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# Fly and Trade: Evidence from Italian Manufacturing Industry

*by Marco Alderighi and Alberto Gaggero*

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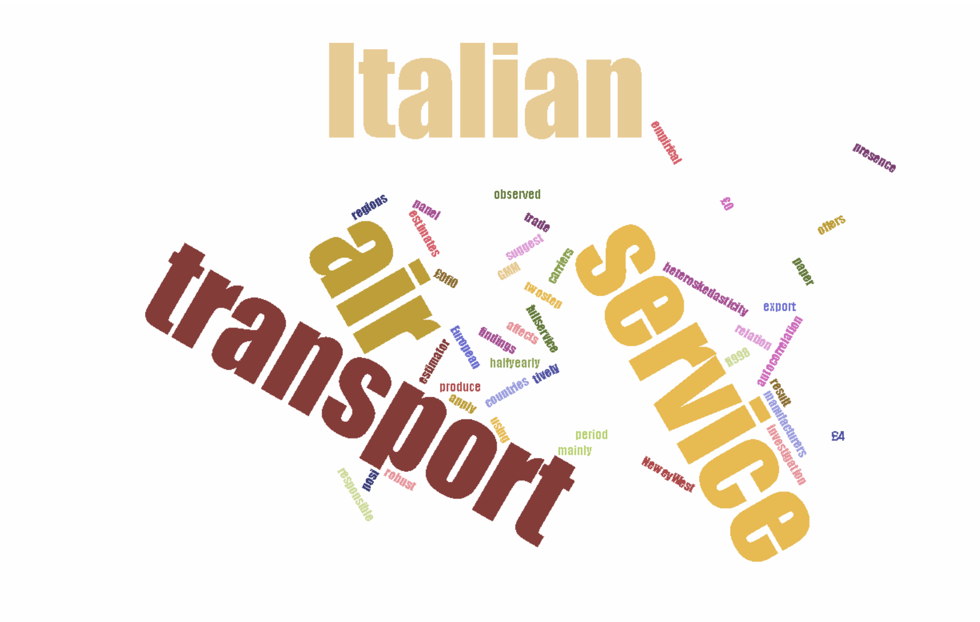


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# Fly and Trade: Evidence from Italian Manufacturing Industry[*]

*by Marco Alderighi and Alberto Gaggero*

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## ABSTRACT

This paper offers an empirical investigation on the relation between air transport service and trade, using a panel of 20 Italian regions and £4 European countries observed, half-yearly, over the period 1998-2010.

We apply a Newey-West two-step GMM estimator to produce estimates which are robust to the presence of heteroskedasticity and autocorrelation. Our findings suggest that air transport service positively affects the export of Italian manufacturers and that full-service carriers are mainly responsible for this result.

Keywords: AIRLINES, NON-STOP FLIGHTS, FULL-SERVICE CARRIERS, LOW-COST CARRIERS, EXPORT, MANUFACTURING FIRMS

JEL classification: L93, F14, N7

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# 1 Introduction

Transport economic theory states that an air business trip should be taken only if it was expected to yield a gain from some activity at the point of destination (Button, 2010).[1] Based on this line of reasoning, an increasing body of literature has been devoted to provide some explanations of the beneficial role of business air trips, and, in particular, of their positive impact on the creation of new trade opportunities (Rauch, 2001; Cristea, 2011). Provided that air trips are usually the most efficient way to travel for sufficiently long distances, the answer to the previous questions can be limited to show that the activity at the point of destination is expected to expand sales in such a way to justify the (opportunity) cost sustained by the firm from the trip.[2]

Authors agree that the importance of a meeting with a business partner depends on the nature of the interaction and in particular on the importance a face-to-face communication. A set of complementary explanations has been offered to clarify the role of face-to-face communication, including the fact that they allow complex business relationships to be managed more effectively than with other media (Saxenian, 1999); they favor the cultivation of trust among business partners (Storper and Venables, 2004); and they facilitate the transfer of knowledge (Hovhannisyan and Keller, 2015). Once the benefits of a direct communication has been established, those of air trip and therefore of air accessibility, immediately follow (Frankel, 1998; Rauch, 1999; Kulendran and Wilson, 2000; Frankel and Rose, 2002).

Within Europe, air accessibility is strongly affected by the existence of non-stop flights, as it allows businessmen reach any destination within two or three hours, so that a business trip can be completed within a day, or, alternatively, reduce the journey time component considerably in the case of a short stay. The availability of a non-stop flight may also affect the decision of a businessman to visit a place and, more generally, may influence the travel choice among a set of possible destinations (Grosche et al. 2007).

Our work contributes to the field by analyzing the impact of non-stop air connections on the export of the Italian manufacturers in Europe. Moreover, in light of the mounting importance of the competition between low-cost carriers (LCCs) and full-service carriers (FSCs), we also investigate the different impact on export induced by these two types of airlines. As it is amply documented, LCCs, even if with some differences, adopt a strictly cost-saving business model that implies a flight offer normally from secondary airports, low flight frequencies,

[1] For example, Gronau (1970) pointed out that the demand for air transport services is a derived demand, which depends "on the direct utility [the demand for air trips] yield and their contribution to the production of a third activity - a visit to the point of destination (p. 13)."

[2] For a review of the methods for valuating business time saving see Wardman et al (2015).

imposing strict baggage restrictions, providing limited seat space (Mason, 2000; Bilotkach et al., 2010).[3] All these aspects make the use of LCCs probably less appealing for businessmen, suggesting that if traveling should favor face-to-face relations and trade, the impact of FSCs should be stronger than than of LCCs.[4]

Data on flight supply, exports and various controls are combined to obtain a fully-balanced panel of 12,000 observations, i.e. 20 regions, 24 countries over 25 semesters. Econometric techniques are employed to estimate a gravity model. We account for the multilateral trade resistance (Anderson and van Wincoop, 2003), country-time and region-time fixed effects (Balazsi et at, 2016), endogeneity and serial correlation (Wooldridge, 2010).

Our findings confirm a positive effect of non-stop flights on exports, suggesting that face-to-face relations have a positive impact on international sales. Moreover, as expected, the supply of direct air connections provided by FSCs has a positive and significant impact on exports, whilst a weaker impact is found for LCCs.

Our paper extends the previous literature in a number of ways. First, the analysis relies on a measure of air accessibility (number of non-stop flights), while previous contributions have employed business travel statistics (Poole, 2013). Second, we distinguish between LCCs and FSCs to take advantage of the differential use of the two types of carriers by business travelers. Finally, our analysis is one of the few using European data.

The rest of the paper is organized as follows. The next section reviews the related literature, while Section 3 offers a background explanation of the Italian air transport and manufacturing sectors. The empirical analysis is conducted in Section 4 (methodology, data and variable description, results). Concluding remarks are presented in Section 5.

[3]In many cases, secondary airports are located at a remote distance from the effective destination. For example, the main airport of Barcelona (El Prat), served by FSCs, is located at less than 15 km from the city center, while the secondary airport (Girona), served by most of the LCCs, is much further away at 90 km. Moreover, the LCC point-to-point strategy combines a sparse flight frequency with a large set of destinations. Thus, it is not rare that, for several routes, LCCs do not provide a daily service. Other factors that may reduce the appeal of LCCs to businessmen, by making the travel experience rather unpleasant and, more generally, hamper in-flight working, are: strict baggage restrictions, and limited seat space.

[4]The period of our analysis spans from 1998 to 2010, when the share of business passengers traveling with LCCs was quite limited. According to the chief marketing officer of Ryanair business people became relevant for the company only in 2014, when their share over the total number of passengers was estimated to be about 22%. Similar figures can be drawn from easyJet, the other major European LCC. Indeed business travelers have been given more attention by easyJet and Ryanair only in very recent years, when they included the option of allowing some flexibility or other adds-on (e.g. priority boarding) to the tickets to meet the needs of business travelers.

## 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 export 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 (2013) underlines the importance of business and social networks in generating trade. She investigates how face-to-face communications 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.

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) concludes 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. Bilotkach (2015) looks at the relationship between air travel and regional economic development using US data for the period 1993-2009. He observes a higher level of employment, a larger number of business establishments, and higher average wages in regions served by non-stop flights. 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) and 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) and Graham (2003) reach the conclusion that better airline accessibility of the site, measured by the supply of airline routes, increases firms' productivity and employment. Furthermore, Ahn et al. (2011) and Bernard et al. (2011) show that improved access to airports contributes to reduce the costs of small and medium-sized enterprizes by facilitating a direct connection to the export market.

Finally, Blonigen and Cristea (2015) examine the contribution of passenger aviation to regional development and urban growth, exploiting the unexpected market changes induced by the US 1978 airline deregulation. They find that the increase in air passenger transport goes along with an increase in population, percapita income, and employment.

## 3 Air transport and manufacturing sectors in Italy

The air transport and manufacturing sectors in Italy have same distinguishing characteristics that are particularly useful for the purpose of our empirical design. They directly come from the geographical morphology and peripheral location of the country, as well as from the economic development trajectory engaged after the World War II. We briefly summarize these characteristics into three points.

**1. Imperfect substitution with other means of transport.** Italy is located in the Southern part of Europe. The Alps in the North and the surrounding Mediterranean Sea 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

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).

supply. 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.[5] The combined features of being diffused at the regional level and publicly-owned mean that Italian airports can easily be influenced by regional policies.

**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 enterprizes, 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.

# 4 Econometric analysis

## 4.1 Methodology

In this sub-section we illustrate the methodology to be implemented in order to identify the impact of air supply ($flights$) on the export of Italian manufactures ($export$), after controlling for different sources of heterogeneity ($controls$). Equation (1) describes the alleged relation:

$$export_{rct} = \alpha \cdot flights_{rct} + \beta \cdot controls_{rct} + \varepsilon_{rct} \quad (1)$$

[5] 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 competitor Rome, Milan's airport system is still publicly-owned.

where $r$ index refers to exporting (Italian) region, $c$ to destination (foreign) country and $t$ to the period; $\varepsilon_{rct}$ is the error term; $flights$ is either a single variable (overall supply) or a couple of variables (FSC and LCC supply); $controls$ comprises the set of variables that are normally employed in the branch of trade literature, usually referred as gravity model, which is inspired by the Newton's law of universal gravitation.

According to the gravity model approach, export flows are proportional to the economic size of the origin and destination areas and trading facilitators; decay with distance; and are negatively affected by trade barriers. In our analysis, the $flights$ variable is considered an additional facilitator of exports.

The estimation of (1) is developed to include different fixed effect formulations. We have considered three different specifications, which are usually employed in trade literature (Balazsi et al., 2015).

The first one hinges on country-time ($\rho_{ct}$) and region-time ($\rho_{rt}$) fixed effects:

$$export_{rct} = \alpha \cdot flights_{rct} + \beta \cdot controls_{rct} + \rho_{rt} + \rho_{ct} + \varepsilon_{rct}. \tag{2}$$

This specification is adopted by Novy (2013) to take into account the so-called "multilateral trade resistance" (Anderson and van Wincoop, 2003). This term is used to indicate that the more a region is resistant to trade with all other regions, the more it is pushed to trade with a given bilateral partner (Anson et al., 2005, Anderson and Yoto, 2012; de Sousa, 2012). Anderson and van Wincoop (2003) show that if multilateral resistance is not controlled for in the regression, the results may suffer from omitted variable bias.

A second approach, proposed by Cheng and Wall (2005), relies on region-country ($\rho_{rc}$) and time ($\rho_t$) fixed effects:

$$export_{rct} = \alpha \cdot flights_{rct} + \beta \cdot controls_{rct} + \rho_{rc} + \rho_{t} + \varepsilon_{rct}. \tag{3}$$

In addition to trade flow analysis, this specification is largely employed in empirical industrial literature and it reflects the panel structure of data: the region-country fixed effect accounts for the panel identifier, and time fixed effect captures the temporal dimension.

A final approach, followed by Baltagi et al. (2003) and Baldwin and Taglioni (2006), provides an extension to the previous specifications. It includes region-country ($\rho_{rc}$), region-time ($\rho_{rt}$), and country-time ($\rho_{ct}$) fixed effects:

$$export_{rct} = \alpha \cdot flights_{rct} + \beta \cdot controls_{rct} + \rho_{rc} + \rho_{rt} + \rho_{ct} + \varepsilon_{rct}. \tag{4}$$

In addition to above considerations, there are other critical points that need to be discussed. First, export equations are usually estimated using a log-log specification, which has the desirable property that the estimated coefficients can be roughly interpreted as an approximation of 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 no flight supply 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.[6] 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.[7]

Second, there can be a risk of endogeneity bias because, even after controlling for unknown heterogeneity with a fixed effect component, the flight variables could still be correlated with the error term of the regression. To correct for such endogeneity bias, we use two-step estimator. In absence of valid external instruments, it is common practice to employ past values of the endogenous variables. In the airline industry, however, there can be autocorrelation because the flight time-table does not change much over time and therefore even past values of the flight frequencies may be correlated with the error term. We tackle this issue by selecting the appropriate lags[8] and by using the two-step, efficient Generalized Method of Moments (GMM) estimator, which ensures that results are robust to arbitrary heteroskedasticity and autocorrelation (Wooldridge, 2010). This estimator employs a kernel-based approach. We rely on the Bartlett-kernel, which is equivalent to Newey-West standard errors. A bandwidth of two is selected, but our findings are robust to other choices of bandwidth. The gains in efficiency due

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

[7] 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 air connection with stopover(s) 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 (the air connection with stopovers), 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.

[8] The validity of these instruments is also confirmed by various diagnostics, namely the Kleibergen-Paap and Hansen statistics, reported at the bottom of each table.

to this two-step GMM estimator relative to the standard two-stage least squares stem from the use of the optimal weighting matrix, the overidentifying restrictions of the model, and the relaxation of the assumption of independent and identically distributed errors (Baum, 2005).

## 4.2 Data and panel data structure

The data employed in the analysis combine information coming mostly from two different sources, the Coeweb database provided by Italian National Institute of Statistics (ISTAT) and the airline schedules database provided by the Official Airline Guide (OAG).

The airline schedules database provides information on airline scheduled flights twice a year: the winter schedule (November-March) and the summer schedule (April-October). The dataset contains for each carrier, all the scheduled flights including information on the origin, the destination, and other relevant statistics. We consider 24 European export destination countries. Coeweb (from ISTAT) contains information of the export and import flows from each Italian region to each origin/destination country on a quarterly bases.

<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>
</table>

Figure 1 : Winter and Summer semester spells

In order to combine the main data sources, we have built a dataset having three dimensions: region of origin, country of destination, and time. As far as the time dimension is concerned, we have chosen to organize data on half-yearly basis, using the time structure of the airline schedules database. Indeed, the quarterly feature of the Coeweb data allows a close relationship with the time dimension of the OAG data. More precisely, the last quarter (Q4) of one year and the first quarter (Q1) of the following year of the ISTAT data are paired with the corresponding 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).

In order to match the spatial dimensions of the panel, we have assigned each flight to the region-country pair, which hosts the origin and destination airports. We have considered all the 20 regions composing Italy and 24 European destination countries.[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 stopover(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 territory, 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 that comprises 20 regions.

Table 2 reports the main descriptive statistics of the variables employed in the analysis.

Trade data originate from Coeweb database (ISTAT). For each Italian region the real value of its manufacturing exports (*exports*) by country of destination is collected on a quarterly basis and summed up to get the half-yearly frequency. Three variables are obtained from OAG data: the bi-directional weekly frequency of non-stop flights for FSCs (*FSC flights*), for LCCs (*LCC flights*) and for the total of the two (*ALL flights*). We define an airline as *low-cost* if it is a member of the European Low Fares Airline Association, and as *full-service* otherwise.[10]

From Googlemaps we retrieve the region-country distance (*distance*), defined as the shortest travel path by car between the capitals of each pair. Data on the use of the same language in the region-country pair (*common language*), of the same border (*common border*) or the presence of landlocked region and/or country pair, are also obtained by ISTAT. From Eurostat, we collect quarterly data on the national GDP of European trading countries (*country GDP*), which are aggregated to achieve the same time structure as the airline data.[11] The time

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

[10] 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.

[11] 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.

series on the GDP of the Italian regions (*region GDP*) are provided by ISTAT on a yearly basis, and converted to the half-year framework. More precisely, the regional GDP has been evenly split among the four quarters, and then aggregated in a similar fashion to the previous variables. A similar procedure is followed for data on Italians residents abroad (*Italians*) and foreign residents in Italian regions (*foreigners*) provided by ISTAT on a yearly basis. All the economic variables are in constant prices with the reference year set in 2005, which stays in the middle of our sample period.[12]

By combining all the information from the above data sources, we obtain a fully-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.[13]

Table 2: Descriptive statistics

| Variable | source | unit | Mean | St. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| exports | ISTAT | mil. € | 96.2 | 253.7 | 0.0 | 3476.4 |
| ALL flights | OAG | weekly flights | 20.1 | 68.5 | 0.0 | 1768.0 |
| FSC flights | OAG | weekly flights | 18.0 | 62.6 | 0.0 | 1768.0 |
| LCC flights | OAG | weekly flights | 2.1 | 13.3 | 0.0 | 394.0 |
| distance | Google | km | 1666.2 | 634.1 | 205.0 | 3375.0 |
| common language | ISTAT | % | 1.4 | 12.0 | 0.0 | 1.0 |
| common border | ISTAT | % | 2.1 | 14.3 | 0.0 | 1.0 |
| landlocked | ISTAT | % | 40.0 | 49.9 | 0.0 | 1.0 |
| country GDP | Eurostat | mil. € | 106321.2 | 141677.1 | 3333.5 | 579501.1 |
| region GDP | ISTAT | mil. € | 61231.8 | 58800.1 | 3184.0 | 268570.7 |
| Italians | ISTAT | '000 people | 4026.8 | 12464.7 | 0.0 | 208261.1 |
| foreigners | ISTAT | '000 people | 954.6 | 4512.0 | 0.0 | 98205.0 |

## 4.3 Variables

Our analysis relies on the following variables:

[12] Exports 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 collect data on flight frequencies starting from 1996, in order to keep the number of observations unchanged, when we use lagged values in the instrumental variable estimation. Data on export before 1998 are not retrieved since previous data have been collected by ISTAT with a different methodology.

- $\log(export_{rct})$ denotes the natural logarithm of exports from region $r$ to country $c$, in semester $t$ of a given year.
- $\log(distance_{rc})$ is log of distance between region $r$ and country $c$.
- $common\ border_{rc}$ is a dummy variable being one if region $r$ and country $c$ share a common border.
- $landlocked_{rc}$ is a dummy variable being one if region $r$ and/or country $c$ are landlocked.
- $\log(country\ GDP_{ct})$ is the GDP of the country of export destination in semester $t$, in logarithms.
- $\log(region\ GDP_{rt})$ is the natural logarithm of region $r$'s gross domestic product in semester $t$. This variable relates to the exporting capacity of $r$, as larger regions are expected to have a larger exporting capacity.
- $\log(Italians_{rct})$ and $\log(foreigners_{rct})$ are respectively the natural logarithm of Italian residents in country $c$ originating from region $r$ and of foreign residents in region $r$ originating from country $c$ in semester $t$.
- $\log(ALL\ flights_{rct})$ is the natural logarithm of bi-directional non-stop flight frequencies between region $r$ and country $c$ in semester $t$.
- $\log(FSC\ flights_{rct})$ and $\log(LCC\ flights_{rct})$ are, respectively, the natural logarithm of FSC and LCC bi-directional non-stop flight frequencies between region $r$ and country $c$ in semester $t$.

Note that depending on the fixed effect specification only a subset of these variables can be considered in the analysis. In particular, in the first approach, equation (2), because of the use of region-time and country-time fixed effects, controls referring separately to region or country over time (e.g. GDP) are excluded. In the second approach, equation (3), the use of region-country fixed effect exclude those controls that are invariant over time (e.g. distance, common border). Finally, in the third approach, equation (4), which combines the previous ones, both categories of controls are excluded.

## 4.4 Results

Table 3 reports a first set of results. The two-stage estimates (even columns) are obtained using a Newey-West two-step GMM estimator, which produces heteroskedasticity and autocorrelation consistent estimates. As instruments we choose two-year and two-half-year lags of the endogenous variable.

Various diagnostics on the validity of the instruments are reported in the table. The Kleibergen-Paap rk LM statistic, statistically significant in columns (2), (4) and (6), highly rejects the null hypothesis that instruments are weak; the Hansen's test of over-identifying restrictions, also reported, shows that the null hypothesis of the instruments being valid, i.e. the instruments are correctly excluded from the estimated equations and they are uncorrelated with the error term, is never rejected at the standard levels of significance.

Columns (1) and (2) are respectively standard OLS and two-stage estimates obtained using the methodology proposed by Anderson and van Wincoop (2003) that takes into account the multilateral trade resistance. This estimator considers country-time and region-time fixed effects. Columns (3) and (4) consider country-region fixed effects and time fixed effects, whilst column (5) and (6) comprise country-region fixed effects as well as country-time and region-time fixed effects.

In line with the expectations of the gravity model, we find that variables facilitating (common language or border) trade and variables hindering trade (higher distance or being landlocked) have positive and negative signs, respectively. Moreover, all coefficients are statistically significant at 1% level.

The coefficient on the GDP of the country of export destination, log(*country GDP*), is statistically significant and positively signed, still in line with the prediction of the gravity model. A rise in a trading partner's GDP positively affects the internal demand of the country, and, consequently, also the demand for Italian goods, all else being equal. This effect is slightly more than proportional, being the estimated coefficient not too far from one.[14]

The GDP of the Italian region, log(*region GDP*), is found to be positive, albeit not always statistically significant at conventional levels. One possible explanation for this result is 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.

Foreign residents at regional levels, when significant, have the expected positive effects on exports, as a larger presence in region $r$ of foreign residents from country $c$ may increase exports from $r$ to $c$.[15] Similar pattern is observed in the case of Italian people coming from region $r$ and living in country $c$.

The variable of interest of this analysis, log($ALL\ flights$), is positive and statistically significant across all the different types of estimators. The back-of-the-envelope calculations of the two-stage estimates show that a 1% increase in the number of non-stop flights between $r$ and $c$ boosts $r$ exports to $c$ by approximately 0.03-0.08%. Finally, from an overall view of the Table, the two-stage coefficient on

[14] This number is not too far rom the findings in the empirical trade literature: for example, in Frankel and Rose (2002) and Rose and Engel (2002), the estimated coefficient on GDP ranges from 0.74 to 0.95.

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

Table 3: Results

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| log(ALL flights) | 0.074*** | 0.083*** | 0.015*** | 0.026** | 0.026*** | 0.043*** |
| | (0.005) | (0.011) | (0.005) | (0.012) | (0.005) | (0.015) |
| log(country GDP) | | | 1.299*** | 1.304*** | | |
| | | | (0.064) | (0.090) | | |
| log(region GDP) | | | 0.347* | 0.329 | | |
| | | | (0.208) | (0.310) | | |
| log(distance) | -0.734*** | -0.731*** | | | | |
| | (0.030) | (0.062) | | | | |
| common language | 0.336*** | 0.347*** | | | | |
| | (0.051) | (0.105) | | | | |
| common border | 0.206*** | 0.201*** | | | | |
| | (0.032) | (0.065) | | | | |
| landlocked | -0.255*** | -0.255*** | | | | |
| | (0.021) | (0.042) | | | | |
| log(Italians) | 0.083*** | 0.083*** | -0.004 | -0.004 | 0.012* | 0.012 |
| | (0.006) | (0.011) | (0.006) | (0.009) | (0.007) | (0.009) |
| log(foreigners) | -0.007 | -0.008 | 0.028*** | 0.027*** | 0.019*** | 0.018* |
| | (0.008) | (0.015) | (0.004) | (0.006) | (0.007) | (0.011) |
| country-time fixed effect (ct) | ✓ | ✓ | | | ✓ | ✓ |
| region-time fixed effect (rt) | ✓ | ✓ | | | ✓ | ✓ |
| country-region fixed effect (cr) | | | ✓ | ✓ | ✓ | ✓ |
| time fixed effect (t) | | | ✓ | ✓ | | |
| instrumental variable | | ✓ | | ✓ | | ✓ |
| Kleibergen-Paap rk LM statistic | | 689.149 | | 210.660 | | 220.036 |
| Kleibergen-Paap rk LM pvalue | | 0.000 | | 0.000 | | 0.000 |
| Hansen $\chi^2$ | | 0.49 | | 2.42 | | 0.503 |
| Hansen pvalue | | 0.484 | | 0.120 | | 0.478 |
| $R^2$ | 0.174 | 0.174 | 0.078 | 0.078 | 0.004 | 0.003 |
| Observations | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 |

(a) Coefficients statistically significant at the 1%, 5% and 10% level denoted by ***, ** and *, respectively.

log($ALL\ flights$) is systematically larger than its corresponding non-instrumented estimate. This result points towards a downward bias in the estimated elasticity.[16]

A robustness check of the results as well as an additional research question to investigate is to separate effect of LCCs and FSCs on exports.Table 4 reports the estimates when log($ALL\ flights$) is replaced by $log(FSC\ flights)$ and $log(LCC\ flights)$.

The coefficient on $log(FSC\ flights)$ is positive and statistically significant, whilst the coefficient on $log(LCC\ flights)$ is of small magnitude and most of the times statistically insignificant. This result implies that the presence of a non-stop flight provided by FSCs can represent an important driver to boost exports, whilst a non-stop flight provided by LCCs has negligible effect on exports. This finding is consistent with the argument anticipated in the Introduction, namely that business travelers tend to dislike LCCs because the business model adopted by LLCs implies a flight offer typically from secondary airports, with no frills, no cabin class differentiation, and with low flight frequencies (Mason, 2000).

Finally, as far as the other regressors are concerned, no great differences are recorded with respect to the finidings of Table 3.

## 5 Conclusion

In 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 relationship with the existing trading partners, brings potential buyers and sellers closer, 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 export destination countries, 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 region-country non-stop flight frequency, distinguishing between FSCs

[16] Consider the following equation: $export = \alpha \cdot flights + controls + \varepsilon$, with $\varepsilon = (u + \theta)$, where $u$ is random, and $\theta$ represents an external factor. If both the error term $\varepsilon$ and the flight frequency $flights$ are correlated by $\theta$, then $Cov\,(flights, \theta) \neq 0$. The impact of flight frequencies on exports is $d(export)/d\,(flights) = \alpha$, whilst estimated with GLS it becomes $\widehat{\alpha}_{GLS} = \alpha + Cov\,(flights, \theta) \neq \alpha$. If $\varepsilon$ and $flights$ are positively correlated, $Cov\,(flights, \theta) > 0$, the GLS estimate has an upward bias, whilst a downward bias is observed in the case of negative correlation, $Cov\,(flights, \theta) < 0$ .

Table 4: Results FSC and LCC

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| log(FSC flights) | 0.066*** | 0.081*** | 0.017*** | 0.027** | 0.022*** | 0.039*** |
| | (0.005) | (0.011) | (0.005) | (0.013) | (0.005) | (0.015) |
| log(LCC flights) | 0.021*** | -0.000 | -0.009** | -0.004 | 0.003 | 0.007 |
| | (0.008) | (0.021) | (0.004) | (0.010) | (0.005) | (0.018) |
| log(country GDP) | | | 1.280*** | 1.289*** | | |
| | | | (0.064) | (0.092) | | |
| log(region GDP) | | | 0.424** | 0.373 | | |
| | | | (0.212) | (0.323) | | |
| log(distance) | -0.735*** | -0.724*** | | | | |
| | (0.030) | (0.063) | | | | |
| common language | 0.328*** | 0.348*** | | | | |
| | (0.051) | (0.106) | | | | |
| common border | 0.215*** | 0.204*** | | | | |
| | (0.032) | (0.066) | | | | |
| landlocked | -0.258*** | -0.260*** | | | | |
| | (0.021) | (0.042) | | | | |
| log(Italians) | 0.083*** | 0.084*** | -0.004 | -0.004 | 0.012* | 0.012 |
| | (0.006) | (0.011) | (0.006) | (0.009) | (0.007) | (0.010) |
| log(foreigners) | -0.007 | -0.007 | 0.028*** | 0.027*** | 0.019*** | 0.019* |
| | (0.008) | (0.015) | (0.004) | (0.006) | (0.007) | (0.011) |
| country-time fixed effect (ct) | ✓ | ✓ | | | ✓ | ✓ |
| region-time fixed effect (rt) | ✓ | ✓ | | | ✓ | ✓ |
| country-region fixed effect (cr) | | | ✓ | ✓ | ✓ | ✓ |
| time fixed effect (t) | | | ✓ | ✓ | | |
| instrumental variable | | ✓ | | ✓ | | ✓ |
| Kleibergen-Paap rk LM statistic | | 173.433 | | 239.748 | | 142.765 |
| Kleibergen-Paap rk LM pvalue | | 0.000 | | 0.000 | | 0.000 |
| Hansen $\chi^2$ | | 3.42 | | 2.56 | | 0.592 |
| Hansen pvalue | | 0.181 | | 0.278 | | 0.744 |
| $R^2$ | 0.172 | 0.172 | 0.078 | 0.078 | 0.003 | 0.002 |
| Observations | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 |

(a) Coefficients statistically significant at the 1%, 5% and 10% level denoted by ***, ** and *, respectively.

and LCCs. We have applied a Newey-West two-step GMM estimator to produce estimates which are robust to the presence of heteroskedasticity and autocorrelation. Also, we have controlled for multilateral resistance in trade, following the approach described by Anderson and van Wincoop (2003), as well as for country-time and region-time fixed effects, as illustrated in Balazsi et at (2016).

We have found that the supply of non-stop flights gears up exports. Moreover, when we distinguish the non-stop frequencies between the different type of carriers (FSCs and LCCs), we find that FSCs have a positive impact on exports, whilst no significant evidence is found for LCC non-stop flights.

From a policy viewpoint, our findings indicate that carriers' composition at airports can play a relevant role. In particular, it suggests that local governors of those regions where manufacturing represents a key driver of the local economy should aim at favoring the entry of FSCs. Although state aid legislation may limit the policy intervention (i.e. it is not possible to discriminate among carrier 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 as Italy, where regional governments control and manage most of the airport infrastructure, this policy might be easier 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 exist some sub-sectors which are more sensitive to the presence of non-stop flights. A deeper analysis could be also 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, 2013): we expect the former to be more dependent on communication than the latter (Rauch, 1999), and therefore be more affected by the presence/absence of non-stop flights.

Finally, a similar approach to the present work could be implemented to study the effect of non-stop flights on tourism flows. Symmetrically to the findings of this paper, LCCs are expected to be more relevant than FSCs to boost tourism, as suggested by the recent literature (Williams and Balaz, 2009).

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