Economic integration, industrial structure, and catch-up growth: firm-level evidence from Poland

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Economic integration, industrial structure, and catch-up growth: Firm-level evidence from Poland*†

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Abstract

We examine if and how deeper economic integration with high-income nations impacts industrial performance. We exploit Poland's accession to the European Union in 2004 as a source of variation in the degree of market integration with Germany. Using data on Polish manufacturing firms in the period 1995-2013, we find that EU accession was followed by significant within-firm growth in output and productivity, notably in industries in which Germany was more specialised at the moment of accession. Increased flows of German investment to these sectors played an important role in shaping these effects.

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†Data Availability Statement. The data that support the findings of this study are available from the from the Central Statistical Office of Poland and the Orbis database of Bureau Van Dijk. Restrictions apply to the availability of these data, which were used under license for this study. The data from the Central Statistical Office of Poland are confidential, but are available to other researchers. The data from Bureau Van Dijk require a subscription. We stand ready to provide interested researchers with the necessary information on how to obtain the data from the Central Statistical Office of Poland and Bureau Van Dijk; as well as the programs, and details for the computations necessary for replication.

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1 Introduction

Suppose that two nations with different levels of income per capita integrate their goods and factor markets. What are the implications for industrial performance in the less developed economy? In the standard Ricardian model of comparative advantage, both countries would gain from the reallocation of productive resources towards the industries in which they are relatively more efficient. However, integration may also induce capital flows to the less developed country, which may contribute to narrow the efficiency gap within industries. If the scope for capital flows and technology transfer is greater in the industries in which the advanced economy is specialised, the less developed country may plausibly observe stronger productivity and output growth in these sectors.

In this paper, we study the interplay between specialisation patterns and foreign acquisitions in shaping the effects of deeper integration on industrial performance in less advanced economies. In particular, we investigate the extent to which this interaction played an important role in driving the patterns of catch-up growth observed in Poland following accession to the European Union in 2004—and the consequent deepening of goods and factor market integration with Germany. Using detailed data on Polish manufacturing firms during 1995-2013 and a difference-in-differences approach, we examine if and how the evolution of German acquisitions and firm performance in Poland, following EU accession, was mediated by pre-determined measures of industrial specialisation in Germany. If the scope for capital movements and technology transfers was higher in sectors in which Germany was relatively more specialised at the moment of accession, improvements in performance would be stronger among Polish firms operating in those sectors.

Poland's integration experience offers several interesting features for this analysis. Following the collapse of the Soviet Union in the late 1980s, a comprehensive reform program enabled the country to transform its socialist-style planned economy into a market economy. Like other post-communist nations, Poland experienced slumps in social and economic standards during this transition. But it became the first post-communist country to reach its pre-1989 income levels, which it achieved by 1995 following a period of strong economic growth. In the years preceding the accession in 2004, Poland observed a sharp increase in the degree of openness to international trade. A significant share of this rise was accounted for by the growth of trade flows with its higher-income neighbour, Germany—Europe's major centre of high-tech industrial production. Following accession, Poland became also an important destination for Germany's FDI, and experienced a period of remarkable catch-up growth: GDP per capita increased from about 18% of Germany's in 2004 to about 29% in 2013.

Our empirical analysis proceeds in several steps. We first examine the effects of German acquisitions on firm performance. Results from a difference-in-differences approach point to sizeable positive effects of German acquisitions on firm size. In a second step, we examine whether German acquisitions following EU integration were greater in sectors in which Germany was more specialised at the moment of accession. Event studies point to a sharp increase in German acquisitions of Polish firms right after EU accession, and at a remarkable greater extent in sectors in which Germany had higher export shares. While these acquisitions began in 2001 in concomitance with the conclusions of the accession negotiations, it was only after joining the EU that FDI observed a sharp rise. Foreign acquisitions increased also from other EU countries, but to a much lower extent. In a final step, we examine if the evolution of firm performance in Poland following EU accession was also mediated by pre-determined measures of industrial specialisation in Germany. Difference-in-differences estimates reveal that Polish manufacturing firms operating in sectors in which Germany was more specialised at the moment of accession experienced stronger output and productivity growth in the post-2004 period. These results capture not only direct effects of German acquisitions on firm performance, but also spillovers to other domestic firms operating in the same broad sector. The estimates remain qualitatively similar across different measures of comparative advantage, including output-based indicators of industrial specialisation and measures of relative factor intensity in the sector. Reassuringly, placebo tests using similar measures of industrial specialisation for Poland, Russia and other less developed non-EU neighbour countries—notably Ukraine and Lithuania—fail to identify systematic links with the evolution of firm performance in the post-2004 period. Taken together, our findings suggest that deeper integration in goods and factor markets stimulates capital flows to the less advanced economy, that these flows occur predominantly in sectors in which the advanced economy had a comparative advantage, and that this contributes to narrow the productivity gap within industries.

This paper complements and extends several strands of literature. A number of cross-country studies have identified systematic empirical links between foreign direct investment and growth, including early work by Blomstrom et al. (1996) and Borensztein et al. (1998). The current paper contributes to this literature by providing microeconomic evidence on these links, exploiting Poland's accession to the EU as a source of variation in the degree of market integration with a high-income country. In doing so, this paper also relates to recent research using firm-level data to document effects of foreign acquisitions on firm performance, including Arnold and Javorcik (2009), Bloom et al. (2012), Guadalupe et al. (2012) and Bastos et al. (2018). In contrast to this strand of literature, we emphasise the key role of initial

specialisation patterns in the advanced economy in driving the impacts of deeper integration on firm performance in less developed countries. To our knowledge, our paper is the first to establish an empirical link between specialisation patterns and foreign acquisitions as drivers of catch-up growth following goods and factor market integration.

The remainder of the paper proceeds as follows. Section 2 describes the institutional and economic background associated with Poland's accession to the European Union in 2004. Section 3 presents the empirical strategy. Section 4 describes the data, before Section 5 reports the empirical results. Section 6 concludes the paper.

2 Background

Poland acceded to the European Union in May 2004. The negotiation process underlying accession began in 1989, when the *Poland and Hungary: Assistance for Restructuring their Economies (PHARE)* programme was launched to promote convergence with the European Union's extensive legislation and promote economic and social cohesion. In June 1993 at the European Council meeting the European Community leaders explicitly endorsed the future accession of Poland conditional on the fulfilment of three conditions (known as the Copenhagen criteria, or membership criteria): (i) the achievement of stable institutions that guarantee democracy, legality, human rights and respect of minorities; (ii) a working market economy, and (iii) the acceptance of all the membership responsibilities, political, economic and monetary.

[Figure 1 about here.]

Poland concluded the accession negotiations in December 2002 and the Copenhagen European Council was declared among the 10 candidate countries that fulfilled the conditions necessary for joining the EU.[1] Poland signed the Accession Treaty on 16 April 2003 in Athens and officially joined the EU in May 2004 after the ratification procedures were completed.

In the years preceding EU accession, Poland observed a rise in the degree of openness to trade. A significant proportion of this increase was accounted for by the growth of trade flows with Germany—Poland's high-income neighbour and main trade partner, and Europe's major centre of high-tech industrial production (see

[1]The other candidates were Cyprus, Estonia, Hungary, the Czech Republic, Slovenia, Latvia, Lithuania, Malta and Slovakia.

Figure 1). Following accession, Poland further became a more important destination for German FDI.[2] At the same time, the country experienced a remarkable period of catch-up growth: Poland's income per capita increased from about 18% of that of Germany in 2004 to about 29% in 2013. Similar patterns of catch-up growth were observed relative to the EU-15: GDP per capita in Poland was about 20% that of the EU-15 in 2004, and it reached about 33% in 2013 (see Figure A.2).[3]

3 Empirical strategy

Our objective is to examine the interplay between economic integration and initial specialisation patterns in shaping German acquisitions and firm performance in Poland. In particular, we investigate the extent to which this interaction played an important role in driving German acquisitions and firm performance in the context of Poland's accession to the European Union in 2004—and the consequent deepening of factor market integration with Germany. We first examine effects of German acquisitions on firm performance. We then investigate whether and how the evolution of German acquisitions and firm performance in Poland, following EU accession, was mediated by pre-determined measures of industrial specialisation in Germany. If the scope for capital movements and technology transfers was higher in sectors in which Germany was relatively more specialised at the moment of accession, improvements in performance would be stronger among Polish firms operating in those sectors.

3.1 Effects of German acquisitions on firm performance

As a first step in our empirical analysis, we look for evidence of direct causal effects of German acquisitions on firm performance. Our empirical approach proceeds in two steps. First, we compare the performance of domestic firms with that of firms that were eventually acquired by a German shareholder using an event-study analysis. We estimate the following equation:

$$\log \text{Emp}_{it} = \sum \delta_t \times G_i^F + \mu_i^F + \eta_t^F + \varepsilon_{ijt}^F \tag{1}$$

[2]Figure A.1 shows the patters of FDI inflows for Poland and other five major economies in the EU. FDI inflows are volatile, yet the patterns seem to suggest that the increase in FDI inflows experienced by Poland after 2004 was much larger than of other EU countries, with the exception of the UK, which however had experienced a large increase in FDI inflows also in 1999-2000.

[3]Prior the 2004 enlargement, the EU was composed of the following 15 member states: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

where Emp_{it} indicates firm-level employment, the available measure of firm performance, and G_i^F is a treatment variable that takes value one if a firm is acquired by a German owner anytime after EU accession, i.e. independently of the year of acquisition; μ_i^F and η_t^F represent time and firm fixed effects, and ε_{ijt}^F is the idiosyncratic error. With this specification, we focus only on within-firm performance and consider solely firms established before 2004 to ensure that the results are not driven by entry during the post-accession period. The focus on incumbents allows us to restrict the findings to the effect of foreign acquisition of existing firms. We also show overall average treatment effects by interacting the treatment variable with an indicator for the post-accession period.

This specification has the advantage of mitigating potential endogeneity related to the timing of the foreign acquisition. For example, a foreign takeover could happen strategically (and systematically) after a firm experienced a decline in performance. First, our specification imposes a common treatment period for all firms. Second, it offers a visual test for the absence of pre-trends in foreign acquisitions, thereby addressing concerns about German shareholders acquiring firms that were already on an upward trajectory in terms of performance. However, in the earlier years post 2004 the treatment group includes also firms that have not yet been acquired. For this reason, the effect of German acquisition is likely to be underestimated.

A second approach allows for time-varying treatment effects. It involves estimating the effect of a time varying indicator of German acquisition on firm performance, as shown in the following equation:

$$\log \text{Emp}_{it} = \lambda G_{it}^V + \mu_i^V + \eta_t^V + \varepsilon_{ijt}^V \tag{2}$$

where G_{it}^V is an indicator for German-owned firms in post-acquisition time periods. This approach is effectively a two-way fixed effects (TWFE) regression with staggered treatment timing. Hence, it can suffer from bias arising from treatment effect heterogeneity due to negative weighting. To address this concern, we adopt the approach proposed by Callaway and Sant'Anna (2021) that uses never-treated or not-yet treated units as controls. This method has also the advantage of producing year-specific treatment effects that allow us to compare early and late acquisitions. In addition, we show results employing Sant'Anna and Zhao (2020)'s doubly robust estimator to appropriately control for pre-treatment covariates.

3.2 Differential effects of EU accession on German acquisitions across sectors

We proceed by providing a formal test for whether Polish firms in sectors in which Germany was more specialised were more likely to be acquired by a German shareholder. To do so, we adopt an event study approach, which does not, a priori, impose a treatment period and allows for the effects to vary over time:

$$G_{ijt} = \sum \theta_t \times S_j + \mu_i^G + \eta_t^G + \varepsilon_{ijt}^G \tag{3}$$

where G_{ijt} is a binary variable indicating whether firm i in sector j was acquired by a German shareholder at time t, and the variable S_j is a measure of Germany's specialisation in sector j measured in the pre-accession period. The specification includes firm, μ_i^G, and year, η_t^G, fixed effects. We include only firms that were established prior to 2004, i.e. we ignore the entry of new German-owned firms. In this specification, θ_t are time-specific coefficients that capture the effect of German specialisation over time.

3.3 Differential effects of EU accession on firm performance across sectors

We then investigate whether Polish firms in sectors where Germany was more specialised improved their performance using the following specification:

$$\log Y_{ijt} = \beta(Post_t \times S_j) + \gamma^P X_{jt} + \mu_i^P + \eta_t^P + \varepsilon_{ijt}^P \tag{4}$$

where Y_{ijt} is a measure of performance of firm i in sector j in year t; $Post_t$ is a dummy variable that takes value 1 for the post-accession period (i.e. from 2005 to 2014). Finally, X_{jt} indicates controls at the sector level. In particular, we control for both output and input tariffs to capture possible changes in Poland's wider trade relationships. These tariffs would correspond to Poland's external tariffs before accession, which were already similar to EU tariffs, and to the EU external tariffs after accession. In addition, we also control for EU external tariff for the entire period. The main coefficient of interest is β, which corresponds to the interaction between the post-accession dummy and the pre-determined sector-level measure of Germany's comparative advantage. Equation (4) can be viewed as a difference-in-differences specification, in which all firms are considered treated after EU accession, but with a different intensity of treatment given by their industry's exposure to Germany's capabilities. We consider different measures of firm performance: a revenue-based measure of total factor productivity (TFPR), total

revenues, employment and exports. For our main specification, we measure TFPR using the Levinsohn and Petrin (2003) methodology, in which total expenditure on material inputs is used as a proxy for unobservable productivity shocks. We also provide results estimating TFPR as in Ackerberg et al. (2015). In order to allow for differences in technologies across sectors, different production functions were estimated for each 2-digit sector. As emphasised by De Loecker and Goldberg (2014), this is a commonly used measure of revenue-based TFP, which also reflects changes in markups, the product mix and product quality.[4] While we cannot exclude that changes in prices are at play, this measure of productivity should be strongly correlated with size, which we can also observe in our data (Kugler and Verhoogen (2011)).

We further conduct an event-study in which our measure of Germany specialisation is interacted with time dummies:

$$\log Y_{ijt} = \sum \kappa_t \times S_j + \gamma^E X_{jt} + \mu_i^E + \eta_t^E + \varepsilon_{ijt}^E \tag{5}$$

This approach has two advantages. First, it allows us to inspect for the existence of pre-trends or anticipatory effects on performance. Second, it allows us to investigate the persistence of the effects. We estimate all specifications using ordinary least squares and cluster the standard errors at the sector level.

The causal interpretation of these specifications relies on the assumption that, in the absence of the accession to the EU, Polish firms across different sectors would have experienced similar trends in performance (known as the parallel trends assumption). This assumption cannot be directly tested. Yet, our event study in equation (5) allows us to test for pre-trends in the pre-accession period. We also provide a set of robustness checks to deal with potential confounding effects. In particular, we are concerned that Germany's specialisation might be correlated with other relevant influential factors such as Poland's specialisation or with the specialisation of other relevant commercial partners. To deal with this latter concern, we present a set of placebo tests where similar measures of specialisation for Poland and other neighbouring non-EU countries are regressed on ownership and performance.

[4] Applications of this method in an international trade context include Pavcnik (2002), Amiti and Konings (2007), Fernandes (2007) and Topalova and Khandelwal (2011), among many others.

4 Data and summary statistics

In order to estimate equations (1), (2) and (3), we use data from the Orbis database of Bureau Van Dijk. The Orbis dataset provides retrospective information on company ownership and reports the country of origin of each foreign shareholder, although the share value is often unknown. It also provides information on employment and turnover. We extracted data on foreign ownership on all manufacturing firms (an annual average of about 63,000 companies) for the period 1997 to 2012. The data covers about 58% of Polish firms as reported by Eurostat and coverage varies significantly across regions (Farole et al., 2017).[5] Figure A.4 shows the evolution of the percentage of companies with at least one foreign shareholder from either Germany, French, USA or the United Kingdom. In the case of German shareholders, sectors are divided into those with the highest pre-determined export share (above median, red line) and those with lower level of specialisation (below median, blue line). The figure confirms the sharp increase in German acquisitions of Polish firms (anticipated in Figure 1) right after EU accession, and at a remarkable greater extent for sectors with higher export shares. The percentage of German owned companies peaked in 2007 and 2009 at about 1.8% overall, corresponding to about 18% of total employment (according to our sample). While foreign acquisitions began in 2001 in concomitance with the conclusions of the accession negotiations, it was only after joining the EU that FDI experienced a sharp rise. Foreign acquisitions increased also from other EU countries, such as France and the United Kingdom, and non-EU major trade partners, such as the US, but to a much lower extent. This suggests that German foreign investment played an important role. This pattern is confirmed also when considering an alternative measure of foreign ownership based on the country of origin of the Global Ultimate Owner (GUO) as shown in Figure A.5. Data on firm performance in the Orbis database, however, are limited to information on employees and revenues.[6] Due to missing data on employment, the final sample is reduced to about 61,000 firms.

The rest of the empirical analysis draws on a survey of firms with more than 10 employees collected by the Central Statistical Office of Poland. These data are best suited to examine overall effects on firm performance, given the limited coverage for performance variables, especially revenues, in the Orbis database. Survey data are available for the period 1995-2013 and contain information on a set of firm

[5] On the other hand, when comparing the distribution of firms across sectors in Orbis and in the survey of firms provided by the Central Statistical Office of Poland (Figure A.3), the two distributions are broadly aligned suggesting that coverage is likely to be similar across sectors.

[6] In our empirical analysis of firm performance, we exclude the year 1999 due to anomalies in the data.

attributes, including employment, wages, capital stock, export, foreign ownership status, and industry affiliation. Unique firm identifiers make it possible to follow firms over time. As is customary in the empirical trade literature, the analysis excludes the "coke and refined petroleum" sector because of highly volatile data. The data set has an unbalanced structure and comprises information on 18,355 manufacturing firms with more than 10 employees, when excluding firms with no information to compute productivity. Data for the period 2000-2002 are available only for firms with more than 50 employees. To deal with this issue, we exclude this time period from the main analysis, but use it in robustness checks that consider only firms with more than 50 employees.

[Table 1 about here.]

Table 1 reports summary statistics on each of these variables. The statistics in column (1) show that manufacturing firms in the estimation sample employed on average about 169 workers during the period 1995-2013. The statistics in columns (2) and (3) also show that average firm size declined in the post-accession period, from about 219 employees in 1995-2004 to 147 employees in 2005-2013. By contrast, TFPR and revenues are higher, on average, in the post-2004 period. Column (1) further reveals that about 67% of firms were exporters during the sample period and 18% were owned by foreign investors. These proportions are moderately higher in the post-accession period (columns (2) and (3)). Table A.1 reports summary statistics on the same variables for each manufacturing sector over the period 1995-2013. The statistics in this table show that the measures of firm performance vary substantially across manufacturing industries. Firm-level TFP tends to be higher, on average, in the sectors "Motor vehicles, other transport", "Electrical, communications, medical", and "Pulp, paper and printing". The former two sectors are also characterised by a relatively high average firm size, both in terms of employment and revenue. They are also sectors with a relatively high share of exporters and, especially, foreign-owned firms.

To implement equations (4) and (5), we consider different measures of Germany's specialisation. In the main analysis, we consider the share of each industry in total exports as our main measure of industrial specialisation. As a robustness check, we also consider the share of each industry in total manufacturing output. In the context of the neoclassical trade model, these output-based measures have the advantage of allowing for both differing technologies and differing factor supplies as drivers of international specialisation (Harrigan (1996); Redding (2002)). For further robustness, we also consider input-based measures of relative factor intensity in each sector, notably average wages, capital stock, and capital stock per worker. Since Germany has relatively large supplies of skilled labor and capital, it

would be expected to have a comparative advantage in the sectors that use these factors more intensively (Levchenko (2007); Debaere (2014)). Industries that are intensive in skilled labor and capital would also be expected to have higher capabilities, which could be transferred to Polish firms through foreign investment. Data for these measures of German influence are obtained from Eurostat, OECD and UNIDO. Finally, we use data on exports from COMTRADE to construct a measure of Germany's revealed comparative advantage (RCA) relative to Poland and to the World.[7] To mitigate concerns about endogeneity, all these measures are constructed using data for Poland's pre-accession period. For example, data on Germany's pre-accession exports and output by sector refer to the averages over the period 1994-2004. Table A.2 in the Appendix reports summary statistics on the main measures. To conduct placebo tests, we further collected data on output-based measures for Poland itself, Russia and other neighbour countries, notably Ukraine and Lithuania.

5 Empirical results

5.1 Effects of German acquisitions on firm performance

Results in this section draw on the Orbis data set, and for this reason refer only to employment as the outcome variable. Unfortunately, the variable turnover presents an excessive amount of missing values, which makes it unreliable. Figure 2 plots the regression coefficients of the event-study (equation (1)) including firm and year fixed effects. Before 2004 there is no discernible difference in employment growth between domestic and to-be-acquired firms. However, after 2004 we observe a positive effect of foreign acquisition on employment growth that persists throughout the period of analysis. Overall, average treatment effects are reported in Table A.3 and indicate that German acquisition increases firm-level employment by 15%. Positive effects are also found when using an alternative measure of foreign ownership based on the number of foreign shareholders (column 2 of Table A.3) and when excluding firms that exit after accession (Table A.4). Results also show that the positive effects are not specific to German ownership. In line with the international evidence (Arnold and Javorcik (2009), Guadalupe et al. (2012), Bastos et al. (2018)), positive effects are also found for French and British shareholders, the second and third largest FDI presence, respectively (Table A.3 second and third row, and Figure A.6).[8] In

[7] This is constructed as the proportion of Germany's exports in a given sector, divided by the proportion of Poland (or World) exports in that sector.

[8] We reject the hypothesis of parallel pre-trends in the case of British ownership, hence its effect should be interpret with caution

the remaining analysis, however, we will maintain the focus on German influence given the greater incidence of German FDI with respect to other major partner countries.

[Figure 2 about here.]

The positive effect of German ownership on employment is also confirmed when using our second approach (given by equation (2)). This approach reflects the actual timing of acquisitions and, therefore, allows us to compare the effects of early and late acquisitions. The results are reported in Table 2, while Figure A.7 shows the event study associated to the double robust estimation and confirms the absence of pre-trends in employment. This approach provides more conservative estimates, yet the effects remain large and indicate that the effect of German acquisition on firm-level employment is between 7.5% and 11%. The estimates by treatment year show that the effects are larger for later acquisitions, which are associated with an increase of more than 14% in employment from 2010 onwards. Overall, both set of results point towards substantial positive effects of German acquisition on firm size.

[Table 2 about here.]

5.2 Differential effects of EU accession on German acquisitions across sectors

Figure 3 shows the results of the event study, which are obtained by estimating equation (3). The results confirm our descriptive evidence and show an increase in foreign acquisitions by German shareholders in the post-accession period. Overall difference in differences results are shown in Table A.5 and are consistent across different measures of German influence. They indicate that a 10% increase in Germany's export share is associated with a 8% increase in German ownership (0.04 percentage points over the average ownership of 0.5%). We do not find evidence of border regions receiving more FDI from Germany (Figure A.8 of the Appendix). As a falsification experiment, we employ the same specification on similar data for Romanian firms, also from the Orbis database. Since Romania acceded the EU in 2007, we would not expect to observe a significant effect in this case. Results in Figure A.9 of the Appendix show indeed no effect of our measure of pre-determined German specialisation on the German acquisition of Romanian firms. The estimates show only a negligible increase in the probability of being acquired by a German shareholder after 2007, which is also not statistically significance. Hence, these estimates argue against the possibility of Germany investing abroad more

heavily after 2004 independently of EU membership. The small increase after 2007 also reflects weaker economic ties between Germany and Romania.

[Figure 3 about here.]

It is worth noting that the sharp increase in foreign acquisitions was not likely driven by the lift of restrictions on FDI. OECD data on FDI restrictiveness for Poland show that screening and legal restrictions on FDI in manufacturing sectors had already been greatly removed by the time of accession. Hence, the observed increase in FDI could be attributed to the removal of the uncertainty regarding the future relationship with EU members and the progressive alignment of regulations associated with EU membership.

5.3 Differential effects of EU accession on firm performance across sectors

In this section, we examine how Germany's initial specialisation patterns shaped the overall effects of EU accession on firm performance. These effects capture not only the direct effects of German acquisitions on firm performance, but also horizontal and vertical spillovers from FDI, as well as broader knowledge transfers (which may be unrelated with FDI).

5.3.1 Main results

Table 3 reports the point estimates yielded by estimating equation (4), using Germany's initial export shares in the sector during 1994-2004 as measures of industrial specialisation. The specification in column (1) considers the effects of accession on TFP. The one reported in column (2) considers effects on revenue. Finally, the estimates in columns (3) and (4) estimate effects on employment and exports, respectively. The point estimates reveal that Polish manufacturing firms operating in sectors in which Germany was more specialised at the moment of accession experienced significantly higher TFP growth in the post-2004 period. More specifically, a 10% increase in Germany's export share is associated to a 0.5% increase in the productivity of Polish firms. The point estimates on revenues and exports are also positive and of slightly larger magnitude. This may reflect the fact that German acquisitions may have targeted Polish firms to exploit lower wages and produce labor-intensive inputs that then are brought to Germany. The effect on employment is positive but imprecisely estimated. In Table A.6 we provide estimates using an alternative method to estimate TFP based on Ackerberg et al. (2015). Results are very much aligned with those from our baseline specification.

[Table 3 about here.]

As noted above, for the years 2000 to 2002 the data include only firms with more than 50 employees. For this reason, data for these years were excluded from the main estimation sample. For robustness, the estimation sample used in column (3) of Table A.7 includes these three years, but considers only firms with more than 50 employees. Reassuringly, the estimates remain qualitatively and quantitatively very similar to those in Table 3. Using this restricted sample, we can interact Germany's indices of industrial specialisation with year dummies to track the effects over time. The results are shown in Figure 4, which provides further evidence on how the evolution of firm TFP was mediated by Germany's industrial specialisation patterns at the moment of accession. The graph shows the coefficient of the interaction term between Germany's export share and a full set of year fixed effects. One advantage of this approach is that it does not impose any specific treatment period. Yet, the sharp increase in the estimated effects coincides with EU accession. Hence, the visual evidence points to a positive relationship between our measure of industrial specialisation in Germany and the evolution of firm TFP in Poland in each year of the the post-accession period. It also suggests that the estimates in Table 3 are not driven by pre-trends.[9] Hence, based on the assumption that these pre-trends are a reasonable proxy for counterfactual trends, our baseline estimates can be interpreted causally.[10] The lack of pre-trends also suggests that possible anticipatory effects are not driving our estimates. [11]

In Figure A.10 we show similar results when using a binary measure of Germany's specialization. To draw a parallel with the standard difference in differences literature, in this specification treated sectors are those with an above-median export share. Our results persist when excluding foreign acquired firms, suggesting substantial spillover effects.[12]

[9] As noted above, the sample used in these regressions includes only firms with more than 50 employees, thereby allowing us to cover all years in the sample period.

[10] Note that this assumption is weaker than that of parallel pre-trends.

[11] We also investigate the presence of anticipatory effects by considering two treatment periods, one after the announcement (2000 - 2004) and another one after accession (post 2004). Results are shown in Table A.11. We find some anticipatory effects, which are mostly driven by labor-intensive sectors, which is consistent with anticipation being more likely in sectors with less irreversible capital. However, we prefer to interpret these results with caution. The event study in Figure 4 shows that sectors with higher influence underperformed in the years 1999 and 2000. Hence, some of these anticipatory effects could be driven by the relative-worsening of performance in 1999.

[12] This hypothesis is further supported by anecdotal evidence that we gathered through interviews to foreign and domestic firms from the automotive sector in the region of Gliwice. The region is currently a cluster for the automotive sector, in which GM Opel operates and where

[Figure 4 about here.]

5.3.2 Robustness

We proceed by assessing the robustness of the main results to alternative subsamples and econometric specifications. First, in column (1) of Table A.7, we exclude potential entries and exits, by considering only a balanced sample, and results are in line with our previous findings. We then address concerns about the fact that since EU accession was pre-announced, some of its impacts might be expected to start materializing before 2004. To account for this possibility, in column (2) we exclude from the sample the years 2000-2004, thereby examining the differential evolution of firm performance across sectors between 1995-1999 and 2004-2013. Reassuringly, the point estimates for TFP and revenue remain very similar to those reported in Table 3 (slightly larger).

The baseline estimates draw on an unbalanced panel including all firms above 10 employees, irrespective of the year in which they were first observed in the data set. The baseline results might therefore partially reflect differential patterns of entry and exit of firms across sectors, as opposed to improvements in the size and efficiency of firms that were already operating prior to EU accession. To account for this possibility, the estimates in column (4) of Table A.7 exclude from the estimation sample firms that are only observed in the post-2004 period. Once again, the point estimates remain very similar when imposing these restrictions.

In the baseline analysis, Germany's pre-determined export shares were measured in the period 1994-2004. If Germany's specialisation patterns changed considerably over this period, one may worry about the extent to which they are an appropriate measure of industrial specialisation at the moment of accession. To account for this concern, the estimates in column (5) of Table A.7 use Germany's export shares measured in the period 2000-2004. Reassuringly, the baseline estimates remain robust when considering this alternative specification.

During the period of analysis, the Polish food and chemicals industries were subject to significant changes in the regulatory environment, which might have direct effects on firm performance. In column (6) of Table A.7, we examine the

domestic suppliers are located. In the auto sector–in which Germany's firms are world leaders– increased trade and investment linkages with Poland were reported to have facilitated knowledge transfers and induced growth of domestic firms. When GM Opel first start operating in Gliwice's special economic zone it created a reaction through the whole supply chain. The zone has now about 80 plants, many of which are supplying to GM Opel, but also to other carmakers in Poland and abroad. Becoming accredited suppliers of GM Opel benefitted domestic firms in two ways. First, they received training and supervision by GM Opel. Second, they acquired the reputation of supplying high-quality products, which improved their prospects with other clients as well.

extent to which the baseline results are sensitive to the exclusion of firms operating in these sectors, while those in column (7) exclude firms that switched sector over the sample period. In column (8) we account for output and input tariff changes, which might also be expected to have direct effects on firm performance. In column (9) we control for EU external tariffs. Changes in EU external tariffs have a negative effect on firm performance, in line with the international evidence, but the effect of German influence remains positive and significant. Finally, in column (10) we exclude firms from the food and chemicals sector and control for tariffs. Once again, the results show that the baseline estimates are robust across these various sub-samples and econometric specifications.

As a further robustness check, in Table A.8 we consider alternative measures of German specialisation. First, we use output shares instead of export shares to measure the extent of industrial specialisation in Germany in the pre-accession period. Reassuringly, the baseline estimates for TFP, revenue, employment and exports remain robust across these various specifications. Second, we consider pre-determined input-based measures of specialisation. In particular, we consider measures of relative factor intensity in each sector, notably average wages, capital stock, and capital stock per worker. Since Germany has relatively large supplies of skilled labor and capital, it would be expected to have a comparative advantage in the sectors that use these factors more intensively (Levchenko (2007); De Loecker and Goldberg (2014)). Finally, we use a standard Balassa measure of revealed comparative advantage, relative to Poland (RCA) and to the world. The results in Table A.8 reveal that our main findings are generally robust across these various alternative measures. In particular, they provide evidence that TFP, revenue and exports growth among Polish firms following EU accession was significantly stronger in German sectors characterised by higher average wages and capital stock at the moment of accession. We also find positive but insignificant effects on employment when using these alternative measures.

In the analysis so far, we have examined the extent to which the evolution of firm performance in Poland following EU accession was mediated by pre-determined measures of comparative advantage in Germany. If these time-invariant measures are systematically correlated with other drivers of firms performance in Poland, our interpretation of the econometric results might be challenged. In particular, we worry that the differential evolution of firm performance across sectors following EU accession reflects, at least in part, Poland's comparative advantage (as opposed to Germany's). To explore this possibility, in columns (1) and (2) of Table 4, we examine the extent to which the evolution of firm performance in the post-2004 period was mediated by Poland's initial export shares across sectors. Reassuringly, the results in column (1) do not show a significant relationship between Poland's

export shares and firm performance in the post-accession period. In column (2), we include simultaneously the pre-determined export shares for Poland and Germany. The results reveal that Germany's initial export share in the sector is a significant predictor or the evolution of firm TFP and revenue in the post-2004 period, while that of Poland is not.

[Table 4 about here.]

In columns (3)-(8), we further assess the validity of our interpretation of the econometric results by conducting a set of placebo tests for Russia, the second major trading partner after Germany, and two other neighbouring countries: Lithuania and Ukraine. Since EU accession did not entail deeper integration with Russia and Ukraine, we would not expect to observe systematic positive effects on firm performance. Lithuania also joined the EU in 2004, but unlike Germany did not have significantly higher levels of income per capita. The econometric results suggest that the export shares for these countries do not have a systematic positive effect on the dynamics of firm performance in Poland after accession to the EU. Finally, in column 10, we also consider the influence of France, the second major trading partner. While the effect of France's export share is positive, the effect disappears when including also Germany's export shares. We interpret this evidence as providing further support to the hypothesis that deeper integration with Germany following EU accession was an important driver of firm performance in the post-accession period. We also find no evidence of firms located in regions bordering Germany benefitting more from German specialisation (Table A.10), which argues against alternative explanations, such as the potential role for border trade or improvements in transport infrastructure. Taken together, these results reported above indicate that EU accession led to a differential increase in German acquisitions and performance improvements in sectors in which Germany had a comparative advantage at the moment of accession.

6 Concluding remarks

The belief that integration with high-income markets can help firms in less developed countries to reduce efficiency gaps is a key argument for pursuing deep agreements. In this paper, we studied the interplay between industrial structure and foreign acquisitions in shaping the effects of deeper integration on firm performance. We examined the extent to which this interaction played a role in driving the patterns of catch-up growth observed in Poland following accession to the European Union in 2004. Drawing on detailed data on Polish manufacturing firms

during 1995-2013 in a difference-in-differences strategy, we examined if and how the evolution German acquisitions and firm performance in Poland following EU accession was mediated by pre-determined measures of industrial specialisation in Germany. If the scope for capital movements and technology transfers was higher in sectors in which Germany was relatively more specialised at the moment of accession, improvements in performance would be stronger among Polish firms operating in those sectors.

We first examined effects of German acquisitions on firm performance. Results from a difference-in-differences estimator point to sizeable positive effects of German acquisitions on firm size. In a second step, we examined if German acquisitions following EU integration were stronger in sectors in which Germany was more specialised at the moment of accession. Event studies pointed to a sharp rise in German acquisitions of Polish firms right after accession, and at a considerably greater extent in sectors in which Germany had higher export shares. Albeit these acquisitions began in 2001 along with the conclusions of the accession negotiations, it was only after joining the EU that FDI observed a sharp rise. Acquisitions increased also from other EU countries, but to a significantly lower extent. We then examine if the evolution of firm performance in Poland following EU accession was also mediated by pre-determined measures of industrial specialisation in Germany. Difference-in-differences estimates revealed that Polish manufacturing firms operating in sectors in which Germany was more specialised at the moment of accession experienced stronger output and productivity growth in the post-2004 period.

Taken together, our findings suggest that deeper integration in goods and factor markets stimulates capital flows to the less advanced economy, that these flows occur predominantly in sectors in which the advanced economy had a comparative advantage, and that this contributes to narrow the productivity gap within industries. These findings point to the benefits of deeper economic integration in goods and factor markets. Despite the fact that both Poland and the EU have eliminated all tariffs ahead of 2004, it was only with the full EU membership that Poland began to significantly enjoy the benefits of FDI-induced productivity gains.

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Table 1: Summary statistics, estimation sample, 1995-2013

	1995-2013	1995-2004	2005-2013
TFPR (log)	4.496	4.586	4.812
	(0.889)	(0.882)	(0.883)
Employment	169.452	218.992	147.329
	(381.65)	(468.696)	(333.21)
Revenues (in 000)	56.145	44.482	61.354
	(283.240)	(199.495)	(313.353)
Export participation	0.667	0.650	0.675
	(0.471)	(0.477)	(0.468)
Share of foreign owned	0.179	0.159	0.188
	(0.383)	(0.366)	(0.391)
N (obs.)	135189	41420	92754
N (firms)	18355	13712	15674

Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. The table reports means and standard deviations (in parentheses) for the estimation sample of manufacturing firms with more than 10 employees over the period 1995-2013 (except 2000-2002). A firm is foreign owned if foreign investors hold at least 50% of capital. Monetary variables are in 2010 prices. TFPR is estimated using the method in Levinsohn and Petrin (2003).

Table 2: Average treatment effects of German acquisition on firm-level employment

	TWFE (1)	Doubly robust (2)
Average treatment effect (German acquisition)	0.075**	0.112**
	(0.035)	(0.038)
Effect by treatment year		
2005	0.057**	0.059**
	(0.026)	(0.028)
2006	0.043*	0.045
	(0.026)	(0.030)
2007	0.040	0.068**
	(0.033)	(0.029)
2008	0.087**	0.117**
	(0.041)	(0.047)
2009	0.059	0.083*
	(0.039)	(0.045)
2010	0.096*	0.140**
	(0.052)	(0.056)
2011	0.117**	0.161***
	(0.052)	(0.062)
2012	0.070	0.177**
	(0.077)	(0.079)

Notes: Authors' calculations based on Orbis data. Results include only firms established before 2004. The doubly robust estimator of Sant'Anna and Zhao (2020) in column (2) has been implemented using pre-treatment levels of employment, age, region and sectoral dummies as covariates. *10% level, **5% level, and ***1% level.

Table 3: Effects of EU accession on firm performance across sectors

Dep. variable:	Log TFPR (1)	Log revenue (2)	Log employment (3)	Log exports (4)
Post × Germany's export share (log)	0.048***	0.082**	0.029	0.162**
	(0.017)	(0.032)	(0.023)	(0.064)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N (obs.)	134174	134176	134178	63992
N (firms)	18355	18357	18359	13245
R-squared	0.105	0.110	0.073	0.110

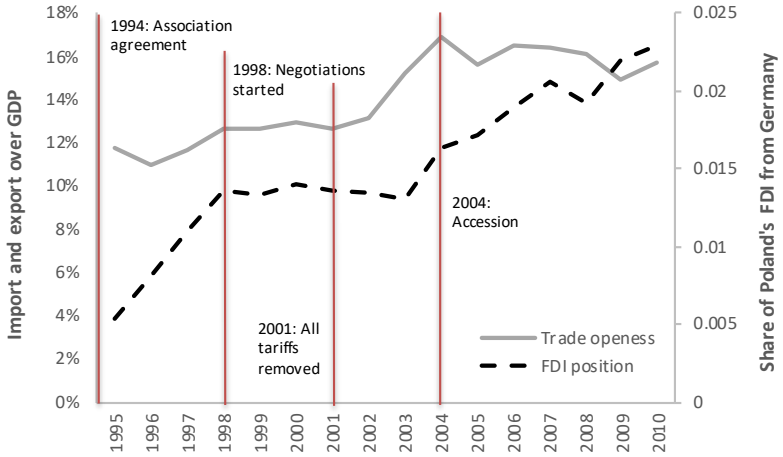
Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. All regressions include firm and year fixed effects. Germany's export shares are measured in the period 1994-2004. TFPR is estimated using the method in Levinsohn and Petrin (2003). When using exports as dependent variable, the sample is restricted to the period 2002-2012 due to a change in the questionnaire, which does not allow for a consistent measure of exports throughout the entire period. The standard errors in parentheses are clustered at 2-digit industry level. *10% level, **5% level, and ***1% level.

Table 4: Placebo test: initial export share for Poland, Russia, Ukraine, Lithuania and France

	Poland		Russia		Ukraine		Lithuania		France	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
B. Dep. Variable: log TFPR										
Post*country's export share	0.002	-0.079***	0.009	-0.047**	0.005	-0.044***	-0.021	-0.031**	0.039*	-0.042
	(0.018)	(0.021)	(0.016)	(0.018)	(0.013)	(0.014)	(0.015)	(0.011)	(0.021)	(0.033)
Post*Germany's export share		0.098***		0.086***		0.085***		0.050***		0.085***
		(0.019)		(0.023)		(0.022)		(0.013)		(0.028)
N (obs.)	134174	134174	134174	134174	134174	134174	134174	134174	134174	134174
N (firms)	18355	18355	18355	18355	18355	18355	18355	18355	18355	18355
R-squared	0.104	0.107	0.104	0.106	0.104	0.106	0.105	0.106	0.105	0.106
B. Dep. Variable: log revenue										
Post*country's export share	0.021	-0.136***	0.022	-0.098***	0.015	-0.089***	-0.042**	-0.063***	0.074	-0.131**
	(0.048)	(0.024)	(0.037)	(0.031)	(0.030)	(0.024)	(0.020)	(0.018)	(0.045)	(0.062)
Post*Germany's export share		0.189***		0.185***		0.182***		0.110***		0.212***
		(0.043)		(0.047)		(0.045)		(0.030)		(0.069)
N (obs.)	134174	134174	134174	134174	134174	134174	134174	134174	134174	134174
N (firms)	18355	18355	18355	18355	18355	18355	18355	18355	18355	18355
R-squared	0.106	0.115	0.107	0.116	0.106	0.115	0.108	0.115	0.108	0.115
D. Dep. variable: log export										
Post*country's export share	0.031	-0.12	0.058	-0.037	0.000	-0.114	-0.12	-0.172*	0.137**	-0.097
	(0.088)	(0.109)	(0.093)	(0.082)	(0.046)	(0.070)	(0.108)	(0.097)	(0.056)	(0.185)
Post*Germany's export share		0.196**		0.177***		0.227***		0.188***		0.239
		(0.077)		(0.05)		(0.074)		(0.058)		(0.181)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N (obs.)	63981	63981	63981	63981	63981	63981	63981	63981	63981	63981
N (firms)	13245	13245	13245	13245	13245	13245	13245	13245	13245	13245
R-squared	0.109	0.11	0.107	0.11	0.108	0.113	0.108	0.113	0.109	0.11

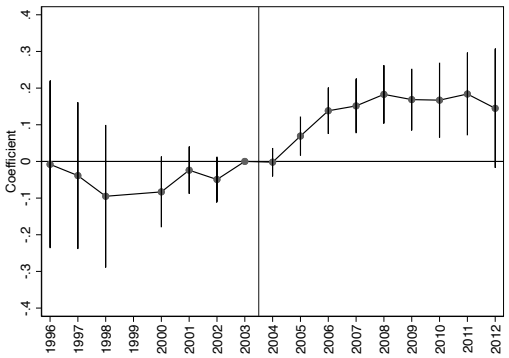
Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. All regressions include firm and year fixed effects. Export shares are measured in the period 1994-2004. TFPR is estimated using the method in Levinsohn and Petrin (2003). Results using TFPR based on ACF method are shown in Table A.9. Standard errors in parentheses clustered at 2-digit industry level. *10% level, **5% level, and ***1% level.

Figure 1: Poland's trade openness and inward FDI from Germany, 1995-2013



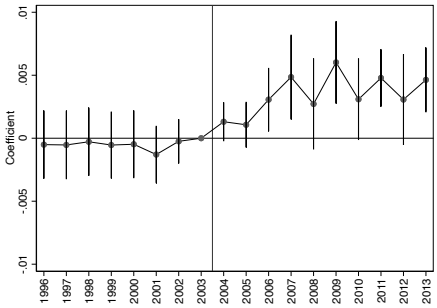
Notes: The grey line depicts the evolution of Poland's degree of trade openness relative to Germany (defined as the sum of bilateral exports and imports with Germany over GDP). The dashed line depicts the share of Poland in Germany's total outward foreign direct investment in the years 1995 to 2012. The sources of the data are UN COMTRADE and the World Development Indicators of the World Bank for trade openness, and OECD for FDI position.

Figure 2: Event study: the effect of German acquisition on firm-level employment: common treatment



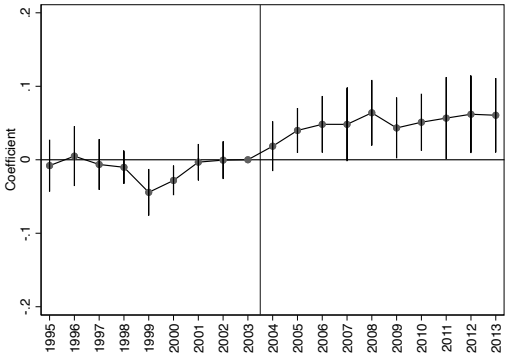
Notes: Authors' calculation based on the Orbis database. The plot is created by regressing the log of employment on a full set of event time indicators interacted with the a dummy variable indicating whether a firm was acquired by a German shareholder after 2004 and controlling for firm and year fixed effects (equation (1)). The omitted baseline is the last pre-treatment year, 2003. The vertical bars indicates 95% confidence interval. Results include only firms established before 2004.

Figure 3: Event study: relationship between pre-determined measure of German comparative advantage and the acquisition of Polish firms.



Notes: Authors' calculation based on the Orbis database. The plot is created by regressing a dummy variable indicating German ownership on a full set of event time indicators interacted with the pre-determined measure of German comparative advantage and controlling for firm and year fixed effects (equation (3)). The omitted baseline is the last pre-treatment year, 2003. The vertical bars indicates 95% confidence interval. Results include only firms established before 2004. Germany's comparative advantages are measured by average sector-level export shares over the period 1994-2004. Overall difference in differences results are shown in Table A.5.

Figure 4: Event study: the effects of Germany's specialisation over time on productivity



Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. The plots are created by regressing firm-level TFPR on a full set of time indicators interacted with Germany's initial export share and controlling for firm and year fixed effects (equation (5)). The omitted baseline is the last pre-treatment year, 2003. Estimates are based on the sample of firms with more than 50 employees. TFPR is estimated using the method in Levinsohn and Petrin (2003).

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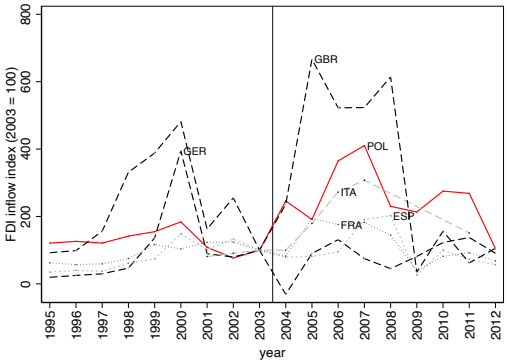
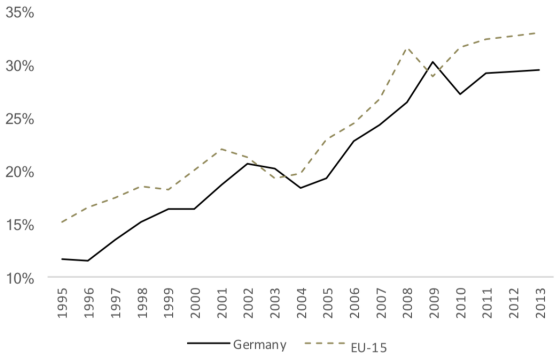
Appendix A: Additional figures

Figure A.1: FDI inflows by country, 1995-2012



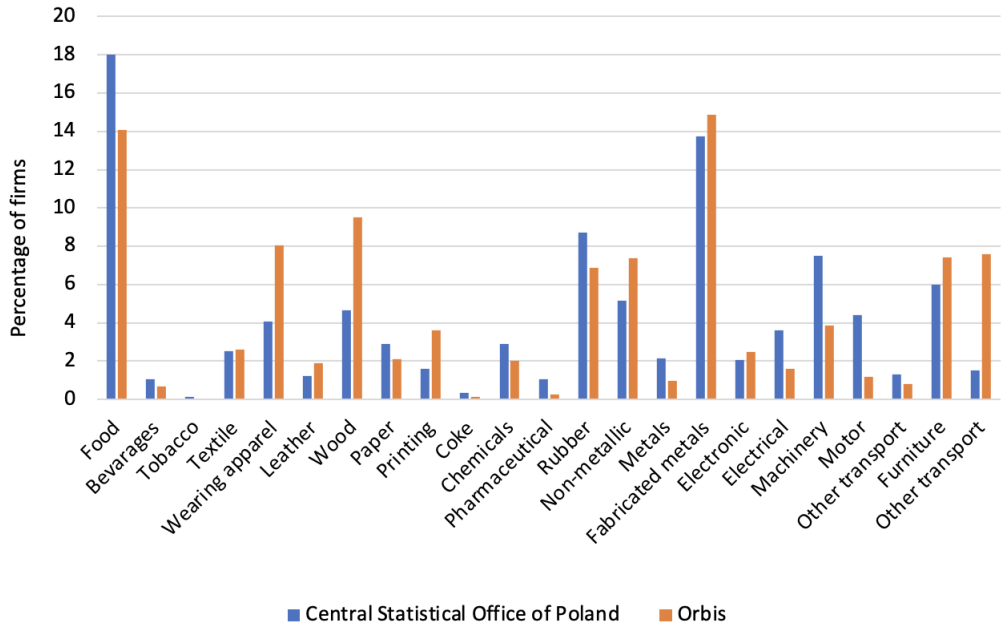
Notes: FDI net inflows are normalised by dividing each flow by the 2003 inflow. Data are from the World Development Indicators.

Figure A.2: Poland's GDP per capita relative to Germany and the EU-15



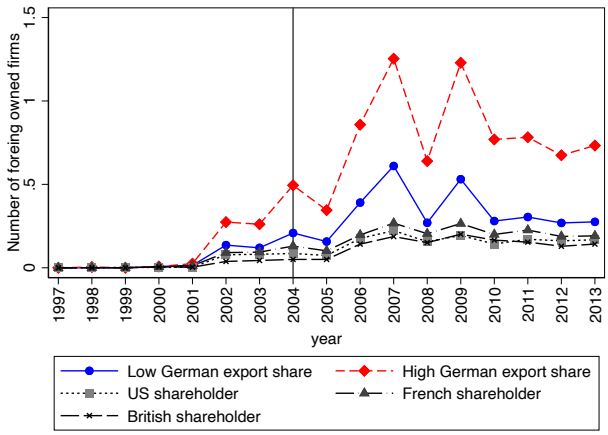
Notes: The figure depicts the evolution of Poland's GDP per capita (in current prices) as a share of that of Germany and the EU-15. The source of the data is the EU AMECO database.

Figure A.3: Percentage of firms by sector



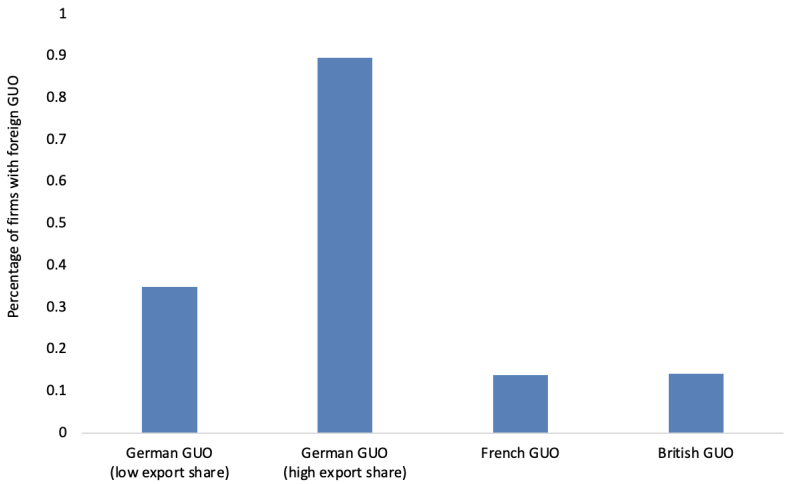
Notes: Authors' calculation based on the Orbis database and the survey data from the Central Statistical Office of Poland. The bars indicate the percentage of firms in each sector.

Figure A.4: Share of foreign owned firms by origin of shareholder



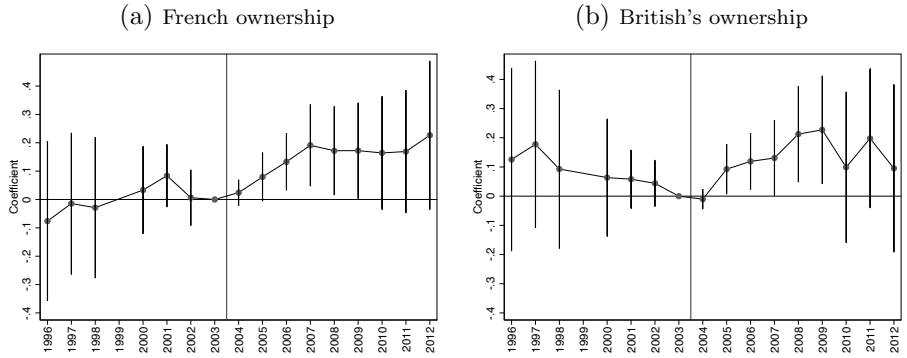
Notes: Authors' calculation based on the Orbis database. The red line shows the shares of firms with a German shareholder in sectors where Germany show greater industrial specialisation (above median). Sectors with a higher export share include: motor vehicle, machinery, chemicals, pharmaceutical, metals, communication and specialised equipment.

Figure A.5: Share of foreign owned firms by country of origin of Global Ultimate Owner (GUO)



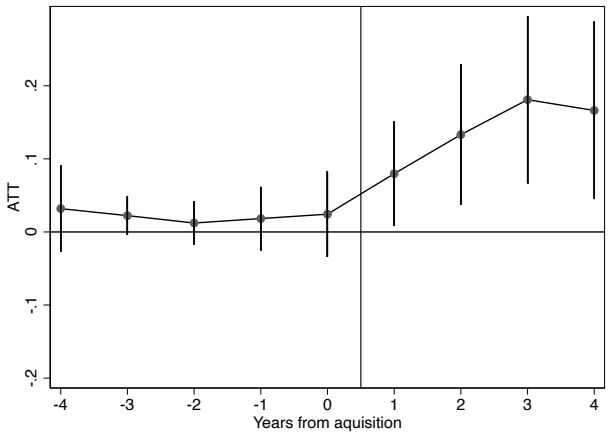
Notes: Authors' calculation based on the Orbis database. Sectors with a higher export share include: motor vehicle, machinery, chemicals, pharmaceutical, metals, communication and specialised equipment.

Figure A.6: Event study: the effect of foreign acquisition on firm-level employment (common treatment)



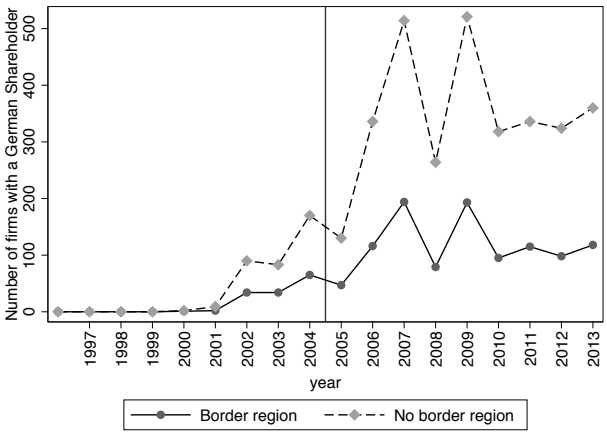
Notes: Authors' calculation based on the Orbis database. The plot is created by regressing the log of employment on a full set of event time indicators interacted with the a dummy variable indicating whether a firm was acquired by a Foreign (either French or British) shareholder after 2004 and controlling for firm and year fixed effects. The estimation includes only firms established before 2004. The omitted baseline is the last pre-treatment year, 2003.

Figure A.7: Event study: effect of German acquisition on employment based on doubly robust estimator



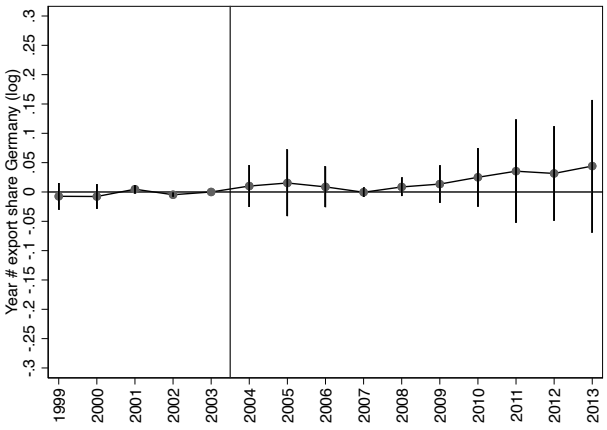
Notes: Authors' calculation based on the Orbis database. The plot is obtained by implementing the doubly robust estimator of Sant'Anna and Zhao (2020). The estimation includes only firms established before 2004. The omitted baseline is the last pre-treatment year, 2003. The vertical bars indicates 95% confidence interval.

Figure A.8: Number of firms acquired by German shareholders by location



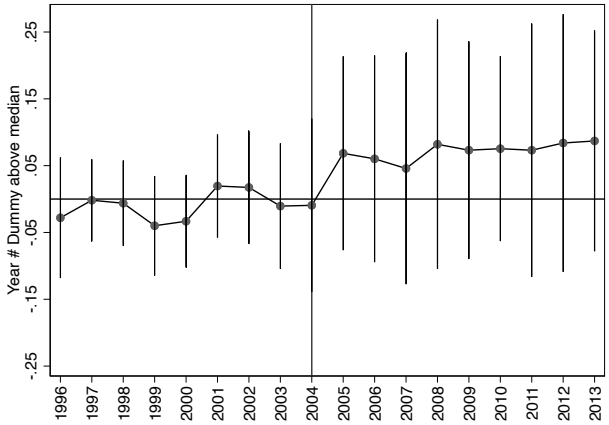
Notes: Authors' calculation based on the Orbis database. Border regions are: Dolnoslaskie, Lubuskie and Zachodniopomorskie.

Figure A.9: Event study: the effect of pre-determined measure of German comparative advantage on the acquisition of Romanian firms.



Notes: Authors' calculation based on the Orbis database. The sample includes only Romanian firms. The plot is created by regressing a dummy variable indicating German ownership on a full set of event time indicators interacted with the pre-determined measure of German comparative advantage and controlling for firm and year fixed effects. The omitted baseline is the last pre-treatment year, 2003. The vertical bars indicate 95% confidence interval. Results include only firms established before 2004. Germany's comparative advantage is measured by average sector-level export shares over the period 1994-2004.

Figure A.10: Event study: effects on TFPR (binary measure of Germany's specialisation)



Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. The plot is created by regressing the firm-level TFPR on a full set of time indicators interacted with a binary measure of Germany's specialisation that assigned 1 to sectors that have above median levels of output share or export share and controlling for firm and year fixed effects. Estimates are based on sample of firms with more than 50 employees. The omitted baseline is the last pre-treatment year, 2003. The estimation includes only firms established before 2004. The vertical bars indicates 95% confidence interval.

Appendix B: Additional tables

Table A.1: Summary statistics, estimation sample, 1995-2013

Sector	TFPR	Employment	Revenues	Exporters	Foreign	N (obs.)	N (firms)
Food and beverages	3.865	151.866	64.439	0.466	0.105	25,841	3,592
	(0.847)	(287.204)	(205.281)	(0.499)	(0.307)		
Tobacco	2.743	829.116	1174.163	0.833	0.5	138	14
	(0.958)	(871.017)	(1391.239)	(0.374)	(0.502)		
Textile, wearing apparel, leather	3.974	157.637	16.212	0.764	0.188	13,782	1,867
	(0.922)	(235.768)	(42.777)	(0.424)	(0.391)		
Wood	3.626	127.085	29.272	0.785	0.152	7,150	1,034
	(0.691)	(195.2)	(110.173)	(0.411)	(0.359)		
Pulp, paper and printing	5.313	116.178	42.833	0.613	0.171	6,686	916
	(0.884)	(206.713)	(147.089)	(0.487)	(0.376)		
Chemicals	4.684	258.429	119.735	0.776	0.244	5,472	687
	(0.886)	(559.629)	(316.885)	(0.417)	(0.43)		
Rubber and plastic	4.066	122.512	38.165	0.778	0.231	11,774	1,622
	(0.708)	(266.831)	(130.317)	(0.416)	(0.421)		
Non-metallic mineral products	4.456	172.164	48.617	0.549	0.197	8,300	1,114
	(0.856)	(298.299)	(108.157)	(0.498)	(0.398)		
Basics and fabricated metals	4.64	141.681	43.103	0.717	0.187	21,419	3,000
	(0.78)	(374.529)	(264.849)	(0.45)	(0.39)		
Machinery and equipment	5.009	152.354	43.198	0.668	0.143	12,704	1,707
	(0.791)	(326.021)	(256.078)	(0.471)	(0.35)		
Electrical, comm., medical	5.227	202.276	71.201	0.709	0.231	9,619	1,262
	(0.949)	(424.024)	(379.659)	(0.454)	(0.421)		
Motor vehicles, other transport	5.419	354	152.26	0.783	0.288	8,348	1,056
	(0.989)	(806.788)	(728.611)	(0.412)	(0.453)		
Other	4.612	202.387	39.12	0.83	0.196	8,004	1,150
	(0.874)	(442.729)	(153.547)	(0.376)	(0.397)		

Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. The table reports means and standard deviations (in parentheses) for the estimation sample of manufacturing firms with more than 10 employees over the period 1995-2013 (except 2000-2002). A firm is foreign-owned if foreign investors hold at least 50% of capital. TFPR is estimated using the method in Levinsohn and Petrin (2003). Monetary variables are in 2010 prices. The Tobacco industry has a small number of firms. To preserve their confidentiality, summary statistics for this industry are not reported.

Table A.2: Export shares by country, 1994-2004

Sector	Description	Germany	Russia	Ukraine	Lithuania	Poland
15	Food products, Beverages	3.97	2.58	10.25	11.84	8.28
16	Tobacco	0.30	0.09	0.32	0.55	0.17
17	Textile	2.42	0.77	0.85	7.18	2.96
18	Leather	1.26	0.52	2.82	9.73	6.24
19	Footwear	0.50	0.24	1.04	0.99	1.34
20	Wood and Products of Wood and Cork	0.62	2.68	1.07	4.92	3.58
21	Paper	2.32	2.94	1.30	1.15	2.88
22	Printing and publishing	1.05	0.95	0.20	0.43	0.69
23	Coke, Refined Petroleum Products and Nuclear Fuel	1.26	22.15	5.81	18.33	2.31
24	Chemicals and Chemical Products	13.43	11.74	11.56	9.41	6.91
25	Rubber and Plastics Products	3.52	0.84	1.55	2.40	3.90
26	Other Non-Metallic Mineral Products	1.49	0.76	1.39	1.50	2.76
27	Basic Metals	4.88	33.52	41.64	1.57	8.07
28	Fabricated Metal Products	3.37	2.05	2.51	1.95	6.04
29	Machinery and Equipment, not elsewhere classified	16.36	4.11	6.59	4.30	7.22
30	Office, Accounting and Computing Machinery	2.82	0.16	0.23	0.60	0.28
31	Electrical Machinery and Apparatus, not elsewhere classified	5.42	1.44	2.69	2.78	5.85
32	Radio, Television and Communication Equipment	4.92	0.68	0.67	4.50	3.80
33	Medical, Precision and Optical Instruments	4.12	1.55	1.22	1.15	0.79
34	Motor Vehicles, Trailers and Semi-Trailers	20.14	2.35	1.37	5.93	12.23
35	Other Transport Equipment	3.94	5.10	4.42	4.78	5.72
36/37	Manufacturing not elsewhere classified; Recycling	1.89	2.77	0.51	4.03	7.98

Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. Table reports export shares by sector over the period 1994-2004 for sectors are classified according to NACE Rev. 1 (2-digit) classification.

Table A.3: Average treatment effects using alternative measures of foreign ownership

	(1)		(2)
Dep. var.:	Employment (log)		Employment (log)
Post*German ownership (binary)	0.156***	Post*German shareholders (num)	0.088***
	(0.041)		(0.020)
Post*French ownership (Binary)	0.155**	Post*French shareholders (num)	0.080**
	(0.066)		(0.037)
Post*British ownership (binary)	0.099	Post*British shareholders (nun)	0.084
	(0.064)		(0.055)
Year FE	Yes		Yes
Firm FE	Yes		Yes
Observations	271555		271555
Firms	61254		61254

Notes: Authors' calculations based on Orbis data. Each cell is obtained from a different specification where the number of employees is regressed on a time-varying indicator of foreign ownership indicated on the row. All regressions include firm and year fixed effects. Coefficients show the average treatment effects of foreign ownership. Results refer to firms that were observed both before and after accession. Data exclude the year 1999 due to anomalies in the data. Foreign ownership in column (1) is measured by a binary indicator taking value one when a firm had a foreign shareholder. Column (2) uses the number of foreign shareholders as an alternative measure of foreign ownership. Standard errors in parentheses are clustered at 2-digit industry level. *10% level, **5% level, and ***1% level.

Table A.4: Average treatment effects using alternative measures of foreign ownership, excluding exits

Dep. var.:	(1) Employment (log)		(2) Employment (log)
Post*German ownership (binary)	0.156***	Post*German shareholders (num)	0.088***
	(0.041)		(0.020)
Post*French ownership (Binary)	0.154**	Post*French shareholders (num)	0.080**
	(0.066)		(0.037)
Post*British ownership (binary)	0.098	Post*British shareholders (nun)	0.083
	(0.064)		(0.056)
Year FE	Yes		Yes
Firm FE	Yes		Yes
Observations	270919		270919
Firms	61073		61073

Notes: Authors' calculations based on Orbis data. These regressions exclude firms that exit after accession. Each cell is obtained from a different specification where the number of employees is regressed on a time-varying indicator of foreign ownership indicated on the row. All regressions include firm and year fixed effects. Coefficients show the average treatment effects of foreign ownership. Results refer to firms that were observed both before and after accession. Data exclude the year 1999 due to anomalies in the data. Foreign ownership in column (1) is measured by a binary indicator taking value one when a firm had a foreign shareholder. Column (2) uses the number of foreign shareholders as an alternative measure of foreign ownership. Standard errors in parentheses are clustered at 2-digit industry level. *10% level, **5% level, and ***1% level.

Table A.5: Difference in differences results: the effect of German influence on German acquisitions of Polish firms

Dep.var: German acquisition (Yes = 1)	(1)	(2)	(3)	(4)	(5)	(6)
Post*Germany's export share (log)	0.004***					
	(0.001)					
Post*Germany's output share (log)		0.002**				
		(0.001)				
Post*Germany's initial average wages (log)			0.003***			
			(0.001)			
Post*Germany's initial capital per worker (log)				0.002***		
				(0.001)		
Post*RCA relative to Poland					0.011***	
					(0.002)	
Post*RCA relative to world						0.008***
						(0.002)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1010349	1010349	1010349	1010349	1010349	1010349
Firms	63971	63971	63971	63971	63971	63971

Notes: Authors' calculations based on Orbis dataset. All regressions include firm and year fixed effects. RCA is a standard measure of comparative advantages of Germany versus Poland and the world. All measures of German influence refer to the period 1994-2004. Regressions consider only firms established before 2004. Standard errors in parentheses clustered at 2-digit industry level. *10% level, **5% level, and ***1% level.

Table A.6: Robustness: alternative measure of TFPR

A. Dep. variable: log TFPR (ACF)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post × Exports share (log)	0.041**						
	(0.018)						
Post × Output share (log)		0.022					
		(0.025)					
Post × initial capital stock (log)			0.022				
			(0.020)				
Post × initial capital per worker (log)				0.024			
				(0.054)			
Post × initial average wages (log)					0.041**		
					(0.019)		
Post × RCA relative to Poland						0.080*	
						(0.040)	
Post × RCA relative to the world							0.116**
							(0.051)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N (obs.)	134174	134174	134174	134174	134174	134174	134174
N (firms)	18355	18355	18355	18355	18355	18355	18355

Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. All regressions include firm and year fixed effects. RCA is a standard measure of comparative advantages of Germany versus Poland and the world. All measures of German influence refer to the period 1994-2004. Standard errors in parentheses clustered at 2-digit industry level. *10% level, **5% level, and ***1% level. TFPR is estimated using the method proposed in Ackerberg et al. (2015).

Table A.7: Robustness across sub-samples and set of controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A. Dep. variable: TFPR										
Post*export share	0.055**	0.065**	0.052**	0.048***	0.049***	0.062***	0.050**	0.048***	0.049***	0.062***
	(0.023)	(0.023)	(0.021)	(0.017)	(0.017)	(0.010)	(0.019)	(0.016)	(0.016)	(0.010)
Output tariffs								-0.003	-0.001	-0.005
								(0.006)	(0.007)	(0.008)
Input tariffs								0.009	0.009	0.022
								(0.014)	(0.016)	(0.022)
EU external tariff									-0.008***	-0.004
									(0.003)	(0.005)
N (obs.)	49184	111050	100888	111478	134174	102736	127020	131450	125541	96094
N (firms)	6175	16647	11669	13720	18355	14131	17663	18355	18338	14117
R-squared	0.159	0.110	0.138	0.117	0.105	0.113	0.105	0.105	0.103	0.110
B. Dep. variable: log revenue										
Post*export share	0.077***	0.090*	0.085**	0.082**	0.086**	0.099***	0.083**	0.080**	0.080**	0.096***
	(0.026)	(0.050)	(0.037)	(0.032)	(0.032)	(0.032)	(0.034)	(0.029)	(0.029)	(0.029)
Output tariffs								0.005	0.007	0.010
								(0.011)	(0.013)	(0.018)
Input tariffs								-0.008	-0.006	-0.014
								(0.028)	(0.031)	(0.049)
EU external tariff									-0.012**	-0.015
									(0.005)	(0.011)
N (obs.)	49184	111050	100888	111478	134174	102736	127020	131450	125541	96094
N (firms)	6175	16647	11669	13720	18355	14131	17663	18355	18338	14117
R-squared	0.185	0.106	0.216	0.113	0.111	0.119	0.106	0.111	0.111	0.119
C. Dep. variable: log employment										
Post*export share	0.016	0.016	0.018	0.029	0.032	0.029	0.032	0.027	0.027	0.027
	(0.022)	(0.040)	(0.028)	(0.023)	(0.024)	(0.023)	(0.024)	(0.021)	(0.021)	(0.020)
Output tariffs								0.005	0.007	0.007
								(0.007)	(0.008)	(0.012)
Input tariffs								-0.013	-0.012	-0.008
								(0.018)	(0.019)	(0.032)
EU external tariff									-0.011**	-0.017*
									(0.005)	(0.008)
N (obs.)	49184	111050	100888	111478	134174	102736	127020	134154	125541	96094
N (firms)	6175	16647	11669	13720	18355	14131	17663	18355	18338	14117
R-squared	0.092	0.072	0.053	0.082	0.074	0.084	0.074	0.074	0.078	0.089
D. Dep. variable: exports										
Post*export share	0.161***	0.215*	0.145*	0.162**	0.167**	0.175**	0.173**	0.163**	0.158**	0.172**
	(0.167)	(0.122)	(0.073)	(0.064)	(0.066)	(0.066)	(0.067)	(0.063)	(0.058)	(0.061)
Output tariffs								0.005	0.012	0.029
								(0.007)	(0.025)	(0.030)
Input tariffs								-0.008	-0.040	-0.104
								(0.022)	(0.050)	(0.076)
EU external tariff									0.005	-0.009
									(0.024)	(0.038)
N (obs.)	24076	49995	58691	56451	63992	52820	59967	63981	63981	52809
N (firms)	4414	12121	9413	10273	13245	10878	12631	13245	13245	10878
R-squared	0.153	0.131	0.143	0.115	0.110	0.111	0.106	0.106	0.110	0.112

Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. All regressions include firm and year fixed effects. Germany's export shares refer to the period 1994-2004. Standard errors in parentheses clustered at 2-digit industry level. TFPR is estimated using the method in Levinsohn and Petrin (2003). Column (1) excludes entries and exits after 2004. Column (2) excludes the period 2000-2004. Column (3) considers only firms with more than 50 employees. Column (4) considers only firms born before 2004. Column (5) uses Germany's export shares for the period 2000-2004. Column (6) excludes the Chemical and Food sectors. Column (7) excludes firms that switch sector over the period. Column (8) includes Poland's input and output tariffs. Column (9) includes EU's external tariff. Column (10) includes tariffs and excludes the Chemical and Food sectors. *10% level **5% level and ***1% level.

Table A.8: Robustness: alternative measures of Germany's comparative advantage

Dep. Variable:	log TFPR (1)	log revenues (2)	log employment (3)	log exports (4)
Post*Germany's output share (log)	0.041**	0.091***	0.062**	0.605***
	(0.018)	(0.041)	(0.026)	(0.211)
Post*Germany's initial average wages (log)	0.053***	0.117***	0.064**	0.605***
	(0.012)	(0.027)	(0.029)	(0.211)
Post*Germany's initial capital per worker (log)	0.022	0.123	0.125**	0.605***
	(0.056)	(0.104)	(0.054)	(0.211)
Post*Germany's initial capital stock (log)	0.037**	0.094***	0.065***	0.605***
	(0.014)	(0.028)	(0.017)	(0.211)
Post*RCA relative to Poland	0.089**	0.140**	0.033	0.605***
	(0.036)	(0.057)	(0.043)	(0.211)
Post*RCA relative to world	0.124**	0.301***	0.129	0.605***
	(0.045)	(0.078)	(0.081)	(0.211)
N (obs.)	134174	134174	134174	63992
N (firms)	18355	18355	18355	13245

Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. Each cell is from a separate regression. All regressions include firm and year fixed effects. TFPR is estimated using the method in Levinsohn and Petrin (2003). RCA is a standard measure of comparative advantages of Germany versus Poland and the world. All measures of German influence refer to the period 1994-2004. Standard errors in parentheses clustered at 2-digit industry level. *10% level, **5% level, and ***1% level.

Table A.9: Placebo test: initial export share for Russia, Ukraine, Lithuania and Poland

	Poland		Russia		Ukraine		Lithuania	
D. Dep. variable: TFPR (ACF)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post × country's export share (log)	-0.015	-0.058***	-0.010	-0.039***	0.014	-0.014	-0.033**	-0.046***
	(0.025)	(0.020)	(0.014)	(0.013)	(0.026)	(0.026)	(0.015)	(0.013)
Post × Germany's export share (log)		0.061***		0.067***		0.049***		0.052***
		(0.020)		(0.019)		(0.017)		(0.014)
N (obs.)	134174	134174	134174	134174	134174	134174	134174	134174
N (firms)	18355	18355	18355	18355	18355	18355	18355	18355
R-squared	0.114	0.116	0.115	0.117	0.115	0.116	0.115	0.117

Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. All regressions include firm and year fixed effects. Export shares are measured in the period 1994-2004. TFPR is estimated using the method in Levinsohn and Petrin (2003). Standard errors in parentheses clustered at 2-digit industry level. *10% level, **5% level, and ***1% level.

Table A.10: The effect of Germany specialisation by distance to the border

Dep. Var.:	(1) TFPR	(2) Revenues	(3) Employment	(4) TFPR	(5) Revenues	(6) Employment
Post × border	0.010	0.074	0.033	0.002	0.008	0.048
	(0.060)	(0.091)	(0.066)	(0.052)	(0.111)	(0.088)
Post × export share	0.046**	0.075**	0.023			
	(0.017)	(0.034)	(0.024)			
Post × export share * border	0.004	0.026	0.022			
	(0.017)	(0.024)	(0.017)			
Post × output share				0.040**	0.089**	0.056**
				(0.018)	(0.040)	(0.026)
Post × output share * border				0.002	0.006	0.027
				(0.015)	(0.032)	(0.024)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	102056	102056	102056	102056	102056	102056
Firms	11764	11764	11764	11764	11764	11764
R-squared	0.121	0.118	0.072	0.121	0.119	0.076

Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. All regressions include firm and year fixed effects. Measures of Germany's specialisation refer to the period 1994-2004. TFPR is estimated using the method in Levinsohn and Petrin (2003). Border is a dummy variable that takes value 1 if a firm is in one of the three regions bordering Germany: Dolnoslaskie, Lubuskie and Zachodniopomorskie. Standard errors in parentheses clustered at 2-digit industry level. *10% level, **5% level, and ***1% level.

Table A.11: Effects of EU accession on firm performance across sectors

Dep. variable: Log TFPR	(1) All	(2) Low labor-intensity	(2) High labor-intensity
Post 2000 # Exports share Ger (log)	0.017**	-0.003	0.028**
	(0.008)	(0.015)	(0.011)
Pos 2004 # Exports share Ger (log)	0.083***	0.071*	0.090***
	(0.015)	(0.032)	(0.024)
	Yes	Yes	Yes
	Yes	Yes	Yes
N (obs.)	102736	51217	51519
N (firms)	14131	6901	7230

Notes: Authors' calculations based on survey data from the Central Statistical Office of Poland. All regressions include firm and year fixed effects. Germany's export shares are measured in the period 1994-2004. TFPR is estimated using the method in Levinsohn and Petrin (2003). Labor intensity is based on the share of wages over value added from UNIDO. Sectors are ranked based on these shares and then divided into two equal groups. We control for input and output Tariffs for Poland and for EU external tariffs. We exclude the Chemical and food sectors. The standard errors in parentheses are clustered at 2-digit industry level. *10% level, **5% level, and ***1% level.