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Exports and Productivity: A survey of the evidence from firm level data

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A survey of the evidence from firm level data

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ABSTRACT

While the role of exports in promoting growth in general, and productivity in particular, has been investigated empirically using aggregate data for countries and industries for a long time, only recently have comprehensive longitudinal data at the firm level been used to look at the extent and causes of productivity differentials between exporters and their counterparts which sell on the domestic market only. This paper surveys the empirical strategies applied, and the results produced, in 45 microeconometric studies with data from 33 countries that were published between 1995 and 2004. Details aside, exporters are found to be more productive than non-exporters, and the more productive firms self-select into export markets, while exporting does not necessarily improve productivity.

Keywords: Exports, productivity, literature survey, micro data
JEL classification: F14, D21

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1 MOTIVATION

Discussions of the role of exports in promoting growth in general, and productivity in particular, have been ongoing for many years. Until some ten years ago, empirical studies in this field used data at the country or industry level to test whether exports promote productivity growth or vice versa (see the surveys by Baldwin (2000) and Giles and Williams (2000a, 2000b)). In 1995 Bernard and Jensen published the first of series of papers that changed this research perspective (see Bernard and Jensen 1995, 1999, 2004a). They used large comprehensive longitudinal data from surveys performed regularly by official statistics in the U. S. to look at differences between exporters and non-exporters in various dimensions of firm performance, including productivity. These papers started a literature. During the ten years following the publication of Bernard and Jensen's Brookings paper researchers all over the world discovered the rich data sets collected by their statistical offices as a source to investigate the export activity of firms, and its causes and consequences.[1] The extent and cause of productivity differentials between exporters and their counterparts which sell on the domestic market only is one of the core topics in this literature.

There are two alternative but not mutually exclusive hypotheses why exporters can be expected to be more productive than non-exporting firms (see Bernard and Jensen 1999; Bernard and Wagner 1997):

The first hypothesis points to self-selection of the more productive firms into export markets. The reason for this is that there exist additional costs of selling goods in foreign countries. The range of extra costs include transportation costs, distribution or marketing costs, personnel with skill to manage foreign networks, or production costs in modifying current domestic products for foreign consumption. These costs provide an entry barrier that less successful firms cannot overcome. Furthermore, the behaviour of firms might be forward-looking in the sense that the desire to export tomorrow leads a firm to improve performance today to be competitive on the foreign market, too. Cross-section differences between exporters and non-exporters, therefore, may in part be explained by ex ante differences between firms: The more productive firms become exporters.

The second hypothesis points to the role of learning-by-exporting. Knowledge flows from international buyers and competitors help to improve the post-entry performance of export starters. Furthermore, firms participating in international markets are exposed to more intense

1 Earlier research using longitudinal micro data from official statistics in Germany to investigate causes and consequences of exporting is summarised in Wagner (1995).

competition and must improve faster than firms who sell their products domestically only. Exporting makes firms more productive.

These two hypotheses are by no means mutually exclusive. This paper reviews the findings of studies that use micro data at the level of firms (i.e. plants, establishments, local production units) to investigate the relationship between export activities and productivity empirically. The rest of the paper is organised as follows: Section 2 describes the various empirical approaches used in the post-1995 literature to identify the extent and direction of the relationship between exports and productivity using micro data at the firm level. Section 3 reviews 45 studies with data from 33 countries and summarises the core results. Section 4 concludes.

2 INVESTIGATING THE EXPORTS / PRODUCTIVITY RELATIONSHIP: EMPIRICAL STRATEGIES

2.1 A standard approach

A common approach to investigate differences in productivity between exporters and non-exporters is to follow (sometimes only in part, and sometimes with modifications and extensions) the methodology introduced by Bernard and Jensen (1995, 1999). Studies of this type use longitudinal data for plants (usually from the regular surveys conducted by official statistics) to document differences in levels and growth rates of productivity between exporters and non-exporters in a first step. Here one starts by looking at differences in average labour productivity (total value of shipments per worker, or value added per worker) or average total factor productivity[2] between exporters and non-exporters. The result is an unconditional productivity differential.

The next step is the computation of so-called exporter premia, defined as the ceteris paribus percentage difference of labour productivity between exporters and non-exporters. These premia are computed from a regression of log labour productivity on the current export status dummy and a set of control variables (usually including industry, region, firm size measured by the number of employees, and year):

$$(1)\quad \ln LP_{it} = a + ß\ Export_{it} + c\ Control_{it} + e_{it}$$

where i is the index of the firm, t is the index of the year, LP is labour productivity, Export is a dummy variable for current export status (1 if the firm exports in year t, 0 else), Control is a

2 To simplify the exposition we will refer to labour productivity only from now on.

vector of control variables (like four-digit industry dummies, dummies for regions, firm size, and year dummies), and e is an error term. The export premium, computed from the estimated coefficient ß as 100(exp(ß)-1), shows the average percentage difference between exporters and non-exporters controlling for the characteristics included in the vector Control. To control for unobserved plant heterogeneity due to time-invariant firm characteristics which might be correlated with the variables included in the empirical model and which might lead to a biased estimate of the exporter premia, a variant of (1) is often estimated with fixed plant effects, too.

Next, differences in productivity growth between exporters and non-exporters are investigated based on an empirical model that can be written as

$$(2)\ \ln LP_{it} - \ln LP_{i0} = a + ß_1\, Start_{it} + ß_2\, Both_{it} + ß_3\, Stop_{it} + c\, Control_{i0} + e_{it}$$

where Control is a vector of plant characteristics in year 0, and the dummies for export status are defined as follows:

$Start_{it} = 1$ if $(Export_{i0} = 0)$ and $(Export_{it} = 1)$

$Both_{it} = 1$ if $(Export_{i0} = 1)$ and $(Export_{it} = 1)$

$Stop_{it} = 1$ if $(Export_{i0} = 1)$ and $(Export_{it} = 0)$

where non-exporting in both years is the reference category. The regression coefficients $ß_1$, $ß_2$ and $ß_3$ are estimates for the increase in growth rates of labour productivity for export starters, exporters in both years, and export stoppers relative to non-exporters in both years, controlling for firm characteristics included in the vector Control. Here we look at $ß_2$ to compare exporters and non-exporters.

To shed light on the empirical validity of the first hypothesis mentioned – namely, that the more productive firms go abroad – the pre-entry differences in productivity between export starters and non-exporters are investigated next. If good firms become exporters then we should expect to find significant differences in performance measures between future export starters and future non-starters several years before some of them begin to export. To test whether today's export starters were more productive than today's non-exporters several years back when all of them did not export, select all firms that did not export between year t-3 and t-1, and compute the average difference in labour productivity in year t-3 between those firms who did export in year t and those who did not. More formally, estimate the empirical model

(3) $\ln LP_{it-3} = a + ß\ Export_{it} + c\ Control_{it-3} + e_{it}$

where i is the index of the firm, t is the index of the year, LP is labour productivity in year t-3, Export is a dummy variable for current export status (1 if the firm exports in year t, 0 else), Control is a vector of control variables (like four-digit industry dummies, dummies for regions, firm size, and year dummies), and e is an error term. The pre-entry premium, computed from the estimated coefficient ß as 100(exp(ß)-1), shows the average percentage difference between today's exporters and today's non-exporters three years before starting to export, controlling for the characteristics included in the vector Control. To investigate the related question whether productivity increased more in export starters in the years before the start than in firms that continue not to export, the empirical model

(4) $\ln LP_{it-1} - \ln LP_{it-3} = a + ß\ Export_{it} + c\ Control_{i0} + e_{it}$

is used. The estimated regression coefficient ß shows the extent in which future exporters outperformed the non-exporting firms in the years prior to entry.

To test for the second hypothesis mentioned – namely, that exporting fosters productivity - the post-entry differences in productivity growth between export starters and non-exporters are investigated. This is done by looking at b_1 from (2) to compare the productivity growth performance of export starters and non-exporters.

Finally, to find out whether stopping to export is negatively related with productivity performance, post-exit differences in productivity growth between export stoppers and non-exporters are investigated by looking at b_3 from (2) to compare the productivity growth performance of export stoppers and non-exporters.

While most of the empirical studies that use (variants of) the now standard approach outlined in this section compare exporters and non-exporters across all (manufacturing) industries, some focus on firms from selected industries only and document interesting similarities and differences (see e.g. Alvarez and López (2004), Blalock and Gertler (2004), De Loecker (2004), and Greenaway and Kneller (2004b)). Furthermore, Damijan, Polanec and Prasnikar (2004) recently looked at differences by foreign markets served and found that it matters whether firms exported to advanced countries or developing countries.

2.2 Extensions

The standard approach outlined in the last section has been augmented by extensions and alternative approaches that deal with some of its weaknesses and problems. Here we will dis-

cuss two of these recent developments that are used more and more in empirical investigations, namely the comparison of productivity between matched firms, and differences in the distribution of productivity as a whole between exporters and non-exporters.

To motivate the first approach mentioned, consider the following situation: Assume that a study reports that plants entering the export market have substantially faster productivity growth in the following years than firms that keep selling their products on the domestic market only. Does this point to a causal effect of starting to export on productivity? The answer is, obviously, no: If better firms self-select into export-starting, and if, therefore, todays export starters are 'better' than today's non-exporters (and have been so in the recent past), we would expect that they should, on average, perform better in the future even if they do not start to export today. However, we cannot observe whether they would really do so because they do start to export today; we simply have no data for the counterfactual situation. So how can we be sure that the better performance of starters compared to non-exporters is caused by exporting (or not)? This closely resembles a situation familiar from the evaluation of active labor market programs (or any other form of treatment of units): If participants, or treated units, are not selected randomly from a population but are selected or self-select according to certain criteria, the effect of a treatment cannot be evaluated by comparing the average performance of the treated and the non-treated. However, given that each unit (plant, or person, etc.) either participated or not, we have no information about its performance in the counterfactual situation. A way out is to construct a control group in such a way that every treated unit is matched to an untreated unit that has been as similar as possible (ideally, identical) at the time before the treatment. Differences between the two groups (the treated, and the matched non-treated) after the treatment can then be attributed to the treatment (for a comprehensive discussion, see Heckman, LaLonde and Smith 1999).

The use of a matching approach to search for causal effects of starting or stopping to export on productivity (and other dimensions of firm performance) has been pioneered by Wagner (2002) and Girma, Greenaway and Kneller (2003, 2004), and it has been used in a growing number of empirical studies ever since (including De Loecker (2004), Arnold and Hussinger (2004), and Alvarez and López (2004)).

As regards the second recent methodological innovation in this literature, consider the comparison of productivity (or productivity growth) between exporters and non-exporters. If one looks at differences in the mean value for both groups only, one focuses on just one moment of the productivity distribution. A stricter test that considers all moments is a test for stochastic dominance of the productivity distribution for exporters over the productivity distribution for non-exporters. More formally, let F and G denote the cumulative distribution functions of productivity for exporters and non-exporters. Then first order stochastic dominance of F rela-

tive to G means that F(z) – G(z) must be less or equal zero for all values of z, with strict inequality for some z. Whether this holds or not is tested non-parametrically by adopting the Kolmogorov-Smirnov test. This method has been used to discuss the issue of exports and productivity for the first time by Delgado, Farinas and Ruano (2002); recent applications comparing firms that produce for the local market only, that export, and that are foreign direct investors are Girma, Kneller and Pisu (2003) and Girma, Görg and Strobl (2004).

A related extension of the standard approach used in the investigation of the relationship between exports and productivity is the application of quantile regression, introduced to this field of analysis by Yasar, Nelson and Rejesus (2003). By construction this method examines the productivity effect of exporting at different points of the conditional output distribution. To state it differently, quantile regression allows to test for differences in the effects of exporting on plant productivity as one moves from the lower to the upper tail of the conditional productivity distribution, and to identify the regions where these effects are especially weak, or strong, or not significantly different from zero at all.

3 A SURVEY OF THE EVIDENCE, 1995 – 2004

During the ten years following the publication of the path-breaking Brookings paper by Bernard and Jensen (1995) researchers all over the world used firm level data to investigate the relationship between exporting and productivity in microeconometric studies. Table 1 gives a synopsis of findings from 45 empirical studies covering 33 countries. Among the countries covered are highly industrialised countries (e.g., U.S., UK, Canada, Germany); countries from Latin America (Chile, Colombia, Mexico); Asian countries (China, Korea, Indonesia, Taiwan); transition countries (Estonia, Slovenia); and least developed countries from sub-Saharan Africa.

Given this wide range of countries the big picture emerging from column two of table 1 that summarises findings on differences in levels and growth rates between exporters and non-exporters is amazingly clear-cut: With only a few exceptions exporters are found to have higher productivity, and often higher productivity growth, and this tends to hold after controlling for observed plant characteristics (like industry and size), too. Exporters are better.

The findings for pre-entry differences surveyed in column three often present evidence in favour of the self-selection hypothesis: Future export starters tend to be more productive than future non-exporters years before they enter the export market, and often have higher ex-ante growth rates of productivity. The good firms go abroad.

Evidence regarding the learning-by-exporting hypothesis is somewhat more mixed: Results for post-entry differences in performance between export starters and non-exporters collected in column four point to faster productivity growth for the former group in some studies only. If matched firms are compared, often no statistically significant exporter premia are found. Exporting does not necessarily improve firms.

Finally, a look at the results for post-exit differences collected in the last column reveals that stopping to export tends to be accompanied by a decrease in productivity in the most cases. Girma, Greenaway and Kneller (2003) in the only study using matched firms, however, find only weak negative effects in the year of exit, and no effect for later years.

Obviously the big picture sketched here – exporters are more productive than non-exporters, and the more productive firms self-select into export markets, while exporting does not necessarily improve productivity - hides a lot of cross-country heterogeneity which is documented in some detail in table 1, and in even more detail in the studies surveyed. Cross-country comparisons, and even cross-study comparisons for one country, are difficult because the studies differ in details of the approach used. Therefore, the jury is still out on many of the issues regarding the relationship between exporting and productivity. One promising approach to generate stylised facts in a more convincing way is to co-ordinate microeconometric studies for many countries ex-ante, and to agree on a common approach and on the specification of the empirical models estimated. The outcome of such a joint effort would be a set of results that could be compared not only qualitatively (i.e. with regard to the signs and the statistical significance of the estimated coefficients) but with a view on the magnitude of the estimated effects, too.[3]

4 CONCLUDING REMARKS

Details aside the big picture that emerges after ten years of microeconometric research in the relationship between exporting and productivity is that exporters are more productive than non-exporters, and that the more productive firms self-select into export markets, while exporting does not necessarily improve productivity. However, given all the difficulties (mentioned above) to compare the results from the vast numbers of studies in detail, it still seems to be too early to speak of these findings as stylised facts, and to discuss any policy conclusions to be based thereon. Furthermore, there are a number of important issues that have only

3 See Bernard, Jensen and Wagner (1997) for this type of study using data for the U.S. and Germany. Volunteers willing to participate in an international study of this kind are asked to contact me!

been touched upon recently in some studies, and that deserve future research efforts that cover more countries:

- If high-productivity firms self-select into export markets, is their high productivity due to an exogeneous random shock, or is it the results of a planned strategy to prepare for entering export markets? Hallward-Driemeier, Iarossi and Sokoloff (2002), López (2003), and Alvarez and López (2004) present evidence for the latter view based on data from five East Asian countries and Chile.

- If exporting improves productivity via technology transfer from international buyers, what are the mechanisms by which this learning from exporting occurs? Blalock and Gertler (2004) report some anecdotal evidence from interviews with Indonesian exporting factory managers on this.

- Which role is played by different target countries of exports for higher productivity as a precondition or result of exporting? Damijan, Polanec and Prasnikar (2004) report that in Slovenia the productivity difference between future export starters and non-exporters is higher for firms that start to export to more advanced markets.

To answer these questions, microeconometric research based on large sets of longitudinal plant level data has to be supplemented by field research in firms, following Susan Helper's (2000) credo that "you can observe a lot just by watching". Case studies of this kind can not only produce the anecdotal evidence that helps us to understand what is behind the estimated coefficients that we produce with our PCs, they can point to the tailor-made questions to be included in future surveys that are aimed to collect data for a new generation of microeconometric studies, too.

Furthermore, there is a different area of future research that is driven by an emerging theoretical literature. While at the dawn of the empirical literature surveyed here Leamer and Levinson (1994, p.1) stated that "(i)nternational microeconomics is primarily a theoretical enterprise that seems little affected by empirical results", this is no longer true for some years now. A number of theoretical papers, including Bernard, Eaton, Jensen and Kortum (2003), Melitz (2003), Helpman, Melitz and Yeaple (2004), and Yeaple (2005), take the results from the empirical literature on firms and exports as a starting point and develop models of international trade with heterogeneous firms which focus on the relationship between productivity and exports. These theoretical models in turn generate testable hypotheses, and serve as catalysts for future microeconometric studies.

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Table 1: Synopsis of findings from empirical studies on exports and productivity using firm level data

	Core findings			
Study (published) Country (period covered)	Differences in levels and growth rates between exporters and non-exporters	Pre-entry differences	Post-entry differences	Post-exit differences
Baldwin and Gu (2003) Canada (1974-1996)	LP and TFP higher for exporters than for non-exporters; difference increased over time. EP for LP increased from 19 to 83 percentage points between 1974 and 1996.	LP and growth of LP higher for starters than for non-exporters	Entrants had faster LP growth than non-entrants.	Exiters 13% less productive than continuers; exiters had slower growth of LP than continuers.
Meller (1995) Chile (1986-1989)	LP significantly higher in small and large export firms than in non-export firms; productivity differential differs between industries.			
Alvarez and López (2004) Chile (1990-1996)	EP positive and significant for LP and TFP. Productivity differentials differ considerably by industry.	Firms that enter export have higher LP and TFP than non-exporters. Firms make conscious efforts to increase productivity before starting to export.	Differences in LP and TFP growth insignificant or negative for export starters compared to non-exporters. Same result for all industry but wood Products. For matched firms no effect on TFP growth, weak positive for LP growth.	

Kraay (2002) China (1988-1992)	LP and TFP significantly higher in exporters than in non-exporters. EP positive and significant for LP and TFP. For established exporters, past exports are positively related to LP and TFP today, controlling for past firm performance and unobserved firm characteristics.		For new entrants to export markets learning effects are insignificant and occasionally negative.	
Clerides, Lach and Tybout (1998) Colombia (1981-1991)	LP higher for exporting firms than for non-exporters.	LP higher for export starters than for other groups of firms (ongoing exporters, non-exporters and export stoppers).	LP improves after starting to export.	LP shows worst performance compared to other groups, particularly around time of exit.
Isgut (2001) Colombia (1981-1991)	LP higher for exporting firms than for non-exporters, 80% - 100% for plants up to 100 employees and 27% - 32% for larger plants. EP ca. 45%. Growth of LP not significantly different for exporters and non-exporters over five year horizon.	Pre-entry premia 20% to 24%. Pre-entry growth 3% - 4% higher in future starters.	LP growth rate differences between export starters and non-exporters not significant for one year horizon; LP grows 1.5% faster for starters over horizon five years after entry.	Growth of LP not significantly lower for stoppers compared to non-exporters over five year horizon.
Sinani (2003) Estonia (1994-1999)	LP higher for exporting firms than for non-exporters; growth of LP much higher for exporters than for non-exporters.			
Bernard / Wagner (1997) Germany (1978-1992)	LP 3-4 % lower in smaller export firms, but 30-50 percent higher in larger export firms. EP about 20 % on average, increasing with share of exports in total sales. Growth of LP slower in exporting than in non-exporting firms.	Pre-entry premia 2-5 % but insign. Pre-entry growth 1.0–1.6 % higher in future starters, but difference insignificant.	Growth of LP significantly higher for export starters than for non-exporters in the year after exporting starts (4.8-6.7 %).	Growth of LP significantly lower for export stoppers than for non-exporters in the year after exporting stops (3.6-8.4 %).

Bernard / Wagner (2001) Germany (1978 – 1992)		Higher productivity strongly positively correlated with future export entry, controlling for unobserved firm effects.		
Wagner (2002) Germany (1978-1989)		EP in year before start positive but insignificant.	Growth of LP in export starters higher than in matched non-starters but difference between both groups not statistically significant.	
Arnold and Hussinger (2004) Germany (1992-2004)	TFP higher for exporters than for non-exporters; high-productivity firms significantly more likely to be exporters, ceteris paribus.	In the two periods preceding entry future exporters experience signific. increase in TFP. Productivity granger-causes exporting.	Productivity gap between exporters and non-exporters does not widen in years after entry. Exporting does not granger-cause productivity. For matched firms there are no differences in levels or growth of TFP between exporters and non-exporters in years after entry.	
Sjöholm (1999) Indonesia (1980-1991)	LP higher for exporting firms than for non-exporters; growth of LP higher for exporters and increasing with share of exports in output.			
Blalock and Gertler (2004) Indonesia (1990-1996)	LP higher for exporting firms than for non-exporters.	Productivity does not rise prior to exporting.	Firms experience a jump in productivity of about 2% to 5% following the initiation of exporting. Effect of exporting is positive in all 10 industries, significant in 7.	No reduction in productivity after stopping to export.

Castellani (2002) Italy (1989-1994)	LP higher for exporting firms than for non-exporters; growth of LP not significantly different. Productivity growth higher in firms with a higher share of exports in total sales.	LP higher in future export starters than in non-starters three years before entry; growth of LP not different for the two groups of firms. LP and growth of LP have no impact on the probability to start to export, cet. par.		
Girma, Görg and Strobl (2004) Ireland (2000)	LP on average higher for exporters than non-exporters, but the hypothesis of identical distribution of productivity cannot be rejected for exporters relative to non-exporters.			
Aw, Chung and Roberts (2000) Korea (Republic of) (1983 – 1993)	Total factor productivity (TFP) between 3.9% and 31.1% higher for exporters than non-exporters in five industries. TFP growth not different between exporters and non-exporters.	Higher TFP levels and growth rates for entrants prior to entry not significant.	Entrants have higher TFP than non-exporters.	Exiting plants have higher TFP than non-exporters in two industries; no difference in three industries.
Hahn (2004) Korea	LP and TFP higher for exporters than for non-exporters. EP about 50% - 20% for LP, 2.5% – 7.5% for TFP.	LP higher for entrants prior to entry than for non-entrants, but no difference for TFP. No strong evidence for difference in growth rates of productivity ex ante.	Starters widen TFP gap with never exporters and close gap with ever exporters. Effect pronounced in period after entry.	Stoppers show decrease in TFP, absolute and relative to ever exporters, starter, and never exporters, before and after exit.

Bernard (1995) Mexico (1986-1990)	LP almost 30% (shipments) or more than 50% (value added) greater for exporters. EP 34 % (value added). Growth of LP not significantly different for exporters and non-exporters.		Growth of LP not significantly different for export-starters and non-exporters.	Growth of LP not significantly different for export stoppers and-non-exporters.
Clerides, Lach and Tybout (1998) Mexico (1986-1990)	LP higher for exporting firms than for non-exporters, export starters and export stoppers.	LP not higher for export starters than for non-exporters and lower than for exporters.	No suggestion of a learning effect from exporting.	LP shows worst performance compared to other groups.
Clerides, Lach and Tybout (1998) Morocco (1984-1991)	LP higher for exporting firms than for non-exporters.	LP higher for export starters than for non-exporters.	LP improves after starting to export.	LP sinks after stopping to export
Damijan, Polanec and Prasnikar (2004) Slovenia (1994-2002)	Productivity of exporters higher than of non-exporters; firms that export to more markets are on average more labor productive.	Productivity in starters higher than in non-starters in years before starting. Productivity difference higher for firms that start to export to more advanced markets.	No continuous productivity improvement from exporting but short run gains, only from serving advanced, high-wage foreign markets.	Firms ceasing exporting exhibit lower productivity levels than old exporters up to 20%.
De Loecker (2004) Slovenia (1994-2000)	EP about 30% for value added per worker.		For matched firms starting to export raises productivity instantly and also in the years following. Analyses by industry find positive effects for most sectors, but these are significant in about half of them only.	

Delgado, Farinas and Ruano (2002) Spain (1991-1996)	TFP distribution for exporters stochastically dominates the distribution for non-exporters	TFP distribution for export starters stochastically dominates the distribution for non-exporters prior to entry	No evidence of divergence of distribution of TFP growth between new exporters and non-exporters; but post-entry growth greater for young entering exporters compared to young non-exporters.	
Farinas and Martin-Marcos (2003) Spain (1990-1999)	LP and TFP higher for exporters than for non-exporters. EP 17%.	LP ex-ante higher for entering exporters than for continuing non-exporters.	LP of entering exporters significantly higher than LP of non-exporters. Growth of LP and TFP not different between entering exporters and continuing non-exporters.	LP of exiting exporters not different from non-exporters; dito for rate of growth of LP and TFP.
Greenaway, Gullstrand and Kneller (2003) Sweden (1980-1997)	LP higher for exporters than for non-exporters; TFP lower for exporters, but around 10% higher after controlling for industry fixed effects.	TFP lower for starters in the year of entry than for never-exporters.	For matched firms first time entry into export markets is not associated with faster TFP growth compared to non-exporters.	
Hansson and Lundin (2004) Sweden (1990-1999)	Productivity higher for exporters than for non-exporters: EP 6.3% for TFP.	LP and TFP higher for future starters two years before entry, but lower (not significant) three years before. Differences in growth of TFP and LP not significant.	No significant differences in TFP growth between various export groups and non-exporters. Starters' LP growth higher than non-exporters'.	

Aw / Hwang (1995) Taiwan (1986)	LP 36% greater for export-oriented than domestic-market-oriented firms in electronics industry; differences vary between products examined.			
Aw, Chen and Roberts (1997) Taiwan (1981 – 1991)	Higher total factor productivity for exporting firms relative to non-exporters from 11% in basic metals to 24% in textiles.	Firms that eventually entered the export market were more productive than their non-entering counterparts in the years prior to their entry.	There may be some productivity improvement associated with have higher exporting.	Firms exiting the export market have higher productivity than non-exporters.
Liu, Tsou and Hammitt (1999) Taiwan (1989-1993)	LP higher for exporters than non-exporters in electronics industry. EP about 15%, and increasing with export share. LP growth not different for exporters and non-exporters.	Pre-entry growth ca. 8% - 12% higher in future starters.	Growth of LP substantially higher for export starters than for non-exporters (6.9% – 8.7%).	Growth of LP slower in export-stoppers than in non-exporters, but coefficients not significant.
Aw, Chung and Roberts (2000) Taiwan (1981 – 1991)	Total factor productivity (TFP) between 11.8% and 27.6% higher for exporters than non-exporters in five industries. TFP growth in three industries not different for exporters and non-exporters, lower in two industries.	Entrants have higher TFP prior to entry than non-exporters. Initial difference widens after entry in three industries.	Entrants are 13.3% to 18.9% more productive than non-exporters.	Exiting plants have average TFP levels 4.4% to 10.3% higher than non-exporters. Plants that exit fall further behind exporting plants in the years following exit (significant in three industries).
Tsou, Liu and Hammitt (2002) Taiwan (1986 – 1996)	Growth of LP significantly higher for plants that export across all three census periods compared to non-exporters, but result sensitive to cyclical patterns: little difference in downturn; exporters outperform non-exporters in upturn period.		Growth of TFP substantially higher for export starters than for non-exporters.	Growth of TFP not different between stoppers and non-exporters.

Yasar, Nelson and Rejesus (2003) Turkey (1990-1996)	EP around 19% (OLS regression). EP vary significantly from 9% to 21% from lower quantile to higher quantile (quantile regression).		Productivity about 23% higher for entrants compared to non-exporters (OLS). Difference varies from 11% to 21% between lowest and highest quantile (quantile regression).	Productivity about 17% higher in stoppers compared to non-exporters (OLS). Difference varies from 7% to 21% between lowest and highest quantile.
Girma, Greenaway and Kneller (2003) UK (1991-1997)				For matched firm exit has negative albeit weak effect on TFP in the year of exit; no effect detected for later years.
Girma, Greenaway and Kneller (2004) UK (1988-1999)	Productivity higher for exporters than for non-exporters.	Entrants more productive before entry than non-entrants.	For matched firms: On entry year, exporters experience TFP growth rate about 1.6 percentage points higher than non-starters. TFP continues to grow by an extra percentage point in the following year. Increase in share of exports raises rate at which TFP grows after entry.	
Greenaway and Kneller (2003) UK (1989-2002)	Productivity of exporters 5.4% above industry mean, of non-exporters 4.6% below the mean.		For matched firms entry is associated with significant increase in LP. No robust evidence of productivity effects beyond the first few years for all firms, but for firms more exposed to export markets.	
Greenaway and Kneller (2004a)	LP 2.2%, TFP 9.7% higher for for exporters compared to non-Exporters; EP 11.4% for LP and 8.3% for TFP.	Past TFP positive effect on entry. Past productivity growth of future entrants higher compared to non-entrants.	For unmatched firms, TFP growth faster in years of and after entry than for continuing non-exporters. For matched firms differences are lower and only significant in entry year.	

Greenaway and Kneller (2004b) UK (1990-1998)		Ceteris paribus the probability of export entry is increasing in the level of FTP.	For matched firms productivity growth in new export firms is on average 2.9% faster than in non-export firms. Effect is consistently lower in industries in which existing exposure to foreign firms is greater.	
Greenaway and Yu (2004) UK (Chemical Industry) (1989-1999)	Exporters more productive than non-exporters; EP 10.4% (output per worker) and 9.1% (TFP).	Higher TFP leads to higher exporting probability.	Learning-by-exporting effect strongest among new entrants, weaker for firms with more past export experience and negative for established exporters.	
Bernard / Jensen (1995) U. S. (1976 – 1987)	LP approx. a third greater for exporters across all plant sizes. EP about 15%.			
Jensen / Musick (1996) U. S. (1987 – 1992)	EP 13% in 1987 and 14 % in 1992 Growth of LP not significantly different for exporters and non-exporters.		Growth of LP not significantly different for export-starters and non-exporters.	Growth of LP not significantly different for export-stoppers and non-exporters.
Bernard / Jensen (1999) U. S. (1984 – 1992)	EP ca. 20% (1984), ca. 16% (1987), ca. 18% (1992). Short run: Higher growth rate of LP in exporters than in non-exporters; long run: no difference.	Pre-entry premia 7% - 8%. Pre-entry growth in future starters generally not statistically signif. different compared to non-starters.	Growth of LP significantly higher for export starters than non-exporters in the short, medium and long run.	Growth of LP significantly lower in export stoppers than in non-exporters in the short, medium and long run.
Bernard / Jensen (2004a) U.S. (1983-1992)	Plants that always export 8%-9% more productive than plants that never export. Exporters have 0.72% lower productivity growth rates per year than similar plants producing solely for domestic market.	Two years before starting entrants have productivity levels significantly above continuing non-exporters, but significantly below continuing exporters.	In the year that they enter starters have significantly faster productivity growth rates than other firms.	Plants that exit the export market have productivity growth rates 0.2%-0.9% lower than continuing non-exporters.

Bernard and Jensen (2004b) U.S. (1984-1992)		More productive plants have higher probability of starting to export, but controlling for plant fixed effects soaks the effect. Productivity effect is even negative (though insignificant) in GMM-first difference specification.			
Bigsten et al. (2000) Cameroon (1992-1995) Ghana (1991-1993) Kenya (1992-1994) Zimbabwe (1992-1994)	Exporters exhibit higher average efficiency levels than non-exporters.	Initial exporters tend to exhibit significantly higher levels of efficiency than other firms.	first year	Exporting in one period raises efficiency in the next period; the of exporting raises efficiency by 14%.	
Hallward-Driemeier, Iarossi and Sokoloff (2002) Indonesia, Korea, Malaysia, Phillipines, Thailand (1996-1998)	TFP larger for exporters than non-exporters; gap is larger the less developed is the local market. Firms that export from the beginning have higher levels of TFP years later, due to different firm policy (investment in fixed and human capital etc.).				
Van Biesebroeck (2003) Nine sub-Saharan African countries (1992-1996)	EP for LP about 50%. Growth of LP higher for exporters than for non-exporters.	LP higher for export starters than for non-exporters prior to entry.	exporters.	LP not different between newly entered and continuous exporters, but higher compared to non-exporting firms.	LP lower in export-stoppers than in continuous exporters, but higher than in non-
Mengistae and Pattillo (2004) Three sub-Saharan African countries (1992-1995)	TFP 17.4% higher on average, 18.6% for Kenya. Difference higher for direct exporters, insignificant for indirect exporters. TFP growth on average 10% higher for exporters. Difference again higher for direct exporters, insign. for indirect exporters.				

Note: Studies are listed in alphabetical order for the countries covered and chronologically for each country (using the most recent version of the study). Studies covering up to three countries are listed separately for each country (if information on each country is available); multi-country studies covering more than three countries are listed at the end of the table.

LP = labour productivity (total value of shipments per worker or value-added per worker.

TFP = Total factor productivity, usually calculated as the residual from an estimated Cobb-Douglas-type production function.

EP = exporter premia: cet. par. percentage difference of LP between exporters and non-exporters , usually based on OLS regressions controlling for industries, regions, firm size (no. of employees) and year.