WORKING PAPER 10-13

WP

Valérie Smeets and Frédéric Warzynski

Learning by Exporting, Importing or Both? Estimating productivity with multi-product firms, pricing heterogeneity and the role of international trade

Department of Economics

ISBN 9788778824622 (print)

ISBN 9788778824646 (online)

Learning by Exporting, Importing or Both?

Estimating productivity with multi-product firms, pricing heterogeneity and the role of international trade[1]

Valérie Smeets and Frédéric Warzynski

(Aarhus University)

October 2010

Abstract

In this paper, we analyze the relationship between exporting/importing status and firm productivity. We use a rich product-firm-level dataset providing both revenue and quantities of all products for a large panel of Danish manufacturing firms over the period 1998-2005 and link it to another dataset describing firms' international trade transactions by product. We use our detailed product level information to compute a firm level deflator and avoid the criticism of biased estimates due to the use of industry level deflator. We find that both importing and exporting behaviours are strongly associated with productivity, but firms involved in both importing and exporting are the most productive. We also find evidence of a self-selection into importing and exporting but no learning effect. Finally, we try to distinguish between cost effect and product quality effect by analyzing the importance of the origin of imports and the destination of exports. We find that both imports from countries with abundant and cheap labor like China and from countries with similar level of development matter, although the mechanism through which productivity is affected is likely to be different. In addition, exporting to more distant OECD economies is more strongly associated to productivity than exporting to neighboring or other EU countries, especially when controlling for the price specific effect.

[1] We thank Eric Bartelsman, Jan De Loecker, Tor Eriksson, Garth Frazer, John Haltiwanger, Amil Petrin, Mark Roberts, Jo Van Biesebroeck, as well as seminar participants at Aarhus School of Business, the EPRU seminar at Copenhagen University, a COST workshop at the Free University of Amsterdam, the DIME-ISGEP meeting in Nice and IIOC2010 in Vancouver. Financial support from the FSE is gratefully acknowledged. All errors are ours.

1. Introduction

A large literature has been devoted to explaining the productivity difference between firms involved in international trade and those only selling on the domestic market. Both import and export decisions have been shown to be associated with higher productivity. So far, only a few studies have jointly considered export and import behaviors[2] and how the size of the premium depends on the origin or the destination. These factors are likely to be important in countries that offshore part of their production process to countries where labor is cheap and then re-import it, and possibly re-export it. It is also important when access to better intermediate inputs facilitates product upgrading and creates new export possibilities.

One additional difficulty stressed in the literature is the bias that arises from deflating sales with an industry level price index. Various indirect methods to correct this problem have been suggested in the literature (e.g. Klette and Griliches, 1996; Levinsohn and Melitz, 2001; De Loecker, 2007b). Recent studies have followed as an alternative a more direct approach using price information (e.g. Foster, Haltiwanger and Syverson, 2008) and the construction of a firm specific index (Eslava et al., 2004).

In this paper, we use a detailed sample of Danish manufacturing firms providing both values and quantities of domestic and international trade transactions to study the link between international trade and productivity deflating sales with a firm-specific price index. We use the Olley and Pakes (1996) methodology modified by De Loecker (2007a) to allow for different market structures between exporters and non-exporters. We find that importing and exporting behaviours are strongly associated with productivity, but the effect of importing is larger in most industries. Firms involved in both importing and exporting are the most productive.

We then investigate the mechanisms behind this effect and try to divide the import effect between access to cheaper intermediate goods, access to offshoring (imports of final goods) and access to

[2] See references below. Bas (2010) specifically looks at the relationship between import access and export behavior and finds that firms in industries with lower tariffs are more likely to become exporter and have an higher productivity premium, suggesting that access to foreign inputs facilitates export and productivity improvements. She does not distinguish between different channels in her empirical analysis.

high quality intermediates. Our findings confirm that all three affect positively productivity, although the mechanism is very different and the size of the effect varies by sector.

Recent papers have used a similar approach (e.g. Muuls and Pisu, 2009; Castellani et al., 2009; Altomonte and Békés, 2009; McCann, 2009) and also found that two-way traders were on average more productive than firms only importing or exporting; a few other papers have addressed the destination/origin specific effect of export/import behavior (e.g. Serti and Tomasi, 2010); but all these papers have largely ignored the pricing heterogeneity issue. On the other hand, recent papers have investigated markup and pricing differences between exporters and non exporters, and strategic price setting behavior on different export markets (see e.g. Manova and Zhang, 2010; De Loecker and Warzynski, 2010; Simonovska, 2010). This paper is an attempt to combine these two different approaches within the standard framework of productivity estimation.

The structure of the paper is the following. We first discuss our methodology in section 2. We then describe our data in section 3. Section 4 shows our preliminary results, while we discuss potential extensions in section 5.

2. Methodology

We study the effect of international trade on firm level productivity following the literature (Van Biesebroeck, 2005; De Loecker, 2007a; Kasahara and Rodrigue, 2008), considering the effects of both importing and exporting behavior. We also use detailed information about firm level prices to compute a firm level price index. We first discuss how we construct our index, and then discuss the production function estimation.

Computing the firm level deflator

We follow Eslava et al. (2004) by constructing a firm-level price index[3]. We use a Tornqvist index, i.e. a weighted average of the growth in prices for all the individual products *h* of firm *i* in time *t*:

[3] An alternative would be to use product quantities at the level of the firm to estimate a production function for multiproduct firms. See Petrin and Warzynski (2010).

$$\Delta P_{it} = \sum_{h} \overline{s}_{hit} \Delta ln(P_{hit})$$

where

$$\Delta ln(P_{hit}) = ln(P_{hit}) - ln(P_{hi(t-1)})$$

and

$$\overline{s}_{hit} = (s_{hit} + s_{hi(t-1)})/2$$

and where s_{hit} is the share of product h in firm *i*'s total sales.

We then use 1998 as the base year ($P_{i,1998}=1$) and then add the computed firm level price change to the index:

$$P_{it} = P_{i(t-1)} + \Delta(P_{it})$$

For firms entering after 1998, we use the industry average by sector for the entry year and then follow a similar procedure.

Dealing with input endogeneity

A well known problem when estimating production functions comes from the endogeneity of inputs. Starting from a production function:

$$Q_{it} = \Theta_{it} f(L_{it}, M_{it}, K_{it})$$

where output Q of firm i in time t (sales deflated by our firm specific price index) is a function of labor (L), materials (M), capital (K) and an index of technical progress (Θ).

Assuming a Cobb-Douglas function and taking logs:

$$q_{it} = \alpha_{Lit}\ l_{it} + \alpha_{Mit}\ m_{it} + \alpha_{Kit}\ k_{it} + \vartheta_{it}$$

where x=log(X) for X=Q,L,M,K and θ=log(Θ), which can be rewritten as:

$$\vartheta_{it} = \omega_{it} + \epsilon_{it}$$

where ω is a measure of log TFP and ε is a true noise.

We use a modified version of the widely used Olley and Pakes (1996) methodology following De Loecker (2007)[4]. Their model delivers an investment policy function that depends on productivity and capital,

$$i_t = i_t(k_t, \omega_t)$$

so that we can invert it to write productivity as a function of investment and capital:

$$\omega_{it} = h_t(i_{it}, k_{it})$$

In addition, we take into account the fact that exporting firms are facing different market structures and factor prices when they make their decisions about exit and investment. In other words:

$$i_t = i_{e,t}(k_t, \omega_{it})$$

and therefore

$$\omega_{it} = h_{e,t}(i_{it}, k_{it})$$

We can follow a similar logic for importing firms:

$$\omega_{it} = h_{imp,t}(i_{it}, k_{it})$$

[4] Amiti and Konings (2007), Kasahara and Rodrigue (2008) and Rizov and Walsh (2009) suggest yet another approach. They endogenize the import/export decision and treat it as an endogenous choice variable in the estimation. We plan to test the robustness of our results using this alternative method.

The first stage of the estimation algorithm consists in estimating the coefficient of the variable outputs, labor and material, semi-parametrically using a polynomial in k and i and allowing the coefficients to be different for importing and exporting firms, as explained above.

$$q_{it} = \alpha_{Lit}\ l_{it} + \alpha_{Mit}\ m_{it} + \phi_{exp,imp,both,t}(i_{it}, k_{it}) + \epsilon_{it}$$

where

$$\phi_{exp,imp,both,t}(i_{it}, k_{it}) = \alpha_{Kit}\ k_{it} + h_{exp,imp,both,t}(i_{it}, k_{it})$$

The second stage estimates the survival decision where the coefficients also depend on international trade status.

$$Pr(\chi_{i(t+1)} = 1 \,|I_t) = p_{exp,imp,both,t}(i_{it}, k_{it})$$

The last stage involves the non-linear least square estimation of the coefficient of capital:

$$q_{it} - \hat{\alpha}_{Lit}\ l_{it} - \hat{\alpha}_{Mit}\ m_{it} = \alpha_{Kit}\ k_{it} + g(\hat{\phi} - \alpha_{Kit}\ k_{it}, \hat{p}_{i,t+1})$$

We also test the robustness of our findings using alternative estimations algorithm following the criticism of Levinsohn and Petrin (2003), Ackerberg, Caves and Frazier (2007) and Wooldridge (2009).

We compare our results when we use as dependent variable revenue deflated by a standard producer price index and revenue deflated by our firm-level price index.

3. Data

For our analysis, we combine various datasets.[5] We start with a transaction level dataset providing values and quantities of all domestic transactions aggregated by product code (8-digit CN) for all manufacturing firms with at least 10 employees over the period 1998-2003 (extended to 2006).

[5] See Smeets and Warzynski (2010) for a more detailed description.

Table 1 provides a description of our sample. As we can see, around 80% of our sample is composed of multi-product firms.

We then merge this information with a dataset containing similar information, but regarding import and export transactions for the periods 1993-2003 (extended to 2008). This dataset covers the entire economy. For each transaction, we know the identification number of the firm buying or selling, the 8-digit CN product code, the value, the quantity, and the destination or origin. Table 2 shows the number of firms involved in international trade and the number of transactions for the period 1993-2003.

Table 3 shows the number of firms in the manufacturing industry with more than 10 employees by trade status once we merge the data with our domestic transactions dataset (for the period 1998-2003). We can see that the percentage of firms involved in both importing and exporting is increasing over time, while the percentage of firms doing none or only exporting is decreasing. The proportion of firms only importing is also increasing.

We then matched firms with the accounting statistics dataset (Regnskab) that contains information on the population of firms for the period 1994-2006. The variables included are turnover, value added, capital, employment and material costs.

4. Results

4.1 Exporter, importer and two-way trader premium

We estimate our production function using a) output deflated with a standard PPI; b) output deflated with our firm-level deflator. Table 4 shows the results for a subset of industries (all sectors where we had at least 1,000 observations in all specifications). We find that, depending on the industry, our estimates can vary quite a lot depending on the type of deflator used, especially the coefficients related to firms only importing or exporting. Results for two-way traders are relatively similar and show that they are more productive than firms involved in only one type of activity, although the coefficient is much higher when using the firm-level deflator (except for the last industry).

4.2 Selection into exporting/importing and learning

We then follow Bernard and Jensen (1999) to try to detect some evidence of learning by exporting and also importing, i.e. try to distinguish the learning from the selection issue. We find strong evidence of selection into exporting and/or importing: among those firms previously non exporting/importing, the more productive ones will enter into exporting/importing. Firms exporting and importing are also more likely to survive in t+1. However, we were not able to detect any evidence of learning by exporting and/or importing. Firms that start exporting and/or importing do not become more productive in t+1, t+2 or t+3.[6]

4.3 Price effect or quality effect?

The next step of the analysis is to try to distinguish between a price advantage of importers or an access to higher quality inputs or capital. We first distinguish between intermediate goods used as inputs and final goods. We identify the 2-digit industry associated to the good and then match it to the 2-digit industry of the firm importing the good. If both industries are the same, we call them final goods; otherwise, we call them intermediate products.[7]

We use the origin of imports as a way to proxy product quality, inferring that products coming from similar developed regions (like old EU member states or other OECD members) are probably of higher quality than goods coming from China, South East Asia or new members of the EU. Table 5 shows the results where we distinguish imports by type of good and by region of origin. We can see that imports of intermediate products from OECD countries are almost always positively related to productivity. These are likely to be high quality inputs or machinery improving efficiency. On the other hand, the coefficient of imports from low-wage countries like China or South East Asia is also positive, suggesting that access to cheaper inputs diminishes costs. Once we use the firm level deflator in our analysis, the size and significance of our results of some of our results are affected, suggesting that firms also adapt their prices and product mix once having access to foreign inputs. In general, the effects are larger with the firm level deflator, suggesting that we might "over-

[6] We also consider alternative specifications, such as adding a new product, adding a new market, or adding a new market in a developed country with high GDP per capita (see e.g. Serti and Tomasi, 2010 for evidence that destination matters for the productivity premium). See next subsection.

[7] One could think of using more detailed definitions using input-output tables for example. We plan to address this issue in future work.

deflate" sales for some firms involved in international trade when using a sector-specific deflator. Table A1 shows the results using ACF. Most results from table 5 are confirmed.

5. Conclusion

In this paper, we looked at the relationship between productivity and firms' international trade decisions controlling for pricing heterogeneity. We found that firms both importing and exporting were on average more productive than firms only involved in one of these activities. We also found that controlling for firm specific prices was affecting the magnitude of these effects. This suggests that future studies should seriously consider the relationship between domestic, import and export prices to understand better the causes of firms' trading activities and their consequences on productivity and product quality.

References

Altomonte, C. and Békés, 2009. Trade Complexity and Productivity. KITeS WP16.

Amiti, M. and Konings, J., 2007. Trade Liberalization, Intermediate Inputs, and productivity: Evidence from Indonesia. American Economic Review 97, 1611-1638.

Bas, M., 2010. Trade, Foreign Inputs and Firms' Decisions: Theory and Evidence. Mimeo, CEPII.

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

Castellani, D., Serti, F. and Tomasi, C., 2010. Firms in International Trade: Importers' and Exporters' Heterogeneity in Italian Manufacturing Industry. World Economy 33, 424-457.

De Loecker, J. 2007a. Do Export Generate Higher Productivity? Evidence from Slovenia. Journal of International Economics, 73, 69--98.

De Loecker, J. 2007b. Production Differentiation, Multi-Product Firms and Estimating the Impact of Trade Liberalization on Productivity. NBER WP # 13155.

De Loecker, J. and Warzynski, F., 2010. Markups and Firm-Level Export Status. Mimeo, Aarhus University.

Eslava, M., Haltiwanger, J., Kugler, A. and Kugler, M. (2004), The effects of structural reforms on productivity and profitability enhancing reallocation: evidence from Colombia. Journal of Development Economics 75, 333-371.

Foster, L., Haltiwanger, J. and Syverson, C., 2008a. Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability? American Economic Review, 98 (1), 394-425.

Foster, L., Haltiwanger, J. and Syverson, C., 2008b. The Slow Growth of New Plants: Learning about Demand? work in progress.

Kasahara, H. and Rodrigue, J., 2008. Does the use of imported intermediates increase productivity? Plant-level evidence. Journal of Development Economics, 87, 106-118.

Klette, T. J. and Griliches, Z., 1996. The Inconsistency of Common Scale Estimators When Output Prices Are Unobserved and Endogenous, Journal of Applied Econometrics, 11, 343-361.

Levinsohn, J. and Melitz, M., 2001. Productivity in a Differentiated Products Market Equilibrium. Mimeo.

Manova, K. and Zhang, 2009. Quality Heterogeneity across Firms and Export Destinations. NBER WP # 15342.

McCann, F., 2009. Importing, Exporting and Productivity in Irish Manufacturing. Working Paper, University College Dublin.

Muuls, M. and Pisu, M., 2009. Imports and Exports at the Level of the Firm. World Economy, 32, 692-734.

Olley, S. G. and Pakes, A., 1996. The Dynamics of Productivity in the Telecommunications Equipment Industry. Econometrica 64 (6), 1263-1297.

Petrin, A. and Warzynski, F., 2010. The Impact of Product and Process R&D on Unobserved Quality, Productivity and Pricing. Work in progress.

Rizov, M. and Walsh, P. P., 2009. Productivity and trade orientation in UK manufacturing. Oxford Bulletin of Economics and Statistics 71, 821-849.

Serti, F. and Tomasi, C., 2010. Self-selection along different export and import markets. Mimeo, LEM.

Siomonovska, I., 2010. Income Differences and Prices of Tradables. UC Davis Working Paper No. 10-15.

Smeets, V. and Warzynski, F., 2010. Multi-Product Firms and Pricing Behavior in Danish Manifacturing. Mimeo, Aarhus University.

Van Biesebroeck, J., 2005. Exporting Raises Productivity in sub-Saharan African Manufacturing Firms. Journal of International Economics, 67 (2), 373-391.

Wooldridge, J. M., 2009. On estimating firm-level production functions using proxy variables to control for observables. Economics Letters 104, 112-114.

Table 1: distribution of firms by year and number of products

	Single product firms	Firms producing between 2 and 5 products	Firms producing between 6 and 10 products	Firms producing more than 10 products	TOTAL
1998	1,628 (33.56%)	2,599 (53.58%)	429 (8.84%)	195 (4.02%)	4,851
1999	1,567 (33.39%)	2,530 (53.91%)	401 (8.54%)	195 (4.16%)	4,693
2000	1,578 (33.14%)	2,580 (54.18%)	405 (8.50%)	199 (4.18%)	4,762
2001	1,564 (33.52%)	2,531 (54.24%)	371 (7.95%)	200 (4.29%)	4,666
2002	1,551 (33.67%)	2,483 (53.91%)	355 (7.71%)	217 (4.71%)	4,606
2003	1,556 (34.31%)	2,416 (53.27%)	350 (7.72%)	213 (4.70%)	4,535
2004	1,481 (34.09%)	2,314 (53.27%)	353 (8.13%)	197 (4.51%)	4,344
2005	1,382 (33.13%)	2,259 (54.15%)	332 (7.96%)	199 (4.77%)	4,172

Table 2: summary statistics (international trade transactions)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Number of firms importing	24,378	23,119	19,920	19,471	*18,315*	18,364	18,805	18,892	18,800	22,435	23,648
Number of firms exporting	18,461	18,053	16,106	15,899	*15,119*	15,270	15,303	15,361	15,402	16,329	16,686
Number of import transactions	441,226	422,388	420,860	417,652	399,164	411,084	423,235	437,287	*408,615*	513,448	527,369
Number of export transactions	322,409	328,564	335,129	345,686	350,775	369,258	386,036	402,813	*356,096*	454,380	494,353

Table 3: summary statistics – manufacturing industry (firms with more than 10 employees)

	1998	1999	2000	2001	2002	2003
Not importing nor exporting	1,261	1,193	1,226	1,149	1,007	948
Importing only	288	305	299	279	290	323
Exporting only	591	560	537	493	412	424
Doing both	2,414	2,401	2,483	2,543	2,706	2,631
	4,554	4,459	4,545	4,464	4,415	4,326

in %

	1998	1999	2000	2001	2002	2003
Not importing nor exporting	27.69%	26.75%	26.97%	25.74%	22.81%	21.91%
Importing only	6.32%	6.84%	6.58%	6.25%	6.57%	7.47%
Exporting only	12.98%	12.56%	11.82%	11.04%	9.33%	9.80%
Doing both	53.01%	53.85%	54.63%	56.97%	61.29%	60.82%
	100%	100%	100%	100%	100%	100%

Table 4: Import, export and two-way trading

Dep. var: OP productivity	With PPI deflator			
	IMP	EXP	BOTH	# obs.
Food and beverages	0.031 (0.023)	0.010 (0.021)	0.089*** (0.013)	*1,655*
Publishing and printing	0.072*** (0.020)	-0.005 (0.015)	0.058*** (0.015)	*2,224*
Rubber and plastic products	-0.005 (0.023)	-0.029 (0.020)	0.008 (0.015)	*1,303*
Fabricated metals (except machinery)	0.003 (0.013)	-0.033*** (0.009)	0.036*** (0.007)	*4,288*
Machinery	-0.003 (0.018)	-0.041*** (0.011)	0.008 (0.008)	*4,018*
Furniture; manufacturing n.e.c.	-0.024 (0.019)	-0.026* (0.014)	0.021* (0.011)	*2,071*

Dep. var: OP productivity	With firm level deflator			
	IMP	EXP	BOTH	# obs.
Food and beverages	0.008 (0.036)	0.021 (0.032)	0.112*** (0.021)	*1,620*
Publishing and printing	0.089** (0.037)	0.078*** (0.029)	0.180*** (0.028)	*2,103*
Rubber and plastic products	-0.061 (0.057)	-0.016 (0.049)	0.023 (0.039)	*1,220*
Fabricated metals (except machinery)	0.003 (0.024)	-0.027 (0.017)	0.065*** (0.013)	*3,885*
Machinery	-0.022 (0.052)	-0.085** (0.034)	-0.004 (0.023)	*3,859*
Furniture; manufacturing n.e.c.	0.005 (0.036)	-0.039 (0.026)	0.010 (0.021)	*2,019*

Table 5: Imports and exports by type of good and region of origin/destination

A. Using PPI deflator

Dep. var: OP productivity	Food and beverages	Publishing and printing	Rubber and plastic products	Fabricated metals (except machinery)	Machinery	Furniture; manufacturing n.e.c.
Import of intermediate products from neighbor country	0.048*** (0.016)	0.010 (0.023)	-0.015 (0.014)	0.023** (0.010)	-0.014 (0.009)	-0.004 (0.012)
Import of intermediate products from rest of EU	-0.002 (0.016)	-0.023 (0.028)	0.010 (0.014)	0.043*** (0.012)	0.011 (0.009)	-0.002 (0.012)
Import of intermediate products from OECD	0.070*** (0.013)	0.002 (0.018)	0.021* (0.011)	0.031*** (0.009)	0.019** (0.008)	0.047*** (0.010)
Import of intermediate products from China	0.126*** (0.024)	0.083** (0.039)	-0.030 (0.019)	-0.009 (0.021)	-0.001 (0.013)	0.044** (0.019)
Import of intermediate products from SE Asia	0.109*** (0.022)	-0.069 (0.052)	0.003 (0.022)	0.045** (0.021)	0.045*** (0.012)	0.025 (0.017)
Import of intermediate products from other Asian countries	0.080*** (0.023)	-0.042 (0.045)	0.044** (0.017)	-0.033* (0.018)	0.031*** (0.012)	-0.012 (0.016)
Import of intermediate products from new EU members	0.010 (0.014)	0.071** (0.032)	-0.005 (0.012)	-0.013 (0.012)	0.006 (0.008)	-0.016 (0.010)
Import of final products from neighbor country	-0.023 (0.016)	0.045* (0.024)	-0.027** (0.014)	0.025** (0.011)	0.006 (0.010)	0.014 (0.012)
Import of final products from rest of EU	0.009 (0.016)	0.010 (0.030)	0.025* (0.014)	-0.023* (0.013)	0.023** (0.011)	0.034** (0.012)
Import of final products from OECD	0.011 (0.014)	0.078*** (0.025)	0.015 (0.011)	0.018 (0.012)	0.000 (0.008)	0.002 (0.013)
Import of final products from China	-0.022 (0.022)	-0.032 (0.062)	-0.026 (0.024)	0.048** (0.023)	-0.012 (0.014)	0.038* (0.020)
Import of final products from SE Asia	0.027 (0.021)	-0.012 (0.061)	-0.003 (0.032)	-0.004 (0.032)	0.010 (0.016)	0.020 (0.018)
Import of final products from other Asian countries	-0.067*** (0.026)	0.231*** (0.056)	0.012 (0.022)	-0.006 (0.023)	-0.012 (0.013)	0.021 (0.019)
Import of final products from new EU members	-0.019 (0.016)	-0.086* (0.047)	-0.015 (0.014)	-0.016 (0.013)	-0.029*** (0.008)	-0.027** (0.011)
Export to neighbor	0.044*** (0.017)	-0.019 (0.014)	-0.023* (0.013)	-0.022** (0.008)	-0.014 (0.009)	0.019 (0.011)
Export to rest of EU	-0.040** (0.016)	0.012 (0.025)	0.030** (0.014)	0.004 (0.011)	0.017* (0.009)	-0.026** (0.011)
Export to OECD	0.004 (0.013)	-0.001 (0.019)	0.027** (0.011)	-0.007 (0.009)	-0.008 (0.009)	-0.008 (0.010)
Adj. R2	0.15	0.03	0.03	0.03	0.02	0.05
# obs.	1655	2224	1303	4288	4018	2071

B. using firm-level price deflator

Dep. var: OP productivity	Food and beverages	Publishing and printing	Rubber and plastic products	Fabricated metals (except machinery)	Machinery	Furniture; manufacturing n.e.c.
Import of intermediate products from neighbor country	0.067** (0.026)	0.008 (0.044)	-0.018 (0.037)	0.042** (0.019)	-0.017 (0.026)	0.008 (0.023)
Import of intermediate products from rest of EU	0.011 (0.025)	-0.004 (0.054)	-0.010 (0.036)	0.060** (0.024)	0.076*** (0.026)	-0.035 (0.024)
Import of intermediate products from OECD	0.077*** (0.021)	-0.011 (0.034)	0.008 (0.029)	0.069*** (0.018)	-0.019 (0.024)	0.008 (0.020)
Import of intermediate products from China	0.153*** (0.039)	0.207*** (0.076)	-0.170*** (0.049)	0.037 (0.040)	0.091** (0.040)	0.033 (0.037)
Import of intermediate products from SE Asia	0.102*** (0.036)	-0.166 (0.101)	0.247*** (0.057)	-0.008 (0.039)	-0.026 (0.036)	0.062* (0.032)
Import of intermediate products from other Asian countries	0.040 (0.037)	-0.120 (0.086)	0.053 (0.044)	-0.166*** (0.035)	0.023 (0.035)	0.013 (0.031)
Import of intermediate products from new EU members	0.016 (0.023)	0.039 (0.061)	-0.020 (0.031)	-0.000 (0.022)	0.026 (0.026)	-0.010 (0.020)
Import of final products from neighbor country	-0.028 (0.025)	0.102** (0.046)	-0.045 (0.035)	-0.012 (0.021)	-0.021 (0.030)	0.020 (0.023)
Import of final products from rest of EU	-0.011 (0.026)	-0.065 (0.058)	0.029 (0.035)	0.019 (0.026)	0.033 (0.032)	0.035 (0.025)
Import of final products from OECD	-0.025 (0.022)	0.114*** (0.048)	0.017 (0.030)	-0.014 (0.023)	-0.027 (0.023)	0.010 (0.026)
Import of final products from China	-0.017 (0.036)	-0.028 (0.118)	0.038 (0.062)	0.014 (0.047)	0.019 (0.042)	0.076** (0.038)
Import of final products from SE Asia	0.086** (0.035)	0.157 (0.108)	0.013 (0.080)	0.088 (0.059)	0.101*** (0.039)	-0.048 (0.035)
Import of final products from other Asian countries	-0.073* (0.041)	0.180 (0.119)	0.015 (0.056)	0.132*** (0.046)	-0.054 (0.049)	-0.019 (0.036)
Import of final products from new EU members	-0.022 (0.026)	-0.063 (0.090)	-0.048 (0.038)	-0.026 (0.025)	-0.036 (0.026)	-0.011 (0.021)
Export to neighbor	0.044 (0.027)	0.037 (0.027)	-0.054 (0.034)	0.008 (0.016)	0.010 (0.029)	0.003 (0.021)
Export to rest of EU	-0.019 (0.026)	0.011 (0.050)	0.081** (0.036)	-0.033 (0.027)	0.021 (0.028)	0.003 (0.021)
Export to OECD	0.018 (0.021)	0.065* (0.036)	0.054* (0.030)	-0.008 (0.017)	-0.011 (0.026)	-0.010 (0.019)
Adj. R2	0.08	0.03	0.03	0.02	0.006	0.004
# obs.	1620	2103	1220	3885	3859	2019

Table A1: Imports and exports by type of good and region of origin/destination

a. PPI deflated

Dep. var: ACF productivity	Food and beverages	Publishing and printing	Rubber and plastic products	Fabricated metals (except machinery)	Machinery	Furniture; manufacturing n.e.c.
Import of intermediate products from neighbor country	-0.049** (0.022)	0.041** (0.019)	-0.005 (0.011)	0.030*** (0.007)	-0.008 (0.006)	0.024** (0.011)
Import of intermediate products from rest of EU	0.001 (0.021)	0.013 (0.023)	0.030*** (0.010)	0.026*** (0.008)	-0.005 (0.006)	-0.015 (0.011)
Import of intermediate products from OECD	0.032* (0.018)	-0.003 (0.014)	-0.002 (0.008)	0.002 (0.006)	-0.001 (0.006)	-0.026*** (0.010)
Import of intermediate products from China	0.084*** (0.032)	0.019 (0.031)	-0.029** (0.014)	0.028** (0.014)	0.006 (0.009)	-0.008 (0.017)
Import of intermediate products from SE Asia	0.066** (0.031)	-0.025 (0.041)	-0.001 (0.016)	-0.014 (0.014)	-0.019** (0.008)	0.035** (0.015)
Import of intermediate products from other Asian countries	-0.023 (0.031)	-0.009 (0.036)	0.019 (0.013)	-0.004 (0.012)	-0.005 (0.008)	0.001 (0.015)
Import of intermediate products from new EU members	0.063*** (0.019)	0.021 (0.026)	0.032*** (0.009)	0.014* (0.008)	-0.002 (0.006)	0.035*** (0.010)
Import of final products from neighbor country	0.020 (0.021)	-0.004 (0.019)	0.012 (0.010)	0.000 (0.008)	0.025*** (0.007)	0.007 (0.011)
Import of final products from rest of EU	-0.028 (0.021)	0.020 (0.025)	0.027*** (0.010)	0.003 (0.009)	0.027*** (0.007)	0.040*** (0.012)
Import of final products from OECD	-0.000 (0.019)	-0.007 (0.020)	-0.011 (0.009)	-0.007 (0.008)	0.015*** (0.005)	-0.034*** (0.012)
Import of final products from China	-0.031 (0.031)	0.147*** (0.047)	-0.029* (0.017)	-0.000 (0.015)	-0.039*** (0.009)	0.039** (0.017)
Import of final products from SE Asia	0.092*** (0.029)	0.082* (0.047)	-0.020 (0.022)	-0.039* (0.022)	-0.004 (0.011)	-0.009 (0.016)
Import of final products from other Asian countries	-0.052 (0.034)	0.067 (0.044)	-0.005 (0.017)	0.008 (0.015)	0.021** (0.009)	-0.015 (0.017)
Import of final products from new EU members	-0.039* (0.021)	-0.039 (0.035)	0.032*** (0.010)	-0.012 (0.008)	0.003 (0.006)	0.060*** (0.010)
Export to neighbor	-0.008 (0.023)	0.029*** (0.011)	-0.002 (0.010)	0.016*** (0.006)	0.041*** (0.007)	0.036*** (0.011)
Export to rest of EU	0.054** (0.022)	-0.022 (0.021)	-0.014 (0.010)	-0.012 (0.007)	0.021*** (0.007)	-0.021** (0.010)
Export to OECD	0.022 (0.018)	0.047*** (0.015)	-0.009 (0.009)	0.010 (0.006)	-0.014** (0.006)	-0.002 (0.009)
# obs.	1366	1861	1135	3432	3346	1779

b. Using firm level deflator

Dep. var: ACF productivity	Food and beverages	Publishing and printing	Rubber and plastic products	Fabricated metals (except machinery)	Machinery	Furniture; manufacturing n.e.c.
Import of intermediate products from neighbor country	-0.036 (0.027)	0.012 (0.021)	-0.039** (0.020)	0.046*** (0.009)	-0.016 (0.011)	0.028* (0.015)
Import of intermediate products from rest of EU	0.002 (0.025)	0.064** (0.027)	0.051*** (0.019)	0.035*** (0.011)	-0.014 (0.011)	-0.017 (0.015)
Import of intermediate products from OECD	0.036* (0.021)	0.013 (0.016)	-0.021 (0.016)	0.011 (0.008)	0.0004 (0.010)	-0.029*** (0.013)
Import of intermediate products from China	0.084** (0.039)	-0.012 (0.035)	-0.053** (0.026)	0.031* (0.018)	0.035** (0.016)	0.050** (0.023)
Import of intermediate products from SE Asia	0.060 (0.037)	0.040 (0.047)	-0.025 (0.030)	-0.036** (0.017)	0.024* (0.014)	0.053** (0.020)
Import of intermediate products from other Asian countries	-0.043 (0.037)	-0.009 (0.036)	0.049** (0.025)	-0.050*** (0.016)	0.017 (0.014)	-0.035* (0.020)
Import of intermediate products from new EU members	0.035 (0.023)	0.021 (0.026)	0.027 (0.016)	0.013 (0.010)	0.020* (0.010)	0.039*** (0.013)
Import of final products from neighbor country	0.015 (0.025)	0.065*** (0.021)	-0.010 (0.019)	0.008 (0.010)	0.016 (0.012)	0.013 (0.015)
Import of final products from rest of EU	-0.040 (0.025)	0.012 (0.029)	0.021 (0.019)	-0.010 (0.012)	0.032** (0.013)	0.042*** (0.016)
Import of final products from OECD	-0.010 (0.022)	-0.036 (0.022)	-0.033** (0.016)	-0.008 (0.010)	-0.005 (0.010)	-0.042** (0.016)
Import of final products from China	-0.048 (0.036)	0.148*** (0.054)	-0.051 (0.032)	0.020 (0.020)	-0.017 (0.017)	0.044* (0.023)
Import of final products from SE Asia	0.086** (0.035)	0.104* (0.054)	0.038 (0.040)	-0.073*** (0.026)	0.026 (0.019)	0.004 (0.021)
Import of final products from other Asian countries	-0.044 (0.040)	0.039 (0.050)	-0.009 (0.030)	0.037* (0.020)	0.012 (0.016)	-0.007 (0.023)
Import of final products from new EU members	-0.008 (0.025)	-0.036 (0.041)	0.020 (0.020)	-0.027** (0.011)	0.011 (0.011)	0.056*** (0.013)
Export to neighbor	-0.008 (0.028)	0.033** (0.013)	0.007 (0.018)	0.026*** (0.007)	0.050*** (0.012)	0.017 (0.014)
Export to rest of EU	0.053** (0.026)	-0.073*** (0.024)	-0.013 (0.019)	-0.025** (0.009)	0.011 (0.012)	-0.007 (0.013)
Export to OECD	0.037* (0.021)	0.056*** (0.017)	0.0003 (0.016)	0.002 (0.008)	-0.019* (0.011)	-0.005 (0.012)
# obs.	1342	1742	1052	3063	3346	1732

Department of Economics:

Skriftserie/Working Paper:

2009:

WP 09-1 Tomi Kyyrä, Pierpaolo Parrotta and Michael Rosholm: The Effect of Receiving Supplementary UI Benefits on Unemployment Duration
ISBN 9788778824035 (print); ISBN 9788778824042 (online)

WP 09-2 Dario Pozzoli and Marco Ranzani: Old European Couples' Retirement Decisions: the Role of Love and Money
ISBN 9788778824165 (print); ISBN 9788778824172 (online)

WP 09-3 Michael Gibbs, Mikel Tapia and Frederic Warzynski: Globalization, Superstars, and the Importance of Reputation: Theory & Evidence from the Wine Industry
ISBN 9788778824189 (print); ISBN 9788778824196 (online)

WP 09-4 Jan De Loecker and Frederic Warzynski: Markups and Firm-Level Export Status
ISBN 9788778824202 (print); ISBN 9788778824219 (online)

WP 09-5 Tor Eriksson, Mariola Pytliková and Frédéric Warzynski: Increased Sorting and Wage Inequality in the Czech Republic: New Evidence Using Linked Employer-Employee Dataset
ISBN 9788778824226 (print); ISBN 9788778824233 (online)

WP 09-6 Longhwa Chen and Tor Eriksson: Vacancy Duration, Wage Offers, and Job Requirements – Pre-Match Data Evidence
ISBN 9788778824240 (print); ISBN 9788778824257 (online)

WP 09-7 Tor Eriksson, Valérie Smeets and Frédéric Warzynski: Small Open Economy Firms in International Trade: Evidence from Danish Transactions-Level Data
ISBN 9788778823861 (print); ISBN 9788778823878 (online)

WP 09-8 Dario Pozzoli and Marco Ranzani: Participation and Sector Selection in Nicaragua
ISBN 9788778823885 (print); ISBN 9788778823892 (online)

WP 09-9 Rikke Ibsen, Frederic Warzynski and Niels Westergård-Nielsen: Employment Growth and International Trade: A Small Open Economy Perspective
ISBN 9788778823908 (print); ISBN 9788778823915 (online)

WP 09-10 Roger Bandick and Holger Görg: Foreign acquisition, plant survival, and employment growth
ISBN 9788778823922 (print); ISBN 9788778823939 (online)

WP 09-11 Pierpaolo Parrotta and Dario Pozzoli: The Effect of Learning by Hiring on Productivity
ISBN 9788778823946 (print); ISBN 9788778823953 (online)

WP 09-12 Takao Kato and Pian Shu
Peer Effects, Social Networks, and Intergroup Competition in the Workplace
ISBN 9788778823984 (print); ISBN 9788778823991 (online)

WP 09-13 Sanne Hiller and Erdal Yalcin: Switching between Domestic Market Activity, Export and FDI
ISBN 9788778824004 (print); ISBN 9788778824028 (online)

WP 09-14 Tor Eriksson and Mariola Pytlikova: Foreign Ownership Wage Premia in Emerging Economies: Evidence from Czech Republic
ISBN 9788778824035 (print); ISBN 9788778824042 (online)

WP 09-15 Astrid Würtz Rasmussen: Family Structure Changes and Children´s Health, Behavior, and Educational Outcomes
ISBN 9788778824059 (print); ISBN 9788778824066 (online)

WP 09-16 Tor Eriksson: How Many Danish Jobs Can (Potentially) Be Done Elsewhere?
ISBN 9788778824073 (print); ISBN 9788778824080 (online)

WP 09-17 Lorenzo Cappellari, Claudio Lucifora and Dario Pozzoli: Determinants of Grades in Maths for Students in Economics
ISBN 9788778824103 (print); ISBN 9788778824110 (online)

WP 09-18 Yingqiang Zhang and Tor Eriksson: Inequality of Opportunity and Income Inequality in Nine Chinese Provinces, 1989-2006
ISBN 9788778824127 (print); ISBN 9788778824134 (online)

WP 09-19 Ricard Gil and Frederic Warzynski: Vertical Integration, Exclusivity and Game Sales Performance in the U.S. Video Game Industry
ISBN 9788778824141 (print); ISBN 9788778824165 (online)

WP 09-20 Christian Gormsen: Intransparent Markets and Intra-Industry Trade
ISBN 9788778824172 (print); ISBN 9788778824189 (online)

WP 09-21 Jan Bentzen and Valdemar Smith: Wine production in Denmark Do the characteristics of the vineyards affect the chances for awards?
ISBN 9788778824196 (print); ISBN 9788778824202 (online)

WP 09-22 Astrid Würtz Rasmussen: Allocation of Parental Time and the Long-Term Effect on Children´s Education
ISBN 9788778824233 (print); ISBN 9788778824240 (online)

2010:

WP 10-01 Marianne Simonsen, Lars Skipper and Niels Skipper: Price Sensitivity of Demand for Prescription Drugs: Exploiting a Regression Kink Design
ISBN 9788778824257 (print); ISBN 9788778824264 (online)

WP 10-02 Olivier Gergaud, Valérie Smeets and Frédéric Warzynski: Stars War in French Gastronomy: Prestige of Restaurants and Chefs'Careers
ISBN 9788778824271 (print); ISBN 9788778824288 (online)

WP 10-03 Nabanita Datta Gupta, Mette Deding and Mette Lausten: Medium-term consequences of low birth weight on health and behavioral deficits – is there a catch-up effect?
ISBN 9788778824301 (print); ISBN 9788778824318 (online)

WP 10-04 Jørgen Drud Hansen, Hassan Molana, Catia Montagna and Jørgen Ulff-Møller Nielsen: Work Hours, Social Value of Leisure and Globalisation
ISBN 9788778824332 (print); ISBN 9788778824349 (online)

WP 10-05 Miriam Wüst: The effect of cigarette and alcohol consumption on birth outcomes
ISBN 9788778824455 (print); ISBN 9788778824479 (online)

WP 10-06 Elke J. Jahn and Michael Rosholm:Looking Beyond the Bridge: How Temporary Agency Employ-ment Affects Labor Market Outcomes
ISBN 9788778824486 (print); ISBN 9788778824493 (online)

WP 10-07 Sanne Hiller and Robinson Kruse: Milestones of European Integration: Which matters most for Export Openness?
ISBN 9788778824509 (print); ISBN 9788778824516 (online)

WP 10-08 Tor Eriksson and Marie Claire Villeval: Respect as an Incentive
ISBN 9788778824523 (print); ISBN 9788778824530 (online)

WP 10-09 Jan Bentzen and Valdemar Smith: Alcohol consumption and liver cirrhosis mortality: New evidence from a panel data analysis for sixteen European countries
ISBN 9788778824547 (print); ISBN 9788778824554 (online)

WP 10-10 Ramana Nanda: Entrepreneurship and the Discipline of External Finance
ISBN 9788778824561 (print); ISBN 9788778824578 (online)

WP 10-11 Roger Bandick, Holger Görg and Patrik Karpaty: Foreign acquisitions, domestic multinationals, and R&D
ISBN 9788778824585 (print); ISBN 9788778824592 (online)

WP 10-12 Pierpaolo Parrotta, Dario Pozzoli and Mariola Pytlikova: Does Labor Diversity Affect Firm Productivity?
ISBN 9788778824608 (print); ISBN 9788778824615 (online)

WP 10-13 Valérie Smeets and Frédéric Warzynski: Learning by Exporting, Importing or Both? Estimating productivity with multi-product firms, pricing heterogeneity and the role of international trade
ISBN 9788778824622 (print); ISBN 9788778824646 (online)