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Demonstration or Congestion? Export Spillovers in Sweden

by

Patrik Karpaty and Richard Kneller

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The Authors

Patrik Karparty is a PhD student at the University of Örebro, Richard Kneller is a Lecturer at the University of Nottingham and a Research Fellow in GEP.

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Abstract

A key feature of the Swedish economy over last decade and a half has been the rapid internationalisation of its economy, both through FDI and trade. In this paper we consider the relationship between these two trends: whether the effect of increased inward FDI on exports by domestic firms may be positive or negative. The first case may occur as a result of demonstration effects. The second may reveal congestion effects. We also consider whether FDI affect the sunk costs or variable costs of exporting. Our results indicate that congestion effects dominate since increased inward FDI has led to a significant reduction in the probability of export market participation.

JEL classification: F13; F23

Keywords: FDI, export spillovers, export platforms

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Non-Technical Summary

In the last few decades Sweden has been successful in increasing the extent of its international exposure, both in terms of increased inward (and outward) FDI flows and export sales. In this paper we consider the extent to which these increased inward FDI flows caused the increased export flows through export spillovers using data from the Swedish manufacturing sector from 1990 to 2002. We allow these effects to be positive, which we called demonstration effects, and negative, which we called congestion effects and to have differential impacts on the extensive (the number of firms that export) and the intensive (the export share in total sales) margins of exporting.

It would appear from our results that to the extent that foreign MNEs had an effect on Swedish firms it was negative, significantly reducing the probability of export market participation. To the extent that that positive demonstration effects are present they are confined to specific firms (high R&D and geographically concentrated). The results also indicated that the effects of congestion were confined to the export participation decision and did not affect the export intensity of the firm. This combination of results allowed us to conclude that foreign firms raised the sunk-costs of export market entry rather than the variable costs of exporting.

Overall, given the general similarity of the results with those of Ireland, this allows us to generalise that in small developed economies that have a high degree of exposure to international markets the effect of the entry of foreign MNEs on the exports of domestic firms is likely to be negative. Congestion effects dominate. Sweden has a history of high levels of exposure to international markets, particularly through trade, which might mean that the possibilities for demonstration effects have been exhausted in a way that they have not for other developed economies such as the UK.

That said the overall policy conclusion must be that the negative effect of increased presence of foreign MNEs within the Swedish economy on total exports are negligible. While increased foreign presence led to a reduction in export entry in Sweden at the margin, given the skewed nature of the distribution of exports, the contribution to total exports from these firms is likely to have been much smaller than their number might suggest. For example, even if we sum together all of the exports from domestic firms that were still able to enter export markets for the first time in Sweden over the sample period (some 511 firms) their exports accounted for just 0.3 per cent of total exports from Sweden over the period. Or, comparing them to total exports from new foreign MNEs they account for 1.2 percent.

Section 1: Introduction.

A key feature of the Swedish economy over the last decade and a half has been the rapid expansion of the stock of foreign owned capital. Sweden was the 7th largest recipient of FDI in the world in the second half of the 1990's (Blomström and Kokko, 2003) and saw the share of foreign to domestically owned firms rise by 10 percentage points in only 10 years (from 17 per cent in 1990 to 27 per cent in 2000). Alongside this increase in inward FDI has been a rapid rise in Swedish exports. As a weighted average the number of firms exporting rose from around 80 per cent at the start of the 1990's to over 90 per cent by the end of the decade (Gullstrand, Greenaway and Kneller, 2005).[1]

An interesting question considered in other contexts (see for example the review in Görg and Greenaway, 2004) has been to what extent these two trends are related. Specifically, are there export spillovers from FDI to domestic firms? Has rising foreign presence in the Swedish economy helped exports by domestic firms to expand, or would it have risen even more dramatically without the presence of inward FDI? Or does the high level of exporting that existed before the 1990's in Sweden mean that such effects are less likely to be positive?

The empirical evidence for other countries would suggest that the presence of multinational firms in the domestic economy can have both positive and negative effects on domestic firms' export decisions. Of the likely channels for spillovers, following the work of Aitken *et al.* (1997), perhaps the most discussed has been demonstration effects. Export spillovers from foreign multinationals lower the sunk-costs associated with export market entry and encourage the expansion of sales in foreign markets extending both the extensive and intensive margins of Swedish exports. Co-location of foreign and domestic firms may also improve information about foreign tastes and markets, or lead to improvements in the domestic infrastructure necessary to provide access to foreign markets or provide channels through which to distribute their goods (Aitken *et al.* 1997). Similarly affiliates of foreign firms may affect the export decision of domestic firms by increasing the level of competition within the market they enter, forcing domestic firms to become more

[1] Bernard and Jensen (1999) report that 54% of US firms export, whilst the comparable figure reported by Girma, Greenaway and Kneller (2004) for the UK is 46%

productive (or exit), and therefore allowing them to start exporting. This effect may be stronger the higher are export entry costs and the more concentrated the industry that the MNE enters is. Strong positive effects of this kind have been previously found for Mexico (Aitken et al, 1997), for Uruguay (Kokko et al, 2001) and the UK (Greenaway et al., 2004; Kneller and Pisu, 2005).

Positive spillovers to domestic firms have not been found in all contexts however. Ruane and Sutherland (2005) for Ireland and Swenson (2005) for China have found that the presence of foreign firms has a negative effect on the export possibilities of domestic firms, while Barrios et al. (2003) for Spain and Sjöholm (2003) find no effect. Explanations of the negative export effect that foreign firms have in Ireland and China differ somewhat. Ruane and Sutherland (2005) suggest that they are explained by the use of Ireland as an export platform to the rest of the European Union, such that there is little interaction between domestic and foreign firms. In her explanation for China, Swenson (2005) draws on the evidence for negative productivity spillovers found by Aitken and Harrison (1999). A firm's entry into export markets is known to be sensitive to its level of productivity (Bernard and Jensen, 1999). If the presence of foreign firms drives up the costs of labour or other factor inputs, then in a heterogeneous firm framework (Melitz, 2003), this would make it less likely that the marginal domestic firm will start to export and lower the extent to which established exporters sell their good abroad. In a similar manner foreign firms may also lead to the congestion of local infrastructure or services necessary for access into, or delivery to, export markets, again raising the costs of exporting.

To address questions surrounding the direction of export spillovers in this paper we use data on Swedish firms for the period 1990 to 2002. Given the rapid increase in inward FDI flows during the sample period and the extensive existing exports of domestic firms these data offers an interesting case through which to study export spillovers, both positive and negative. Building on the work of Greenaway et al. (2004) we are able to separate the sales of foreign firms into those aimed at the domestic market and those exported abroad. This difference should allow us to determine whether any spillover effects we observe are general, in that they do not depend on the destination of final sales, or specific to export markets. For example if negative spillover effects exist this might be because of congestion

in product markets (as identified by Aitken and Harrison, 1999), or of the infrastructure (road and rail networks and sea ports) necessary to export. In such a case the different measures of foreign presence (domestic versus export sales) should have different effects on domestic firms export choices. We are also careful to allow for separate effects of multinationals on the extensive (number of firms who export) and the intensive margins (the intensity with which those firms export) of exporting, accounting for the interdependence of these decisions through a Heckman selection model. From this we infer information about the effect on fixed and variable costs.

In addition to this however, the data contain some unique characteristics that might enable us to disentangle the explanations for export spillovers. Typical in the export spillovers literature has been the use of separate measures for the size of the foreign firm and the volume of their exports, with the belief that export demonstration effects are more likely to follow from multinational firms that are export oriented. It would seem likely however, that if these exports represent the transfer of goods back to affiliates within the same firm, i.e. they are intra rather than inter firm exports, then such demonstration effects are less likely to occur. Similarly, competition effects have been seen as another channel through which foreign multinationals might affect the export decision of domestic firms. Again these effects are likely to be weaker when foreign production is intra rather than inter firm. The Swedish data available contains such information, along with similar information on sales in the domestic economy.

In keeping with the motivation of heterogeneity in the effect of foreign presence according to intra and inter firm sales (domestic and foreign), we also explore heterogeneity across a number of other dimensions. Firstly, we explore whether the effect of export spillovers differ according to the characteristics of the domestic firm. Such absorptive capacity effects have been explored in the productivity spillovers literature by Cohen & Levinthal (1989); Grünfeld (2002; 2003); Girma & Wakelin (2002); Haskel et al (2002); Kokko et al (1996). Second, we remove the assumption that multinationals are of equal importance in the provision of spillovers, where we use the relative productivity of the foreign firm as weights. Finally, we explore whether there are regional limits to the spillover effects, with the expectation that some elements of any spillovers, such as negative congestion effects,

are more likely to be influenced by geography than others. Such effects have previously been explored by, amongst others, Aitken *et al.* (1997), Kneller and Pisu (2005) and Sjöholm (2003), albeit where the latter does not distinguish between the industries in which foreign multinational firms operate.

The rest of the paper is organised as follows. Section 2 provides a summary of the empirical evidence on export spillovers from FDI. As is made clear from this summary, the results from this literature appear to depend crucially on the context under which it is considered. In order to discuss the potential effects of foreign multinational firms on domestic firms in the remainder of Section 2 we present a theoretical model of export market participation and intensity. Section 3 presents the empirical methodology used in the estimation and Section 4 the data sources and the construction of the main variables of the paper. Section 5 presents the empirical results. These include the main results as well as tests of heterogeneity, geographical limits to spillovers and further evidence on congestion. Finally, Section 6 concludes.

Section 2: Empirical Literature and Theoretical Motivation

Export spillovers from FDI

While the literature on export spillovers from foreign multinationals is small relative to that on productivity spillovers (see Görg and Greenaway, 2004), both literatures share the same feature of inconsistency in the effect of foreign presence on domestic firms across studies. While the earlier literature identified strong positive spillover effects (Aitken *et al*., 1997; Kokko *et al*., 2001; Greenaway *et al*., 2004) more recent studies have either found no and in some cases negative impacts (Barrios *et al*., 2003; Ruane and Sutherland, 2005; Swenson, 2005).

Outside of differences in the country from which the underlying data are taken there would appear little obvious explanation for these inconsistencies: there is little variability for example in the methodology and almost all use the same measure of foreign presence (the share of employment or output in the industry). A good example of the inconsistencies that remain can be found ~~in a comparison~~ by comparing the Greenaway *et al.* (2004) and Ruane

and Sutherland (2005) for the UK and Ireland respectively. Here, while both studies find that both the likelihood of exporting and the export share are increasing in the industry-level foreign presence index, they reach contrasting results for the export activities of foreign firms. Greenaway *et al.* (2004) find a positive and weakly significant effect for the export decision and a insignificant effect on the decision of how much to export for the UK, while Ruane and Sutherland (2005) find negative effects on both the export decision and the export share (with a suggestion the latter is due to the presence of US multinationals) for Ireland. Ruane and Sutherland (2005) explain their results as being due to the use of Ireland as an export platform to the rest of the EU. Export spillovers they argue, are unlikely where the country is used as an export platform because competition with domestic firms in local product markets is limited. It should be remembered however that the UK is similarly used as an export platform by US MNEs (Kneller and Pisu, 2004).

In a similar vein to the productivity spillovers literature, this might be used to suggest that there might be more to be learnt about the effect of foreign presence from both further refinement of the measures of foreign presence used[2] and a comparison of studies in which the economic conditions are likely to be more similar. That is, context is important. Some 11 studies are listed in Greenaway and Kneller (2005) on export spillovers, covering around 10 countries. These include relatively large developed economies such as the UK and US, small developed economies such as Spain and Ireland and a number of developing countries such as Mexico, Indonesia and China. In such a case it is perhaps more likely that as a small developed economy that is open to international trade, that the results for Sweden will match those for Ireland and Spain rather than other countries. As noted already the evidence for Ireland suggests negative spillover effects and Spain (Barrios et al., 2003) insignificant effects.

Theoretical Motivation

To motivate the empirical section of the paper we, like Aitken et al. (1997) and Greenaway et al. (2004), begin with a representative firm model of export participation. While used only to provide some structure to the empirical analysis it is worth noting that this model contrasts with that used by Swenson (2005). There, multinationals lead to an improvement

[2] Kneller and Pisu (2005) for example consider vertical as well as horizontal spillovers.

in the quality of matches in a model of search by Rauch and Trindade (2003), increasing the probability of exporting by domestic firms. Despite differences in the structure of the model used here and in Swenson (2005), because multinationals have similar information spillover effects in the models the outcomes, from an empirical perspective at least, are similar.

We assume that the choice facing the domestic firm is whether to serve the domestic market, foreign markets through exports, or both, so at to maximise its profits.

$$\max_{qD,qF} P_D q_D + P_F q_F - h(q_D + q_F) - m_D(q_D) - m_F(q_F)$$

$$s.t. \quad q_D, q_F \geq 0$$

where *D* and *F* refer to domestic and foreign markets and *P* and *q* to prices and quantities. The function *h(.)* refers to production costs, and $m_D(.)$ *and* $m_F(.)$ to distribution costs for domestic and foreign markets. We assume that these costs include both fixed and variable elements. Production costs are assumed to be invariant to where the output is sold, whereas distribution costs depend upon markets. In line with the empirical evidence (such as Roberts and Tybout, 1993) costs are higher when products are sold overseas than in the domestic market. To provide detail the cost structure is therefore given as:

$$h(q_D + q_F) = \frac{a}{2}(q_D + q_F)^2 + g(q_D + q_F)$$

$$m_i(q_i) = \frac{1}{2} b_i q_i^2 + c_i q_i \qquad i = D, F$$

where

$$g = g(X, \Omega_{MNE})$$
$$c_D = c_D(X, Z_D)$$
$$c_F = c_F(X, Z_F, \Phi_{MNE})$$

The costs contained in X are common to both domestic and foreign markets, whereas the remainder are specific, contained in Z_D and Z_F respectively. The effect of foreign presence on distribution costs is captured by the term Φ_{MNE}. Its effect can be positive, i.e. it raises costs, or negative, lowers costs. If the effects is negative this would suggest that there are positive demonstration or competition effects on the costs of exporting, whereas if positive

this would suggest that multinationals congest resources necessary to export.[3] A number of different factors might be thought to cause such positive or negative effects. If the presence of foreign multinationals is assumed not to affect the costs of export market participation directly but to improve information about these costs, their effect is likely to be negative. Similarly if their presence leads to an improvement in the local provision of infrastructure necessary to supply foreign markets, they will have a negative effect on costs. In contrast, to the extent that their presence leads to the congestion of existing resources such as infrastructure, or the sunk cost of access to distribution networks, their effect may be positive. Finally, sunk costs are probably lower for subsidiaries of MNEs as they are part of an international production network and therefore have information about foreign markets. In summary, the effect of foreign presence on distribution costs is unknown a-priori and is therefore given by.

$$0 \leq \frac{\delta m_F(q_F)}{\delta \Phi_{MNE}} \leq 0$$

The effect the presence of foreign multinational firms have on production costs is captured by the term, Ω_{MNE}. Again this term is interpreted as including both fixed and variables costs and can be positive or negative. A channel often discussed with regard to export spillovers is competition. This effect may be stronger the higher the entry cost and the more concentrated the industry MNEs enter is. Cantwell (1989) reported that the entry of US multinationals firms resulted in smaller market share of EU firms and Blomström and Kokko (1998) claimed that MNEs appear to establish subsidiaries in less competitive industries, but not to cause them. Foreign firms affiliates will render the market they enter more competitive, forcing domestic firms to become more productive (or exit), and therefore allowing them to start exporting. Under such effects it is expected that higher levels of foreign presence lead to incentives to lower production costs.

Alternatively the presence of foreign firm may raise costs. For example, Aitken and Harrison (1999) argue that if foreign firms, who have lower average costs due to some firm

[3] In this paper we refer to 'congestion' as an increase in demand without a corresponding increase in supply such that the direct price or opportunity cost on goods and services necessary for distribution and sale of Swedish manufacturing goods abroad rises. In this sense we follow Aitken et al. (1997) in allowing the congestion of not only transport networks but also product markets.

specific advantage, attract inputs away from domestic firms this may force domestic firms to reduce production and move up their average cost curve. Or foreign firms may crowd the specialist legal or marketing services necessary to start exporting. Overall the effect on costs is at the outset ambiguous and given by.

$$0 \leq \frac{\delta g(q_F + q_D)}{\delta \Omega_{MNE}} \leq 0$$

To complete the description of the model we derive the first order conditions for profit maximisation for a representative domestic firm as,

$$q_D = \frac{1}{a + b_D}[P_D - aq_F^* - g(X, \Omega_{MNE}) - c_D(X, Z_D)]$$
$$q_F^* = \frac{1}{a + b_F}[P_F - aq_D - g(X, \Omega_{MNE}) - c_F(X, Z_F, \Phi_{MNE})]$$

To estimate the model we re-write these as:

$$\begin{aligned} q_{Dj} &= \alpha_1 P_D + \alpha_2 q_{Fj}^* + \alpha_3 Z_{Dj} + \alpha_4 X_j + \alpha_5 \Omega_{MNE} + u_{Dj} \\ q_{Fj}^* &= \beta_1 P_F + \beta_2 q_{Dj} + \beta_3 Z_{Fj} + \beta_4 X_j + \beta_5 \Phi_{MNE} + u_{Fj} \end{aligned} \qquad (1)$$

where j is the index for the firm, Z_{ij} is a (1 * K) vector of cost variables specific to market i, X_{ji} a (1 * J) vector of cost variables common to both markets, $\square_3$ and $\square_3$ and $\square_4$ and $\square_4$ are (1 * K) and (1 * J) vectors of coefficients respectively and u is a normally distributed error term.

These can be transformed to reveal the optimal quantity to be solved in the foreign market which we transform to the following model (Greenaway, et al., 2004):

$$\Pr(d_j = 1) = \Pr[\begin{matrix} \beta_1 P_F + \beta_2(\alpha_1 P_D + \alpha_3 Z_{Dj}) + \beta_3 Z_{Dj}) + (\beta_2 \alpha_4 + \beta_4) X_j \\ + (\beta_5 + \beta_2 \alpha_5) \Omega_{MNE} + \beta_5 \Phi_{MNE} + v_j \geq 0 \end{matrix}]$$

where $v_j = \square_2 u_{Dj} + u_{Fj}$

Section 3: Empirical Methodology

In this exercise we are interested in modelling the export decision of domestic firms. Because of sunk costs of export market entry, this can be thought as a two-stage decisional process whereby firms firstly decide whether to export or not, and secondly how much to export. Our econometric analysis accounts for both decisions and the fact that they are interdependent, thus avoiding any bias involved were they to be considered separately. Two equations were estimated,

$y^*_{it} = x_{it}\beta + u_{it}$ (export share regression);

$d^*_{it} = z_{it}\gamma + v_{it}$ (export decision);

with

$y_{it} = y^*_{it}$ if $d_{it} = 1$

$y_{it} = 0$ if $d_{it} = 0$

and

$d_{it} = 1$ *if* $d^*_{it} > 0$

$d_{it} = 0$ *if* $d^*_{it} \leq 0$

The second equation describes the firm's export participation decision and is therefore estimated as a probit regression. The first equation describes the intensity with which the firm exports. Thus, the observed export share (y_{it}) is zero when the firm decides not to export ($d_{it} = 0$) and assumes a positive value when the firm decides to export ($d_{it} = 1$). The distribution of the error terms (u_{it}, v_{it}) is assumed to be bivariate normal with correlation ρ. The two equations (i.e. decisions) are related if $\rho \neq 0$. In this case estimating only the export share regression would induce sample selection bias in the estimate of β since the error tem u_{it}, and the regressor x would be correlated. To avoid this problem both equations must be estimated. The estimation can be conducted via maximum likelihood or two-step method proposed by Heckman (1979), where we employ the former. [4]

The vectors of covariates x_t and z_t may be the same. If this is the case, and if $\gamma = \beta$ and $u = v$ (i.e. $\rho = 1$) the model reduces to the Tobit: the two choices (whether to export or not and

[4] The two-step methodology involves estimating first the probit of the export decision (i.e. selection equation), computing the inverse of the Mills ratio and inserting it as regressor in the export share regression.

how much to export) are the same. In this instance, the explanatory variables will affect exporters and non-exporters in the same way. The model is, in principle, identified, but identification relies exclusively on the model and the normality assumption concerning the two error terms being correct. These assumptions are in most cases too weak (Johnston and DiNardo, 1997 pp. 450). For this reason, we estimated the two equations adding in the selection equation (equation modelling the decision whether to export or not) the lagged export dummy. This is theoretically consistent with the recently developed models of exports (Melitz, 2004; Helpman *et al.*, 2004; Bernard *et al.*, 2003) and in addition it has the advantage of helping to identify the model more easily. If the effect of the lagged export dummy is significant and positive, as we expect, there is evidence of sunk costs to exporting.

The use of the two-step methodology has another advantage in the context being considered in this paper. The discussion made around the theoretical model made clear that the co-location of foreign multinationals could impact either the sunk costs or variable costs of exporting, or both. These changes in costs will impact on the probit regression and the export share regression in different ways and therefore allow us to separately identify the effect on one or both. If for example, the co-presence of foreign firms has a negative effect on the export participation decision but not the export intensity equation, then we might conclude that they congest the resources necessary to start exporting but do not raise variable costs and so do not affect the export intensity of the firm.

An important estimation issue within the interpretation of the results is the possible endogeneity of the foreign presence variables. For example, if foreign firms tend to exploit Sweden's existing comparative advantage, they may be attracted to industries and regions where the export intensity already is high. In such a case the direction of causation would be reversed and we would have falsely concluded in favour of demonstration effects. Unfortunately, as with the previous literature, we have no good way of dealing with this problem as no satisfactory instruments for foreign presence exist, although it should be remembered that our main results suggest negative rather than positive effects. Instead we follow standard practice in using lagged foreign presence measures and apply caution when interpreting results suggesting positive spillover effects, where lagged foreign presence is at

least predetermined relative to a contemporaneous regressor. [5] Finally, in an attempt to control for the possibility that foreign firms choose to locate in more export intensive industries we include in the regressions a measure of the domestic industry export share (lagged). This variable should also capture any spillover effects from other domestic firms.

A final problem associated with the estimation approach adopted is the use of both industry and firm level variables in the same regression. Multiple observations per firm, industry, year, or country may lead to underestimated standard errors in a longitudinal framework. We estimate all specifications using the Moulton, (1990), White standard errors adjusted to account for possible correlation within a cluster.

Section 4: Data Sources and Construction of Variables

The data, supplied by Statistics Sweden (SCB), include all manufacturing firms in Sweden with at least 50 employees for the years 1990-2002. Two different databases from SCB have been merged together: the Financial Statistics Database and the Regional Labour Market Statistics Database (Rams). Combining this data provides us with information not only on the profit and loss account of the firm, and its associated variables such as gross production and value added, employment, capital stock, purchases of other inputs, R&D expenditure etc., but also detailed information on education by firm (e.g. the share of employees with post secondary college education). Another unique feature of the data is that we have information on exporting activities of firms divided into intra and inter firm domestic sales and exports, enabling us to track the sources of export spillovers more thoroughly.

Included in our estimated equations are a number of firm and industry level determinants found in other studies to be important determinants of the firms export decision as well as our measures of foreign presence and a full set of time, industry and region fixed effects to control for unobservable factors, such as industry and regional differences in e.g. infrastructure and local labour markets. The question we ask in this paper is whether the

[5] Yet another reason to use lagged foreign presence is that one may assume that potential spillovers takes time to materialize.

export intensity in domestic firms is higher due to the presence of FOFs, conditional on other firm characteristics. Accordingly, the firm level variables included are the size, TFP, R&D intensity and previous export market experience, while a discussion of their use in other contexts can be found in Greenaway and Kneller (2005).[6]

A description of these measures can be found in Table 1, some summary statistics in Table 2a and a correlation matrix in the Appendix. We discuss their construction and characteristics only briefly here. TFP is measured using the Törnqvist Index number approach. Since the Törnqvist Index does not fulfil the transitivity requirements, i.e. its not comparable across industries, we use a relative measure (firm i*s* TFP relative to the industry maximum). In order to simplify comparisons between the different models we use the same transformation of R&D intensity (as suggested by Grünfeld 2002; 2003), and described later in equation 3. Finally, size is measured as the log of employment.

The summary statistics on domestic versus MNEs (domestic and foreign) in Table 2a suggest that the characteristics of Swedish firms are similar to those witnessed in other country settings. Domestic firms are noticeably smaller and less productive than MNEs, and they export less. Of the two types of MNEs it would appear that Swedish MNEs are on average larger, more export intensive and perform more R&D than their foreign counterparts.

Of the main globalisation trends discussed in the introduction only one is clearly evident in Table 2a; there has been a large increase in the presence of foreign owned firms in Sweden over the sample period (from 363 to 624 by 2002). The second, the rising volume of trade, is less clear. While the number of foreign MNEs that export has risen with the number of foreign MNEs more generally the share of foreign MNEs that export has fallen (from 89 to 79 per cent). Even more stark has been the absolute decline in the number of domestic non-

[6] By including both firm level R&D and skill intensity we would introduce a double counting problem, since a substantial part of the R&D expenditures are wages to high skilled employees. Gustavsson & Poldahl (2004) have estimated that for Swedish manufacturing during the 1990's, about 20% of the R&D expenditures is actually wages to high skilled employees. In the analysis we choose to exclude skill intensity. The other obvious option would be to adjust firm level R&D intensity to consider this double counting problem. Not reported, but with qualitatively similar results are specifications using skill intensity instead of R&D intensities.

MNEs that export from 603 to 454 (although the relative number of firms that export has remained about the same) and the same with domestic MNEs (from 574 to 390). Overall the percentage share of firms in Sweden that exports have decreased, from around 75% in 1990 to 71% in 2002.[7] Despite this decrease in the number of exporters however, the absolute value of exports has risen considerably, from around 277 milliards in 1990 to almost 646 milliards in 2002. This occurred across all groups, albeit unevenly. Domestic and foreign MNEs together compose the largest fraction of Swedish export and saw the largest increase exports during this period. [8] Of these the largest was in foreign MNEs, where there was a 5-fold increase in exports.

The destination of sales

Construction of the foreign presence variables requires us to be able to discriminate between domestic and foreign owned firms within Sweden. Foreign ownership is defined by SCB as the case where a foreign firm has a controlling position in a Swedish firm, which in turn is defined as possessing 50% or more of the votes (not necessarily equal to 50% of the shares, since Swedish firms may – and do – issue shares with widely different voting power). [9] The foreign ownership statistics does not automatically reveal the first year the firm was foreign owned however, and thus a firm acquired by a foreign owner could be reported as foreign owned with one or more lags. Fortunately, the Swedish Institute for Growth Policy Studies (ITPS) sends each year a questionnaire to the 'stock' of foreign owned firms where among other questions they are asked about the year they became a subsidiary of a foreign multinational (if it is a Greenfield investment the year they established in Sweden). The results from the questionnaire are jointly administered by SCB and ITPS. The foreign ownership variable was complemented by this additional information by SCB upon special request. [10]

[7] In year 2000 the share of all firms that export was around 85%.
[8] We define a domestic MNE as a Swedish firm with positive (intra firm) exports to affiliates abroad.
[9] Obviously the issue of foreign control is not so simple that it can be completely described by a binary variable switching from 0 to 1 at a certain level of voting power, here 50%, since - depending on the ownership structure - a share of the votes much lower than that may be sufficient to give a high degree of control.
[10] We wish to thank Statistics Sweden for assistance on the provision and matching of the ITPS data on the year the firms became foreign owned to the stock data in Financial Statistics Database.

The measure of presence of foreign owned firms, *P*, used in the paper is given by the ratio of sales by foreign owned firms (FOF) in of total sales, where the category of sales is varies across domestic and export sales and intra and inter firm sales.

$$P_{jt} = \frac{\sum_{i=1}^{n} Y_{ijt}^{F}}{\sum_{i=1}^{N} Y_{ijt}} \qquad (2)$$

where P_{jt} is the presence of foreign owned firms in industry *j* at time *t* defined as the ratio between Y_{ijt}^{F}, i.e. the sales in the *i*th firm in the *j*th industry at time *t* accounted for by all foreign owned firms (F) relative total industry sales at time *t*.

In this paper the focus is on export spillovers and we assume that the potential for knowledge diffusion or congestion from foreign affiliates in Sweden is greater from their export sales rather than domestic sales and when sales are intra rather than inter firm. The total sales of foreign owned firms are therefore divided into domestic sales and export sales and then further divided into intra-firm sales by FOFs to their parent companies or other related entities and inter firms sales. This latter distinction is new to this literature. The scope for learning and competition effects from intra firm exports could be lower if the intra firm export mainly is a transfer of intermediate or final goods for resale by foreign affiliates through existing distribution and marketing activities. Foreign multinationals arms-length sales activities in Sweden (inter firm export from Sweden) on the other hand are assumed to be more associated with sunk costs in marketing and market research, and thus these activities may generate larger scope for potential benefits in domestic firms. Similarly, the competition effect from FOFs intra firm sales of intermediate or final goods in Sweden is expected to be of a different kind to that from the remainder of the FOFs domestic sales. [11] For example it seems likely that the effects of competition, whether positive or negative, are likely to be weaker the greater is the level of intra firm sales (both domestic and foreign) compared to inter firm sales. This might be because the prices of intra-firm traded goods could be unrelated to market prices and costs as these are established within the same group of firms and not on a competitive market. For other spillovers there may be less of a distinction between the two types of sales; for example if

[11] Aghion, P et al (2005) model and analyze heterogenous responses of firms to increased inward FDI in India.

foreign multinationals force bid for scare resources forcing up their price then it should matter less where the output produced is directed.

For these reasons we compute four variants of the index above; domestic sales to firms within the same group of companies (horizontal domestic intra) and to other firms (horizontal domestic inter), exports to firms within the same group of companies (horizontal export intra) and to other firms (horizontal export inter).[12] Table 2b provides the distribution between 21 industries at the two digit level in 1990 and 2002. The distribution of intra/inter domestic/export sales by foreign MNEs is characterized by large heterogeneity between different industries and years. Consistent with the rising presence of foreign firms in the Swedish economy over time the observed trend across is upwards across these different measures. Of the different combinations of intra/inter domestic/export sales for the 22 industries listed in Table 2a foreign presence fell between 1990 and 2002 on only 8 out of 84 measures, where these are confined largely to domestic (intra or inter) sales.

Of the four measures of foreign presence we use in the analysis, the export intra firm sales index have changed the most during the period. This could indicate that the main target for foreign acquisitions of Swedish firms during the 1990's have been large Swedish MNEs, such as Astra, Pharmacia, Volvo Car, Saab Automobile. These firms have already a large intra firm export to their affiliates abroad. By looking in more detail in Table 2b we find some support for this, for example in the noticeably large changes of foreign presence in the Chemical industry and the industry for Motor vehicles. Moreover, foreign multinationals seems to have increased their host-market sales mainly in the food industry and other manufacturing.

Absorptive capacity and sender capacity

[12] The term horizontal spillovers refer to within industry spillovers. Spillovers may also follow input-output flows, upstream – from a foreign-owned customer to a domestic seller - and downstream (backward and forward linkages). See e.g. Griliches (1992) and (1995) on the issue of input output flows and knowledge spillovers. These between industry spillovers may be tracked by using input-output tables. This is however, beyond the scope of this paper.

The flow of export spillovers from FDI may depend on both the sender and receiver (absorptive) capacity and two hypotheses are formulated. The first hypothesis is that export spillovers should be greater the larger the technology gap between the foreign and domestically owned firms. The larger the gap the more scope for catching up or learning effects (Findlay 1978). The second hypothesis is that the level of technological and commercial sophistication of the receiving firm is important, i.e. a minimum absorptive capacity may be required in order to learn from foreign firms (Cohen & Levinthal 1989).

To explore these issues we introduce interaction variables as suggested by e.g. Grünfeld (2002; 2003) and a weighted measure of foreign presence. The interaction variables intended to capture absorptive capacity are calculated as the product of the presence variables and the R&D intensity "abs" of the domestic firm (absorptive capacity

$$P_{jt} * abs_{ijt}, \quad where\, abs_{ijt} = \frac{r^{I}{}_{ijt}}{1 + r^{I}{}_{ijt}} \tag{3}$$

and $r^{I}{}_{ijt}$ is the domestic firm *i*s R&D intensity. This transformation allows the marginal absorptive capacity to vary with the firms own R&D intensities in a nonlinear way, see Grünfeld (2003). The marginal return to absorptive capacity is decreasing in a firms R&D intensity. For firms with low initial R&D intensity an increase in a firms R&D intensity have a positive effect on the absorptive capacity, whereas for high initial values the marginal increase in the absorptive capacity is smaller. For almost two out of three firms in our sample report zero R&D expenditure. For this reason we construct this measure without taking logarithms of the R&D variable.

The above analysis assumes that the value of spillovers from foreign MNEs is proportional to their size. The second hypothesis removes this assumption and allows the effects to differ according to the productivity of the foreign firm, with the view that the most productive firms offer the greatest potential for spillovers. We compute this new weighted index of foreign presence (P_{jt}^{W}) by multiplying each foreign firms output by its relative productivity and then summing across foreign firms. This gives greater weight to those foreign MNEs in the top percentiles of the distribution.

$$P_{jt}^{W} = \sum_{i}^{n} p_{ijt} * w_{ijt}, \quad where\, w_{ijt} = \frac{TFP_{ijt}^{F}}{\max[TFP_{jt}]} \qquad (4)$$

and p_{ijt} is the foreign firms sale (intra/inter) or export (intra/inter). $TFP_{ijt}^{F}/maxTFP_{jt}$ is the productivity in foreign owned firm *i* in industry *j* relative the max productivity among all firms in the same industry and year.

Regional Spillovers

The scope for spillovers is assumed to be reduced by the geographical distance between the domestic firms and the FOFs. When domestic firms are learning from FOFs by observing and imitating when knowledge about exporting practices occurs through labour turnover, this is likely to be limited by a spatial dimension, such as a local labour market. We choose a rather aggregated level of regional dimension, i.e. 21 counties and compute an index that considers only those firms operating in a certain county and industry. [13]

$$P_{jrt} = \frac{\sum_{i=1}^{n} Y_{irjt}^{F}}{\sum_{i=1}^{N} Y_{ijrt}} \qquad (5)$$

where Y_{irjt}^{F} is the total sales in a foreign firm *i* operating within industry *j* and region *r* at time *t*. Again, four different indexes will be computed considering the different parts of sales, i.e. intra and inter domestic sales and exports.

Domestic industry export share

We use lagged "domestic industry export share" to control for the possibility that foreign firms choose to locate in industries where Swedish firms have a comparative advantage and

[13] The interpretation of the measure of regional and industry presence of FOFs according to eq. (5) is complicated by the existence of large multi-plant firms which are registered by region by the location of the headquarters. Since we do not have access to plant data we cannot properly address this problem. We thus choose to compute these regional indices on a more aggregated level than our data allows.

thus high export intensities.[14] Alternatively one could have explored this issue more thoroughly by including industry level variables assumed to capture Swedens comparative advantage, such as skill-, capital-, natural resource- and energy intensity in the industry. We will later show that the estimates are robust to use of these alternative measures of comparative advantage.

Section 5: Empirical results

The Heckman's selection model are used in Tables 3-9 to test empirically whether the export intensity in a domestically owned firm can be shown to be higher due to the presence of foreign owned firms.[15] The Heckman method uses an ordinary probit model in the first step to obtain consistent estimates of the parameters of the selection equation. In the second step, the export share is evaluated and eq (1) is estimated by OLS for the observations with positive export only. If the estimated ρ is significantly different from zero, we may reject the hypothesis of no correlation between the two error terms from the export decision and the export share equations respectively. This should indicate that the Heckman selection model is relevant. λ provides the estimated coefficient on the inverse Mills ratio. When λ is different from zero this would suggest that sample selection bias is present. From the estimates reported in Tables 3-9 both ρ and λ are significantly different from zero indicating that the two equations are related and that there is sample selection present. Column 1 in Table 3 reports the results from the export participation decision (the probit model) and in column 2 we report the results for the export share (the second step). In this base regression we have divided the foreign presence variables into four parts, two of which relate to the export orientation of foreign multinational firms and two to their domestic presence.

Of the control variables reported in column 1, most match our prior expectations. Amongst the firm level variables the lagged export status of the firm would appear to be a very important predictor of exporting. The effect of the lagged export dummy is positive and highly significant indicating that there is persistence in the export decision due to sunk

[14] Swedish firms have been found to have a comparative advantage in skill and capital intensive industries, not R&D intensive industries (Hansson & Lundberg 1987).
[15] All models are estimated using robust standard errors: cluster by industry to account for serial correlation.

costs in export market entry. Similarly, the probability that a Swedish firm exports is increasing in its size, its relative TFP and firm R&D (absorptive capacity), albeit where the two latter effects are significant at the 10 per cent level only. Of the industry level control variables the industry export share is insignificant, while the producer price index is significant at the 10 percent level only. The former result is explained by the inclusion of the industry fixed effects in the regression equation suggesting that the between industry variation is more important than the within industry component for their positive effect.

Of the firm level variables in the second step regression all have the expected effects. Export intensity is rising in the R&D intensity, size of the firm and its relative productivity. All effects are strongly significant. The results emphasizes that both the decision to start exporting and the export share is more natural for large and high performing firms. The export intensity of the industry is now also significant suggesting that comparative advantage impacts more strongly on the intensive margin of exporting.

The presence of foreign multinationals within the Swedish economy has an interesting impact on the export decision of domestic firms. Firstly, it has no statistically significant effect on the export intensity of established export firms. It does not affect the export intensity of the firm. It is however, associated with the extensive margin of exporting. Of the foreign presence variables only those on the degree of intra and inter firm exports by foreign multinationals are statistically significant however. [16] Moreover these effects are negative suggesting congestion rather than demonstration effects. Therefore, as expected, the results display greater similarity with those for Ireland in Ruane and Sutherland (2005) compared to other European countries such as the UK (Greenaway et al., 2004; and Kneller and Pisu, 2005) and Spain (Barrios et al. 2003), where the co-presence of foreign multinationals was found to increase both the extensive and intensive margins of exporting at the firm level.

As argued above a combination of insignificant effects on intra and inter firm sales to the domestic market and significance of the export sales of foreign multinationals is consistent

with an interpretation of congestion effects of the resources necessary for exporting rather than the type of congestion of product markets identified by Aitken and Harrison (1999), where we would expect no difference because of the destination of sales. The insignificance of the same variables in the export intensity regressions would also suggest that these congestion effects are specific only to the sunk-costs of export market entry, rather than the usual congestion of infrastructure necessary for exporting, such as road or rail networks or sea ports, which would affect the variable costs of exporting lowering the export intensity of the firm. Competition from foreign owned firms forces domestic firms up their average cost curve as foreign firms crowd access to the transport infrastructure necessary for exports, such as distribution networks, or access to skilled services, such as legal, informational or marketing. In a heterogeneous firm framework (Melitz, 2003) this would make it less likely a firm will start to exporting for a given level of sunk-costs. Presumably however, these access constraints are likely to affect export market entry in the short-run rather than the longer run, following necessary changes to supply.[17]

That there is no difference in whether the foreign firms' exports are for other consumers or producers or back to subsidiaries within the same organisation is interesting and one that we attempt to consider more deeply below when looking at geographic differences in spillovers.[18]

In Table 9 we estimate the marginal effect of a change in each of the right hand side variables of the regression, where the marginal effect is calculated at the mean of each of the variables. Concentrating on the intra and inter export sales of foreign owned firms in the table shows that the effect of a 1 per cent increase in the foreign export presence will decrease the probability of exporting by 0.09 and 0.06 percentage points respectively. To put this in perspective the marginal effect of a change in TFP or size on the probability of

[16] A concern might be that the results are being driven by the acquisition of Swedish MNEs by foreign MNEs over the sample period. However when we drop Swedish MNEs from the sample the results for domestic firms remains. These results are available from the authors on request.
[17] As a check of robustness, we examined whether the estimates were robust to the use of alternative control variables capturing Sweden's comparative advantage. Hansson & Lundberg (1987) have previously found that Swedish firms have a comparative advantage in skill and capital intensive industries, but not R&D intensive industries. We computed three new industry level variables, capital-, skill- and energy intensity and replaced the "Domestic industry export share" by these indices. The estimates using these control variables are very close to those reported above and are available from the authors on request.
[18] We also test whether the coefficient on these two variables is equal and cannot reject the hypothesis.

entry is similar at 0.035 and 0.05, while the effect of R&D is significantly higher at 0.214. That said, as if with previous studies for other countries these firm specific effects are dominated by the lagged export status of the firm. Export market participation in the previous period raises the probability of exporting by 0.52.

Homogeneity

The above regressions find no evidence of demonstration effects. One possible explanation is that we have assumed that export spillovers are the result of the interaction between two homogenous groups of firms, foreign owned and domestically owned. In this section we explore heterogeneity on both sides (domestic and foreign) in order to search deeper for demonstration effects we might have missed thus far and for further detail on the nature of any congestion effects. That is we explore for differences in the informational capacity of both senders and receivers of export knowledge.

The first extension we make to the above analysis is to allow for differences in the ability of domestic firms to absorb the knowledge contained within the foreign firm. To test this we use a measure of the level of R&D expenditure of the receiver (domestic) firm interacted with the foreign presence variables, as described in expression 3 above.[19] These results are presented in Table 4.[20]

The results in Table 4 support the hypothesis that the absorptive capacity of the domestic firms is important for the demonstration effects, where the effect comes from both domestic (intra) and export (inter) sales by foreign firms on the export intensity of domestic firms.[21] In contrast none of the interaction terms in the first step probit regression are significant. It would therefore appear that the congestion effects identified in Table 3 do not discriminate between domestic firms in which the level of R&D is high, low or zero.

[19] As an alternative measure of absorptive capacity we used the skill intensity. The interaction of skill intensity, measured by the proportion of the labour force with post secondary education, gives similar results.
[20] Table A2 in Appendix reveals that the correlation between the interaction terms is very high, although when we include them separately (see Table A5 in the Appendix) none of the results change.
[21] A test of the joint hypothesis that net effect of the foreign presence are zero is rejected

To the extent that we can identify demonstration effects for Swedish firms they are confined to exporters (it affects the export intensity equation only) in which the R&D of the domestic firm is high (the direct effects are insignificant, but the absorptive capacity interaction terms are significant). However these demonstration effects would appear to come from a somewhat unusual combination results, from increased within conglomerate domestic sales and from between firms (inter) export sales. It is difficult to satisfactorily conclude that the positive correlation between the export intensity of high R&D domestic firms and sales by foreign firms producing in Sweden is due to demonstration effects and not to the endogeneity bias discussed above. While it might plausibly be the case that domestic firms are imitating product features following their direct observance of foreign products on sale in Swedish markets, presumably they will already have observed the same products in other foreign markets (given that these firms already export) and if so why the effect is confined to domestic sales within the same group of firms. Similarly, a second plausible interpretation might be that domestic firms are diversifying their sales across markets as a result of direction competition, and potential loss of market share, following increased entry by foreign firms. Again however, it is not clear why this effect would come from intra-firm domestic sales or inter-firm exports sales.

Our second study of heterogeneity allows for differences amongst sender (foreign) firms. In Table 5 we consider whether information from high productivity foreign firms is of greater value. To generate such a measure we weight the presence of foreign firms by its relative productivity performance in the industry. The indexes are computed as described in expression 4 above, i.e. the ratio between the productivity in foreign firm *i* in industry *j* and the max productivity among all firms in the same industry.

It would appear from Table 5 that sender capacity is not important for the results. The results alter little compared to those in Table 3, indicating that the negative export spillovers identified previously are not an increasing function of the productivity of foreign firms.

Geographic dimension of MNE presence

To the extent that the presence of foreign owned firms affects the export decision of Swedish firms it would appear to be confined to congestion of resources necessary for export market entry, rather than the congestion of product markets (the raising of real wages of Aitken and Harrison, 1999) or the transport infrastructure necessary for exports (such as roads and sea ports). In this section of the paper we investigate further the evidence of competition and congestion effects in Table 3 by considering a geographic dimension to the spillovers observed thus far.

Firstly, if we are truly observing congestion effects we would expect that they should depreciate relatively quickly across space, say compared to that of competition effects. Therefore if the results are robust to the use of geographic boundaries we might be confident we are truly observing congestion. Secondly, we follow up the result in Table 3 that the effect of foreign firm exports matters little whether it is sold to firms within the same group (intra firm) or outside the group (inter firm). Again if we are observing congestion effects we might reasonably expect that these are more likely to be greatest impact when exports are of an inter-firm kind. In Table 6 we explore this by considering not only the effects of foreign presence that occur in the same industry but also the same region. So for example, the export behaviour of a domestic firm *i* in the *j*th industry in the *r*th region may be affected by the foreign owned firms share of total sales in that region and industry.

Comparing between Tables 6 and 3 for the probit regression we find that one noticeable change is the loss of significance of the first of two foreign presence export variables, that of intra firm exports from Sweden. The coefficient on inter-firm exports by foreign owned firms in contrast remains significant and the magnitude of the effect changes relatively little. The other noticeable change for the probit regression is the positive effects from domestic sales by foreign firms, which is significant at the 10 and 5 per cent level respectively. One explanation could be that domestic firms are more likely to begin exporting if their domestic market shares are decreasing due to the increased competition when foreign multinationals increase their host-market sales. The probability that a domestic firm is exporting is thus decreasing in the inter firm export by foreign

multinationals, but increasing in the host-market oriented sales by foreign multinationals. Even though a chi test cannot reject that the joint significance of the export and domestic sales is zero, this result is nevertheless very important. It suggests that it is meaningful to consider both the spatial dimension of foreign presence as well as the orientation of the foreign firm's sales. The results are still consistent with our expectations; on the one hand the foreign inter-firm exports variable captures the effect of congestion of the goods and services necessary for distribution and sale of Swedish manufactured goods abroad. On the other hand, when adding the spatial dimension (the geographical boundaries) to the foreign presence indicator, positive competition or demonstration effects are observed as well. While distribution factors are likely to be the same for intra firm exports the necessary legal, marketing and informational aspects are likely to differ. It is the congestion of these service sunk-costs that would appear to help explain why some Swedish firms do not export in Table 3.

The role of Swedish MNEs

It is of course the case that nothing in the above argument about demonstration or congestion is specific to the presence of foreign multinational firms, larger number of domestic or foreign owned firms that export will likely crowd scarce resources in a similar manner. That said if prices reflect increased demand in the market it might still be the case that larger firms through their ability to pay these higher prices still dominate these resources. In such a case we might then expect no difference in the effect of foreign compared to domestic multinational firms i.e. from large firms.

We explore this below by the addition of two sets of regressions. Firstly, we add to the regression used to generate Table 3 a count of the number of firms that export in the industry (along with the export intensity of the industry already included). These results are reported in Table 7. Second, we replace foreign with domestic (Swedish) multinational firms in the regression, albeit where we simplify proceedings by aggregating together the intra and inter components of sales.[22] These are reported as Table 8.

To some extent these results lead us no further on, outside of being able to say that the effects we have observed in Table 3 are specific to foreign multinational firms. Foreign ownership matters for the congestion effects we observe in Table 3 and it is not simply a size effect. In Table 7 the number of other exporters (domestic and foreign) would appear to raise the variable costs of exporting, through the congestion of distribution networks perhaps, but not the sunk-costs of exporting. The foreign presence export measures remain significant in these regressions. While in Table 8 we find that the effects of Swedish MNEs on the export decisions of non-MNE domestic firms is very different from that of foreign MNEs.[23] For these firms both demonstration and congestion effects would appear to be present.

Section 6: Conclusion

In the last few decades Sweden has been successful in increasing the extent of its international exposure, both in terms of increased inward (and outward) FDI flows and export sales. In this paper we consider the extent to which these increased inward FDI flows caused the increased export flows through export spillovers. We allowed these effects to be positive, which we called demonstration effects, and negative, which we called congestion effects. We also allowed for differential impacts on the intensive and extensive margins of exporting and for the effects to differ according to the destination of sales (domestic and foreign) and whether they were intra or inter firm. This rich disaggregation of the measures of foreign presence generated results that allow us to point at the specific nature of export spillovers in the Swedish context.

It would appear from our results that to the extent that foreign MNEs had an effect on Swedish firms it was negative, significantly reducing the probability of export market participation. To the extent that that positive demonstration effects are present they are confined to specific firms (high R&D and geographically concentrated). The results also indicated that the effects of congestion were confined to the export participation decision and did not affect the export intensity of the firm. This combination of results allowed us to

[22] Additional regressions show that this has no bearing on matters.
[23] This conclusion is unchanged if we add the foreign MNE indicators back into the regression. It is also not due to the removal from the sample Swedish MNEs more generally. When foreign MNE domestic and export

conclude that foreign firms raised the sunk-costs of export market entry rather than the variable costs of exporting.

Of the effect of foreign presence on the export participation equation we found a difference according to the direction of sales by foreign MNEs. There was no effect on the export participation decision of domestic firms from sales by foreign firms within Sweden, but there was from their sales abroad. This allowed us to conclude against the congestion of product markets, such as labour, in favour of an argument that the effect was specific to the sunk costs associated with export market entry. By considering the geographic boundary to such effects we found that this congestion was both of sunk costs associated with factors such as distribution, such as access to transport networks, and those associated with specialist services, such as legal and marketing.

Overall, given the general similarity of the results with those of Ireland in Ruane and Sutherland (2005), this allows us to generalise that in small developed economies that have a high degree of exposure to international markets the effect of the entry of foreign MNEs on the exports of domestic firms is likely to be negative. Congestion effects dominate. Sweden has a history of high levels of exposure to international markets, particularly through trade, which might mean that the possibilities for demonstration effects have been exhausted in a way that they have not for other developed economies such as the UK.

That said the overall policy conclusion must be that the negative effect of increased presence of foreign MNEs within the Swedish economy on total exports are negligible. Two points can be made in support of such a conclusion. Firstly, it would appear that to the extent that foreign MNEs cause congestion it is of privately produced goods and services. If this increase in market demand leads to a corresponding change in supply the congestion effects are likely to be greater in the short compared to the long run. Secondly, while increased foreign presence led to a reduction in export entry in Sweden at the margin, given the skewed nature of the distribution of exports, the contribution to total exports from these firms is likely to have been much smaller than their number might suggest. For example,

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sales are added to the regression the negative effect of foreign MNE exports on the export participation decision returns.

even if we sum together all of the exports from domestic firms (with at least 50 employees) that were still able to enter export markets for the first time in Sweden over the sample period (some 511 firms) their exports accounted for just 0.3 per cent of total exports from Sweden over the period. Or, comparing them to total exports from new foreign MNEs they account for 1.2 percent.

TABLE 1. DESCRIPTION OF VARIABLES

Variable name	Description
R&D intensity	Ratio between firm level deflated R&D expenditure and firm level deflated total sales. Source: Financial Statistics.
abs	Hyperbolic transformation: R&D intensity /(1+ R&D intensity). Defined for every domestic firm i and year t.
Log of employment	Number of employees in firm i, year t. Source: Financial Statistics.
Relative TFP	The log of TFP in firm i industry j year t relative the max log of TFP in industry j (4-digit), year t
Producer price index	The disaggregated producer price index j (4-digit), in year t
Domestic industry export share	Total domestic firms exports in industry j (4-digit), year t, / total domestic firms sales, year t
Export intra	The sum of the ratio between FOFs intra firm export and total sales in industry j, year t
Export inter	The sum of the ratio between FOFs inter firm export and total sales in industry j, year t
Domestic intra	The sum of the ratio between FOFs intra firm domestic sales and total sales in industry j, year t
Domestic inter	The sum of the ratio between FOFs inter firm domestic sales and total sales in industry j, year t[1]
Weights	The ratio between productivity in a foreign firm and the max productivity in industry j, year t: weight=TFPijt / max of TFPjt[2]

Dummies	We use the 21 regions regions (län); 200 j (4-digit), industry codes and yearly time dummies in all specifications.

Notes:

1. Note that these indices do not sum up to 1 because the denominator "sales in industry j", includes both domestic and foreign firm sales and export.

2. The productivity weight (sender capacity) is used in the computation of foreign presence in Table 5. When a foreign firms move up the percentiles it will gain greater weight due to increases in productivity.

Table 2a Summary statistics for firms 1990 and 2002

Variables	All firms		Domestic MNEs		Domestic non MNEs		Foreign MNEs	
	1990	2002	1990	2002	1990	2002	1990	2002
Employment	607,329	508,620	303,484	169,027	180,479	110,511	115,332	229,081
Number of firms	2014	1877	574	390	1077	863	363	624
Employment per firm	301.55	270.97	528.72	433.40	167.58	128.05	317.72	367.12
Number of exporting firms	1501	1338	574	390	603	454	324	494
Export (milliards)	277.484	645.770	190.134	285.496	28.892	41.304	58.459	318.969
Number of exporting firms	1501	1338	574	390	603	454	324	494
Average labour productivity	302.109	420.482	311.017	465.533	292.670	359.556	316.027	476.587
Average R&D intensity	1.31	4.45	1.99	11.7	0.59	1.23	2.20	2.56

Source: Statistics Sweden. Note that the sample is truncated at 50 employees. Average R&D intensity is expressed as the percentage share of R&D relative output.

Table 2b Percentage share of total sales in foreign MNEs by industry & year 1990 and 2002

		1990				2002			
Industry	sni92 Codes	Intra export	Inter export	Intra domestic	Inter domestic	Intra export	Inter export	Intra domestic	Inter domestic
Food & beverages	15	0.47	1.40	0.35	12.22	4.20	3.10	0.55	41.19
Tobacco products	16	0	0	0	0	0	0	0	0
Textiles	17	4.8	14.5	2.20	9.14	8.56	27.40	0.25	10.82
Apparel	18	0	0	0.40	0.59	17.54	2.68	1.65	40.04
Leather, footwear	19	0	0	0	0	0	0	0	0
Wood	20	0.11	1.59	0.02	1.81	8.24	10.20	2.44	12.09
Paper & pulp	21	0.33	8.16	0.06	4.78	5.37	28.01	2.07	7.66
Publishing, printing	22	0.30	0.16	1.24	4.41	0.56	0.88	1.00	16.8
Coke & petroleum	23	19.12	5.44	17.42	48.64	9.30	23.87	34.04	32.77
Chemicals	24	4.80	15.25	0.52	21.46	47.88	21.49	1.79	19.43
Rubber & plastic	25	2.96	5.17	1.85	19.60	9.74	13.53	2.05	17.87
Non-metallic mineral	26	1.89	4.78	1.80	30.55	9.03	11.44	2.01	37.35
Basic metals	27	2.70	5.01	6.74	4.53	17.71	11.91	3.00	5.50
Fabricated metal	28	0.82	4.77	0.99	10.38	3.83	7.22	4.77	14.83
Machinery, equipm.	29	8.67	9.64	3.22	8.27	14.35	23.29	1.65	10.83
Electrical & optical	30	31.77	0.04	0.99	37.5	6.50	14.99	0	0.67
Electrical machinery	31	10.91	9.55	10.84	27.42	22.87	21.31	13.03	22.83
Radio TV	32	4.08	3.84	3.61	3.57	0.76	3.73	0.06	5.47

Medical instruments	33	28.61	6.57	4.27	8.67	14.64	21.85	7.12	14.57
Motor vehicles	34	0.32	0.79	0	2.81	30.81	7.40	8.82	6.90
Other transport eq.	35	4.37	0.02	0.12	9.87	4.16	7.70	7.19	18.55
Other manufacturing	36	1.56	2.56	0.50	0.12	2.97	2.72	1.88	31.80

Notes: The sample is truncated at 50 employees. The foreign presence indices have been recalculated at the two digit level and are expressed as percentage share of export and domestic sales to total domestic sales. Source: Statistics Sweden.

Table 3: Heckman selection model of export spillovers on Swedish manufacturing firms, 1990-2002.

	Export Dummy	Export share
	(1)	(2)
Lag export dummy	2.124	
	(0.048) ***	
Lag log of employment	0.345	0.029
	(0.044) ***	(0.010) ***
Lag relative TFP	0.506	0.115
	(0.259) *	(0.040) ***
Lag abs	2.102	1.239
	(1.177) *	(0.356) ***
Producer price index	-0.004	-0.000
	(0.002) *	(0.000)
Lag domestic industry export share	-0.210	0.365
	(0.235)	(0.033) ***
Lag export intra	-0.913	0.069
	(0.457) **	(0.065)
Lag export inter	-0.598	0.008
	(0.295) **	(0.037)
Lag domestic intra	0.122	0.047
	(0.805)	(0.064)
Lag domestic inter	0.024	0.025
	(0.300)	(0.030)
Constant	-1.456	-0.189
	(0.360) ***	(0.072) ***
ρ	-0.275	
	(0.057) ***	
λ	-0.061	
	(0.014) ***	
Log pseudo likelihood	-1873	
No. of obs	13129	

Censored obs	
Uncensored obs	

Notes: (i) MLE estimates. (ii) Cluster (industry) adjusted std errors standard errors in parentheses. (iii) *** significant at the one percent level, ** significant at the five percent level, * significant at the ten percent level. Year-, regional- and 4-digit industry dummies are included.

Table 4: Heckman selection model of export spillovers on Swedish manufacturing firms controlling for receiver capacity.

Variables	Export Dummy	Export share
	(1)	(2)
Lag export dummy)$_{t-1}$	2.127	
	(0.048) ***	
Lag log of employment	0.344	0.031
	(0.044) **	(0.010) ***
Lag relative TFP	0.537	0.115
	(0.259) **	(0.040) ***
Lag abs	0.646	0.576
	(2.133)	(0.511)
Producer price index	-0.004	-0.000
	(0.002) *	(0.000)
Lag industry export share	-0.213	0.366
	(0.234)	(0.033) ***
Lag export intra	-0.827	0.044
	(0.467) *	(0.073)
Lag export inter	-0.649	-0.044
	(0.309) **	(0.043)
Lag domestic intra	-0.050	-0.042
	(0.820)	(0.069)
Lag domestic inter	-0.006	0.003
	(0.309)	(0.038)
Lag export intra*abs	-4.551	0.293
	(7.044)	(1.753)
Lag export inter*abs	6.777	3.877
	(11.264)	(1.384) ***
Lag domestic intra*abs	16.648	6.055
	(28.177)	(2.319) ***
Lag domestic inter*abs	5.723	2.031
	(7.961)	(1.883)
Constant	-3.060	-0.199

	(0.375) ***	(0.072) ***
ρ	-0.263	
	(0.057) ***	
λ	-0.058	
	(0.013) ***	
Log pseudo likelihood	-1835	
No. of obs	13129	
Censored obs	2454	
Uncensored obs	10675	

Notes: (i) MLE estimates. (ii) Cluster (industry) adjusted std errors standard errors in parentheses. (iii) *** significant at the one percent level, ** significant at the five percent level, * significant at the ten percent level. Year-, regional- and 4-digit industry dummies are included.

Table 5: Heckman selection model of export spillovers on Swedish manufacturing firms controlling for sender capacity .

	Export Dummy	Export share
	(1)	(2)
Lag export dummy	2.123	
	(0.048) ***	
Lag log of employment	0.345	0.029
	(0.044) ***	(0.010) ***
Lag relative TFP	0.574	0.112
	(0.259) **	(0.041) ***
Lag abs	2.129	1.239
	(1.178) *	(0.357) ***
Producer price index	-0.004	-0.000
	(0.002) *	(0.000)
Lag domestic industry export share	-0.215	0.364
	(0.234)	(0.033) ***
Lag weight export intra	-0.972	0.048
	(0.461) **	(0.075)
Lag weight export inter	-0.643	-0.001
	(0.329) **	(0.043)
Lag weight domestic intra	-0.056	0.048
	(0.838)	(0.074)
Lag weight domestic inter	-0.032	0.020
	(0.345)	(0.034)
Constant	-3.112	-0.185
	(0.375) ***	(0.071) ***
ρ	-0.275	
	(0.057) ***	
λ	-0.061	
	(0.014) ***	
Log pseudo likelihood	-1875	
No. of obs	13129	

Censored obs	
Uncensored obs	

Notes: (i) MLE estimates. (ii) Cluster (industry) adjusted std errors standard errors in parentheses. (iii) *** significant at the one percent level, ** significant at the five percent level, * significant at the ten percent level. Year-, regional- and 4-digit industry dummies are included.

Table 6: Heckman selection model of regionally constrained export spillovers on Swedish manufacturing firms.

	Export Dummy	Export share
	(1)	(2)
Lag export dummy	2.119	
	(0.048) ***	
Lag log of employment	0.349	0.029
	(0.044) ***	(0.010) ***
Lag relative TFP	0.497	0.116
	(0.256) *	(0.040) ***
Lag abs	2.157	1.242
	(1.167) *	(0.357) ***
Producer price index	-0.003	-0.000
	(0.002)	(0.000)
Lag domestic industry export share	-0.202	0.361
	(0.237)	(0.033) ***
Lag export intra region	-0.248	0.018
	(0.234)	(0.067)
Lag export inter region	-0.500	0.091
	(0.215) **	(0.064)
Lag domestic intra region	0.664	0.108
	(0.339) *	(0.068)
Lag domestic inter region	0.386	-0.055
	(0.158) **	(0.035)
Constant	-3.096	-0.187
	(0.375) ***	(0.072) ***
ρ	-0.278	
	(0.058) ***	
λ	-0.062	
	(0.014) ***	
Log pseudo likelihood	-1867	
No. of obs	13129	

Censored obs	
Uncensored obs	

Notes: (i) MLE estimates. (ii) Cluster (industry) adjusted std errors standard errors in parentheses. (iii) *** significant at the one percent level, ** significant at the five percent level, * significant at the ten percent level. Year-, regional- and 4-digit industry dummies are included.

Table 7: Heckman selection model of export spillovers on Swedish manufacturing firms, controlling for the number of exporters

	Export Dummy	Export share
	(1)	(2)
Lag export dummy	2.124	
	(0.048) ***	
Lag log of employment	0.345	0.030
	(0.044) ***	(0.010) ***
Lag relative TFP	0.499	0.111
	(0.257) *	(0.039) ***
Lag abs	2.098	1.237
	(1.177) *	(0.356) ***
Producer price index	-0.004	-0.000
	(0.002) *	(0.000)
Lag domestic industry export share	-0.219	0.362
	(0.233)	(0.033) ***
No. of exporters in industry	-0.002	-0.001
	(0.004)	(0.000) ***
Lag export intra	-0.916	0.068
	(0.457) **	(0.064)
Lag export inter	-0.608	0.004
	(0.295) **	(0.036)
Lag domestic intra	0.111	0.039
	(0.793)	(0.065)
Lag domestic inter	0.027	0.026
	(0.299)	(0.031)
Constant	-3.025	-0.149
	(0.382) ***	(0.073) ***
ρ	-0.274	
	(0.057) ***	
λ	-0.061	
	(0.014) ***	

Log pseudo likelihood	
No. of obs	
Censored obs	
Uncensored obs	

Notes: (i) MLE estimates. (ii) Cluster (industry) adjusted std errors standard errors in parentheses. (iii) *** significant at the one percent level, ** significant at the five percent level, * significant at the ten percent level. Year-, regional- and 4-digit industry dummies are included.

Table 8: Heckman selection model of export spillovers by Swedish MNEs.

	Export Dummy (1)	Export share (2)
Lag export dummy	2.242	
	(0.065) ***	
Lag log of employment	0.224	-0.006
	(0.043) ***	(0.010)
Lag relative TFP	0.316	0.025
	(0.360)	(0.048)
Lag abs	1.804	0.851
	(1.057) *	(0.319) ***
Producer price index	-0.003	-0.000
	(0.002)	(0.000)
Lag domestic industry export share	-0.258	0.444
	(0.349)	(0.052) ***
Lag export SW MNEs	0.144	-0.351
	(0.365)	(0.062)
Lag domestic SW MNEs	0.898	0.053
	(0.261) ***	(0.027) **
Constant	-2.424	0.062
	(0.427) ***	(0.074)
ρ	-0.237	
	(0.043) ***	
λ	-0.045	
	(0.014) ***	
Log pseudo likelihood	-663	
No. of obs	7397	
Censored obs	2273	
Uncensored obs	5124	

Notes: (i) MLE estimates. (ii) Cluster (industry) adjusted std errors standard errors in parentheses. (iii) *** significant at the one percent level, ** significant at the five percent level, * significant at the ten percent level. Year-, regional- and 4-digit industry dummies are included.

Table 9: Marginal effects of the Heckman MLE selection model from Table 3

	Export Dummy	Export share
	(1)	(2)
Lag export dummy	0.515	
	(0.048) ***	
Lag log of employment	0.035	0.034
	(0.044) ***	(0.010) ***
Lag relative TFP	0.051	0.121
	(0.259) *	(0.040) ***
Lag abs	0.214	1.264
	(1.177) *	(0.356) ***
Producer price index	-0.000	-0.000
	(0.002) *	(0.000)
Lag domestic industry export share	-0.021	0.363
	(0.235)	(0.033) ***
Lag export intra	-0.093	0.059
	(0.457) **	(0.065)
Lag export inter	-0.061	0.001
	(0.295) **	(0.037)
Lag domestic intra	0.012	0.048
	(0.805)	(0.064)
Lag domestic inter	0.002	0.025
	(0.300)	(0.030)
Constant	-1.456	-0.189
	(0.360) ***	(0.072) ***
ρ	-0.275	
	(0.057) ***	
λ	-0.061	
	(0.014) ***	
Log pseudo likelihood	-1873	
No. of obs	13129	
Censored obs	2454	

Uncensored obs

Notes: (i) MLE estimates. (ii) Cluster (industry) adjusted std errors standard errors in parentheses. (iii) *** significant at the one percent level, ** significant at the five percent level, * significant at the ten percent level. Year-, regional- and 4-digit industry dummies are included.

Appendix Descriptive statistics

Table A1: Correlation matrix

	ln employ-ment	**relative TFP**	**abs**	**industry export share**	**Export intra**	**Export inter**	**Domestic intra**	**Domestic inter**
lnemployment	1.00							
relative TFP	-0.03	1.00						
abs	0.20	-0.02	1.00					
Ind. export share	0.16	-0.03	0.24	1.00				
Export intra	-0.02	-0.07	0.16	0.35	1.00			
Export inter	-0.06	-0.06	0.05	0.26	0.35	1.00		
Domestic intra	-0.04	-0.03	0.05	0.12	0.34	0.21	1.00	
Domestic inter	-0.11	0.01	0.00	-0.12	0.15	0.27	0.08	1.00

Table A2: Correlation matrix

	Export Intra	**Export Intra**	**Export Intra*abs**	**Export Inter*abs**	**Domestic Intra**	**Domestic Inter**	**Domestic Intra*abs**	**Domestic Inter*abs**
Export intra	1.00							

Export inter	0.35	1.00						
Export intra*abs	0.38	0.09	1.00					
Export inter*abs	0.21	0.29	0.58	1.00				
Domestic intra	0.34	0.21	0.11	0.08	1.00			
Domestic inter	0.15	0.27	0.02	0.08	0.08	1.00		
Domestic intra*abs	0.20	0.07	0.52	0.46	0.35	0.01	1.00	
Domestic inter*abs	0.14	0.11	0.46	0.71	0.03	0.20	0.31	1.00

Note! The correlation matrix illustrates the correlation between the foreign presence variables in Table 4. The Table reveals
some correlation between the different foreign presence variables. In Table A5 these presence variables have been separated.

Table A3: Correlation matrix

	Weighted Export intra	**Weighted Export inter**	**Weighted Domestic inter**	**Weighted Domestic intra**
Weighted Export intra	1.00			
Weighted Export inter	0.31	1.00		
Weighted Domestic inter	0.29	0.19	1.00	
Weighted	0.15	0.24	0.08	1.00

Domestic intra	

Note! The correlation matrix illustrates the correlation between the foreign presence
variables in Table 5.

Table A4: Correlation matrix

	Region Export Intra	**Region Export Inter**	**Region Domestic Intra**	**Region Domestic Inter**
Region Export Intra	1.00			
Region Export Inter	0.27	1.00		
Region Domestic Intra	0.15	0.06	1.00	
Region Domestic Inter	0.15	0.29	0.04	1.00

Note! The correlation matrix illustrates the correlation between foreign presence
variables where the regional dimension have been added in Table 6. The variables are computed according to Table 1

Table A5: Heckman MLE selection model (R&D interaction, receiver capacity)

Variables	Specification (i)		Specification (ii)		Specification (iii)		Specification (iv)	
	Export Dummy	Export share	Export Dummy	Export share	Export Dummy	Export share	Export Dummy	Export share
$(\text{export dummy})_{t-1}$	2.123		2.123		2.120		2.123	
	(0.048)		(0.048)		(0.048)		(0.048)	
	***		***		***		***	
$(\text{log of employment})_{t-1}$	0.345	0.030	0.345	0.030	0.346	0.030	0.346	0.030
	(0.044)	(0.010)	(0.044)	(0.010)	(0.044)	(0.010)	(0.044)	(0.010)
	***	***	***	***	***	***	***	***
$(\text{relative TFP})_{t-1}$	0.500	0.113	0.508	0.114	0.493	0.114	0.517	0.119
	(0.260) *	(0.040)	(0.256)	(0.040)	(0.255)	(0.040)	(0.254)	(0.040)
		***	**	***	*	***	**	***
$(\text{abs})_{t-1}$	2.391	1.023	1.219	0.844	1.791	1.060	1.131	0.912
	(1.806)	(0.482)	(1.637)	(0.410)*	(1.361)	(0.401)	(1.689)	(0.449)
		**		*		***		**
Producer price index	-0.003	-0.000	-0.004	-0.000	-0.003	-0.000	-0.003	-0.000
	(0.002) *	(0.000)	(0.002)	(0.000)	(0.002)	(0.000)	(0.002)	(0.000)
			*				*	
$(\text{industry export share})_{t-1}$	-0.189	0.366	-0.230	0.367	-0.210	0.360	-0.211	0.365
	(0.238)	(0.036)	(0.237)	(0.033)	(0.229)	(0.033)	(0.231)	(0.033)
		***		***		***		***
$(\text{export intra})_{t-1}$	-0.886	0.019						
	(0.438)	(0.074)						
	**							
$(\text{export inter})_{t-1}$			-0.707	-0.056				
			(0.295)	(0.047)				
			**					
$(\text{domestic intra})_{t-1}$					-0.228	-0.053		
					(0.821)	(0.079)		

$(\text{domestic inter})_{t-1}$							-0.144	-0.007
							(0.299)	(0.040)
$(\text{export intra*abs})_{t-1}$	-2.803	2.353						
	(8.063)	(2.096)						
$(\text{export inter*abs})_{t-1}$			9.101	5.696				
			(10.701)	(1.885) ***				
$(\text{domestic intra*abs})_{t-1}$					14.174	6.737		
					(29.347)	(3.362) **		
$(\text{domestic inter*abs})_{t-1}$							6.070	3.235
							(7.00)	(2.024)
Constant	-3.062	-0.191	-3.757	-0.190	-3.065	-0.189	-3.076	-0.196
	(0.376) ***	(0.071) ***	(0.437) ***	(0.071) ***	(0.297) ***	(0.071) ***	(0.378) ***	(0.071) ***
ρ	-0.271		-0.271		-0.274		-0.271	
	(0.057) ***		(0.056) ***		(0.056) ***		(0.057) ***	
λ	-0.060		-0.060		-0.061		-0.060	
	(0.013) ***		(0.013) ***		(0.013) ***		(0.013) ***	
Log pseudo likelihood	-1867		-1856		-1869		-1864	
No. of obs	13129		13129		13129		13129	
Censored obs	2454		2454		2454		2454	
Uncensored obs	10675		10675		10675		10675	

Notes: (i) MLE estimates. The dependent variables are export dummy and export share (ii) Cluster (industry) adjusted std errors standard errors in parentheses. (iii) *** significant at the one percent level, ** significant at the five percent level, * significant at the ten percent level. Year and 4-digit industry are included.

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