The University of Nottingham

research paper series

Globalisation, Productivity and Technology

Research Paper 2004/40

Exports, Restructuring and Industry Productivity Growth

by

Rod Falvey, David Greenaway, Zhihong Yu, JoakimGullstrand

The Centre acknowledges financial support from The Leverhulme Trust under Programme Grant F114/BF

GEP Leverhulme Centre for Research on Globalisation and Economic Policy

The Authors

Rod Falvey is Professor of International Economics and an Internal Fellow of the Leverhulme Centre for Research on Globalisation and Economic Policy (GEP). David Greenaway is Professor of Economics and Director of GEP, University of Nottingham. Zhihong Yu is a Postgraduate Research Student in GEP, University of Nottingham. Joakim Gullstrand is a Lecturer in Economics at Lund University.

Acknowlegements

The authors are grateful to The Leverhulme Trust for financial support under Programme Grant F114/BF.
Corresponding author: david.greenaway@nottingham.ac.uk

Exports, Restructuring and Industry Productivity Growth

by

Rod Falvey, David Greenaway, Zhihong Yu, JoakimGullstrand

Abstract

The impact of firm level productivity heterogeneity on export market entry has been the subject of theoretical innovation and extensive empirical scrutiny in recent years. The latter has focused on falling trade costs and firm level productivity, notwithstanding the fact that theory also points up links between trade and industry level productivity. This paper decomposes productivity growth in Sweden into its various components and links exporting to net entry and reallocation effects. We show that exporting has a sizeable impact on industry productivity growth which is independent of the links between exporting and firm productivity.

JEL classification: F14, D21, L23

Keywords : Productivity growth, Restructuring, Exports

Outline

Non-Technical Summary

In recent years there has been a marked change in the way in which economists think abut international trade, with growing attention being paid to firm and industry level adjustment. One issue has attracted particularly close scrutiny, namely the links between exporting and firm level productivity. This is an issue on which traditional trade theory has nothing to say, but where new trade theory, with its emphasis on productivity heterogeneity across firms, has yielded important new insights. It has for example helped us understand why some firms export and others do not. It also helps us understand links between exporting and productivity growth.

The focus of this paper is the links between exporting and industry productivity growth in Sweden. Using highly disaggregated, firm level, data we decompose productivity growth into its constituent parts and estimate the impact of exporting on them. We find a clear productivity hierarchy. Firms that stay in export market are most productive, followed by new entrants and then firms that exit. We find that inter-firm reallocation of output among stayers accounts for around 15 per cent of total industry productivity growth, with the contribution of entry and exit being twice that, at 30 per cent. We find that exporting activity has a significant impact on these net entry effects, pointing to a clear causal link between exporting and industry productivity, independent of the link between exporting and firm productivity.

The paper contributes to the literature in several ways. First, it is the first study to link sectoral exports growth to firm turnover. Previous research on the role of exports decomposes the productivity growth of continuing firms of the whole of manufacturing into domestic and export shipments. By contrast, our decomposition separates the contributions of entering and exiting firms for each industry, and then investigates whether exports growth has a positive effect by running dynamic panel regressions at the industry level. Second, we decompose productivity growth at a highly disaggregated industry level. This enables us to focus on restructuring *within* a narrowly defined industry, which is closer to the setup of the theory. Third, we extend existing decomposition methods to explicitly consider how cross-industry switchers affect industry productivity growth and examine whether our results are robust to exclude these switchers. Finally, we use firm data from a very open and highly export oriented economy which is an ideal candidate for this research. Because such a large share of Swedish firms are involved in exporting, one would expect the impact of export growth on industry restructuring to be nontrivial.

1 Introduction

Neither traditional trade theory nor new trade theory allow for productivity heterogeneity across firms impacting upon entry to foreign markets. Thus, for example, in Krugman (1979), and others, falling trade costs result in all firms exporting (or exporting more). Yet in reality some firms export and some do not. Incorporating sunk costs associated with exporting provides a simple basis for explaining the latter and for making an explicit link between exporting and productivity. If there are fixed costs, only the most productive firms self-select into export markets and must therefore raise their productivity prior to entry. In explaining this, Clerides, Lach and Tybout (1998) also show that after entry, if firms have a stronger incentive to innovate, or have to reduce x-inefficiency to compete, productivity could increase further.

The literature searching for links between exporting and intra-firm productivity has grown rapidly. But it has also stimulated work on exporting and industry productivity. The seminal paper is Melitz (2003) which demonstrated that through a combination of entry effects and industry rationalisation, exporting opportunities stimulate industry level productivity change. Bernard, Eaton, Jensen and Kortum (2004) reach the same conclusion, but with a different industrial organisation set up and different transmission channel. These models point to a further and potentially very important connection between exporting and productivity and it is that connection we explore in this paper.

Using firm level data over a long period in 4 digit Swedish manufacturing industries, we decompose productivity growth and estimate the impact of exporting on its components. Our analysis uses two different methods and we are able to extract the contributions of inter-firm reallocation, firm entry and exit. We find a clear productivity hierarchy, with stayers being the most productive, followed by entrants and exiters. Our decomposition analysis suggests that inter-firm reallocation among stayers. Only accounts for around 15% of total industry productivity growth and is sensitive to alternative decomposition methods, whilst the contribution of entry and exit is around 30%. Finally we find that exporting has a significant impact on these net entry effects, which points to a clear causal link between exporting and industry productivity, independent of the link between exporting and firm productivity

Our study contributes to the literature in several ways. First, it is the first study to link sectoral exports growth to firm turnover. Previous research on the role of exports decomposes the productivity growth of continuing firms of the whole of manufacturing into domestic and export shipments. By contrast, our decomposition separates the contributions of entering and exiting firms for each industry, and then investigates whether exports growth has a positive effect by running dynamic panel regressions at the industry level. Second, we decompose productivity growth at a highly disaggregated industry level. This enables us to focus on restructuring *within* a narrowly defined industry, which is closer to the setup of the theory. Third, we extend existing decomposition methods to explicitly consider how cross-industry switchers affect industry productivity growth and examine whether our results are robust to excluding these switchers. Finally, we use firm data from a very open and highly export oriented economy which is an ideal candidate for this research. Because such a large share of Swedish firms are involved in exporting, one would expect the impact of export growth on industry restructuring to be nontrivial.

The remainder of the paper is organised as follows. In Section 2 we review theory and evidence on exporting and industry productivity. Section 3 explains our methods for decomposing productivity growth and sets out the hypotheses to be tested. In Section 4 we describe our data set and sample frame and in Section 5 we report on and discuss our results. Section 6 concludes.

2 Exports, restructuring and productivity growth

Theory: Does exposure to international trade raise productivity? In a Ricardian framework with cross-sector productivity differences, trade leads countries to specialize (completely or partially) in their comparative advantage industries. This results in input and output reallocation towards more productive sectors, and raises productivity at the country level.

By contrast, the Heckscher-Ohlin model is silent on this, since technology is assumed to be identical across sectors and countries. Similarly, new trade theory which emphasises the role of intra-industry trade, also assumes identical productivity across firms and countries, and does not allow productivity gains due to reallocation. However, one of the key findings from recent plant-and firm-level studies is the importance of within industry heterogeneity to trade. There is robust evidence that, even within a very narrowly defined industry, firms differ dramatically in their productivity with only the more productive firms surviving and self-selecting into export markets[1]. These findings have stimulated a new wave of heterogeneous trade models which incorporate firm heterogeneity into trade theory. The major point of these models is the identification of a new channel through which intra-industry trade promotes productivity growth, namely within industry reallocation of inputs and outputs towards more productive firms.

In the pioneering heterogeneous firm trade model of Melitz (2003), trade raises industry productivity via within industry restructuring. Under Dixit-Stiglitz monopolistic competition, firms face pre-entry uncertainty in productivity, and randomly draw their productivity levels from an exogenous distribution after entry. With sunk costs associated with entry and exporting, firms with the highest productivity draw export, those with a lower draw remain domestic and those with even lower productivity draws exit. A reduction in trade costs leads to between firm reallocation which raises aggregate productivity. Firstly, the increase in export opportunities attracts new entrants as well as increasing the exports of more productive exporters who can afford the fixed costs. The increased factor demand by new entrants and more productive firms will, however, bid up real factor prices. Melitz shows that this will raise the survival productivity threshold, leading the least productive marginal firms to exit and to contraction of less productive non-exporters. Hence there are two channels through which increased exposure to export markets can promote productivity growth. Firstly, the net entry effect, whereby the least productive exiters are replaced by more productive entrants. Secondly, the reallocation effect whereby the less productive non-exporters lose their market share to the most productive exporters. With CES preferences, no firm's output responds to the number of competing firms and import competition. Therefore it is increased exposure to exporting, rather than import penetration that leads to the net entry and reallocation effects.

[1] Aw and Hwang (1995), Bernard and Jensen (1999), Bernard and Wagner (1997), Clerides, Lach and Tybout (1998), Girma, Greenaway and Kneller (2003), Greenaway and Yu (2004), Delgado, Fariñas and Ruano (2002), Castellani (2002),Wagner (2002) and Hansson and Lundin (2004).

Note that Melitz (2003) restricts his analysis to trade between symmetric countries with identical productivity distributions. Falvey, Greenaway and Yu (2004) extend Melitz to allow cross-country differences in productivity distributions. In their model, the technologically advanced country has a superior firm productivity distribution relative to the less advanced country. Increased exposure to export markets induces more entry as well as more exports in the technologically advanced country. As a consequence, the net entry and reallocation effects will be stronger and aggregate productivity growth higher. One implication of this is that increased exposure to export markets will make a country's comparative advantage industry reap more aggregate productivity gains via within industry restructuring. A similar idea is also found in Bernard, Redding and Schott (2004), which integrates Melitz with a Heckcher-Ohlin framework to incorporate country endowment differences, industry factor intensity differences and firm heterogeneity. Their model predicts that a reduction in trade costs leads to a greater degree of within industry restructuring and aggregate productivity improvement in a country's comparative advantage industries relative to its comparative disadvantage industries.

One limitation of the models building on Melitz is that import competition does not play a. role. In a different setup, Bernard, Eaton Jenson and Kortum (2003) explicitly stress the impact of foreign competition. There many potential firms compete to produce each variety but only the most efficient can become the producer. Countries differ in their distributions from which the most efficient producer for each variety draws their efficiency levels. Among other things, they show that a reduction in trade costs induces some more efficient foreign firms to penetrate the domestic market and displace less efficient domestic firms. Simultaneously this induces the most efficient home producers to expand by breaking into export markets. As a consequence, market share will be shifted away from less efficient exiters towards more efficient exporters, which leads to an improvement in weighted average productivity.

Empirical Analysis: A growing literature uses plant or firm-level data to break down changes in aggregate productivity and quantify the relative importance of *within* and *restructuring* effects. The former accounts for the change in productivity due to improvement *within* individual firms or plants; the latter can be further broken down into: a net entry effect - the simultaneous entry of new firms and exit of incumbents; [2] and a reallocation effect - market share and resource reallocation between continuing producers. One of the key findings is a large and positive contribution of restructuring. Despite differences in decomposition methods and productivity measures, its contribution typically accounts for at least 30%-40% of productivity growth. However, the relative importance of reallocation and net entry varies significantly.

Nonetheless, only a very limited number of studies have investigated the impact of trade on restructuring. Bernard and Jensen (2004) decomposed aggregate productivity growth of continuing plants in the US during 1983-92 and concluded that export growth contributes 8%-60%[3] to overall productivity growth via the reallocation effect. Using a similar approach, Hansson and Lundin (2004) estimate that increased exports contribute 62%[4] of annual aggregate productivity growth via the reallocation effect in Sweden. One important feature of these studies is that decomposition methods are applied to *all* manufacturing. Hence the contribution of exports to productivity growth includes both *cross-industry* and *within* industry reallocation. More importantly, both studies only calculated productivity changes for continuing plants, thereby ignoring changes in industry productivity due to entry and exit in the domestic market. Thus, it is not clear to what extent export growth affects productivity growth via another important channel of restructuring i.e. the net entry effect.

By contrast Criscuolo, Haskel and Martin (2004) focus on the importance of entry and exit for raising within industry labour productivity growth, and link it to increased globalisation. They find that the share of productivity growth of 2 digit industries in the UK due to entry and exit has risen sharply from 25% in the 1980s to about 50% in the 1990s. To explain this, they examine the impact of globalisation, measured by import penetration and ICT (Information Computer Technology) in the form of capital intensity. They report a significant and positive

---

[2] Some literature (Disney eral 2003) also call the “within” effect as ‘internal restructuring’, and uses ‘external restructuring’ to refer to reallocation and churning.

[3] Bernard and Jensen (2004), admit that it is difficult to quantify the importance of exports in aggregate productivity growth by relying only on the decomposition methods which are not unique. However, they took efforts to estimate a “lower” and “upper” bound of the contribution of exports as 8% and 60% by decomposing the aggregate TFP growth, and caution that the 60% could be a large overstatement of the importance of exporting.

[4] Since Hansson and Ludin (2004) follow the decomposition approach by Bernard and Jensen (2004), the 62% is the upper bound of the contribution of exporting to aggregate productivity growth.

coefficient of both import penetration and ICT. This suggests that increased globalisation, measured in this way, is positively correlated with the net entry component of aggregate industry productivity growth.

3 Empirical Methodology

Decomposition of Productivity growth: To examine the impact of exports on restructuring and productivity growth, one first needs to quantify the contribution of the reallocation and net entry effects. We define aggregate industry productivity as the output share weighted sum of firm total factor productivity levels

$$P_{jt} = \sum_i s_{ijt} \, p_{ijt} \qquad [1]$$

where subscripts *i, j, t* denote the firm, industry and time period, respectively and P_{jt} , s_{ijt} and p_{ijt} represent aggregate industry productivity ($lnTFP_{jt}$), and the share of firm sales in total industry sales and firm's productivity level ($lnTFP_{ijt}$). Firm level TFP is generated from the residual of a 3 factor OLS regression (see appendix 1 for details).

A number of studies decompose the cross period change in aggregate industry productivity, (denoted as $\Delta P_{jt} = P_{jt} - P_{jt-\tau}$), into different components that quantify the contribution of the within firm effect, reallocation effect and entry and exit effect, (for example, Bailey, Hulten and Campbel 1992, Griliches and Regev 1995, Foster, Haltiwanger and Krizen 1998 and Baldwin and Gu 2003)[5]. We focus on the decomposition methods proposed in Grilliches and Regev (1995) (GR) and Foster, Haltiwanger and Krizen (1998) (FHK).

The GR method decomposes aggregate productivity growth as:

---

[5] See Foster, Haltiwanger and Krizen 2001 and Baldwin and Gu 2003 for a review.

$$\Delta P_{jt} = \sum_{i\in C} \bar{s}_{ijt} \Delta p_{ij} + \sum_{i\in C} (\bar{p}_{ijt} - \bar{P}_{jt}) \Delta s_{ij} + \sum_{i\in N} s_{ijt} (p_{ijt} - \bar{P}_{jt}) + \sum_{i\in X} s_{ijt-\tau} (\bar{P}_{jt} - p_{ijt-\tau}) \qquad [2]$$

Here C, N and X denote continuing firms, new entrants and exiters respectively. A bar indicates the average of a variable across $t-\tau$ and t, and a delta the change from $t-\tau$ to *t*. GR show that the four terms on the right hand side sum to aggregate productivity growth. The first represents the contribution of the within firm effect, where firm level productivity changes are weighted by their average market share across periods. The second term measures the importance of reallocation, which reflects firm level changes in market shares, weighted by the deviation of productivity from the industry mean. This will be positive if firms with high productivity capture more market share whilst low productivity firms shrink. The sum of the last two terms reflects the contribution of net entry. The third term measures the contribution of entering firms, which is the sum of the deviations of entrant's productivity from the industry mean, weighted by market shares. Analogously, the fourth term measures the contribution of exiting firms.

Foster, Haltiwanger and Krizen (1998) pointed to a problem with GR: it allows the measurement of the within effect to partially reflect reallocation since it incorporates the end period share of each firm, and the reallocation measure partially captures the within effect as it incorporates end period productivity.[6] Thus, FHK decompose aggregate growth into five components as follows:

$$\Delta P_{jt} = \sum_{i\in C} s_{ijt-\tau} \Delta p_{ij} + \sum_{i\in C} (p_{ijt-\tau} - \hat{P}_{jt-\tau}) \Delta s_{ij} + \sum_{i\in C} \Delta p_{ij} \Delta s_{ij} + \sum_{i\in N} s_{ijt} (p_{ijt} - \hat{P}_{jt-\tau}) + \sum_{i\in X} s_{ijt-\tau} (\hat{P}_{jt-\tau} - p_{ijt-\tau}) \qquad [3]$$

[6] See Foster, Haltiwanger and Krizen (1998) for a discussion of the advantages and disadvantages of these two methods.

Note that $\hat{P}_{jt-\tau}$ represents the unweighted average of firm productivity in industry j at the *initial* year. The first two terms represent the within and between firm effects and the last two the entry and exit effects. FHK differs from GR in two ways. First, the between firm and entry and exit terms use average productivity in the *initial* year, rather than the average across initial and end years (as in GR) as the industry mean. Hence an entrant (exiter) contributes positively to productivity growth if, weighted by market share, it is more (less) productive than the *initial* average of the industry. The second interesting feature of FHK is the third term, the covariance effect, which will be positive if firms increasing their productivity also capture more market share over time, irrespective of their productivity *levels.*

Since our focus is within industry restructuring and exporting, we apply both methods to decompose the *annual* change in aggregate productivity by industry. While previous studies worked with long time periods at the level of all manufacturing or 2 digit industries, our decomposition is at the minimum time interval and most disaggregated industry level. This has the merit of focusing sharply on firm level changes. However it also means that we are working at a level where some firms can be seen to switch between industries. Therefore entry and exit may reflect not only firms' entry and exit from our sample, but also some switching into or out of specific industries.[7] Since the heterogeneous firm trade models are silent on the impact of trade on firms' switching behaviour, we extend the GR and FHK methods to break down the entry (exit) components into real entry (exit) and switching in(out) terms:

GR method :

Entry effect

$$= \sum_{i \in N} s_{ijt}(p_{ijt} - \overline{P}_{jt}) = \sum_{i \in NE} s_{ijt}(p_{ijt} - \overline{P}_{jt}) + \sum_{i \in NW} s_{ijt}(p_{ijt} - \overline{P}_{jt}) \quad [4]$$

Exit effect

[7] A firm will be classified as an exiter in industry *j* if it disappeared from our sample or if it remains in our sample but switched to another industry. Reasoning analogously, a firm will be classified as an entrant if it appeared in our sample for the first time or it previously operated in another industry and then switched in.

$$= \sum_{i \in X} s_{ijt-\tau}(\bar{P}_{jt} - p_{ijt-\tau}) = \sum_{i \in XR} s_{ijt-\tau}(\bar{P}_{jt} - p_{ijt-\tau}) + \sum_{i \in XW} s_{ijt-\tau}(\bar{P}_{jt} - p_{ijt-\tau})$$

[5]

FHK method :

Entry effect

$$= \sum_{i \in N} s_{ijt}(p_{ijt} - \hat{P}_{jt}) = \sum_{i \in NR} s_{ijt}(p_{ijt} - \hat{P}_{jt}) + \sum_{i \in NW} s_{ijt}(p_{ijt} - \hat{P}_{jt})$$

[6]

Exit effect

$$= \sum_{i \in X} s_{ijt-\tau}(\hat{P}_{jt_{jt}} - p_{ijt-\tau}) = \sum_{i \in XR} s_{ijt-\tau}(\hat{P}_{jt} - p_{ijt-\tau}) + \sum_{i \in XW} s_{ijt-\tau}(\hat{P}_{jt} - p_{ijt-\tau})$$

[7]

where NR, NW, XR and XW denote real entrants, switching entrants, real exiters and switching exiters, respectively. The advantage of this is that it enables us to differentiate the components of aggregate productivity growth due to within industry entry and exit, as measured by the first terms in [4]-[7], from that due to cross-industry switching, the second terms in [4]-[7].

Exports and restructuring: Applying these methods reveals the contribution of restructuring to overall productivity growth. But the central question is how exports impact on restructuring. Recall that heterogeneous firm trade models predict a positive impact of export growth on the net entry contribution, as well as a positive association between export growth and the reallocation contribution. Hence the propositions we test can be summarized as:

Hypothesis A: An increase in export growth leads to a greater contribution of net entry to aggregate industry productivity growth.

Hypothesis B: An increase in export growth leads to a greater contribution of between firm reallocation effects to aggregate industry productivity growth.

We use the following industry level estimating equations to test these

$$\Delta P_{jt}^{RE} = \alpha + \beta_1 \Delta P^{RE}{}_{jt-1} + \beta_2 \Delta X_{jt} + \beta_3 \Delta X_{jt-1} + \delta_j + \delta_t + \varepsilon_{jt} \quad [8]$$

and

$$\Delta P_{jt}^{EN} = \chi + \theta_1 \Delta P^{EN}{}_{jt-1} + \theta_2 \Delta X_{jt} + \theta_3 \Delta X_{jt-1} + \omega_j + \omega_t + \varepsilon_{jt} \quad [9]$$

where ΔP_{jt}^{EN} and ΔP_{jt}^{RE} represent the net entry contribution as measured by the sum of the last two terms in FHK or GR, and the between firm reallocation contribution as measured by the second term. ΔX_{jt} denotes annual export growth of industry *j* at *t,* and ω_j and ω_t the unobserved time invariant industry specific effect and time dummies, respectively. To allow for potential serial correlation, we include lagged dependent variables.

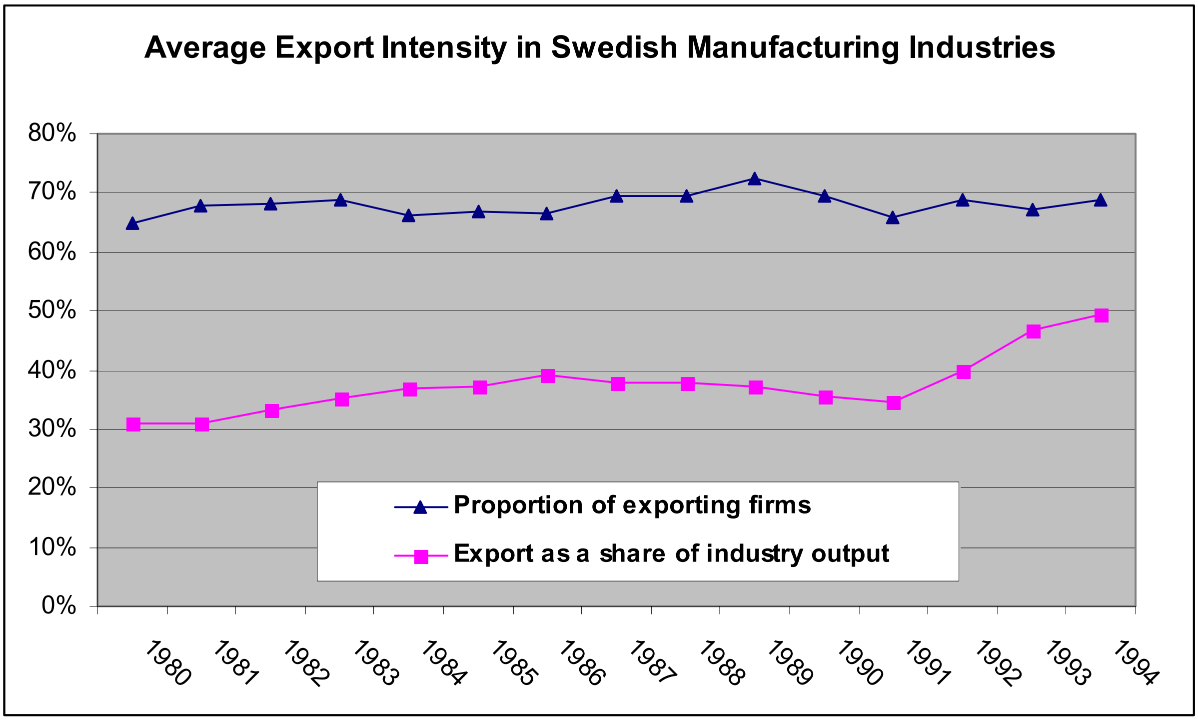
Standard OLS regression with first differences is inappropriate for estimating [8] and [9] for two reasons. First, potential endogeneity. A positive relationship between the net entry contribution and exports growth may just reflect self-selection. Second, due to the presence of a lagged dependent variable, the first differenced OLS will give biased and inconsistent estimates. For these reasons, we apply GMM. Thus the export growth variables are treated as potentially endogenous and appropriate lags of dependent and independent variables are used as instruments for the first differenced versions of [8] and [9].

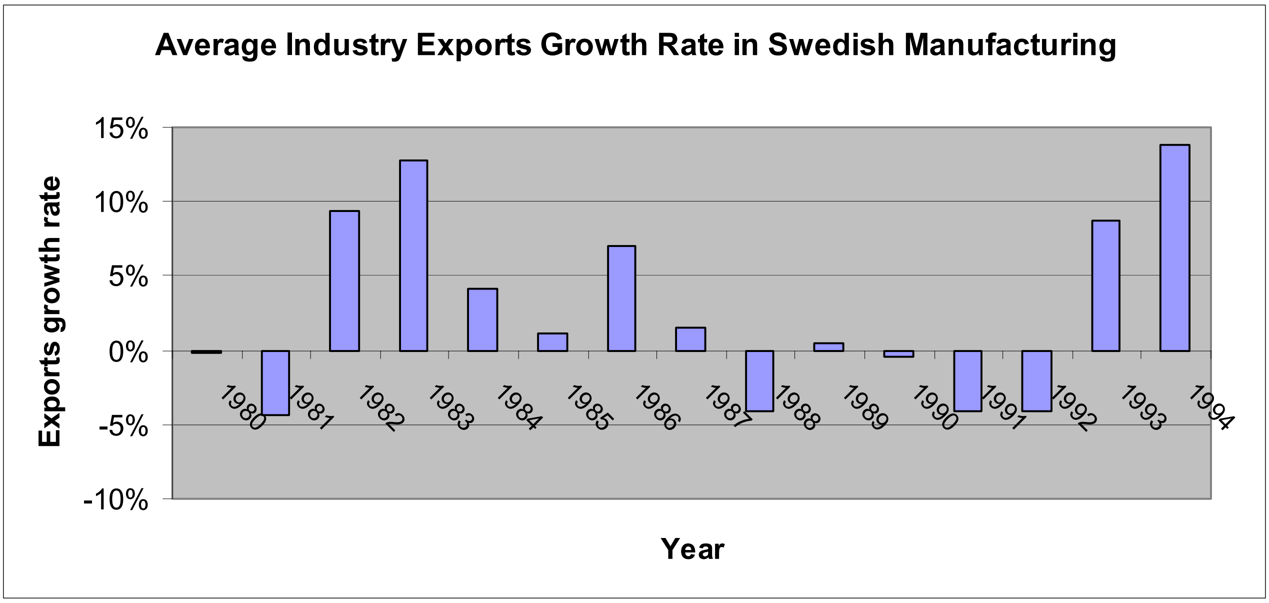
4 Sample Frame and Data

Our dataset is a census covering all firms in Swedish manufacturing between 1980 and 1994 that have at least 20 employees. However only firms with 50 or more employees have reported exports and R&D information. Firms that enter and exit several times during the period are excluded and our final dataset covers 3484 firms over 15 years in 79 4-digit SNI69 industries, generating 36618 observations with value added, sales, exports, employment, capital stock, age, wage, ownership and industry. A producer price index at the 2 digit industry level is used as a deflator to calculate real values of output, value added and capital stock.

One striking feature of Swedish manufacturing is its degree of export-orientation. As shown in Figure 1, export intensity, measured by either the proportion of firms that export or the share of exports in output at the 4 digit industry level, is remarkably high. The upper panel shows that the average industry export-output ratio rises from 30% in 1980 to 50% in 1994. The average number of firms that export as a share of the total in each industry is stable: at around 60% to 70% . This indicates that the rise in the export-output ratio is largely driven by within firm increases in export intensity. By contrast, as shown in the lower panel, the annual export growth rate of Swedish manufacturing sectors is quite volatile across time.

Figure 1 Export Intensity and growth rate of Swedish Manufacturing Industries





We classify firms into three types: entrants, exitors and stayers. A firm present in industry j at time *t*, would be classified as a new entrant if it is absent in industry j at year *t-1* and before ; as an exitor if it is absent in industry *j* at *t+1* and afterwards; and as a stayer if it is neither an entrant nor an exiter.

Several issues arise regarding entry and exit. First, they may not necessarily reflect the creation or destruction of a firm. Entry may be due to *true* entry, i.e. the creation of a new firm, or *disguised* entry, e.g. the employment level of a small firm not sampled previously increases above the statistics threshold. Analogously, exit may be either *true* exit or *disguised* exit, i.e. firms' employment falling below the threshold, or a change in ownership. These might have implications for interpretation of our results. First, the entrant flow could be underestimated since only large entrants will be identified. Second, exiter flow may be overestimated since some firms could continue operating after the year they disappear from the sample. As we show below, correcting this strengthens our results. Another issue is that firms that reallocate the majority of their employment across industries will be classified as switchers. So such firms will be counted as an entrant to one industry, but as an exitor to another.

Table 1 reports annual average entry and exit rates, defined as the number of entrants and exiters in the current year as a share of the total number of firms in each industry. The first column reports the average entry rates across industries and the standard deviation within each year. We also calculate entry rates when switchers are excluded, and results are shown in the second column. Numbers for exiters are in the last two columns. On average, the proportion of firms that enter or exit are close: 7% are new entrants and 8% exit. When switchers are excluded, 5% enter or exit annually. However, the variation of firm turnover rates across time and industry is large.

Table 1. Industry Level Entry and Exit Rates

YEAR	Entry rates		Exit Rates	
	All	**Non-switchers**	**All**	**Non-switchers**
1980	**-** -	**-** -	**2%** (4%)	**0%** (0%)
1981	**5%** (12%)	**4%** (12%)	**3%** (5%)	**0%** (0%)
1982	**7%** (11%)	**4%** (7%)	**7%** (13%)	**6%** (13%)
1983	**9%** (11%)	**7%** (9%)	**7%** (10%)	**5%** (9%)
1984	**6%** (8%)	**5%** (7%)	**6%** (8%)	**5%** (8%)
1985	**6%** (7%)	**5%** (6%)	**5%** (7%)	**3%** (5%)
1986	**6%** (8%)	**5%** (7%)	**6%** (8%)	**5%** (7%)
1987	**7%** (9%)	**6%** (9%)	**6%** (13%)	**6%** (13%)
1988	**7%**	**7%**	**16%**	**7%**

	(13%)	(13%)	(18%)	(12%)
1989	**12%** (15%)	**6%** (12%)	**13%** (16%)	**9%** (15%)
1990	**11%** (13%)	**7%** (10%)	**9%** (11%)	**5%** (7%)
1991	**3%** (7%)	**1%** (3%)	**14%** (16%)	**12%** (15%)
1992	**11%** (12%)	**8%** (9%)	**14%** (15%)	**12%** (15%)
1993	**9%** (14%)	**7%** (14%)	**7%** (10%)	**7%** (10%)
1994	**5%** (8%)	**5%** (8%)	**-** -	**-** -
Total	**7%** (11%)	**5%** (9%)	**8%** (12%)	**5%** (11%)

Notes: Entry and exit rates are defined as the share of the number of firms that enter or exit in the total number of firms in each 4 digit industry for each year. The cross industry mean of entry and exit rates, including or excluding switchers, are reported with standard deviations in parenthesis

5 Empirical Results

Decomposition: Table 2 sets out average TFP of each group of firms by year. To purge industry effects, we calculate a firm's TFP relative to the industry mean,[9]. The last row shows that on average there is a clear productivity hierarchy: Stayers are most productive, at 2%

[9] The industry TFP mean is calculated in GR fashion, i.e. the $\overline{P}_{jt}$ in equation [2] which represents the mean industry productivity across the start and end period. This means that for time t, the average of relative productivity of stayers, entrants and exiters is $\frac{\sum_{i\in C} p_{ijt} - \overline{P}_{jt}}{N_c}$, $\frac{\sum_{i\in N} p_{i\,jt} - \overline{P}_{jt}}{N_N}$ and $\frac{\sum_{i\in X} p_{ijt-1} - \overline{P}_{jt}}{N_X}$, respectively.

above the industry mean. Entrants are second most productive with productivity levels 1.4% below the industry average. Exiters are 20% less productive than average. When we break down the data year by year, these patterns remain robust. One interesting result is that once we distinguish between non-switcher entrants/exiters and switchers, we find that switchers are usually in the middle of the productivity spectrum, less productive than new entrants but more productive than true exiters. Also note that while the last column shows that switching exiters are usually less productive than the mean of their leaving industries, the fifth column tells us that switching entrants are in many years more productive than the mean of their destination industries.

Table 2 : TFP comparison across different types of firms

Year	Stayers	Entrants			Exiter		
		All	Non-switchers	Switchers	All	Non-switchers	Switchers
1981	-2.3%	-12.1%	-2.0%	-35.3%	-28.1%	-	-28.1%
1982	1.8%	0.3%	2.7%	-4.4%	-23.7%	-5.3%	-24.8%
1983	3.2%	3.8%	4.3%	1.0%	-22.6%	-29.1%	0.4%
1984	2.2%	9.8%	15.6%	-4.0%	-13.5%	-18.3%	-4.8%
1985	0.9%	5.9%	6.4%	4.1%	-51.1%	-70.4%	1.3%
1986	0.9%	1.9%	2.8%	-1.1%	-12.0%	-7.2%	-30.4%
1987	3.7%	-12.2%	-4.4%	-44.1%	-16.9%	-10.1%	-42.2%
1988	4.0%	-2.3%	-2.5%	4.4%	-24.1%	-24.3%	-19.3%
1989	1.8%	1.4%	2.2%	0.8%	-9.3%	-14.9%	-5.3%
1990	1.5%	-12.0%	-16.4%	-1.4%	-13.0%	-17.8%	-3.0%
1991	1.4%	5.6%	18.6%	3.1%	-12.6%	-19.3%	6.5%
1992	4.5%	4.2%	2.9%	9.8%	-23.9%	-25.8%	-14.8%
1993	4.2%	-10.4%	-5.5%	-24.9%	-12.8%	-16.0%	6.1%

1994	4.9%	1.6%	1.6%	-	-17.9%	-17.9%	-
Total	**2.3%**	**-1.4%**	**0.1%**	**-5.0%**	**-18.0%**	**-21.5%**	**-9.4%**

Notes: Each entry represents the average TFP of each type of firms at year t, while firms' TFP are calculated as their deviation from their industry mean as measured by GR method. For entrants (exiters) who switch between industries, the industry mean refer to the average productivity of their destination (leaving) industry.

In Table 2 we summarise the decomposition results calculated from [2]-[7]. Since our focus is restructuring, only the between firm reallocation and entry and exit effects are reported (full decomposition results are in appendix 2). Column 2 reports the mean of annual productivity growth across 4 digit sectors for each year. In 9 of 14 years Swedish manufacturing experienced positive TFP growth of up to 9%: The growth rate was negative in the middle of the 1980s and early 1990s, the lowest being -5%. This suggests that average industry TFP growth rates vary significantly from year to year, hence it is essential to take time effects into account. When averaged across years and industries, annual TFP growth rate at the 4 digit level is 2.1%.

Table 3: Average Industry Productivity growth (4 digit) and Contribution of Restructuring

YEAR	Overall TFP growth (%)	Method	Between firm Effect (%)	Entry Effect		Exit Effect	
				All (%)	Non-switchers (%)	All (%)	Non-Switchers (%)
1981	-5.42	*FHK*	0.01	0.29	0.29	0.40	0.00
		GR	0.53	0.32	0.33	0.36	0.00
1982	5.49	*FHK*	0.85	1.05	0.58	0.07	0.00
		GR	0.65	0.48	0.23	0.08	0.00
1983	4.17	*FHK*	-0.31	-0.66	-0.95	-0.26	-0.05
		GR	0.13	-0.89	-1.07	-0.15	0.17
1984	-2.11	*FHK*	-0.23	0.47	0.90	0.19	0.53
		GR	-0.11	0.38	0.82	0.47	0.65
1985	-0.73	*FHK*	-0.18	0.21	0.18	0.39	0.34
		GR	0.08	0.27	0.24	0.12	0.27

1986	0.84	*FHK* *GR*	-0.04 0.41	-0.01 0.01	-0.02 0.01	0.34 0.12	0.16 0.23
1987	4.68	*FHK* *GR*	-0.90 -0.13	-0.54 -0.53	0.10 0.08	0.52 0.98	0.29 0.21
1988	4.08	*FHK* *GR*	0.52 1.00	1.43 0.99	1.34 0.91	0.77 0.69	0.30 0.68
1989	2.15	*FHK* *GR*	0.04 0.24	2.01 1.83	0.92 0.76	-0.52 -0.20	0.14 0.18
1990	-2.68	*FHK* *GR*	0.20 1.52	0.69 0.97	0.59 0.64	-0.09 1.06	0.15 0.34
1991	-1.24	*FHK* *GR*	2.16 1.51	0.66 0.57	0.17 0.15	-0.78 -0.84	-0.43 -0.52
1992	8.60	*FHK* *GR*	-0.07 0.75	1.41 0.81	1.51 1.04	0.84 1.17	0.93 1.43
1993	7.08	*FHK* *GR*	1.03 1.65	2.24 1.71	1.58 1.10	-0.61 -0.25	-0.29 0.02
1994	4.30	*FHK* *GR*	-4.78 -2.82	0.27 0.16	0.27 0.16	-0.56 -0.19	-0.56 -0.58
Total	**2.07**	*FHK* *GR*	**-0.11** **0.39**	**0.63** **0.51**	**0.49** **0.38**	**0.05** **0.25**	**0.11** **0.22**

Column 3 reports the decomposition method on which the remaining results are calculated[10]. Column 4 reports productivity growth due to market share reallocation across continuing firms, as calculated from the second term in equations [2] and [3]. The results are sensitive to decomposition method. Calculated from FHK, the between firm effect is negative in 6 years, positive in 8 years, and slightly below zero on average across all years. However, the GR results show a more positive role of the between effect: the sign is positive in 11 of 14 years and its average contribution is 0.3%, about 15% of average TFP growth.

By contrast, productivity growth effects due to entry or exit are very robust across decomposition method. In column 5 entrants are defined as both switching entrants and new firms. Clearly the entry of these firms in most years makes a positive contribution. The

[10] Note that by comparing equation [2] and [3], one can see the major difference between these two methods on the calculation of the between firm effect and entry/exit effect is the measure of an " average firm " in an industry at a given time : the FHK method uses $\widetilde{P}_{jt-1}$, the lagged mean of firm productivity, whereas the GR method uses $\overline{P}_{jt}$, the average firm productivity across both period t-1 and t. Hence the difference between the GR and FHK results is largely due to the difference between $\overline{P}_{jt}$ and $\widetilde{P}_{jt-1}$.

magnitude of the effect across all years is 0.7% (0.5%) by FHK (GR) method, accounting for about 35% (25%) of the average TFP growth. Furthermore, when we exclude switching entrants (column 6) and calculate the contribution of new entrants, the entry contributions fall only slightly. This indicates that it is entry of new firms, rather than switchers from other industries that dominates the entry contribution, although the entry of switchers also contributes positively to overall productivity growth. However, the contributions of exiters are smaller. The last two columns show the exit effect with and without switchers. The contribution varies between -0.6% to 1%, and is 0.1%- 0.2% on average, only 5%-10% of average TFP growth. Again, excluding switching exiters does not have a significant impact, as shown in the last column.

To summarise, we find a significant role for within industry restructuring. As the last row shows, on average the sum of between firm effect, entry and exit effect is 0.7%-1% TFP growth, or about 30%-50% of annual TFP growth (2.1%). However, each of the three restructuring components is playing a different role. The between firm effect is ambiguous and sensitive to decomposition methods, whereas the net entry effect is positive, large and robust to decomposition methods. Furthermore, it is the entry of new firms that dominates the net entry contribution, while the role of exiters though small is still positive. Finally, our results remain robust when switchers are separated out, hence the contribution of net entry is driven by the creation or disappearance of firms, rather the switching behaviour of existing firms.

***Exports and Restructuring*:** But how do exports impact on the components of restructuring? To reveal this, we regress each restructuring component on exports growth at the industry level as set out in equations [8] and [9]. In table 4, we report GMM results for dependent variables calculated from alternative decomposition methods as a robustness check. The coefficients and standard errors are estimated from one-step estimation, whereas the Sargan test and AR2 test are from two-step estimation.

Table 4 Exports growth and Restructuring: GMM Results

	Method	**Dependent variables**			
		Between	**Net Entry Effect**	**Entry Effect**	**Exit Effect**

			All	Non-switcher	All	Non-switcher	All	Non-switcher
Lagged Depend. var.	*FHK*	-.034 (.144)	-.121 (-.055)**	-.108 (.041)***	-.095 (.042)**	-.062 (.0353)*	-.098 (.049)**	-.165 (.042)***
	GR	-.071 (.13)	-.11 (.028)**	-.12 (.04)***	-.115 (.027)***	-.095 (.012)	-.102 (.033)	-.167 (.045)
Exports growth (ΔX_{jt})	*FHK*	-.030 (.024)	**.029 (.0119)****	**.030 (.011)*****	**.015 (.008)****	**.016 (.006)*****	.011 (.0074)	.010 (.0078)
	GR	-.022 (.016)	**.025 (.013)***	**.031 (.013)****	**.012 (.0069)***	**.011 (.0052)****	.010 (.0099)	.014 (.009)
Lagged Exports growth (ΔX_{jt-1})	*FHK*	-.0165 (.021)	.039 (.024)	.020 (.012)	.0018 (0.32)	-.0027 (.0069)	.033 (.021)	.0316 (.022)
	GR	-.027 (.027)	.020 (.018)	.022 (.015)	.0003 (.0027)	-.0007 (.0026)	.019 (.017)	.021 (.016)
AR2 (p value)	*FHK*	.47	.69	.78	.25	.30	.19	.21
	GR	.61	.90	.95	.26	.37	.14	.24
Sargon (Chi2 value)	*FHK*	51	57	53	62	68	58	49
	GR	62	57	57	64	65	50	59
Observations	884	884	884	884	884	884	884	884

Notes : (a) Robust standard error in parenthesis (b) ***, **, * indicates coefficients are significant at 1%, 5% and 10% levels.(c) Sargon and AR2 from 2 step estimations (d)all regressions include year dummies

Estimation results from equation [8] are reported in column 1. All coefficients are insignificant regardless of which method is used to calculate the between firm effect. This is not unexpected. Hansson and Lundin(2004)decompose the between firm reallocation term into domestic and export sales reallocations They find that while export sales are reallocating towards more efficient firms, domestic sales are simultaneously reallocated towards less efficient firms. Theory does not predict an adverse reallocation of domestic sales. However, if the negative reallocation of domestic sales offsets the positive reallocation of exports sales, then simply regressing the between firm sales reallocation effect on exports growth may not yield a significant coefficient. But, expors growth does appear to have a positive impact on the net entry effect, as shown in column (2). The coefficient of current exports growth is positive and significant, and higher when FHK is used. The estimation also passes Sargan and AR2 tests.

Interestingly, column 3 shows that our results are strengthened if we focus on non-switching entrants/exiters only. If the contribution of switchers is removed from the net entry effect[11], the significance and magnitude of the export growth coefficient rises. Furthermore, the magnitude of the impact of export growth on productivity growth due to net entry is ssubstantial: a 10% increase in the export growth rate will lead to a 0.3% TFP growth attributable to net entry, about 15% of average annual TFP growth.

Since the net entry effect is the sum of entry and exit effects, does exports growth have a positive impact on one or both of these? Columns [4]-[7] provide the answer: the coefficients of exports growth are positive for both entry and exit effects, but statistically significant only for the former. And this result is again robust to different decomposition methods and to the exclusion of switchers. Recall that Melitz (2003) predicts that increased export opportunities tend to attract more new firms to enter, and simultaneously force low productivity firms to quit. Our results suggest that exports growth raises overall productivity growth largely through the first channel, its positive impact on the entry of new firms[12].

[11] In column (3), the dependent variable = the first terms in equation [4]+ the first terms in equation [5] under FHK method, and equals the first terms in equation [6+ the first terms in equation [7] according to GR method.
[12] We also run a industry level regression in which the entry rates are regressed on exports growth rates, the coefficient is found to be very significant and positive.On the other hand, we also find a significant and positive link between entry rates and the entry effect in productivity growth decomposition. This implies that exports

6 Conclusions

The interaction between new theories of trade with heterogenous firms and the growing availability of large micro-level datasets has stimulated an exciting new literature from which we are learning a great deal about links between globalization and productivity change. Despite the rapid growth of cross-border investment over the last twenty years, armslength exporting remains the most widely adopted globalization strategy of firms. Recent research has revealed evidence of a definite link between exporting and intra-firm productivity across a range of industrialized and developing countries.

New theoretical insights building on the seminal work of Melitz (2003) provide convincing reasons for believing that exporting and industry productivity are also causally linked through various reallocations which follow trade expansion. As yet however this has been subjected to little by way of empirical scrutiny.. In this paper we search for this link using a large micro level dataset for Swedish manufacturing firms. To our knowledge this is the first study to link sectoral exports growth to firm turnover. Our decomposition of productivity growth at a highly disaggregated industry level enables us to focus on restructuring *within* narrowly defined industries, which is closer to the setup of the relevant theory.We decompose productivity growth to separate out the relative contribution of reallocation, entry and exit, then we assess the impact of exporting on each. We find a clear productivity hierarchy, with stayers being the most productive, followed by entrants and exiters. Inter-firm reallocation among stayers accounts for around 15% of total industry productivity growth, whilst the contribution of entry and exit is around 30%. Finally we find that exporting has a significant impact on these net entry effects. This points to a clear causal link between exporting and industry productivity, independent of the link between exporting and firm

---

growth does attract more entrants and through which raise the entry contribution. The regression results are available from the authors upon request.

References

Aw, B., Chen X. and Roberts M. (2001) Firm-level evidence on productivity differentials and turnover in Taiwanese manufacturing , *Journal of Development Economics*, Vol. 66, pp. 51-86

Baldwin J. and Gu W. (2004), Trade Liberalisation, Export Market Participation, Productivity Growth and Innovation. *Oxford Review of Economic Policy*, Vol. 20, pp. 372-392

Bailey, M., Hulten, C. and Campbell, D. (1992) Productivity Dynamics in Manufacturing Plants , *Brookings papers on Economic Activity*, Microeconomics, pp. 187-249

Bernard, A. and Jensen, B. (1999), Economics, Exceptional exporter performance: cause, effect,

or both? ,*Journal of International Economics* Vol. 47, pp. 1-25.

Bernard, A. and Jensen, B. (1999), Exporting and Productivity in the US. *Oxford Review of Economic Policy*, Vol. 20, pp. 343-357

Bernard, A., Eaton, J, Jensen, B., and Kortum, S. (2003) Plants and Productivity in International Trade *American Economic Review*, 93, pp. 1268-1290.

Bernard, A, Redding, S. and Schott, P. (2004), Comparative Advantage and Heterogeneous Firms NBER Working Papers, *NBER working paper series* No. W10668

Bernard, A. and Wagner, J. (1997), 'Exports and Success in German Manufacturing *Weltwirtschaftliches Archiv* , Vol 133,, pp.134-157.

Castellani, D. (2002) Export Behaviour and Productivity Growth: Evidence from Italian Manufacturing Firms, *Weltwirtschaftliches Archiv*, Vol. 138, pp.605-628.

Clerides, M., Lach, S. and Tybout, J. (1998) Is learning by exporting important? Micro-Dynamic

Evidence From Colombia, Mexico, and Morocco, *Quarterly Journal of Economics*, Vol. 113, pp.903-904.

Criscuolo, C., Haskel, J. and Martin R. (2004) Import Competition, Productivity, and Restructuring in UK Manufacturing, *Oxford Review of Economic Policy*, Vol. 20, pp. 393-408

Delgado, M., Farinas, J. and Ruano, S., 2002. Firm productivity and export markets : a non-parametric approach. *Journal of International Economics*, Vol. 57, pp.397-422

Falvey, R., Greenaway, D. and Yu Z. (2004) Intra-industry Trade Between Asymmetric Countries with Heterogeneous Firms, *Leverhulme Centre for Research on Globalisation and Economic Policy, University of Nottingham , Research Paper* 04/05

Foster, L., Haltiwanger J. and Krizen C. (1998) Aggregate productivity growth : lesions from Mircoeconomic Evidence ‘ in New Developments in Productivity Analysis, NBER/University of Chicago Press, 2001

Girma, S. Greenaway, D. and Kneller, R. (2003a) Does Exporting lead to better performance? A Microeconometric Analysis of Matched Firms *Review of International Economics*, Vol. 14, pp. 855-866

Greenaway and Yu (2004) Firm-level Interactions between Exporting and Productivity : Industry-Specific Evidence , *Review of World Economics*, Vol. 140, pp.376-392

Griliches Z, Regev H (1995), Firm productivity in Israeli industry: 1979-1988 *NBER Working Paper* no. 5790

Hansson, P. and Lundin, N. (2004) Exports as an Indicator on or Promoter of Successful Swedish Manufacturing Firms in the 1990s , *Review of World Economics*, Vol. 140, pp.415-445

Karpaty, P. and Lundberg, L. (2004) Foreign Direct Investment and Productivity Spillovers in Swedish Manufacturing. *FIEF Working Paper 194*.

Helpman, E. and Krugman, P. (1985), Market *Structure and Foreign Trade*, Cambridge: MIT Press

Meltiz, M. (2003), The Impact of Trade on Intra-Industry Reallocations and Aggregate Productivity*, Econometrica*, Vol. 71, pp. 1695-1725

Pavcnik N. (2002), Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants *Review of Economic Studies,* Vol. 69, pp. 245-76.

Tybout, J. and Westbrook, D. (1995),Trade liberalisation and the dimensions of efficiency change in Mexican manufacturing industries , *Journal of International Economics*, Vol. 39, pp.53-78

Wagner, J. (2002) The Causal Effect of Exports on Firm Size and Labour Productivity, *Economics Letters*, Vol. 77, pp.287-292.

Appendix 1 Total Factor Productivity measure

The firm level productivity measure in our paper is generated as

$$\ln TFP_{ijt} = \ln Y_{ijt} - \alpha_L \ln L_{ijt} - \alpha_K \ln K_{ijt} - \alpha_M \ln M_{ijt}$$

where Y_{ijt}, K_{ijt}, L_{ijt} and M_{ijt} represent real output, real capital, labor and intermediate inputs. 2 digit SNI92 producer price index are used as price deflator. The factor shares are estimated from three factor OLS regressions allowing input coefficients to vary across 3 digit SNI92 industries.

Appendix 2 Additional results on Aggregate Productivity growth decomposition

Table A1-1 Aggregate productivity growth decomposition with all components and their shares : FHK results

Year	Agg. Growth	Within		Between		Covarience		Entry		Exit	
		Absolute	*Relative*	Absolute	*Relative*	Absolute	*Relative*	Absolute	*Relative*	Absolute	Relative
1981	-0.0542	-0.0713	*90%*	0.0001	*-10%*	0.0117	*-2%*	0.0029	*15%*	0.0040	*6%*
1982	0.0549	0.0481	*101%*	0.0085	*-3%*	-0.0100	*-21%*	0.0105	*30%*	0.0007	*-7%*
1983	0.0417	0.0434	*72%*	-0.0031	*-11%*	0.0080	*23%*	-0.0066	*33%*	-0.0026	*-18%*
1984	-0.0211	-0.0381	*135%*	-0.0023	*21%*	0.0094	*-27%*	0.0047	*18%*	0.0019	*-46%*
1985	-0.0073	-0.0181	*75%*	-0.0018	*1%*	0.0077	*3%*	0.0021	*2%*	0.0039	*19%*
1986	0.0084	0.0000	*96%*	-0.0004	*-7%*	0.0042	*11%*	-0.0001	*10%*	0.0034	*-11%*
1987	0.0468	0.0472	*14%*	-0.0090	*-3%*	0.0045	*-28%*	-0.0054	*31%*	0.0052	*86%*
1988	0.0408	0.0025	*86%*	0.0052	*1%*	0.0120	*1%*	0.0143	*14%*	0.0077	*-2%*
1989	0.0215	0.0002	*52%*	0.0004	*2%*	0.0053	*5%*	0.0201	*10%*	-0.0052	*31%*
1990	-0.0268	-0.0568	*10%*	0.0020	*158%*	0.0345	*-77%*	0.0069	*-41%*	-0.0009	*50%*
1991	-0.0124	-0.0268	*112%*	0.0216	*44%*	-0.0019	*2%*	0.0066	*10%*	-0.0078	*-68%*
1992	0.0860	0.0436	*81%*	-0.0007	*10%*	0.0077	*4%*	0.0141	*22%*	0.0084	*-18%*
1993	0.0708	0.0360	*14%*	0.0103	*22%*	0.0172	*-198%*	0.0224	*-7%*	-0.0061	*269%*
1994	0.0430	0.0593	*63%*	-0.0478	*-4%*	0.0349	*20%*	0.0027	*14%*	-0.0056	*8%*
Total	0.0207	0.0048	*72%*	-0.0012	*16%*	0.0103	*-20%*	0.0068	*12%*	0.0005	*21%*

Table A2-2 Aggregate productivity growth decomposition with all components and their shares : GR results

Year	Agg. Growth	Within		Between		Entry		Exit	
		Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative
1981	-0.0542	-0.0661	*93%*	0.0053	*-8%*	0.0032	*15%*	0.0036	*0%*
1982	0.0549	0.0429	*80%*	0.0065	*-18%*	0.0048	*27%*	0.0008	*10%*
1983	0.0417	0.0488	*73%*	0.0013	*1%*	-0.0089	*28%*	-0.0015	*-2%*
1984	-0.0211	-0.0278	*74%*	-0.0011	*-32%*	0.0038	*15%*	0.0047	*43%*
1985	-0.0073	-0.0141	*78%*	0.0008	*9%*	0.0027	*-1%*	0.0012	*15%*
1986	0.0084	-0.0004	*100%*	0.0041	*-2%*	0.0001	*8%*	0.0012	*-7%*
1987	0.0468	0.0487	*-4%*	-0.0013	*-10%*	-0.0053	*38%*	0.0098	*76%*
1988	0.0408	0.0081	*88%*	0.0100	*3%*	0.0099	*12%*	0.0069	*-3%*
1989	0.0215	0.0030	*69%*	0.0024	*6%*	0.0183	*8%*	-0.0020	*15%*
1990	-0.0268	-0.0381	*-38%*	0.0152	*111%*	0.0097	*-20%*	0.0106	*43%*
1991	-0.0124	-0.0266	*116%*	0.0151	*13%*	0.0057	*11%*	-0.0084	*0%*
1992	0.0860	0.0464	*77%*	0.0075	*8%*	0.0081	*15%*	0.0117	*-1%*
1993	0.0708	0.0486	*-65%*	0.0165	*-40%*	0.0171	*24%*	-0.0025	*181%*
1994	0.0430	0.0754	*73%*	-0.0282	*7%*	0.0016	*9%*	-0.0019	*11%*
Total	0.0207	0.0105	*58%*	0.0039	*3%*	0.0052	*13%*	0.0025	*27%*

Table A1-1 and A1-2 report the full results of productivity growth decomposition. These two tables complement table 3 in two aspects. Firstly, contributions of within firm components and covariance components are reported. Secondly, we also report the cross-industry mean of the *fractions* of productivity growth due to within, between, entry and exit effects. In previous literature, there are two ways to measure the contributions of each growth component to aggregate productivity growth. One is the 'absolute' measure of contributions, which are the values of the decomposition terms at the right hand side of equation [2] and [3]. We denote them as ΔP_{jt}^{K} , where K = within, between, covariance, entry and exit effects. Another is the 'relative' or 'share' measures of the contributions, which are the shares of each component in aggregate productivity growth, calculated as $SH_{jt}^{K} = \frac{\Delta P_{jt}^{K}}{\Delta P_{jt}}$. While the 'absolute' measures reflect the *magnitude* of each growth component as a part of the aggregate growth, the " relative " measures show the weights or relative importance of each component as a fraction of aggregate growth. When both ΔP_{jt} and ΔP_{jt}^{K} are positive, then the absolute measure ΔP_{jt}^{K} and the relative measure SH_{jt}^{K} will have same sign. However, when the aggregate productivity growth is negative, the relative measure may have opposite sign. For example, if ΔP_{jt}<0 and ΔP_{jt}^{Entry}>0, then the relative measure of component K's contribution will be *negative,* this would be interpreted as that the entering firms has a *negative* impact on overall productivity change. In fact, since the absolute measure of the entry contribution ΔP_{jt}^{Entry} is positive, the entering of new firms should have *raised* the productivity growth. In our paper, we focus on the absolute measures of the contributions of each growth components in the decomposition and regression results. This is because we have lots of negative annual productivity growth at 4 digit industry level, hence it would be problematic to evaluate the true contributions of each growth component by relying on the relative measure. More importantly, another reason is that the theory only predicts a positive link between exports growth and the absolute contribution of restructuring, not their relative importance in productivity growth.

In Table A1, different column report the cross-industry mean of the contributions of each productivity growth components, where the contributions are calculated in both absolute and relative terms. Hence entries in the 'absolute' term columns equal $\frac{\sum_j \Delta P_{jt}^{K}}{J_t}$, whereas the entries in the "relative" term columns equal $\frac{\sum_j \frac{\Delta P_{jt}^{K}}{\Delta P_{jt}}}{J_t}$, where j and J_t denotes the 4-digit industry index and the number of 4 digit industries at time t. The last row shows the average of each productivity components across all years and all industries. Several interesting results arise. Firstly, looking at the total row, the within effect dominates the aggregate growth. On average, the fraction of productivity changes due to within firm productivity changes account for 72% (58%) by FHK (GR) method. Secondly, regardless of the measure of the contribution, productivity growth due to entering and exiting firms is quite large. The last row shows that 33% (40%) of the productivity changes are due to firms' entry and exit. Finally, relative and absolute contribution measures of each growth component do differ in their signs in many cases. For example, under FHK method, the absolute contribution of between effect is negative and small, but the relative contribution is positive and nontrivial. This may indicate that the between effect is playing a relatively important role when productivity growth is decreasing.

Appendix 3 Additional results from productivity growth components regression :

Table A2 Summary of exports coefficients in productivity growth components regression

Dependant var. / Method	**Within**		**Between**		**Entry**		**Exit**		**Covarience**	
	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative
FHK	.033 (.023)	.056 (.38)	-.030 (.024)	-1.06 (1.00)	.015 (.008)**	.236 (.195)	.011 (.0074)	.138 (.31)	.009 (.021)	-.14 (.33)
GR	.031 (.028)	-.74 (.79)	-.022 (.016)	-.062 (.48)	.012 (.0069)*	.15 (.22)	.010 (.0099)	.20 (.129)	-	-

Notes: (a) all entries are the coefficients of current exports growth in GMM regression, in which the productivity growth components are used as dependent variables. (b) robust standard errors in parenthesis

Table A2 shows the coefficients of current exports growth in the GMM regressions as specified in equation [8] or [9], where the dependent variables are each components of productivity growth. Firstly, as shown in the first column, exports growth has no statistically significant impact on the within effects in our GMM regression. However, when we regress the within effect on exports growth in OLS regression, we get a statistically significant positive coefficient for exports. Since the GMM specification can treat the exports growth regressor as potentially endogenous, our interpretation is that exports growth does not *cause* the within firm productivity growth. This is consistent with a finding in Greenaway, Gullstrand and Kneller (2003) that the learning by exporting hypothesis is not supported for Swedish manufacturing firm data. Secondly, we find that exports growth has no statistically significant effect on the "relative "contributions of each growth components. Especially, while exports growth has a positive impact on the 'absolute' entry contribution, it has no significant effect on the 'relative' contribution. This could simply because of the role of negative aggregate productivity growth.