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

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Abstract

This document examines whether the probability of entering into new external markets or the increase in new export products on the part of Mexican firms are related to the proximity of diverse multinational firms exporting under different trade regimes (processing, ordinary or hybrid). The evaluation was made using a panel based on data from Mexican Customs and production from a sampling of national firms from 2003-2010. The results show that export spillover are far from homogeneous vis-à-vis Mexican firms, since their existence is related to the export activity (products and/or destinations) of neighboring foreign firms. Moreover, spillovers are more likely to appear in places where neighboring national and foreign firms have in common not only the same trade regime, but also the same technological level of production.

Key words: international trade, spillovers, agglomeration economic activity

JEL Classification: JEL: F14, D22, R12

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I. Introduction

As a result of the economic process of globalization, various countries, principally developing ones, boosted their participation in international trade, permitting the location of *multinational firms* (MNFs) 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 benefited from exemptions in paying taxes on inputs imported. 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 huge importance acquired by the presence of companies elaborating processed products in many countries around the world, the literature examining whether the presence of MNFs has an influence on domestic firms' decisions to export has concentrated mainly

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

on examining MNFs trading ordinary (non-processed) products.[2] Findings from such evaluations are mixed. In some cases, they confirm the influence of MNFs (Aitken et al., 1997; Kokko et al., 2001; Greenaway et al., 2004; Anwar and Nguyen, 2011) and, in others; they do not corroborate this phenomenon (Barrios et al., 2003). The few studies[3] that has directly evaluated whether foreign-exporting PCS propitiate the incorporation into export activities or expansion of destination markets for domestic firms, has yielded inconclusive results, since the findings head off in two directions: in contra (Mayneris and Poncet, 2015) and in pro (Fu, 2011).

Mexico represents an interesting case, in virtue of having, for more than three decades, established foreign firms that export PCS products operating under the program known as *maquila* and, more recently through the program known as PITEX (*Programa de Importación Temporal para Producir Artículos de Exportación)*, that providing companies established in Mexico (domestic and foreign) the ease to buy inputs abroad to elaborate export products, with the same customs-tariff exemptions and tax benefits contemplated in the *maquila* program.[4] In 2006, sales of processed products represented an important percentage of manufactured exports of Mexico (Sargent and Matthew, 2008); this shows that exporting PCS products is widely spread through the Mexican economy.

In addition, in Mexico, there are other foreign firms exporting under a regime of *ordinary trade* (ORD), that is to say, they do not carry out any activities processing goods. There is also a third type of foreign firm, that we denominate *hybrid* (HBR), which export both PCS as well as ORD products.

[2] The reason lies principally in the fact that, in the countries considered in the studies, there are no firms that trade processed goods or the export of these PCS are not relevant.

[3] Frequently, the limiting factor is the non-existence of or null access to detailed information identifying the regime by which firms export, necessary for doing this type of study. In the case of Mexico, information from customs offers the possibility of identifying those firms trading processed and ordinary (non-processed) products abroad. It likewise allows identification of those companies selling both types of products abroad.

[4] 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).

In this manuscript, we evaluate whether the probability of domestic firms´ exporting is positively related to the proximity of different types of MNFs[5] in the same area. Our evaluation is based on the hypothesis know in the literature as *export spillovers*, which supposes that companies, in order to enter into an export activity, have to tackle high fixed entry costs[6] (Bernard and Jensen, 2004; Melitz, 2003; Wagner, 2007), which may be diminished due to the proximity of established exporting firms.

Proximity to other exporters may help lower fixed costs as a result of externalities deriving both from market interactions as well as from other non-market ones. The first presupposes that the increase in the presence of exporters in a particular area may attract other companies facilitating export activities,[7] such as input suppliers or trade intermediaries. The second is related with the informal exchange of information on export activity or the characteristics products must have to enter into different international markets.

In practice and without proper data, these externalities are difficult to identify. However, those externalities suggest that a non-exporting company, located where there is a high concentration of exporters, would have better access to information about getting into other markets and therefore a greater probability of selling abroad. For this reason, in this document, as in Clerides et al. (1998), Greenaway and Kneller (2008), and Koenig et al. (2010), we investigate the total effect[8] of spillovers deriving from the agglomeration of other neighboring exporters, which, in our case, are different types of foreign-exporting firms.

This study contributes to the literature on the topic in several ways. First, we argue that export spillovers from different foreign firms manifest themselves heterogeneously on domestic firms, in terms of destination country and/or export product, a topic a topic

[5] In our evaluation, we define MNFs as those companies with majority foreign-direct investment. This description also applies when we refer to foreign or non-local companies in this document.
[6] These costs may include commercialization and distribution channels, compliance with regulations, market research, information on consumer likes and preferences external markets (Kneller and Pisu, 2007).
[7] Also, public intervention for the creation or improvement of infrastructure generates positive externalities bringing down costs.
[8] These encompass the net result of market transactions, non-market interactions, as well as the effect derived from competition among firms.

receiving very little attention in previous research. In Fernandes and Tang (2015), they show that PCS and ORD companies behave differently in their exporting activities. PCS firms, being part of a global production/distribution network, have more concentrated sales regarding certain products and markets. In turn, ORD firms prove to be more diversified in terms of product and destinations abroad. This differentiated behavior may be a reflection of the influence exercised by the different types of foreign companies vis-à-vis their domestic counterparts.

Second, the data used in this study contributes to the analysis of an interesting type of foreign firm, the HBR, which carry out both processed and ordinary (non-processed) trade. The influence of this type of company on the domestic industry has yet to be treated by the other studies on the topic of spillovers.

Finally, this is the first document in the literature that delves into the presence of spillovers, jointly considering the trade regime under which they export and the technological intensity of the products elaborated by foreign companies vis-à-vis their domestic counterparts; both elements have been observed to have an influence on the existence of spillover. Kokko (1994) documents that one limiting factor in adopting information on the part of local companies is the technological gap they might have vis-à-vis MNEs. Meanwhile, Mayneris and Poncet (2015) show that the similarity in the trade regime using by foreign companies and their domestic counterparts is important for the existence of spillovers.

The theoretical framework guiding our empirical evaluation is based on a simple model inspired in Melitz (2003), in which the fixed costs of exporting to a specific destination are reduced by the concentration of other nearby firms also selling to the same market. The data used comes from a panel of manufacturing firms created by merging information from a sample of domestic companies in Mexico and from detailed figures from trade export operations recorded by customs. The panel of manufacturing firms encompasses the period 2003-2010. This information has the advantage of identifying the level of product and destination country, sales made by domestic firms and, in the estimates, permits controlling for those individual characteristics related to their entry into the export market. Similarly,

merging customs data with a national directory of manufacturing companies permits constructing agglomeration variables for foreign companies at a fine geographical level, such as the municipal.

Estimates show that spillovers appear heterogeneously in Mexican exporting firms and that their existence depends on the similarity between foreign firms and their Mexican counterparts with regard to a variety of factors such as export product/destination, export regime and level of technological intensity. Therefore, findings show that export spillover from foreign PCS firms are specific as to their country destination and their influence is limited to Mexican ORD and HBR firms with medium and high technological intensity, respectively.

In turn, foreign ORD firms exhibit specific product-country destination spillovers. Their influence is solely perceived in domestic ORD firms with low technological performance. Finally, we find that the presence of external HBR firms increases participation on foreign markets for domestic HBR firms, specifically those with a high technological level. As to the contribution of spillovers to the increase in the possibility of domestic firms exporting to markets other than the U.S. and Canada, only in the case of foreign ORD firms is evidence found 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

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

First of all, there are studies that investigate the presence of export spillover from MNFs on domestic companies. Most of these studies examine whether their existence is due to horizontal or vertical linkages,[11] competition among firms and/or the existence of demonstration/imitation effects,[12] among others. This is the case of the pioneering study 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 MNC´s in the same region or by the presence of non-local export-oriented firms. In contrast to the positive evidence, Barrios et al., (2003) argue that there is no evidence

[9] 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.

[10] 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.

[11] The term *horizontal linkage* refers to interaction between companies in the same industry (intra-industry), whereas *vertical linkage* corresponds to forward and backward linkage (client-provider relationships) between firms from different industries (inter-industry).

[12] For an understanding of how channels of competition and of demonstration/imitation operate, see Görg and Greenaway (2004), and Kneller and Pisu (2007).

supporting the presence of export spillover from MNFs on Spanish firms located in the same sector of economic activity for the period 1990-1994.

Another line of literature researches whether the presence of export spillovers originates from the agglomeration of exporters in general on firms located within certain specific 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.

Requena and Castillo (2007), using data extracted from Spanish customs houses and a sampling of companies, document that the probability of Spanish firms exporting to an non-local market, in the year 1994, was influenced positively by the concentration of neighboring exporters, who sold the same market[13] and 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) find support for the existence of destination specific spillovers in decisions to export by French firms at the end of the nineties. In the case of Denmark, Choquette and Meinen (2014) following the same strategy of using data extracted from customs houses, provide statistical evidence that suggest that the dissemination of information regarding a specific export market can be transmitted between firms through contacts intra-industry and inter-industry.

This document is closely related to the both focuses in the literature in a variety of ways. Just as in the first, here we consider the existence of export spillover from MNFs on domestic companies. This choice is due to the fact that identifying the factors that can influence the development of the export potential of local industry is a topic of priority in

[13] The use of detailed information from the trade 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.

terms of public policy. Moreover, trying to get this type of policy considering the generality of exporters could lead skewed results since foreign companies are better able to absorb knowledge than their domestic counterparts, as pointed out by Barrios et al., (2003) and documented by Harasztosi (2016).

As to the second focus, there is a similarity when considering the net effect of spillovers deriving from the agglomeration of other neighboring exporters. In our case, agglomeration measurements are constructed distinguishing different types of foreign companies. The preference for the use of this focus is due to the fact that export spillovers can be the joint result of market and non-market interactions. They are difficult to distinguish empirically without the proper proxy variables, as is our case.

As regards the distinction made of MNFs by the type of trade regime that they use to export (PCS and ORD), this paper is close to the study of Mayneris and Poncet (2015) and Fu (2011), who provide different evidence. Using aggregate data at a provincial level for China, Mayneris and Poncet (2015) found export spillovers emanating mainly from ORD firms and benefit only their domestic counterparts that carry out ordinary trade activities. 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.

Unlike Mayneris and Poncet (2015) 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 (2015), the analysis is done specifically considering the effect of non-local firms on domestic establishments using firm-level data. The disaggregated 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 and firm size,, 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

In this section, we introduce the conceptual framework serving as the basis for the empirical analysis, which is inspired in the model posited by Melitz (2003). Selecting this theoretical approach as a guide for practical evaluation is due to the fact that, on the one hand, it permits formalizing the empirical evidence with regard to the relationship between the productivity of the firms and the fixed entry costs[14] to be assumed by entering into export activities[15] and, on the other hand, it provides the possibility of incorporating the hypothesis regarding a reduction in said costs deriving from the externalities generated by the agglomeration of other firms selling to specific destinations.[16]

The demand side

In this paper is assumed that the world is composed of $i = 1,...,N$ 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 have identical and homothetic preferences in the consumption of both goods. The utility function of the representative individual in the country j is defined as a Cobb -Douglas function, as follows:

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

[14] Bernard and Jensen (2004) show that such entry costs are not insignificant and that individual characteristics, such as company size, sharply increase the probability of exporting. Likewise, Robert and Tybout (1997) find that sunk costs to enter external markets are important.

[15] In the Melitz (2003) model, productivity and fixed entry costs play a relevant role in company decisions to export, in virtue of the fact that only firms with a sufficient level of productivity are capable to overcome the high entry costs and accessing foreign markets. Therefore, only the most productive companies choose to enter into export activities. For a review of the empirical studies that have examined the hypothesis of self-selection, see Wagner (2007).

[16] This criterion of modeling was chosen due to the fact that the existence of spillovers may be more closely associated with exporting to certain specific countries, as is shown by Koenig (2009). Moreover, under a different focus, Krautheim (2009) finds that the exchange of information between firms selling to the same market reduces the individual fixed costs associated with exporting and increases the probability of selling abroad.

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

$$F_j = \left[\sum_{i=1, i\neq j}^{N} \int_{\omega \in \Omega_{ij}} \left[q_{ij}(\omega) \right]^{\rho} d\omega \right]^{1/\rho}, \quad 0 \prec \rho \prec 1 \tag{2}$$

In this expression $q_{ij}(\omega)$ represents the amount of the variety ω elaborated by firm i and consumed in j. Ω_{ij} represents the group of companies that sell a variety produced in country i to destination j, meanwhile, $\sigma = \frac{1}{1-\rho}$ is the elasticity of substitution between varieties differentiated good which is assumed strictly greater than one. [17] 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 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.

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

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

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

[17] Several studies provide evidence for this assumption. For U.S. and Canada (Head and Ries , 2001) and for a group of countries (Erkel-Rousse and Mirza , 2002).

The supply side

The firms compete in a frame of a monopolistic competition and obtain benefits π_i assuming that the only factor is labor, as in the standard model of Dixit-Stiglitz-Krugman.

$$\pi_{ij} = p_i q_{ij} - w_i l_i \tag{5}$$

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.

$$l(\omega) = f_{ij}(A_j) + \frac{q_{ij}}{\varphi(\omega)} \tag{6}$$

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, [18] 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, q_{ij} 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.

$$p_i(\omega) = \frac{1}{\rho\varphi(\omega)} \tag{7}$$

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.

$$\pi_{ij}(\varphi) = (\rho\varphi)^{\sigma-1} \tau_{ij}^{-\sigma} \frac{\mu R_j}{\sigma P_j^{1-\sigma}} - \overline{f}_{ij} A_j^{-\theta} \tag{8}$$

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

$$\left(\rho\varphi_{ij}^*\right)^{\sigma-1} \tau_{ij}^{-\sigma} \frac{\mu R_j}{\sigma P_j^{1-\sigma}} = \overline{f}_{ij} A_j^{-\theta} \tag{9}$$

From the above we can observe that a minimum productivity level is required (*cut-off*) φ_{ij}^* for which $\pi_{ij}\left(\varphi_{ij}^*\right) = 0$. Therefore, firms with a productivity of φ_{ij}^{**} over φ_{ij}^* will be able to

[18] From this expression we can see that $\frac{\partial f_{ij}(A_j)}{\partial A_j} < 0$, so that a high agglomeration of exporters would lead to a decrease in fixed costs of a specific destination j.

serve market j, while a firm with a productivity 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:

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

Given $\sigma>1$, then the first term on the right side of (10) 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 destination 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).[19] This level of detail in specifying products allows us to establish clear differences

[19] 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.

between the goods exported by a single firm[20] 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.[21] 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 by using fixed firm-product-destination effects, reasonably considering that they do not vary notably down through time.[22]

In the case of transport costs $\left(\tau_{ij}\right)$, 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[23] to reach those buyers.[24]

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[20] 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.

[21] 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 capture better the demand of local consumers on the different products imported.

[22] With the inclusion of these effects can also control other aspects which are assumed to not vary widely over time, such as export strategies or preferences to sell certain products to certain destinations abroad.

[23] 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

As for the term σ, 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,[25] 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 $\left(A_j\right)$ with which we analyze the presence of export spillovers, it approximates by the number of other foreign-exporting firms in the same municipality, selling the same destination as the domestic firm (destination-specific measure). This variable is similar to that used in other studies researching the topic of export spillovers, [26] such as Koenig et al., (2010) and Harasztosi (2016).

In addition, in this document, we use other agglomeration variables to measure the presence of spillovers. These measures are product-specific[27] (# of other foreign exporting firms in the same municipality, selling the same product abroad) and product-destination specific (#

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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.

[24] 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.

[25] 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: $l(\omega) = \left(\varphi(\omega)P_j\right)^{\sigma-1}\left(\frac{\rho}{\tau_{ij}}\right)^{\sigma} \mu R_j + f_{ij}(A_j)$,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 labor.

[26] On the topic of 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, 2015), among others.

[27] 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-destination variable can be seen as a horizontal measures particular to a destination.

of other foreign exporting firms in the same municipality, selling the same product to the same destination).

The expression $\left(E_{ij}\right)$ 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,[28] 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).[29]

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 between export capacity and productivity. This inconveniency is present between the export capacity and the measure 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

[28] 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.
[29] The technique proposed by Chamberlain (1980) uses conditional estimates of maximum-verosimilty to correct the problem of inconsistency in parameters.

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 variables lag behind one period in time.[30]

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 calculating 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)[31] and year for the period 2003-2010.[32] Moreover, in this exporters´ database (*Base de datos de exportadores: BDE*), there is a variable that permits identifying those products exported under the regimen trade of processing (PCS), ordinary (ORD) or both (HBR). By using this data, also from the Secretary of the Economy, the BDE was

[30] 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.

[31] 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.

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

complemented in order to identify firms according to the origin of their capital, be it domestic or foreign.[33]

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[34]/number of employees), size of the company (number of employees)[35] and location of the manufacturing plant.

One limitation of the EIA is that it only allow identify firms that exported mainly in trade regimes of ORD and HBR. This is because, during the period of analysis, information on PCS companies was contained in a different survey, therefore was 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 of their different locations; iii) to avoid excess null trade flows, it only considered those countries representing up to 95% of the firms´ export operations; iv) the information corresponding to 2003 was eliminated from the database in virtue of the fact that it was taken as referent

[33] 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.

[34] Sales figures are expressed in real terms, using the Producer Price Index (PPI) and based on the Banco de México and INEGI (Base year: 2003 =100).

[35] In order to maintain confidentiality, the merges of 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 consisted of processing the information at INEGI installations under the supervision of its personnel, integrating the final database with the anonymized information.

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, was incorporated into the BDE-EIA 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,[36] which came from the CEPII (*Centre d'Études Prospectives et d'Informations Internationales*) database.[37] Meanwhile, import figures (6-digit HS) came from the U.N. 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.

[36] 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.
[37] http://www.cepii.fr/anglaisgraph/bdd/distances.htm.

V.2 Spillover Variables

A foreign companies contained in the BDE were assigned the municipality where its production plant is located, using the Sistema de Información Empresarial Mexicano (SIEM).[38] In computing the measurements of specific destination spillovers, we added the number of companies exporting to the same country located within the same municipality. This procedure was done for each type of foreign company (PCS, ORD or HBR).

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.

[38] 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 2 shows descriptive statistics on the number of neighboring foreign-exporting firms that domestic firms have, in accordance with the specific measure of destination. 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%.

These comparisons point to it being more probable that domestic exporting companies receive influence from foreign HBR companies, in virtue of the fact the great majority of positive export flows occur in municipalities with a high concentration of HBR firms.

On the other hand, the agglomeration of PCS firms shows greater dispersion with regard to the average calculated, suggesting the existence of a broad heterogeneity in the location of this type of establishment among the municipalities where domestic firms are located. Therefore, it is feasible to think that their influence is negligible or limited to places where the economic activity of these firms is more concentrated.

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 of foreign-exporting firms regarding the probability that domestic firms can sell to a market j This is dealt considering the measure of spillover destination-specific, as well as others measures de spillover product-specific and product-destination specific. Below, we evaluate once again said influence, considering three types of foreign companies according with 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, the sample of domestic companies was segmented according to the type of goods 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 the measure of spillover destination-specific 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, in line with the findings reported by Koenig (2009) and Koenig et al. (2010).

Table 3. Logit Estimates on the Export Decisions of domestic Firms, 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					
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.[39] In Column 3, we include a specific product variable. The results shed

[39] The specific product measurement was done by adding, to the foreign companies exporting, the same product (4 digits of the HS) and that were located in the same municipality. In the case of the specific product-country measurement, the aggregate considered companies within the municipality that exported the same product to the same country.

light on the fact that the coefficient of this measure 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-destination-specific measure 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 the specific destination of the sales abroad than with 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 measures 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 see that the estimated coefficients for the three measures related to the concentration of foreign-exporting PCS firms do not provide evidence in favor of the existence of spillovers. One possible explanation is that the influence on domestic exporting activity may be restricted to certain productive sectors or to very specific destination markets.

In turn, results from Column 2 reflect the existence of specific product-destination spillover from non-local ORD firms on domestic ones. In contrast to PCS firms, the effect may be associated with sharing specific information on the product, such as the design, labeling, packing, demand or quality that are required by foreign marketplaces. This result tends in the same direction as those reported in other studies reporting on the existence of specific product-destination spillovers on countries with a slight or nil presence of PCS firms, as in the case of Koenig et al., (2010) and Harasztosi (2016).

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

Dependent Variable: *Dummy* E_{ijt}

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

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. Compared to the other two types of foreign companies, this situation seems to reflect that the influence on domestic companies derives from sharing specific information on access to destination countries, such as things related to customs requisites and restrictions, commercial regulations, ways of doing business, market structure, language, etc.

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.[40] 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

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

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.

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).

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: Firm-product-country	Not considering municipalities with larger number of cells: Firm-product	Export status
Measurements of spillovers from foreign firms								
Firms: PCS								
Destination-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-destination-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								
Destination-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								
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.

Column 2 of Table 6 reports the coefficients of spillover variables 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 between domestic and foreign firms are more likely to show up in agglomerations where both types of companies have the same trade regime in common, as was found by Mayneris and Poncet (2015) in the case of China.

Table 6. Logit Estimate on the Decision to Export in Different Domestic Firms, 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			
Destination-specific	0.0176	0.00393	0.0229
	(1.50)	(0.55)	(1.64)
Firms: ORD			
Prod-destination specific	0.211**	0.223**	0.194
	(2.73)	(4.13)	(1.32)
Firms: HBR			
Destination-specific	0.0144**	0.0139+	0.0145*
	(2.72)	(1.73)	(2.00)
Fixed firm-product-country and year effects			
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 $Ln\ imports_{ijt} / Ln\ \text{distance}_{jt}$. The marks **, * and + indicate a significance level of 1%, 5% and 10%, respectively.

When considering foreign HBR firms, we find a positive and significant effect at 10% on the probability of domestic ORD firms going to a new destination. This influence may be related to the fact that HBR firms not only have strong links 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 externalities emanating from the presence of foreign companies are reinforced when occurring in a trade regime similar to that of domestic ones.

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.

To evaluate such an effect, spillover measures are multiplied by two dummy variables indicating the export destination. 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.

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.

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

Dependent Variable: *Dummy* E_{ijt}

	(1)	(2)	(3)
	Domestic firms		
	All	ORD	HBR
Measurement of spillover from foreign firms			
Firms: PCS			
Destination-specific	0.0188	0.00581	0.0240+
X dummy U.S.-Canada	(1.59)	(0.78)	(1.71)
Destination-specific	-0.0122	0.0144	-0.00984
X dummy no U.S.-Canada	(-0.14)	(0.07)	(-0.10)
Firms: ORD			
Prod-destination-specific	0.265**	0.229**	0.291+
X dummy U.S.-Canada	(2.97)	(3.75)	(1.80)
Prod-destination-specific	0.0396	0.205*	-0.0805
X dummy U.S.-Canada	(0.42)	(2.03)	(-0.62)
Firms: HBR			
Destination-specific	0.0165**	0.0172*	0.0165*
X dummy U.S.-Canada	(2.94)	(2.12)	(2.05)
Destination-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			
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.6 Export Spillovers and Technological Intensity of Domestic Firms

When explaining the existence and magnitude of the effect of export spillovers, one major aspect which has not received much attention is that its influence is related to the type of activity of domestic companies. 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).[41] Analyzing the findings reported in Column 1 of Table 8, we see that the concentration of foreign PCS and HBR firms has a positive influence on the propensity to export of domestic companies producing goods in high-tech sectors. Said effect is mainly observed, to a greater degree, in domestic HBR firms, (Column 7).

One possible hypothesis to explain this result is that companies in high-tech sectors need continual information on the changing needs of the marketplace abroad, since the life cycle of the products they elaborate and customer tastes for the same are short-lived due to the speed with which technology evolves. These factors force to the companies to make continual adjustments to the costs associated with the commercialization, distribution and marketing of their products abroad, among others. In order to cover this constant need for information, domestic companies may be being nourished by foreign PCS or HBR firms, since the later form part of a global production chain that elaborates processed products by having updated knowledge on worldwide consumer and logistic trends for high-tech products. Transmitting information to domestic MIX firms is quite probable, favored by the environments of high agglomeration that distinguish high-tech sectors in Mexico, with noteworthy participation by companies trading processes goods (Carrillo and Gomis, 2007).

[41] 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.

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 would seem to say that this type of domestic ORD exporting company in certain sectors also benefits from the proximity of 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 findings suggest that domestic companies operating under a HBR trade regime in sectors with high technological intensity are more likely to benefit from externalities emanating from foreign firms elaborating processed products. On the contrary, the assimilation of said externalities on the part of domestic ORD firms seems to be present solely in sectors with low technological intensity. Therefore, the existence of spillovers is not totally conditioned by the affinity foreign and domestic firms have in the exporting regime within an industrial concentration, but also by the technological similarity between the companies within the agglomerations.

VII Conclusions

By using a rich database that combines information from the trade and production of domestic companies, as well as detailed measure that capture the agglomeration of foreign firms at a very fine level, this research questions whether the presence of foreign-

exporting firms using different trade regimes increases the probability that domestic firms will begin to export or to diversify their presence on foreign markets.

Just as in other research (Aitken et al., 1997; Kokko et al., 2001; Greenaway et al., 2004), the estimates generated provide statistical support to state that the export decisions of domestic firms in Mexico, in general, 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 follow. The results show that the effects of spillovers are not present, nor do they occur homogenously on domestic firms. The findings point to the fact that the presence of spillovers is not only favored by the environment where domestic and non-local companies have the same trade regime in common, but also by the fact that their existence shows up in sectors where the goods produced and the technology used are more similar between said companies despite not sharing the same trade regime. This could explain the no conclusive evidence on the existence of spillovers from PCS firms on domestic firms, contributed by the studies of Mayneris and Poncet (2015) y Fu (2011), showing that both findings can be considered special cases of a more general analysis, which takes into account both the technological intensity, as the trade regimen of domestic and foreign firms as determining factors in the existence of export spillovers.

Moreover, the findings might be used as a guide to elaborate more effective public policy for incorporating domestic firms into export activities. Since, if one seeks a policy spurring domestic firms to enter markets other than the North American area, it would be most recommendable, in light of the findings, to stimulate the presence of foreign ORD firms vis-à-vis their domestic counterparts. However, according to estimates, it is quite probable that their influence is limited to sectors of low technological intensity. In turn, if what is desired is to spur entry into export activity or the sale of new products abroad by domestic companies from sectors with medium and high technological intensity, what is most recommendable would be to propitiate the presence of PCS or HBR firms.

However, it would be expected that the new additions would center on the U.S. or Canadian markets.

There are still issues for future research on the incidence of export spillovers on foreign PCS or HBR firms with regard to the possibility of entering into export activities or diversifying markets by domestic manufacturers. It is necessary to research the mechanisms by which the effects of spillovers are generated between different foreign companies with different domestic ones.

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

Dependent Variable: *Dummy* E_{ijt}

	(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									
Destination-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-destination-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									
Destination-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								
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.

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