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The role of new imported inputs and multinationality

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Abstract

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1. Introduction

A large number of studies, starting from the seminal work of Posner (1961) and the related "technology gap" literature, highlighted the important nexus between the ability of firms to constantly introduce innovative products and their ultimate export success (Fagerberg, 1988; Wakelin, 1998; Basile, 2001; Cassiman et al., 2010; Dosi et al., 2015). Only through the constant introduction of brand new products firms can remain competitive on international markets, where rents stemming from the introduction of innovations are quickly eroded by the fast imitation of foreign competitors. Much more than firms that only operate in domestic markets, exporting firms need to constantly renew and adapt the portfolio of products that they sell abroad, by upgrading the quality of existing products, or by introducing radically new ones. In such a turbulent competitive landscape, the ability of firms to start exporting new products represents a crucial indicator of their competitiveness and ability to stay ahead of competition in international markets.

In this paper, we focus on exporting firms and introduce the notion of "export innovation", that is the export of a product that was never exported before by a firm. This indicator is a good proxy of the ability of exporters to constantly introduce significantly new and improved products to be sold abroad. Indeed the fact that an exporter adds a new product among its export portfolio indicates that it has invested the resources necessary to render it competitive in international markets: this might correspond to a technological upgrade of an existing product, its adaptation to the requirements of foreign markets or the introduction of a completely new item. Moreover, in line with a classical demand-pull perspective, since exporting means accessing a larger market and higher level of sales, one can expect that firm will dedicate significant investments especially to innovate the products that they plan to sell abroad.

Since, according to this framework, the introduction of export innovations is an important determinant of the overall competitiveness of firms, it is crucial to identify the main drivers of their ultimate introduction. In this paper we focus on two main factors that are likely to influence the rate of introduction of export innovations: the role importing new inputs and being part of a multinational enterprise (MNE).

Importing new inputs can allow firms to benefit from technology embodied in the inputs that they use for their production activities with a channel of technology upgrade, in addition to upgrading their technologies through internal innovative activities. Existing empirical studies in emerging and developing countries showed that easier access to imported inputs can significantly contribute to improve the quality of the products of domestic firms (Kugler and Verhoogen, 2009; Goldberg et al., 2010). More recently the same relationship was found also in an analysis at the sectoral level in European countries (Colantone and Crino', 2014).

To the extent that imported inputs help upgrading firms' product portfolio, they can also contribute to their ability to export such products. In line with this view, recent evidence has supported the idea that the import of new inputs can explain the probability of firms to export, together with the more usual determinants such as firm size, innovation and productivity. Recent studies have provided detailed evidence on the links between importing and exporting activities, showing that importing inputs strongly fosters future exporting activities. Evidence in this direction have been provided for countries as diverse as France (Bas and Strauss-Kahn, 2013), Italy (Lo Turco and Maggioni, 2013), Slovenia (Damijan and Kostevc, 2015), and a sample of firms from 27 Central and Eastern European countries (Aristei et al., 2013).

Together with imported inputs, also being part of a MNE (multinationality) can substantially affect the ability of firms to introduce export innovations. It can increase the

ability of firms to come up with novel products to export, thanks to the superior technological knowledge generated within the multinational network. Moreover firms might also benefit from the in-depth knowledge of foreign markets of the MNE. However becoming part of a MNE might also have negative effects on the ability of firms to introduce new exports: firms might be integrated in intra-corporation international value chains in which they supply very specific products to other subsidiaries, hence limiting the overall number of exported products. Also, especially in the case of firms that become part of foreign-owned multinationals, firms' activities might be re-directed in order to target primarily the domestic market.

Finally, controlling for the multinational status of a firm can also allow to understand whether imported inputs really boost export innovations or whether they simply represent a by-product of being part of an MNE, in which inputs are increasingly sourced from foreign subsidiaries of the business group[1].

We use very extensive data from the population of Swedish manufacturing firms over the 2001-2012 period. We introduce a measure of export innovation by taking advantage of transaction-level data of export flows at a uniquely disaggregated product level (8-digit CN8 classification) for each firm. Trade data is also used to identify the new inputs imported by a firm in each year t. We also matched these data with the register of business groups in Sweden, which allows us to identify which firms are part of multinational groups, distinguishing between groups in which the ultimate owner is a Swedish or a non-Swedish company. We are able to control for a number of additional firm-level factors that might influence their overall ability to introduce export innovations, such as patenting activity, firm size, productivity, and capital intensity.

The results of the empirical analysis point to the role of new imported inputs as an important factor able to foster the introduction of export innovations by firms, particularly for small and medium size enterprises (SMEs), which seem to benefit the most from the access to new imported inputs. The impact of multinationality is instead more mixed. We find that firms that are included in foreign-owned MNEs experience a decrease of export innovation, and this is especially true for small firms. On the contrary large firms establishing a multinational network experience an increase of the level of export innovations.

The paper contributes to the literature in several ways. First we provide a new perspective on the literature that focuses on the introduction of brand new products in the existing export portfolio of firms (Cirera et a., 2015), by introducing the definition of export innovation and by highlighting its importance for firms' competitive advantage. Second, we submit that our approach of gauging innovation from the change in a firm product portfolio may provide a novel way of measuring innovation at the firm level. Third, we improve on the existing literature focussed on the relationship between import and export activities by including also the dimension of multinationality, as an important factor to take into account in order to net out the actual contribution of import activities. Finally we provide brand new evidence about the relationship between multinationality and exporting activities, in particular providing new insights about the possible effects of the incorporation of exporting firms within multinational groups and its effects in terms of export dynamism.

The paper is organised as follows. Section 2 revises the relevant literature, section 3 describes the data and provides some descriptive statistics, Section 4 lays out our econometric analysis and discusses the results. Section 5 concludes.

[1] For example, in a similar context, Haller (2012) shows that once controlled if a firm engage in intra-firm trade the productivity premium of exporters vanishes.

2. Background literature

2.1. The role of new imported inputs

In order to be able to export new products firms can either improve and upgrade the quality of their existing products or they can create brand new products that, because of their technological superiority (or because of higher cost competitiveness), are better suited for international markets. Innovative activities, such as investments in in-house product development or more formalized R&D expenditures, are a typical way through which firms can achieve such results. However often the relevant technology needed for product upgrading and innovation can also be embodied in the inputs that are used in the production processes and which need not to be necessarily developed internally by the firm, but can be also purchased from other firms. Accordingly, together with in-house innovative activities, access to better (or cheaper) inputs can substantially affect the efficiency of the production process, as well as the overall ability of firms to produce new products that can be competitive on international markets.

The possibility to access imported inputs from abroad can greatly boost this specific channel of product upgrading, since it expands the overall spectrum of specialized suppliers from which firms can source inputs (and relative embodied technologies) that are needed in their own production processes (Andersson and Stone, 2017). This channel of product upgrading has been documented in many recent studies, that have shown that imported inputs can have a strong positive effect on the ability of firm to start producing better products (Goldberg et al. 2010; Colantone and Crinò, 2014).

In line with the idea that improved and upgraded products are also more likely to be exported (Ganotakis and Love, 2011), recent studies have also found a positive relationship between importing and exporting activities, showing that importing inputs can be an important determinant of future exporting activities. Lo Turco and Maggioni (2013) show that imported inputs increase the probability that Italian firms start to export, Bas and Strauss-Kahn (2013) find that imports increase the number of exported products of French exporters, similar results are found by Damijan and Kostevc (2015), using a sample of Slovenian firms.

Firms that start to export a new product that had never been exported before (i.e. an "export innovation") might benefit to a great extent from the access to imported inputs. They might be able to use brand new and technologically superior inputs that are not available in the domestic markets. Or they may simply be able to find a better combination between domestically and internationally sourced inputs (Halpern et al., 2015). Finally, broadening the range of sources of inputs used into production might also allow firms to find cheaper inputs from suppliers worldwide. For all these reasons one can expect a general positive effect of new imported inputs and export innovation at the firm level.

However, the role of imported inputs might vary for exporters of different sizes. Indeed while in principle imported inputs with embodied relevant technology should benefit all types of firms, small firms, which usually display more limited internal innovative capabilities, tend to rely more on the access to external-to-the-firm technology with respect to medium and large firms. Indeed while larger firms might possess the tangible and intangible resources to generate

internally the knowledge that is necessary to upgrade their existing production processes (either through innovation or vertical integration), small firms might be more dependent on the availability of external knowledge produced by other economic actors, and accessible for example through the purchase of intermediate goods. Accordingly it is possible that the impact of new imported inputs on export innovations might vary according to the specific size of the company.

2.2. The role of multinationality

Another channel that might have an important effect on the ability of a firm to introduce export innovations is its inclusion within a multinational network, managed either by a foreign or a domestic multinational company. Being part of a multinational network might affect a company ability to introduce export innovations in different ways.

First, firms might benefit from the access to new technological knowledge from within the MNE. Multinational firms have generally higher innovative performances than domestic firms (Castellani and Zanfei, 2007b; Criscuolo et al., 2010), hence knowledge flows between the network of affiliates might allow individual firms to access superior technological knowledge, originating from within the multinational firm, and use it to innovate its own product portfolio (Guadalupe et al., 2012). This in turn might also foster the export success of these products, as shown by the higher export intensity of the subsidiaries of multinational companies found in many empirical studies (Gelubke, 2013). Moreover by being included in a multinational network of integrated subsidiaries, often firms can access more easily other foreign markets, thanks to the existence of already existing relationship with foreign distributors, or because they can take advantage of the superior knowledge of foreign markets accumulated over the years within the MNE (Guadalupe et al., 2012). This can feed back information that can be used to improve products produced at home (Cantwell, 1989; Kogut and Zander, 1993; Castellani and Zanfei, 2006).

Finally, the literature on international value chains shows that firms that are part of a multinational network can be heavily involved in integrated production networks in which intra-firm trade plays a major role (Hanson et al, 2005). This might have differentiated effects on the introduction of new exported products by a firm. In some cases firms might export a new products in order to supply other subsidiaries of the MNE with specific intermediate goods. However in other cases the integration of a firm within the MNE's international value chain might also result in a reduction of its export portfolio. For example, becoming part of a multinational group may entail a rationalization in product scope, in order to focus only on the products that are actually complementary to those produced in the rest of the multinational group. As a matter of fact this might decrease the overall rate of introduction of new exported products.

Being part of a MNE might also be correlated with the import of new inputs. Also in this case it is found that intra-firm trade in large multinational corporation is often a used solution that allows for greater integration of international activities. Therefore becoming part of a MNE might allow a firm to access new inputs from abroad, but still within the boundaries of the multinational corporation. If that is the case the increase of import innovations might simply be a by-product of multinationality. This fact might undermine the role of imported inputs as a boost to export innovation, because if using new intermediate inputs is simply a consequence of becoming part of a MNE, then we should not see any effect of importing per se.

3. Data and descriptive statistics

We take advantage of a rich dataset provided by Sweden Statistics (SCB), which allows to combine data on international trade activities of Swedish firms with information on firms' business statistics and ownership structure. Moreover we are also able to associate patent information to each firm, through the use of a dedicated dataset of Swedish-based inventors who applied for a patent at the EPO[2]: for each firm we can detect if any of their employees applied for a patent for each year in the time period considered. The trade data covers the period from 2001 to 2012, it includes firms' product specific information about imports and exports for each year considered, as well as information on the specific sources and destinations of trade flows.

We choose to focus on manufacturing firms since our research questions apply to firms which specifically engage in the production of goods. In order to exclude self-employment and micro-firms we set the condition that firms should have at least a median of 5 employees in the years observed to be included in the dataset.[3] After this first cleaning procedure we are left with a total of 14,818 individual firms active in all manufacturing sectors. The great advantage of our dataset is its extensive coverage: for each year we have an average number of 11,000 firms. According to the data provided by Eurostat, in the time span considered Sweden had an average number of 12,000 active enterprises with more than 4 employees, meaning that our dataset covers approximately 90% of all active manufacturing firms with 5 or more employees in Sweden in the years 2001-2012.

3.1. The variables

Dependent variable: export innovations

We are interested in measuring the number of products that are exported for the first time by a firm, as well as the number of imported products that have never been imported before by a firm. In the following we will refer to the former as "export innovations". It must be stressed that export innovations might have been produced for the domestic market also before their introduction as exported products. However we believe that the fact that a firm starts exporting a specific product represent a meaningful fact, which might also correspond to an increase in the quality of the product itself or to a decreased cost of production. Moreover, especially for firms based in countries with a small domestic market, like Sweden, exporting a product that previously was only produced for the domestic market also means that the overall scale of production increases dramatically. For Swedish firms, the only way to scale-up their production is through exports. This suggests that, even more than in countries with a larger domestic market, innovative investments will be strongly focused on exported products, since the domestic market would not be enough to motivate the cost of such investments. This confirms our choice of defining products exported for the first time as "export innovations".[4]

[2] Details on the construction and characteristics of these data are found in Jung and Ejermo (2014)

[3] This procedure excludes from our dataset 5,132 firms.

[4] It must be stressed that for companies based in large economies, such as the US, our definition of export innovation is less likely to proxy the same innovative effort. In these cases, the innovative process might resemble

The first problem that we face in order to identify export innovations has to do with the product classifications of traded goods changing over time, resulting in the risk that the same product might be considered new in a specific year, only because its classification code has changed. In our data export and import products are classified according to the 8-digit Combined Nomenclature (CN8). In order to obtain a harmonized classification for the products we implement a procedure recently suggested by Van Beveren et al. (2012) which allows to obtain harmonized CN8 classifications for any specific time period considered.[5] To roughly sum up how the procedure works, whenever at a specific year *t* the homogeneous category of products *x* is divided into different ones (say *y* and *z*), the algorithm proposed by Van Beveren et al. (2012) creates an artificial category *x** which includes products *x*, *y* and *z* for all the period considered. If instead in year *t* a product *j* is included inside the category of products *k*, the algorithm creates a new category *k** which always includes *j* and *k* products for all the period considered. As it is evident, one typical outcome of this procedure is to reduce the overall number of product categories. In our context this is not a problem since it would only imply that we lose thinner distinctions between product types, meaning that when a firm introduces an export innovation, according to the harmonized classification, the chances that this is a truly different product with respect to the ones already exported is higher.

On the basis of the harmonized CN8 classification we are able to identify our main variable of interest - the number of export innovations- which correspond to the number of products that have never been exported before by a specific firm. The number of export innovations *X_INNO* hence corresponds to the sum of the different typologies *k* of products P^X that a firm *i* exports in year *t* and that was not exported in any period before. Formally:

$$X\_INNO_{it} = \sum_{k} P^{X}_{kit}$$

$$\text{Where } P^{X}_{kit-j} = 0 \quad \text{for all } j \geq 1$$

It must be stressed that by definition this measure cannot distinguish between persistent exporters who start exporting a new type of product and domestic firms who simply start to export. In both cases the products exported will be counted as export innovations. Since in this study we are not interested in the determinants of the decision to engage in international trade, we will only focus on persistent exporters, hence on a sub-sample of the overall number of firms present in our data. [6]

Independent variables

Import innovations

more the product-cycle model originally devised by Vernon (1966), according to which innovative products are first designed and produced for the internal market of high income economies and only later on, when the products are more mature, they are exported.

[5] See Van Beveren et al. (2012) for a detailed description of the procedure implemented to obtain harmonized classifications.

[6] See Castellani and Fassio (2016) for a comprehensive analysis of the determinants of the propensity to (and patterns of) export, using the same data.

In order to identify new imported inputs we adopt a similar procedure to measure the number of imported inputs that are imported for the very first time by a firm: for the sake of consistency we label them as "import innovations". Just like for the case of export innovations, also import innovations might simply be intermediate products that a firm previously sourced locally in the national market. However, also in this case the fact that a firm decides to start importing a product from a foreign partner might indicate an increase in the quality of the product (or a decrease in the cost) which can be roughly associated to the introduction of a process innovation.

The number of import innovations *IM_INNO* hence corresponds to the sum of the different *k* typologies of products P^{IM} that a firm *i* imports in year *t* and that was not imported in any period before.

$$IM\_INNO_{it} = \sum_{k} P_{kit}^{IM}$$

$$Where \;\; P_{kit-j}^{IM} = 0 \quad for \;\; all \;\; j \geq 1$$

Multinationality

Together with export and import variables we are also interested in the ownership structure of Swedish firms, since we believe that this factor will also impact on the ability of firms to introduce export innovations and it is correlated with the importing patterns. Our data allows us to distinguish, for each firm and all years in our sample, between independent firms, Swedish groups without foreign subsidiaries, Swedish groups with foreign affiliates (henceforth Swedish MNE) and foreign groups with Swedish subsidiaries (henceforth Foreign MNE). This is a relevant innovation in the literature linking firms' importing and exporting activities. In fact, firms that are part of MNEs have access to a large network of possible sources of inputs and exports may serve other units within the group. By controlling for multinationality, we are able to assess to what extent importing actually help explaining the export of new products, or if this is in fact a figment of firms being part of a MNE.

Other controls

The data allows us to introduce also a relatively rich set of controls, such as the number of employees, total investments in physical capital, labor productivity (measured as the log of value added per employee) and a dummy variable that controls whether the firm employ any inventor that has introduced at least one patent in year *t*. In Table (1) we provide detailed information about the construction of each of the variables used in our empirical analyses.

In addition to the measure of export and import innovation we also build two other variables that will allow us to control for the characteristics of firms who are involved in international trade. We define the total number of the typologies of exported products in year *t*, as well as the total number of the typologies of imported products. While export and import innovations can be considered as flow measures, indicating the number of new exported or imported products in a specific year, these additional variables can be interpreted as stock measures, reporting the overall number of imported and exported products by an individual firm. These measures can also be considered as a proxy of the (otherwise unmeasured) overall trade

experience of each individual firm, i.e. its exposure to international markets. The higher is the involvement of firms in trade activities the lower will be the fixed costs (due for instance to information asymmetries) related to the export of a new product. The two measures of total exported and imported products are built as follows:

$$TOT\_X_{it} = \sum_{k} P_{kit}^{X}$$

$$TOT\_IM_{it} = \sum_{k} P_{kit}^{IM}$$

Moreover, in line with recent evidence that highlights the important role of the variety of product-country combinations of imported inputs (Colantone and Crinò, 2014), we also build two additional variables that measure to what extent a firm relies on specific product-country combinations in its own import portfolio, since this factor might be an important determinant of the new introduction of new exported products. We first define the number of new varieties in time *t*, where a variety is defined as an imported *product* that is imported *from a specific country* for the first time by an individual firm, where PC_{kit} denotes a specific product-country combination. In line with the previous set of variables above this can be considered as a flow measure:

$$IM\_VAR_{it} = \sum_{k} PC_{kit}$$

$$Where \;\; PC_{kit-j} = 0 \quad for \;\; all \;\; j \geq 1$$

Then we also build a stock variable (*TOT_SOURCES*) that measures the total number of product-country combinations in year *t*:

$$TOT\_SOURCES_{it} = \sum_{k} PC_{kit}$$

Finally, the data on the group status allows us to build measures of industry-region activity of multinational and non-multinational firms, that can capture the role of externalities. In fact, a vast literature shows evidence that the local presence of foreign and domestic multinationals might positively affect the probability that firms introduce new products in the export markets (Crescenzi et al. 2015). We then include a measure of horizontal intra-industry spillovers, using three different proxy to capture the presence of multinational enterprises in the region and the sector in which each firm is located.

3.2. Descriptive statistics

In the upper panel of Table 2 we show the general composition of the firms in our dataset, distinguishing by level of internationalization and by type of ownership. Firms involved in international trade account for around 65% of the all sample along the years. This is in line with the high level of participation to international trade among Swedish firms, with respect to other European countries.[7] The majority of firms engaging in international trade are two-way

[7] As shown by Lööf and Andersson (2010) the share of Swedish firms involved in international trade among those with more than 10 employees is around 75%.

traders, which both import and export products. The number of firms who only export is almost twice as much the number of firms who only import. For what concerns the type of ownership, Table 2 shows that a large (but decreasing over time) share of firms are independent (45%), followed by Swedish groups with no foreign subsidiaries (30%). Swedish MNEs account for 13% of all firms, while Foreign MNEs are 10%. In line with existing evidence (Bandick, Görg and Karpaty, 2014), we find that the number of foreign MNEs has increased over time by about 15%, as well as the number of Swedish groups (18% growth).

INSERT TABLES 2 AND 3 ABOUT HERE

In Table 3 we show that, as expected, independent firms are those with the highest share of domestic firms. Relevant differences emerge also between Swedish groups and Swedish MNE with respect to Foreign MNE: while for the first two groups the share of firms who only export is higher than those who only import, among foreign MNE this is not the case, suggesting that foreign ownership is generally associated with higher import intensity. This is also confirmed by the substantially higher share of two-way traders among foreign MNE with respect to Swedish MNE.

As previously anticipated, since in this study we are not interested in what drives firms to start exporting, but rather in what allows exporters to add a new product typology to their export portfolio, for each year we will restrict our analysis only to the firms who export both in year t and in year t-1.

In the bottom panel of Table 2 we show the composition of this restricted sample. Since we need to make sure that firms exported also in the previous year we cannot use data for 2001, therefore the restricted sample includes only the years from 2002 to 2012. Our restriction decreases the overall sample by roughly 50%, so that now on average we have 5500 firms per year. Most of the firms in the restricted sample are two-way traders (80%), while 10% only export, but do not have any import activity. Swedish groups still represent 30% of all firms, while Swedish and Foreign MNE account for a larger share with respect to the overall sample (respectively 21% and 18%). In the lower panel of Table 3 we see that the share of two-way trader is substantially higher for MNE than for groups and independent firms.

We now turn to our main variables of interest: export and import innovations. In Table 4 we show that, in 75% of our firm-year observations a firm introduced at least one export innovation; in the case of import innovations this share decreases to 68%. This means that among continuous exporters the introduction of export and import innovations is not rare. However they are relatively less common then the introduction of new varieties (that is combinations of either new products of new source/destination markets (respectively 85% and 72% of observations). While for large firms import and export innovations are equally common, among small firms instead import innovations are relatively less common (60% versus 70%).[8] The same is true for Foreign and Swedish MNE with respect to Swedish Groups

[8] We define small and medium enterprises as those firms that during the period considered (2001-2012) have a median number of employees lower or equal to 50. While this classification differs from the usual categorizations used in the existing literature, it seems better suited for our specific dataset, which covers more than 10 years. Indeed in such a long period firms might substantially change their size and hence risk being classified sometimes

and independent firms: while for the former the two types of innovations are equally common, for the latter import innovations are substantially less frequent.

INSERT TABLE 4 ABOUT HERE

In Table 5 we also show concrete examples of export innovations. In particular, we display the most common innovations in the year 2006, a mid-point in the time period that we analyze. In the left panel of Table 5 we show the 5 most common export innovations, as described by their CN8 classification and relative description. The most common types of export innovations among Swedish firms in 2006, exported for the first time by 105 firms, were devices related to hydraulic engineering such as maritime and waterway structures of iron or steel (CN8 code:73089010), followed by parts of machinery for bulldozers and excavators (CN8 code: 84314980), exported by 101 firms. The other common types of export innovations were "Parts and accessories for tractors and large motor-vehicles" (77 firms), "Articles of wood" (56 firms) and "Office or school supplies made of plastics" (54 firms). These results show first of all that in our measure of export innovation there are many products with a relevant technological content (even if not necessarily high-tech products). Moreover the results are also in line with our expectations, as in most cases these are products for which Sweden is likely to have some kind of competitive advantage, due to the abundance of natural resources (forests in the case of wood producers), or to the historical excellence in specific skills (water management), or to the presence of relevant players in the specific industry (see the Volvo Construction Equipment - part of the Volvo Group – for the case of excavators and bulldozers).

INSERT TABLE 5 AND FIGURE 1 ABOUT HERE

The right panel of Table 5 instead allows to understand how the new types of exports relate to the existing export portfolio of the firms which introduced them for the first time. We report the most common types of product exported in the year 2005 among the firms that introduced a specific export innovation in 2006. We do this because we want to avoid the risk to classify as export innovations tiny changes in the existing export portfolio of the firms, i.e. new products which do not require a high level of investment by the side of the firms. Since we adopt a relatively thin product classification (8-digits) we could face the risk that a tiny change in the export portfolio of an exporter figures as an export innovation. Instead we want to make sure that the introduction of export innovations is something that requires some kind of innovative effort. The results in Table 5 suggest that we are not likely to face this risk: with respect to the most common export innovations the types of products that firms exported in the previous years are related, but not too similar to the new typology exported. This somehow reassures as that what firms introducing export innovations are really introducing new products in their export portfolio that they have never exported before. In order to ease the understanding of some of the description of the product codes reported in Table 5, in Figure 1 we show a graphical representation of one of the most common export innovations (parts of machinery

as small, medium or large, according to the specific year considered. Using the median number of employees over time allows us to attribute each firm to only one size category in our data.

for bulldozers and excavators - CN8 code: 84314980) and we also show which are the types of product that these firms were exporting in the previous year.

INSERT FIGURES 2 AND 3 ABOUT HERE

In order to further investigate the properties of export and import innovations we plot the histogram of each of the variables in Figure 2. The two graphs show that the distribution of both types of innovations is extremely skewed. Symmetrically to Table 4, we can observe that about 25% of firm-year observations have zero new exported products and more than 30% have no new imported inputs. Furthermore, 22% of firms introduced only one new product and 17% imported a new product. These frequencies sharply drop as the number of products increases, and only in a handful of cases we observe more than 5 new exported or imported products. In Figure 3 we further distinguish by firms' size and type of ownership, using Kernel's densities. The plots in the upper part of Figure 3 show that the distribution of exported and imported innovations is more skewed for small than for large firms, suggesting that among small firms the majority of firms have very small numbers of exported and imported innovations. A similar picture emerges from the plots in the lower part of Figure 3, where we distinguish two very well defined and different patterns: independent firms and Swedish Groups have a substantially more skewed distribution of both types of innovations with respect to Swedish and Foreign MNE.

4. Econometric analysis and results

Methodology

We want to identify the main determinants of export innovations and we are particularly interested in the role of import innovations and types of firms' ownership. In order to do that with an empirical model, we need to take into account the specific features of the dependent variable -export innovations- which is a count variable with relatively high over-dispersion. Table 6 indeed indicates that the variance of export innovations is much higher than its mean. We then resort to the negative binomial regression method with firm fixed effects, which is specifically suited for overdispersed dependent variables (Cameron and Trivedi, 2005). The empirical specification is hence as follows:

$$E\left[X\_INNO_{it} \mid \mathrm{x}_{\mathrm{it}}\right] = \exp\left[\alpha_1 \ln IM\_INNO_{it-1} + \alpha_2 \ln MNE_{it-1} + \beta\, x_{it-1} + \eta_i + \lambda_t + u_{it}\right] \qquad (1)$$

where *X_INNO* indicates export innovations, *IM_INNO* denotes new imported inputs and MNE describes the multinational status of firms. Moreover x_{it} indicates a number of controls that we will introduce in our specification to account for various characteristics of the exporting firms: these include size, labour productivity, patenting activity, as well as the local presence of multinationals. Firm specific fixed effects are indexed by η_i, while λ_t denotes common time trends that are controlled for through the use of time dummies. Finally u_{it} indicates firm-specific idiosyncratic shocks. Due to the properties of negative binomial regression models, expressing independent variables in logs or binary form allows to interpret the estimated coefficients as elasticities.

The panel dimension of our dataset, as well as the inclusion of a productivity measure among our controls, allows us to account for most of the heterogeneity in the time invariant and time varying characteristics of the firm. This allows us for example to rule out the possibility that the unobserved quality of firms, which might be correlated with their ability to introduce both import and export innovations, might bias our results. Similarly, innovative activities might also be an important confounding factor for our empirical analysis: indeed the introduction of product or process innovations might both require the use of new imported inputs and increase the export success of new or existing products. Also in this case the availability of data on patenting activity of firms allows us to control for this possible source of endogeneity of our estimates. Finally a further identification problem could be due to the fact that firms might strategically choose to import new intermediate inputs in order to be able to start exporting a new product. In order to alleviate this reverse causality issue we lag all the independent variables by one year.

INSERT TABLE 7 ABOUT HERE

Results

In column (1) of Table 7 we present our baseline specification, where we only include the controls, without the variables related to import. We find that the total number of typologies of exported products (*TOT_X*) has a positive and significant effect on the number of export innovations, suggesting the presence of a scale-effect by which the higher the number of exported products by a firm, the higher also the number of export innovations. However, since the coefficient is significantly smaller than 1, we can detect some decreasing marginal returns.[9] We also find a positive and significant effect of the number of employees (as a proxy for size), labor productivity and, with a smaller coefficient, investments in physical capital. These results basically confirms the usual hypotheses according to which larger and more productive firms are more likely to be successful on international markets. However they add to this that larger and more productive firms are also better able to introduce new products that had never been exported before. We also control for the role of patenting activity through a dummy for firms who patent and find a positive effect, but with a rather large standard error. Finally, we notice that the dummies indicating the different ownership types are never significantly different from zero. It must be stressed that in this specific panel setting the coefficient of the dummies should be interpreted as the effect of a change in the ownership type on the number of export innovations.[10] In column (2) we introduce a dummy for import activity (*IMP*) which shows a positive and significant coefficient, suggesting that starting to import generally increases the number of export innovations introduced by a firm.
In order to investigate more in depth the role of imported products, in column (3) we introduce our main variable of interest –the number of import innovations (*IM_INNO*)- which displays a positive and highly significant coefficient. We also notice that once we account for the number of import innovations the import dummy becomes negative and significant. This result highlights the fact that it is not importing *per se* which increases the chances of introducing

[9] It is worth mentioning that this also entails that it would be incorrect to use the share of new exported products as the dependent variable

[10] Indeed, estimates from a pooled cross-section regression, available from the authors, reveal a large positive coefficient for Swedish and Foreign MNE. This suggests that belonging to MNE groups is associated with more export innovation, but the change in ownership is not.

export innovations, but rather the import of new products. As our results show, once accounted for import innovations the impact of import is even negative, meaning that importing without introducing any new imported products can actually decrease the number of export innovations. Interestingly, the introduction of the import dummy (IMP) and the number of import innovations (*IM_INNO*) also increases the significance of the negative coefficient of the dummy for Foreign MNE. This is consistent with the idea that becoming part of foreign MNE (e.g. by being acquired) is also associated with an increase in importing activities. However, our results suggest that import activity, more than belonging to an international organization, is better able to foster the introduction of new varieties of export products. Instead, once controlled for the increase in import activity, becoming part of a foreign MNEs may actually decrease the rate of introduction of new exported products. When we introduce import innovations in our model we also find that the patent dummy is not longer significant.

In order to check whether there is a specific effect of imports that is related to the novelty of the imported products, in column (4) we introduce in our specification also the number of new imported variety (IM_VAR). As already explained above, an increase in the number of the new varieties might be either due to a new imported product that had never been imported before by a firm but it can also be due to a product that was already imported in the previous years, which in year *t* is imported from a new source country. We find that the inclusion of the varieties induces a relative drop in the coefficient of the import innovations, which is not surprising, given the latter is a subset of the former, while the coefficient of the varieties is positive and significant. However, the coefficient associated with import innovations is more than twice as large as the coefficient of new imported varieties (a chi-squared test of equality of the two coefficients rejects at the 10% level the null hypothesis), suggesting a much stronger role of the latter for the increase of export innovations. Finally, in column (5) we also introduce the total number of the different typologies of imported products (*TOT_IM*), as well as the total number of product-country combinations (*TOT_SOURCES*). We do this in order to control whether the effect of import innovations and new import varieties might catch respectively the overall scope of imported products of a firm or the overall number of possible sources of imports. Results show that the coefficient of import innovations slightly increases when we include the total number of typologies of imported products, the total number of different imported products instead displays a negative and significant sign. Since the number of import innovations is a subsample of the total number of typologies of imported inputs we interpret this coefficient as an indication that, once we account for import innovations, all the other imported inputs have actually a negative effect on the level of export innovations, similarly to the effect of importing *per se*, that we analyzed through the import dummy (*IMP*). On the contrary the inclusion of the total number of product-country combinations has a positive effect on the level of export innovations, but also in this case its inclusion does not change the positive and significant coefficient of new import innovations.

In the last three columns of Table 7 we account for the possible effect of local horizontal externalities from different types of multinational companies on the introduction of export innovations. We introduce three different sources of externality: in column (6) we introduce the (log of) the number of foreign and MNEs in the same region[11] and in the same industry of

[11] We adopt the classification of "functional region" as provided by Statistics Sweden. This classification is based on commuting patterns, which is better suited at studying local interaction with respect to normal administrative classifications such as NUTS2 or NUTS3.

the focal firm. Here we introduce the absolute value of the (log of) MNE overall activities.[12] We distinguish between the total number of Foreign MNE in the same region and in the same industry of a firm, as well as the number of Swedish MNE. The results show a strong positive and significant effect of the presence of foreign MNE on export innovation of firms within the same industry and region. Results suggest that increasing the number of foreign MNE by 10% raises the rate of export innovation by 0.5%. In column (7) we introduce our second measure of horizontal spillovers, which uses employment levels: we include in our specification the (log of) the number of employees employed respectively in Swedish MNE, foreign MNE and in the total number of firms active in the same region and same industry of each firm. The difference with the previous measure of spillovers is that in this case we also take in to account the size of multinational companies. The results are extremely consistent with the previous measure: again only the level of employment of foreign MNE positively influences the level of export innovations. Finally in column (8) we use our third and last measure of spillovers, that is the sum of the (log of) value added of each of the two categories of MNE, as well as the total value added for all firms. Results confirm a positive externality from foreign MNEs on export innovation, although the magnitude of the effect is smaller when the presence of MNEs is measured in terms of employment and (even more) value added, than in terms of number of firms. This may reveal that while the entry of foreign MNEs is generally a source of positive externality which foster export innovation in Swedish firms, in the case of large foreign MNEs the positive externality may be compensated by a relatively large competition effect.

Summing up, we find that export innovations depend strongly on the introduction of import innovations, and to a lesser extent to the introduction of new product-country combinations of imports. On the contrary, the overall number of typologies of imported products, as well as importing per se, do not have a positive effect on the level of export innovations. We also find that the effect of importing new products is not related to becoming (or being acquired by) a MNE. Instead, results point in the direction that being acquired by a foreign MNE can actually reduce the number of new exported products. At the same time, we find that the presence of foreign MNEs can be a source of externality that boosts the introduction of new exported products within the same industry and region.

The role of firm size

In Table 8 we investigate more carefully the heterogeneity of the effect of import innovations on the introduction of new export innovations. Indeed, we have reasons to believe that the effect might differ substantially among small firms with respect to medium and large firms. In column (1) of Table 8 we present results obtained using the same specification of Table 7, but focusing only on small and medium size firms. Interestingly, we notice that the coefficient of import innovations increases by roughly 20% with respect to the estimates of Table 7, while the coefficient of new imported varieties decreases in size and becomes not longer significant. Also, the coefficient of the total number of sources (product combinations) increases by almost 50% with respect to the specification that included the whole sample. The statistical significance of other coefficients does not change, although some changes in magnitude, with respect to Table 7, is worth noting. In particular, being acquired by a foreign MNE shows an even larger negative and significant coefficient for small firms.
Finally in column (4) we show the results obtained when we only analyze the determinants of export innovations among large firms. In this case, we find that instead the coefficient of import

[12] As opposed to the commonly used share of MNE to total activity, this specification allows more flexibility, since does not impose any constraint on the coefficient of the numerator and denominator of MNE presence ratio which – as shown by Castellani and Zanfei (2007a) - may bias the externality coefficients.

innovations decreases slightly with respect to our baseline specification and it becomes slightly smaller than the coefficient of new imported varieties, which instead increases by more than 60%. Most importantly we find that the coefficient of Swedish Group and Swedish MNE becomes positive and significant, showing that for larger firms becoming part of a group or opening new subsidiaries abroad increases also the number of export innovations introduced. In this case the coefficient of foreign MNE is positive, but very imprecisely estimated, suggesting that being acquired by a foreign firm does not necessarily decrease the number of export innovations, in the case of large target firms. The local presence of foreign MNE instead remains a positive and statistically significant factor enhancing the ability of large firms to increase the variety of new exported products. The externality appropriated by large Swedish firms is particularly sizable when we consider the number of foreign MNEs as the source of externality.

INSERT TABLES 8 AND 9 ABOUT HERE

The role of type of imported inputs

Our hypothesis about the role of new imported inputs as carriers of embodied technology that allows firms to export new products implicitly assumes that imported inputs need to be used in the production processes of the firms that source them. In other words the type of inputs that seem better able to allow firms to upgrade their technologies are intermediate imported inputs. Using the Broad Economic Classification of traded goods we are able to distinguish between imports in product categories that are classified as intermediate goods, capital goods or consumption goods. With this piece of information we can then break down the number of new imported products into the number of new imported intermediates, new imported capital goods and new imported final goods. We then include three new variables in equation (1) and check whether the impact of each type of good differs between each other.
The results in Table 9 show that the coefficient of intermediate inputs is higher than the coefficient of the other types of goods: the effect of intermediate goods is almost twice that of capital goods and 50% larger than that of consumption goods (a test of the equality of the three coefficients rejects the null at the 5% level[13]).
When instead we distinguish between small firms and large firms we find that intermediate goods always display the highest impact: the main difference is that also capital goods play an important role in the introduction of export innovations among small firms, while for large firms capital goods do not significantly impact the introduction of export innovations.

5. Concluding remarks

This paper contributes to a fast-growing literature on the role of imported inputs for the export activity of the firm, by focusing on export innovation, that is innovation in a firm export product portfolio. Unlike most of the literature, in order to stress the extent of innovation in exported

[13] The null hypothesis of equality between the coefficient of intermediate goods and capital goods is rejected at the 1% level, while the equality between intermediate goods and consumer goods is rejected at the 5% level.

products, we focus on *new products* that are exported *for the first time* by each firm. This approach, while it has some limitations, it has the potential to complement the use of patents and innovation surveys to capture firms' innovation efforts. Moreover this new measure allows to provide a good proxy of the dynamism of exporting firms and of their ability to constantly renew and upgrade their existing export portfolio.

In the paper we investigate the role of two important drivers of the introduction of export innovations: the access to new imported inputs and the inclusion in multinational groups. We believe that both factors can provide exporters with an additional channel of technology upgrading which can eventually lead to start exporting new products. New imported inputs can embody relevant technology, to be used in the firms' productive process for the upgrade of existing products or for the introduction of brand new ones. Being part of a MNEmight instead allow a firm to gain access to superior technological knowledge thanks to the existence of relevant knowledge flows between the network of affiliates. Analysing these two factors jointly is also important to identify better the role of imported inputs in fostering exporting activities, with respect to existing studies. Indeed by becoming part of a MNEs, or by establishing their own network of affiliates abroad, firms can also gain access to a variety of sources of imported inputs. This raises the question of whether the importance of the flows of imported inputs is instead a figment of the fact that importing firms are part of MNE. Finally it seems relevant to investigate whether the impact of each of these factors differs between small and large firms: since these two types of firms typically have also very different internal technological capabilities, the impact of imported inputs and multinationality might have a different effect on their export innovativeness.

By linking foreign transaction level data with business register information on whether companies are independent or rather they are part of a domestic MNE or a foreign MNE, we are able to provide a richer interpretation into the role of imported inputs for firms' export performance. Our empirical analysis, based on a sample of more than 14,000 Swedish manufacturing firms (representing more than 90% of the overall population of firms) over the period 2000-2012 and including a large number of firm-level controls, allows us to identify the impact of new imported inputs and of multinationality on the introduction of export innovations. As an additional robustness check, we control for the existence of indirect effects of multinational groups on the introduction of export innovations by individual firms: by measuring the presence of foreign and domestic MNEs in a given sector-region we check whether this is able to generate externalities for other firms in the introduction of new exported products.

The results show, first of all, that importing new products is a key determinant of innovation in exported products, also after controlling for multinationality. In particular, we find that firms' export innovation benefits from importing new types of intermediate inputs and, to a lesser extent, new capital goods.

Interestingly, our results point in the direction of a differentiated effect of importing new products vs. being part of a MNE as factors explaining export innovation for large and small firms. Indeed while all firms benefit from importing new products, the effect is higher for small firms. On the contrary, large firms benefit more than small ones from being part of a group, and of a Swedish MNE in particular. This may be related to the fact that for small firms the cost of becoming MNE may overcome the benefit of establishing a multinational network. For these firms, importing new products is hence a key strategy to improve their products and innovate their export portfolio. Conversely, for larger firms combining import of new products and establishing a multinational network can be a more complex, but more effective strategy for innovating their export portfolio.

Foreign MNEs have instead an ambivalent effect on export innovation of Swedish firms. On the one hand, small firms acquired by foreign MNEs show a reduction in export innovation (at least in the short term) but, on the other hand, we find that foreign MNEs can provide some positive externality, both to small and large firms, contributing to their export innovation.

As a corollary to our empirical analysis it is worth mentioning that gauging firm innovations from the portfolio of exported products has both advantages and limitations. On the positive side, using new products as a measure of innovation can be an interesting development in the literature, which is often based on patents, which have known limitations in capturing innovation in certain industries, or on innovation surveys that rely on self-reported information, which is subjective and aggregated at the firm-level. Information on newly introduced products can provide a richer picture, based on observable information, of the direction of product innovation. On the negative side, product innovation may well occur even within a granular level, such as the 8-digit product classification, and thus not be captured by data at this level of detail, and in some cases the introduction of a new product may reflect product differentiation rather than true innovation. Furthermore, these measures would clearly only capture product innovation and do not provide any information on process or organizational innovation. A limitation that pertains specifically to this paper is that by looking at exported products only, we may miss the products that are introduced for the domestic market only, or get an imprecise picture due to product that are exported with some delay after the introduction in the domestic market. The use of Swedish firm data, i.e. of firms operating in a very small domestic market, suggests us that in our case innovative activities are likely to be directed mainly to exported products, since the limited domestic sales would not justify the high innovative fixed costs. However it must be stressed that for firms based in countries with a large domestic market our measure might be less effective in proxying real innovative efforts.

Keeping in mind these important limitations, our results can provide interesting insights for public policies aimed at improving the overall dynamism of exporting firms. First, our results suggest that accessing new intermediate inputs allows firms to renew their export portfolio and start exporting new products. In a global context where imported goods are increasingly seen as crowding out domestic productions, and protectionists measures are invoked to safeguard domestic firms and jobs, our results instead remind us that the goal of economic integration is to be able to import goods that cannot be efficiently produced in the domestic economy. But in addition to the classical argument, this paper points out that restricting import, may jeopardize the ability of domestic firms to introduce innovations. Second, we show that the effect of imported inputs on export innovations is larger for SMEs. Since these firms are those that usually face larger difficulties in international markets -and are often the target of export oriented policies- it is important to bear in mind, that protectionists measures may end up curtailing an important channel of technology upgrading and export success of SMEs. Third, results on the role of foreign multinationals suggest that policies aimed at attracting Foreign Direct Investments should acknowledge both the positive indirect role that foreign MNEs (much more than Swedish MNEs) can exert on the export innovations of other firms located in the same sector and region, but, also the negative effect on the small companies that they acquire. Future research might investigate more in depth what are the channels that may drive both the positive effect of imported inputs and the negative effect of foreign ownership.

References

Andersson, M., Stone, T.A. (2017) Global Sourcing and Technical Efficiency: a firm-level study on the ICT industry in Sweden, *Journal of Business Economics and Management*, forthcoming.

Aristei, D., Castellani, D., & Franco, C. (2013). Firms' exporting and importing activities: is there a two-way relationship?. *Review of World Economics*, *149*(1), 55-84.

Bandick, R, H Görg and P. Karpaty (2014), Foreign acquisitions, domestic multinationals, and R&D. *Scandinavian Journal of Economics* 116(4), 1091–1115.

Bas, M., Strauss-Kahn, V. (2014). Does importing more inputs raise exports? Firm-level evidence from France. *Review of World Economics*, *150*(2), 241-275.

Barba Navaretti, G., Castellani, D., & Disdier, A. C. (2010). How does investing in cheap labour countries affect performance at home? Firm-level evidence from France and Italy. *Oxford Economic Papers*, 62(2), 234-260.

Basile, R., (2001), Export behavior of Italian manufacturing firms over the Nineties: the role of innovation. *Research Policy*, 30 (8), 1185–1201.

Bernard, A. B., Jensen, J. B., Redding, S. J., & Schott, P. K. (2012). The Empirics of Firm Heterogeneity and International Trade. *Annual Review of Economics*, 4(1), 283-313.

Broda, C., & Weinstein, D. E. (2006). Globalization and the Gains From Variety. *The Quarterly Journal of Economics*, 121(2), 541-585.

Bustos, P. (2011). Trade liberalization, exports, and technology upgrading: Evidence on the impact of MERCOSUR on Argentinian firms. *The American Economic Review*, 101(1), 304-340.

Cameron, A. C., Trivedi, P. K., (2005). *Applied microeconometrics using STATA*. New York: STATA Press.

Cantwell, J., (1989). *Technological innovation and multinational corporations*. Cambridge, MA: B. Blackwell.

Cassiman, B., Golovko, E. and Martínez-Ros, E., (2010), Innovation, exports and productivity. *International Journal of Industrial Organization*, 28(4), 372-376.

Castellani, D., & Fassio, C. (2016). Import, Export and Multinationality. Evidence from Swedish Firms*, John H Dunning Center Discussion Papers 2016-08*. Henley Business School, Reading University.

Castellani, D., & Zanfei, A. (2006). *Multinational firms, innovation and productivity*. Edward Elgar Publishing.

Castellani, D., & Zanfei, A. (2007a). Multinational companies and productivity spillovers: is there a specification error?. *Applied Economics Letters*, *14*(14), 1047-1051.

Castellani, D. & Zanfei, A. (2007b), Internationalisation, innovation and productivity: How do firms differ in Italy?. *World Economy*, 30 (1), 156-76

Castellani, D., Serti, F., & Tomasi, C. (2010). Firms in international trade: Importers' and exporters' heterogeneity in Italian manufacturing industry. *The World Economy*, 33(3), 424-457.

Cirera, X., Marin, A., & Markwald, R. (2015). Explaining export diversification through firm innovation decisions: The case of Brazil. *Research Policy*, 44(10), 1962-1973.

Colantone, I. and R. Crinò (2014). New imported inputs, new domestic products. *Journal of International Economics*, 92, 147–165.

Conyon, M.J., Girma, S., Thompson, S. & Wright, P.W. (2002). The productivity and wage effects of foreign acquisition in the United Kingdom. *Journal of Industrial Economics*, 50(1), 85–102.

Costantini, J., & Melitz, M. (2008). The dynamics of firm-level adjustment to trade liberalization. *The organization of firms in a global economy*, *4,* 107-141.

Crescenzi, R., Gagliardi, L. & Iammarino, S. (2015). Foreign multinationals and domestic innovation: Intra-industry effects and firm heterogeneity. *Research Policy*, 44 (3), 596-609

Criscuolo, C, Haskel, J.E., Slaughter, M.J. (2010). Global engagement and the innovation activities of firms. *International Journal of Industrial Organization*, 28(2), 191–202.

Damijan, J. P., & Kostevc, Č. (2015). Learning from trade through innovation. *Oxford Bulletin of Economics and Statistics*, 77(3), 408-436.

Damijan, J. P., Konings, J., & Polanec, S. (2014). Import Churning and Export Performance of Multi-product Firms. *The World Economy*, 37(11), 1483-1506.

Dosi, G., Grazzi, M., and D. Moschella, (2015), Technology and costs in international competitiveness: From countries and sectors to firms. *Research Policy*, 44(10), 1795–1814.

Fagerberg, J., (1988). International competitiveness. *The Economic Journal*, 98 (391), 355–374.

Ganotakis, P. & Love, J.H. (2011) R&D, product innovation, and exporting: evidence from UK new technology based firms. *Oxford Economic Papers*, 63, 279–306.

Gelübcke, J.P., (2013). The performance of foreign affiliates in German manufacturing: evidence from a new database. *Review of World Economics* 149 (1), 151–182.

Girma, S., Gong, Y., Görg, H. & S. Lancherosa (2015) Investment liberalisation, technology take-off and export markets entry: Does foreign ownership structure matter? *Journal of Economic Behavior & Organization*, 116, 254–269.

Girma, S., Kneller, R. & Pisu, M. (2005a) Exports versus FDI: An Empirical Test. *Review of World Economics*, 141(2), 193–218.

Girma, S., Kneller, R. & Pisu, M. (2005b) Acquisition FDI and the Export Intensity of Multinational Firms. *Research Paper Series, Globalisation, Productivity and Technology, University of Nottingham*, num. 2005/01.

Goldberg, P. K., Khandelwal, A. K., Pavcnik, N., & Topalova, P. (2010). Imported Intermediate Inputs and Domestic Product Growth: Evidence from India. *The Quarterly Journal of Economics*, 125(4), 1727-1767.

Haller, S. A. (2012), Intra-firm trade, exporting, importing, and firm performance. Canadian *Journal of Economics/Revue canadienne d'économique*, 45: 1397–1430.

Halpern, L., Koren, M., & Szeidl, A. (2015). Imported inputs and Productivity. *The American Economic Review*, 105(12), 3660-3703.

Hanson, G. H., Mataloni, R. J. & M. J. Slaughter (2005) Vertical Production Networks in Multinational Firms. *The Review of Economics and Statistics*, 87(4), 664-678.

Harding, T., & Javorcik, B. S. (2012). Foreign direct investment and export upgrading. *Review of Economics and Statistics*, *94*(4), 964-980.

Head, K. & Ries, J. (2004) Exporting and FDI as Alternative Strategies. *Oxford Review of Economic Policy*, 20 (3): 409-423.

Iacovone, L., & Javorcik, B. (2010). Multi-Product Exporters: Product Churning, Uncertainty and Export Discoveries. *The Economic Journal*,*120*(544), 481-499.

Iacovone, L., & Javorcik, B. (2012). Getting ready: Preparation for exporting, mimeo.

Javorcik B., A. Lo Turco and D .Maggioni (2015) "New and Improved: FDI and the Building Blocs of Complexity", mimeo.

Jung, T. and O. Ejermo (2014) Demographic patterns and trends in patenting: gender, age, and education of inventors. *Technological Forecasting and Social Change*, 86, 110–124

Kogut, B., & Zander, U. (1993). Knowledge of the firm and the evolutionary theory of the multinational corporation. *Journal of international business studies*, 24(4), 625-645.

Kugler, M., & Verhoogen, E. (2009). Plants and imported inputs: New facts and an interpretation. *The American Economic Review*, 99(2), 501-507.

Lo Turco, A., & Maggioni, D. (2013). On the role of imports in enhancing manufacturing exports. *The World Economy*, 36(1), 93-120.

Lo Turco, A., & Maggioni, D. (2015). Imports, exports and the firm product scope: evidence from Turkey. *The World Economy*, 38(6), 984-1005.

Lööf, H., & Andersson, M. (2010). Imports, Productivity and Origin Markets: The Role of Knowledge-intensive Economies. *The World Economy*, 33(3), 458-481.

Muûls, M., & Pisu, M. (2009). Imports and Exports at the Level of the Firm: Evidence from Belgium. *The World Economy*, 32(5), 692-734.

Swenson, D. L., & Chen, H. (2014). Multinational exposure and the quality of new Chinese exports. *Oxford Bulletin of Economics and Statistics*, 76(1), 41-66.

Van Beveren, I., A. B. Bernard and H. Vandenbussche (2012). Concording EU Trade and Production Data over Time. *NBER Working Paper Series,* num. 18604.

Vogel, A., & Wagner, J. (2010). Higher productivity in importing German manufacturing firms: self-selection, learning from importing, or both?. *Review of World Economics*, 145(4), 641-665.

Wagner, J. (2007). Exports and productivity: A survey of the evidence from firm-level data. *The World Economy*, 30(1), 60-82.

Wagner, J. (2012). International trade and firm performance: a survey of empirical studies since 2006. *Review of World Economics*, 148(2), 235-267.

Wagner, J. (2016). A survey of empirical studies using transaction level data on exports and imports. *Review of World Economics*, 1-11.

Wakelin, K., (1998), Innovation and export behaviour at the firm level. *Research Policy*, 26(7), 829–841.

Table 1. Variables description

Variable	Description
Dependent variable	
X_INNO	number of different types of products (CN8 8-digits) for the first time by the firm in year t
Independent variables	
Importing and exporting activities	
ln(IM_INNO)	log of the number of different types of products (CN8 8-digits) imported for the first time by the firm in year t*
IMP (dummy)	=1 if the firm is an importer at time t
ln(IM_VAR)	log of the number of new product-country combinations of imported products in year t*
ln(IM_TOT)	log of the sum of the different types of products imported in year t*
ln(IM_SOURCES)	log of the sum of all the product-country combinations of imported products in year t*
ln(X_TOT)	log of the sum of the different types of products exported in year t*
Ownership type	
Independent firm (dummy)	=1 for a firm not belonging to a group
Swedish group (dummy)	=1 for a firm belonging to a Swedish group
Swedish MNE (dummy)	=1 for a firm belonging to a Swedish group with foreign subsidiaries
foreign MNE (dummy)	=1 for a firm belonging to a foreign group with Swedish subsidiaries
Firm-level controls	
ln(Productivity)	log of labor productivity (value added over number of employees)
ln(Employment)	log of the number of employees
ln(Investments)	log of the level of investments in machinery and equipment*
Patents (dummy)	=1 for a firm having at least one employee who patented in year t
MNE externality within industry-region	
ln(# Swedish MNE within industry-region)	log of the number of Swedish MNE active in the same sector and same region of a firm*
ln(# Foreign MNE within industry-region)	log of the number of Foreign MNE active in the same sector and same region of a firm*
ln(# All firms within industry-region)	log of the total number firms active in the same sector and same region of a firm*
ln(employment in Swedish MNE within industry-region)	log of the overall sum of employees of Swedish MNE active in the same sector and same region of a firm*
ln(employment in Foreign MNE within industry-region)	log of the overall sum of employees of Foreign MNE active in the same sector and same region of a firm*
ln(employment in All firms within industry-region)	log of the overall sum of employees of all the firms active in the same sector and same region of a firm*
ln(value added in Swedish MNE within industry-region)	log of the overall sum of value added of Swedish MNE active in the same sector and same region of a firm*
ln(value added in Foreign MNE within industry-region)	log of the overall sum of value added of Foreign MNE active in the same sector and same region of a firm*
ln(value added in All firms within industry-region)	log of the overall sum of value added of all firms active in the same sector and same region of a firm*

* to avoid the log of zero, we add 1 before taking the ln

Table 2. The composition of the sample

Full sample													
year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Domestic firms	4,235	4,049	4,046	4,119	4,160	4,101	4,022	3,958	4,006	3,932	4,023	3,931	48,582
Only exporters	1,545	1,557	1,545	1,557	1,593	1,546	1,555	1,538	1,552	1,545	1,379	1,345	18,257
Only importers	814	793	794	798	826	846	870	859	786	846	773	757	9,762
Two way traders	4,788	4,930	4,926	4,866	4,697	4,740	4,749	4,748	4,510	4,392	4,357	4,244	55,947
Independent firms	5,887	5,672	5,560	5,548	5,355	5,208	5,109	4,938	4,718	4,493	4,288	4,108	60,884
Swedish groups	3,047	3,111	3,202	3,243	3,349	3,445	3,480	3,509	3,525	3,610	3,621	3,604	40,746
Swedish MNE	1,462	1,445	1,424	1,425	1,446	1,440	1,422	1,459	1,427	1,425	1,457	1,431	17,263
Foreign MNE	986	1,101	1,125	1,124	1,126	1,140	1,185	1,197	1,184	1,187	1,166	1,134	13,655
Total by year	11,382	11,329	11,311	11,340	11,276	11,233	11,196	11,103	10,854	10,715	10,532	10,277	132,548

Restricted sample												
year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Only exporters	952	1,034	1,078	1,147	1,132	1,119	1,089	1,168	1,152	1,070	997	11,938
Two way traders	4,273	4,480	4,477	4,350	4,372	4,395	4,431	4,188	4,093	4,067	3,923	47,049
Independent firms	1,724	1,810	1,800	1,718	1,665	1,657	1,559	1,463	17,251	1,281	1,187	17,251
Swedish groups	1,473	1,579	1,636	1,675	1,698	1,701	1,771	1,719	18,325	1,705	1,644	18,325
Swedish MNE	1,149	1,182	1,160	1,163	1,177	1,154	1,168	1,147	12,726	1,162	1,136	12,726
Foreign MNE	879	943	959	941	964	1,002	1,022	1,027	10,685	989	953	10,685
Total by year	5,225	5,514	5,555	5,497	5,504	5,514	5,520	5,356	58,987	5,137	4,920	58,987

Table 3. trade participation and type of ownership

Full sample **Firm ownership**	**Domestic firms**	**Only exporters**	**Only importers**	**Two way traders**	**Total**
independent firms	31,675	9,591	4,849	14,769	60,884
perc.	*52.03*	*15.75*	*7.96*	*24.26*	*100*
swedish group	14,259	6,806	3,523	16,158	40,746
perc.	*34.99*	*16.7*	*8.65*	*39.66*	*100*
swedish MNE	1,744	1,329	772	13,418	17,263
perc.	*10.1*	*7.7*	*4.47*	*77.73*	*100*
foreign MNE	904	531	618	11,602	13,655
perc.	*6.62*	*3.89*	*4.53*	*84.97*	*100*

Restricted sample **Firm ownership**	**Domestic firms**	**Only exporters**	**Only importers**	**Two way traders**	**Total**
independent firms	-	5,881	-	11,370	17,251
perc.	-	*34.09*	-	*65.91*	*100*
swedish group	-	4,744	-	13,581	18,325
perc.	-	*25.89*	-	*74.11*	*100*
swedish MNE	-	951	-	11,775	12,726
perc.	-	*7.47*	-	*92.53*	*100*
foreign MNE	-	362	-	10,323	10,685
perc.	-	*3.39*	-	*96.61*	*100*

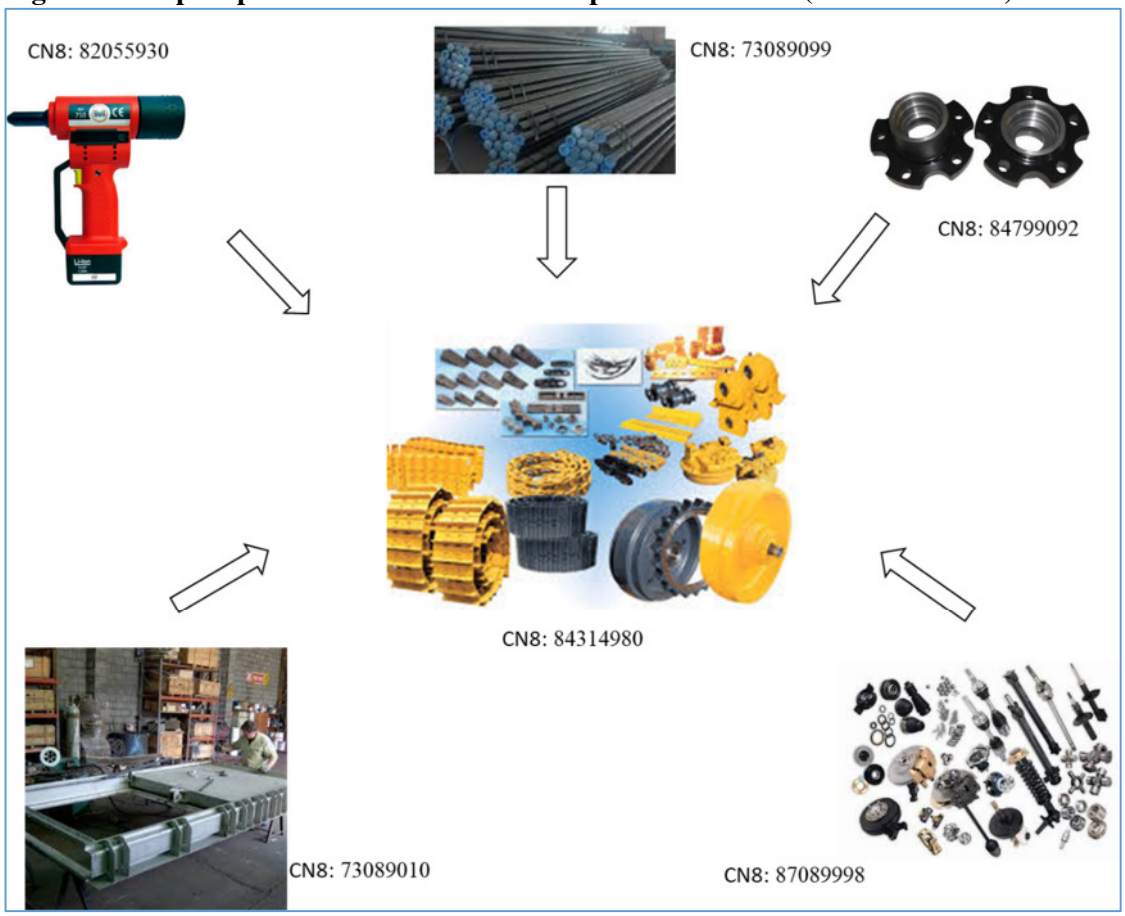
Table 4. Export and import innovations

restricted sample	All firms	Small firms	Large firms	Independ. firms	Swedish groups	Swedish MNE	Foreign MNE
firms with export innovations	44,601	30,410	14,191	11,680	13,025	10,727	9,169
firms with import innovations	40,024	25,581	14,443	8,974	10,922	10,589	9,539
tot. number of firms	58,987	42,911	16,076	17,251	18,325	12,726	10,685
share firms with export innovations (%)	*75.6*	*70.9*	*88.3*	*67.7*	*71.1*	*84.3*	*85.8*
share firms with import innovations (%)	*67.9*	*59.6*	*89.8*	*52.0*	*59.6*	*83.2*	*89.3*
firms with new exported varieties	50,316	34,942	15,374	13,404	15,067	11,862	9983
firms with new imported varieties	42,638	27,639	14,999	9,680	11,863	11,190	9,905
share firms with new exp. varieties (%)	*85.3*	*81.4*	*95.6*	*77.7*	*82.2*	*93.2*	*93.4*
share firms with new imp. varieties (%)	*72.3*	*64.4*	*93.3*	*56.1*	*64.7*	*87.9*	*92.7*
export innovations (mean)	3.514	2.365	6.581	1.999	2.275	5.285	5.975
import innovations (mean)	4.126	2.377	8.794	1.839	2.325	6.137	8.510
tot number of export types	11.633	6.795	24.546	5.394	6.594	19.081	21.478
tot number of import types	15.253	7.291	36.506	5.289	7.431	23.794	34.583
share of export innovations (%)	*30.2*	*34.8*	*26.8*	*37.1*	*34.5*	*27.7*	*27.8*
share of import innovations (%)	*27.0*	*32.6*	*24.1*	*34.8*	*31.3*	*25.8*	*24.6*

Table 5. Most common export innovations in 2006 among Swedish exporters.

Most common export innovations in 2006			Most common exported products in 2005 among the firms who introduced the export innovation to the left in 2006		
freq.	**cn8 - code**	**description**	**freq.**	**cn8 - code**	**description**
105	73089010	Weirs, sluices, lock-gates, landing stages, fixed docks and other maritime and waterway structures, of iron or steel	10	87089998	Parts and accessories for tractors, motor vehicles for the transport of ten or more persons, motor vehicles …
			10	84799092	Parts of machines and mechanical appliances having individual functions, of cast iron or cast steel, n.e.s.
			7	94032010	Metal furniture, for civil aircraft (excl. for offices, seats and medical, surgical, dental or veterinary furniture)
			7	84099900	Parts suitable for use solely or principally with compression-ignition internal combustion piston engine, n.e.s.
			6	84314980	Parts of machinery of heading 8426, 8429 and 8430, n.e.s.
101	84314980	Parts of machinery for ships' derricks, self-propelled bulldozers, angledozers, levellers, excavators and other moving, levelling, scraping or excavating machinery.	23	84799092	Parts of machines and mechanical appliances having individual functions, of cast iron or cast steel, n.e.s.
			12	87089998	Parts and accessories for tractors, motor vehicles for the transport of ten or more persons, motor vehicles …
			9	73089010	Weirs, sluices, lock-gates, landing stages, fixed docks and other waterway structures, of iron or steel
			9	73089099	Structures and parts of structures of iron or steel, n.e.s. (excl. bridges and bridge-sections
			8	82055930	Cartridge-operated riveting, wallplugging, etc., hand tools
77	87089998	Parts and accessories for tractors, motor vehicles for the transport of ten or more persons, motor cars and other motor vehicles for the transport of persons and goods, special purpose motor vehicles.	10	85364900	Relays for a voltage > 60 V but <= 1.000 V
			9	84859080	Machinery parts of chapter 84, not intended for a specific purpose, n.e.s.
			9	84139110	Parts of pumps for liquids, for civil aircraft, n.e.s.
			8	84798991	Machines for glazing and decorating ceramic products
			7	84099900	Parts suitable for use solely or principally with compression-ignition internal combustion piston engine, n.e.s.
			7	85369010	Connections and contact elements, for wire and cables, for a voltage of <= 1.000 V
56	44219098	Articles of wood, n.e.s.	7	94032010	Metal furniture, for civil aircraft (excl. for offices, seats and medical, surgical, dental or veterinary furniture)
			7	94032091	Metal beds (excl. for civil aircraft and hospital beds with mechanical fittings)
			7	94032099	Metal furniture (excl. for civil aircraft, for offices, medical, surgical, dental or veterinary furniture, beds and seats)
			5	44189090	Builders' joinery and carpentry, of wood, incl. cellular wood panels, of wood
			5	44071091	Spruce of the species "Picea abies Karst." or silver fir "Abies alba Mill."
			5	48211010	Self-adhesive paper or paperboard labels of all kinds, printed
54	39261000	Office or school supplies, of plastics, n.e.s.	7	39231000	Boxes, cases, crates and similar articles for the conveyance or packaging of goods, of plastics
			7	85369010	Connections and contact elements, for wire and cables, for a voltage of <= 1.000 V
			6	39069090	Acrylic polymers in primary forms
			5	39241000	Tableware and kitchenware, of plastics
			5	87089998	Parts and accessories for tractors, motor vehicles for the transport of ten or more persons, motor vehicle…

Figure 1. Graphic presentation of one of the export innovations (CN8: 84314980) of Table 5



Note: the picture provides an example of the category of products represented by each Cn8-code. The products with the arrows on the corners of the figure indicate the most common exported products in 2005 among the firms that introduced the product CN8: 84314980 – in the centre of the figure- for the first time in 2006 (i.e. as an export innovation)

Figure 2. Distribution of export and import innovations (2002-2012)

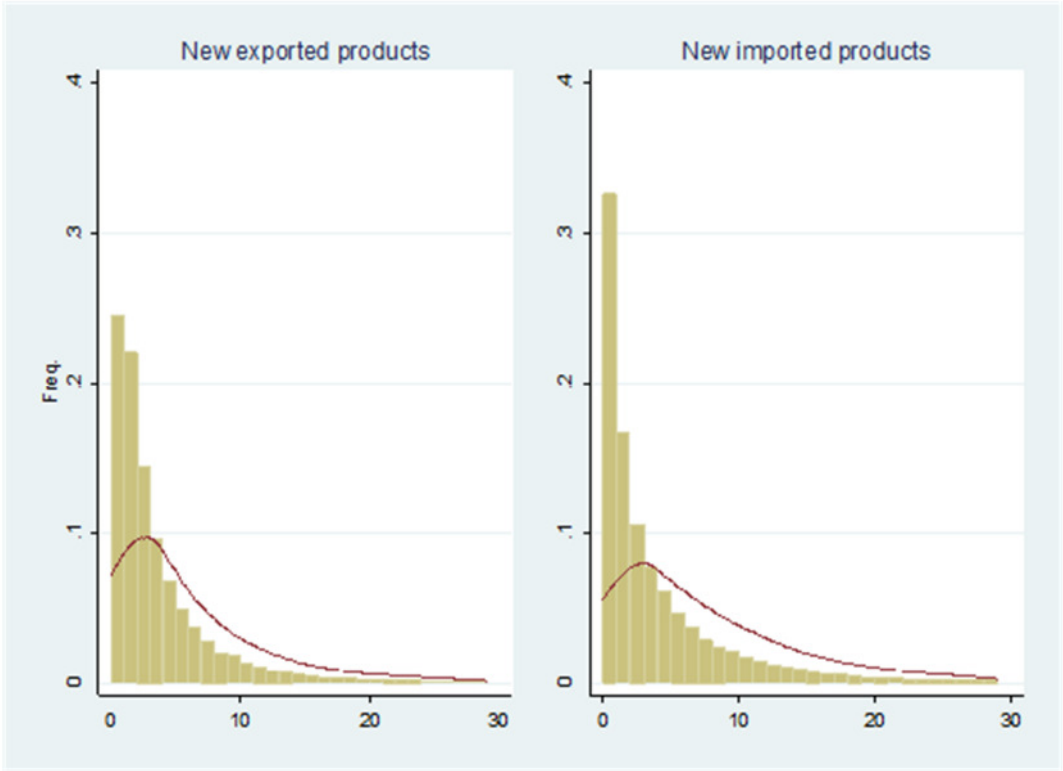


Figure 3 Distribution of export and import innovations by size and ownership (2002-2012)

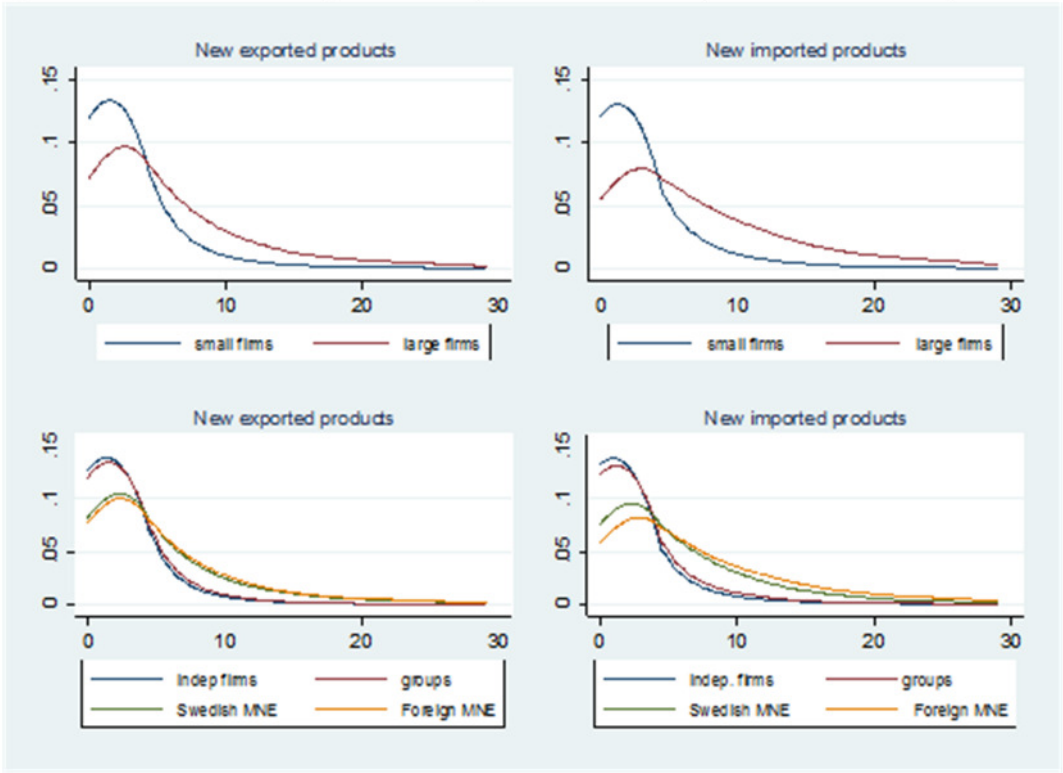


Table 6. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
X_INNO	58987	3.514	6.360	0	293
IMP (dummy)	58987	0.797	0.402	0	1
ln(TOT_X)	58987	1.725	1.122	0	6.395
ln(IM_INNO)	58987	1.120	1.002	0	5.771
ln(IM_VAR)	58987	1.444	1.237	0	7.227
ln(TOT_IM)	58987	1.829	1.365	0	6.553
ln(TOT_SOURCES)	58987	2.052	1.554	0	7.963
ln(Productivity)	58987	13.203	0.511	6.236	20.036
ln(Employment)	58987	3.294	1.286	0	10.057
ln(Investments)	58987	14.535	2.680	0	23.658
Independent firm (dummy)	58987	0.308	0.462	0	1
Swedish group (dummy)	58987	0.305	0.460	0	1
Swedish MNE (dummy)	58987	0.212	0.409	0	1
Foreign MNE (dummy)	58987	0.174	0.380	0	1
Patents (dummy)	58987	0.046	0.209	0	1
ln(# Swedish MNE within industry-region)	58987	1.752	1.128	0	4.205
ln(# Foreign MNE within industry-region)	58987	1.463	1.088	0	3.989
ln(# All firms within industry-region)	58987	3.130	1.347	0	5.838
ln(employment in Swedish MNE within industry-region)	58987	5.250	2.614	0	10.062
ln(employment in Foreign MNE within industry-region)	58987	4.904	2.861	0	10.014
ln(employment in All firms within industry-region)	58987	5.780	1.668	0	10.022
ln(value added in Swedish MNE within industry-region)	58987	16.539	7.193	0	24.266
ln(value added in Foreign MNE within industry-region)	58987	15.612	7.929	0	24.731
ln(value added in All firms within industry-region)	58987	18.649	3.041	0	21.730

Table 7. The determinants of export innovations

	(1)	(2)	(3)	(4)	(5)	(6) *Externalities from # firms*	(7) *Externalities from # employees*	(8) *Externalities from value added*
IMP_{it-1} (dummy)		0.043**	-0.039**	-0.047***	0.003	0.004	0.004	0.003
		(0.017)	(0.018)	(0.018)	(0.020)	(0.020)	(0.020)	(0.020)
$ln(IM\_INNO)_{it-1}$			0.100***	0.073***	0.103***	0.104***	0.103***	0.103***
			(0.007)	(0.013)	(0.015)	(0.015)	(0.015)	(0.015)
$ln(IM\_VAR)_{it-1}$				0.032**	0.052***	0.052***	0.052***	0.052***
				(0.013)	(0.018)	(0.018)	(0.018)	(0.018)
$ln(TOT\_IM)_{it-1}$					-0.146***	-0.148***	-0.145***	-0.146***
					(0.032)	(0.032)	(0.032)	(0.032)
$ln(TOT\_SOURCES)_{it-1}$					0.063**	0.062**	0.060**	0.062**
					(0.030)	(0.030)	(0.030)	(0.030)
$ln(TOT\_X)_{it-1}$	0.162***	0.161***	0.140***	0.138***	0.145***	0.145***	0.144***	0.145***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Ownership type								
reference: independ. Firms								
Swedish group $_{it-1}$	0.011	0.010	0.008	0.008	0.007	0.006	0.007	0.007
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Swedish MNE $_{it-1}$	0.015	0.013	0.007	0.005	0.008	0.005	-0.003	0.002
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Foreign MNE $_{it-1}$	-0.036	-0.038*	-0.051**	-0.054**	-0.043*	-0.065***	-0.071***	-0.062***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.024)	(0.024)	(0.024)
Patents $_{it-1}$ (dummy)	0.032*	0.032*	0.026	0.025	0.025	0.024	0.024	0.025
	(0.018)	(0.018)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
$ln(Productivity)_{it-1}$	0.044***	0.043***	0.037***	0.035***	0.040***	0.038***	0.039***	0.039***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
$ln(Employment)_{it-1}$	0.084***	0.083***	0.060***	0.057***	0.066***	0.066***	0.065***	0.066***
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
$ln(Investments)_{it-1}$	0.010***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Within industry-region externalities								
Swedish MNE $_{it-1}$						-0.002	0.004	0.000
						(0.013)	(0.004)	(0.001)
Foreign MNE $_{it-1}$						0.050***	0.016***	0.003***
						(0.012)	(0.004)	(0.001)
All firms $_{it-1}$						-0.015	-0.015**	-0.004
						(0.013)	(0.006)	(0.002)
Time dummies	YES	YES	YES	YES	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Constant	-0.553***	-0.570***	-0.403***	-0.376***	-0.430***	-0.432***	-0.419***	-0.406***
	(0.141)	(0.141)	(0.140)	(0.140)	(0.141)	(0.143)	(0.144)	(0.147)
Observations	58,987	58,987	58,987	58,987	58,987	58,987	58,987	58,987
Number of firms	7,497	7,497	7,497	7,497	7,497	7,497	7,497	7,497

The dependent variable is the number of export innovations in time t. All models are estimated with negative binomial estimators with firms' fixed effects. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 8. The determinants of export innovations, by firm size

	(1) Small firms	(2) Small firms	(3) Small firms	(4) Large firms	(5) Large firms	(6) Large firms
	Externalities from # firms	*Externalities from # employees*	*Externalities from value added*	*Externalities from # firms*	*Externalities from # employees*	*Externalities from value added*
IMP_{it-1} (dummy)	-0.002	-0.003	-0.003	-0.005	-0.006	-0.007
	(0.022)	(0.022)	(0.022)	(0.062)	(0.061)	(0.061)
$\ln(IM\_INNO)_{it-1}$	0.126***	0.125***	0.125***	0.079***	0.076***	0.076***
	(0.021)	(0.021)	(0.021)	(0.023)	(0.023)	(0.023)
$\ln(IM\_VAR)_{it-1}$	0.023	0.023	0.023	0.087***	0.088***	0.087***
	(0.023)	(0.023)	(0.023)	(0.028)	(0.028)	(0.028)
$\ln(TOT\_IM)_{it-1}$	-0.187***	-0.185***	-0.185***	-0.103**	-0.095**	-0.096**
	(0.042)	(0.042)	(0.043)	(0.048)	(0.048)	(0.048)
$\ln(TOT\_SOURCES)_{it-1}$	0.118***	0.117***	0.118***	-0.010	-0.014	-0.012
	(0.040)	(0.040)	(0.040)	(0.046)	(0.046)	(0.046)
$\ln(TOT\_X)_{it-1}$	0.126***	0.126***	0.126***	0.189***	0.189***	0.189***
	(0.009)	(0.009)	(0.009)	(0.013)	(0.013)	(0.013)
Ownership type						
reference: independ. firms						
Swedish group $_{it-1}$	-0.013	-0.012	-0.011	0.091**	0.088*	0.091**
	(0.020)	(0.020)	(0.020)	(0.045)	(0.045)	(0.045)
Swedish MNE $_{it-1}$	-0.017	-0.019	-0.015	0.120***	0.099**	0.111***
	(0.027)	(0.026)	(0.027)	(0.042)	(0.043)	(0.042)
Foreign MNE $_{it-1}$	-0.098***	-0.099***	-0.097***	0.057	0.045	0.067
	(0.032)	(0.032)	(0.032)	(0.043)	(0.044)	(0.043)
Patents $_{it-1}$ (dummy)	0.047	0.047	0.047	0.019	0.020	0.021
	(0.036)	(0.036)	(0.036)	(0.020)	(0.020)	(0.020)
$\ln(Productivity)_{it-1}$	0.037***	0.037***	0.037***	0.049***	0.050***	0.051***
	(0.013)	(0.013)	(0.013)	(0.015)	(0.016)	(0.016)
$\ln(Employment)_{it-1}$	0.126***	0.126***	0.126***	0.056***	0.055***	0.056***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)	(0.015)
$\ln(Investments)_{it-1}$	0.003	0.003	0.003	0.020***	0.020***	0.020***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Within industry-region externalities						
Swedish MNE $_{it-1}$	0.007	0.003	-0.000	-0.009	0.004	0.001
	(0.017)	(0.005)	(0.001)	(0.021)	(0.006)	(0.002)
Foreign MNE $_{it-1}$	0.036**	0.015***	0.004***	0.072***	0.017***	0.003*
	(0.016)	(0.005)	(0.001)	(0.019)	(0.006)	(0.002)
All firms $_{it-1}$	-0.019	-0.012	-0.003	-0.022	-0.018**	-0.005
	(0.018)	(0.009)	(0.004)	(0.020)	(0.009)	(0.003)
Time dummies	YES	YES	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES
Constant	-0.427**	-0.442**	-0.423**	-0.879***	-0.856***	-0.852***
	(0.192)	(0.192)	(0.200)	(0.244)	(0.246)	(0.249)
Observations	42,911	42,911	42,911	16,076	16,076	16,076
Number of firms	5,718	5,718	5,718	1,779	1,779	1,779

The dependent variable is the number of export innovations in time t. All models are estimated with negative binomial estimators with firms' fixed effects. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 9. The determinants of export innovations: different types of new imported inputs

VARIABLES	(1) all firms *Externalities from # firms*	(2) all firms *Externalities from # employees*	(3) all firms *Externalities from value added*	(4) Small firms *Externalities from # firms*	(5) Small firms *Externalities from # employees*	(6) Small firms *Externalities from value added*	(7) Large firms *Externalities from # firms*	(8) Large firms *Externalities from # employees*	(9) Large firms *Externalities from value added*
IMP_{it-1} (dummy)	0.030	0.030	0.029	0.026	0.025	0.025	0.021	0.019	0.018
	(0.020)	(0.020)	(0.020)	(0.022)	(0.022)	(0.022)	(0.062)	(0.062)	(0.062)
ln(IM_INNO_intermediate goods) $_{it-1}$	0.072***	0.071***	0.071***	0.092***	0.092***	0.091***	0.061***	0.058***	0.058***
	(0.011)	(0.011)	(0.011)	(0.015)	(0.015)	(0.015)	(0.016)	(0.016)	(0.016)
ln(IM_INNO_capital goods) $_{it-1}$	0.038***	0.038***	0.038***	0.074***	0.073***	0.074***	0.013	0.013	0.013
	(0.009)	(0.009)	(0.009)	(0.013)	(0.013)	(0.013)	(0.012)	(0.012)	(0.012)
ln(IM_INNO_final goods) $_{it-1}$	0.046***	0.046***	0.046***	0.053***	0.053***	0.053***	0.046***	0.046***	0.046***
	(0.009)	(0.009)	(0.009)	(0.014)	(0.014)	(0.014)	(0.012)	(0.012)	(0.012)
ln(TOT_X) $_{it-1}$	0.143***	0.143***	0.143***	0.126***	0.126***	0.126***	0.186***	0.186***	0.186***
	(0.007)	(0.007)	(0.007)	(0.009)	(0.009)	(0.009)	(0.013)	(0.013)	(0.013)
ln(IM_VAR) $_{it-1}$	0.057***	0.057***	0.057***	0.029	0.029	0.029	0.080***	0.080***	0.079***
	(0.016)	(0.016)	(0.016)	(0.020)	(0.020)	(0.020)	(0.025)	(0.025)	(0.025)
ln(TOT_IM) $_{it-1}$	-0.140***	-0.137***	-0.138***	-0.186***	-0.184***	-0.185***	-0.105**	-0.097**	-0.098**
	(0.030)	(0.030)	(0.030)	(0.040)	(0.040)	(0.040)	(0.045)	(0.045)	(0.045)
ln(TOT_SOURCES) $_{it-1}$	0.055**	0.053*	0.056**	0.113***	0.112***	0.113***	-0.005	-0.009	-0.007
	(0.028)	(0.028)	(0.028)	(0.038)	(0.038)	(0.038)	(0.044)	(0.044)	(0.044)
Ownership type									
reference: independ. firms									
Swedish group $_{it-1}$	0.005	0.006	0.007	-0.013	-0.013	-0.012	0.090**	0.087*	0.090**
	(0.018)	(0.018)	(0.018)	(0.020)	(0.020)	(0.020)	(0.045)	(0.045)	(0.045)
Swedish MNE $_{it-1}$	0.004	-0.004	0.001	-0.017	-0.020	-0.016	0.118***	0.098**	0.110***
	(0.021)	(0.021)	(0.021)	(0.027)	(0.026)	(0.027)	(0.042)	(0.043)	(0.042)
Foreign MNE $_{it-1}$	-0.065***	-0.071***	-0.062***	-0.098***	-0.100***	-0.098***	0.055	0.044	0.066
	(0.024)	(0.024)	(0.024)	(0.032)	(0.032)	(0.032)	(0.043)	(0.044)	(0.043)
ln(Productivity) $_{it-1}$	0.038***	0.038***	0.039***	0.037***	0.037***	0.037***	0.048***	0.049***	0.050***

	(0.010)	(0.010)	(0.010)	(0.013)	(0.013)	(0.013)	(0.015)	(0.015)	(0.015)
ln(Employment) $_{it-1}$	0.063***	0.062***	0.062***	0.124***	0.125***	0.124***	0.054***	0.053***	0.054***
	(0.009)	(0.009)	(0.009)	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)	(0.015)
ln(Investments) $_{it-1}$	0.009***	0.009***	0.009***	0.003	0.003	0.003	0.020***	0.020***	0.020***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Patents $_{it-1}$ (dummy)	0.020	0.020	0.021	0.046	0.046	0.046	0.018	0.019	0.020
	(0.017)	(0.017)	(0.017)	(0.036)	(0.036)	(0.036)	(0.020)	(0.020)	(0.020)
Within industry-region externalities									
Swedish MNE $_{it-1}$	-0.002	0.004	0.000	0.006	0.003	-0.000	-0.009	0.004	0.001
	(0.013)	(0.004)	(0.001)	(0.017)	(0.005)	(0.001)	(0.021)	(0.006)	(0.002)
Foreign MNE $_{it-1}$	0.051***	0.016***	0.004***	0.035**	0.015***	0.004***	0.074***	0.017***	0.003*
	(0.012)	(0.004)	(0.001)	(0.016)	(0.005)	(0.001)	(0.019)	(0.006)	(0.002)
All firms $_{it-1}$	-0.016	-0.015**	-0.004	-0.019	-0.012	-0.003	-0.023	-0.018*	-0.005
	(0.013)	(0.006)	(0.002)	(0.018)	(0.009)	(0.004)	(0.020)	(0.009)	(0.003)
Time dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	58,987	58,987	58,987	42,911	42,911	42,911	16,076	16,076	16,076
Number of firms	7,497	7,497	7,497	5,718	5,718	5,718	1,779	1,779	1,779

The dependent variable is the number of export innovations in time t. All models are estimated with negative binomial estimators with firms' fixed effects. All models include time dummies. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.