



UNIVERSITY OF WARSAW

Faculty of Economic Sciences

WORKING PAPERS

No. 42/2015 (190)

JAN HAGEMEJER

PRODUCTIVITY SPILLOVERS IN THE GVC THE CASE OF POLAND AND THE NEW EU MEMBER STATES

WARSAW 2015



UNIVERSITY OF WARSAW

Faculty of Economic Sciences

Productivity spillovers in the GVC. The case of Poland and the New EU Member States

JAN HAGEMEJER

Faculty of Economic Sciences

University of Warsaw

National Bank of Poland

e-mail: j.hagemejer@uw.edu.pl

Abstract

The new EU member states have been experiencing firm internationalization not only through inward foreign direct investment but also through exporting, importation of foreign technology in investment goods and increased use of imported intermediates. We argue that there are important productivity spillovers within the global value chains, i.e. FDI alone does not tell the whole story of the reallocation processes going on in the economies of the NMS. We augment the standard TFP spillover empirical model with modern measures of GVC participation. We show that increased foreign content of exports brings additional productivity gains on top of the ones attributed to exporting. Moreover, we show that in selected cases, participation in the GVC leads to a smaller productivity gap between foreign and domestic firms.

Keywords:

global value chains, productivity, New Member States, productivity spillovers

JEL:

L25, C67, F10, F23, O12

Acknowledgements:

The views presented here are those of the author and not necessarily of the National Bank of Poland. The paper was written thanks to financing by the National Science Centre, grant no: UMO-2013/09/D/HS4/01519.

I thank Juan Kania-Morales for outstanding research assistance. I also thank Zhi Wang, Shan-Jin Wei and Kunfu Zhu for providing the data from their 2013 paper. All errors are mine.

Working Papers contain preliminary research results.

Please consider this when citing the paper.

Please contact the authors to give comments or to obtain revised version.

Any mistakes and the views expressed herein are solely those of the authors.

Introduction

The new EU member states (of the 2004 EU enlargement, NMS hereafter) are somewhat special in terms of the structural changes in that they have been undergoing them for the last 25 years. Since the early 1990s, a transition from a centrally planned to a market economy has been going on, initially often in the form of shock therapy, where prices were freed and rapid privatization begun. By the mid-1990s, the region was already deeply involved in a process of integration with the western part of the European Union, both through the Association Agreements and through bilateral and multilateral trade agreements within the Central and Eastern Europe group. This process was culminated through the EU enlargement in 2004 and subsequent liberalization measures (the Schengen treaty, greater opening up of EU-15 labour markets and the EU Service Directive). However, the NMS have been caught in another, global trend related to the establishment of the Global Value Chain and the ongoing fragmentation of world production. At the firm level, one could observe increasing internationalization, both through inward foreign direct investment and also through exporting, importation of foreign technology in investment goods, increased use of imported intermediates and also, to a limited extend, through outward FDI.

In this paper we analyze the NMS and Poland in particular. We believe that unlike the other NMS, Poland is somewhat special due to its size, relatively large internal market and a sustained importance of the agriculture and food sector in the output and exports of goods. Therefore we attempt to establish the differences between the Polish and other NMS firm-level responses to participation in the GVC.

We bridge the literature on firm internationalization and productivity spillovers together with the growing literature on the global value chain. We base our empirical model on the now-standard spillover equation specification coming from Smarzynska-Javorcik (2004) and the earlier analysis of Haddad and Harisson (1993), Aitken and Harrison (1999) as well as Djankov and Hoekman (2000) or Konings (2001). The Smarzynska-Javorcik methodology has been used extensively in a number of similar papers as reviewed by Crespo et al (2009). Havranek and Irsova (2013) analyse more than a thousand estimates of spillovers in a large-scale up-to date meta-analysis showing that, in the case of the NMS, the overall evidence of FDI spillovers is

heterogeneous. As far as Poland is concerned, Kolasa (2008) provides evidence on horizontal and backward spillovers. A larger study by Hagemeyer and Kolasa (2011) shows large spillovers from sectoral internationalization (FDI, exporting, imports of intermediates) in the largest available dataset for Poland at the time of publication. Additionally, Bijsterboch & Kolasa (2010) provide sectoral data evidence on important productivity effects of FDI in Central and Eastern Europe that underline the importance of the absorptive capacity for materialization of productivity gains from FDI.

We make the argument that FDI is just one source of productivity spillovers that can bring productivity gains. Furthermore, we argue that there are important productivity spillovers within the global value chains, ie. FDI alone is not fully telling of the reallocation processes going on in the economies of the NMS. Clearly in the environment of the European Union, FDI remains an important feature of the catching up economies. However, due to low trade barriers, it seems natural that it is vertical FDI that matters most. Still, while the global value chain is to a large extent managed by multinationals, it also encompasses the domestic firms that may benefit from access to global demand. Examples include the car manufacturing industry in Poland, Slovakia and the Czech Republic, where small and medium enterprises supply parts, components and intermediate services to large multinational car and car component plants, or the Polish aviation sector producing specialized aircraft parts and components.

We augment the standard spillover empirical model with measures of GVC participation. Here, we combine two related strands of literature – the fragmentation and the supply chain literature. We build on seminal work of Hummels et al. (2001) who proposed the term “vertical specialization” (VS) in order to describe the increasingly sequential nature of world production. , a broad measure of foreign content of country’s exports. The measures of VS was further combined with the notion of foreign value added in exports, as described by another seminal paper of Johnson and Noguera (2012), which decomposes gross exports into domestic and foreign components by taking care of the so-called double counting of intermediate goods that inflate the value of gross exports by crossing borders several times. These measures have been further refined by Koopman, Wang, and Wei (2014) to provide full accounting of gross exports and finally by Wang, Wei and Zhu (2013) who provide a complete decomposition

framework of gross exports into domestic and foreign components, intermediate and final goods, and various forms of double counting.. This framework provides accurate measures of domestic and foreign components and both sector and bilateral levels, thus making it suitable for sectoral and firm-level analysis. On the other hand, we use the upstreamness measures coming from the supply chain literature, notably Antras et. al (2012). This analysis would not be possible without the tremendous work on the international input-output data within the World Input-Output Database, and the work by Timmer et al. (2015) and Stehrer (2012).

This paper is organized as follows: in the subsequent section we shed some light on the methodology used, the sources of data, and procedures of data handling. We then provide some preliminary and descriptive results. We progress to the detailed analysis of the foreign firm productivity premia and its relation to the position in the GVC. Subsequently we provide an analysis of TFP spillovers augmented with GVC measures. The last section concludes the paper.

Methodology and data

In our study we combine firm-level data with international sectoral input-output data. Firm level data come from the Amadeus database. In order to maximize the number of observations, we combine data from multiple Amadeus waves. The resulting firm-level data sample covers the period of 1997-2011. However, the number of observations in the initial years is rather limited, therefore the bulk of the data comes from 2000-2011. Thanks to the firm identifiers that are common across the different revisions of Amadeus, we are able to track individual firms over time. The combined database contains information from the balance sheets and the income statements, in particular the levels of fixed assets, the use of materials and the firms' value added together with the NACE codes of the main activity (revision 1 and revision 2 where applicable), as well as the level of employment. We also identify firms with foreign ownership using the information on the origin of firm ownership.

In this paper, we use the methodology by Smazynska and Javorcik (2004) augmented with measures of GVC participation to analyze the various channels of internationalization. In order to obtain a measure of total factor productivity we use the now-standard approach by Levinshohn and Petrin . The estimated equation will take the form:

$$y_{it} = \alpha_0 + \alpha_1 l_{it} + \alpha_2 k_{it} + \epsilon_{it},$$

where y_{it} is log of firm i value added at time t , l_{it} is the labour input and k_{it} is the capital input, ϵ_{it} is the residual. As a capital variable we use the (log of) stock of fixed assets deflated with the deflator of investment goods at sector level (WIOD classification). Value added is deflated by a sectoral value added deflator (WIOD classification).

The first part of the subsequent analysis is aimed at determining the relevant differences between the foreign and domestic firms. The following equations are estimated:

$$TFP_{it} = \beta_1 foreign_{it} + \beta_2 foreign_{it} \cdot GVC_{it} + \beta_3 GVC_{it} + \epsilon_{it},$$

where TFP_{it} is the log of firm-level total factor productivity and $foreign_{it}$ is the foreign ownership dummy variable. We also include an interaction term of the $foreign_{it}$ dummy with the measures of the position of particular sector and country in the global value chains. These measures include the share of foreign value added in exports of intermediate and final goods, the degree of vertical specialization (total foreign content) in exports of intermediate and final goods, and the upstreamness measures. The sign of the interaction term shows whether participation in a particular stage of the value chain leads to a catching up of domestic firms to the TFP levels of foreign firms or vice versa. We estimate all the foreign ownership premia equations using standard panel methods – by employing sector and year-level fixed effects to account for sectoral variation and business cycles.

The above analysis will be complemented by an analysis of spillovers from foreign-owned firms. At the firm level we estimate the following equation:

$$\Delta TFP_{ijt} = \alpha_0 + \alpha_1 \Delta HZ_{jt} + \alpha_2 \Delta BW_{jt} + \alpha_3 \Delta FW_{jt} + \alpha_4 \Delta GVC_{jt} + \alpha_5 \Delta EXP_{jt} + \epsilon_{it}$$

Where ΔTFP_{ijt} is a change of TFP in firm i in sector j and time t . HZ_{jt} , BW_{jt} , FW_{jt} are the measures of horizontal, backward and forward linkages as defined originally by Smazynska-Javorcik (2004)). In their study, they measure the share of foreign firms in the output of sector j (HZ), the shares of foreign firms in the downstream sectors (FW) weighted by their respective input-output shares, and the shares of foreign firms in the upstream sectors (BW) weighted by their respective input-output shares. We augment this equation with other modes of (sectoral) internationalization, notably the share of exports in output (to take into account the Melitz-

type selection effects) and GVC indicators to verify if the position in the GVC and the foreign content of exports have additional effects on firm-level growth.

As far as the sectoral data is concerned, we extensively use the freely available World Input-Output Database (WIOD) as described in Timmer et al. (2015). This database provides us with sectoral gross output levels, imports and exports of final as well as intermediate goods and sectoral deflators of intermediate use, capital goods and value added. We use the WIOD database to construct most of the GVC indicators indicated above.

We measure upstreamness according to the definition provided by Antras et. al (2012):

$$u_i = 1 \cdot \frac{X_i}{Y_i} + 2 \cdot \frac{\sum_{ij} z_{ij} X_j}{Y_i} + 3 \cdot \frac{\sum_{k=1}^N \sum_{ij} z_{ij} z_{jk} X_i}{Y_i} + \dots,$$

where Y_i is the gross output of sector i and X_i is the final demand for goods from sector i where z_{ij} is the input-output coefficient of the intermediate use of goods from sector i used in the production of sector j . Therefore the measure weighs the of the stage: 1 if output is used in final demand, 2 if output is used in production of goods that are subsequently used in final demand, 3 if output is used in production of goods that are used further in production of intermediate goods that are then used in satisfying final demand and so on. This measure is therefore bounded below by 1. Instead of computing the upstreamness indicators using national input-output changes, we use the World Input Output Database and instead compute the upstreamness indicator for the global input output database, therefore encompassing all the national and international production stages (in the same vein as Miller and Temurshoev, 2013). For details and some comparative analysis see Hagemeyer and Ghodsi, 2014.

Wang et al. 2013 provide a way of decomposing foreign content of exports by distinguishing exports of intermediate and final goods. The difference between foreign value added and vertical specialization share provided by Wang et al. 2013, is the share of pure double counting due to the back and forth intermediate goods trade originating from a foreign countries. The new methodology allows for identification of these four components of the foreign content of country's exports. The double counting stems from the fact that whenever intermediate goods are exported, used to produce other intermediates goods and then exported again, they appear in gross trade statistics but do not attribute to GDP of any trading partner. *A large share of*

foreign value-added in a country's final goods exports may indicate that the country mainly engages in final assembling activities based on imported components and just participates in cross-country production sharing on the low end of a global value chain, while an increasing foreign value added share in a country's intermediate exports may imply the country is upgrading its industry to start producing intermediate goods for other countries, especially when more and more of these goods are exported to third countries for final goods production (Wang et al. 2013, p. 34). Moreover, if additionally the share of double counting increases over time, it indicates a greater degree of production sharing in the particular section and therefore a greater involvement in the GVC. The sectoral measures of foreign value added in exports split into intermediate goods and final goods together with the revised measures of vertical specialization are taken from a database provided by Wang et al. (2013).

The spillover estimations are all performed in annual changes to take care of firm-specific heterogeneity (firm-level fixed effects). To capture sector-level heterogeneity and the business cycle effects, we also include sectoral dummies and time-dummies. In the cross-country regression we make all the fixed effects country-specific. Moreover, as all the explanatory variables are measured at sector level, we cluster all standard errors accordingly.

Descriptives and preliminary results

The process of opening up of the NMS that has been ongoing since the beginning of the 1990s manifested itself in the increased importance of international trade in the NMS economies as well as an increased participation of foreign capital in the ownership of enterprises. Figure 1 shows shares of foreign enterprises in the total number of firms as portrayed by the Amadeus database for the selected NMS economies. In most of the analyzed countries this share was between 5 to 15 percent. However, in terms of the value added produced, the foreign firms in all analyzed economies generated over 20 percent of the value added of all enterprises in the Amadeus database.

Foreign firms tend to be larger than domestic firms. They are also more productive. We compute the TFP premia from foreign ownership filtering out the sectoral and time fixed effects to account for sector-specific heterogeneity. We find that the difference in productivity

levels between domestic and foreign firms is gigantic and ranges from 37,4% in Poland to over 60% in Czech Republic, Estonia and Hungary over the analyzed period.

Figure 1 Shares of foreign firms

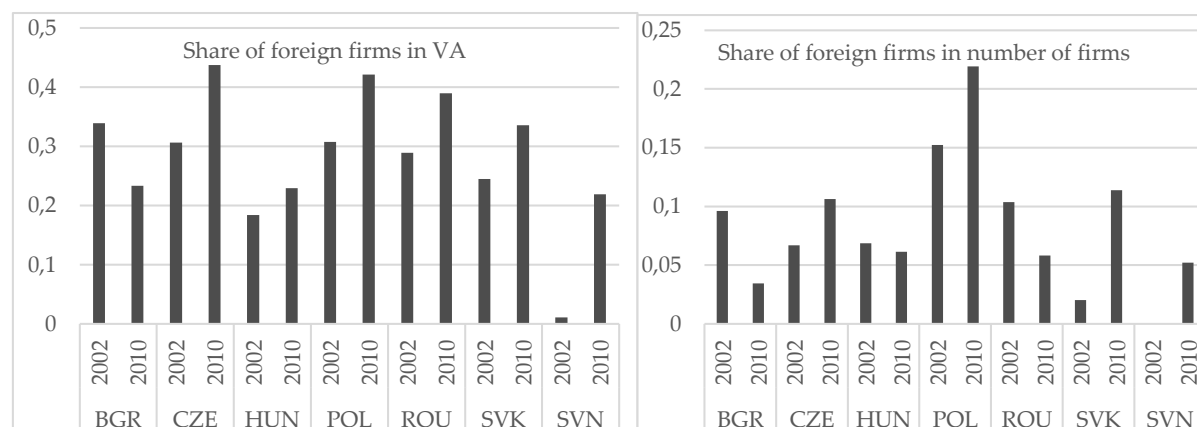


Table 1 TFP premia from foreign ownership

VARIABLES	(1) BGR	(2) CZE	(3) EST	(4) HUN	(6) POL	(7) ROU	(8) SVK	(9) SVN
Foreign	0.418*** (0.0226)	0.614*** (0.0213)	0.648*** (0.0261)	0.651*** (0.0492)	0.374*** (0.0130)	0.385*** (0.0146)	0.530*** (0.0252)	0.394*** (0.0260)
Constant	-4.591*** (0.0552)	-0.896*** (0.0393)	-2.104*** (0.283)	-1.151*** (0.0177)	-0.274*** (0.0393)	-4.158*** (0.0381)	-0.466*** (0.0333)	-0.966*** (0.0476)
Observations	66,761	95,901	17,385	13,761	57,173	350,733	33,855	17,650
R-squared	0.626	0.546	0.306	0.383	0.459	0.292	0.494	0.431

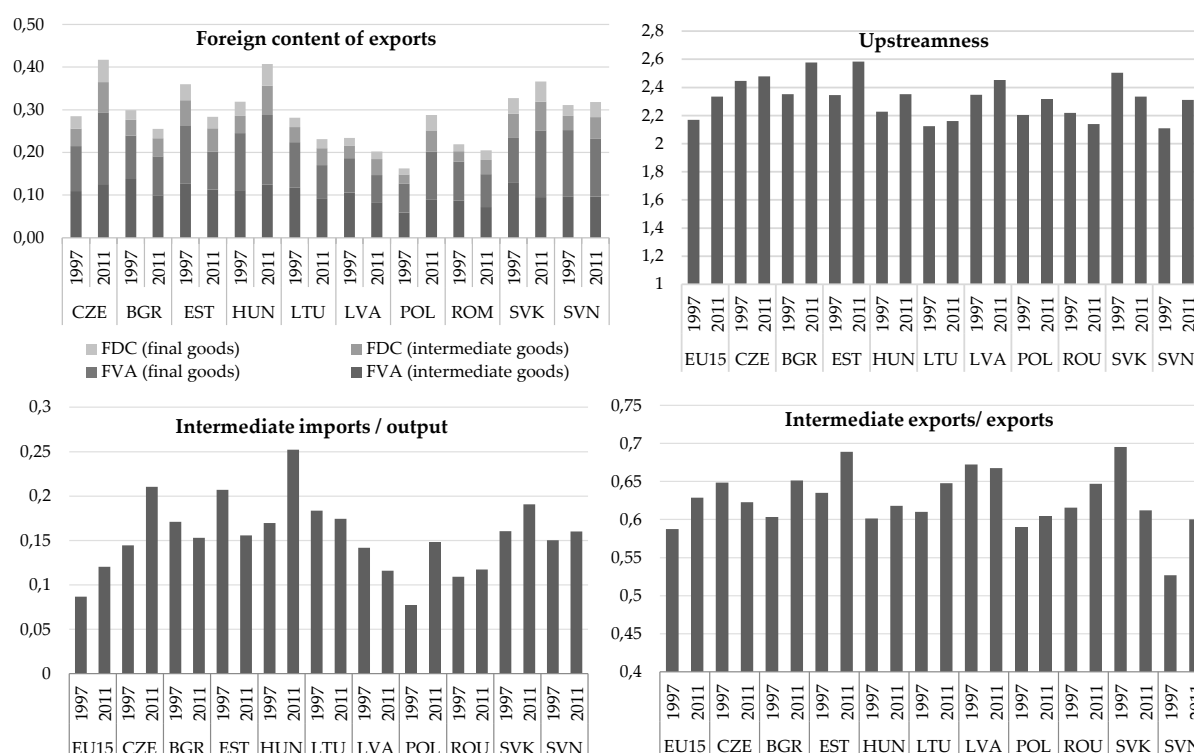
Robust standard errors in parentheses

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

However, foreign capital is not the only mode of internationalization that gained importance over the time of analysis. What we also observe in many NMS is a significant increase in the importance of imported intermediates in the production costs, which by 2011 amounted to roughly 15% of the value of gross output in most economies. We also observe that even though intermediates constituted a large part of exports already in 1997, this share grew over time in many NMS economies. The upstreamness of exports (the distance from final demand) has also increased over time both due to the overall increases of fragmentation in the world production and the greater specialization of NMS economies in intermediate goods. We observe that over the analyzed period the foreign content of exports (vertical specialization, as defined by Wang

et. al, 2013) has increased and by 2011 was the lowest in Romania and Latvia (around 20%) and the highest in Czech Republic and Hungary (over 40%). It is worth noting that in Poland the content has increased from 15% to almost 30%.

Figure 2 Standard GVC indicators



We also provide the decomposition of the foreign content of exports into the foreign value added (in final and intermediate goods, FVA) and the double counting components (FDC, also due to final and intermediate goods). It is worth noting that in some countries the FVA in final goods is more important than in intermediate goods, as is the case in the Czech Republic, Hungary, Slovakia and Slovenia. In the remaining countries, the two shares are at similar levels. It can also be noted that countries with a higher value added export content of final goods have a larger double counting component – the production process of the exported final goods involves the use of imported intermediate goods that cross borders several times.

As a first step, we estimate the standard spillover equation for all the NMS with available firm level data. Estimation results show that the incidence of foreign productivity spillovers is quite heterogeneous and present only in selected countries. We find significant horizontal spillovers from foreign ownership in manufacturing only in Slovakia. Backward spillovers are

found in the Czech Republic, Poland and Slovakia. When we consider the full sample (not just manufacturing, Table 10 in the Appendix), on top of spillovers found for manufacturing we also find evidence of horizontal spillovers in Estonia and Slovenia, due to the inclusion of the service sector in the sample.

Table 2 Productivity spillovers in individual countries (manufacturing)

VARIABLES	(1) BGR	(2) CZE	(3) EST	(4) HUN	(6) POL	(7) ROU	(8) SVK	(9) SVN
Horizontal FDI	-0.825** (0.385)	0.104 (0.113)	-0.100 (0.0878)	0.00311 (0.0784)	0.143 (0.103)	-0.106 (0.0786)	0.162* (0.0904)	0.138 (0.0971)
Forward FDI	0.341 (0.468)	-0.867*** (0.303)	-0.0875 (0.145)	-0.721 (0.462)	-0.155 (0.366)	-0.120 (0.199)	-0.436* (0.237)	0.245 (0.775)
Backward FDI	1.717 (1.174)	1.972*** (0.337)	0.0563 (0.190)	-0.322 (0.331)	1.323*** (0.390)	0.228 (0.144)	0.405* (0.238)	-0.908* (0.525)
Constant	-0.0789* (0.0425)	-0.00488 (0.0146)	-0.00826 (0.0712)	-0.175*** (0.0131)	-0.117*** (0.0138)	-0.0946*** (0.0120)	-0.0569*** (0.0162)	-0.0433*** (0.0123)
Observations	35,840	63,348	10,114	7,029	30,041	218,561	21,834	9,966
R-squared	0.108	0.083	0.036	0.046	0.100	0.082	0.051	0.093

Robust standard errors in parentheses

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

Foreign productivity premia and the GVC

We interact the productivity premia with various GVC indicators to understand the degree of complementarity or substitutability of various modes of internationalization in its impact on TFP. As far as the Polish economy is concerned, the upstreamness of a particular sector (distance from final demand) is not significant in explaining the productivity differences among domestic and foreign firms. However, we observe that foreign content of exports does reduce the foreign firm premia significantly, i.e. in sectors with high foreign content embedded in exports, domestic firms are able to perform better than in sectors with low foreign content, relative to foreign firms. This relationship is however not statistically significant when the sample is reduced to just the manufacturing sectors. We also note that the interaction term is higher on the foreign content embedded in intermediate goods than in final goods, suggesting that the reduction in the productivity gap between foreign and domestic firms is lower in production of intermediate goods rather than in the process of assembly of final goods.

When we pool all the NMS data together and estimate a similar equation by additionally controlling for country-sector-year heterogeneity, we find that there is indeed a significant

relationship between the premium of foreign firms and the upstreamness of sectors, i.e. the closer the sector is to the final demand (and upstreamness is lower), the smaller is the foreign premium. This is also true whenever the sample is reduced to just the manufacturing sector. However, by pooling the data we are able to explore the heterogeneity of NMS and therefore trace this relationship more fully. We also see that overall firm productivity is higher further away from final demand.

Table 3 Foreign firms productivity premia (Poland)

VARIABLES	(1) All	(2) All	(3) Mnfc	(4) Mnfc	(5) All	(6) Mnfc	(7) All	(8) Mnfc	(9) Mnfc
Foreign	0.502*** (0.0155)	0.595*** (0.0494)	0.731*** (0.0264)	0.461*** (0.0527)	0.456*** (0.0562)	0.613*** (0.0235)	0.661*** (0.0226)	0.382*** (0.0279)	0.421*** (0.0368)
Foreign * Upstreamness		-0.115* (0.0602)		-0.107* (0.0597)					
Upstreamness		0.269 (0.202)		0.0846 (0.345)					
Foreign * VS			-1.271*** (0.121)		-0.321 (0.202)				
VS			3.078*** (0.347)		2.497*** (0.557)				
Foreign * VS (final goods)						-1.285*** (0.176)		-0.0684 (0.197)	
VS (final goods)						3.723*** (0.522)		1.730** (0.726)	
Foreign * VS (intermediate goods)							-1.679*** (0.156)		-0.359 (0.234)
VS (intermediate goods)							1.829*** (0.586)		1.739*** (0.651)
Constant	2.790*** (0.123)	2.586*** (0.193)	2.424*** (0.125)	2.725*** (0.337)	2.361*** (0.249)	2.584*** (0.126)	2.669*** (0.128)	2.665*** (0.237)	2.624*** (0.226)
Observations	138,117	138,117	138,117	57,173	57,173	138,117	138,117	57,173	57,173
R-squared	0.422	0.422	0.425	0.501	0.501	0.424	0.424	0.501	0.501

Robust standard errors in parentheses

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

In the full NMS sample we also observe a weakly positive term on the interaction between overall vertical specialization – suggesting that overall foreign content of exports is in fact enhancing the gap between foreign and domestic firms. However, through closer inspection we see that this result is in fact a composite of two opposite relationship – vertical specialization in final goods and in intermediate goods. Higher foreign content in the exports of final goods leads to a decrease of foreign firm premia. At the same time the foreign content

of exports of intermediate goods is related to increasing foreign firm premia. This is consistent with the initial result, which is that across the NMS firms the foreign productivity premia is lower at the bottom of the value added chain (close to final demand).

Table 4 Foreign firms productivity premia (NMS)

VARIABLES	(1) All	(2) All	(3) Mnfc	(4) Mnfc	(5) Mnfc	(6) All	(7) All	(8) Mnfc	(9) Mnfc
Foreign	0.457*** (0.00615)	0.319*** (0.0142)	0.464*** (0.0144)	0.358*** (0.0164)	0.398*** (0.0223)	0.470*** (0.00928)	0.424*** (0.0112)	0.453*** (0.0147)	0.386*** (0.0139)
Foreign * Upstreamness		0.180*** (0.0174)		0.111*** (0.0209)					
Upstreamness		0.265 (0.164)		0.202* (0.110)					
Foreign * VS			-0.0364 (0.0614)		0.137* (0.0725)				
VS			0.715* (0.431)		1.334*** (0.262)				
Foreign * VS (final goods)						-0.154** (0.0676)		-0.118 (0.0888)	
VS (final goods)						-0.0620 (0.201)		0.632** (0.314)	
Foreign * VS (intermediate goods)							0.320*** (0.0792)		0.384*** (0.0780)
VS (intermediate goods)							2.657*** (0.436)		1.027*** (0.285)
Constant	-2.469*** (0.0303)	-2.669*** (0.131)	-2.574*** (0.0714)	-2.329*** (0.0829)	-2.469*** (0.0669)	-2.462*** (0.0336)	-2.697*** (0.0484)	-2.256*** (0.0491)	-2.305*** (0.0498)
Observations	2,172,960	2,172,960	2,172,960	654,106	654,106	2,172,960	2,172,960	654,106	654,106
R-squared	0.796	0.796	0.796	0.839	0.839	0.796	0.797	0.839	0.839

Robust standard errors in parentheses

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

Inspection of foreign ownership premium in individual countries shows a great deal of heterogeneity. The results show that in Bulgaria, Czech Republic, Hungary and Romania, the large degree of vertical specialization in final goods is related to a lower productivity premium of foreign enterprises. In Poland and Estonia, the interaction term is also negative, but it remains statistically insignificant. However, in Slovakia and Slovenia, high degree of VS in final goods in fact increases the productivity gap between domestic and foreign enterprises.

Table 5 Foreign firms productivity premia in individual countries (NMS) – interaction with VS in final goods, manufacturing

VARIABLES	(1) BGR	(2) CZE	(3) EST	(4) HUN	(6) POL	(7) ROU	(8) SVK	(9) SVN
Foreign	0.709*** (0.0605)	0.601*** (0.0483)	0.686*** (0.0517)	1.036*** (0.125)	0.382*** (0.0279)	0.434*** (0.0240)	0.389*** (0.0370)	0.287*** (0.0584)
Foreing * VS (final goods)	-1.786*** (0.317)	0.0443 (0.213)	-0.208 (0.234)	-1.952*** (0.456)	-0.0684 (0.197)	-0.365*** (0.115)	0.832*** (0.208)	0.649** (0.322)
VS (final goods)	0.398 (0.855)	4.517*** (0.430)	0.726** (0.349)	1.252** (0.545)	1.730** (0.726)	-0.0175 (0.416)	-0.417 (0.647)	0.313 (1.184)
Constant	-1.269*** (0.168)	2.288*** (0.0791)	1.280*** (0.288)	2.394*** (0.103)	2.897*** (0.103)	-0.755*** (0.0563)	3.188*** (0.0874)	2.903*** (0.160)
Observations	66,761	95,901	17,385	13,761	57,173	350,731	33,855	17,651
R-squared	0.549	0.530	0.371	0.545	0.501	0.251	0.497	0.591

Robust standard errors in parentheses

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

Table 6 Foreign firms productivity premia in individual countries (NMS) – interaction with VS in intermediate goods

VARIABLES	(1) BGR	(2) CZE	(3) EST	(4) HUN	(6) POL	(7) ROU	(8) SVK	(9) SVN
Foreign	0.295*** (0.0312)	0.749*** (0.0523)	0.616*** (0.0574)	0.987*** (0.0913)	0.421*** (0.0368)	0.350*** (0.0237)	0.555*** (0.0584)	0.455*** (0.0761)
Foreign * VS (intermediate goods)	0.885*** (0.195)	-0.741*** (0.239)	0.162 (0.272)	-1.693*** (0.400)	-0.359 (0.234)	0.369** (0.168)	-0.164 (0.353)	-0.366 (0.414)
VS (intermediate goods)	0.603 (0.541)	3.745*** (0.679)	0.881** (0.379)	-0.127 (0.637)	1.739*** (0.651)	0.834* (0.466)	3.960*** (0.607)	-0.309 (1.036)
Constant	-1.275*** (0.0705)	2.281*** (0.137)	1.206*** (0.293)	2.648*** (0.128)	2.878*** (0.107)	-0.822*** (0.0499)	2.556*** (0.0943)	2.998*** (0.192)
Observations	66,761	95,901	17,385	13,761	57,173	350,731	33,855	17,651
R-squared	0.549	0.528	0.371	0.544	0.501	0.251	0.498	0.591

Robust standard errors in parentheses

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

Turning to the effects of vertical specialization in intermediate goods, one can see that the negative interaction term remains significant in the Czech Republic and Hungary, with the coefficient being of roughly similar magnitude. In Slovakia the interaction coefficient is also negative showing, thus, that moving further away from final demand is more beneficial to domestic firms. One can also observe that a direct relationship between productivity and VS is positive whenever it is statistically significant. This is the case for Czech Republic, Estonia, Hungary and Poland in the case of VS in final goods and additionally for Slovakia in the case of intermediate goods but not for Hungary.

Productivity spillovers to domestic firms within the GVC

Turning to the analysis of spillovers, we perform several regressions of the spillover equation including the various measures of GVC participation for the economy of Poland. It has to be noted that due to some partial correlation between the sectoral measures related to FDI and participation in the GVC together with sectoral export intensity, inclusion of the GVC terms in the spillover equation renders the “traditional” spillovers measures not significant in explaining domestic firms productivity. Sectors where there is high presence of FDI are also usually involved in global value chains. We only find some evidence of backward spillovers whenever all firms are considered. This channel of interaction is however not significant when the sample is restricted to manufacturing.

As expected, export intensity is positively related to productivity both in manufacturing and in the overall sample of firms, which is consistent with the findings of the new-new trade literature focused on firm heterogeneity. We find, also, that once we include all sectors in the sample, higher productivity of domestic firms relates to a more downstream position in the value chain. This relationship is robust to the sample choice and it holds even in manufacturing where the variation of upstreamness is much smaller. We also find a strong and positive relationship between the overall vertical specialization measure and domestic firm productivity both in overall sample and in manufacturing. Turning to the split between vertical specialization in final and intermediate goods, we find a significant coefficient only in the case of intermediate goods (both for the value added content and overall foreign content of exports).

As a robustness check, we offer several additional regressions that are shown in the Table 11 of the appendix. We perform the spillover analysis using labour productivity instead of TFP. We find similar magnitude of the backward spillovers and positive relationship between vertical specialization and domestic firms labour productivity. We also run standard TFP spillover regression on the sample of all firms (domestic and foreign) and then foreign firms separately. We find that the elasticity on the vertical specialization is even higher for those specifications and the coefficients on VS (final goods) is roughly the same as the one on VS (intermediate goods). One can conclude that while the presence of the sector in the GVC brings overall welfare gains on top of the standard FDI-related spillovers. However, in the case of

domestic producers, those GVC-related productivity spillovers are associated with their presence in the middle of the value chain: what matters is the foreign content of exported goods but it is also important that the exported goods are intermediate and further used in the production processes. Such firms enjoy the type of spillovers that resemble the backward and forward spillovers from FDI but are transmitted through the production global production process. On the other hand, production of goods close to the primary resources (high upstreamness and low foreign content) is related to relatively low productivity levels.

Table 7 Spillovers (Poland)

VARIABLES	(1) All	(2) Mnfc	(3) Mnfc	(4) Mnfc	(5) Mnfc	(6) Mnfc	(7) Mnfc
Horizontal FDI	-0.0894 (0.0799)	-0.00942 (0.0900)	-0.000230 (0.0864)	-0.000230 (0.0864)	-0.000279 (0.0861)	-0.00936 (0.0888)	0.0122 (0.0852)
Forward FDI	-0.903** (0.351)	-0.390 (0.359)	-0.262 (0.362)	-0.262 (0.362)	-0.165 (0.330)	-0.315 (0.377)	-0.393 (0.357)
Backward FDI	1.584*** (0.370)	1.180*** (0.350)	1.173*** (0.364)	1.173*** (0.364)	1.078*** (0.325)	1.211*** (0.380)	1.204*** (0.364)
Export share	0.710*** (0.160)	0.834*** (0.132)	1.166*** (0.160)	1.166*** (0.160)	1.229*** (0.165)	1.074*** (0.101)	0.965*** (0.183)
VS	0.676 (0.519)	1.071*** (0.327)					
Upstreamness	-0.731*** (0.170)	-0.252* (0.133)	-0.413** (0.185)	-0.413** (0.185)	-0.408** (0.192)	-0.318** (0.138)	-0.426** (0.170)
Foreign VA (final goods)			-0.659 (0.694)	-0.659 (0.694)	-1.014 (0.698)		
Foreign VA (intermediate goods)			0.942 (0.620)	0.942 (0.620)		1.225** (0.609)	
VS (final goods)							0.202 (0.664)
VS (intermediate goods)							1.439*** (0.347)
Constant	-0.0469 (0.158)	-0.0157 (0.285)	-0.0190 (0.284)	-0.0190 (0.284)	-0.0199 (0.280)	-0.0191 (0.285)	-0.0140 (0.286)
Observations	71,336	30,041	30,041	30,041	30,041	30,041	30,041
R-squared	0.113	0.122	0.122	0.122	0.121	0.121	0.122

Robust (clustered) standard errors in parentheses

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

We perform a similar analysis of the pooled sample of all NMS. Similarly to the Polish example, we observe significant backward spillover. The relationship between the export share and domestic firms FDI is positive and stable across specification. Unlike in the case of Poland, we do not find an overall effect of vertical specialization on productivity. This stems

both from the heterogeneity of response to VS in final and intermediate goods as well as from inter country heterogeneity (and different country overall positions in the GVC). Vertical specialization in final goods is related positively to domestic firms productivity while VS in intermediate goods is negatively related to firm-level productivity. It seems that Poland and Hungary are rather exceptional in their high productivity spillovers from foreign content in intermediate goods. Robustness checks shown in Table 12 include extra regressions for different groups of firms and different productivity measures. Vertical specialization in final goods is associated with an even higher productivity of foreign firms.

Table 8 Spillovers (NMS)

VARIABLES	(1) All	(2) Mfcs	(3) Mfcs	(4) Mfcs	(5) Mfcs	(6) Mfcs	(7) Mfcs
Horizontal FDI	-0.185 (0)	-0.121 (0.0793)	-0.117 (0.0765)	-0.117 (0.0765)	-0.117 (0.0758)	-0.119 (0.0782)	-0.117 (0.0763)
Forward FDI	-0.0592 (0)	-0.0226 (0.164)	-0.0664 (0.158)	-0.0664 (0.158)	-0.0832 (0.158)	-0.0238 (0.163)	-0.0734 (0.157)
Backward FDI	0.345 (0)	0.466** (0.182)	0.451** (0.179)	0.451** (0.179)	0.463** (0.186)	0.447** (0.176)	0.450** (0.182)
Export share	0.663 (0)	0.650*** (0.159)	0.565*** (0.153)	0.565*** (0.153)	0.513*** (0.122)	0.658*** (0.0873)	0.575*** (0.166)
VS	-0.335 (0)	-0.116 (0.417)					
Upstreamness	-0.204 (0)	-0.183 (0.125)	0.0221 (0.0870)	0.0221 (0.0870)	0.0189 (0.0872)	-0.100 (0.129)	0.0711 (0.0847)
Foreign VA (final goods)			0.768 (0.680)	0.768 (0.680)	1.030* (0.535)		
Foreign VA (intermediate goods)			-0.783 (0.606)	-0.783 (0.606)		-1.140*** (0.393)	
VS (final goods)							0.830 (0.568)
VS (intermediate goods)							-0.875** (0.405)
Constant	-0.451 (0)	-0.424*** (0.0232)	-0.417*** (0.0230)	-0.411*** (0.0230)	-0.416*** (0.0228)	-0.417*** (0.0226)	-0.416*** (0.0229)
Observations	1,295,481	397,210	397,210	397,210	397,210	397,210	397,210
R-squared	0.090	0.102	0.103	0.103	0.103	0.102	0.103

Robust standard errors in parentheses

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

An analysis of spillovers in the individual NMS countries shows that the response to FDI spillovers, internationalization and the involvement in GVC is heterogeneous. Once the

additional variables are included in the spillover equations, the standard FDI spillovers are significant only in the case of Bulgaria, Czech Republic and Poland. Sectoral export share is positively related to domestic firms productivity in Bulgaria, Czech Republic, Poland Romania and Slovakia. Vertical specialization in final goods is related positively to domestic firms productivity only in the Czech Republic, Estonia, Hungary and Slovakia, while VS in intermediate goods is important in the Hungary, Poland and Slovakia. Therefore the response to the presence of GVC is heterogenous. In Czech Republic and Slovakia, where the most important manufacturing sectors are the car manufacturers that are relatively close to final demand is where most of the productivity growth is located. However, in Poland and Hungary, it is the middle of the supply chain that is associated with the highest productivity spillovers – foreign content of exports matters for productivity much more in the case of intermediate goods.

Table 9 Spillovers (NMS) –individual countries

VARIABLES	(1) BGR	(2) CZE	(3) EST	(4) HUN	(5) POL	(6) ROU	(7) SVK	(8) SVN
Horizontal FDI	-0.820** (0.338)	0.180* (0.105)	-0.116 (0.0831)	0.00571 (0.0701)	0.0122 (0.0852)	-0.111 (0.0747)	0.0862 (0.0803)	0.127 (0.0921)
Forward FDI	0.123 (0.414)	-0.695** (0.284)	-0.0122 (0.150)	-1.420*** (0.289)	-0.393 (0.357)	-0.121 (0.199)	-0.518** (0.230)	-0.127 (0.597)
Backward FDI	1.333** (0.610)	0.907*** (0.287)	-0.0893 (0.132)	0.0704 (0.243)	1.204*** (0.364)	0.212 (0.131)	0.110 (0.218)	-0.585 (0.383)
Export share	1.673*** (0.522)	0.441*** (0.130)	-0.0413 (0.0627)	-1.152*** (0.340)	0.965*** (0.183)	0.282** (0.122)	0.376** (0.189)	-0.141 (0.315)
VS (final goods)	-0.149 (1.404)	2.424*** (0.441)	0.648** (0.319)	1.484* (0.789)	0.202 (0.664)	0.241 (0.426)	2.463*** (0.590)	1.628 (1.159)
VS (intermediate goods)	-3.243*** (1.109)	-1.490*** (0.541)	-0.219 (0.194)	3.265*** (0.547)	1.439*** (0.347)	-0.583** (0.249)	1.464** (0.592)	0.608 (0.609)
Upstreamness	-0.0374 (0.402)	0.705*** (0.160)	0.419*** (0.103)	-0.0785 (0.214)	-0.426** (0.170)	0.0437 (0.0623)	0.0132 (0.233)	-0.00488 (0.190)
Constant	-0.0618 (0.0404)	0.00707 (0.0154)	-0.0207 (0.0668)	-0.189*** (0.0124)	-0.129*** (0.0119)	-0.0953*** (0.0116)	-0.0566*** (0.0204)	-0.0372*** (0.0142)
Observations	35,840	63,348	10,114	7,029	30,041	218,561	21,834	9,966
R-squared	0.151	0.108	0.038	0.064	0.122	0.083	0.073	0.110

Robust standard errors in parentheses

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

Conclusions

The New Member States have been experiencing firm internationalization both through inward foreign direct investment but also through exporting, importation of foreign technology in investment goods and increased use of imported intermediates. We argue that there are important productivity spillovers within the global value chains, ie. FDI alone is not telling the whole story of the reallocation processes that are going on in the economies of the NMS. We augment the standard TFP spillover empirical model with modern measures of GVC participation.

By merging multiple editions of the Amadeus database we are able to track a long sample (1997 to 2013) of firms from the new EU member states and we revisit the evidence of foreign productivity spillovers. We show that most of that spillovers in the now-standard notion due to Smazynska-Javorcik in the region are backward oriented (with limited evidence of horizontal spillovers for individual countries). We also analyze the foreign firm productivity premia over the domestic firms that unequivocally turns out to be large and significant.

We argue that those productivity spillovers from FDI do not account for the whole story of internationalization-driven productivity growth. Somewhat different strand of literature related to global value chain provides measures for the foreign content of exports and upstreamness that shows the degree of involvement and the type of involvement in the global value chain on the sectoral level. The estimates of the spillover equation augmented with those measures show a significant relationship between the GVC measures and firm-level productivity. While backward spillovers are still important in the analyzed sample, foreign value content of exports and exporting itself are important productivity drivers. However, the productivity response to the foreign content of export is somewhat heterogeneous and consistent with the results of the estimations of the determinants of foreign premia. In Poland, most of the GVC related productivity gains are in the production of intermediate goods and this is where foreign content of exports is associated with lower productivity differences between domestic and foreign enterprises. On the other hand, in most of the other countries (except Hungary where results are similar to that of Poland) where positive spillovers in the GVC exist, they tend to stem from production of final goods. However, the new member states differ economically in many dimensions: eg. size and the degree of economic specialization.

Poland's economy is relatively diversified unlike those of eg. the Czech Republic and Slovakia. This degree of specialization may lead to different outcomes in the actual presence of spillovers within the GVC and other productivity driving forces, such as eg. factor allocation. Moreover, while the above estimations clearly show a significant but heterogeneous response to GVC, a more rigorous theoretical framework linking the presence in the GVC to other factors already present in the Melitz (2003) derived framework would be needed to inquire the source of that heterogeneity. This could be a promising avenue for further research.

References

- Aitken, B. J. , Harrison, A.E. (1999), "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela", *American Economic Review*, June 1999, 89(3), pp. 605–18.
- Antras, P, Chor, D., Fally, T., Hillberry, R. (2012) "Measuring the Upstreamness of Production and Trade Flows", *American Economic Review* 102(3): 412-16, May
- Djankov, S. and Hoekman, B. (2000), *Foreign Investment and Productivity Growth in Czech Enterprises*", *World Bank Economic Review*, January 2000, 14(1), pp. 49 – 64
- Haddad, M. and Harrison, A.E. (1993), *Are There Positive Spillovers from Direct Foreign Investment? Evidence from Panel Data for Morocco*", *Journal of Development Economics*, October 1993, 42(1), pp. 51–74.
- Iršová, Z., Havránek, T. (2013), "Determinants of Horizontal Spillovers from FDI: Evidence from a Large Meta-Analysis", *World Development*, Elsevier, vol. 42(C), pages 1-15.
- Johnson, R., Noguera, G. (2012), "Accounting for Intermediates: Production Sharing and Trade in Value-added", *Journal of International Economics*: 86:224-236
- Kolasa, M. (2008). "How does FDI inflow affect productivity of domestic firms? The role of horizontal and vertical spillovers, absorptive capacity and competition", *The Journal of International Trade & Economic Development*, Taylor & Francis Journals, vol. 17(1), pages 155-173.
- Konings, J. (2001) "The Effects of Foreign Direct Investment on Domestic Firms", *Economics of Transition*, November 2001, 9(3), pp. 619–33.
- Koopman, R., Wang, Z., Wei, S.J. (2014), "Tracing Value-added and Double Counting in Gross Exports," *American Economic Review*, 104(2):459-494
- Crespo, N., Fontoura M.P., Proença, I. (2009), "FDI spillovers at regional level: Evidence from Portugal", *Papers in Regional Science*, Wiley Blackwell, vol. 88(3), pages 591-607, 08.

Miller, R. E. and Temurshoev, U. (2013), "Output upstreamness and input downstreamness of industries/countries in world production", GGDC Research Memorandum GD-133, Groningen, Growth and Development Centre, University of Groningen.

Stehrer, R. (2012), "Trade in Value Added and the Valued Added in Trade," wiiw Working Papers 81, The Vienna Institute for International Economic Studies, wiiw.

Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R. and de Vries, G. J. (2015), "An Illustrated User Guide to the World Input–Output Database: the Case of Global Automotive Production", *Review of International Economics* (DOI: 10.1111/roie.12178)

Wang, Z., Wei, S. J., Zhu, K. (2013), "Quantifying international production sharing at the bilateral and sector levels", NBER Working Paper No. w19677, National Bureau of Economic Research.

Hagemejer, J., Ghodsi, M. (2014), "Up or down the value chain? The comparative analysis of the GVC position of the economies of the new EU member states", University of Warsaw, mimeo.

Smarzynska-Javorcik, B. (2004), "Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers Through Backward Linkages," *American Economic Review*, American Economic Association, vol. 94(3), pages 605-627, June.

Appendix

Table 10 Productivity spillovers in individual countries (all firms)

VARIABLES	(1) BGR	(2) CZE	(3) EST	(4) HUN	(6) POL	(7) ROU	(8) SVK	(9) SVN
Horizontal FDI	-0.457** (0.209)	-0.0492 (0.0726)	0.169* (0.0935)	0.00696 (0.0749)	0.0171 (0.0948)	-0.267* (0.142)	0.0643 (0.0765)	0.146** (0.0707)
Forward FDI	-0.0197 (0.196)	-0.0765 (0.208)	-0.366*** (0.126)	0.419 (0.378)	-0.740* (0.390)	-0.00662 (0.204)	-0.418 (0.270)	-0.0516 (0.516)
Backward FDI	0.859 (0.642)	1.447*** (0.233)	0.149 (0.170)	-0.639** (0.277)	1.290*** (0.354)	0.144 (0.0895)	0.109 (0.228)	-0.775** (0.361)
Constant	-0.0473* (0.0243)	-0.0359** (0.0170)	0.191 (0.124)	-0.131*** (0.0173)	-0.128*** (0.00997)	0.0621*** (0.0203)	-0.0594*** (0.00972)	-0.0306*** (0.00730)
Observations	111,971	176,676	38,638	20,597	71,336	773,269	72,494	29,057
R-squared	0.074	0.050	0.031	0.029	0.093	0.093	0.029	0.096

Robust standard errors in parentheses

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

Table 11 Spillovers (Poland) – extra regressions

VARIABLES	(1) Mnfc	(2) Labprod	(3) Labprod	(4) All_firms	(5) Foreign
Horizontal FDI	0.143 (0.103)	0.163* (0.0877)	0.0594 (0.0757)	0.0390 (0.0845)	0.181 (0.123)
Forward FDI	-0.155 (0.366)	0.422 (0.287)	0.256 (0.244)	-0.476 (0.324)	-0.796** (0.370)
Backward FDI	1.323*** (0.390)	0.657** (0.318)	0.357* (0.193)	1.115*** (0.339)	0.789* (0.414)
Export share			0.531*** (0.126)	0.860*** (0.162)	0.633*** (0.203)
VS (final goods)			1.249*** (0.452)	0.772 (0.629)	1.708* (0.890)
VS (intermediate goods)			1.362*** (0.315)	1.589*** (0.367)	2.129*** (0.680)
Upstreamness			0.128 (0.0973)	-0.421*** (0.156)	-0.555* (0.282)
Constant	-0.0457 (0.280)	-0.145 (0.298)	-0.112 (0.300)	0.257 (0.287)	0.863*** (0.0538)
Observations	30,041	30,041	30,041	37,561	7,520
R-squared	0.100	0.117	0.130	0.120	0.128

Robust (clustered) standard errors in parentheses

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

Table 12 Spillovers (NMS) – extra regressions

VARIABLES	(1) Mnfc	(2) Labprod	(3) Labprod	(4) All_firms	(5) Foreign
Horizontal FDI	-0.00157 (0.0941)	-0.135 (0.0823)	-0.146* (0.0762)	-0.00201 (0.0838)	0.164** (0.0769)
Forward FDI	-0.0327 (0.193)	0.0248 (0.148)	-0.0432 (0.140)	-0.0742 (0.172)	0.264 (0.183)
Backward FDI	0.275 (0.182)	0.338* (0.176)	0.288* (0.152)	0.188 (0.145)	-0.0419 (0.107)
Export share			0.355*** (0.124)	0.576*** (0.145)	0.433*** (0.103)
VS (final goods)			0.888** (0.445)	1.004** (0.489)	1.708*** (0.406)
VS (intermediate goods)			-0.831** (0.371)	-0.742** (0.334)	0.250 (0.372)
Upstreamness			0.147* (0.0873)	0.0835 (0.0831)	-0.0105 (0.144)
Constant	-0.405*** (0.0330)	-0.604*** (0.0499)	-0.611*** (0.0474)	-0.139*** (0.0333)	0.102*** (0.0226)
Observations	397,213	397,221	397,221	438,207	40,994
R-squared	0.093	0.125	0.128	0.099	0.094

Robust standard errors in parentheses

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

Table 13 Summary statistics, first differences

variable	NMS			Poland		
	mean	p50	sd	mean	p50	sd
TFP	-0,03123	-0,01346	0,60020	0,03223	0,02514	0,44632
Labprod	0,07147	-0,00818	27,38400	0,53189	0,24310	15,29800
Horizontal	0,01182	0,00718	0,10132	0,01211	0,01096	0,07275
Forward	0,00977	0,01091	0,04472	0,00641	0,00336	0,03421
Backward	0,01001	0,01027	0,04350	0,00795	0,00510	0,03501
Exports	0,00162	0,00000	0,05451	0,00330	0,00222	0,06031
FVA_i	-0,00050	0,00001	0,01361	0,00058	0,00073	0,01018
FVA_f	0,00018	-0,00013	0,04899	0,00043	0,00037	0,01375
VS_i	-0,00042	0,00000	0,01872	0,00108	0,00124	0,01616
VS_f	0,00010	-0,00028	0,04891	0,00053	-0,00015	0,01520
Upstreamness	0,00169	0,00344	0,06893	0,00371	0,00628	0,05794

Table 14 Summary statistics, levels

variable	NMS			Poland		
	mean	p50	sd	mean	p50	sd
foreign	0,069	0	0,253	0,166	0	0,373
TFP	0,514	0,032	1,83	2,94	2,92	0,88
Labprod	6,81	0,428	44,4	16	9,14	31,5
Export share	0,196	0,163	0,195	0,179	0,077	0,213
FVA_i	0,071	0,067	0,044	0,063	0,055	0,034
FVA_f	0,061	0,053	0,065	0,063	0,055	0,043
VS_i	0,095	0,088	0,063	0,089	0,068	0,052
VS_f	0,075	0,061	0,068	0,08	0,067	0,049
Upstreamness	0,738	0,768	0,277	0,759	0,8	0,222

Table 15 Correlation table, spillovers, differences, NMS sample

	TFP	Labprod	Horizontal	Forward	Backward	Exports	FVA_i	FVA_f	VS_i	VS_f	Upstreamness
TFP	1.00										
Labprod	0.12 (0.00)	1.00									
Horizontal	-0.02 (0.00)	-0.00 (0.44)	1.00								
Forward	-0.10 (0.00)	-0.00 (0.00)	0.27 (0.00)	1.00							
Backward	-0.07 (0.00)	-0.00 (0.05)	0.26 (0.00)	0.54 (0.00)	1.00						
Exports	0.02 (0.00)	0.01 (0.00)	0.08 (0.00)	0.08 (0.00)	0.14 (0.00)	1.00					
FVA_i	0.00 (0.00)	-0.00 (0.08)	0.07 (0.00)	0.02 (0.00)	0.12 (0.00)	0.20 (0.00)	1.00				
FVA_f	-0.01 (0.00)	0.00 (0.01)	0.01 (0.00)	0.04 (0.00)	-0.05 (0.00)	0.31 (0.00)	-0.19 (0.00)	1.00			
VS_i	0.01 (0.00)	-0.00 (0.60)	0.09 (0.00)	0.03 (0.00)	0.14 (0.00)	0.28 (0.00)	0.95 (0.00)	-0.21 (0.00)	1.00		
VS_f	-0.01 (0.00)	0.00 (0.00)	0.02 (0.00)	0.05 (0.00)	-0.04 (0.00)	0.35 (0.00)	-0.14 (0.00)	1.00 (0.00)	-0.15 (0.00)	1.00	
Upstreamness	0.01 (0.00)	0.00 (0.00)	0.05 (0.00)	0.01 (0.00)	0.21 (0.00)	0.14 (0.00)	0.36 (0.00)	-0.18 (0.00)	0.41 (0.00)	-0.15 (0.00)	1.00

P-values below the correlation measure

Table 16 Correlation table, spillovers, differences, Poland sample

	TFP	Labprod	Horizontal	Forward	Backward	Exports	FVA_i	FVA_f	VS_i	VS_f	Upstreamness
TFP	1.00										
Labprod	0.49 (0.00)	1.00									
Horizontal	0.00 (0.71)	0.03 (0.00)	1.00								
Forward	0.04 (0.00)	0.04 (0.00)	0.47 (0.00)	1.00							
Backward	0.05 (0.00)	0.01 (0.02)	0.50 (0.00)	0.61 (0.00)	1.00						
Exports	0.13 (0.00)	0.07 (0.00)	0.21 (0.00)	0.10 (0.00)	0.11 (0.00)	1.00					
FVA_i	0.05 (0.00)	0.05 (0.00)	0.01 (0.00)	0.08 (0.00)	-0.07 (0.00)	0.32 (0.00)	1.00				
FVA_f	0.11 (0.00)	0.05 (0.00)	0.14 (0.00)	0.08 (0.00)	-0.03 (0.00)	0.58 (0.00)	-0.05 (0.00)	1.00			
VS_i	0.08 (0.00)	0.06 (0.00)	0.07 (0.00)	0.13 (0.00)	0.05 (0.00)	0.42 (0.00)	0.92 (0.00)	-0.04 (0.00)	1.00		
VS_f	0.14 (0.00)	0.07 (0.00)	0.18 (0.00)	0.11 (0.00)	0.02 (0.00)	0.72 (0.00)	0.11 (0.00)	0.96 (0.00)	0.18 (0.00)	1.00	
Upstreamness	-0.01 (0.01)	0.04 (0.00)	0.17 (0.00)	0.18 (0.00)	0.25 (0.00)	0.11 (0.00)	0.30 (0.00)	-0.36 (0.00)	0.44 (0.00)	-0.20 (0.00)	1.00

P-values below the correlation measure

Table 17 Correlation table, spillovers, levels, NMS sample

	foreign	TFP	Labprod	Exports	FVA_i	FVA_f	VS_i	VS_f	Upsreamness
foreign	1.00								
TFP	0.11 (0.00)	1.00							
Labprod	0.05 (0.00)	0.26 (0.00)	1.00						
Exports	0.09 (0.00)	0.06 (0.00)	-0.00 (0.00)	1.00					
FVA_i	0.01 (0.00)	0.19 (0.00)	0.04 (0.00)	0.13 (0.00)	1.00				
FVA_f	0.04 (0.00)	0.08 (0.00)	0.01 (0.00)	0.49 (0.00)	-0.18 (0.00)	1.00			
VS_i	0.02 (0.00)	0.25 (0.00)	0.05 (0.00)	0.24 (0.00)	0.97 (0.00)	-0.16 (0.00)	1.00		
VS_f	0.05 (0.00)	0.15 (0.00)	0.03 (0.00)	0.58 (0.00)	-0.04 (0.00)	0.98 (0.00)	0.01 (0.00)	1.00	
Upstreamness	0.02 (0.00)	0.26 (0.00)	0.07 (0.00)	0.11 (0.00)	0.50 (0.00)	-0.42 (0.00)	0.56 (0.00)	-0.30 (0.00)	1.00

P-values below the correlation measure

Table 18 Correlation table, spillovers, levels, Poland sample

	foreign	TFP	Labprod	Exports	FVA_i	FVA_f	VS_i	VS_f	Upstreamness
foreign	1.00								
TFP	0.25 (0.00)	1.00							
Labprod	0.17 (0.00)	0.37 (0.00)	1.00						
Exports	0.12 (0.00)	0.24 (0.00)	0.02 (0.00)	1.00					
FVA_i	0.04 (0.00)	-0.06 (0.00)	0.01 (0.00)	0.36 (0.00)	1.00				
FVA_f	0.06 (0.00)	0.26 (0.00)	-0.01 (0.00)	0.68 (0.00)	-0.12 (0.00)	1.00			
VS_i	0.06 (0.00)	-0.00 (0.88)	0.02 (0.00)	0.49 (0.00)	0.95 (0.00)	-0.08 (0.00)	1.00		
VS_f	0.09 (0.00)	0.28 (0.00)	-0.00 (0.56)	0.83 (0.00)	0.07 (0.00)	0.96 (0.00)	0.16 (0.00)	1.00	
Upstreamness	0.11 (0.00)	-0.08 (0.00)	0.04 (0.00)	0.21 (0.00)	0.42 (0.00)	-0.33 (0.00)	0.54 (0.00)	-0.13 (0.00)	1.00

P-values below the correlation measure



FACULTY OF ECONOMIC SCIENCES
UNIVERSITY OF WARSAW
44/50 DŁUGA ST.
00-241 WARSAW
WWW.WNE.UW.EDU.PL