Journal of Urban Economics 66 (2009) 186–195

Contents lists available at ScienceDirect

Journal of Urban Economics

www.elsevier.com/locate/jue

Agglomeration and the export decisions of French firms

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ARTICLE INFO

Article history:
Received 11 July 2007
Revised 7 July 2009
Available online 17 July 2009

JEL classification:
F1
R12
L25

Keywords:
Export decision
Export market
Destination-specific spillovers

ABSTRACT

This paper asks whether export spillovers influence the export behavior of French manufacturers. I use a database containing export flows by firm and importing country between 1986 and 1992. The decision to start exporting to a particular country is estimated using a logit model, controlling for the specific characteristics of firms, locations, countries and years. The export spillovers identified are industry- and/or destination-specific, and are computed at a very disaggregated geographical level. The results indicate that the pool of local exporters positively affects the decision to start exporting to a country. These effects are clearly destination-specific, and are larger for firms that export to remote markets.

1. Introduction

Increasing exports by domestic firms often appears to be one of the priorities of policy makers, in both developed and developing countries. For instance, in December 2004, the French Foreign Trade minister argued that "Exports are a national cause for which the government is mobilized". He then announced a set of measures to be taken by the government in order to "consolidate the international presence of firms already exporting, and broaden the number of exporters (···)".

From the economic point of view, such interventions are justified in the case of market failures. One potentially important failure in the case of exports is positive export-agglomeration economies, or export spillovers: proximity to other exporters can benefit local firms and help them to start exporting to a given market. While the effect of exporters on neighboring firms' export performance is called *export spillovers* in the literature, the relationship captured in empirical work (including in the present paper) comprises more than just informal information-sharing between local firms.[1] Duranton and Puga (2004) distinguish sharing, matching and learning mechanisms in the microeconomic foundations of agglomeration economies. Proximity to other exporters can indirectly affect a firm's export behavior through the same mechanisms, via cost-sharing (transaction costs, and the cost of gathering information on export markets), or informal information transfers which lower the variable or fixed costs of exports.

Rosenthal and Strange (2004) distinguish the literature on the presence and scope of agglomeration economies from work specifically aimed at characterizing the source of urban increasing returns. The current paper appears in the first category: using individual export panel data by destination country and detailed data on the location of exporters, I evaluate the extent of export-agglomeration economies in French data.

Export spillovers have been analyzed in a number of recent papers. Aitken et al. (1997) find the probability that Mexican plants export in 1986 and 1989 to be positively linked to the presence of multinational firms in the same State, but uncorrelated with proximity to exporters in general. Greenaway et al. (2004) show that the presence of multinational firms in the UK positively influences the export decisions of domestic firms over the 1993–1996 period. Lovely et al. (2005) assume that exporting requires specialized knowledge of foreign markets, and that this type of information is more difficult to obtain when markets are less accessible. The degree of spatial concentration of exporters' headquarters is compared to that of non-exporters in the US in 2000. Export destinations are classified by the difficulty of the trading environment (in particular, the instability of the political climate). The results show that the geographic concentration of exporter headquarter activity relative to the domestic sector increases with the share of an industry's exports destined for countries with difficult trading environments. However, Barrios et al. (2003) find no

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[1] In the following, I will use the expressions "export-agglomeration economies" and "export spillovers", both of which refer to the overall impact of exporters' agglomeration on firm export performance.

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doi:10.1016/j.jue.2009.07.002

evidence that Spanish firms between 1990 and 1998 benefitted from either the export activity of other firms or the activity of multinationals. Equally, Bernard and Jensen (2004) find no role for export-agglomeration economies in a panel of US manufacturing firms, either from local exporters or from export activity by other firms in the same industry.

While the evidence thus appears mixed, the empirical literature has almost uniquely looked at export spillovers across all destinations: the underlying assumption is that the presence of other exporters affects the cost of exporting, and thus the export decision, for all destination countries. In this context, one natural question regarding export spillovers is: what if export spillovers are in fact destination-specific? It appears reasonable to imagine that the relevant information that allows a firm to start exporting somewhere be destination-specific. When looking for foreign markets in which to sell its product, a manufacturer will want to learn about consumer preferences and the structure of distribution markets abroad, both of which are destination-specific. Any cost-sharing effect related to exporter agglomeration is also likely to refer specifically to one importing country.

In this paper, I investigate the presence of export spillovers, allowing these effects to be general, industry-specific, or industry- and destination-specific. I use a database provided by the French Customs, containing individual export flows by French manufacturers and destination countries between 1986 and 1992. The Customs data are matched to firm-level information, such as the address of the firm, sales, value-added and the number of employees. I estimate a discrete-choice model of the probability that a firm start to export to a country. Issues relating to the identification of agglomeration economies, such as omitted variables and endogeneity, are addressed by the use of firm–country fixed effects and the inclusion of an appropriate country demand variable. I identify potential export spillovers via time variation in the right-hand side local spillovers variable, measured as the number of other exporters located in the same area as the firm in question. Agglomeration is likely to have both positive and negative effects on export behavior, which latter come from increasing congestion in export infrastructure or greater competition regarding the exported good. Our estimations will thus capture the net effect of all of these impacts of exporter agglomeration on export behavior.

The paper is structured as follows. In Section 2, I describe the theoretical foundations of the logit model of the decision to start exporting. Section 3 describes the data sources and the variables that will be used in the estimations. I also emphasize a number of important aspects of the database, including the number of firms that start to export by country. In Section 4, I set out the identification strategy, and describe the results of the logit estimations, explaining how the preferred specification is determined. Last, Section 5 concludes.

2. The empirical model

Consider a firm i facing the decision whether to export to country j. If it does decide to export, the firm will make an annual profit of Π_{ij}. However, if the firm has not exported to j before, it incurs a sunk cost of f_j to cover the cost of entering the market. Amongst firms that are observed to export to a given country in a given year, we will thus have both firms that are continuing exporters and firms which have just started to export to j; these correspond to firms that have already paid the sunk cost and those that now do so.

In the model, we will assume that spillovers act through the sunk export cost. In order to work on a homogenous set of firms, and for the coefficient on the spillovers not to be incorrectly estimated, the estimation thus needs to distinguish starters from continuers. Following Roberts and Tybout (1997), the empirical literature on export decisions in panel data has used lagged export status to identify firms that were already exporters the year before. However, as noted by Roberts and Tybout (1997) and Bernard and Jensen (2004), due to serial correlation, introducing lagged export status as a right-hand side variable creates an endogeneity issue due to the correlation of the lagged export status and the error term.

The approach chosen in this paper is to consider only firms that start to export to a given market. By doing so, I do not need to use the lagged export status variable which creates the endogeneity bias. This method also has the advantage that firms in the remaining sample are likely to have the same sensitivity to spillovers. I correct for the potential remaining serial correlation by using robust standard errors. Note that by concentrating on switchers (those that start to export), I imply that some movement must have occurred in the right-hand side agglomeration variable: either the firm has changed location or there has been a change in the number of exporting neighbors in the location.

We now model the firm's export behavior. Firm i starts to export to country j if the present value of the ensuing future profits is greater than the sunk entry cost f_j:

$$\sum_{t=0}^{+\infty} \frac{\Pi_t}{(1+r)^t} > f_{jt}, \tag{1}$$

which, assuming no uncertainty about future profits, can be written as

$$\frac{\Pi}{r} > f_{jt}. \tag{2}$$

The probability that a firm starts to export to country j is then:

$$Pr(S_{ijt} = 1) = Pr(\Pi_{ijt}/r > f_{jt}). \tag{3}$$

Eq. (3) contains two elements that we will now specify in more detail: the profit of the firm abroad and the sunk entry cost. The firm is assumed to trade within a Dixit–Stiglitz–Krugman monopolistic competition framework. Under the standard assumption of a CES utility function, the demand from country j for firm i's product is given by:

$$x_{ij} = \frac{p_{ij}^{-\sigma}}{P_j^{1-\sigma}} \mu_j Y_j, \tag{4}$$

with $P_j = \left[\int_l p_{lj}^{1-\sigma} dl\right]^{1/(1-\sigma)}$ being the local price index, σ the elasticity of substitution between goods, μ_j the share of expenditures devoted to the representative industry, and Y_j the income in j, which is equal to GDP.

The final price paid by consumers, p_{ij}, is the mill price set by the firm multiplied by the trade cost: $p_{ij} = p_{ij}\tau_j$. Trade costs are ad valorem and are assumed to be of the 'iceberg' type, i.e. a fraction of the good melts away during the journey. Trade costs are a function of the distance to the destination country: $\tau_j = d_j^{\delta}$. The price set by the firm results from the optimization of the following gross profit function: $\Pi_{ij} = p_i x_{ij} - a_i w_i x_{ij}$. The production costs for x_i units of the good are $a_i w_i$, where w_i is the nominal wage and a_i the number of units of labor used by the firm. Following Melitz (2003), firms are heterogeneous with respect to their productivity, with firm i having an inverse productivity level of a_i. With the mill price $p_i = \frac{\sigma}{\sigma-1} a_i w_i$, the gross annual profit of a firm on market j is given by

$$\Pi_{ij} = \left[\frac{a_i w_i \tau_j}{(\sigma-1)P_j^{1-\sigma}}\right]^{1-\sigma} \mu_j Y_j. \tag{5}$$

To complete the description of Eq. (3), we define the sunk entry cost as $f_j(z_{ij})$, where z_{ij} is a measure of local exporting activity, specific to the industry and/or the destination country. Hence, the

number of neighboring exporters, or the number of local employees who work in firms that already export to market j, is an index of the potential reduction in the sunk cost of entry for firm i into market j due to the presence of other exporters. Written in logs, Eq. (3) yields

$$Pr(S_{ijt} = 1) = Pr(\ln \Pi_{ijt} > \ln r + \ln f_{jt}(z_{ijt})), \tag{6}$$

with profit abroad and the sunk cost being written as

$$\ln \Pi_{ijt} = \beta_0 + \beta_1 \ln a_{it} + \beta_2 \ln w_{it} + \beta_3 \ln d_j + \beta_4 \ln \mu_j + \beta_5 \ln P_j + \beta_6 \ln Y_{jt} \tag{7}$$

$$\ln f_{jt}(z_{ijt}) = \gamma_0 + \gamma_1 \ln z_{ijt} + \varepsilon_{ijt}, \tag{8}$$

where ε_{ijt} includes the effects specific to firms, locations, countries, and years.

The probability of starting to export is then:

$$Pr(S_{ijt} = 1) = Pr(\beta_0 + \beta_1 \ln a_{it} + \beta_2 \ln w_{it} + \beta_3 \ln d_j + \beta_4 \ln \mu_j + \beta_5 \ln P_j + \beta_6 \ln Y_{jt} > \ln r + \gamma_0 + \gamma_1 \ln z_{ijt} + \varepsilon_{ijt}). \tag{9}$$

Rearranging this, we have:

$$Pr(S_{ijt} = 1) = Pr(\beta_0 - \gamma_0 - \ln r + \beta_1 \ln a_{it} + \beta_2 \ln w_{it} + \beta_3 \ln d_j + \beta_4 \ln \mu_j + \beta_5 \ln P_j + \beta_6 \ln Y_{jt} - \gamma_1 \ln z_{ijt} > \varepsilon_{ijt}) \tag{10}$$

Under the assumption that ε_{ijt} is distributed logistically, Eq. (10) can be estimated via a Logit model.

3. Data

I now describe the three main data sources and explain how the variables are constructed. I then illustrate some salient features of exporters and markets, in particular the number of firms that start to export per destination country.

3.1. Sources

The main data source is a database collected by the French Customs, comprising French export flows aggregated by firm, year and destination country. French firm-level export data has been available to researchers since the beginning of 2000, and was used for the first time by Eaton et al. (2004, 2008). The same firm-level export database is used in the current paper, for the period 1986–1992. The database provides exports by firm (through their identification number, *Siren*), year, and destination country. In order to obtain more information on firm performance and location, I match the information provided by the Customs to administrative data from the Annual Business Surveys (*Enquête Annuelle d'Entreprises*, EAE), collected by the French Ministry of Industry. These Annual Business Surveys contain firm- and establishment-level information on all firms with more than 20 employees in the manufacturing sector: their address, industry, sales, production, number of employees, and wages.

The sample of exporters in the final database is restricted in the following ways. First, the additional information on firms in the EAE only applies to firms with more than 20 employees. The final sample of exporters thus omits smaller firms. Second, the export data provides the identification number of the exporting firm, but does not specify the exact establishment from which the exports originate. This is a problem for the analysis of local spillovers, since the local agglomeration variable should apply to the exporting establishment. Two solutions are possible. The first is to drop all multi-establishment firms, and keep single-plant firms only. This is the choice made here. The second possibility is to retain all exporters, and to compute the spillover variable for the location of the exporter's headquarters. This second approach is used in the robustness checks.

The final restriction imposed on the customs database applies to its international dimension. Seventy-nine destinations are retained in the final database, corresponding to the countries for which imports data is available by country, industry and year in the Trade and Production database constructed by Nicita and Olarreaga (2006) at the World Bank.

3.2. The variables

The dependent variable S_{ijt} is a dummy variable indicating whether firm i starts to export to country j in year t. The alternative countries faced by each firm at each t are the 79 countries in the database. The values of S_{ijt} depend on the export status of the firm at $t-1$ and t: S_{ijt} equals one when the firm exports now but was not an exporter to that country the year before; it equals zero if the firm was not an exporter to that country in $t-1$ and does not start in t. The values of S_{ijt} corresponding to the cases where the firm continues to export, or stops exporting to a country, and to the year 1986 which is the first year of the database are dropped. Firms that appear for one year only over the sample period, whether they be exporters or not, are also dropped as we do not know whether they start to export.

The spillover variable refers to the other exporting firms which are located in the same geographical area as the firm facing the export decision. The presence of local exporters is taken into account in a number of different ways in the existing literature: the number of other local exporters (Bernard and Jensen, 2004; Henderson, 2003, regarding productivity spillovers), the number of employees working in local exporting firms (Henderson, 2003), or a monetary measure of export activity (Aitken et al., 1997; Bernard and Jensen, 2004). In the following, I present the results obtained using the number of exporting neighbors. This comprises all plants (from multi- and single-plant firms with more than 20 employees) in all industries, located in the given area, which export to the country in question. The headquarters of some of these plants may be located in different areas of France. A plant is then considered as exporting if it is part of an exporting firm. The spillover variable is expressed as a percentage of the total number of firms in the area. If the firm itself exports, it is dropped from the count of neighbors.

The spillover variables are computed at a fine geographical level called the employment area (*zone d'emploi*). Employment areas (henceforth areas) are defined by the French statistical institute (INSEE) using workers' commuting patterns, to obtain geographical areas comprising employees' work and residential locations. These areas form part of the largest French administrative area (the *Région*, of which there are 22 in France), and overlap with the second administrative level (the *Département*, of which there are 95 in France): there are 340 employment areas in mainland France.

A number of different spillover variables are considered. We first consider the number of plants, across industries, located in the same area which export to country j. Three other versions of the spillover variable are tested: destination- and industry-specific, industry-specific across destinations, and all industries-all destinations. The spillover variable is lagged one year and is written in logs as:

$$\ln\left(\frac{(1 + \#\text{ of exporting plants in the area, all industries-same destination}_{t-1})}{\text{Total }\#\text{ of plants in area}_{t-1}}\right)$$

The other explanatory variables in Eq. (10) are computed as follows. a_{it} is the firm's labor productivity, measured as value-added divided by the number of employees. I expect labor productivity to influence export behavior positively. The wage w_{it}, which is computed as total wages divided by the number of employees, was tested but does not appear in the final results: the relevant

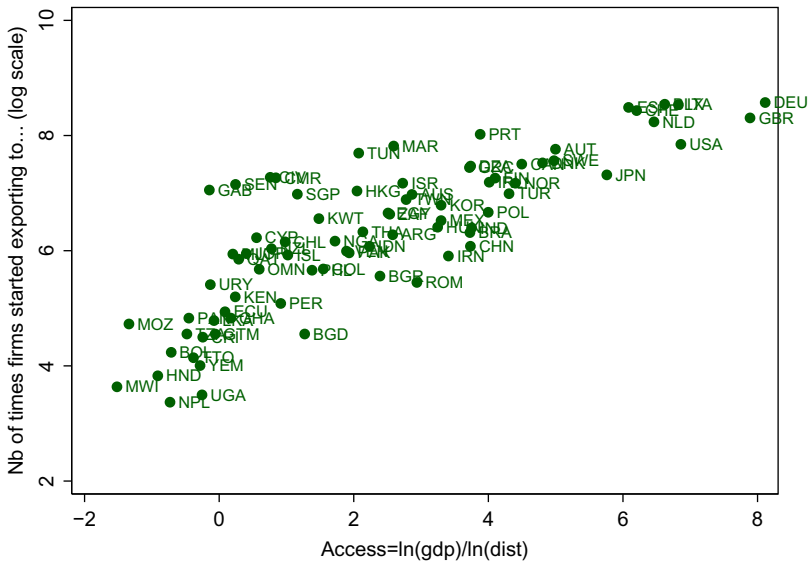

Fig. 1. Number of export starts to each country.

coefficient was mostly insignificant, and its introduction did not increase the explanatory power of the estimations. The size of the firm, e_{it}, is introduced as an additional proxy for productivity. This is measured by the number of employees, and is expected to have a positive impact on the decision to start exporting.

The distance d_j is calculated as that between France and the final destination, and is available from the CEPII's website.[2] Finally, imports Y_{kjt} are computed as the total imports, by industry and year, of each importing country. This data is from the Trade and Production database constructed by Nicita and Olarreaga (2006) at the 3-digit ISIC-rev two industry level, which were matched via a correspondance table to fit the French industry classification from 1986 to 1992.

The final database is an unbalanced panel of 14,008 French manufacturers which started to export at some point during 1987–1992.

3.3. Characteristics of exporters and markets

The 14,008 single-plant firms of the sample are found in 35 different manufacturing sectors. The average size of these firms is relatively small (88 employees) compared to those used in the literature: this is due to the restriction to single-plant firms. When considering industries by the number of times firms start to export to one of the countries in the sample, four industries stand out by their high level of 'starts': industrial equipment, metalwork, textiles and clothing.

Regarding the number of 'starts' by destination country, I follow Eaton et al. (2004) and express the volume of trade between France (F) and a foreign country j as $m_{Fj} = N_{Fj}\bar{x}_{Fj}$, with m_{Fj} being total exports from F to j, N_{Fj} the number of French exporters to j, and $\bar{x}_{Fj}$ average sales per firm in j. The gravity equation can then be written as:

$$N_{Fj}\bar{x}_{Fj} = \frac{Y_F Y_j}{d_{Fj}}, \tag{11}$$

Here Y_F and Y_j represent French supply capacity and foreign demand capacity, respectively, and d_{Fj} the geographical distance between France and country j. Holding Y_F and $\bar{x}_{Fj}$ constant, the number of firms that export to j is likely to vary with the foreign country's market access, broadly defined as its market size weighted by its distance from France. Fig. 1 illustrates this relationship, with both variables expressed in logs.[3] The number of export starts to each of the countries is plotted on the vertical axis, and market access appears on the horizontal axis. The number of 'starts' can be seen to increase systematically with market access. This accords with the theoretical predictions of new models of trade with heterogeneous firms, in the case of different country sizes (Melitz and Ottaviano, 2008).

A second feature is apparent from the countries that clearly lie above the main trend. Compared to other countries with similar market access, significantly more firms export to countries which are former French colonies: Senegal, the Ivory Coast, Mali, Tunisia and Morocco. The cost of entering these markets, which have kept close links to France, is likely to be lower than that for other destinations with similar market access. While spillovers are not visible at this level of data aggregation, this is consistent with destination-specific information being relevant for foreign-market entry.

Tables A-1 and A-2 describe further characteristics of the data according to the destination market. Countries are presented in decreasing order of the number of export starts received. In column 4 of these tables, the number of 'starts' rises with market access, as was already apparent in Fig. 1. Column 5 shows average labor productivity per employee: firms with lower average productivity export to the most-accessible countries, and the average productivity of firms that started to export to less-accessible countries is higher. This is consistent with the profitability of exports varying across destinations: countries with greater market access are more profitable, so that the marginal firm that exports to them will have lower productivity than the marginal exporter to a less-profitable destination. The last two columns show the destination-specific spillover variable: "Spillovers" corresponds to the share of local plants that export to the given country. The share of local exporters to larger or closer countries is higher than that to smaller or remoter countries.

4. Firm-level estimation

I first discuss the main estimation issues regarding export spillovers, and then present the results.

[2] http://www.cepii.fr.

[3] The data on GDP by country is obtained from the CHELEM database (CEPII).

4.1. The identification strategy

As emphasized by Rosenthal and Strange (2004), a number of important estimation issues have to be addressed in measuring agglomeration economies: omitted variables, endogeneity, and selection bias.

4.1.1. Omitted variables

Under export spillovers, we expect the local number of country-specific exporters to positively affect the decision to start exporting to a given country. To be sure of this causal interpretation, it is essential to control for all other variables that may produce the same positive relationship between local exporter agglomeration and the decision to start exporting.

First, the exogenous characteristics of locations such as first-nature advantages (natural advantages) and second-nature advantages (transport infrastructure) will attract firms, amongst which exporting firms. If they are not controlled for, the comparative advantages of areas might be misinterpreted as export spillovers. Area fixed effects can control for time-invariant local attributes. Our preferred specification uses firm–country fixed effects: the firm dimension controls for the characteristics of the area in which the firm is located, as we have explicitly dropped firms who, erroneously or otherwise, were listed as having changed location over the sample period.

Equally, any characteristics common to the area and the destination country, such as lower trade costs (shorter distances, historical and cultural links, a common language, etc.), are likely to affect the export-spillover coefficient, as they will produce both a greater number of local exporters to the country and more firms that start to export to that country. The relationship between areas and importing countries can be controlled for by area–country fixed effects, which are picked up in the firm–country fixed effects used in the preferred specification.

The firm–country fixed effects will also capture any firm heterogeneity. As a function of the product it makes, or managerial preferences, firms may start to export to a given country due to their unobserved characteristics. If these are time-invariant, they will be captured by the firm–country fixed effect. Even if these unobserved characteristics do vary over time, they will not affect the estimated coefficient on the spillover variable as long as they are orthogonal to other firms' export behavior.

Finally, demand shocks in the importing country, or destination- and industry-specific shocks that vary over time should be controlled for, as they could be confounded with the presence of agglomeration economies. A change in EU trade barriers regarding particular countries, for example, would boost the export activity of existing exporters, and also lead marginal firms to begin exporting to these countries. To control for industry-destination-time effects, I compute a country demand variable that varies over time and industry, using the Trade and Production database constructed by Nicita and Olarreaga (2006): the total imports by the country from the rest of the world, by industry and year.

Last, the country dimension of the firm–country fixed effects used in the preferred specification controls for any time-invariant characteristics of the countries. Assuming that P_j is constant over time, the price index in Eq. (10) measuring the degree of competition abroad is controlled for in the final estimation.

4.1.2. Endogeneity

In estimating the effect of firm-specific determinants and local export activity on the export decision, we need to control for the endogeneity of both the firm and the spillover variables. Reverse causality could bias the estimated coefficients, were firm size to be affected by the export decision, or were the export activity of other local exporters to depend on the export behavior of the firm under consideration. To address these endogeneity concerns, I lag all right-hand side variables one year.

4.1.3. Selection bias

As noted in the Data section, I consider a sample of single-plant exporters, as the Customs database does not indicate from which plant of multi-plant firms export flows originate. This choice does however raise a selection issue, which I address by re-running the same estimation on the whole sample of firms (both multi- and single-plant). In this latter case, spillovers are computed via the number of other exporters in the area where the firm's headquarters are located. The results shown in Table 3 indicate that the effect of local exporter agglomeration remains unchanged when using the whole sample of firms.

Table 1
Logit on the decision to start exporting to country *j*.

	(1)	(2)	(3)	(4)	(5)
ln (Productivity_*i*)	0.654[a]	0.855[a]	0.044[c]	0.052[b]	0.172[a]
	(0.026)	(0.029)	(0.025)	(0.026)	(0.024)
ln (Employment_*i*)	0.669[a]	0.676[a]	0.264[a]	0.266[a]	0.586[a]
	(0.017)	(0.016)	(0.033)	(0.033)	(0.033)
ln (Distance_*j*)	−0.302[a]	−0.305[a]	−0.338[a]	−0.834[a]	
	(0.007)	(0.006)	(0.006)	(0.015)	
ln (Imports_*kj*)	0.176[a]	0.184[a]	0.194[a]	0.239[a]	0.230[a]
	(0.005)	(0.005)	(0.005)	(0.008)	(0.019)
ln (Share of exporters in area, all ind – same dest)	0.856[a]	0.875[a]	1.410[a]	0.384[a]	0.356[a]
	(0.019)	(0.019)	(0.020)	(0.017)	(0.025)
Observations	5,776,140	5,776,140	4,332,820	4,332,820	216,643
Year dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	No	Yes	n/a	n/a	n/a
Firm FE	No	No	Yes	Yes	n/a
Country dummy	No	No	No	Yes	n/a
Firm–country FE	No	No	No	No	Yes

Robust standard errors in parentheses. All right-hand side variables are lagged one year.
Productivity_*i* and Employment_*i* are, respectively, labor productivity and the number of employees in firm *i*.
Distance_*j* is the distance from France to the destination country. Imports_*kj* are the total imports in industry *k* by country j.
[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.1$.

Table 2
Logit on the decision to start exporting to country *j*, with different spillovers.

	(1)	(2)	(3)	(4)
ln (Productivity_*i*)	0.172[a]	0.171[a]	0.169[a]	0.172[a]
	(0.024)	(0.024)	(0.024)	(0.024)
ln (Employment_*i*)	0.586[a]	0.585[a]	0.582[a]	0.585[a]
	(0.033)	(0.033)	(0.033)	(0.033)
ln (Imports_*kj*)	0.230[a]	0.251[a]	0.257[a]	0.239[a]
	(0.019)	(0.019)	(0.020)	(0.019)
ln (Share of exporters in area, all ind – same dest)	0.356[a]			
	(0.025)			
ln (Share of exporters in area, all ind – all dest)		0.068		
		(0.124)		
ln (Share of exporters in area, same ind – all dest)			−0.007	
			(0.026)	
ln (Share of exporters in area, same ind – same dest)				0.140[a]
				(0.018)
Observations	216,643	216,643	216,244	216,643
	Firm–country FE, year dummies			

Robust standard errors in parentheses. All right-hand side variables are lagged one year.
Productivity_*i* and Employment_*i* are, respectively, labor productivity and the number of employees in firm *i*.
Imports_*kj* are the total imports in industry *k* by country *j*.
[a] $p < 0.01$.
[b] $p < 0.1$.
[c] $p < 0.05$.

4.2. Results

The identification strategy for export-agglomeration economies is illustrated in Table 1, which contains five columns. From left to right, the columns present estimations including an increasing number of controls for locations, firms, country-specific and country and industry-specific effects. Column 1 is the baseline estimation with controls only for year dummies (as well as the firm-level observables), to which column 2 adds industry dummies. Column 3 includes firm fixed effects and year dummies. The model in column 4 adds export-destination dummies to column 3, and thus controls for time-invariant characteristics of destinations. The demand variable in all columns varies by industry, destination country and year, and controls for industry-specific demand shocks in the spillover coefficient. Finally, column 5 is the preferred specification which I use in the remaining estimations. The identification of a change over time in the export status of a firm arises from movements in the spillover variable due to either firm relocation or a change over time in spillovers within an area. As the database is restricted to firms that do not change location, identification results from variation in spillovers over time within an area.

The estimated coefficients in Table 1 have the expected signs. Firm-level productivity and employment positively affect the export decision, as does destination-country demand. The results in which we are most interested appear in the last row: the spillover coefficient is positive in all of these specifications. The presence of firms in the same area that export to a given country, whatever their industry, positively affects the firm's decision to start exporting to that country.

Table 2 is complementary to Table 1 and provides more detail on the nature of spillovers, using the preferred specification from Table 1. It is useful to compare the effect of the different spillover variables: the most general measure comprising all exporting firms across destinations and industries has no effect on the probability of starting to export. Hence, all else equal, having more exporting firms in the same location in general has no effect on the firm's decision to start exporting to a specific country. Equally, the presence of only industry-specific local exporters, whatever the country, does not matter for export decisions.

The results in Table 2 are important in two respects. First, they provide essential information on the nature of spillovers: they in

Table 3
Logit on the decision to start exporting to country *j*, robustness checks.

	(1)	(2)	(3)	(4)	(5)	(6)
ln (Productivity_*i*)	0.172[a]	0.172[a]	0.171[a]	0.146[a]	0.171[a]	0.171[a]
	(0.024)	(0.024)	(0.024)	(0.019)	(0.024)	(0. 024)
ln (Employment_*i*)	0.583[a]	0.585[a]	0.583[a]	0.599[a]	0.584[a]	0.583[a]
	(0.033)	(0.033)	(0.033)	(0.025)	(0.033)	(0. 033)
ln (Imports_*kj*)	0.248[a]	0.248[a]	0.230[a]	0.214[a]	0.226[a]	0.227[a]
	(0.019)	(0.019)	(0.019)	(0.015)	(0.019)	(0. 019)
ln (Exporting employment in area, all ind – same dest)	0.096[a]					
	(0.009)					
ln (Share of exp. employment in area, all ind – same dest)		0.093[a]				
		(0.009)				
ln (Number of exporters in area, all ind – same dest)			0.358[a]			
			(0.025)			
ln (Share of exporters in area, all ind – same dest)				0.392[a]	0.272[a]	0.261[a]
				(0.020)	(0.020)	(0.021)
ln (Share of exporters in area, all ind – same dest) ∗ ln (export intensity)						−0.004[c]
						(0.002)
Observations	216,643	216,643	216,643	335,456	216,599	216,599
	Firm–country FE, year dummies					

Robust standard errors in parentheses. All right-hand side variables are lagged one year.
Columns 1 and 2: employment spillover variable.
Column 3: spillover variable in levels.
Column 4: all firms (multi- and single-plant firms).
Columns 5 and 6: all firms (multi- and single-plant firms), only headquarters used to compute spillovers.
[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.1$.

Table 4
Logit on the decision to start exporting to country *j*, by group of countries I.

	(1) Border	(2) EEA non-border	(3) EEA	(4) CEEC	(5) Africa
ln (Productivity_*i*)	0.246[a]	0.197[a]	0.228[a]	0.287[c]	0.124[b]
	(0.049)	(0.049)	(0.035)	(0.170)	(0.060)
ln (Employment_*i*)	0.664[a]	0.620[a]	0.643[a]	0.611[b]	0.369[a]
	(0.063)	(0.068)	(0.047)	(0.237)	(0.081)
ln (Imports_*kj*)	0.277[a]	0.354[a]	0.331[a]	0.157[b]	0.251[a]
	(0.056)	(0.056)	(0.040)	(0.074)	(0.043)
ln (Share of exporters in area, all ind – same dest)	0.311[a]	0.120	0.214[a]	0.176	0.411[a]
	(0.119)	(0.085)	(0.073)	(0.140)	(0.033)
Observations	63,365	50,339	111,314	5873	36,407
	Firm–country FE, year dummies				

Robust standard errors in parentheses. All right-hand side variables are lagged one year.
Productivity_*i* and Employment_*i* are, respectively, labor productivity and the number of employees in firm *i*.
Imports_*kj* are the total imports in industry *k* by country *j*.
[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.1$.

particular show that export-agglomeration economies are destination-specific, in the sense that the benefits newly-exporting firms can draw from neighboring exporters are likely linked to the characteristics of the foreign market. Second, the net effect from the presence of other exporters is either null or positive, but never negative. Competition between firms and congestion in the use of export infrastructure appear to be nullified or even outweighed by the advantages of sharing information and costs.

Table 3 presents some robustness checks of our preferred specification's results. The first two columns show the results when the spillover variable is computed using exporting employment in the same area. As is typically the case in our analysis, the spillover variable is calculated using all plants (from both multi- and single-plant firms with more than 20 employees) located in the same employment area, in all industries, which export to the given country. A plant is tagged as being an exporter if it is part of an exporting firm. Column 1 shows the results for this variable in levels, and column 2 for this variable as a percentage of total employment in the area that exports to the given country. Export-agglomeration economies are found when the spillover variable is computed in number of employees: the estimated coefficient is positive and significant. Column 3 contains the preferred specification estimated with the spillover variable in levels: the number of neighboring plants, in all industries, exporting to the same country in the same area. The difference between the coefficients on the variable in levels and as a percentage is small, as the size of the area and other time-invariant area characteristics are picked up by the firm-level fixed effect (the sample only contains firms which did not change location over the period).

In column 4 I investigate whether the restriction of the sample to single-plant exporters affects the results: the preferred specification is re-estimated using the whole sample of firms. As the Customs database does not indicate from which of the firm's plants the exports originate, we assume that export-agglomeration economies, if they exist, will apply around the firm's headquarters. The spillover variable is hence the number of exporting neighbors (expressed as a percentage) in the area where the firm's headquarters are located. As can be seen in the table, the results remain unchanged when the whole sample is used, and the estimated coefficient remains positive and significant. Column 5 further checks for selection bias by changing the sample of firms. Here the exporters are all of the firms in the sample (multi- and single-plant firms), as in column 4. The spillover variable here is calculated using only plants which are headquarters. The idea here is to see whether only the number of headquarters matters for export-agglomeration economies: it

Table 5
Logit on the decision to start exporting to country *j*, by group of countries II.

	(1) South America	(2) North America	(3) Middle East	(4) Asia	(5) Oceania
ln (Productivity_*i*)	0.096	0.024	0.307[a]	0.044	0.033
	(0.103)	(0.102)	(0.118)	(0.071)	(0.155)
ln (Employment_*i*)	0.628[a]	0.715[a]	0.615[a]	0.528[a]	0.483[b]
	(0.143)	(0.143)	(0.148)	(0.107)	(0.244)
ln (Imports_*kj*)	0.148[b]	0.011	−0.007	0.186[a]	0.015
	(0.094)	(0.070)	(0.048)	(0.060)	(0.274)
ln (Share of exporters in area, all ind – same dest)	0.143[c]	0.513[b]	0.459[a]	0.121	0.251
	(0.094)	(0.213)	(0.089)	(0.085)	(0.224)
Observations	11,306	10,539	9422	22,628	3772
	Firm–country FE, year dummies				

Robust standard errors in parentheses. All right-hand side variables are lagged one year.
Productivity_*i* and Employment_*i* are, respectively, labor productivity and the number of employees in firm *i*.
Imports_*kj* are the total imports in industry *k* by country *j*.
[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.1$.

Table 6
Increase in the probability of starting to export due to a one SD increase in the destination-specific spillover variable.

Countries	Border	EEA non-border	EEA	CEEC	Africa
β	0.311	n/s	0.214	n/s	0.411
$cv(z)$	0.061	n/a	0.079	n/a	0.192
$(1+cv(z))^{\beta}$	1.048	n/a	1.0165	n/a	1.074
Countries	South America	North America	Middle East	Asia	Oceania
β	0.143	0.513	0.459	n/s	n/s
$cv(z)$	0.206	0.938	0.202		
$(1+cv(z))^{\beta}$	1.027	1.047	1.088	n/a	n/a

β is the coefficient on the spillover variable in Tables 4 and 5; $cv(z)$ is the coefficient of variation of the spillover variable; $(1+cv(z))^{\beta}$ is the increase in the probability of starting to export due to a one standard-deviation increase in the spillover variable.

could be that these embody valuable information and may be able to take important decisions that non-headquarters plants are not able to take. Headquarters do seem to play a role in export spillovers. The results in the last column come from the same firms as in column 5, and check to see whether the export intensity of the area changes the impact of the number of exporting neighbors. Export intensity is measured as the total volume of exports by firms in the area to the given country. The coefficient on the interaction between spillovers and export volume is negative and significant at the 5% level. However, the introduction of this interaction leaves the coefficient on the main spillover variable almost unchanged. Hence, for a given number of exporting neighbors, the fact that they export more does not help firms that are making export decisions; the effect is actually negative, which might reflect greater competition on the export market.

How large is the effect of spillovers on the export probability? The coefficients in the preferred specification can be linked to the elasticity of the probability of starting to export with respect to the number of local exporting firms, η. If $\hat{\beta}$ is the estimated coefficient and Pr the probability to start exporting to country j, then $\eta = \hat{\beta}(1-Pr)$. In this case, the average Pr is 0.2743, which gives a probability elasticity of 0.2583 for destination-specific and 0.1016 for destination- and

Table A-1
Descriptive statistics: countries 1–40 sorted by number of export 'starts' received.

Country	Code	Nb obs	Nb start	Avg pty	Access	Spillovers	
						Mean	SD/mean
Germany	DEU	50,189	5273	91.3	8.1	0.51	0.19
Belgium–Lux	BLX	45,698	5140	91.9	6.6	0.56	0.18
Italy	ITA	57,386	5089	93.6	6.8	0.44	0.22
Spain	ESP	60,819	4864	96.4	6.1	0.39	0.24
Switzerland	CHE	53,846	4598	95.6	6.2	0.47	0.23
United Kingdom	GBR	58,958	4045	94.8	7.9	0.42	0.21
Netherlands	NLD	62,010	3779	97.9	6.5	0.38	0.23
Portugal	PRT	68,677	3038	99.2	3.9	0.28	0.29
USA	USA	66,097	2557	101.4	6.9	0.32	0.28
Morocco	MAR	69,558	2478	102.3	2.6	0.27	0.33
Austria	AUT	69,170	2354	102.0	5.0	0.27	0.28
Tunisia	TUN	71,117	2197	103.4	2.1	0.24	0.35
Sweden	SWE	69,833	1930	102.5	5.0	0.26	0.29
Denmark	DNK	70,640	1852	102.9	4.8	0.24	0.30
Canada	CAN	70,592	1810	103.2	4.5	0.23	0.31
Algeria	DZA	72,370	1754	105.3	3.7	0.21	0.40
Greece	GRC	71,660	1710	102.7	3.7	0.23	0.33
Japan	JPN	71,870	1506	103.4	5.8	0.20	0.34
Ivory Coast	CIV	72,439	1443	105.5	0.8	0.22	0.40
Cameroon	CMR	72,609	1429	105.2	0.8	0.21	0.40
Finland	FIN	72,308	1423	103.9	4.1	0.21	0.32
Ireland	IRL	73,672	1328	103.5	4.0	0.17	0.32
Israel	ISR	73,225	1304	104.6	2.7	0.17	0.37
Norway	NOR	72,813	1302	104.7	4.4	0.20	0.33
Senegal	SEN	73,451	1274	106.0	0.2	0.19	0.42
Gabon	GAB	73,411	1156	105.8	−0.1	0.20	0.41
Hong Kong	HKG	73,810	1139	103.4	2.0	0.17	0.38
Turkey	TUR	74,873	1084	105.1	4.3	0.14	0.42
Singapore	SGP	74,504	1075	105.4	1.2	0.16	0.41
Australia	AUS	73,686	1069	105.0	2.9	0.18	0.36
Taiwan	TWN	74,953	981	104.6	2.8	0.13	0.43
Korea	KOR	75,199	888	105.3	3.3	0.13	0.43
Poland	POL	75,848	786	105.8	4.0	0.10	0.50
Egypt	EGY	75,357	778	106.3	2.5	0.14	0.46
South Africa	ZAF	76,308	760	106.4	2.5	0.05	1.35
Kuwait	KWT	75,700	704	106.3	1.5	0.12	0.46
Mexico	MEX	75,877	680	106.0	3.3	0.10	0.46
Hungary	HUN	75,942	608	105.9	3.2	0.11	0.43
India	IND	75,385	599	105.9	3.8	0.12	0.46
Thailand	THA	75,943	560	105.7	2.1	0.12	0.44

Note: The table reports average figures for the 1987–1992 period. "Spillovers" is the share of plants in the area (all industries) that export to the country. "Access" is $ln(gdp)/ln(dist)$. "Avg pty" is the average labor productivity of exporters.

Table A-2
Descriptive statistics: countries 41–79 sorted by number of 'starts' received.

Country	Code	Nb obs	Nb start	Avg pty	Access	Spillovers	
						Mean	SD/mean
Brazil	BRA	75,903	553	106.4	3.7	0.11	0.47
Argentina	ARG	76,143	532	106.6	2.6	0.10	0.47
Cyprus	CYP	75,944	505	106.3	0.6	0.12	0.41
Nigeria	NGA	76,356	477	106.6	1.7	0.10	0.51
Chile	CHL	76,134	470	106.6	1.0	0.11	0.45
Indonesia	IDN	76,396	436	106.6	2.2	0.10	0.50
China	CHN	76,412	435	106.3	3.7	0.09	0.53
New Zealand	NZL	75,992	418	106.5	0.8	0.10	0.44
Venezuela	VEN	76,399	401	106.7	1.9	0.09	0.48
Pakistan	PAK	76,355	389	106.2	1.9	0.08	0.50
Jordan	JOR	76,361	384	106.7	0.4	0.10	0.48
Malta	MLT	76,472	380	106.9	0.2	0.08	0.44
Iceland	ISL	76,315	373	106.7	1.0	0.08	0.43
Iran	IRN	76,769	367	106.9	3.4	0.06	0.56
Qatar	QAT	76,420	348	106.8	0.3	0.08	0.50
Colombia	COL	76,523	294	106.6	1.5	0.09	0.46
Oman	OMN	76,686	293	107.0	0.6	0.07	0.50
Philippines	PHL	76,600	288	106.4	1.4	0.06	0.53
Bulgaria	BGR	76,658	259	106.7	2.4	0.07	0.53
Romania	ROM	76,896	233	107.1	2.9	0.06	0.57
Uruguay	URY	76,723	224	107.0	−0.1	0.07	0.53
Kenya	KEN	76,841	181	107.0	0.2	0.08	0.53
Peru	PER	76,813	161	107.1	0.9	0.06	0.55
Ecuador	ECU	76,929	140	107.2	0.1	0.05	0.57
Panama	PAN	76,931	125	107.1	−0.4	0.04	0.59
Ghana	GHA	77,078	125	107.4	0.2	0.04	0.61
Sri Lanka	LKA	77,021	120	107.0	−0.1	0.05	0.56
Mozambique	MOZ	77,087	113	107.2	−1.3	0.04	0.58
Tanzania	TZA	77,094	95	107.3	−0.5	0.03	0.64
Guatemala	GTM	77,064	95	107.3	−0.1	0.03	0.59
Bangladesh	BGD	77,066	95	107.3	1.3	0.04	0.57
Costa Rica	CRI	77,058	90	107.3	−0.2	0.05	0.53
Bolivia	BOL	77,144	69	107.3	−0.7	0.03	0.63
Trinidad and Tobago	TTO	77,118	63	107.3	−0.4	0.03	0.64
Yemen	YEM	77,207	55	107.4	−0.3	0.01	1.28
Honduras	HND	77,141	46	107.4	−0.9	0.03	0.67
Malawi	MWI	77,191	38	107.3	−1.5	0.03	0.61
Uganda	UGA	77,181	33	107.3	−0.3	0.03	0.62
Nepal	NPL	77,191	29	107.4	−0.7	0.02	0.85

Note: The table reports average figures for the 1987–1992 period. "Spillovers" is the share of plants in the area (all industries) that export to the country. "Access" is $ln(gdp)/ln(dist)$. "Avg pty" is the average labor productivity of exporters.

industry-specific neighboring exporters. A 1% increase in the share of firms exporting to country j increases the probability of starting to export to that country by 0.26%.

Another way of interpreting the coefficients consists in taking into account not the percentage variation, but rather the actual variation in the explanatory variable, by computing the effect of a one standard-deviation increase in the spillover variable on the probability of starting to export. Consider an area with the mean level of the spillover variable (destination-specific exporting firms), and denote the associated probability of starting to export as $\overline{P}$. A one standard-deviation rise in the spillover variable changes this probability to $\overline{P'}$, where:

$$\frac{\overline{P'}}{\overline{P}} = exp(\beta[ln(\bar{z} + stdev(z)) - ln(\bar{z})]) = (1 + cv(z))^{\beta},$$

where $cv(z) = stdev(z)/mean(z)$ is the coefficient of variation of the spillover variable. The coefficient of variation of the share of local firms exporting to a specific country is 0.143 for the estimation sample, which yields 1.0487 for the ratio of the probabilities. Thus, a one standard-deviation increase in the share of local exporters increases the probability of starting to export by 4.9%.

The next step in assessing export spillovers is to see whether they vary with a measure of market accessibility. Are there more spillovers in certain regions? In Tables 4 and 5, countries are sorted in groups according to an (imperfect) measure of their accessibility.[4] We then evaluate the effect of export spillovers via the two methods described above.

The effect of a 1% increase in the share of local exporters generates an increase in the probability of starting to export to the country which ranges from 0.15% to 0.33% for the groups of countries with significant estimated coefficients. Three regions produce larger spillover elasticities: Africa, North America, and the Middle East. Table 6 shows the effects of a one standard-deviation increase in the spillover variable. The coefficient of variation ranges between 0.06 for Border countries and 0.938 for North America. A one standard-deviation increase in the share of local firms exporting to one of the border countries thus increases the probability of starting to export to this country by almost 5%. The figures range between 1.7% for countries in the European Economic Area to

[4] EEA border countries = Belgium and Luxembourg, Germany, Italy, Spain, Switzerland, and the United Kingdom, Non-border EEA countries = Netherlands, Ireland, Denmark, Greece, Portugal, Iceland, Norway, Sweden, Finland, Austria, Malta, and Cyprus, Africa = Morocco, Algeria, Tunisia, Egypt, Senegal, Ivory Coast, Ghana, Nigeria, Cameroon, Gabon, Kenya, Uganda, Tanzania, Mozambique, Malawi, and South Africa, South America = Mexico, Guatemala, Honduras, Costa Rica, Panama, Trinidad and Tobago, Colombia, Venezuela, Ecuador, Peru, Brazil, Chile, Bolivia, Uruguay, and Argentina, North America = USA and Canada, CEEC = Poland, Hungary, Romania, and Bulgaria, Middle East = Turkey, Iran, Israel, Jordan, Kuwait, Qatar, Oman, and Yemen, Asia = Pakistan, India, Bangladesh, Sri Lanka, Nepal, Thailand, Indonesia, Singapore, the Philippines, China, Korea, Japan, Taiwan, and Hong Kong, Oceania = Australia and New Zealand.

8.8% for countries in the Middle East. A form of ordering does appear, showing a larger presence of export spillovers for remote countries. The Middle East and Africa are among the groups of countries which exhibit the highest computed coefficient.

5. Conclusions

This paper builds on existing empirical literature that has analyzed the broad question of export spillovers. I investigate the impact of proximity to other exporters on the export behavior of individual French manufacturers. This paper differs from the previous literature in two respects. First, export spillovers are identified via time variation within firm–country pairs, controlling for omitted variables and endogeneity, and spillovers are considered as either general, industry-specific, or industry- and destination-specific. Second, spillovers are computed at a very disaggregated geographical level, which is consistent with the empirical evidence on the local nature of spillovers. The results show distinct evidence of export-agglomeration economies. Local exporters positively influence the probability of starting to export to a given country. These effects are clearly destination-specific, and are weaker when we use more general spillover variables at the industry or exporting-country level. Last, country-specific export spillovers tend to be more important for firms that export to remoter markets.

Acknowledgments

I thank Andrew Clark, Keith Head, Francis Kramarz, Megan MacGarvie, Jacques Melitz, and two anonymous referees for very helpful comments and suggestions. I also thank Philippe Lagarde for helping me to access the data. This paper was written while I was at CREST.

Appendix

See Tables A-1 and A-2.

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