Do non-stop flights boost exports?*

Marco Alderighi†
University of Valle d'Aosta

Alberto A. Gaggero‡
Univeristy of Pavia

March 2, 2012

Abstract

We study the role of Full Service Carriers (FSC) and Low-Cost Carriers (LCC) in boosting the exports of the Italian manufacturing sector. We focus on the link among non-stop flights and outgoing trade of the Italian regions towards the main European countries with a panel of 12,000 half-yearly observations ranging from 1998 to 2010. The analysis shows that the supply of non-stop flights by FSC has a positive impact on the exports of Italian regions, whilst no significant evidence is found for LCC. Consequently, FSC attraction could play a relevant role in international policy. The estimates point out that the elasticity of export to FSC non-stop flights is between 2.7% and 4.1% when we use internal instruments, while it grows up considerably ranging between 13.7% and 17.1%, when we rely on new ad-hoc instruments tailored to the airline industry.

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

Keywords: Export, full-service carriers, low-cost carriers, manufacturing.

---

*We wish to thank Alessandro Cento. The responsibility for the arguments and results expressed in this paper is entirely ours.

†Università della Valle d'Aosta, Grand Chemin 73/75, 11020 Saint Christophe, AO, Italy. Email: m.alderighi@univda.it.

‡Department of Economics and Quantitative Methods, University of Pavia, Via S. Felice 5, I- 27100 Pavia, Italy. Email: alberto.gaggero@unipv.it.

1 Introduction

An important tool to build and maintain networks is face-to-face contacts. Indeed, face-to-face contacts favor the transfer of tacit knowledge (Poole, 2010; Bower et al, 2001), increase the trust in business partners (Storper and Venables, 2004), facilitate a more efficient match between buyers and sellers (Rauch, 1999) and allow to get a more vivid information on local culture, consumers habits and tastes. (Cristea, 2011).

As markets become more interdependent, networks are often international and a way in which people fasten their relations is by traveling. Indeed, a common fashion for citizens to move around Europe is by flying. Some mid-haul destinations are accessible by car or by high-speed train, however for a travel distance above 600 kilometers flying seems to be the preferred mean of travel, at least for businessmen.

In this work, we study the role of Full-Service Carriers (FSC) and Low-Cost Carriers (LCC) in boosting the exports of the Italian manufacturing sector. We focus on the link among non-stop flights and outgoing trade of the Italian regions towards the main European countries. The existence of a non-stop flight in Europe gives the opportunity to reach any continental destination within two or three hours, and hence makes it possible to complete a business mission within a day or to avoid wasting too much time on traveling in case of a short stay. The existence of a non-stop flight, therefore, can be pivotal for the decision of a businessman to visit a place and it can also direct his site choice among a set of possible destinations. Of course any site with a nearby airport is reachable by air using connections, however such travel option yields longer journey time and therefore is less appealing to businessmen.[1]

In other words, lower journey time guaranteed by non-stop flights favors face-to-face contacts, enlarges the knowledge of the market, brings potential trading partners nearer, augments their reciprocal trust, and, ultimately, accrues the likelihood of exporting (Frankel, 1998; Frankel and Rose, 2002; Kulendran and Wilson, 2000; Rauch, 1999).

A preview of the data to be described later reveals a direct relation between non-stop flights and export. Figure 1 scatters the weekly supply of non-stop flights and the value of annual exports averaged over the period

[1] By measuring the frequency of non-stop flights connecting a given Italian region to a certain European country we aim at capturing the the additional boost to export given by a non-stop flight with respect to the connecting flight, set as the base category.

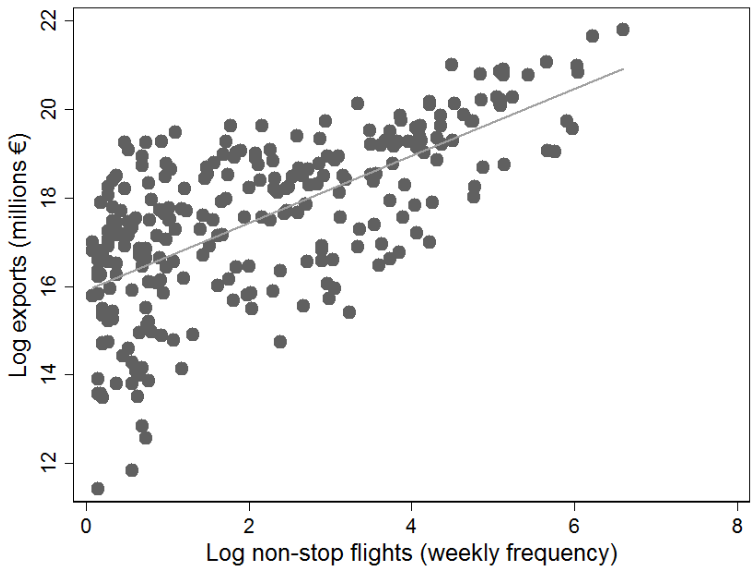

Figure 1: Non-stop flights and exports of Italian regions towards European trading partners.

1998-2010. Every point in the graph represents a single Italian region paired with one European trading partner. The figure also depicts a fitted regression line, which suggests a positive relation among the two variables, corroborated by the correlation coefficient equal to 67,1%.

This finding represents a first confirmation of the conjecture proposed in this study, i.e. that non-stop flights may boost exports. Throughout the paper, we will rest on econometric techniques to furtherly test the validity of previous conjecture and to manage different concerns coming from infrastructure-growth litarature: spurious correlation, reverse causality and persistence. Concerning the first point, it can be claimed that there is spurious correlation since both flight offer and exports are both affected by scale and proximity effects (Cristea, 2011). Reverse causality issues can emerge since the transmission channel from air travel to exports may not be unidirectional: a larger export volume may induce a larger flight offer and not *vice versa* (Poole, 2010). Third, export persistence may arise due to informational costs or start-up sunk costs in building an international business partnership: once it is established, it normally stays or grows in time (Roberts and Tybout, 1997; Grossman, 1998; Disdier and Head, 2008).

In order to investigate more deeply and provide sound results on the alleged relationship, we combine different data sources on airline and trade variables in a database suitable to panel data analysis. We collect a sample of non-stop flights and exports of the Italian regions towards the main European countries observed half-yearly during the period 1998-2010, for a total of 12,000 observations, plus other related variables.

The econometric analysis is conducted using various techniques to check the robustness of the results in presence the three concerns described above. Our main finding confirms a positive relation between non-stop flights and export. Moreover, it indicates a differentiated impact of FSC and LCC. In particular, the analysis shows that the supply of non-stop flights by FSC has a positive impact on the exports of Italian regions, whilst no significant evidence is found for LCC. This latter result is not so obvious, since business people could also use low cost airlines, especially for short haul journeys (Mason, 2000, 2001). The estimates point out that the elasticity of export to FSC non-stop flights is between 2.7% and 4.1% when we use internal instruments, while it grows up considerably ranging between 13.7% and 17.1%, when we rely on new instruments tailored for the airline industry.

Our work contributes to the recently expanding literature on airline travel and international trade (Cristea, 2011; Poole 2010), by providing empirical evidence in favor of a positive effect of non-stop flights on export. Furthermore, to the best of our knowledge, we are the first to distinguish between FSC and LCC in the analysis. From a policy point of view, our findings of a positive and significant coefficient on FSC combined with a negligible and statistically insignificant coefficient on LCC suggest that, if the goal is to boost exports, policymakers should give more attention to FSC and discard LCC.

Finally, from a computational viewpoint, using internal instruments seems to underestimate the impact of non-stop flights on exports. The use ad-hoc instruments could be useful for researchers to address this issues.

The rest of the paper is organized as follows. The next section revises some of the literature focusing on face-to-face as link between air passanger transport and international trade. Section 3 offers a snapshot of the Italian airport system and manufacturing sector. Section 4 presents the data. The econometric model is illustrated in Section 5, whilst the results and robustness checks are reported in Section 6. Finally Section 7 summarizes and presents some concluding remarks.

2 Literature review on face-to-face contacts

The closest branch of literature to our work analyzes the role of air travel in favoring trade. Frankel (1997) highlights the importance of international travel for international trade. He focuses on the export high-tech capital goods from Unites States. In his work, flights are an important factors for exporters because of the pre-sale activity to be performed in a foreign country.

Poole (2010) underlines the importance of business and social networks in generating trade. She investigates how business travel, as a form of face-to-face communication, is used to enhance international trade between countries. Using information on passengers traveling abroad from the USA during the period 1993-2003, she finds that a higher proportion of business travelers over leisure travelers has a positive impact on export; further she finds that this effect is stronger in case of high-skilled travelers (those travelers in professional and managerial occupations) and in case of differentiated products. As substantial barriers hindering trade continue to exist (countries differs by language, culture, tradition, legislation, currency, etc), simpler international business travel boosted by non-stopping flights can represent an effective way to communicate and to facilitate business networks.

Head and Ries (2010) investigate whether regular trade missions conducted by Canadian officers since 1994 generate new business deals. After controlling for country-pair fixed effects, they find that trade missions have small, negative, and mainly insignificant effects.

Cristea (2011) studies empirically the impact of exports in increasing the demand for business travelers. In the export-travel relationship, her causal link is precisely symmetrical to ours. However, her study and our study do not contrast. She uses US state level data on international business class air travel towards various destinations, whilst we look at non-stop flights which could be ...

3 Air transport system in Italy

Table 1 shows that in 2010, Italy has 41 airports operating internationally, i.e. on average about two per administrative region. The total aircraft movements by these airports in the whole year equals 774,969 units, and therefore considerably lower than other comparable countries (e.g. in France or Germany). The Italian airport system is characterized by a lower average size of major airports, a larger number of medium-sized airports and many small size airports that however offer international connections.[2] The proliferation of small airports is mainly due to the fact that administrative regions have the power to authorize and often they provide the financial resourses to the building of new airports. Indeed, most of the Italian airports are public, although since the mid nineties, some of these has been a move towards private ownership.[3] These factors affected the configuration of the air transport system in Italy, which is not some of them operate near full capacity whist some others are unfertilized. Recently, the national regulatory authority, ENAC (Ente Nazionale per l'Aviazione Civile) has provided some objectives (ENAC, 2011) in terms of air transport system strategy to comply with the Single European Sky Performance Scheme Regulation (EC) No. 691/2010, in which it was noted that "The ENAC oversight philosophy is based on the principle of the minimum interference with the normal activity of Stakeholders [..] 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 'first attempt', and could be changed during the period itself", (p. 4).

****
Table 1 here
****

Many commentators, suggest that the dispersed distribution of airports among different small towns, in some sence among the others may also be driven ba a similarlly diffused dispersion of economic activity and in particular of the manufacturing sector. In Italy, the secondary sector is about 12% of the gross domestic product, the most noteworthy manufactured products include machine tools, textiles and clothing, motorized road vehicles, domestic appliances, arms, fertilizers, and petrochemicals. The industry is mainly

[2]Statistics provided by ENAC do not allow to separate Intercontinental from continental flights. Once considering that the two main airports, Rome-Fiumicino and Milan-Malpensa also offer intercontinental flights, it more clearly emerges that in terms of continental offer the number of airports having comparable market shares is vast.

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

composed by small and medium-sized enterprisers, which account for about 8% of the gross domestic product. Many Italian SME are specialized and export a large part of their production.

From the description above the following picture emerges. Airports are spread through the whole Italian peninsula, and a large part of Italian export is within Europe. This continent is very variegated as it includes countries with different language, culture, habit, religion, etc. The identifying feature that makes Italy and Europe probably the best sample to test the effect of non-stop flights on export is that such between-country variability is comprised within a relative small surface and therefore we expect that face-to-face meetings is even more important than elsewhere (e.g. in the case of English-speaking countries).

4 Data

The dataset used in this work stems from several sources.

The first source of data is the Official Airline Guide (OAG), which provides the bi-directional weekly frequency of non-stop flights by carriers operating in each route and, hence, allows to separate the flights supplied by FSC from those ones supplied by LCC.[4] The flight frequency is sampled half-yearly to reflect the winter schedule (November-March) and the summer schedule (April-October). We cover 24 European countries of export destinations.[5] We select European routes only and thus discard intercontinental (i.e., extra-European) destinations as their inclusions is not particularly interesting for the purpose of our analysis. This is because, contrary to intra-Europe flights which are spread over the entire Italian peninsula, intercontinental flights gravitate only on two Italian airports (Rome and Milan) and thus covers only two regions. Furthermore, the travel time of an intercontinental flight with stop-over and the travel time of a intercontinental flight with no

[4] We classify an airline as low-cost if it is a member of the European Low Fares Airline Association, thus 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 which are not classified as LCCs. Note also that OAG does not comprise charter airlines.

[5] 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.

stop-over do not differ much in relative terms as the overall journey takes in any case most of a day.

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

****

Table 2 here

****

The second source of data is the National Institute of Statistics (Istat), which provides for each Italian region the Gross Domestic Product (GDP) and the real value of the exports towards the 24 European countries under analysis on a quarterly basis. The quarterly feature of these data allows a keener correspondence with the time framework of the OAG data when we aggregate quarterly values to half-yearly. More precisely, the first quarter (Q1) of the current year and the fourth quarter (Q4) of the previous year are matched with the same winter semester, whilst the second and third quarters (Q2 and Q4) are associated to the summer semester (see figure 2 for an illustration).

<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 2 : Winter and summer semester definition.

Finally Eurostat provides the macro-data such as: the GDP of the European trading partner, seasonally adjusted; the population and population of age 14-65 of the trading partner, the real exchange rate Italy-trading partner, etc. This information was also on a quarterly basis and was aggregated in the same fashion described above.

Combining all the above datasets, we create one single dataset, which is a balanced panel comprising the 20 Italian regions and 24 European countries observed half-yearly during the period 1998-2010, for a total of 12,000 observations.

5 Model

The model of this work rests on the export equation model which explains exports of a region with the GDP of the country of export destination and with the competitiveness of the country (Pozo, 1992; Obstfeld and Rogoff, 1996; Klaassen, 2004). As an additional, important component explaining export, we include in the model the number of bi-directional non-stop flights between a given Italian region and its trading partner. Our model also comprises panel fixed effects on origin-destination, as well as time fixed effects. Thus we estimate the following equation:

$$\begin{aligned} \log(Export_{rct}) \quad = \quad & \alpha_1 \log(FSC\ freq_{rct}) + \alpha_2 \log(LCC\ freq_{rct}) + \\ & + \alpha_3 \log(country\ GDP_{ct}) + \alpha_4 \log(Real\ Exch\ Rate_{rct}) + \\ & + \rho_{rc} + \tau_t + \varepsilon_{rct} \end{aligned} \qquad (1)$$

- $\log(Export_{rct})$ denotes the log of exports in million euros from region r to country c in semester t of a given year.

- $\log(FSC\ freq_{rct})$ and $\log(LCC\ freq_{rct})$ are respectively the log of FSC and LCC bi-directional non-stop flight frequency between region r to country c. As argued previously, non-stop flights help to establish contacts with foreign markets and therefore are expected to boost exports. The sign and the magnitude of α_1 and α_2 are useful to investigate which carrier type is more relevant as export transmission channel. We expect FSC to be preferred by business travelers to a larger extent and hence to be more relevant for export than LCC, which, instead, are more likely to meet tourists' needs ($\alpha_1 > \alpha_2 \geq 0$).

- $\log(GDP_{ct})$ is the country of destination GDP, seasonally adjusted, in logs. The higher the GDP, the larger the demand of *all* imported products and therefore also of Italian goods, all else being equal.

- $\log(Real\ Exch\ Rate_{rct})$ represents the real exchange rate Italy-trading partner. If foreign prices are higher relatively to Italian prices, Italian goods become cheaper in foreign countries which, as a consequence, will import more from Italy, all else being equal.

- The parameter ρ_{rc} comprises all the time invariant components which are region and/or country specific (e.g., distance, common language, common border, landlocked Italian region or foreign country, etc.). It therefore represents the region-country fixed effect.

- The parameter τ_t is the half-yearly time fixed-effect.

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

Before proceeding to the estimates there are some critical issues that need to be considered.

Equation (1) describes a log-log specification, which has the desiderable property that its estimated coefficients can be interpreted as elasticities. This transformation relies on the assumption that variables are positive. However, for export and flight frequency variables there are some "zeros". Although the use of logarithms can produce inconsistent estimates, especially when there many zero observations on the dependent variable (Silva and Tenreyro, 2006), in our sample zero values emerge only 12 times over 12,000. Therefore, in this analysis such concern is negligible. Indeed, our results are robust to different specifications and, above all, to the exclusion of those 12 observations. As far as FSC and LCC frequencies are concerned, zero values appear in case of no direct flights between the exporting region and the destination country.We tackle this issue using a simple monotonic transformation which adds one to these variables before taking the logarithm.

Following Cristea (2011), we do not include the population of the country of destination in the regressors for several reasons. First, country GDP and population are highly correlated (about 84%): this result is not surprising, since both variables tend to capture the same effect - the size of the country -, but their joint inclusion in the model could raise multi-collinearity concerns. Second, we observe a very low within-group variation of population versus a very high between-group variation: as we will employ fixed-effect techniques which hinge on a high within-group variation, the estimate on population may not be very reliable. Third, for data availability the time variation of population is not even synchronized with the time dimension of the panel: this occurs because population is sampled yearly, whilst all the other variables of the sample are sampled every semester, which represents the time dimension of the panel. In our trials, we have included population in the regression, although the estimated coefficient on population misbehaves, probably for the reasons above, the variables of interest remain unaffected both in terms of significance and sign. (These results are not reported, but are available upon request).

Even with the included fixed effect, 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 istance, to a renewal in the airport charges' contract) may affect an airline's number of flights involving that airport. To address these issues we will instrument for the flight frequency variables, as ignoring their endogeneity could bias our estimates.

6 Results

The analysis proceeds in three steps. Each of them comprises a different specification of the model or applies a different estimation technique, thereby providing robustness to the results. First, we present the base line results, including both FSC and LCC variables to be instrumented with past values. Second, we add dynamics and estimate the model with the techniques explained in Arellano and Bond (1991), Arellano and Bover (1995). Third, we re-estimate the model with usual instrumental variable techniques, however we depart from the standard approach by suggesting an original set of instruments specific to the airline context.

6.1 Baseline results

The estimates of equation (1) in the base version are reported in Table 3. We cluster standard errors by four European macro-areas[6] and year, in order to

[6]Following the categorization used by the United Nation, which defines North-Europe: Finland, Ireland, Norway Sweden, United Kingdom; West-Europe: Austria, Belgium, France, Germany, Luxembourg, Netherlands, Switzerland; East-Europe: Bulgaria, Check Republic, Hungary, Poland, Romania, Slovakia; South-Europe: Albania, Greece, Portugal, Spain, Turkey.

allow the residuals of countries of the same macro-area in the same year to be correlated. In other words we take into account the fact that neighboring or nearby countries could have similar business cycles than distant countries and hence possibly parallel trade pattern[7].

The first column reports the Generalized Least Squares (GLS) fixed-effect estimates (i.e., not-instrumented). Interestingly, the coefficient on FSC frequency is positive and statistically significant, whilst the coefficient on LCC frequency is close to zero and statistically insignificant. Although we have not controlled for endogeneity yet, this result provides preliminary evidence of one the main findings of our work, namely that the presence of FSC has a positive effect on exports, while the presence of LCC is irrelevant to boost exports.

****

Table 3 here

****

The next step is to control for endogeneity to be confident that the estimated coefficients are not biased and the conclusions are sound. To do so, we need to find valid instrument(s), i.e. variables correlated with flight frequency, but uncorrelated with the regression error. Since the research of instruments is usually a compelling task, at a first stance we rely on the temporal structure of the data and use the past values of the endogenous variables.

Column 2 of Table 3 reports the two-stage least squares estimate using the past-semester values of the log of FSC frequency and LCC frequency. The Hausman (1978) test rejects the null hypothesis of joint exogeneity with a p-value of 0.07. Also in this case the coefficient on FSC frequency is positive and significant; additionally, its magnitude doubles, which indicates that the GLS estimates are downward biased.The estimated coefficient of 0.037 on $\log(FSC\ freq)$ indicates that doubling the frequency of FSC (e.g., from one daily flight scheduled on the route to two daily flights) increases exports of the Italian region towards the country by about 3.7%. The estimated coefficient on LCC frequency remains insignificant and with a negligible magnitude, providing further evidence in favor of no-causal effect of LCC on exports in our sample.

[7] More specifically a given European region could be hit by a shock changing the demand for foreign goods in all the countries of the area.

The remaining regressors included in the model are statistically significant and with the sign predicted by the economic theory. A rise in trading partner GDP positively affects the internal demand of that country and consequently also the demand for Italian goods, all else being equal. Column 2 shows this effect is slightly almost proportional: the estimated coefficient of 1.044 on GDP implies that a one-percent increase of GDP of the country of export destination implies a 1.04% increase of Italian exports in that country. The estimated coefficient of the relative price competitiveness of Italian regions, proxied by the relative exchange rate, is equal to 0.462 and indicates that a one-percent increase of foreign prices relative to the Italian prices boosts Italian exports by 0.462%.

These numbers are not in contrast with the empirical litterature on trade: in a gravity-model framework the estimated coefficients on the products of the GDP ranges 0.74 to 0.95 (Frankel and Rose 2002; Rose and Engel 2002).

On the real exchange rate, Bergstrand (1989) includes in his model a measure of importent currency appreication, which is found to have a positve effect on trade. Since the instruments used in column 2 refer to different seasons, we also investigate what happens by using the past-year (i.e. same season) values of flight frequency. The estimates are reported in Column 3 and substantially confirm previous findings.

6.2 Dynamic issues

Although some variables such as exports and flight frequency can be volatile in response to the cyclical components of demand, they can present a certain level of persistence since once established a commercial network it is likely to be maintained through time. (Frankel, 1997) The aim of this subsection is precisely to consider the persistency of some variables and to show that the conclusions of the previous section are not altered when persistency is accounted.

More precisely, consider the following equation:

$$
\begin{aligned}
\log(Export_{rct}) &= \sum_{j=1}^{t} \alpha_{0,j} \log(Export_{rct,-j}) + \sum_{j=0}^{t} \alpha_{1,j} \log(FSC\ freq_{rct,-j}) + \\
&+ \sum_{j=0}^{t} \alpha_{2,j} \log(LCC\ freq_{rct,-j}) + controls + \\
&+ \rho_{rc} + \tau_t + \varepsilon_{rct},
\end{aligned} \tag{2}
$$

where the lagged values of the dependent variable as well as the endogenous explanatory variables are present.

The use of a fixed-effect two-step estimator may however be plagued by inconsistency when the model is dynamic (Nickell, 1981). This inconsistency can be relevant if an explanatory variable in some time period is correlated with ε_{rct}. (Wooldridge, 2010).

In order to control for this issue, we employ the dynamic panel technique proposed by Arellano and Bond (1991) and Arellano and Bover (1995). This approach is built on the Generalized Methods of Moments (GMM) and hinges around two main key features. First, it takes the first difference of equation (2) to manage the region-country specific effect. Second, it imposes a set of moment conditions which provides consistent estimates even if there is correlation between the error term and the explanatory variable, under the assumption that this correlation is constant over time. The moment conditions are as follows:

$$
\begin{aligned}
E\left(\left(\varepsilon_{rct} - \varepsilon_{rc,t-1}\right) Z_{rc,t-j}\right) &= 0\ j = 2,..t-1;\ t = 3,..,T, \quad (3) \\
E\left(\left(Z_{rct} - Z_{rc,t-1}\right)\left(\rho_{rc} + \tau_t + \varepsilon_{rct}\right)\right) &= 0\ j = 2,..t-1;\ t = 3,..,T, \quad (4)
\end{aligned}
$$

where Z stays for FSC (or LCC) frequency, T is the total number of periods. Note that the consistency of the estimator relies on the assumption of no serial correlation in the error terms.

In table 4 we present the main results of the estimates. Column 1 shows the GLS estimates (i.e. without controlling for heterogeneity). In Columns 2 and 3, the Arellano-Bond (1991) estimator for equation (1) with respectively $t = 1$ and $t = 2$ are presented.[8] Also in this specification, the trading partner GDP and the real exchange rate are significant and with the expected

[8] As the estimator only allows a limited set of clusters, we are obliged to change the clustering, which is now by panel individual, i.e. by the pair region-country.

sign. Moreover, the most of the coefficients of FSC frequency are significant. The cumulative impact of FSC frequency is given by 0.041 when $t = 1$ and 0.031when $t = 2$. On the contrary, the LCC frequency has no impact on the export, being its cumulate coefficient approximately null, both in Columns 2 and 3.

To conclude, the estimates of the dynamic model are similar to those presented in table 3. We find robust evidence that non-stop flights provided by FSC affect the exports of Italian regions and the magnitude is at least as large as in the basic model.

In the next Section, in order to provide additional evidence, we use a new set of instruments which are not based on the lagged values of the explanatory variables, but are taken from the analysis of the airline route strategy.

****

Table 4 here
****

6.3 New instruments

One of the main findings of the empirical analysis is that FSC positively and significantly affect exports, whilst LCC seem to play no role. From a joint look at tables 3 and 4, we observe that in none of the columns LCC frequency nor its lags are statistically significant. This finding indicates that $\log(LCC\ freq)$ is irrelevant in the regression, yet basic principles of competition theory advocate that the LCC variable should be negatively correlated with the FSC frequency. This suggests that LCC frequency or some related measures may be valid candidates to instrument for FSC frequency.

However, this type of instruments relate to airline schedule only from a competition perspective; since we wish to include in our set of instruments also some determinants of the demand for FSC airline service, we construct a variable - Regional GDP share - representing the regional GDP as a percentage of the total Italian GDP. This variable aims to proxy the relative importance of a region in terms of its wealth, as it is more likely that richer areas will demand for more airline service, especially from FSC, which normally suit better the needs of wealthy travelers than LCC. Furthermore it is more plausible that airline companies tend to be more present in richer regions, as there the demand for goods in general will be higher and, hence, also for airline service in particular. This argument clearly sustains a positive correlation between Regional GDP share and FSC frequency. Finally, note that Regional GDP share is much more attached to domestic (i.e., Italian) demand for goods than to foreign demand (i.e., Italian exports abroad), therefore it can represent another possible instrument for FSC frequency.

Thus to sum up we next estimate exclude $\log(LCC\ freq)$ from the explanatory variables and rest on the following set of instruments. On the LCC-type line we use two instruments: $\log(LCC\ freq)$ and LCC share. The former is simply the variable appeared among the regressors in the previous estimation. The latter is another alternative measure of LCC presence and is calculated as the LCC frequency in the observed region-country pair over the total flight frequency linking the observed region to all the countries of the sample but the observed country.[9] The idea is to create a *quasi*-market-share for LCC in a given Italian region, as the observed country of the region-country pair is excluded from from the count.

On the demand-type line we use Regional GDP share described above. As we wish to always have both the LCC-type and demand-type components in our set of instruments, the available specifications reported in table 5 are three: LCC frequency and Regional GDP share in column (1); LCC share and Regional GDP share in column (2); LCC frequency, LCC share and Regional GDP share in column (3).

In order to avoid any potential simultaneous determination of flight schedule, we use the values of LCC frequency and LCC share of the previous semester. The identifying assumption hinges around the fact that competitors' past period schedule is likely to affect the current schedule: this seems reasonable since airline schedule generally presents some persistence. By a similar fashion, we also employ past semester values of GDP share; as in the short run fleet capacity is fixed, airlines tend to allocate more aircraft to the richest regions, which ultimately are more likely to demand for additional flights.

Each column of table 5 reports the two-stage, fixed-effect estimate together with the first-stage estimate in order to gauge the validity of the

[9]In formula: $LCC\ share = (LCC\ freq)_{rc} \ / \ \sum_{i=1}^{n-1} [(FSC\ freq)_{ri} + (LCC\ freq)_{ri}]$; with rc being the observed region-country pair, n representing the total number countries in the sample and $i \neq c$. Note that LCC share does not comprise the total (i.e., FSC + LCC) flight frequency of rc for obvious endogeneity concerns, therefore it can be considered a LCC quasi-share.

instruments. As shown in the bottom part of the table all the LCC-type instruments are negatively correlated with FSC frequency, as competition theory suggests. Furthermore this relations is highly statistically significant. Regional GDP share is also statistically significant in all the three fist-stage estimates, confirming its expected positive relationship with the demand for FSC service. Additionally the Hansen test of overidentifying restriction is also reported in the table: the null hypothesis that the instruments are 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.

As far as the estimated coefficients on the regressors are concerned, we observe that the variable of interest - $\log(FSC\ freq)$ - is positive and statistically significant across the three specifications. Its impact ranges from 0.137 to 0.171 and it is of higher magnitude compared to the estimates in the previous tables. Taking the intermediate value in column (3), which stems from employing all the instruments, the estimated coefficient of 0.142 on $\log(FSC\ freq)$ indicates that doubling the frequency of FSC (e.g., from one daily flight scheduled on the route to two daily flights) increases exports of the Italian region towards the country by about 14%.

This result has a twofold interpretation. First, it confirms the main finding of the paper, namely that FSC can contribute to boost export by providing non-stop flight service between a given Italian region and its country of export destination. Second, it shows that using past values as instruments can lead to underestimate the effect of non-stop flight on exports and hence instruments tailored to the sector should be given consideration, especially in the airline industry.

****

Table 5 here
****

7 Conclusion

Based on the importance of face-to-face meetings in facilitating trade, this paper has studied empirically the effect of non-stop flights on exports. The baseline idea is that a direct flight connection to the country of export favors in-person visits, consolidates the relation with the existing trading partners, brings potential trading partners nearer, augments their reciprocal trust, and, hence, it accrues the likelihood of exporting. 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 region - European country of export destination, sampled half-yearly from 1998 to 2010. We matched the exports of each Italian region to each of the 24 European countries of the sample with the non-stop flight frequency, separating Full Service Carriers (FSC) form Low-Cost Carriers (LCC). Applying panel data fixed-effect techniques with instrumental variables, we found that the supply of non-stop flights by FSC has a positive impact on export whilst no significant evidence is found for LCC. This result is robust to different model specifications and estimation techniques. The estimates point out that the elasticity of export to FSC non-stop flights is between 2,7% and 4,1% when we use internal instruments, while it grows up considerably ranging between 13,7% and 17,1%, when we rely on new instruments tailored for the airline industry.

The following implications emerge from this analysis. First, from an computational point of view, using internal instruments can underestimate the effect; therefore researchers should consider using specific instruments proper of the sector under analysis, as we suggest for the case of airline industry, in order to evaluate the correct impact of the variable(s) of interest.

Second, and perhaps more importantly, this analysis suggests that, if the goal is to boost exports, policymakers should give more attention to FSC and discard LCC.

The results of this analysis lead to two avenues of possible future research. Upon 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 there exist some sub-sectors which are more affected by the presence of non-stop flights. A deeper analysis could also be carried at product level (or macro-categories of products) to test whether non-stop flights are more relevant in generating trade for differentiated goods than for homogeneous goods: we expect the former to hinge on more communication than the latter (Rauch, 1999) and hence to be more affected by the presence/absence of non-stop flights.

Finally, a similar approach to the present work studying the effect of non-stop flights on tourism would complete the picture. Symmetrically to the findings of this paper, we expect LCC to be the relevant carrier boosting tourism.

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

References

[1] Antras P., (2003) "Firms, contracts and trade structure", *Quarterly Journal of Economics*, vol. 4, pp. 1375-1418.

[2] Arellano M. and S. Bond (1991) "Some tests of specification for panel data. Monte Carlo evidence and an application to employment equations", *Review of Economic Studies*, vol. 59, pp. 277-297.

[3] Arellano M. and O. Bover (1995) "Another look at the instrumental variable estimation of error-components models", *Journal of Econometrics*, vol 68, pp.29-51.

[4] Bergstrand J. (1989) "The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade," *The Review of Economics and Statistics*, vol. 71(1), pp. 143-153.

[5] Cristea A. (2011) "Buyer-seller relationship in international trade: Evidence from U.S. States' Exports and Business-Class Travel", *Journal of International Economics*, vol. 84(2), pp. 207-220.

[6] Disdier A. and K. Head (2008) "The Puzzling Persistence of the Distance Effect on Bilateral Trade", *Review of Economics and Statistics*, vol. 90, pp.37-48.

[7] ENAC (2011) "The Italian Performance Plan for Air Navigation Services", Reference Period 1, 2012-2014.

[8] Frankel J. (1997) "Regional trading blocs in the world economic system", Institute for International Economics.

[9] Frankel J. (1998) "The regionalization of the world economy", University of Chicago Press.

[10] Frankel J. and A. Rose (2002) "An Estimate of the Effect of Common Currencies on Trade and Income", *Quarterly Journal of Economics*, vol. 117(2), pp. 437-466.

[11] Grossman G. (1998) "Comments on Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?", in "The Regionalization

of the World Economy", edited by J. Frankel Chicago: The University of Chicago Press, 1998, pp. 29-31.

[12] Grossman G. and E. Helpman (2002) "Integration versus outsourcing in industry equilibrium", *Quarterly Journal of Economics*, vol. 117, pp. 85-120.

[13] Head K. and J. Ries (2010) "Do trade missions increase trade?" *Canadian Journal of Economics*, vol. 43(3), pp. 754-775.

[14] Klaassen F. (2004) "Why is it so difficult to find an effect of exchange rate risk on trade?", *Journal of International Money and Finance*, vol. 23(5), pp. 817-839.

[15] Kulendran N. and K. Wilson (2000) "Is there a relationship between international trade and international travel?", *Applied Economics*, vol. 32, pp. 1001-1009.

[16] Mason K. (2000) "The Propensity for Business Travellers to use Short Haul, Low Cost Airlines", *Journal of Transport Geography*, vol.8(2) pp. 107-119.

[17] Mason K. (2001) "Marketing low cost airline services to business travellers", *Journal of Air Transport Management*, vol. 7(2), pp. 103-109.

[18] Nickell S. (1981) "Biases in Dynamic Models with Fixed Effects", *Econometrica*, vol. 49, pp. 1417-1426.

[19] Obstfeld M. and K. Rogoff (1996) "Foundations of International Macroeconomics" Cambridge MIT press.

[20] Poole J. (2010) "Business Travel as an Input to International Trade" mimeo.

[21] Pozo S. (1992) "Conditional exchange-rate volatility and the volume of international trade: evidence from the early 1990s", *Review of Economics and Statistics*, vol. 74(2), pp. 325-329.

[22] Rauch J. (1999) "Networks versus Markets in International Trade", *Journal of International Economics*, vol. 48, pp. 7-35.

[23] Rose A. and C Engel (2002) “Currency Unions and International Integration,” *Journal of Money, Credit and Banking*, vol. 34, pp. 1067-1089.

[24] Roberts M. and J. Tybout (1997) "The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs", *The American Economic Review*, 87(4), pp. 545-564.

[25] Santos Silva J. and S. Tenreyro (2006) "The Log of Gravity", *The Review of Economics and Statistics*, vol. 88(4), pp. 641-658.

[26] Storper ADD

[27] Wooldridge J. (2010) "Econometric Analysis of Cross Section and Panel Data" (2nd ed.), MIT Press.

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

Airport name	AM (intl.)	% of total	Airport name	AM (intl.)	% of total
Rome Fiumicino	192942	24.90	Trieste	5190	0.67
Milan Malpensa	153939	19.86	Trapani	4994	0.64
Venice	51662	6.67	Alghero	3768	0.49
Bergamo	47957	6.19	Forlì	3698	0.48
Bologna	45705	5.90	Brindisi	2504	0.32
Milan Linate	33087	4.27	Pescara	2373	0.31
Rome Ciampino	32995	4.26	Lamezia Terme	2352	0.30
Pisa	26128	3.37	Perugia	1394	0.18
Turin	21009	2.71	Cuneo	1331	0.17
Naples	20856	2.69	Parma	1131	0.15
Florence	20341	2.62	Brescia	1039	0.13
Verona	19835	2.56	Reggio Calabria	745	0.10
Treviso	14342	1.85	Albenga	590	0.08
Catania	11736	1.51	Elba	334	0.04
Olbia	9205	1.19	Siena	228	0.03
Bari	9092	1.17	Foggia	213	0.03
Genoa	7208	0.93	Salerno	169	0.02
Cagliari	6765	0.87	Taranto	120	0.02
Rimini	6087	0.79	Bolzano	44	0.01
Palermo	5914	0.76	Pantelleria	40	0.01
Ancona	5888	0.76	Total	774969	100

Source ENAC. Only international traffic is considered.

Table 2: Descriptive statistics.

Variable	Mean	St. Dev.	Min	Max
Exports (in millions €)	95.846	255.983	0	3606.923
FSC non-stop flight weekly freq.	18.024	62.561	0	1768
LCC non-stop flight weekly freq.	2.112	13.297	0	394
Real exchange rate	103.761	27.817	1	200.13
GDP trading partner (in mil. €)	107397	148693	857	604210

Number of observations 12000.

Table 3: Impact of non-stop flights on exports - baseline results.

Dep. variable: log(export)	(1) GLS	(2) IV	(3) IV
log(FSC frequency)	0.020***	0.037***	0.027*
	(0.006)	(0.014)	(0.016)
log(LCC frequency)	-0.004	-0.001	-0.000
	(0.006)	(0.009)	(0.009)
log(GDP trading partner)	1.006***	1.044***	1.158***
	(0.129)	(0.226)	(0.240)
log(Real exch. rate)	0.535***	0.462***	0.388***
	(0.075)	(0.109)	(0.087)
Country-Region fixed effect	Yes	Yes	Yes
Time fixed effect (season)	Yes	Yes	Yes
R^2	0.270	0.076	0.075
Observations	12000	11520	11040

Robust standard errors to heteroscedasticity and serial correlation in parenthesis, clustered by Year and European macro area of export destination.
Statistically significance at 1%, at 5% and at 10% respectively denoted by ***, ** and *.
Both log(FSC frequency) and log(LCC frequency) assumed endogenous in models (2) and (3), instrumented with their past semester and past year values, respectively.

Table 4: Impact of non-stop flights on exports - Arellano-Bond (AB) estimation.

Dependent variable: log(export)	(1) GLS	(2) AB	(3) AB
$\log(\text{export})_{t-1}$	0.531***	0.271***	0.308***
	(0.027)	(0.028)	(0.027)
$\log(\text{export})_{t-2}$			0.113***
			(0.031)
log(FSC frequency)	0.004	0.022**	0.031***
	(0.005)	(0.011)	(0.011)
$\log(\text{FSC frequency})_{t-1}$	0.003	0.019*	0.018*
	(0.006)	(0.012)	(0.010)
$\log(\text{FSC frequency})_{t-2}$	0.002		-0.013
	(0.005)		(0.010)
log(LCC frequency)	-0.008	0.003	0.000
	(0.006)	(0.011)	(0.012)
$\log(\text{LCC frequency})_{t-1}$	0.006	0.001	0.002
	(0.006)	(0.009)	(0.011)
$\log(\text{LCC frequency})_{t-2}$	0.005		0.011
	(0.005)		(0.010)
log(GDP trading partner)	0.595***	0.779***	0.751***
	(0.082)	(0.198)	(0.181)
log(Real exch.rate)	0.177***	0.270***	0.255***
	(0.065)	(0.092)	(0.089)
Country-Region fixed effect	Yes	Yes	Yes
Time fixed effect (season)	Yes	Yes	Yes
R^2	0.436		
Observations	11040	11040	10560

Robust standard errors to heteroscedasticity and serial correlation in parenthesis, clustered by the pair Italian region - trading partner.
Statistically significance at 1%, at 5% and at 10% respectively denoted by ***, ** and *.
Both log(FSC frequency) and log(LCC frequency) assumed endogenous in models (2) and (3), instrumented with one and with one and two lags, respectively.

Table 5: Impact of non-stop flights on exports - new instruments.

Dependent variable: log(export)	(1) IV	(2) IV	(3) IV
log(FSC frequency)	0.171**	0.137*	0.142**
	(0.081)	(0.076)	(0.061)
log(GDP trading partner)	0.897***	0.934***	0.929***
	(0.285)	(0.280)	(0.275)
log(Real exch. rate)	0.448***	0.452***	0.451***
	(0.096)	(0.095)	(0.096)
Country-Region fixed effect	Yes	Yes	Yes
Time fixed effect (season)	Yes	Yes	Yes
Hansen χ^2	0.062	1.410	1.581
R^2	0.006	0.034	0.031
Observations	11520	11520	11520

Dep. variable: log(FSC freq.)	First-stage estimates		
log(GDP trading partner)	1.048***	1.089***	1.056***
	(0.178)	(0.182)	(0.177)
log(Real exch. rate)	0.089	0.109	0.099
	(0.119)	(0.115)	(0.117)
(Regional GDP share)$_{t-1}$	0.108**	0.109**	0.122**
	(0.045)	(0.045)	(0.047)
log(LCC frequency)$_{t-1}$	-0.055***		-0.036**
	(0.017)		(0.015)
(LCC share)$_{t-1}$		-0.942***	-0.747***
		(0.302)	(0.273)
Country-Region fixed effect	Yes	Yes	Yes
Time fixed effect (season)	Yes	Yes	Yes
R^2	0.070	0.071	0.072
Observations	11520	11520	11520

Robust standard errors to heteroscedasticity and serial correlation in parenthesis, clustered by Year and European macro area of export destination.
Statistically significance at 1%, at 5% and at 10% respectively denoted by ***, ** and *.
log(FSC frequency) assumed endogenous, instrumented with past semester values of:
- log(LCC frequency) and Regional GDP share in Model (1);
- LCC share and Regional GDP share in Model (2);
- log(LCC frequency), LCC share and Regional GDP share in Model (3).