we capture the

multiplicative (boosting) effect generated by non-stop flights on exports.

[16] We adopt the categorization used by the United Nation, which defines the European macro-areas as follows. North-Europe: Finland, Ireland, Norway Sweden and United Kingdom; West-Europe: Austria, Belgium, France, Germany, Luxembourg, Netherlands and Switzerland; East-Europe: Bulgaria, Czech Republic, Hungary, Poland, Romania and Slovakia; South-Europe: Albania, Greece, Portugal, Spain and Turkey.

[17] In a gravity-model framework, the estimated coefficients on the products of the GDP ranges from 0.74 to 0.95 (Frankel and Rose, 2002; Rose and Engel, 2002).

[18] Indeed the correlation of regional GDP between regions is found to be quite high in our sample.

[19] Intuitively, foreign residents of country c can use their domestic networks to export region r's goods to c.

[20] This can be written as:

$$(LCCshare)_{rc} = \frac{(LCCfreq)_{rc}}{\sum_{i \in H} (FSCfreq)_{ri} + (LCCfreq)_{ri}},$$

with r being the observed region and c the observed country; n representing the total number countries in the sample; and $H = \{1, .., c-1, c+1, .., n\}$. Note that the LCC share does not comprise the total (i.e. FSC plus LCC) flight frequency of rc for obvious endogeneity concerns, therefore it can be considered an LCC *quasi*-share.

Tables and figures

Table 1: Italian airports ranked by Aircraft Movement (AM) in 2010.

Airport name	Macro area	AM (intl.)	% of total	Airport name	Macro area	AM (intl.)	% of total
Rome Fiumicino	C	192,942	24.90	Trieste	NE	5,190	0.67
Milan Malpensa	NW	153,939	19.86	Trapani	I	4,994	0.64
Venice	NE	51,662	6.67	Alghero	I	3,768	0.49
Bergamo	NW	47,957	6.19	Forlì	NE	3,698	0.48
Bologna	NE	45,705	5.90	Brindisi	S	2,504	0.32
Milan Linate	NW	33,087	4.27	Pescara	S	2,373	0.31
Rome Ciampino	C	32,995	4.26	Lamezia Terme	S	2,352	0.30
Pisa	C	26,128	3.37	Perugia	C	1,394	0.18
Turin	NW	21,009	2.71	Cuneo	NW	1,331	0.17
Naples	S	20,856	2.69	Parma	NE	1,131	0.15
Florence	C	20,341	2.62	Brescia	NW	1,039	0.13
Verona	NE	19,835	2.56	Reggio Calabria	S	745	0.10
Treviso	NE	14,342	1.85	Albenga	NW	590	0.08
Catania	I	11,736	1.51	Elba	C	334	0.04
Olbia	I	9,205	1.19	Siena	C	228	0.03
Bari	S	9,092	1.17	Foggia	S	213	0.03
Genoa	NW	7,208	0.93	Salerno	S	169	0.02
Cagliari	I	6,765	0.87	Taranto	S	120	0.02
Rimini	NE	6,087	0.79	Bolzano	NE	44	0.01
Palermo	I	5,914	0.76	Pantelleria	I	40	0.01
Ancona	C	5,888	0.76	Total		774,969	100.00

(a) Source Italian Civil Aviation Authority (ENAC).
(b) Only international traffic is considered.
(c) Macro-areas: North-West (NW), North-East (NE), Center (C), South (S), Isles (I).

Table 2: Descriptive statistics.

Variable	Mean	St. Dev.	Min	Max
Exports (mil. €)	96.2	253.7	0.0	3476.4
Country GDP (mil. €)	106321.2	141677.1	0.416	579501.1
Region GDP (mil. €)	61231.8	58800.1	3184.0	268570.7
Real exchange rate	118.9	54.8	72.7	413.5
Foreign residents ('000)	954.6	4512.0	0.0	98205.0
Oil price (€/barrel)	40.3	17.4	9.3	78.2
Distance (Km)	1666.2	634.1	205.0	3375.0
FSC frequency (weekly)	18.0	62.6	0.0	1768.0
LCC frequency (weekly)	2.1	13.3	0.0	394.0

(a) Number of observations 12,000.

Table 3: Baseline results.

Regressand log(Export)	(1)	(2)	(3)	(4)	(5)
log(Country GDP)	1.031*	0.895*	0.885*	0.886*	0.876*
	(0.372)	(0.358)	(0.349)	(0.355)	(0.346)
log(Region GDP)	0.361	0.175	0.147	0.232	0.205
	(0.458)	(0.432)	(0.416)	(0.477)	(0.459)
log(Real exch. rate)	0.508*	0.389*	0.385*	0.386*	0.382*
	(0.186)	(0.150)	(0.149)	(0.150)	(0.149)
log(Foreign residents)		0.026**	0.025**	0.026**	0.025**
		(0.005)	(0.005)	(0.005)	(0.005)
Distance∗log(Oil price)		-0.102*	-0.104*	-0.102*	-0.104*
		(0.035)	(0.035)	(0.035)	(0.035)
log(FSC frequency)			0.019*		0.020*
			(0.008)		(0.008)
log(LCC frequency)				-0.008	-0.008
				(0.008)	(0.008)
R^2	0.185	0.195	0.196	0.195	0.196
Observations	12,000	12,000	12,000	12,000	12,000

(a) Robust standard errors to heteroscedasticity and serial correlation in parenthesis, clustered by European macro-area of export destination.
(b) Statistically significance at the 1%, 5% and 10% level, respectively, denoted by ***, ** and *.
(c) The regressions include country-region and time (i.e. season) fixed effects.

Table 4: Instrumental variable approach.

Second-stage: regressand log(Export)	(1)	(2)	(3)
log(Country GDP)	0.979***	0.929***	0.894***
	(0.301)	(0.305)	(0.267)
log(Region GDP)	0.114	0.121	-0.076
	(0.366)	(0.366)	(0.313)
log(Real exch. rate)	0.428***	0.408***	0.362***
	(0.129)	(0.129)	(0.107)
log(Foreign residents)		0.009**	0.014***
		(0.004)	(0.005)
Distance∗log(Oil price)			-0.125***
			(0.036)
log(FSC frequency)	0.117***	0.122***	0.100**
	(0.043)	(0.042)	(0.047)
Cragg-Donald Wald F stat.	17.16*	18.66*	19.85*
R^2	.0472	.0448	.065

First-stage: regressand log(FSC freq.)	(1)	(2)	(3)
LCC dummy$_{t-1}$	-0.185*	-0.192*	-0.197*
	(0.073)	(0.074)	(0.069)
log(Country GDP)	0.788**	0.431	0.490
	(0.167)	(0.386)	(0.438)
log(Region GDP)	1.158	1.253	1.549
	(1.839)	(1.876)	(1.720)
log(Real exch. rate)	0.348	0.204	0.270
	(0.152)	(0.124)	(0.133)
log(Foreign residents)		0.068**	0.064**
		(0.015)	(0.014)
Distance∗log(Oil price)			0.165
			(0.108)
R^2	0.016	0.027	0.031
F test of excluded instruments	6.50*	6.70*	8.23*
Observations	11,520	11,520	11,520

(a) Robust standard errors to heteroscedasticity and serial correlation in parenthesis, clustered by European macro area of export destination.
(b) Statistically significance at 1%, at 5% and at 10%, respectively denoted by ***, ** and *.
(c) The regressions include country-region and time (i.e., season) fixed effects.
(d) See text discussion of instruments for log(FSC frequency).

<table>
<tr><td>...</td><td colspan="4">Year 2004</td><td colspan="4">Year 2005</td><td>...</td></tr>
<tr><td>...</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>...</td></tr>
<tr><td colspan="2">Winter 2003</td><td colspan="2">Summer 2004</td><td colspan="2">Winter 2004</td><td colspan="2">Summer 2005</td><td colspan="2">Winter 2005</td></tr>
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Figure 1 : Winter and Summer semester spells