Does the Type of Neighbor Matter?: Evidence of heterogeneous Export Spillovers on Domestic Companies in Mexico

Cardoso-Vargas, Carlos-Enrique

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Carlos Enrique Cardoso-Vargas*

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This document examines whether the agglomeration of foreign processing firms (PCS) assembling imported inputs to make export products favors the incorporation to the export activity or market expansion of domestic companies. Similarly this situation is evaluated by considering ordinary foreign firms (ORD) or not manufactured processed products and non-local hybrid companies (HBR) that act in both regimes of commerce. The theoretical framework guiding the empirical evaluation is based on a simple model inspired by Melitz (2003), which is evaluated by means of a conditional logit model with panel data. The findings show evidence that the concentration of these types of foreign companies increases the probability that domestic companies show a presence in certain markets. Notwithstanding, these export spillovers widely heterogeneous in virtue of the fact that their existence and sphere of influence are associated with their specificity in terms of country or product, as well as with the regime of commerce and the technological capacity used by domestic companies vis-à-vis neighboring foreign companies.

Palabras clave: international trade, agglomeration externalities, company homogeneity

JEL Classification: JEL: F14, F13, F21

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I. Introduction

As a result of the economic process of globalization, various countries, principally underdeveloped ones, boosted their participation in international trade, permitting the location of foreign firms operating under a regime of trade processing goods, that is to say, assembling or transforming imported input to make export products. These processing firms (PCS) usually have obtained benefits from exemptions in paying customs duties and from tax incentives. The economic justification on the part of governments for permitting the establishment of this type of company has been mainly based on the job creation, technology transfer, attracting foreign investment and obtaining foreign currency.

Over the past decade, the importance of trade in processed goods increased in the economies of quite a few nations. In Southeast Asian countries,[1] between 2000 and 2003, PCS firms generated close to 36 million sources of jobs and, in some cases, sales abroad of processed products represented 50% of total exports. During the same period, in Mexico and Central America, these firms employed approximately 2 million workers (Singa, 2003). Moreover, between 2005 and 2006, this activity in Southeast Asian countries provided jobs for almost 57 million people. In the region of Mexico and Central America, that figure doubled, totaling 5 million workers. In some countries such as Malaysia, Macao (China) and Vietnam, exports of processed products came to represent 80% of total exports (Singa, 2007).

Despite the great importance taken on by the presence of foreign firms elaborating processed product around the world, there are few studies[2] evaluating whether their presence entails benefits to domestic companies entering international markets due to export spillovers, which is precisely of interest for a variety of reasons.

The first has to do with the heterogeneous effect that might be generated in domestic industry by the presence of foreign firms as a function of the knowledge they have of other countries deriving from their export strategy and from their interaction with domestic firms.

[1] Singapore, Korea, China, Indonesia, Malaysia, Philippines, Thailand, Cambodia, Japan, Mongolia and Vietnam.

[2] Frequently, the greatest limiting faction is the lack of or no access to detailed information identifying the regime by which companies export, a necessary quality for carrying out this type of study. In the case of Mexico, the information from its customs authorities allows one to recognize those firms involved abroad with processed products and those with ordinary (non-processed) ones. This also provides the possibility of identifying the companies selling both types of products abroad.

For example, foreign PCS firms, by being part of a worldwide production/distribution chain, may have more concentrated sales in certain products and markets (Fernandes and Tang, 2015). In addition, their strong links forward and backward with other countries would presuppose little contact with local industry. In contrast, foreign exporting firms that do not manufacture processed products or that act under a regimen of ordinary trade (ORD) prove to be more diversified in terms of products and destinations abroad, due to not having such strong ties to purchasing input from abroad or restrictions in selling their products on local marketplaces; it is expected they show a closer connection to domestic companies.

In the great majority of studies that look into the presence of export spillover coming from foreign firms, they have concentrated on ORD firms and the few that have dealt with the case of PCS firms report inconclusive evidence, since findings head off in two different directions: those without solid statistical support (Mayneris and Poncet, 2013) and those with evidence in favor (Fu, 2011).

In addition, the issue is important because of its implications for economic policy. Thus, if the presence of firms operating a PCS regime, besides generating jobs, spurs the incorporation and expansion of export markets for domestic companies, it would be desirable to attract this type of company. In contrast, if we see there is competition with regard to local firms, this would generate a trade-off between the goals of creating jobs and the internationalization of domestic firms.

Mexico represents an interesting case, in virtue of having, for more than three decades, established foreign firms that export PCS products operating under the programs known as *maquiladora* exports and the Temporary Import Programs to Produce Export Articles (PITEX), providing domestic companies or those setting up within its territory, the ease to buy inputs abroad to elaborate export products, with the same customs-tariff exemptions and tax benefits contemplated in the maquiladora program.[3] This shows that exporting PCS products is widely spread through the Mexican economy.[4] Moreover, the information from customs records in Mexico allows us to identify, both firms exporting ORD or PCS products, as well as hybrid firms (HBR) selling abroad both processed and non-processed products, adding another hereto unexplored dimension to the literature.

In this study, we investigate whether the agglomeration of foreign firms with a different trade profile abroad propitiates the incorporation of domestic firms into export activities or

[3] The maquiladora program began operations in 1965 and the PITEX program in 1985. At the end of 2006, the Mexican government published a decree by means of which both programs merged into a single promotional plan called Program of the Maquiladora Export Manufacturing Industry (IMMEX). Although in the beginning the maquiladora programs and PITEX showed substantial differences, over time, such difference diminished, so that their combination into a single program turned out to be desirable.

[4] According to Sargent and Matthew (2008), exports of processed products represent a major percentage of manufactured exports in Mexico.

extends their destination markets. Specifically, we examine whether the presence of foreign PCS, ORD or HBR firms increases the probability that domestic firms start exporting or expanding destination markets to sell their products. The theoretical framework underlying the empirical evaluation is based on a simple model inspired by Melitz (2003), where the fixed costs of exporting to a specific destination are reduced because of the concentration of other firms also selling to that same market. The idea is that domestic firms can lower fixed costs when entering export markets through positive externalities known as *export spillovers*, which have their origin in agglomeration economies [5] generated by other exporting companies operating nearby.

This evaluation contributes to the literature on the topic in a variety of ways. First, it examines different hypotheses so as to show the relevance of making a distinction between non-local companies operating in different trade regimes due to the heterogeneity of spillover effects that they generate on domestic companies. This covers an existing vacuum existing in present-day research. Second, the data used in this study goes beyond that of other studies, adding thereto the analysis of foreign HBR companies sharing characteristics with ORD and PCS firms. Finally, it is the first document in the literature that deals with the presence of spillovers emanating from different non-local companies considering both the regime of commerce under which they export and the technological intensity of the products elaborated by domestic companies.

To deal with these issues, we use a panel of companies created by merging information from a sampling of domestic manufacturing companies in Mexico and from detailed figures from commercial export operations recorded by customs agencies. This information has the advantage of identifying the level of the product and the destination of the sales made by domestic firms, as well as controlling, in the estimates, those individual characteristics related to their entry into the export marketplace. Likewise, by merging customs data with a national directory of manufacturing companies, it allows us to construct agglomeration variables at a finely-detailed geographical level, such as the municipal level.

Estimates show not only the existence of export spillovers from foreign companies on their domestic counterparts, as was already posited by Aitken et al. (1997) for the case of Mexico, but their presence emerges heterogeneously and their influence turns out to be closely related to the type of export plan and the level of technological intensity used by domestic companies. Therefore, the findings show that export spillovers from foreign PCS firms are destination-specific and are found only in ORD and HBR domestic firms with medium and high technological intensity, respectively. In turn, foreign ORD firms exhibit specific spillover relative to product-country. Their influence is only perceived in domestic

[5] Agglomeration economies may be the result of a learning process from neighboring firms (effect-demonstration), of the mobility of skilled labor, or of backward and forward linkage among companies.

ORD firms with low technological performance. Finally, it has been found that the presence of non-local HBR firms increases the foreign-marketplace participation of domestic HBR firms, specifically those with a high technological level. Insofar as the contribution of spillovers on the possibility of domestic firms exporting to markets other than the U.S. is concerned, only in the case of foreign ORD firms was there evidence of this possibility.

The document is structured into various sections. At the end of the introductory section, Section II describes the pertinent literature. Section III explains the model posited and derives the algebraic expression for empirical evaluation. Section IV explains the empirical approximation of the variables for the model and the statistical technique being used. Sections V and VI deal with the origins of the data and findings from the empirical evaluation of the model's hypotheses, respectively. Finally, Section VII states the conclusions.

II. Related Literature

Generally speaking, the hypothesis on the existence of export spillovers posits that they occur when the economic activity of certain firms, usually those with knowledge of international markets, reduces the fixed costs involve in non-exporting firms starting to export. The rationality behind this is that companies beginning their export activity face high fixed entry costs[6] (Bernard and Jesen, 2004; Melitz, 2003; Wagner, 2007) which, by interacting with firms with ties abroad, may be reduced, thereby increasing the likelihood of exporting.[7]

The literature mentions various channels by means of which said costs can be reduced by the interaction between firms. One of those refers to the externalities of information generated by companies with experience on the international marketplace in favor of non-exporting firms,[8] allowing the latter can get their hands on key information regarding logistics, marketing, distribution costs, market structure, regulations and consumer likes and dislikes in foreign markets, etc. Other channels in which export spillovers may occur are in the competition between firms and/or the existence of demonstration/imitation

[6] These costs may include marketing and distribution channels, complying with regulations, market research, information on the likes and preferences of consumers in foreign markets (Kneller and Pisu, 2007).

[7] Following a network-theory focus, Krautheim (2009) finds that the exchange of information between firms selling on the same marketplace reduces the individual fixed costs associated with exporting and increases the probability of exporting.

[8] The exchange of information can take place with the existence of commercial links between companies through intra-industrial (horizontal) or inter-industrial (vertical) contact, the latter taking place through linkage forward or backward (client-provider relations). Other conduits for transmitting information between companies include labor mobility and geographical proximity.

effects.[9] At present, research related to the topic of export spillovers is not very extensive in comparison with that examining this phenomenon related to the topic of productivity.[10] However, among the studies published, there are differences as to the definition of export spillovers used.[11]

At first glance, there are studies treat the existence of export spillovers from foreign firms to domestic companies. This is the case of the pioneering work of Aitken et al. (1997), who, with information from a panel of firms for the period 1986-1990 report that the probability of Mexican firms exporting was positively related to the existence of foreign firms. In line with these findings, Kokko et al. (2001) find that, in 1998, the export decisions of domestic firms in Uruguay were influenced by the presence of multinational exporting firms.

Greenaway et al. (2004) show that, during the period 1992-1996, the presence of multinational firms had a positive influence on the export decisions of domestic companies in the U.K. and on their propensity to export. In turn, Anwar and Nguyen (2011) found that, during 2000, the probability of exporting of firms in Vietnam was boosted by the presence of foreign firms in the same region or by the presence of non-local export-oriented firms. In contrast to the positive evidence, Barrios et al. (2003) state that there is no evidence supporting the presence of export spillovers from multinational companies to Spanish firms located in the same sector during the period 1990-1994.

Another line of literature researches the presence of export spillover deriving from the agglomeration of exporters, without distinguishing the origin of their capital, on firms located within certain geographical areas. With such a focus, Clerides et al. (1998) show positive evidence that this type of spillover exists for Colombia, Mexico and Morocco. In a recent document, Greenaway and Kneller (2008) find that the agglomeration of exporters in the same region and industry was relevant for the entry of U.K. firms into exporting activity during the period 1989-2002. In contrast, Bernard and Jesen (2004) find no support for the existence of export spillovers in U.S. plants getting into exporting between the years 1984 to 1992.

[9] For an understanding of the process by means of which competition channels and demonstration/imitation ones operate, see Görg and Greenaway (2004) and Kneller and Pisu (2007).

[10] For a review of empirical studies encompassing the existence of this type of spillover, one can consult Blomström and Kokko (1998), Görg and Strob (2001), Greenaway and Kneller (2008), as well as Görg and Greenaway (2004). In the latter, moreover, one can find studies that evaluate the presence of spillover on domestic-company wages. For the case of Mexico, Reyes et al. (2004) review of the most relevant empirical studies applied to Mexico involving the topic of spillovers arising from the presence of foreign capital.

[11] By way of synthesis, the differences lie basically in what type of company do the spillovers come from (foreign exporters or exporters in general) and the non-exporting firms that reap benefit from these externalities, be they domestic or all types of establishments.

Requena and Castillo (2007), using data culled from Spanish customs houses and a sampling of companies, document that the probability of Spanish firms exporting to an non-local market, particularly in 1994, was influenced positively by the agglomeration of exporters close-by who sold to that same market[12] and that belonged to the same industry. Moreover, with a panel of firms based on the merger of data from customs records and business surveys, Koenig (2009) and Koenig et al. (2010) likewise find support for the existence of specific destination-export spillovers in decisions to export by French firms at the end of the nineties. Recently, Choquette and Meinen (2014), following the same strategy of using data culled from customs houses, contribute statistical evidence for the case of Denmark that points toward the dissemination of information on a specific market being transmitted through intra-industry and inter-industry contacts.

This document is closely related to the two focuses in the literature in different ways. As in the first one, here we consider the existence of export spillovers from foreign firms to domestic ones. However, in this study, we consider three distinct types of non-local exporting companies to be relevant, not only for the influence this class of company may have with regard to its local counterparts, in virtue of greater information on international markets arising from their experience in exporting activity and from their condition of foreign company, but also because the distinctions between the commercial regimes they use, that allows identifying the existence of differentiated effects on local companies.

In turn, the choice of evaluating the presence of export spillovers solely among domestic companies is due to the fact that the identification of factors that could have a bearing on the development of local industry's exporting potential is a priority issue in terms of public policy. Moreover, attempt to obtain this type of policy, taking exporters in general into consideration, might cause bias in the results, since non-local companies are better able to absorb knowledge than their domestic counterparts, as is pointed out by Barrios et al. (2003) and documented by Harasztosi (2015).

As in Requena and Castillo (2007), Koenig (2009) and Koenig et al. (2010), in this study, we use spatial-agglomeration measures[13] related to destination country. The preference for this type of variable is due to the fact that physical proximity among companies (foreign and domestic) is a milieu propitious for greater interaction and creation of externalities of information (Aitken et al., 1997). Therefore, the transmission of information toward a destination in particular is expected to be more feasible within an agglomeration of firms selling to the same external markets.

[12] The use of detailed information from the commercial operations of firms provides the authors the opportunity to distinguish not only whether the firm exported, but also to what destination market it did so. With such data, it was possible to evaluate dimension hereto unexplored in the literature.
[13] These measures consider the concentration of exporters within a delimited geographical area.

As concerns the distinction that is made of firms by type of commercial regime they use, this study is close to the work of Mayneris and Poncet (2013) and Fu (2011), who provide different evidence. Using aggregate date at a provincial level for China, Mayneris and Poncet (2013) find no support for the existence of export spillover for firms selling PCS products abroad on companies commercializing ORD products. Meanwhile, Fu (2011), with information on Chinese firms from high-tech sectors in the period 2000-2007, reports the presence of export spillover by PCS firms on local companies.

In contrast to Mayneris and Poncet (2013) and Fu (2011), in this document, we not only consider the existence of export spillover for PCS or ORD firms, but also for companies exporting both HBR products. In addition, in contrast to Mayneris and Poncet (2013), the analysis is done specifically considering the effect of non-local firms on domestic establishments by means of using company-level information. This splitting of data permits avoiding possible bias in the estimates, since it makes it possible to control different aspects influencing the export decisions of firms, such as productivity, consumer preferences abroad, shipping costs, as well as other aspects that cannot be observed directly, such as individual strategies and specific fixed destination costs, which are approximated by means of incorporating fixed effects.

In contrast to Fu (2011), this evaluation is not done in a particular sector, but considers the entire manufacturing sector and distinguishes the effects of spillovers from different foreign firms on a variety of domestic firms.

III. Theoretical Framework

The demand side

In this paper is assumed that the world is composed of N symmetrical countries and in each there are two goods: the foreign good (F) and the home good (H), used as numeraire. Consumers in all countries share identical and homothetic preferences for consumption of both goods. The utility function of the representative individual in the country j is defined as a Cobb -Douglas function, as follows:

$$U_j = H_j^{1-\mu} F_j^{\mu}, \quad 0 < \mu < 1 \qquad [1]$$

Terms (1 - μ) and μ represent the proportion of the expenditure on home and foreign goods, respectively, that consumers located in j make. As well, F_j is a good that comprises different varieties of foreign goods with a constant elasticity of substitution (CES) among them.

$$F_j = \left[\sum_{i=1, i \neq j}^{N} \int_0^1 \left[q_{ij}(\omega) \right]^{\rho} d\omega \right]^{1/\rho}, \quad 0 < \rho < 1 \qquad [2]$$

In this expression $q_i(\omega)$ represents the amount of the variety ω elaborated by firm i and consumed in j. We assume that the elasticity of substitution between varieties is $\sigma = \frac{1}{1-\rho} > 1$. When the firms sell their products to the rest of countries, they incur transportation costs. We consider these costs as *iceberg* costs, where if a unit of the good is sent to another country, only a fraction reaches its final destination, and therefore, $p_{ij}(\omega) = p_i(\omega) * \tau_{ij}$ where $p_i(\omega)$ is the price in country i and $\tau_{ij} > 0$ are the transportation costs. Additionally, considering that the available income of consumers in country j for the two types of products is R_j and resolving the maximization of the representative consumer utility of [1], we obtain the demand in j for the variety produced in country i.

$$q_{ij}(\omega) = \frac{p_{ij}(\omega)^{-\sigma}}{P_j^{1-\sigma}} \mu R_j \qquad [3]$$

In which P_j represents the index of prices of tradable goods in region j which depend on the prices of the varieties produced in i and sold in j.

$$P_j = \left[\sum_{i=1, i \neq j}^{N} \int_0^1 p_{ij}(\omega)^{1-\sigma} \, d\omega \right]^{\frac{1}{1-\sigma}} \qquad [4]$$

The supply side

The companies of foreign goods compete in a frame of a monopolistic competition and obtain benefits π_i assuming that the only factor is labor.

$$\pi_i = p_i q_i - w_i l_i \qquad [5]$$

Where w_i and l_i are the salary and the number of hired workers, respectively. In every country there is a continuum of massive consumers/workers that offers its unit of work time inelastically. The technology used by the firms is represented by a production function, which comprises a fixed part and a variable part, and where we standardize salaries to one.

$$l(\omega) = f_{ij}\left(A_j\right) + \frac{q_{ij}}{\varphi(\omega)} \qquad [6]$$

Where the term $f_{ij}(A_j)$ correspond to fixed costs to produce and sell in i to j. To incorporate into the model the hypothesis that the presence of exporting firms reduce costs of access to foreign markets for other companies, such costs are expressed as $f_{ij}(A_j) = \overline{f_{ij}} A_j^{-\theta}$, where the term $(\overline{f_{ij}})$ represents the specific fixed costs of a destination j, which are assumed to include entry costs as well as the operation, promotion, and distribution as well as training costs incurred by a firm to export to j, meanwhile, A_j is the agglomeration of nearby establishments that sell the same external market.

As for the θ parameter, this represents the effect of agglomeration of firms on the specific fixed costs of destination and can be interpreted as an indication for the existence of spillovers export, since if θ equals zero it has that fixed costs will simply be equivalent to $\overline{f_{ij}}$.

As Melitz (2003) firms are heterogeneous with respect to productivity, so the marginal costs specific of every firm are $\left(\frac{1}{\varphi(\omega)}\right)$, where the term $\varphi(\omega)$ corresponds to the specific productivity of each firm. Additionally, qij represents the number of product sold from i to j. Maximizing the benefits of the firm in i that produces and exports to j, we obtain the sale price optimum for country j is.

$$p_i(\omega) = \frac{1}{\rho\varphi(\omega)} \qquad [7]$$

Replacing [3] and [7] in [5] we can find the net benefits obtained by the firm in i that exports to j the variety ω.

$$\pi_{ij}(\varphi) = (\rho\varphi)^{\sigma-1}\tau_{ij}{}^{-\sigma}\frac{\mu R_j}{\sigma P_j^{1-\sigma}} - \overline{f_{ij}}A_j^{-\theta} \qquad [8]$$

As in Melitz (2003) this suggests a free entrance in the market, therefore, the condition of cero benefits for the company in i that wishes to export at the productivity level φ_{ij}^* equals:

$$\left(\rho\varphi_{ij}^*\right)^{\sigma-1}\tau_{ij}{}^{-\sigma}\frac{\mu R_j}{\sigma P_j^{1-\sigma}} = \overline{f_{ij}}A_j^{-\theta} \qquad [9]$$

From the above we can observe that a minimum productivity level is required (*cut-off*) φ_{ij}^* for which $\pi_{ij}(\varphi_{ij}^*) = 0$. Therefore, firms with a productivity of φ over φ_{ij}^* will be able to serve market j, while a firm with a productivity φ under φ_{ij}^* will not be able to do so because the costs of exporting to destination j will be higher than the benefits it could

obtain by selling to that market. In this sense, if set to E_{ij} as the export status of companies, which takes the value 1 if and only if $\varphi_{ij}^{**} > \varphi_{ij}^{*}$ and zero in any other case, then the probability of export of a company from i to j is expressed as:

$$P[E_{ij} = 1] = P\left[\left(\rho\varphi_{ij}^{**}\right)^{\sigma-1}\tau_{ij}{}^{-\sigma}\frac{\mu R_j}{P_j^{1-\sigma}} - \sigma\overline{f_{ij}}A_j^{-\theta} + \varepsilon_{ij} > 0\right] \quad [10]$$

Given $\sigma > 1$, then the first term on the right side of [11] establishes that the decision of exporting to a specific market j on the part of a firm in i depends positively on its productivity level, and therefore more productive firms will have the capacity to serve farther markets. Similarly, the probability of exporting will also increase due to the preferences of consumers in the host country with respect to the imported goods, and decreases by the transportation costs and the fixed costs that are specific of each host market. Also, considering that the fixed costs would be diminished by the existence of export spillovers, this effect would affect positively on the possibility of exporting. Finally, the term represents a random ε_{ij} term denoting those unobservable aspects of the firms in their export decisions.

IV. Empirical Approach

The theoretical model posited requires, for its empirical evaluation, detailed information on the products exported by firms to different destinations. To do so, we use the information on products exported by companies, according to the 8-digits of the Harmonized System (HS).[14] This level of detail in specifying products allows us to establish clear differences between the goods exported by a single firm[15] and provides the possibility of examining the presence of export spillover on export decisions at the level of firm-product-destination country.

As a proxy for the term $\left(\varphi_{ij}^{*}\right)$, we used labor productivity calculated as total sales over the number of workers at firm level, the expression $\left(\frac{\mu R_j}{P_j{}^{1-\sigma}}\right)$, approximating the imports made by destination countries at 6-digit HS level.[16] For fixed costs $\left(f_{ij}\right)$, there is no information available that takes this level of detail into consideration, such that they are approximated

[14] The Harmonized System (HS) is a nomenclature for products implemented by the World Customs Organization (WCO), the purpose of which is to set up a classification system for goods traded worldwide.

[15] In the case of Mexico, this is the most detailed level of breakdown possible, with which it is possible to assume the existence of differentiated products.

[16] The choice of this (6-digit) disaggregation in import flow is due to the fact that it is the most detailed level, where the nomenclature of products is homogeneous internationally. In addition, the advantage of using this variable, in contrast to the GDP of destination countries, is that its better encompasses the demand of non-local consumers on the different products imported.

by using fixed firm-product-destination effects, reasonably considering that they do not vary notably down through time.[17]

In the case of shipping costs (τ_{ij}), the literature on international trade traditionally approximates them by using the physical distance between the different trade locations. However, their inclusion in the estimates entails some inconveniencies. This variable, varying solely among destinations, leads to debilitating its influence within the estimate by incorporating fixed firm-product-destination effects.

Therefore, the strategy to be followed in its effect is to create a new variable, consisting of dividing imports by destination countries by the physical distance implied in reaching those markets. Therefore, the new variable would have the advantage of representing an indicator of market access, which would involve both the purchasing capacity of the consumers in destination countries as well as the distance[18] to reach those buyers.[19]

As for the term ρ, which is a function of the substitution elasticity of goods imported by consumers abroad, we believe that, with the inclusion of fixed firm-product-destination effects, the existing differences between the elasticities of products belonging to different sectors are controlled. One major aspect that is also taken into account in the evaluation is the size of the firms,[20] which, according to empirical evidence (Bernard and Jensen, 2004), is a factor influencing firms' decisions to export. Moreover, variables of job productivity, company size and market-access indicator are expressed in logarithms in the estimates.

For the case of the agglomeration variable (A_j), with which we analyze the presence of export spillovers, it approximates the number of other foreign-exporting firms located in the same municipality as domestic firm and that sell to the same destination country as the latter (specific destination measure). This variable is similar to that used in other studies

[17] With the inclusion of these effects, there is also control of other aspects assumed to not vary widely down through time, such as export strategies or preferences to sell certain products to certain destinations abroad.

[18] In this study, calculating the physical distance between Mexico and the country where the goods are sold was done applying the great-circle formula, which measures the shortest line between two points on the globe. This takes into consideration the location (longitude and latitude) of the points. In contrast to the Euclidean distance, which calculates the distance between two points on a straight line, this measurement replaces straight lines with curved ones. This makes it possible to obtain more approximate distances between two locations, considering Earth's geography.

[19] The creation of a new variable does not modify the essence of the expression [10], since by simple algebraic treatment, it can be expressed within said equation.

[20] In terms of the theoretical model developed in this document, this factor is present implicitly. If we consider the number of workers required by the firm (equation 6), jointly [3] and [7], one finds the following expression:

$l(\omega) = \left(\varphi(\omega)P_j\right)^{\sigma-1}\left(\frac{\rho}{\tau_{ij}}\right)^{\sigma}\mu R_j + f_{ij}\left(A_j\right)$, where it is possible to see that $\frac{\partial l(\omega)}{\partial \varphi(\omega)} > 0$, that is, the most productive firms also turn out to be the biggest in terms of work.

researching the topic of export spillovers, [21] such as Koenig et al. (2010) and Harasztosi (2015).

In addition, in this document, we use other agglomeration variables to measure the presence of spillovers. These measures are product-specific[22] (# of other exporting firms selling the same product abroad) and product-country (# of other exporting firms selling the same product abroad to the same destination).

The expression (E_{ij}) is defined as a dichotomous variable indicating whether the firm began to export product i to destination j in time t, where E_{ij} takes the value of one when recording a flow of exports done by the triad firm-product-destination country in time t and not done in $t-1$. Moreover, it takes the value zero when the triad firm-product-destination country did not sell abroad in t and nor so the previous year. In this specification, permanent export flows are not considered. The advantage of this definition, in contrast to using a binary variable with the export status, lies in the fact that persistent flows of exports do not influence the estimates, allowing one to focus the evaluation on cases where firms begin to export a specific product to a particular market, which is when they incur fixed entry costs for the destination country and where export spillover should be of importance.

In virtue of the fact that the empirical evaluation [10] involves estimating a panel model with a large number of fixed effects defined for every firm-product-destination country, the use of a Probit model would lead to a problem of incidental bias in parameters, [23] as described by Lancaster (2000). One possible solution would be to use a linear-probability model. However, this type of regression also produces inconsistencies, since the estimated probability is not always between zero and one. To correct these inconsistencies, we use a conditional logit model such as the one proposed by Chamberlain (1980).[24]

In the estimate from equation [10], there are other aspects likewise requiring attention, such as the endogenous issue. Bernard and Jensen (1999) prove the existence of double causality

[21] On the topic if export spillovers, there is no consensus on the type of measure considered and it depends to a good degree on the information available. In the literature, variables have been used such as: the logarithm of the percentage of exporting companies (Koenig, 2009), the number of exporters (Aitken et al. 1997; Requena and Castillo, 2007), the logarithm of (1 + number of exporters), as in Andersson and Weiss (2012), and Dumont et al. (2010); the relative importance of the exports of a group of businesses (Greenaway et al., 2004) or dummy variables to indicate the presence of exports (Mayneris and Poncet, 2013), among others.

[22] This specific product variable may be interpreted as a means for detecting the presence of spillovers horizontally, since it takes into consideration firms in the same industry (intra-industry), agglomerates within an area. Similarly, the specific product-country variable can be seen as a horizontal measures particular to a destination.

[23] When the temporal dimension of the panel is short, the imprecision in estimating a large number of fixed effects contaminates the other parameters in the estimation, due to the non-linearity of the model.

[24] The technique proposed by Chamberlain (1980) uses conditional estimates of maximum-verosimilty to correct the problem of inconsistency in parameters.

between export capacity and productivity. This inconveniency is present between the export capacity and the measurement of spillovers, in virtue of the fact that if the agglomeration of neighboring firms positively influences a company's decision to export, it will begin to sell abroad, increasing the agglomeration which, once again, will have an effect on its capacity to export. To solve the matter of double causality, we follow Bernand and Jensen (2004) and the covariables lag behind one period in time.[25]

Another point attended to is the problem of clustering described by Moulton (1986, 1990), arising when microdata is used in regressions with regard to aggregate variables, which leads to standard error being underestimated. To deal with this aspect in all estimates, standard errors are corrected clustering at the municipal level, where exporting firms are located physically.

V. Description of Data and Variables

In this section, we describe the information sources used to put together the variables described in the empirical approximation, as well as the way in which the databases were constructed.

V.1 Databases on Domestic Companies

The information used in this document comes from the foreign-trade data of the Secretary of the Economy, whose sources are Mexican customs houses. The information extracted comprises aggregate export flows at the level of firm, destination country, product (8-digit HS tariff code)[26] and year for the period 2003-2010.[27] Moreover, in this exporters´ database (*Base de datos de exportadores: BDE*), there is a variable that permits identifying those products exported under the categories of processed (PCS), ordinary (ORD) or both (HBR). By using this data, likewise from the Secretary of the Economy, the BDE was complemented in order to identify firms according to the origin of their capital, be it domestic or foreign.[28]

[25] So as to further isolate the possibility of double causality in spillover measures, by make-up, these variables only take into account the presence of other firms within the area.

[26] For reasons of confidentiality, firm-product-destination country trade flows were identified by means of a binary variable where 1 represented the existence of exports and 0 the absence thereof. Also, to preserve the anonymity of establishments, no information was considered regarding tax-identification numbers or codes, such that the information used can be considered a catalogue of exporters by product and destination.

[27] By means of the binary variable identifying firm-product-destination country flows for the years 2003-2010, the term E_{ijt} was constructed.

[28] For the identification of categories, a binary variable was constructed. The criterion for considering a firm to be foreign is that at least 51% of its capital be foreign.

Subsequently, the BDE was merged with a random sample of manufacturing firms that are included in the Annual Industrial Survey (*Encuesta Industrial Annual: EIA*) elaborated and processed by the National Institute of Statistics and Geography (*Instituto Nacional de Estadística and Geografía: INEGI*) of Mexico. The EIA contains information relative to the personnel used, production, sales and remuneration of manufacturing establishments (excluding *maquila*) with more than 15 employees, in the 21 manufacturing industries. The period used for the EIA encompasses 2003 to 2009 and, from this source, was obtained the information on labor productivity (sales[29]/number of employees), size of the company (number of employees)[30] and location of the manufacturing plant.

One limitation of the EIA is that it only provides an opportunity to locate domestic firms operating mainly in the regimes of ORD and HBR commerce. This is because, during the period of analysis, information on domestic PCS companies was obtained from a different survey and is not considered in this study.

For the purposes of analysis, the resulting BDE-EIA database was restricted as follows: i) it only considered firms that coincided in those information sources; ii) it did not take into account companies with more than one establishment or multi-plants, since it was not feasible to identify what products and trade flows corresponded to which one of their different locations; iii) so as to avoid an excess of null trade flows, only those countries were considered that represent up to 95% of the export operations of the firms; iv) the information corresponding to 2003 was eliminated from the database in virtue of the fact that it was taken as referent for the construction of the dependent variable; and v) due to the fact the evaluation focuses on domestic companies, those establishments that were identified as foreign were eliminated.

Finally, incorporated into the BDE-EIA was the information relative to the distance between Mexico and different destination countries for the exports of domestic firms, as well as the data on total imports made by those destination countries. For the first case, the values were calculated by the great-circle formula using location information (longitude and latitude) on the capitals of the countries,[31] which came from the CEPII (*Centre*

[29] Sales figures are expressed in real terms, using the Producer Price Index (PPI) and based on the Banco de México and INEGI.

[30] In order to maintain confidentiality, the cross-referenced information, calculations and estimates presented in this document, were done in two stages. The first consisted of elaborating lines of code that were later executed by INEGI personnel. The second was the processing of the information at INEGI installations and under the supervision of its personnel. When the final database was compiled, names of the firms were eliminated and substituted by a single ID which was used when dealing with the information.

[31] To calculate the distances between Mexico and the U.S., we considered the distance between the municipality where the firm is located and the centroid referring to the mid-point of the U.S.

d'Études Prospectives et d'Informations Internationales) database.[32] Meanwhile, import figures (6-digit HS) came from the UN COMTRADE database.

The final database comprises 2,663 companies with domestic capital, exporting at least one product to one of 79 possible destinations during the period 2004-2010. It represents an unbalanced panel because of the imperfect merges with the variables considered.

In Table 1, we show the descriptive statistics of the final database. The data shows differences in the levels of productivity and size of companies among the varying geographical areas considered. Average productivity and firm size are greater when their destination markets are further away. This can be seen clearly if we compare the American continent with Asia. In the first case, we get an average in the logarithms of productivity and size of 6.44 and 5.26, respectively, with an average in the distance logarithm of 6.21. In turn, for Asia, there is an average of 6.64 in the productivity logarithm and 5.49 company-size logarithm, while the average for the distance is 9.21. This suggests that, in order to access markets further away, firms have to make an additional effort in productivity that allows them to take on the shipping costs implied by reaching remote marketplaces. Moreover, figures for the indicator of market access reflect that the greater the demand exercised by consumers for imported goods and the shorter the distance to these buyers, trade to those destination is more feasible.

V.2 Construction of Spillover Variables

To calculate spillover variables, the BDE was merged with the directory of manufacturing companies found in the System of Mexican Business Information (*Sistema de Información Empresarial Mexicano: SIEM*),[33] permitting it to determine the municipality where the productive plant of said firm is located. In this case, all domestic companies were eliminated in order to calculate the measurements that would only be involved by the agglomeration of foreign firms within the municipalities of the country. The level of detail of the variable constructed was 4-digit HS considering the type of firm (PCS, ORD or HBR). Using this information to elaborate spillover variables has the advantage of identifying foreign-manufacturing firms that really exported during the period of study in the geographical area where domestic firms carry out their productive activity.

[32] http://www.cepii.fr/anglaisgraph/bdd/distances.htm.

[33] SIEM is a public database containing information on the characteristics and locations of productive establishments and activities regarding trade, industry and services in Mexico. This system was created by the Mexican government as a tool for promoting business, linking companies and elaborating statistics. Information updates are mandated by law: www.siem.gob.mx .

Table 1. Descriptive Statistics of the Variables in BDE-EIA

Africa	**Average**	**Std. Dev.**	**Minimum**	**Maximum**
Ln productivity	6.7469	1.0296	2.6299	9.5832
Ln company size	5.4926	1.2260	1.3863	8.7182
Ln imports	8.7864	2.0418	-1.0189	13.8492
Ln distance	9.4808	0.0709	9.3139	9.5266
Ln market access	0.9273	0.2080	0.1153	1.4537
Americas	**Average**	**Std. Dev.**	**Minimum**	**Maximum**
Ln productivity	6.4402	0.9126	0.8144	11.3838
Ln company size	5.2647	1.0804	0.6931	8.7182
Ln imports	9.2061	3.1398	-6.9078	18.1431
Ln distance	7.5235	0.6268	6.2146	8.9311
Ln market access	1.2495	0.4766	-0.9912	2.9194
Asia	**Average**	**Std. Dev.**	**Minimum**	**Maximum**
Ln productivity	6.6480	0.9781	2.5234	10.7784
Ln company size	5.4980	1.1309	0.6931	8.7182
Ln imports	9.8300	2.3957	-4.1352	17.5458
Ln distance	9.5037	0.1262	9.2814	9.7469
Ln market access	1.0364	0.2557	-0.4263	1.8359
Europe	**Average**	**Std. Dev.**	**Minimum**	**Maximum**
Ln productivity	6.6179	0.9483	2.6299	10.7784
Ln company size	5.5799	1.1736	0.6931	8.7182
Ln imports	11.1479	1.9295	0.3279	17.3693
Ln distance	9.1591	0.0583	9.0460	9.3446
Ln market access	1.2173	0.2113	0.0359	1.9017
Pacific	**Average**	**Std. Dev.**	**Minimum**	**Maximum**
Ln productivity	6.6207	1.0049	0.8144	10.7784
Ln company size	5.7244	1.2594	1.0986	8.7182
Ln imports	9.4586	1.9610	-1.3056	16.0735
Ln distance	9.4405	0.0601	9.3243	9.4716
Ln market access	1.0016	0.2061	-0.1378	1.6970

Source: Own elaboration with information from the BDE-EIA described in Section V.1. The market-access variable is calculated as Ln imports/Ln distance.

Table 2 shows descriptive statistics on the number of neighboring foreign-exporting firms that domestic firms have, in accordance with sales destination abroad. Domestic-exporting firms showed, on the average, 1.9 neighboring foreign PCS firms exporting to the same country one year earlier. The percentage of domestic companies with zero neighbors was 89.5% and, with more than 10, it rose to 2.2%, reaching a maximum of 302 neighboring establishments. In turn, the average for neighboring ORD foreign firms was 1.2, with a maximum of 19 establishments. The percentage of domestic companies exporting, with no neighbor, was 64.8% and, with more than 10, it reached 0.6%. In the case of non-local HBR companies, the average neighbors for domestic firms were 12.1, with a limit of 293

establishments within the same municipality. The percentage of domestic companies with no neighboring foreign company was 24.2% and those with more than 10 rose to 28.1%.

When comparing the coefficient of variation of the spillover variables for the three types of non-local companies, we observe that the agglomeration of PCS firms showed greater dispersion with regard to the average calculated, suggesting the existence of a wide-ranging heterogeneity in the location of this type of establishment among the municipalities where domestic firms are located. This behavior contrasts with the concentration of foreign HBR firms registering less variability with regard to the average calculated.

Table 2. Agglomeration of Foreign Exporting Firms
that Sold to the Same Destination as Domestic Firms

Type of firm	Descriptive Statistics					Percentage of Cells Where $E_{ijt} > 0$			
	Avg.	Std. Dev.	Min	Max	CV	Zero	1-5	5-10	>10
PCS	1.9	16.0	0	302	8.4	89.5	7.6	0.7	2.2
ORD	1.2	2.3	0	19	1.9	64.8	28.7	5.9	0.6
HBR	12.1	21.9	0	293	1.8	24.2	28.8	18.8	28.1

Source: Own elaboration with information from BDE. Information reported corresponds to foreign firms exporting to the same country as domestic firms one year earlier.

VI. Results

In this section, we show the results of the empirical estimates of equation [10] relative to company export decisions. As a first point, we examine the influence of spillovers for all foreign-exporting firms regarding the probability that domestic firms can sell to a market j. This is dealt with considering an agglomeration variable for specific firms of a destination country, as well as others specifying the product, destination-country and number of exporters, in general. Below, we evaluate once again said influence, considering three types of foreign companies according to the product they trade abroad (PCS, ORD and HBR). Moreover, we analyze the importance for local companies of the spillovers generated by the three types of foreign companies with the possibility to export to different geographical areas. Finally, we segment the sample of domestic companies according to the type of good exported (PCS or HBR) and we examine the influence of three types of foreign companies regarding their decisions to export to a particular destination j.

VI.1 Effects of Export Spillover on Domestic Firms

The first column of Table 3 reports the results of the estimates of the equation, describing the export decision of firms as a function of certain observable characteristics. The parameters obtained are significant at 1% and the signs are in keeping with that derived from the algebraic expression of [10], that is, the productivity of domestic firms has a positive influence on their decisions to begin exporting to a particular destination. Moreover, company size is also relevant for the internationalization of their sales.

Results between productivity-size and exporting activity point to the fact that larger firms have a greater possibility of complementing each other and of being vertically integrated so as to generate economies of scale, compared to small firms. This advantage allows them to be more productive and better face the costs associated with selling their products abroad. Moreover, the less costly it is to reach a large number of external consumers, that is, easier access to external markets, the greater the possibility of exporting, in keeping with Melitz's model (2003).

When country-specific spillover is considered in the regression (Column 2), the findings indicate that exports by domestic firms to country j are influenced positivily by the agglomeration of other neighboring foreign firms that sold to the same country j one year earlier,[34] in line with the findings reported by Koenig (2009) and Koenig et al. (2010).

[34] Due to the fact the spatial proximity between agents may give rise to different direct and indirect effects (Duranton and Puga, 2004; Rosenthal and Strange, 2003) and have an influence on the exporting behavior of companies, the spillover coefficients presented in this document may be interpreted as the net effect deriving from the interactions made by firms within the agglomeration.

Table 3. Logit Estimates on the Export Decisions of domestic Companies, Considering Different Spillover Variables

Dependent Variable: $Dummy\ E_{ijt}$

	(1)	(2)	(3)	(4)	(5)
$Ln\ firm\ size_{it}$	0.546**	0.546**	0.546**	0.546**	0.546**
	(6.59)	(6.60)	(6.60)	(6.61)	(6.61)
$Ln\ job\ productivity_{it}$	0.277**	0.275**	0.275**	0.275**	0.275**
	(3.80)	(3.82)	(3.82)	(3.83)	(3.82)
$Ln\ market\ access_{jt}$	0.522**	0.503**	0.503**	0.502**	0.501**
	(4.17)	(4.07)	(4.07)	(4.06)	(4.05)
Measures of spillover from foreign firms					
Destination-specific		0.0127*	0.0127*	0.0131**	0.0130**
		(2.57)	(2.57)	(2.67)	(2.64)
Product-specific			-0.000550		0.00351
			(-0.15)		(0.72)
Product-destination specific				-0.00648	-0.00988
				(-1.25)	(-1.32)
Fixed effects: firm-product-country and year					
Pseudo R2	0.00856	0.00887	0.00887	0.00888	0.00888
Observations	379,594	379,594	379,594	379,594	379,594

Statistics in parentheses. The statistics are constructed using standard errors clustered at the level of municipality. All independent variables lag behind one period. The variable *market access* was calculated as $Ln\ imports_{ijt}/Ln\ distance_{jt}$. The marks **, * and + indicate a significance level of 1%, 5% and 10%, respectively.

So as to evaluate the existence of other types of spillovers, in the following estimates, we gradually incorporate other measures related to the specificity of the product and of the product-destination. In Column 3, we include a specific product variable. The results shed light on the fact that the coefficient of this measurement is not statistically significant, since the magnitude of the variable of the destination-specific spillover remained unaltered and significant at 5%. In the fourth regression, when the product-country-specific measurement is considered, no statistical evidence is obtained supporting the presence of this type of spillover.

In the last column, we report estimated coefficients, considering all the variables from previous regressions. The parameter referring to the measure of destination-specific spillover shows a slight increase and remains significant. These findings point the fact that the effect, in general, of the spillover of non-local companies on domestic ones is more closely associated with a specific destination of the sales abroad than to the elaboration of a product in particular.

VI.2 Effects of Export Spillover on Domestic Firms by Type of Foreign Company

In Table 4, we report estimated coefficients, considering the three spillover measurements used in the last regression in Table 3 for the three types of foreign PCS, ORD and HBR firms. In Column 1 of Table 4, we observe that the estimated coefficients for the three measurements related to the concentration of non-local PCS exporting firms does not provide any evidence in favor of the existence of spillovers. This can be explained due to the fact that PCS companies, by keeping a close interrelationship with external markets in purchasing inputs and selling final products, have little contact with the domestic industry and, therefore, a milieu less propitious to manifesting the externalities of information. Another possibility is that the influence on domestic exporting activity is restricted to certain productive sectors or to very specific destination markets.

In turn, results from Column 2 reflect the existence of specific product-country export spillover from non-local ORD firms on domestic ones. In contrast to PCS firms, the effect can be associated by means of a productive interrelationship with domestic companies through horizontal or client-provider relations, where specific information is shared on the demand for, distribution of or commercialization of certain products in particular sales markets abroad. This result tends in the same direction as those reported in other studies reporting on the existence of specific product-country spillovers on countries with a slight or nil presence of PCS firms, as in the case of Koenig et al. (2010) and Harasztosi (2015).

When the case of non-local HBR firms is analyzed, we find a positive and significant effect of the concentration of foreign firms that sold one year earlier at the same destination as the domestic companies. In contrast to the other two types of foreign companies, this situation seems to reflect that the influence on domestic firms would derive from sharing specific information on access to destination countries, as might be aspects related to customs requisites and restrictions, trade regulations, how to do business, market structure, language, etc.

Table 4. Logit Estimate of the Decision to Export by Domestic Companies, Considering Different Types of Foreign Firms

Dependent Variable: $Dummy\ E_{ijt}$

	(1)	(2)	(3)	(4)	(5)
Foreign-firm spillover measures					
Firms: PCS					
Country-specific	0.0114			0.0153	0.0176
	(0.78)			(1.33)	(1.50)
Product-specific	-0.0156			-0.0180	
	(-0.87)			(-0.93)	
Product-country-specific	0.0005			-0.0063	
	(0.03)			(-0.36)	
Firms: ORD					
Country-specific		-0.0119		-0.0138	
		(-0.98)		(-1.07)	
Product-specific		0.0300		0.0308	
		(0.89)		(0.87)	
Product-country-specific		0.172*		0.190*	0.211**
		(2.26)		(2.32)	(2.73)
Firms: HBR					
Country-specific			0.0130*	0.0156**	0.0144**
			(2.45)	(3.08)	(2.72)
Product-specific			0.00282	0.0024	
			(0.49)	(0.38)	
Product-country-specific			-0.0119	-0.0050	
			(-1.02)	(-0.37)	
Fixed firm-product-country and annual effects					
Pseudo R2	0.00865	0.00864	0.00880	0.00906	0.00899
Observations	379,594	379,594	379,594	379,594	379,594

Statistics in parentheses. The statistics are constructed using standard errors clustered at the level of municipality. All the independent variables lag behind one period. Estimates also include as covariables $Ln\ firm\ size_{it}$, $Ln\ job\ productivity_{it}$ and $Ln\ market\ access_{jt}$. Variable market access was calculated as $Ln\ imports_{ijt}/Ln\ distance_{jt}$. The marks **, * and + indicate a significance level of 1%, 5% and 10%, respectively.

VI.3 Robustness Check

To find out whether the results obtained are valid for different subsamples, a serious of tests were run considering factors that might have a bearing on the existence of the export spillovers reported. In the first column of Table 5, by way of comparison, we see the coefficients of the last estimate of Table 4, representing the specification to be validated.

In the second regression are the estimated parameters of spillover variables without considering the firms' main export products.[35] This, in virtue of the fact that the majority of firms, when beginning to export, do so to a single country and later add on countries to their portfolio (Lawless, 2009), so that the effect of spillovers may only be concentrated or only show up in the most relevant products. The results obtained show no substantial changes with regard to the Column 1 of Table 5 and suggest that spillovers are relevant for the subsequent products that companies sell abroad.

One aspect that might cast doubt on the results is that of the geographical concentration of exporting activity, due to the fact that location near large centers of imported-goods consumers propitiates a greater density of foreign and domestic exporting companies, thereby generating a favorable environment for a prolific exchange of information on the nearby marketplace. This factor may signal serious differences with the rest of the country and lead one to think that the existence of spillovers is due, in great part, to a border effect. In the case of Mexico, this situation is all the more relevant, since it neighbors on the U.S, the world´s biggest market.

To discount this probable border effect from the estimates, regression 3 shows the coefficients obtained without considering all the Mexican municipalities sharing a border with the U.S. The parameters calculated once again show no major modifications. Similarly, to ensure that export spillovers are not to be explained by an effect influenced by greater economic activity, such as that of the central part of Mexico, Column 4 of Table 5 shows the estimate without considering municipalities belonging to the Federal District and the State of Mexico which, jointly, represent Mexico's capital region. The parameters calculated increase in magnitude in the variables considered. Notwithstanding, their significance persists.

The following regression does not take into account the municipalities of the capital region nor border ones with the U.S. In contrast to the coefficients of Column 1, we can see an increase in size without changing the tendency in the results. Moreover, we perceive that the spillover measure associated with PCS firms is once again significant at 10%, reinforcing the idea that its effect does not generally occur for all domestic companies, but, rather, its sphere of influence is limited. To prove the findings of Column 1 do not solely come from firms exporting a large number of products to different destination, in the estimates shown in Columns 6 and 7, we exclude the municipalities concentrating the greatest number of cells with positive export flows at the level of firm-product-country and firm-products, respectively. These restrictions in the number of observations do not influence the conclusions made by the first regression.

[35] To include a greater number of products, these were defined as a 4-digit HS.

Table 5. Robustness check

Dependent Variable: $Dummy\ E_{ijt}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Comparison estimate	Excluding main products	Without municipalities bordering U.S.	Not including municipalities from capital region	Without municipalities from capital region and bordering U.S.	Not considering municipalities with larger number of cells		Export status
						Firm-product-country	Firm-product	
Measurements of spillovers from foreign firms								
Firms: PCS								
Country-specific	0.0176	0.0159	0.0164	0.0218	0.0260+	0.0160	0.0182	0.0172
	(1.50)	(1.30)	(1.23)	(1.61)	(1.77)	(1.35)	(1.48)	(1.49)
Firms: ORD								
Prod-country-specific	0.211**	0.227**	0.210**	0.333**	0.344**	0.239**	0.211**	0.250**
	(2.73)	(2.66)	(2.59)	(3.36)	(3.16)	(2.63)	(2.73)	(4.10)
Firms: HBR								
Country-specific	0.0144**	0.0143*	0.0150**	0.0156**	0.0162**	0.0161*	0.0138**	0.0163**
	(2.72)	(2.37)	(2.58)	(2.91)	(2.66)	(2.38)	(2.62)	(3.10)
Fixed firm-product-country and annual effects								
Pseudo R2	0.00899	0.00885	0.00911	0.0117	0.0122	0.00982	0.00927	0.0142
Observations	379,594	334,937	371,517	209,387	201,310	274,865	370,314	431,184

Statistics in parentheses. The statistics are constructed using standard errors clustered at the level of municipality. All the independent variables lag behind one period. Estimates also include as covariables $Ln\ firm\ size_{it}$, $Ln\ job\ productivity_{it}$ and $Ln\ market\ access_{jt}$. The variable *market access* is calculated as $Ln\ imports_{ijt}/Ln\ distance_{jt}$. The marks **, * and + indicate a significance level of 1%, 5% and 10%, respectively.

In the final regression, the exporting status of firms is used as dependent variable, permitting persistent export flows to influence estimates. Although the change in variables considerably increases the number of observations, initial findings are not modified.

VI.4 Effect of Export Spillovers on Different Types of Domestic Companies

To delve further into the influence of export spillovers on foreign firms, the sample was divided into domestic firms exporting ORD or HBR products and, for each subsample, the specification of the comparison regression was applied (Column 1, Table 6).

Column 2 of Table 6 reports the coefficients of spillover covariables considering the subsample of domestic companies trading ORD products abroad. Findings show that the agglomeration of foreign firms nearby likewise selling PCS products, in general, does not influence the possibility of exporting to a specific market for this type of local company. In contrast, foreign ORD companies show positive evidence regarding the presence of export spillovers on domestic firms also catalogued as ORD. The preceding suggests that the externalities of information between domestic and foreign firms are more likely to show up in a milieu where both types of companies have the same trade regime in common, as was found by Mayneris and Poncent (2015) in the case of China.

When considering foreign HBR firms, we find a positive and significant effect at 10% on the probability of going to a new destination on the part of domestic ORD firms. This influence can be related to the fact that HBR firms not only have strong ties abroad, but also have commercial contacts with different local productive sectors.

When the subsample of domestic companies involving HBR products is used, the panorama is different. In this case, no contribution coming from non-local PCS or ORD companies is found. Meanwhile, only positive effects come from the presence of foreign firms which are similarly HBR ones. This would seem to indicate once again that communication ties between domestic and foreign companies are favored when sharing a regime of similar trade.

Table 6. Logit Estimate on the Decision to Export in Different Domestic Companies, Considering Different Types of Foreign Firms

Dependent Variable: $Dummy\ E_{ijt}$

	(1)	(2)	(3)
	Domestic firms		
	All	ORD	HBR
Measure of spillover from foreign firms			
Firms: PCS			
Country-specific	0.0176	0.00393	0.0229
	(1.50)	(0.55)	(1.64)
Firms: ORD			
Prod-country specific	0.211**	0.223**	0.194
	(2.73)	(4.13)	(1.32)
Firms: HBR			
Country-specific	0.0144**	0.0139+	0.0145*
	(2.72)	(1.73)	(2.00)
Fixed firm-product-country and year effects			
Pseudo R2	0.00899	0.0100	0.00903
Observations	379,594	119,416	260,101

Statistics in parentheses. The statistics are constructed using standard errors at the level of municipality. All independent variables lag behind one period. Estimates also include as covariables $Ln\ firm\ size_{it}$, $Ln\ job\ productivity_{it}$ and $Ln\ market\ access_{jt}$. The variable *market access* was calculated as $Ln\ imports_{ijt}/Ln\ distance_{jt}$. The marks **, * and + indicate a significance level of 1%, 5% and 10%, respectively.

VI.5 Geographical Dimension of Spillovers

One aspect that is relevant for economies that depend greatly on a small number of countries, such is the case of Mexico, is whether the influence of export spillovers contributes to increasing the possibility that domestic firms export to other different international markets.

Thereto, spillover variables interact with two dummy variables indicating the destination of exports: the first identifying the U.S.-Canadian market, and the second, the rest of the countries. Just as in the preceding section, the evaluation is done distinguishing between types of domestic companies.

In the first Column of Table 7, we can see that, in general terms, spillovers generated by foreign firms on Mexican companies are solely associated with sales abroad with the

U.S. and Canada as destinations This situation is due to the proximity of non-local ORD and HBR exporting companies, while PCS firms show no type of effect.

When only domestic ORD companies are taken into consideration, the situation is quite similar to the one shown in the preceding regression. However, there is also significant evidence that the proximity of non-local ORD firms exporting the same product to the same destination as domestic ones propitiates the internationalization of the latter to access markets other than the U.S. market.

Table 7. Logit Estimates on Decisions to Export to Different Markets by Domestic Companies

Dependent Variable: $Dummy\ E_{ijt}$

	(1)	(2)	(3)
	Domestic firms		
	All	ORD	HBR
Measurement of spillover from foreign firms			
Firms: PCS			
Country-specific	0.0188	0.00581	0.0240+
X dummy U.S.-Canada	(1.59)	(0.78)	(1.71)
Country-specific	-0.0122	0.0144	-0.00984
X dummy no U.S.-Canada	(-0.14)	(0.07)	(-0.10)
Firms: ORD			
Prod-country-specific	0.265**	0.229**	0.291+
X dummy U.S.-Canada	(2.97)	(3.75)	(1.80)
Prod-country-specific	0.0396	0.205*	-0.0805
X dummy U.S.-Canada	(0.42)	(2.03)	(-0.62)
Firms: HBR			
Country-specific	0.0165**	0.0172*	0.0165*
X dummy U.S.-Canada	(2.94)	(2.12)	(2.05)
Country-specific	0.00685	0.00383	0.00728
X dummy no U.S.-Canada	(0.78)	(0.21)	(0.65)
Fixed firm-product-country and year effects			
Pseudo R2	0.00902	0.0101	0.00908
Observations	379,594	119,416	260,101

Statistics in parentheses. The statistics are constructed using standard errors at the level of municipality. All independent variables lag behind one period. Estimates also include as covariable $Ln\ firm\ size_{it}$, $Ln\ job\ productivity_{it}$ and $Ln\ market\ access_{jt}$. The variable *market access* was calculated as $Ln\ imports_{ijt}/Ln\ distance_{jt}$. The marks **, * and + indicate a significance level of 1%, 5% and 10%, respectively.

Upon examining domestic HBR companies, we find a marked presence of export spillovers associated with the sale of products to the U.S.-Canadian area. In addition, the results emanating from variables corresponding to foreign PCS and HBR firms seem to point to the fact that the principal sales market abroad for domestic firms elaborating processed products are the neighboring countries to the North.

VI.6 Export Spillovers and Technological Intensity of Domestic Firms

A major issue when explaining the existence and magnitude of the export-spillover effect and one that has not enjoyed much attention is the fact that its influence is related to the type of activity carried out by domestic countries. Kokko (1994) provides evidence that the incidence of foreign firms on their local counterparts does not occur the same in all sectors, due to the fact that non-local companies can be operating preponderantly in certain industries where products and technologies have more in common with domestic establishments.

To take this issue into account, subsamples of domestic companies were divided into three headings according to the technological intensity of the products elaborated, using as a basis the classification proposed by the Organisation for Economic Co-operation and Development (OECD).[36] Upon analyzing the results reported in Column 1 of Table 8, we can see that both the concentrations of foreign PCS and HBR firms have a positive influence on the propensity to export of domestic firms producing goods in high-tech sectors. Such an effect is seen principally in domestic HBR firms, where their magnitude is greater (Column 7).

One possible hypothesis on this result comes from the fact that companies in high-tech sectors need on-going information regarding the every-changing needs of marketplaces abroad, since the life cycle of the products they elaborate and consumer tastes are short-lived due to the speed with which technology evolves. These factors force said companies to make constant adjustments in the costs associated with commercializing, distributing and marketing their products abroad, among others. To cover this constant need for information, domestic companies may be being nourished by foreign PCS or HBR firms, since they form part of a worldwide production chain through the elaboration of processed products, permitting them up-to-date their knowledge of worldwide consumer trends and the logistics of high-tech products. The transmission of information

[36] Included in the high-tech sector are industries related to chemicals, machinery and equipment, computer-equipment manufacturing, electric- and electronic-equipment manufacturing, and transportation equipment. Considered of average technological intensity are the industries related to oil and coal, plastics and rubber, non-metallic ore products and metallic products. The case of low technological intensity encompasses the rest of the industries.

toward HBR domestic firms is quite probably favored by the environment of high agglomeration distinguishing the high-tech sectors in Mexico, where the participation of processed-product companies is outstanding (Carrillo and Gomis, 2007).

From the estimated presented in Column 2 of Table 8, we can see, in general terms, that there is no influence of foreign exporting firms on domestic companies operating in sectors with average technological intensity. However, when distinguishing between ORD and HBR domestic firms, there is a positive and significant effect for domestic ORD establishments coming from foreign PCS ones (Column 5). This seems to show that this type of domestic ORD exporting companies in certain sectors are also nourished by the information from their foreign counterparts elaborating PCS products.

On the other hand, in Column 3 of Table 8, we can see the presence of export spillovers in low-tech domestic firms coming from foreign ORD firms, which show up concretely in domestic establishments likewise elaborating ORD products (Column 6). One way of interpreting these findings is that firms in low-intensity technological sectors face entry barriers to getting into non-local markets, since low-skilled labor can limit their capacity to boost productivity and take on the costs associated with export activity. Therefore, domestic firms seem to highly value information on non-local market acquired from foreign ORD companies through the client-provider links they establish.

The aforementioned finding suggest that domestic companies operating under a regime of HBR trade in sectors intensely high-tech will probably get more benefit out of it for accessing non-local markets from the externalities of information emanating from the foreign firm elaborating processed products. On the contrary, the assimilation of said externalities on the part of domestic ORD firms seems to be present only in sectors with low technological intensity.

VII Conclusions

By using a wide range of information, combining trade and production data from domestic companies, as well as detailed measurements encompassing the agglomeration of non-local firms at a precise level, this research delves into whether the presence of foreign exporting firms using different trade regimes increases the probability of domestic firms beginning to export or boosting their presence in non-local markets when selling their products.

Just as in other research (Aitken et al., 1997; Kokko et al., 2001; Greenaway et al., 2004), the estimates generated provide statistical support in favor of the fact that the export decisions of domestic firms in Mexico are indeed influenced by the presence of foreign exporting firms. However, this conclusion cannot be extended when considering foreign

companies separately according to the trade regime they use. Thus, the results show that the effects of spillovers are not found present nor do they occur homogeneously on domestic firms.

In addition, the findings point to the fact that the presence of spillovers is not only favored by environments where domestic and non-local companies have the same trade regime in common, but they exist in sectors where the goods produced and the technology used are more similar between said companies, despite not sharing the same trade regime. This might explain the contradictory evidence on the existence of spillovers coming from PCS firms, as contributed by the studies of Mayneris and Poncet (2013) and Fu (2011), showing that both are particular results emanating from considering or not the technological intensity with which domestic firms operate.

The evidence provided in this document represents a guide to elaborating more effective public policies with regard to the internationalization of domestic firms. Theus, if we are to seek policies to spur the entry of domestic firms into different areas of North America (U.S. and Canada), it would make the most sense to stimulate the presence of foreign ORD firms vis-à-vis their domestic counterparts. However, according to estimates, their influence is quite probably limited to low-intensity tech sectors. In turn, if what is intended is to spur entry into exporting activity or selling new products abroad for domestic companies in sectors with medium- and high-intensity technology, it would be reasonable to propitiate the presence of PCS or HBR firms. It would therefore be expected that the new ties be centered on U.S. and Canadian markets.

There still exist issues for further research on the incidence of export spillover on foreign PCS or HBR firms with regard to the possibility of entering into exporting activity or boosting markets on the part of domestic manufacturing establishments There is a need to investigate the mechanisms by means of which spillover effects are generated among a variety of foreign companies with different domestic companies.

Table 8. Logit Estimate on the Decision to Export of Different Domestic Companies in Sectors of High, Medium and Low Technological Intensity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All			ORD			HBR		
	High	Medium	Low	High	Medium	Low	High	Medium	Low
Measurement of spillover of foreign firms									
Firms: PCS									
Country-specific	0.0542+	0.0145	-0.0021	-0.0846	0.0487**	-0.0173	0.0677*	0.00476	0.00425
	(1.66)	(1.15)	(-0.28)	(-1.50)	(3.05)	(-1.17)	(2.50)	(0.31)	(0.54)
Firms: ORD									
Prod-country-specific	0.411	0.235	0.123*	0.0276	0.375	0.150*	0.611	-0.0678	0.0875
	(1.11)	(1.55)	(2.37)	(0.18)	(1.30)	(2.32)	(1.21)	(-0.35)	(0.85)
Firms: HBR									
Country-specific	0.0261*	0.00202	0.00503	0.00476	0.0123	0.0178	0.0307*	-0.00433	-0.00128
	(2.55)	(0.21)	(0.94)	(0.29)	(0.96)	(1.44)	(2.33)	(-0.35)	(-0.18)
Fixed firm-product-country and year effects									
Pseudo R2	0.0168	0.0108	0.00465	0.0193	0.0110	0.00826	0.0176	0.0120	0.00384
Observations	151,749	90,453	137,392	41,584	29,437	48,395	110,147	60,987	88,967

Statistics in parentheses. The statistics are constructed using standard errors at the level of municipality. All independent variables lag behind one period. Estimates also include as covariables $Ln\ firm\ size_{it}$, $Ln\ job\ productivity_{it}$ and $Ln\ market\ access_{jt}$. The variable *market access* was calculated as $Ln\ imports_{ijt}/Ln\ distance_{jt}$. The marks **, * and + indicate a significance level of 1%, 5% and 10%, respectively.

VIII. Bibliography

Aitken B., G., Hanson y A., Harrison, (1997). "Spillovers, foreign investment, and export behavior", *Journal of International Economics*, Vol. 43(1), pp. 103-132.

Andersson M. y J. Weiss (2012). "External trade and internal geography: Local export spillovers by industry characteristics and firm size", *Spatial Economic Analysis* Vol. 7(4), pp. 421-446.

Anwar, S. y L. P. Nguyen, (2011), "Foreign direct investment and export spillovers: Evidence from Vietnam", *International Business Review*, Vol. 20(2), pp. 177-193.

Barrios, S., H. Görg y E. Strobl, (2003). "Explaining Firms' Export Behaviour: R&D, Spillovers and the Destination Market", *Oxford Bulletin of Economics and Statistics*, Vol. 65 (4), pp. 475-496.

Bernard, A. y J. B. Jensen, (2004), "Why do firms export", *The Review of Economics and Statistics,* Vol. 86(2), pp. 561–569.

Bernard, A., & J.B., Jensen, (1999). "Exceptional exporter performance: cause, effect or both?", *Journal of International Economics* No. 47, pp. 1–25.

Blomström, M. y A. Kokko (1998), "Multinational Corporations and Spillovers". *Journal of Economic Surveys*, Vol. 12, pp. 247-277.

Cardoso-Vargas, C. E. (2016). "Desigualdad salarial y potencial de mercado. Evidencia para México". El Trimestre Económico, Vol. LXXXIII (1).

Carrillo J. y R. Gomis, (2007), "La maquila evoluciona y podrá evolucionar en el nuevo contexto?" en Carrillo J. y Barajas R. (coords.) Maquiladoras fronterizas. Evolución y Heterogeneidad en los sectores electrónico y automotriz", Ed. Miguel Ángel Porrúa/COLEF, México, pp. 17-49.

Chamberlain, G. (1980), "Analysis of covariance with qualitative data". *Review of Economic Studies*, Vol. 47, pp. 225-238.

Choquette, E. y P. Meinen, (2014). "Export Spillovers: Opening the Black Box". World Economy. doi: 10.1111/twec.12225.

Clerides, S., S. Lach, y R. Tybout (1998). “Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico and Morocco,” *Quarterly Journal of Economics,* Vol. 113(3), pp. 903-947.

Dumont M., B. Merlevede, C. Piette y Glenn Rayp (2010), “The productivity and export spillovers of the internationalisation behaviour of Belgian firms” Working Paper Research 201, National Bank of Belgium.

Duranton, G. y D. Puga (2004). “Micro-foundations of urban agglomeration economies.” In: Henderson, J.V., Thisse, J.-F. (Eds.), Handbook of Urban and Regional Economics, Vol. 4, pp. 2063-117.

Erkel-Rousse, H. y D. Mirza, (2002). “Import Elasticities: Reconsidering the Evidence,” *Canadian Journal of Economics*, Vol. 35(2), pp. 282–306.

Fernandes, A. y Tang, H. (2015). “Scale, scope, and trade dynamics of export processing plants”. Economics Letters, Vol. 133, pp. 68-72.

Fu, X. (2011), “Processing-trade, FDI and Exports of Indigenous Firms: Firm-level Evidence from High-technology Industries in China”, *Oxford Bulletin of Economics and Statistics*, Vol. 73 (6), pp. 792-817.

Greenaway, D. y R. Kneller, (2008). “Exporting, productivity and agglomeration”. *European Economic Review,* Vol. 52, pp. 919–939.

Greenaway D., N. Sousa y K. Wakelin (2004), “Do Domestic Firms Learn to Export from Multinationals?", *European Journal of Political Economy*, Vol. 20, pp. 1027-1043.

Görg, H. y D. Greenaway, (2004). “Much Ado about Nothing? Do Domestic Firms Really Benefit from Foreign Direct Investment?”. *The World Bank Research Observer*, Vol. 19 (2), pp. 171-197.

Görg, H. y E. Strobl, (2001). “Multinational Companies and Productivity Spillovers: A Meta-analysis, *Economic Journal,* Vol. 111, pp. F723-F739.

Harasztosi, P. (2015). “Export spillovers in Hungary”. Empirical Economics, pp. 1-30.

Head, K. y J. Ries, (2001). “Increasing Returns Versus National Product Differentiation as an Explanation for the Pattern of US-Canada Trade,” *American Economic Review,* Vol. 91(4) pp. 858–876.

Hering, L. y S. Poncet, (2009). "The impact of economic geography on wages: Disentangling the channels of influence", *China Economic Review*, Vol. 20(1) pp. 1-14.

Kneller, R. y M. Pisu, (2007). "Industrial Linkages and Export Spillovers from FDI". *World Economy*, Vol. 30, pp. 105-134.

Koenig, P., (2009). "Agglomeration and the export decisions of French firms". *Journal of Urban Economics,* Vol. 66 (3), 186–195.

Koenig, P., F. Mayneris, y S. Poncet, (2010). "Local Export Spillovers in France". *European Economic Review*, Vol. 54, pp. 622-641.

Kokko, A., M. Zejan y R. Tansini, (2001). "Trade Regimes and Spillover Effects of FDI: Evidence from Uruguay", *Review of World Economics*, Vol. 137 (1), pp. 124-149

Krautheim, S. (2009). "Gravity and Information: Heterogeneous Firms, Exporter Networks and the 'Distance Puzzle", mimeo, Paris School of Economics.

Lancaster, T. (2000), "The incidental parameter problem since 1948". Journal of Econometrics, Vol. 95, pp. 391-413.

Lawless, M. (2009). "Firm Export Dynamics and the Geography of Trade", *Journal of International Economics,* Vol. 77(2), pp. 245-254.

Mayneris, F. y S. Poncet (2013). "Chinese Firms' Entry to Export Markets: The Role of Foreign Export Spillovers". World Bank Economic Review, Vol. 29 (1), pp. 150-179.

Melitz, M., (2003), "The impact of trade on intra-industry reallocations and aggregate industry productivity". *Econometrica*, Vol 71(6), pp. 1695–1725.

Moulton B. R., (1990), "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Unit", *The Review of Economics and Statistics*, Vol. 72(2), pp. 334-338.

Moulton, Brent R. (1986), "Random Group Effects and the Precision of Regression Estimates," *Journal of Econometrics*, Vol. 3(3), pp. 385–397.

Requena, F. y J. Castillo, (2007). "Information Spillovers and the Choice of Export Destination: A Multinomial Logit Analysis of Spanish Young SMEs", *Small Business Economics,* Vol. 28(1), pp. 69-86.

Reyes A., D. Romo y C. Bazdresch, (2004). “El estudio de las derramas de la inversión extranjera directa en la industria manufacturera mexicana. Una nota histórica”. Centro de Investigación y Docencia Económicas, A. C., *Documento de Trabajo* no. 305.

Roberts M. y J. Tybout (1997). “The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs”, The American Economic Review, Vol. 87(4), pp. 545-564.

Rosenthal, S. y W. Strange (2003). “Geography, industrial organization, and agglomeration.” *Review of Economics and Statistics*, Vol. 85 (2), pp. 377-93.
Sargent, J. y L. Matthews (2008). “Capital Intensity, Technology Intensity, and Skill Development in Post China/WTO Maquiladoras”. *World Development*, Vol. 36(4), pp. 541–559.

Singa, J., (2007). “ILO database on export processing zones (Revised), Sectoral Activities”. Programme, Working Paper 251, International Labour Organization, Geneva.

Singa, J., (2003). “ILO database on export processing zones (Revised), Sectoral Activities”. Programme, Working Paper 251, International Labour Organization, Geneva.

Wagner, J. (2007), “Exports and Productivity: A Survey of the Evidence from Firm-level Data”. *World Economy*, Vol. 30, pp. 60–82.