# Globalisation and the Polish economy: macro and micro growth effects

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## Abstract

We analyse the macro and micro effects of globalisation in Poland. We show that exports were a major contributor to economic growth in the transition period and after the 2004 EU enlargement. While exporting and foreign capital are associated with faster productivity growth at the sector level, we show that internationalised firms, both through exporting and foreign direct investment, perform better than non-internationalised firms. While this difference in performance between firms as well as a sizeable premium in capital/labour ratio manifest themselves in a large difference in average wages, we show that labour productivity-adjusted wages are in fact lower in exporters than in non-exporters, which can be associated with downward competitive pressure on wages.

Keywords: internationalisation, productivity, growth, wages.

JEL classification: L25, F23, F15, O12.

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# Introduction

Globalisation is associated with increased trade flows and foreign direct investment. From the 1990s, in addition, production processes have been fragmented through outsourcing and offshoring. The pattern of trade has gradually changed from 19th century inter-industry trade, where the advanced economies produced manufactured goods and the emerging market economies (EMEs) produced basic goods to a pattern where manufacturing is located in both advanced economies and EMEs and, instead of specialisation in products, countries specialise in different production tasks and processes. Specialisation is designed to improve production efficiency and hence can lead to productivity growth and improvements in factor allocation (see eg Baldwin (2014)).

In Poland and other central and eastern European countries, the process of integration with the global economy overlapped with the transition process and later with the EU accession. Opening up involved not only access to foreign markets but also the inflow of foreign direct investment. FDI provided capital that was scarce in the transforming economies and it helped build their export potential. At the same time, access to modern technologies and improved organisational structures, know-how, labour discipline and corporate culture have helped to expand exports and contribute to overall economic growth.

The emergence of trading firms within EMEs may potentially polarise a country's economy. The modern globalised sector flourishes due to technological advancements and productivity growth while traditional sectors (or non-tradable sectors) lag behind (McMillan and Rodrik (2011)). The trade literature finds grounds also for within-sector variation in productivity. Melitz (2011)-type models postulate self-selection mechanisms that allow only the most productive firms to enter export markets (due to the fixed costs of exporting) while less productive firms either sell to the domestic market only or exit. Alternatively, firms may learn from participation in export markets (learning-by-exporting) and gradually increase productivity after entering foreign markets (see for example Bernard and Jensen (1999), De Loecker (2013) and Hagemejer (2017) for early evidence for Poland).

Foreign direct investment can have direct productivity effects through access to modern technology and managerial procedures. As documented by many authors those direct effects can be exaggerated due to selection issues (foreign investors invest in better firms, see for example Greenaway and Kneller (2007), and Hagemejer and Tyrowicz, (2012)). Apart from these direct effects, there is a broad empirical evidence that suggests indirect productivity benefits. As shown in a meta-analysis by Havranek and Irsova (2011), they mostly take a form of backward spillovers, ie domestic firms supplying intermediate goods and services to foreign and multinational firms benefit from productivity improvements. In this vein, the related literature provides systematic empirical evidence in favour of the importance of spillovers for CEE countries. Finally, in the context of the Polish economy, Hagemejer and Kolasa (2011) document that there are significant productivity spillovers from firm internationalisation and more importantly, that this empirical regularity is robust to a choice of measure of international activity (hosting FDI, exporting and importing of investment goods).

In this paper, we show, using the results from two recent papers by Hagemejer (2017) and Hagemejer and Mućk (2017) that between 1995 and 2014 exports were responsible for more than half of overall economic growth. Then we turn to sector-
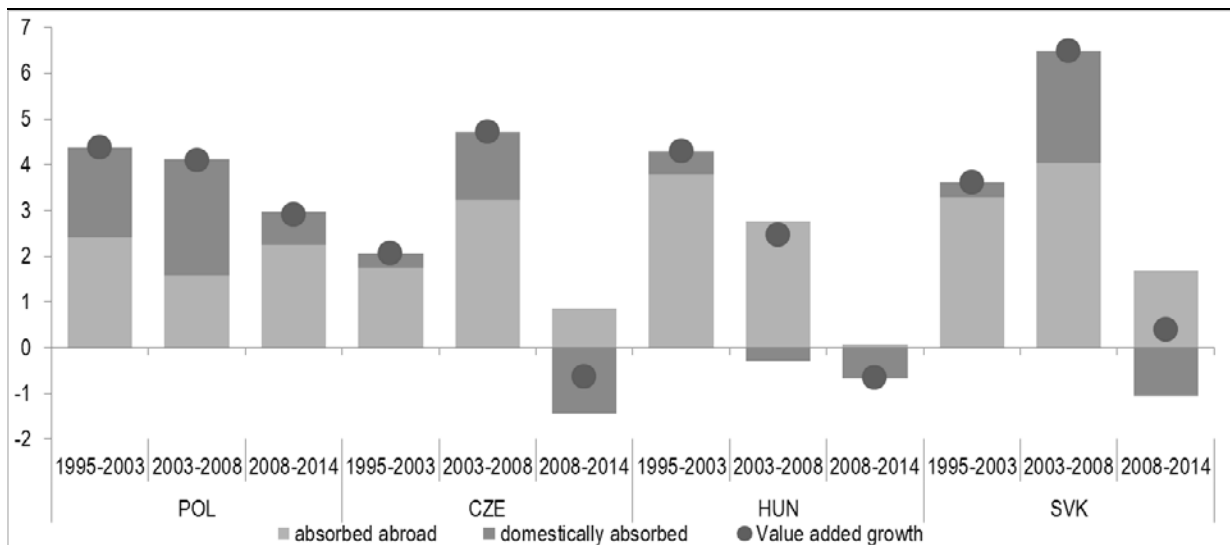
and firm-level analysis to show that exporting and foreign direct investment are indeed associated with higher productivity, faster productivity growth and better factor allocation. Within sectors, firm internationalisation is additionally associated with higher average wages, thus contributing to the dispersion of income in the economy. We also show that foreign and exporting firms have systematically lower productivity-adjusted average wages, which may stem from the necessity of sustaining cost-competitiveness.

# Export led-growth in central and eastern Europe and Poland

Fragmentation of production processes may lead to a misinterpretation of gross trade statistics. In order to produce a final good, intermediate goods may cross borders several times. At each stage, exports require significant amount of imports and hence only a small fraction of gross exports contributes to the GDP of the exporting country by creating domestic value added. The net exports contribution to GDP growth is misleading, since both imports and exports contain intermediate and final goods and at the same time the final demand aggregates in GDP have a varying import intensity. In particular, in EMEs, investment demand is import-intensive and hence raw net exports contributed negatively to the GDP growth of CEE countries throughout much of the transition period.

Decomposition of value added growth                                        Graph 1



Sources: Hagemejer, (2017), Hagemejer and Mućk, (2017). The "domestically absorbed" bar corresponds to the growth in value added that is generated in production of goods and services and finally absorbed by domestic final demand. The "absorbed abroad" bar corresponds to the growth in value added that is consumed as part as foreign domestic demand. The two bars sum up to overall domestic real value added growth.
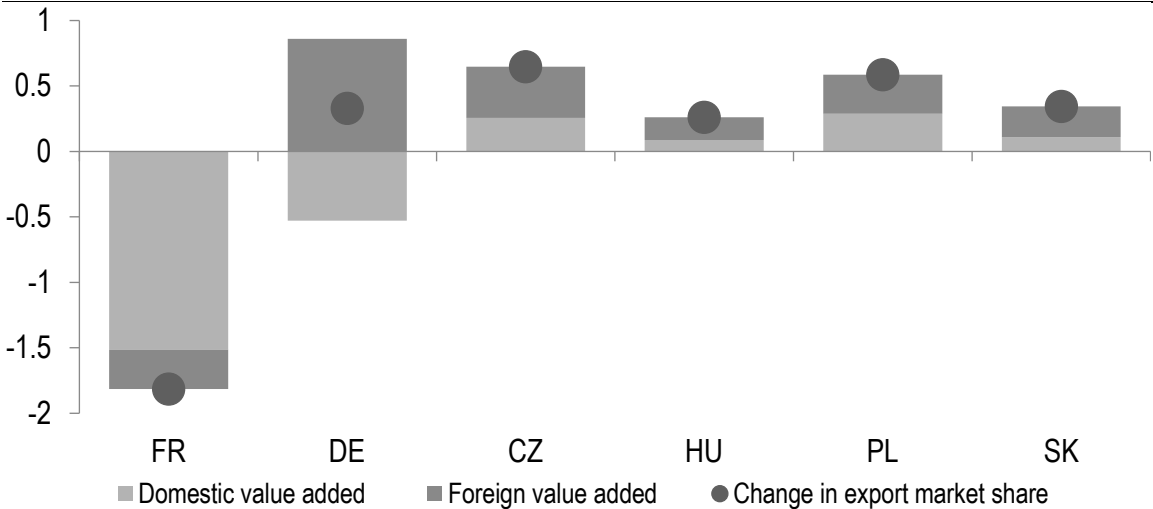
In order to overcome this measurement problem, Kranderdonk and Verbruggen (2005) correct for the varying import intensity of final demand components based on input-output tables. Given the availability of yearly World Input Output Tables, Hagemejer (2017) proposes instead to use the Johnson and Noguera (2012)

decomposition of overall GDP to value added that is absorbed domestically and the one that is exported – hence providing a direct accounting of the GDP contribution from exports.

As Graph 1 shows, in Poland and in other CEE countries, exports have been the predominant driver of economic growth for most of the period analysed, from 1995 to 2014. This reflects an increasing export specialisation in the CEE countries, ie that an increasing share of output was directed towards exports. At the same time final demand has become increasingly dependent on imports. In Poland, the contribution of exports to overall value added output is, in relative terms, lower than elsewhere due to a larger domestic market than in other CEE countries. However, the greater diversification of Polish exports has helped Poland to maintain higher export growth following the Great Financial Crisis (GFC) than other economies in the region.

As shown by Hagemejer (2017), on average around 60% of CEE exports are intermediate goods. Trade in intermediate goods is associated with the activity of global value chains, ie these intermediate goods are further processed elsewhere along the GVC. One can decompose the changes in the share of world exports to parts attributable (i) to the growth of domestic value added (contribution of exports to domestic GDP) and (ii) to foreign value added, indicating the changes in the trade value that are driven by the process of production relocation and offshoring. Such a decomposition is shown in Graph 2 for 2000–14. While the gain in German market share was due solely to offshoring to other countries (including the CEE), in Poland and other CEE countries it was also driven by the contribution of domestic value added.

Decomposition of changes in market share 2000–14, manufacturing                Graph 2



■ Domestic value added    ■ Foreign value added    ● Change in export market share

Source: Hagemejer and Mućk (2017. The figure shows the decomposition of a change in the world's exports to parts that are attributable to domestic value added growth and foreign value added growth (import intensity of exports).
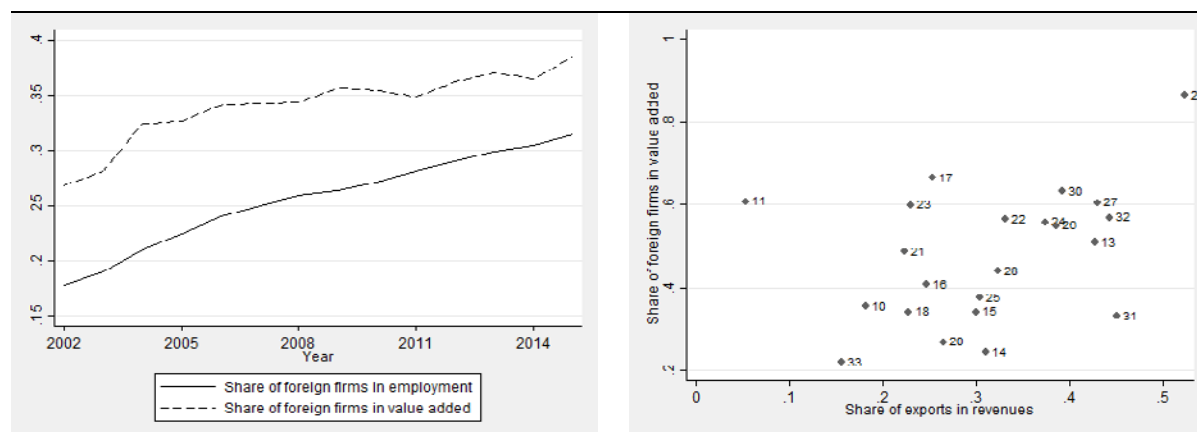
# Exports, foreign ownership and productivity at the sector level

In order to look more closely at the role of exports and FDI in shaping economic activity in Poland, we explore a rich firm-level data set from the Polish Central Statistical Office that covers all firms with 10 or more employees. It includes data from the profit and loss statements as well as the balance sheet, which is complemented by information on the form of ownership of every firm. Due to important changes in the structure of the data set, we are able to look at aggregate measures starting from 2002 but the consistent sectoral breakdown of the data is available starting from 2005, the year of Poland's EU accession.

As shown in Graph 3, foreign firms were responsible for a large share of the value added generated in the economy as well for a large share of employment. In 2015 these shares amounted to more than 32% and 38%, respectively. Since 2002, these numbers have been growing fast. The corresponding share of exporters in the overall sample are more volatile due to firms exiting and entering the exporter category (we take a threshold of 10% of revenues to classify firms as exporters to exclude firms that export sporadically and in very small amounts). However, in 2015 the shares of exporters in employment and value added were of about the same magnitude as the ones for foreign enterprises. FDI is also closely related to exporting, in particular in the tradable sector – manufacturing – where highly export-oriented sectors are also dominated by firms with foreign capital. Notable exceptions include beverage production (sector 11[2]), where foreign capital is predominant but the industry is geared towards the domestic market, as well as apparel (14) and furniture (31), which are export-oriented but comprise mostly domestic firms.

Share of foreign firms in overall economy (left), export shares of revenues and foreign firm shares in value added in manufacturing (right)                    Graph 3

In line with the literature, the internationalisation of firms and sectors of production is associated with higher labour productivity. This regularity is more pronounced in the case of foreign ownership (Graph 3, right-hand panel) rather than
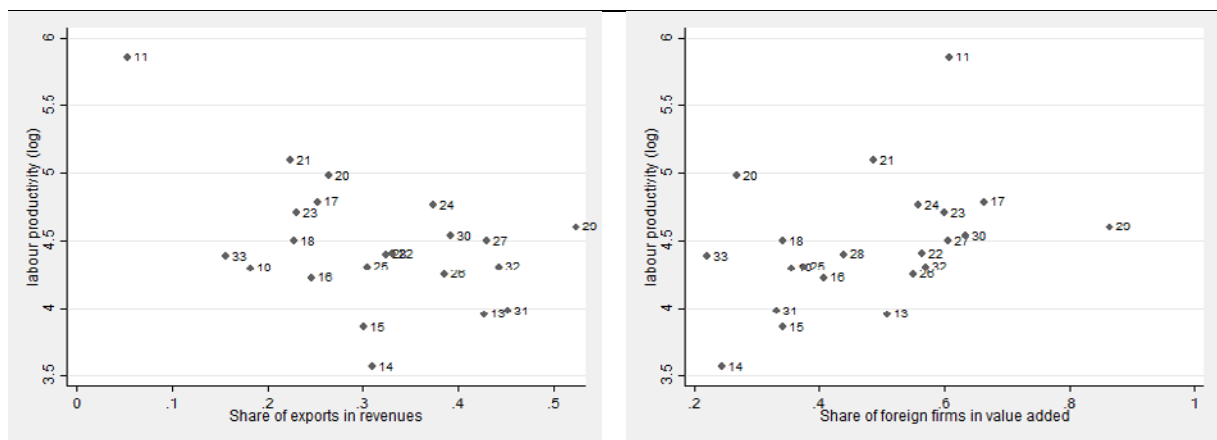
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[2] NACE rev. 2 sector codes are listed in Appendix B.

exporting. Outliers include such sectors as chemicals (20) as well as pharmaceuticals (21) that are capital-intensive and also involve non-tangible assets in production, as well as beverage production (11), which, as noted above, is domestic-market oriented but has a large share of foreign firms.

The 10-year real growth rates of labour productivity (Graph 11 in the Appendix) reveals a similar pattern and shows a robust association between sector internationalisation and labour productivity growth. There are, however, two outstanding sectors where the scale of labour productivity growth was the highest in the period analysed: the food sector and beverage production. In both of these sectors labour productivity increased threefold. While both of these sectors are geared mainly towards the domestic market, the food sector is the largest manufacturing sector in Poland and, given its size, is among the top exporting sectors.

## Labour productivity levels and sector internationalisation, 2015
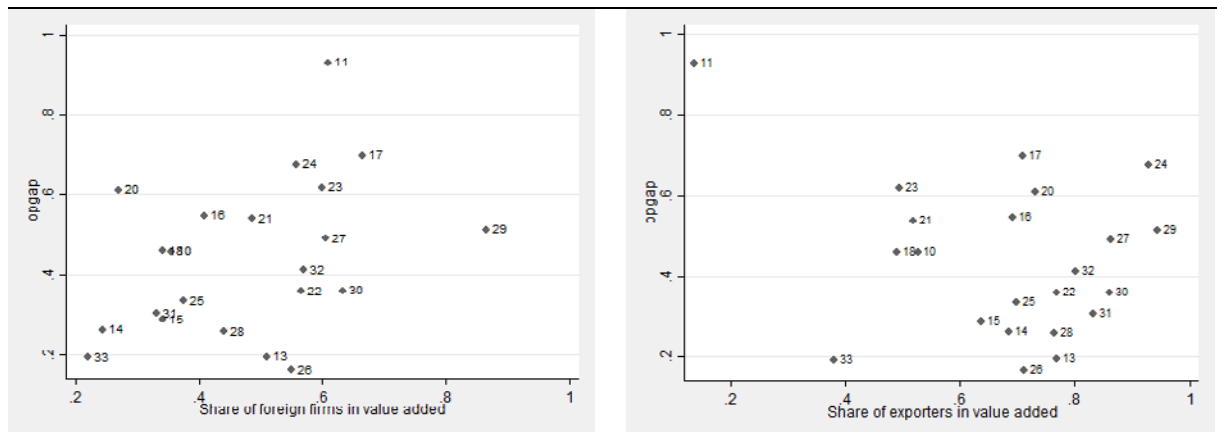
Graph 4



Source: Authors' calculations using firm-level data. Numbers in scatter plots refer to NACE rev. 2 sectors (listed in Appendix B.

## Allocative efficiency (OP-gaps) and sector internationalisation

Graph 5



Source: Authors' calculations using firm-level data.

According to Olley and Pakes (1996), sector-level (employment-weighted) labour productivity can be decomposed to firm-level (unweighted) labour productivity and the covariance component between firm size and productivity (the so-called OP-gap). The covariance component can be understood as the measure of allocation of resources, ie the larger the (positive) covariance, the more efficient is the allocation of resources (more productive firms grow larger). A negative covariance term is associated with resource misallocation. Graph 5 shows the OP-gap measure for the manufacturing sectors, which turns out to be positive for all sectors and shows a positive relationship between sectoral internationalisation and allocative efficiency.

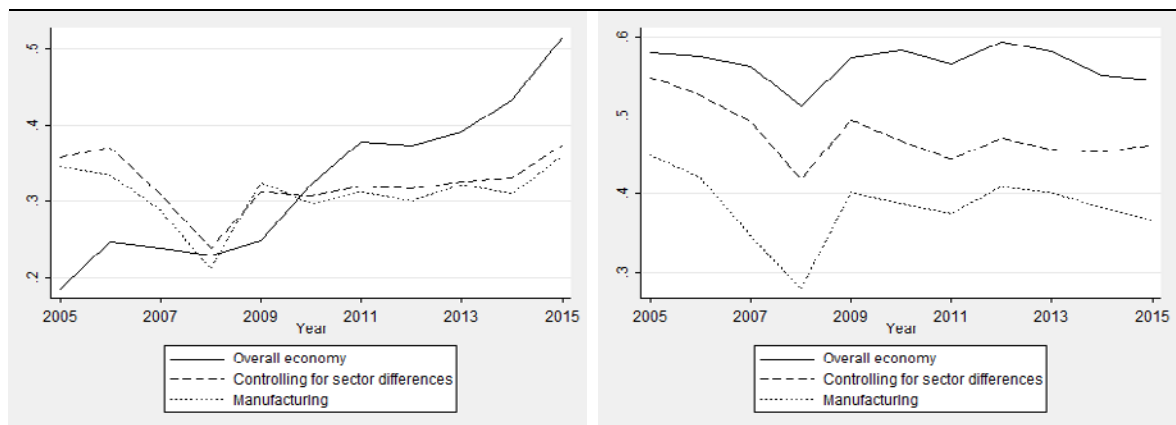## Internationalisation, firm-level productivity and wages

In order to inquire into the intra-sectoral effects of globalisation, we follow Bernard and Jensen (1996) and estimate simple regressions of the form:

$$\ln(X_i) = \alpha + \beta Int_i + \gamma Industry_i + \varepsilon_i,$$

where the $X_i$ variable is a performance indicator (labour productivity, TFP[3], average wage, capital-labour ratio), $Int_i$ is a firm-level internationalisation dummy (exporting or foreign ownership) and $Industry_i$ are the industry fixed effects. We estimate such cross-sectional regressions for every year between 2005 and 2015 for the overall sample of firms and for manufacturing, with and without the industry fixed effects (for manufacturing only with fixed effects). We concentrate on the estimates of $\beta$ showing the approximate percentage differences in the $X_i$ between internationalised and non-internationalised firms. Graphs 6–9 and 11 (in the Appendix) are all constructed in the same manner. The "Overall economy" line corresponds to the level of the $\beta$ estimates without any sectoral controls, the "Controlling for sector differences" line shows the $\beta$ estimated for all firms in a regression including two-digit sector fixed-effects and "Manufacturing" shows the estimates of $\beta$ in that sector controlling for two-digit sectors in manufacturing.

Labour productivity differences (in percent): exporter vs non-exporters (left),
foreign vs domestic firms (right)                                           Graph 6



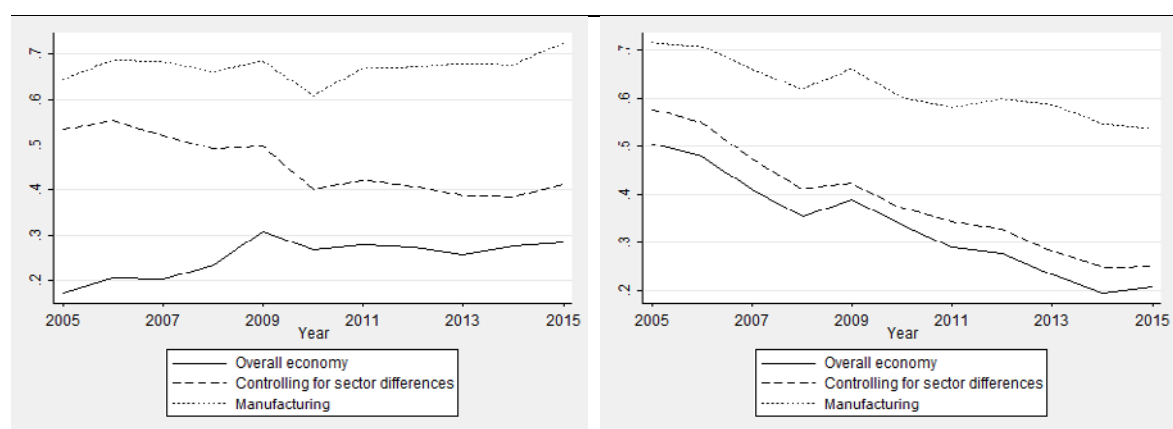Source: Authors' calculations using firm-level data

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[3]    We estimate firm-level total factor productivity with the Levinsohn-Petrin (2003) method, using materials to control for unobservables. In order to produce TFP estimates comparable across sectors, we restrict the capital and labor parameters to be the same across all sectors.

Graph 6 shows the comparison of labour productivity levels between exporters and non-exporters (left-hand panel) and foreign and domestic firms (right-hand panel). One can see that these differences are sizeable and they greatly differ depending on the sample analysed and the method of comparison. The exporter productivity premium turns out to be almost 35% in manufacturing and in the overall sample by the end of the period analysed after controlling for sector specificity. When these controls are not included, differences stemming from the intersectoral variation of productivity are not only greater but also increase over time. The productivity premia of foreign firms over domestic enterprises are more stable over time and they range from about 40% in manufacturing to considerably more for the overall sample. Similar patterns can be observed for TFP differences (Graph 12 in the Appendix). Appendix Table 1 and 2 show the exporter and foreign productivity premia for exporters and foreign firms estimated on a sample pooled for 2005–15 and show that, while the foreign firm productivity advantage is higher than that of exporters, these premia are not additive, ie some of the advantage foreign firms have over domestic firms comes from the fact that they tend to be exporters at the same time.

The exporter and foreign firm labour productivity advantage comes from the facts that internationalised firms have higher total factor productivity and that they also tend to have more capital per worker. These differences are shown in Graph 7. While in the productivity comparison a large part of the productivity difference was due to inter-sectoral differences, the differences between internationalised and non-internationalised firms tend to be larger within sectors than across sectors and they are considerably higher in manufacturing than elsewhere, ie export participation in manufacturing involves a capital-labour ratio that is higher by almost 70% in manufacturing and by 40–50% overall. Foreign firms are also likely to have more capital than domestic firms but, unlike in the case of exporters, this advantage seems to be fading out over time.

Capital/labour ratio differences (in percent): exporter vs non-exporters (left),
foreign vs domestic firms (right)

Graph 7



Source: Authors' calculations using firm-level data.

Large differences in productivity and K/L ratios between internationalised and non-internationalised firms lead to large wage differences. While we do not control specifically for the skill premium of labour, the sector-level fixed effects should take care of the inter-sectoral differences in skill requirements. Wage differences between exporters and non-exporters exhibit a different pattern than do those of foreign and

domestic firms. In the case of the former comparison, differences between sectors are less important than differences in wages within sectors, which amount to roughly 25% of the wage premium of exporters vs non-exporters and seem to have gone up after the GFC. While for the overall economy the foreign firm wage premium is large and amounts to a stable 50% even after controlling for sector specificity, it is considerably lower in manufacturing (35%). Overall, both the increasing exporter wage premium and the increasing importance of foreign firms affect overall wage growth in Poland as well as aggravating income inequality.

In order to inquire further into the wage premia from internationalisation, we normalise the wage level by labour productivity and regress the log of this ratio on the internationalisation dummy variables to understand to what extent labour is remunerated in line with its productivity. The coefficient of the internationalisation dummies for all years under consideration is presented in Graph 9. It shows that productivity-adjusted wages are significantly lower for exporters than for non-exporters after the GFC by 5–10%. This result stems from two possible sources: (i) the cost-price competitiveness of exporters that keeps wage growth below the growth rate of productivity and (ii) persistently higher capital share of value added by exporters than by non-exporters. While this phenomenon is present in exporters both in manufacturing and in the overall sample, in the case of foreign-domestic firms comparison the pattern is similar only in manufacturing, ie the tradable sector. In the overall sample, the wage/productivity ratio is higher for foreign firms than for domestic firms suggesting that in non-tradable sectors the downward competitive pressure on wages is lower than in manufacturing (see also Table 5 for estimates for the pooled sample and standard errors).

Average wage differences (in percent): exporter vs non-exporters (left), foreign vs domestic firms (right)                                                                    Graph 8
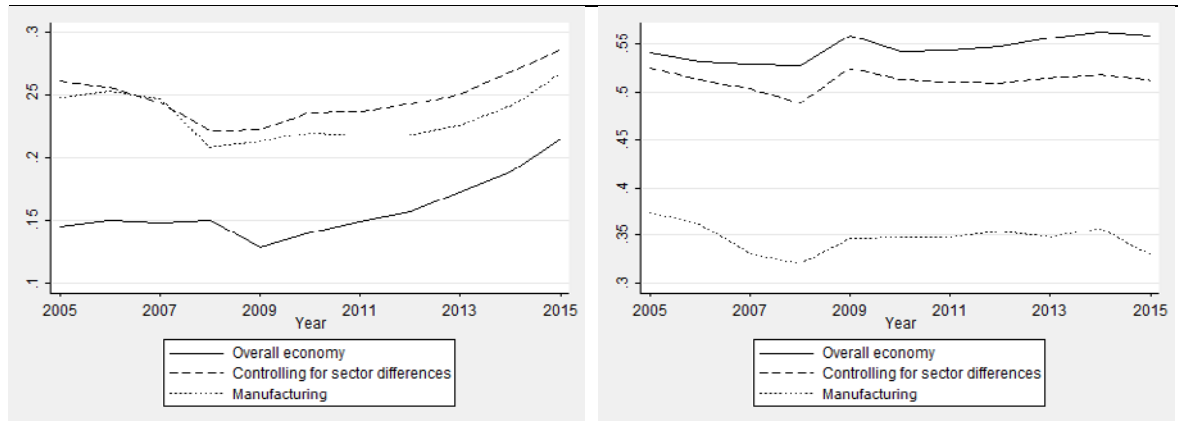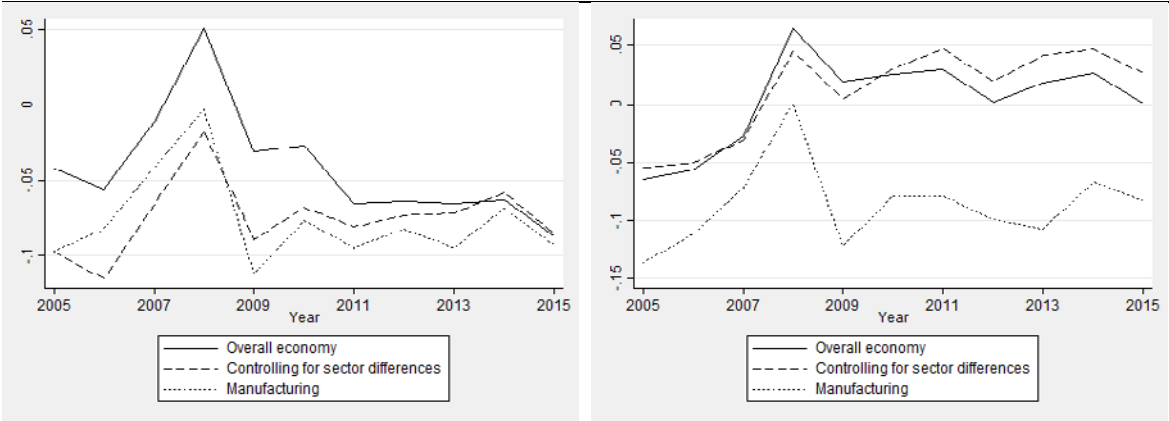


Source: Authors' calculationss using firm-level data.

Wage/productivity ratio differences (in percent): exporter vs non-exporters
(left), foreign vs domestic firms (right)

Graph 9



Source: Authors' calculations using firm-level data.

## Conclusions

We provide empirical evidence on the contribution to economic growth of participation in export markets and foreign direct investment. We show that, throughout much of the transition period, the post-accession period and after the GFC, exports have been a major growth driver for direct value added. This finding applies to Poland and to some extent to other CEE countries. The post-crisis differences in growth performance stem from a different pattern of specialisation in exports, ie Poland's exports focus to a larger extent on consumption goods and intermediates used in the production of such goods.

We show, using Polish firm-level data, that firms' participation in export markets and in hosting foreign direct investments is also related to productivity growth and productivity level differences. Productivity growth is due to the processes taking place in firms: ie productivity gains of firms with foreign capital through adoption of modern technology and managerial improvements, as well as the learning-by-exporting of domestic exporters. Additionally, FDI inflows and exporting are associated with a higher degree of allocative efficiency, ie resources are re-allocated to more productive firms.

However, participation in global markets has its distributional consequences. Sectors that engage in trade are more productive than others and firms that export have a productivity premium over firms focused on the domestic market. However, productivity differences translate to wage differences only to some extent. While exporters and foreign firms pay higher wages than non-exporters and domestic firms do, the productivity-adjusted wage premium of exporters has been negative, in particular after the GFC. One possible reason for this persistent difference is the necessity for exporters to maintain their price-cost competitiveness.

A question for future research is how far export-driven growth is sustainable in the longer run. Poland and other CEECs have enjoyed sizeable productivity improvements thanks mainly to FDI substituting for domestic innovation and capital As such, the export growth model has been based on price-cost competitiveness and proximity to markets. Future wage growth in the export-oriented segment will depend on how far the the country can shift towards higher value added goods and services, creating its own global value added chains and outward FDI, thus gaining additional shares in global markets. Those improvements can be facilitated by a predictable institutional environment as well as appropriate innovation-oriented incentives to enterprises.
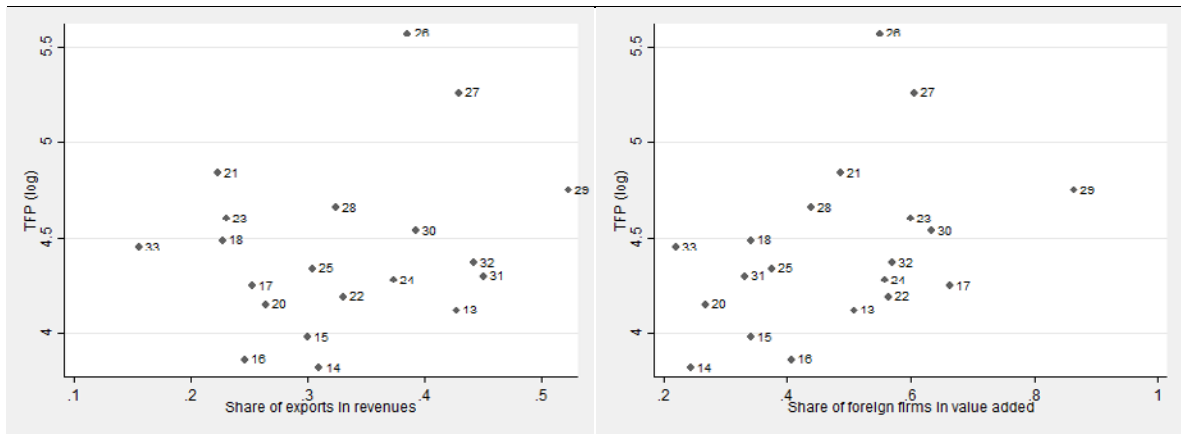
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# Appendix A – additional figures and tables

## Total factor productivity levels, 2015

Source: Authors' calculations using firm-level data. Numbers in scatter plots refer to NACE rev. 2 sectors (listed in Appendix B.
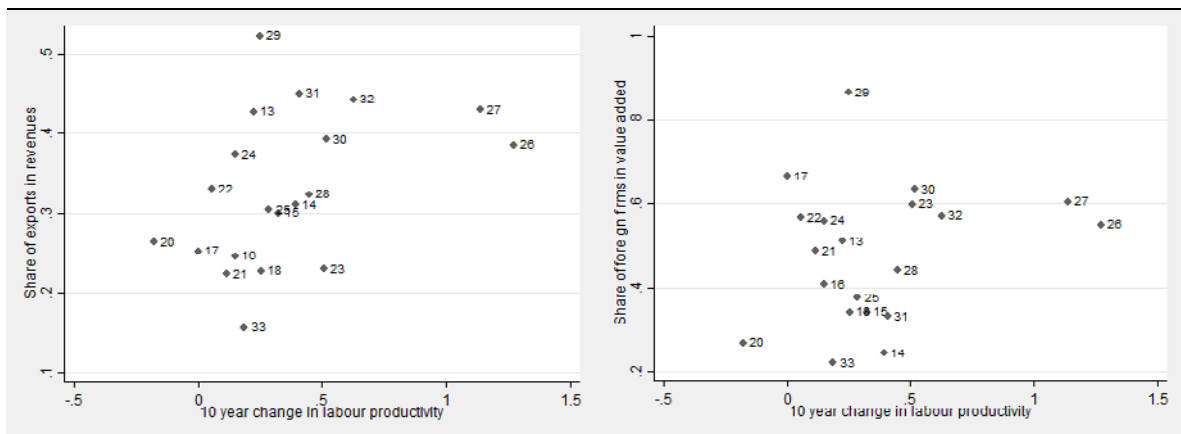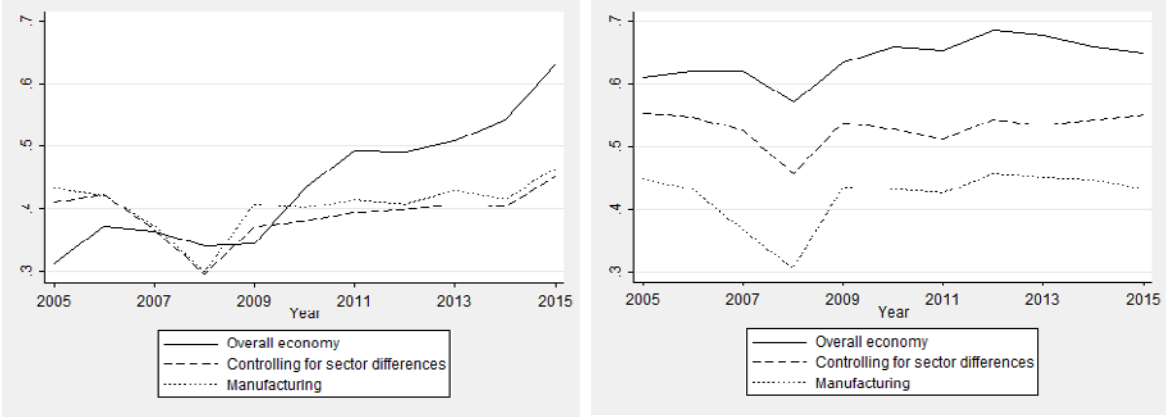
## Labour productivity growth

Source: Authors' calculations using firm-level data. Numbers in scatter plots refer to NACE rev. 2 sectors (listed in Appendix B.

Total factor productivity differences (in percent): exporter vs non-exporters (left), foreign vs domestic firms (right)

Graph 12



Source: Authors' calculationss using firm-level data.

# Appendix A – regression results

## Labour productivity premium regressions

Table 1

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | **Overall sample** | | | | **Manufacturing** | | | |
| Foreign | | 0.445*** | 0.368*** | 0.517*** | | 0.368*** | 0.276*** | 0.411*** |
| | | (0.00395) | (0.00411) | (0.00622) | | (0.00621) | (0.00650) | (0.0170) |
| Exporter | 0.331*** | | 0.236*** | 0.283*** | 0.320*** | | 0.245*** | 0.260*** |
| | (0.00354) | | (0.00366) | (0.00395) | (0.00528) | | (0.00553) | (0.00579) |
| Exporter*Foreign | | | | -0.260*** | | | | -0.158*** |
| | | | | (0.00820) | | | | (0.0183) |
| Constant | 3.930*** | 3.956*** | 3.907*** | 3.898*** | 3.949*** | 4.050*** | 3.934*** | 3.927*** |
| | (0.00153) | (0.00135) | (0.00154) | (0.00156) | (0.00381) | (0.00277) | (0.00380) | (0.00388) |
| Observations | 372,081 | 372,081 | 372,081 | 372,081 | 112,016 | 112,016 | 112,016 | 112,016 |
| R-squared | 0.163 | 0.171 | 0.180 | 0.183 | 0.159 | 0.158 | 0.173 | 0.173 |

Note: Standard errors in parentheses, columns show separate regressions. All regressions include two-digit sector fixed effects.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

## TFP premium regressions

Table 2

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | **Overall sample** | | | | **Manufacturing** | | | |
| Foreign | | 0.507*** | 0.412*** | 0.569*** | | 0.412*** | 0.285*** | 0.386*** |
| | | (0.00380) | (0.00393) | (0.00599) | | (0.00607) | (0.00629) | (0.0166) |
| Exporter | 0.399*** | | 0.293*** | 0.342*** | 0.418*** | | 0.340*** | 0.351*** |
| | (0.00340) | | (0.00350) | (0.00377) | (0.00513) | | (0.00536) | (0.00562) |
| Exporter*Foreign | | | | -0.272*** | | | | -0.118*** |
| | | | | (0.00785) | | | | (0.0179) |
| Constant | 4.198*** | 4.233*** | 4.173*** | 4.163*** | 4.247*** | 4.395*** | 4.232*** | 4.227*** |
| | (0.00148) | (0.00130) | (0.00148) | (0.00150) | (0.00372) | (0.00270) | (0.00370) | (0.00378) |
| Observations | 365,929 | 365,929 | 365,929 | 365,929 | 110,760 | 110,760 | 110,760 | 110,760 |
| R-squared | 0.177 | 0.185 | 0.201 | 0.203 | 0.171 | 0.157 | 0.186 | 0.187 |

Note: Standard errors in parentheses, columns show separate regressions. All regressions include two-digit sector fixed effects.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

## K/L premium regressions

Table 3

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | **Overall sample** | | | | **Manufacturing** | | | |
| Foreign | | 0.365*** | 0.240*** | 0.330*** | | 0.619*** | 0.410*** | 0.583*** |
| | | (0.00826) | (0.00860) | (0.0130) | | (0.0108) | (0.0113) | (0.0297) |
| Exporter | 0.450*** | | 0.389*** | 0.417*** | 0.669*** | | 0.558*** | 0.577*** |
| | (0.00736) | | (0.00768) | (0.00828) | (0.00917) | | (0.00962) | (0.0101) |
| Exporter*Foreign | | | | -0.158*** | | | | -0.202*** |
| | | | | (0.0172) | | | | (0.0321) |
| Constant | 3.506*** | 3.570*** | 3.491*** | 3.485*** | 3.286*** | 3.531*** | 3.264*** | 3.255*** |
| | (0.00316) | (0.00280) | (0.00320) | (0.00325) | (0.00664) | (0.00484) | (0.00663) | (0.00678) |
| Observations | 374,452 | 374,452 | 374,452 | 374,452 | 110,763 | 110,763 | 110,763 | 110,763 |
| R-squared | 0.226 | 0.223 | 0.228 | 0.228 | 0.160 | 0.145 | 0.170 | 0.171 |

Note: Standard errors in parentheses, columns show separate regressions. All regressions include two-digit sector fixed effects.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

## Average wage premium regressions

Table 4

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | **Overall sample** | | | | **Manufacturing** | | | |
| Foreign | | 0.486*** | 0.441*** | 0.566*** | | 0.338*** | 0.277*** | 0.393*** |
| | | (0.00272) | (0.00283) | (0.00423) | | (0.00373) | (0.00390) | (0.0102) |
| Exporter | 0.254*** | | 0.140*** | 0.181*** | 0.236*** | | 0.160*** | 0.173*** |
| | (0.00251) | | (0.00254) | (0.00274) | (0.00321) | | (0.00331) | (0.00347) |
| Exporter*Foreign | | | | -0.223*** | | | | -0.135*** |
| | | | | (0.00563) | | | | (0.0110) |
| Constant | 3.552*** | 3.552*** | 3.525*** | 3.518*** | 3.421*** | 3.482*** | 3.406*** | 3.400*** |
| | (0.00105) | (0.000911) | (0.00103) | (0.00105) | (0.00232) | (0.00166) | (0.00228) | (0.00233) |
| Observations | 397,696 | 397,696 | 397,696 | 397,696 | 112,012 | 112,012 | 112,012 | 112,012 |
| R-squared | 0.184 | 0.225 | 0.231 | 0.234 | 0.189 | 0.208 | 0.224 | 0.225 |

Note: Standard errors in parentheses, columns show separate regressions. All regressions include two-digit sector fixed effects.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

## Wage/productivity premium regressions

Table 5

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | **Overall sample** | | | | **Manufacturing** | | | |
| Foreign | | 0.0416*** | 0.0710*** | 0.0542*** | | -0.0268*** | 0.00282 | -0.0131 |
| | | (0.00283) | (0.00295) | (0.00440) | | (0.00403) | (0.00425) | (0.0111) |
| Exporter | -0.0741*** | | -0.0923*** | -0.0979*** | -0.0779*** | | -0.0787*** | -0.0804*** |
| | (0.00254) | | (0.00265) | (0.00286) | (0.00342) | | (0.00361) | (0.00378) |
| Exporter*Foreign | | | | 0.0301*** | | | | 0.0186 |
| | | | | (0.00587) | | | | (0.0120) |
| Constant | -0.464*** | -0.486*** | -0.469*** | -0.468*** | -0.414*** | -0.451*** | -0.414*** | -0.413*** |
| | (0.00106) | (0.000946) | (0.00107) | (0.00109) | (0.00247) | (0.00179) | (0.00248) | (0.00254) |
| Observations | 397,677 | 397,677 | 397,677 | 397,677 | 112,008 | 112,008 | 112,008 | 112,008 |
| R-squared | 0.082 | 0.081 | 0.084 | 0.084 | 0.055 | 0.051 | 0.055 | 0.055 |

Note: Standard errors in parentheses, columns show separate regressions. All regressions include two-digit sector fixed effects.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

# Appendix B – NACE rev. 2 sector codes, manufacturing

| Code | Description |
|---|---|
| 10 | Manufacture of food products |
| 11 | Manufacture of beverages |
| 12 | Manufacture of tobacco products |
| 13 | Manufacture of textiles |
| 14 | Manufacture of wearing apparel |
| 15 | Manufacture of leather and related products |
| 16 | Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials |
| 17 | Manufacture of paper and paper products |
| 18 | Printing and reproduction of recorded media |
| 19 | Manufacture of coke and refined petroleum products |
| 20 | Manufacture of chemicals and chemical products |
| 21 | Manufacture of basic pharmaceutical products and pharmaceutical preparations |
| 22 | Manufacture of rubber and plastic products |
| 23 | Manufacture of other non-metallic mineral products |
| 24 | Manufacture of basic metals |
| 25 | Manufacture of fabricated metal products, except machinery and equipment |
| 26 | Manufacture of computer, electronic and optical products |
| 27 | Manufacture of electrical equipment |
| 28 | Manufacture of machinery and equipment n.e.c. |
| 29 | Manufacture of motor vehicles, trailers and semi-trailers |
| 30 | Manufacture of other transport equipment |
| 31 | Manufacture of furniture |
| 32 | Other manufacturing |
| 33 | Repair and installation of machinery and equipment |