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Learning-by-Exporting Revisited

– the role of intensity and persistence

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Abstract

Two not mutually exclusive hypotheses can explain the empirically established export premium: self-selection of more productive firms into export markets and learning-by-exporting. We reassess the learning-by-exporting hypothesis and maintain that the scope for learning is related to the persistence and the intensity of a firm's exporting activity. Using a rich panel of Swedish manufacturing firms, we show that there is a causality going from exports to productivity only for persistent exporters with high export-intensity. No such relationship is found for either temporary exporters or persistent exporters with low export-intensity. Learning-by-exporting in the form of a causality going from exports to productivity only pertains to firms that persistently export a large fraction of their sales on a global scale. Results are robust to the inclusion of several firm characteristics such as imports, physical capital, firm size, skilled labour, capital structure, corporate ownership structure, and industry classification.

Keywords: export productivity premium, learning-by-exporting, productivity dynamics, panel data, dynamic models, temporary and persistent exporters

JEL: C16, F14, L25, O33

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1. INTRODUCTION

This paper studies the relationship between firms' exports and productivity and presents comprehensive evidence of 'learning-by-exporting'. It focuses on the temporal dimension of firms' exporting activities and the scope for learning effects.

The analysis is based on the assumption that learning-by-exporting are primarily to be found among persistent exporters who repeatedly export a large fraction of their sales. These are the firms that export on a global scale and are exposed to a variety of customers and competitors, and are the type of firms most likely to be able to identify best-practice technologies and business processes. Strong learning from exports effects that influence a firm's productivity are unlikely to take place when exporting is a temporary activity and of minor importance for the firm's sales. For example, the average number of exporting destinations among persistent exporters with at least 50 percent of exports in total sales amounts to about 30. The corresponding figure for persistent exporters with low exporting intensity and temporary exporters is 9 and 1, respectively.

In the paper, we exploit a rich panel of about 5,000 annual observations on Swedish manufacturing firms over a period of eight years. Nearly nine out of ten firms are exporters, and a large heterogeneity is shown among the group of exporting firms regarding key firm characteristics as well as exporting status. By estimating a dynamic panel model with a GMM system two-step estimator, we find robust results suggesting that there is a causality going from exports to productivity for persistent exporters with high export-intensity, but not for other types of exporters. No such relationship is found for either temporary exporters or persistent exporters with low export-intensity.

Bernard and Jensen (1999) is one of the few previous studies that come close to this paper. They discriminate between temporary and persistent exporters but do not consider the intensity of exports. Using US plant-level data Bernard and Jensen report no differences in productivity growth between exporters and non-exporters overall. With regard to temporary versus persistent exporters they find that the latter have slightly higher productivity growth but not significantly different from zero. In comparison to Bernard and Jensen (1999), our analysis is based on a more extensive data set which allows us to control for factors such as import intensity, knowledge intensity, corporate ownership structure and local milieu. Moreover, our econometric analysis takes into account both endogeneity and heterogeneity issues which can potentially have a severe impact on the results.

Section 2 provides a background discussion on learning-by-exporting and the basic hypothesis for the present study. Section 3 presents data and descriptive statistics. The general model, model specification and estimation methodology are presented in Section 4. The regression results are displayed and discussed in Section 5. The final section concludes.

2. MOTIVATION AND HYPOTHESIS

There is a general agreement in the literature that exporters are more productive than non-exporters. Two different and not mutually exclusive explanations has been advanced in the literature (see for instance Clerides et al. 1998, Bernard and Jensen 1999). The first is that the more productive firms self-select into an exporting status because they are in a better position to recover sunk costs of entry. The second is 'learning-by-exporting'. Several theoretical rationales for such an effect have been proposed. Exporting firms may for example acquire knowledge and technology by being active on foreign markets, such that exports have positive effects on firms' knowledge and technology accumulation. Presence in foreign markets can also stimulate innovation activity in a firm by raising returns to innovation (cf. Holmes and Schmitz 2001). Moreover, if export markets are more competitive than the domestic ones, exporting can imply the reduction of X-inefficiency and stimulate the renewal of development and production processes (Greenaway and Kneller 2007a). While the evidence for self-selection is strong, it is at best weak for the learning hypothesis (Bernard et al. 2007, Arnold and Hussinger 2005).[1]

One reason why the current literature typically reports weak evidence for learning-by-exporting could be attributed to the design of the empirical analyses. The standard approach for investigating the relationship between exports and productivity growth effects involves analyses of the post- and pre-entry performance of firms (Wagner 2007).

The learning-by-exporting hypothesis is often analyzed by comparing the productivity growth of export starters, defined as firms reporting no exports in a period t but positive exports in a period $t+\tau$, with non-exporters. The argument is that learning should manifest itself in such a way that the productivity growth is higher for export starters than for non-exporters.

Several issues are associated with this type of empirical strategy in the context of testing a learning effect. Conceptually, learning evolves over time as experience is accumulated.[2] The potential for learning from an activity is in this view linked to the persistence of the activity. By persistently performing an activity over time an increasing amount of experience is accumulated and the firm can learn how to organize and manage the activity in an effective

[1] Castellani (2002), Castellani and Zanfei (2003), Criscuolo et al. (2004), Hansson and Lundin (2004), Greenaway and Kneller (2007b) are example of studies which find support for a learning effect. Damijan et al. (2008) find that exporting lead to productivity improvements, by influencing process innovations.

[2] Arrow (1962), for instance, conceptualized learning-by-doing partly in view of empirical observations of productivity growth and learning curves associated with the production of airplane bodies over long time periods. He also discussed briefly the famous "Horndal effect" described by Lundberg (1961). The productivity growth of the Horndal iron works in Sweden amounted to almost 2 % per year in the absence of investments.

manner. Such a perspective is an essential part of evolutionary economics, in which the accumulated knowledge in a firm is generally regarded as consisting of two parts: (i) technology and (ii) routines for production and development activities (cf. Nelson and Winter 1982). Routines reflect a process of cumulative adaptation to the business environment.

The motivations for a learning-by-exporting effect discussed above generally adhere to such effects that likely require persistent exports over longer periods of time to materialize and become significant in the sense of influencing a firm's productivity. Knowledge and information flows from e.g. foreign customers and competitors as well as development of better business processes (reduction of X-inefficiencies) are certainly expected to require persistence in exporting activity to be identified and implemented. Thus, we would expect substantial time lags before post-entry effects on productivity show up.[3] This implies a general difficulty for researchers applying the standard method since most analyses are based on relatively short periods of time, normally 8-10 years. Bernard and Jensen (1999), for instance, define the long-run as the period 1984-1992.

The emphasis on persistent exports also raises questions about the *a priori* assumption of a learning effect among firms defined as export starters based on observations of how their exporting status changes between a given pair of years. Bernard and Jensen (1999) demonstrate with US plant-level data that more than 10 percent of the plants switch status each year. In the present paper, a similar finding is reported. Nearly 30 percent of the Swedish firms in the sample are temporary exporters that switch status from year to year. Most studies, however, do not make a distinction between temporary and persistent exporters.

Based on the argument of the role of persistence, it is theoretically questionable to classify temporary exporters as export starters when testing for learning effects. By simply comparing the exporting status between pairs of years, firms that only export occasionally will be classified as export starters. However, for these firms that may stop exporting after a while, we do not expect to find an effect on productivity going from exports to productivity. In our empirical analysis we discriminate between non-exporters, temporary exporters and persistent exporters by studying the exporting status of firms over a period of eight years.

Furthermore, ample evidence suggests that the internationalization of firms is a slow and gradual process. Models of internationalization in the management and marketing literature emphasize how firms develop with respect to the geographical market served and their product adjustments (see e.g. Knudsen and Madsen 2002, Andersen 1993). Case studies and other types of analyses in this vein typically find that firms start to export to nearby and more familiar countries and gradually expand their exporting activities on a more global scale.[4]

[3] Isgut (2001) find results that point in this direction. He finds that export starters have somewhat higher productivity growth than non-exporters when expanding the time horizon to 5 years after entry.
[4] In a Swedish context, for instance, familiar and nearby markets would comprise the Nordic countries.

During the internationalization process, the firm progressively learns how to organize production processes, adjust products etc. to be competitive in international markets.[5]

The slow and gradual process of firms getting established in the global market is another pertinent aspect for the analysis of learning effects, particularly when learning effects are likely to be of such magnitude that they can influence a firm's productivity. According to the internationalization models in the management and marketing literature the early stages of the internationalization process should be characterized by low export-intensity and concentration of exports to a few familiar and nearby markets. Even though the firm might export persistently at this stage, the scope for learning effects in terms of knowledge and information flows and exposure to best-practice business processes and technology are likely to be limited. Rather, it is in the later stages of the process, when the firm exports on a global scale and is exposed to a variety of customers and competitors, that the learning effect is most likely to occur. Based on these arguments we formulate the basic hypothesis in this paper as follows:

> **Hypothesis:** Learning-by-exporting, manifested by a causality going from exports to productivity, depends on the persistence and the intensity of the exporting activity. Exports will only have a positive effect on productivity among firms that persistently export a significant share of their sales. The scope for strong learning effects is highest for firms of this category.

We emphasize that a learning effect among persistent exporters with high exporting intensity is not at odds with self-selection. On the contrary, productivity thresholds associated with export initiation and expansion combined with heterogeneity across firms is likely to be an important explanation of why not all firms make it to the point where learning effects are strong. Only firms that have a competitive advantage, due to superior product attributes, R&D strategy, technology or other reasons, are likely to be able to reach a position as a persistent exporter with high export-intensity. A learning effect among the firms on the top of the exporting hierarchy can explain why these firms tend to retain a productivity advantage. It also suggests one reason for why firms that once achieved a leading position in an industry tend to remain in that position. Persistence in within-industry productivity leadership across firms is for example a well-documented phenomenon (see. e.g. Cantwell and Andersen 1996).

[5] This view resembles the idea that exports can reduce X-inefficiency.

3. DATA AND DESCRIPTIVE STATISTICS

3.1 Data

The data source used is this study covers the period 1997-2004. The initial data set consists of about 130 000 observations on all manufacturing firms in Sweden with one or more employees. In order to construct an appropriate data set for the purpose of the study, the following censoring strategy has been applied: First we restrict the data to firms that could be observed all eight years. This was necessary in order to discriminate between temporary and persistent exporters. We then imposed a censoring level on 10 employees for each individual year in order to guarantee the quality on the export and trade data. This implies that a firm is not observed in a particular year if it has at that time less than 10 employees, which results in a slightly unbalanced sample. The resulting panel has 38,929 observations.

By studying the firms' exporting status over the whole period, we distinguish between four different types of firms: no exports (*ne*), temporary exports (*te*), persistent exports with an exports to sales ratio less than 50 percent (*pe*) and persistent exports with an exports fraction equal to or more than 50 percent, (*pe_e*). Temporary exporters are firms that export occasionally during the period, whereas persistent exporters are firms that export continuously during the whole period studied.

3.2 Descriptive statistics

The upper part of Table 1 reports that 14 percent of the manufacturing firms in Sweden with 10 or more employees supplied only the domestic market during the period 1997-2004. Nearly 30 percent of the firms were occasional exporters. The majority of the firms, 57 percent, were persistent exporters over the eight-year period. However, a large fraction of the firms (42 percent) exported less than 50 percent of its production while the remaining 15 percent are persistent exporters that mainly focus on the foreign market.

The lower part of Table 1 reports that the median firm has 23 ordinary employees and 1 employee with a university education of three years or more. In the following we label the latter as "skilled employees." Since the mean values for ordinary and skilled labour are 85 and 11, respectively, we conclude that the distribution of firms is skewed with many small firms and few large firms. Our additional economic variables are those commonly used in the literature that we are referring to in the present study. Apart from the key variable of labour productivity, they include physical capital, measured as investments in machinery and equipment and imports as a measurement on knowledge spillovers across the border. All

variables are expressed in logarithm and labour productivity is value added per employee. We also control for the financial situation of the firm with information on the capital structure.

Table 2 presents the distribution of firm characteristics after the exporting classification. Panel A shows that, on average, exporting firms are more productive than firms serving only domestic markets. Moreover, on average, persistent exporters are more productive than temporary exporters, and persistent exporters with high export-intensity are more productive than other firms.

Over the eight-year period investigated, the typical temporary exporter sells two export products to one single destination country and the export income accounts for about 3 percent of the sales income. Persistent exporters are distinguished from other firms in several respects. A notable difference can also be found between the two categories of persistent exporters. While the export-to-sales ratio is 17 percent for less export-intensive firms, it is 70 percent for the typical export-intensive firm. The descriptive statistics also report that the 15 percent highly import-intensive firms have higher labour productivity, more employees, larger fraction of skilled employees and higher import-intensity than all other firms including persistent exporters that export less than 50 percent of their sales. Moreover, persistent exporters with high export-intensity are also less leveraged than other firms.

Table 3 informs that temporary exporters typically serve the Scandinavian market. 60 percent of exports goes to the neighbouring countries. Interestingly, Panel B shows that this figure is high also for less export-intensive, but persistent exporters; 57 percent. The second group of persistent firms (*pe_e*) has a high presence on all five markets considered and their main focus is the G7 countries.

Panel C shows that non-exporters are typically from among the so called labour intensive and resource intensive firms. About two out of three of temporary exporters and persistent but less intensive exporters are labour or scale intensive. Four out of ten (*pe_e*) firms are specialized on differentiated products or high tech products.

Table 4 reports pair wise correlations for Swedish manufacturing firms. A close association can be found between labour productivity on the one hand, and imports, exports and capital-investment and skilled labour on the other signaling possible endogeneity problems. Moreover, while the correlation coefficient is 0.23 for persistent-I firms, it is close to zero or negative for firms with another exporting status.

3.3 Variables

The objective of this study is to analyze the relationship between exporting and productivity among firms with differences in their exporting performance status. We will now introduce

our key control variables. The first is *physical capital*, defined as annual investments in machinery and equipment (*K*). Next, we consider *imports (M)*. Typically, analyses on exports and productivity do not include a firm's importing activity. The correlation matrix (Table 4) shows that the correlation coefficient between exports and imports is very high, 0.72. This informs us that export-intensive firms have high import-intensity and the literature has shown difficulties in identifying their separate effect on productivity (see e.g. Andersson, Lööf and Johansson 2008). However, since we don't consider exports explicitly, only exporting status, imports is a necessary control-variable in order to identify how foreign markets affect productivity via a particular exporting strategy.

In the regression, we split labour into *ordinary labour* (*L*) and *knowledge-intense labour* (*H*), where the latter is assumed to be associated with a firm's R&D efforts. The *(H)* –variable is defined as employees with at least 3 years of university education. An issue related to this separation is how labour productivity should be measured. There are two options. The standard measure is total value added over total employment. The second is based on arguments put forward in Griliches and Mairesse (1984), and it considers the results of R&D efforts as an input to the basic production process, which implies that the return to R&D is reflected by its effect on the productivity of ordinary labour, i.e., its effect on $q = Q / L$. This approach considers the distinction between the production of knowledge and the returns to its use (Geroski, Machin and van Reenen, 1993), where the latter aspect is reflected by the impact of knowledge on *q*. Of course, at each point in time *(H)* reflects the capacity to expand future knowledge. The size of *(H)* will also reflect the knowledge stock of a firm and its capacity to absorb external knowledge, in particular for firms serving an international market.

Our final explanatory variable is capital structure (CS*)*, which is supposed to capture the financial situation of the firm. We define (*CS)* as total debt over total debt and equity. Thus, the higher the capital structure, the more indebted the firm. Moreover, it can be assumed that higher interest expenditures due to increased leverage, will leave less room for investment expenditures. In this case the contemporaneous effect on productivity will be negative. Table 3 (panel B) reports that firms with a persistent exporter's status serving the global market are less leveraged than other firms. In correspondence to the import variable, we assume that not controlling for capital structure will result in an upward bias of the coefficient for persistent and ambitious exporting status.

In order to test the robustness of a basic specification of the production function we will investigate the importance of two alternative control variables. The first is corporate ownership structure and the other is the local environment. Our hypothesis is that multinational firms and firms located in metropolitan areas are more productive than other

firms and controlling for this fact will reduce the explanatory power of the exporting status variables.

4. EMPIRICAL MODEL AND ESTIMATION STRATEGY

4.1 Model

We estimate a two-step system GMM model from an eight year panel. Our panel is unbalanced, with some firms having more observations than others. The general model is a standard Cobb-Douglas production function, which can be expressed as:

$$Q_{it} = K_{it}^{\beta_K} L_{it}^{\beta_L} H_{it}^{\beta_H} e_{it} \tag{1}$$

where the subscript $i=1,2,\ldots N$ refers to a cross-sectional unit, subscript $t=1,2\ldots,T$ refers to a point in time, Q_{it} is the value added of firm i at time t , K_{it} is the capital input, L_{it} is the ordinary labour input, H_{it} is skilled labour and e_{it} represents idiosyncratic shocks.

By dividing Q with ordinary labour, our preferred productivity measure, we can express (1) as a labour productivity function:

$$q_{it} \equiv \frac{Q_{it}}{L_{it}} = K_{it}^{\beta_K} L_{it}^{(\beta_L - 1)} H_{it}^{\beta_H} e_{it} \tag{2}$$

Taking natural logs on both sides transform the equation (2) to:

$$\ln q_{it} = \beta_K \ln K_{it} + (\beta_L - 1) \ln L_{it} + \beta_H \ln H_{it} + \ln e_{it} \tag{3}$$

In a simplified notification, equation (3) can be reformulated as follows:

$$\tilde{q}_{it} = \beta_K \tilde{K}_{it} + (\beta_L - 1) \tilde{L}_{it} + \beta_H \tilde{H}_{it} + \tilde{e}_{it} \tag{4}$$

$$\tilde{e}_{it} = \eta_i + \nu_{it} + u_{it}$$

$$\nu_{it} = \sum_{n=1}^{\bar{n}} \psi_{t-n} \nu_{i,t-n} + e_{it} \qquad |\psi_{t-n}| < 1 \qquad n = 1,\ldots,\bar{n}$$

where tilde (~) denotes the natural logarithm of a variable, the error term now consists of three variables: η_i is an unobserved firm-specific time-invariant effect which allows for

heterogeneity in the means of q_{it} series across firms, ν_{it} is a possible autoregressive technologically chock and u_{it} reflects serially uncorrelated measurement errors.

4.3 Methodology

Since increased productivity is associated with adjustments costs and other inertia factors, it can be expected that output is delayed in time by a process of adjustment of factors such as capital, labour and knowledge. Contemporaneous productivity of a firm is also closely related its productivity in previous periods. Both kinds of arguments motivate a lag structure of the model. Let us therefore consider equation (4) as a dynamic model specified with the variables presented in section 3 in a time-series cross-section context (*t* refers to a point in time and *i* refers to a cross sectional observation):

$$\tilde{q}_{it} = \alpha\tilde{q}_{i,t-n} + \sum_{n=0}^{\bar{n}} \beta_{K,t-n}\tilde{K}_{i,t-n} + \sum_{n=0}^{\bar{n}} (\beta_{Ln} - 1)\tilde{L}_{i,t-n} + \sum_{n=0}^{\bar{n}} \beta_{L,t-n}\tilde{L}_{i,t-n} \sum_{n=0}^{\bar{n}} \beta_{H,t-n}\tilde{H}_{i,t-n} \quad (5)$$

$$+ \sum_{n=0}^{\bar{n}} \beta_{M,t-n}\tilde{M}_{i,t-n} + \sum_{n=0}^{\bar{n}} \beta_{CS,t-n}CS_{i,t-n} + STRAT'\phi + YEAR'\varphi + IND'\gamma + \eta_i + \nu_{it} + u_{it}$$

where and *K*, *L* and *H* are as defined above, *M* is import value and CS_{it} is capital structure, *STRAT* is a vector with the four different export status – or export strategy - dummy variables, *YEAR* is a vector with eight year dummies and *IND* is a vector with 13 industry dummies. Of the error components, ηi, is an unobserved time-invariant firm specific effect and ν_{it} is autoregressive shock and u_{it} measurement errors.

Since $q_{i,t-n}$ is endogenous to the fixed effects in the error term (and omitted variables as well), equation (6) faces an endogeneity problem; productivity is determined simultaneously with the explanatory variables. The general methodology to handle simultaneity bias is some instrumental variables approach. Building on Holz-Eakin, Newey and Rosen (1988), Arelleano and Bond (1991) suggested an estimator that has become widely popular in a situation characterized by: (i) "small T, large N" panels; (ii) a linear functional relationship; (iii) a left hand side variable explained by its own lagged values; (iv) some regressors may be endogenous; (v) fixed individual effects; and (vi) heteroskedasticity and autocorrelation within individuals, but the idiosyncratic disturbances are uncorrelated across firms.

The Arellano-Bond estimator uses Generalized Method of Moments (Hansen 1982) and the so called "difference" GMM. The basic idea of this approach is to write the regression equation as a dynamic panel data model, take the first-difference to remove unobservable and time-invariant firm-specific effects, and then instrument the right-hand-side variables in the

first-differenced equations using levels of the series lagged two periods or more, under the assumption that the time-varying disturbances in the original level equations are not serially correlated.

By assuming that the first differences of instrumenting variables are uncorrelated with the fixed effects, Arellano-Bover(1995)/Blundell-Bond(1998) augment the original Arellano-Bond estimator. This allows for more instruments in the model which can dramatically improve the efficiency.

The Arellano-Bover/Blundell-Bond estimator allows for two different transformations of the original model-specification. One is the first difference transformation ("difference GMM"). Applying first difference to (5), however, implies that the time-invariant variable describing a firm's long-rum export status is gone . The same will happen with our year and industry dummies. Another problem with the difference transformation is that the lagged dependent variable still is endogenous since the $q_{i,t-1}$.term in $\Delta q_{i,t-1} = q_{i,t-1} - q_{i,t-2}$ correlates with $\nu_{i,t-1}$ in $\Delta\nu_{i,t-1} = \nu_{i,t-1} - \nu_{i,t-2}$ Likewise, any predetermined right-hand side variable in x that are not strictly exogenous become potentially endogenous because they too may be related to $\nu_{i,t-1}$. Moreover, the first-differences have tone additional disadvantages in the present study. First, since we have a slightly unbalanced panel, it will magnify the gaps. When some observations on q_{it} are missing, then both Δq_{it} and $\Delta q_{i,t+1}$ are missing in the transformed data.

An attractive alternative to the difference transformation is forward orthogonal transformation which will preserve time-invariant regressors in the estimation process. The basic idea with this methodology is that, instead of subtracting the previous observations from the present one, it subtracts the average of all future observations of a variable. This version of the estimator builds a system of two equations – the original equation as well as the transformed one – and is known as "system GMM". Moreover, the two-step version of can make the Windmeijer (2005) finite-sample correction to the reported standard errors in two-sample estimation, without which these standard errors tend to be severely downward biased, and it allows finer control over the instrument matrix

As a first check of the validity of our employed system GMM estimator we will compare the point estimate of the lagged dependent variable with the results from Least squares (OLS) estimator and Within Groups estimator. Both these estimators are likely to be biased and in opposite directions. Bond (2002), suggest that a candidate consistent estimator can be expected to lie between the OLS and between groups estimate.

5. RESULTS

5.1 Basic model

We now consider the results of applying a two-step GMM estimator to the estimation of expected relationship between the different types of exporters and labour productivity with an autoregressive distributed lag model. We use panels on Swedish manufacturing observed over the period 1997-2004. Our results for the basic specification of equation (1) are reported in Table 5. The dependent variable lp_{it}, is log value added per ordinary employee of firm *i* at time *t*.

Our main interest is on the coefficient estimate of the exporting status variables: firms that export persistently and mainly serve foreign markets, firms exporting persistently, but mainly serving the domestic market, temporary exporters and non exporters. The covariates are physical investments, imports, ordinary labour, skilled labour, and capital structure. In order to control for industry or time specific shocks industry dummies and year dummies are included in the model.

The first two columns of Table 5 report the results using OLS levels and Within group estimators respectively. The literature (Hsiao 1986 and others) suggests the OLS-estimate of the autoregressive parameter α (the impact of lagged labour productivity on the current productivity) will be biased upwards in the presence of individual-specific effects. Moreover, the Within Groups is supposed to give an estimate of the lagged dependent variable that is downward biased since the panels are short (Nickell 1981). Nerlove (1999), Bond et al (2001) and Roodman (2006) suggest that the consistent estimate of the lagged dependent variable can be expected to lie in the interval between the OLS and Within estimates. Table 5 reports that the endpoints of this interval are 0.62 and 0.10.

Columns 3-5 report the GMM-estimates with different lag structures. By treating all five covariates: physical investments and capital structure, ordinary labour and skilled labour as potentially endogenous variables, together with the lagged labour productivity, these estimates allows for the possibility of serially uncorrelated measurement error in either of these explanatory variables. All three GMM-results in columns 3-5 indicate a close association between labour productivity and persistent and intensive exports in terms of exports as a fraction of sales. We are now interested in the validity of these estimates.

The table reports that our three GMM-estimates all lie above the Within-Group estimate and below the OLS estimate. Thus, we regard this information as a signal that bias due to weak instruments is not present in the GMM-regressions. Neither the Hansen test of over identification, nor the test for autoregressive validity indicates any problem with our specification. However, the difference-in Sargan test of exogeneity on instrument subsets, which focuses on additional instruments used in the system GMM estimators suggests a

problem with the instrument validity for the GMM-estimates with one or two lagged period, respectively (reported in columns 3 and 4). In the final column of Table 5, we specify the model to be lagged up to three periods. In this case the Difference Sargan test does not indicate any serious problems with the validity of the instrumental variables. We therefore concluded that the basic model with three years lag structure is our preferred model.

The GMM-estimates presented in Table 5 indicate that being a persistent and intensive exporter has a positive and highly significant effect on the level of labour productivity, even after controlling for the productivity of previous years, unobserved firm-specific effects and allowing for potential endogeneity of imports, physical investment, leverage, employment and skill. The reference group is non-exporting firms. The coefficient estimate for the two other groups of exporters – temporary exporters and less export-intensive persistent exporters– which accounts for 80 percent of all exporting firms in Swedish manufacturing is not significantly different from the reference group.

The estimated effects of the lagged dependent variable and the additional covariates are reasonable and agree with what one would expect. The size of lagged productivity is 0.44 and consistent with the literature that suggests that productivity differences between firms are highly persistent. As could be expected, column 5 also reports that the contemporaneous marginal effect of physical capital and imports as a proxy for global knowledge spillovers is positive and highly significant. The capital variable is partly capturing a firm size effect on productivity and is influencing the explanatory power of ordinary labour, which also is a size variable in the model. As could be expected due to the specification of the model, the estimated sign of ordinary labour is negative. In contrast, the coefficient estimate for skilled labour is positively related to labour productivity. Finally, we see that a contemporaneously increased leverage is strongly and negatively related to productivity, suggesting that raising debts in order to finance new investments has an instantaneously negative impact on productivity. However, when lagging one period, the effect is the opposite indicating that the investments contribute to increased value added.

5.2 Robustness check

We now proceed to a robustness test of the main results for the preferred lag-structure of the SYS GMM estimator. See Table 6. The first part of the sensitivity test explores the effect of removing and adding alternative covariates. In the two final robustness checks, labour productivity is defined in the traditional manner and the sample is limited to only small firms, respectively.

The motivation for including imports in the production function is to control for the fact that import-intensity is highly correlated with export-intensity. Thus, persistent exporters are

more dependent on knowledge associated with imported goods and services than other firms. Moreover, persistent highly export-intensive firm have a larger import-to sales ration than other firms. Without the import-variable, we therefore assume that the status indicators will be upward biased. This is also confirmed by the results presented in Column 1. The coefficient estimates for all three categories of exporters are significant, although only at 10 percent for temporary exporters. Removing the capita structure variable has only a neglected impact on the size of the variables of interest. However, the degree of significance of estimated relationship between the highly export-intensive firms and productivity goes from 1 percent level to 5 percent level. See column 2.

The descriptive statistics presented in Table 2 showed that non-exporters, temporary exporters and less export-intensive persistent exporters are mainly non-affiliate firms, or firms belonging to a group with only domestic affiliates, while the typical persistent exporter with high export-intensity is a multinational firm. Column 3 considers the corporate ownership structure and reports that domestically and foreign owned MNEs are more productive than other firms ceteris paribus. When we control for ownership, the explanatory power of the exporting variables is somewhat reduced. Though, the main message does not change: export is not enough for a firm's productivity performance. The critical issue is to be established on a global market and serve many markets persistently.

Recent literature has convincingly shown the importance of local environment on firm performance. Using cross-sectional Community Innovation survey data, Johansson and Lööf (2008) find that the Swedish economy has a "Stockholm-effect". Stockholm is the only functional region proper in Sweden and every thing else equal firms in Stockholm are more productive than in the rest of Sweden. This finding is confirmed in column 5 which compares Stockholm with Goteborg, Malmo and rest of Sweden. Taking the local environment into account reduces the explanatory power of a persistent exporter status.

When specifying the variables in our production function, labour productivity is defined as value added over ordinary labour. The assumption is that knowledge intensive labour can be associated with a firm's R&D efforts and should not be included in the labour productivity measure. Column 6 reports results when the preferred model is re-estimated with a traditional labour productivity measure. The general pattern remains; persistent exporters serving the global market are distinguished from other manufacturing firms in Sweden regarding the estimated correlation with productivity. It should be noted, however, that the coefficient estimate for this export status is significant at the 5 percent level when we use the traditional labour productivity measure and at 1 percent otherwise.

Finally, the preferred model is applied on a sub sample consisting only of firms with 10-25 employees. Column 7 reports that the estimates for temporary exporters and less export intensive persistent exporters are not significantly different from non-exporters. There is,

however, a weakly significant and positive estimate also for small firms that export persistently and mainly focus on domestic markets.

6. SUMMARY AND CONCLUSION

Learning-by-exporting has been advanced as one theoretical explanation for the empirically verified export premium. The rationales for such an effect focus on knowledge and information flows from foreign customers and competitors, incentives for innovation and reduction of X-inefficiency through stimulating the renewal of development and production processes. The empirical literature, however, has frequently rejected the learning effects from exports.

In this we test the hypothesis that learning-by-exporting, manifested by a causality going from exports to productivity, consist of two different parts: persistency in exports over a long period of time and high export-intensity expressed as the ratio of export to sales.

The empirical analysis distinguishes between temporary exporters and persistent exporters with low and high export-intensity. First, the distinction shows that a significant number of firms classified as exporters a given year are temporary exporters. The descriptive statistics also show that the persistence and the intensity of exporting activity are related to the potential for strong learning effects, as hypothesized in the paper. For example, the average number of exporting destinations among persistent exporters with at least 50 percent of exports in total sales amounts to about 30. The corresponding figure for persistent exporters with low export-intensity and temporary exporters is 9 and 1, respectively. In the paper we quantify persistency to eight years of annual exporting activities, and export-intensive firms are those that in average export 50 percent or more of their production over the eight years.

Our argument is that the mechanisms for learning – e.g. exposure to knowledge flows, best-practice business and production processes, etc. – require persistent exporting activities on a more global scale. This perspective raises some questions about analyses which test for learning effects by analyzing the post-entry performance of export starters, especially as a significant fraction of firms that start to export a given year are temporary exporters. Strong learning effects from exporting that influence a firm's productivity are unlikely to take place when exporting is a temporary activity and of minor importance for the firm's sales.

By estimating a dynamic panel model with a GMM system two-step estimator, we find robust results confirming our hypothesis on a causality going from exports to productivity for persistent exporters with high export-intensity, but not for other types of exporters. We find no relationship between exports and productivity for temporary and persistent exporters with low export-intensity. Consistent with our hypothesis, we thus find a causality going from

exports to productivity only among firms that persistently export a large fraction of their sales on a global scale.

We emphasize that a learning effect among persistent exporters with high export-intensity is not at odds with self-selection. On the contrary, productivity thresholds associated with export initiation and expansion combined with heterogeneity across firms is likely to be an important explanation why not all firms make it to the point at which learning effects are strong. Only firms that have a competitive advantage, due for instance to superior product attributes, R&D strategy or technology, are likely to be able to reach a position as a persistent exporter with high export-intensity. A learning effect among the firms in the top of the exporting hierarchy can explain why these firms tend to retain a productivity advantage.

REFERENCES

Andersen, O. (1993). On the Internationalization Process of Firms – a critical analysis. *Journal of International Business Studies*, 24: 209-231.

Andersson, M., Lööf, H., Johansson, S. (2008). Productivity and International Trade – evidence from a small open economy. *Review of World Economics*, 144 (4). Forthcoming.

Arellano. M., Bond, S. (1991). Some test of specification for panel data: Monte Carlo evidence and application to employment equations. *The Review of Economic Studies*, 58: 277-97.

Arelleno, M., Bover, O. (1995). Another Look at Instrumental Variable Estimation of Error Component Models. *Journal of Econometrics*, 68: 29-51.

Arnold, J.M., Hussinger, K. (2005). Export Behavior and Firm Productivity in German Manufacturing: A Firm-Level Analysis, Review of World Economics 141 (2): 219-243.

Arrow, K. (1962). The Economic Implications of Learning-by-Doing. *Review of Economics and Statistics*, 29: 155-173

Bernard, A.B., Bradford Jensen, J. (1999). Exceptional exporter performance; cause, effect, or both? *Journal of International Economics*, 47: 1-25.

Bernard, A.B., Bradford Jensen J., Redding, S.J., Schott, P.K. (2007). Firms in International Trade. *NBER WP series, 13054*.

Blundell RS, Bond S (1998). Initial Conditions and Moment Restrictions in Dynamic Panel data Models. *Journal of Econometrics*, 87: 115-43.

Bond, S., Hoffler, A., Temple, J. (2001). GMM Estimation of empirical Growth Models, College, *University of Oxford in its series Economics Papers 2001-W21*.

Bond, S. (2002). Dynamic Panel Data Models: A Guide to Micro Data methods and practice, *CWP09/02*.

Cantwell, J., Andersen, H.B. (1996). A Statistical Analysis of Corporate Technological Leadership Historically. *Economics of Innovation and New Technology*, 42: 211-234.

Castellani, D. (2002). Export Behavior and Productivity Growth: evidence from Italian manufacturing firms. *Review of World Economics*, 138: 605–628.

Castellani, D., Zanfei, A. (2003). Technology Gaps, Absorptive Capacity and the Impact of Inward Investments on Productivity of European Firms. *Economics of Innovation and New Technology*, 12: 555-576.

Clerides, S., Lach, S., Tybout, J. (1998). Is Learning by Exporting Important: micro-dynamic evidence from Colombia, Mexico and Morocco. *Quarterly Journal of Economics*, 113: 903-947.

Criscuolo, C., Haskel, J., Slaughter, M.J. (2004). Why are Some Firms more Innovative? – knowledge inputs, knowledge stocks and the role of global engagement. Tuck School of Business, Mimeograph.

Geroski, P. Machin, S., Van Renen, J. (1993). The profitability of innovating firms. *RAND Journal of Economics*, 24 (2): 198-211.

Greenaway, D., Kneller, R. (2007a). Firm Heterogeneity, Exporting and Foreign Direct Investment. *Economic Journal*, 117: 134-161.

Greenaway, D., Kneller, R. (2007b). Industry Differences in the Effect of Export Market Entry: learning by exporting? *Review of World Economics*, 143: 416-432.

Griliches, Z., Mairesse, J. (1984). Productivity and R&D at the firm level, in Z. Griliches (ed.), *R&D Patents and Productivity*, Chicago, University of Chicago Press: 339-375.

Hansen, L.P. (1982). Large Sample Properties of generalised method of Moment Estimators. *Econometrica*, 50: 1029-1054.

Hansson, P., Lundin, N. (2004). Export as an Indicator on or Promoter of Successful Swedish Manufactruing Firms in the 1990s. *Review of World Economics*, 140: 415-445.

Holmes, T. J., Schmitz, J. A. (2001). A gain from trade: From unproductive to productive entrepreneurship,' *Journal of Monetary Economics*, 47: 417-446

Holtz-Eakin D, Newey W, Rosen HS (1988). Estimating Vector Autoregressions with Panel Data. *Econometrica*, 56: 1371-95.

Isgut, Alberto E. (2001). What's Different about Exporters? Evidence from Colombian Manufacturing. *Journal of Development Studies*, 37: 57-82.

J.P. Damijan, Kostevc, C. and Polanec, S, (2008). From innovation to exporting or vice versa? Causal link between innovation activity and exporting in Slovenian micro data. LICOS *Discussion Papers 20408, LICOS - Centre for Institutions and Economic Performance, K.U.Leuven*.

Johansson, B., Lööf, H. (2008). Innovation Activities Explained by Firm Attributes and Location. *Economics of Innovation and New Technology*, 17(6): 533-522.

Knudsen, T., Madsen, T. K. (2002). Export Strategy: a dynamic capabilities perspective, *Scandinavian Journal of Management*,. 18(4): 475-502.

Lundberg, E. (1961). *Produktivitet och Räntabilitet*, PA Norstedt och Söner, Stockholm

Nelson, R.R., Winter, S.G. (1982). *An evolutionary theory of economic change*. The Belknap Press of Havard University Press, Cambridge, MA.

Nickell, S. (1981). Biases in dynamic models of the theme too many instruments. *Econometrica*, 49, 1417-1926.

Norlove, M. (2000). Likelihood of inference for dynamic panel models. *L'Annales d'Economie et de Statistique*, 55:1-41

Roodman. D, (2006). How to Do xtabond: An Introduction to “Difference” and”System” GMM an Stata. *CGDEV Working Paper 103*.

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

Windmeijer, F. (2000). Efficiency Comparisons for a system GMM Estimator in Dynamic Panel data Models. In Heijmans R.D.H., S.S.G. Pollock and A. Satorra (eds.), *Innovations in Multivariate Statistical Analysis. A Festschrift for Heinz Neudecker*, Kluver Akademic Publishers: 175-84.

Table section

Table 1. Key economic variables.

	Mean	Std dev	Median	Min	Max
Non-Exporters, (*ne*)	0.14	0.35	0	0	1
Temporary exporters, (*te*)	0.28	0.45	0	0	1
Persistent exporters<50, export/sales<50, (*pe*)	0.42	0.49	0	0	1
Persistent exporters≥50, export/sales≥50, (*pe_e*)	0.15	0.36	0	0	1
Employment, (*E*)	96	499	24	10	23,321
- Ordinary labour[a] (*L*)	85	411	23	0	22,707
- Skilled labour[b] (*H*)	11	130	1	0	8,534
Labour productivity, log (*lp*)	3.91	0.44	3.88	-2.30	8.36
Physical capital, log (*K*)	5.67	2.07	5.59	-4.60	14.33
Capital Structure[c] (*CS)*	0.67	0.21	0.71	0	1
Import value, log (*M*)	2.63	4.38	2.93	-2.30	14.66
Export value, log (*X)*	3.67	4.54	4.68	-2.30	14.93

38, 929 observations 1997-2004

Notes

The table reports average summary descriptive statistics in 1000 Euros for the period 1997-2004

Non-exporters (*ne*) are firms with no export during the period 1997-2004.

Temporary exporters (*te*) are firms that only exported occasionally between 1997 and 2004.

Persistent exporters (*pe*) are firms which export less than 50% of the production.

Persistent exporters(*pe_e*) are firms which export 50% or more of the production.

(a) Number of employees with university education less than 3 years as a fraction of total employment.

(b) Number of employees with university education 3 years or more as a fraction of total employment. (c) Total debt/(total debt+equity)

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Table 2. Distribution of key firm characteristics after export classification.

Panel A

	Labour Productivity[a]		Export/ Sales		Export Destinations[b]		Export Products	
Export status	Mean	SDev	Mean	SDev	Mean	SDev	Mean	SDev
ne	3.74	0.36	-	-	-	-	-	-
te	3.84	0.41	2.7%	9.8	1.3	3.3	1.8	5.8
pe	3.93	0.42	17.1%	16.6	9.3	10.5	12.3	22.6
pe_e	4.16	0.50	69.7%	18.8	30.5	21.9	29.8	52.3

Panel B

	Import/ Sales		Total Employment		Skilled Labor/ Employment[c]		Capital/ Sales[d]		Capital Structure[e]	
	Mean	SDev	Mean	SDev	Mean	SDev	Mean	SDev	Mean	SDev
ne	0.5%	3.1%	20	19	3.1%	6.6%	11.8%	15.6%	0.68	0.21
te	3.2%	10.4%	43	404	3.9%	7.6%	13.8%	16.0%	0.70	0.21
pe	11.3%	16.1%	97	332	4.5%	7.0%	12.2%	13.0%	0.67	0.21
pe_e	16.0%	19.2%	254	986	8.5%	9.3%	13.5%	15.1%	0.62	0.21

Notes

The table reports average summary descriptive statistics in 1000 Euros for the period 1997-2004

Non-exporters (*ne*) are firms with no export during the period 1997-2004.

Temporary exporters (*te*) are firms that only exported occasionally between 1997 and 2004.

Persistent exporters (*pe*) are firms which export less than 50% of the production.

Persistent exporters(*pe_e*) are firms which export 50% or more of the production.

(a) In 1,000 Euros.

(b) Countries

(c) Employees with university education 3 years or more as a fraction of total employment,

(d) Investment in machinery and equipment

(e) Total debt/(total debt+equity)

Table 3. Distribution of other firm characteristics after export classification, percent

Panel A. Fraction of exporting firms on different export markets

Export status	Scandinavian	Pol/balt	G7	EU15 excl G7	Rest of the world
te	77	16	30	12	37
pe	94	49	68	50	73
pe_e	97	79	98	93	96

Panel B. Total export value after destination, percent

Export status	Scandinavian	Pol/balt	G7	EU15 excl G7	Rest of the world	Total
te	61	8	14	3	14	100
pe	57	6	20	7	10	100
pe_e	22	3	47	13	15	100

Panel C. Sector classification

Export status	Labour intensive	Differentiated products	High tech products	Resource intensive	Scale intensive	Total
ne	36	14	3	34	13	100
te	38	13	4	18	27	100
pe	30	19	5	15	31	100
pe_e	17	28	15	19	21	100

Panel D. Corporate ownership structure

Export status	Non affiliate	Company with only domestic affiliates	Domestically owned MNE	Foreign owned MNE	Total
ne	60	34	4	2	100
te	48	38	10	4	100
pe	39	33	24	10	100
pe_e	17	16	40	27	100

Notes

The table reports average summary descriptive statistics in 1000 Euros for the period 1997-2004

Non-exporters (*ne*) are firms with no export during the period 1997-2004.

Temporary exporters (*te*) are firms that only exported occasionally between 1997 and 2004.

Persistent exporters (*pe*) are firms which export less than 50% of the production.

Persistent exporters(*pe_e*) are firms which export 50% or more of the production

Table 4. Pairwise correlation.

	lp	*m*	*x*	*k*	*lo*	*ls*	*cs*	*pe≥50*	*pe<50*	*te*	*ne*
lp	1.00										
M	0.29	1.00									
X	0.29	0.72	1.00								
K	0.34	0.46	0.48	1.00							
L	0.21	0.59	0.58	0.69	1.00						
H	0.39	0.56	0.52	0.51	0.68	1.00					
CS	-0.21	-0.08	-0.09	-0.02	-0.01	-0.04	1.00				
pe_e	0.23	0.38	0.51	0.27	0.31	0.37	-0.09	1.00			
pe	0.03	0.31	0.42	0.12	0.15	0.09	-0.01	-0.36	1.00		
te	-0.10	-0.35	-0.48	-0.17	-0.24	-0.22	0.07	-0.26	-0.53	1.00	
ne	-0.15	-0.39	-0.52	-0.24	-0.24	-0.23	0.02	-0.17	-0.34	-0.25	1.00

Number of observations 38,829

Notes
The table shows a high correlation between that several of the key variables. Further, there is a large similarity between how various variables correlate with import and export, respectively. Considering the four different classes of export-status, only *pe_e* has a close and positive correlation with labour productivity.

lp: log labour productivity
M: log import value
X. export value
K: log investments in machinery and equipment
L: log ordinary labour
H log skilled labour
CS: capital structure
*pe*_e: persistent exporters with an export fraction corresponding to 50 percent or more
p: persistent exporters with an export fraction less than 50 percent
te: temporary exporters
ne: non-exporters

Table 5. Production Function Estimates

Dependent variable is log value added per employee

	OLS LEVELS t-1	WITHIN t-1	GMM SYS t-1	GMM SYS t-2	GMM SYS t-3
lp_{t-1}	0.620	0.105	0.297	0.378	0.438
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
K_t	0.031	0.233	0.032	0.029	0.027
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
K_{t-1}	-0.001	0.003	0.004	0.001	0.001
	(0.703)	(0.552)	(0.217)	(0.745)	(0.735)
L_t	-0.128	-0,156	-0.089	-0.134	-0.123
	(0.035)	(0.009)	(0.006)	(0.000)	(0.01)
L_{t-1}	0.068	-0.012	0.032	0.094	0.069
	(0.260)	(0.758)	(0.293)	(0.000)	(0.001)
H_t	0.029	0.021	0.032	0.029	0.028
	(0.00)	(0.000)	(0.000)	(0.000)	(0.000)
H_{t-1}	-0.000	-0.002	-0.006	-0.010	0.011
	(0.863)	(0.326)	(0.045)	(0.001)	(0.001)
CS_t	-0.430	-0.428	-0.463	-0.412	-0.385
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CS_{-1}	0.329	0.233	-	0.291	0.300
	(0.000)	(0.000)		(0.086)	(0.000)
M_t	0.008	0.007	0.009	0.006	0.006
	(0.000)	(0.001)	(0.000)	(0.000)	(0.004)
M_{-1}	-0.003	-0.001	-0.000	-0.002	-0.003
	(0.007)	(0.001)	(0.870)	(0.109)	(0.025)
pe_e	0.019	-	0.071	0.109	0.119
	(0.023)		(0.063)	(0.004)	(0.000)
pe	-0.005	-	0.004	0.029	0.035
	(0.306)		(0.839)	(0.221)	(0.222)
te	0.001	-	0.017	0.009	0.009
	(0.699)		(0.151)	(0.423)	(0.013)
ne	Ref	-	Ref	Ref	Ref
AR(1)			(0.000)	(0.000)	(0.000)
AR(2)			(0.124)	(0.917)	(0.457)
Hansen overid			(0.000)	(0.000)	(0.003)
Dif-Sargan			(0.000)	(0.000)	(0.219)
Observations	32 550	32 550	32 550	26 984	21 800

Notes

Columns 1-3 presents results when the key variables are lagged 1 period

Columns 3-5 presents results when the key variables are lagged 2 periods and 3 periods, repsctively

P-values are reported between parentheses

Year dummies included in all models

Industry dummies included in all models

GMM results are two-step estimators with Windmeijer corrected standard errors

AR(1) is test for first-order serial correlation, the critical value is <0.05

AR(2) is test for second-order serial correlation, the critical value is >0.05

Hansen is a test for overidentifying restrictions for the GMM estimators

Dif-Sagan is the Difference Sargan test

Table 6. Robustness test

Dependent variable is log value added per employee

	IMPORT (1)	CAP STRUCT (2)	CORP OWNER (3)	LOCALI-ZATION (4)	TRAD LPROD (6)	SMALL FIRMS (7)
lp_{t-1}	0.449	0.463	0.443	0.444	0.461	0.378
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
M	-					
CS		-				
Dom. Non-affiliates			Ref			
Dom			0.022			
Uninational			(0.033)			
Dom MNE			0.072			
			(0.028)			
Foreign			0.075			
MNE			(0.057)			
Stockholm				0.069		
				(0.000)		
Goteborg				0.016		
				(0.347)		
Malmo				0.008		
				(0.630)		
Rest of Sweden				Ref		
pe_e	0.150	0.111	0.073	0.090	0.089	0.080
	(0.001)	(0.027)	(0.041)	(0.062)	(0.020)	(0.078)
pe	0.061	0.032	0.011	0.021	0.027	0.007
	(0.023)	(0.304)	(0.650)	(0.478)	(0.261)	(0.027)
te	0.020	0.009	0.002	0.005	0.012	-0.001
	(0.099)	(0.521)	(0.844)	(0.698)	(0.279)	(0.094)
ne	Ref	Ref	Ref		Ref	Ref
AR(1)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	(0.304)	(0.283)	(0.498)	(0.431)	(0.644)	(0.329)
Hansen overid	(0.004)	(0.003)	(0.003)	(0.001)	(0.001)	(0.241)
Dif-Sargan	(0.231)	(0.124)	(0,220)	(0.342)	(0.419)	(0.256)
Obs.	21 800	21 800	21 800	21 800	21 800	9 139

Notes

Se notes to Table 5.

P-values are reported between parentheses

The preferred GMM-SYS t-3 equation in Table 5 with the following re-specifications

(1) The import variables is removed

(2) The capital structure variable is removed

(3) Four corporate ownership structure variables are included

(4) Localization variables are included

(5) Starters and Stoppers are included among temporary exporters

(6) Labour productivity is defined as value added over total employment and log total labour (l) and fraction of the employees with a university education 3 years or more (H) are included among the covariates

(7) Firms with 10-25 employees

Only selected coefficient estimates from the regressions are reported