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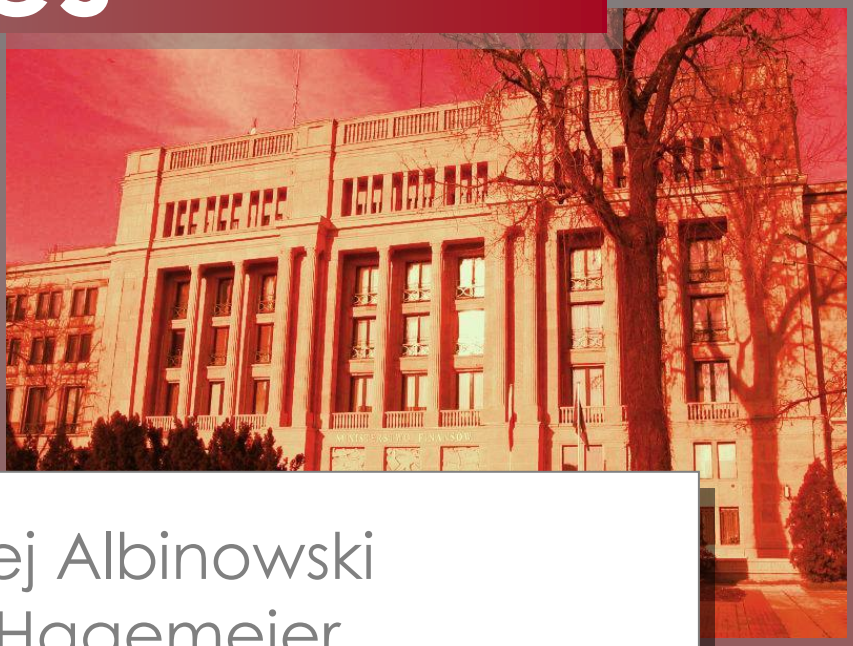

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Sustaining Micro Competitiveness to Ensure Convergence and Macro Resilience of the Polish Economy

MINISTRY OF FINANCE
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Sustaining Micro Competitiveness to Ensure Convergence and Macro Resilience of the Polish Economy

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Abstract

We use export transaction and firm-level data to analyze Poland's export competitiveness over the period 2005 - 2013. Polish firms have become increasingly internationalized through exports. We observe a substantial increase in the number of exporters and a decrease in their average size, which indicates that fixed costs associated with exporting have decreased – mainly with the EU. Decomposition of export growth reveals that diversification is an increasingly important factor in explaining export growth. Exporters have become more diversified in the analyzed period, and export quality has been converging to the levels of high-income country exporters. We find that the process of quality upgrading is concurrent with market diversification: exporters upgrade in quality as they diversify into new destinations, likely because clients demand improvements in product specifications. Polish export flows are highly sustainable and we identify factors conducive to their survival. When analyzing determinants of participation in the export markets we find that the effect of real exchange rate varies across firms, depending on the extent to which firms participate on regional or global value chains (as measured by the firms' share of imported inputs in the total input bill). Productivity, financial constraints and sunk costs also matter for the export decision. In additional we find substantial evidence of local sectoral spillovers on exports. Finally, productivity dynamics were analyzed. Productivity growth in the analyzed period has been solid and resulted both from within-firm gains and allocative efficiency gains. Both domestic and foreign firms experienced productivity gains during the period. For domestic firms, an important source of these gains appears associated with FDI vertical spillovers through forward linkages. Increased FDI stocks in upstream markets account for between 5 and 30 percent of the TFP gains observed during the period 2005-2013 in most sectors.

Keywords: export competitiveness, export decision, export diversification, total factor productivity, vertical spillovers

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Executive Summary

This report examined the competitiveness of Polish firms in export markets. It is structured in three chapters that look at competitiveness from complementary angles.

In the first chapter, we assess how exporters perform in the global marketplace by looking at four dimensions of competitiveness: growth, diversification, quality upgrading and survival. We benchmarked Poland's performance against that of comparator or aspirational countries provided data is available. Exploiting a rich exporter-transaction level dataset, we identified firms' heterogeneous performance, and the main factors associated with successful patterns of internationalization.

We found that Polish firms have become increasingly internationalized through exports. This has contributed to solid export growth in comparison to other countries in the region, to a consolidated export diversification, and to a gradual process of quality upgrading of their export basket. More importantly, the process of internationalization is a positive development because it is typically associated with productivity convergence to the levels of its main trading partners.

In particular:

a. **Growth**
   i. Polish exports grew at an average rate of 15 percent per year compared to 7 percent on average for EU27 countries during the period 2004-2013.
   ii. The number of exporters has increased by 36 percent during the last decade, with the largest expansion being in the transport and machinery sectors where exporters increased by 100 and 40 percent respectively.
   iii. Exports per firm have been decreasing, from 380 thousands PLN in 2005 to 177 thousands PLN in 2013, indicating that increasingly more small firms are able to access the export market.

b. **Diversification**
   i. In terms of country reach and firm-level diversification, Poland's performance in terms of country reach and product scope is on par with European and high-income peers and this applies to almost all export sectors**.**
   ii. Poland's exports reach more than 200 destinations, with 80 percent of exporters orienting their flows to the European Union and to the Commonwealth of Independent States. Top destination markets are Germany and the Ukraine
   iii. Diversification is increasingly contributing to export growth. Diversification explained 16 percent of overall export growth in the period 2005-2007, and 27 percent of it in the period 2010-2013.
   iv. Smaller exporting firms are increasing in number. Very small exporters are still vulnerable to country and product specific shocks as they typically focus

on one destination and one product only. These small firms that are highly concentrated in one market and one product accounted for only 1 percent of aggregate export values.

c. **Quality**
    i. Poland's export quality has been converging to the quality levels displayed by mature EU members.
    ii. Firms that export high quality products are smaller, focus on fewer products and destinations, but grow faster than other firms. These are most likely successful small businesses with high flexibility in their production lines that allows them to serve high quality and niche markets that demand constant changes in product specifications.
    iii. Quality upgraders tend to increase their quality of products through a process of market diversification. They also concentrate on few destinations and products, and are more likely to export towards most frequent destinations.

d. Survival
    i. The survival probability of Polish export flows is higher that observed in comparator countries including some mature EU members such as Spain.
    ii. It is highest in the Food sector, where the country has a strong comparative advantage, and lowest in the Transport and Machinery, the top exporting sectors.
    iii. Survival varies substantially by destination, being highest when flows are oriented towards EU27 (in particular to Czech Republic and Slovakia) and lowest for exports towards the USA and Ukraine.
    iv. Firms that are able to survive longer are larger and more diversified both in terms of products and destinations.
    v. Firms benefit from accumulated knowledge about destination markets (information about exporting to a given destination is more likely to flow more easily), but suffer from competition from other firms exporting similar products (where information is likely to constitute a competitive edge for firms and they may be less inclined to share it).

In the second chapter, we look at the main drivers associated with firms' participation in export markets, and with the intensity with which they participate. We explore the importance of six factors: the real exchange rate, productivity and productivity dynamics, the sunk costs associated with the exporting decision, export spillovers, liquidity and access to finance, and research and development investments.

We found that productivity in the manufacturing sector has been growing fast, led both by within-firm improvements in efficiency, but equally importantly, by a sustained process of reallocation of resources into more productive firms and activities. We also found that while exporting firms respond to real exchange changes, this response depends on whether the firm is highly reliant on imported inputs or participates actively in global value chains. Results show that

other factors aside from the real exchange rate matter for export participation and performance: productivity, information and mentoring (as suggested by strong export local spillovers and high sunk costs of exporting), and liquidity. Exports are not particularly intensive in R&D.

In particular:

a. Productivity

vi. Aggregate productivity grew by 5 percent per year due to both firms increasing their productivity and more productive firms gaining market shares. The contribution of the latter component is higher than observed in other countries. Firm entry & exit contributed little to productivity growth.

vii. The 2009 economic crisis that hit the hardest sectors most exposed to the international markets and in particular the EU, also helped reallocating resources into more productive activities. During 2009 and 2010 allocative efficient contributed twice as much as the average of the entire 2006-2013 period to aggregated productivity gains.

b. Export participation

viii. Exporters are exceptional performers, as it is the case elsewhere. They are on average 3 times larger, 12 percent more productive and are 5 times more likely to be foreign owned than non-exporters.

ix. Firms face high fixed (sunk) costs for entering export markets. This makes firms that exported in the previous year up to 50 percent more likely to export also in the following year because they have acquired an intangible asset associated with information and know-how. The returns of having paid these sunk costs, however, depreciate rapidly over time meaning that firms rapidly lose the benefits of the initial investments if they exit export markets even temporarily.

x. Proximity between exporters in the same sector reduces entry costs. This is likely due to lower cost of production given by an increased availability of specialized capital or/and labor inputs, or due to the increased availability of market information, which reduces search costs.

xi. Real exchange rate shocks affect firms' revenues and costs. Through this channel, the real exchange rate affects firms' decisions of entering export markets. The effect however depends on the intensity with which they use imported intermediates and participate in global value chains. Our estimates reveal that 80 percent of exporters are not fully 'hedged' against exchange rate shocks. The rest tend to use high portions of imported inputs, borrow in foreign currency or have wage contracts indexed to foreign currency – these types of firms are most commonly found in the motor vehicles sector.

xii. Liquidity plays an important role by facilitating entry in the export markets while R&D expenditure does not affect participation.

c. Export Intensity

xiii. Total factor productivity growth is a significant driver of export competitiveness and growth. We find that a 10 percent increase in productivity is associated with 0.8 percent increase in exports.

In the third chapter, we examine the role of inward FDI in improving firms' competitiveness via productivity spillovers. We look at vertical spillovers, associated with potential benefits (or costs) that firms may face due to increased FDI in upstream sectors, and at horizontal spillovers, associated with benefits (or costs) that firms may face due to increased FDI in the same sectors as they operate.

On the back of its large internal market and an investor-friendly environment, Poland received more FDI than the average EU, ECA or high-income country. Still it lagged behind some of the best performers in the region such as Czech Republic, Slovakia or Lithuania. The country also keeps some restrictions to FDI, particularly in the form of equity limits to foreigners that are higher than in neighboring countries and that are likely limiting FDI inflows from outside the EU. At the same time, some FDI inflows have received public support, *on the assumption* that FDI would lead to increased productivity to other firms in the economy. In this chapter we do find evidence of positive spillovers from FDI on the productivity of other firms operating in Poland, both vertical (through suppliers-clients relationships) and horizontal (through competitors' relationships). The spillovers do not accrue to all firms equally. The presence of multinationals in the same sector tends to benefit more productive firms that are likely those with greater absorptive capabilities to gain from knowledge transfers, and that stand a better chance to compete with multinationals. The presence of multinationals in upstream sectors tends to benefit the most firms that are medium and large – likely to interact more intensively with multinationals in upstream sectors that the small ones.

In particular:

d. FDI inflows and policy restrictiveness

xiv. Poland's attractive internal market and friendly business environment helped secure substantial inflows of FDI over the period 1995-2013 that averaged 3.38 percent of GDP per year. These were higher than for the average of ECA, EU or high-income countries but lagged behind some new member states of the EU that have been top performers, such as Czech Republic, Lithuania, Estonia or Slovakia.

xv. Poland has been making fiscal efforts to incentivize the attraction of FDI through, for example, tax holidays to certain foreign investments. Still, the country maintains some restrictions to FDI, mainly in the form of equity limits for foreigners that make the economy more restrictive to foreign investment than the aforementioned top performers. The FDI regime in Poland is, in any case, relatively liberal.

e. FDI Spillovers

xvi. FDI in upstream sectors benefitted firms in downstream sectors in Poland. We find that increased FDI stocks in upstream markets account for between 5 and 30 percent of the TFP gains observed during the period 2005-2013 in most sectors, suggesting that the spillovers are not only significant statistically, but also economically.

xvii. FDI spillovers, both vertical and horizontal accrue to firms conditional on their degree of interaction with multinationals, and on their ability to absorb new knowledge or technologies.

This analysis is relevant in the context of preparation for Euro Adoption for three interrelated reasons.

First, a crucial condition for Euro Adoption is economic resilience at the macro level. Competitiveness at the micro level is a key element of the former. A resilient economy is better positioned to face idiosyncratic shocks when some of the traditional shock absorbers, such as the exchange rate, cease to be an available policy instrument. The current account assessment conducted as part of this project reveals that overall the expected path for external imbalances in the years to come, associated with the process of convergence of the Polish economy, should not pose major challenges in terms of financing needs. Still, to reduce vulnerabilities, these imbalances need to be kept under control. The observed increases in the country's net foreign liabilities suggest that the deficit in the income balance of the current account will continue to grow, stressing the importance of an increase in the trade balance. Assessing the competitiveness of the export sector at the micro level and identifying the main obstacles for diversified growth and upgrading is crucial, for competitiveness at the micro level is at the heart of economic resilience at the macro level.

Second, a sustained process of real convergence is a necessary condition for the success of Poland's participation in the Euro Area. Firms' internationalization tends to contribute to productivity upgrading and convergence. Integration through trade and investment tends to be a powerful vehicle for productivity upgrading. It is the best performers that typically succeed in international markets. But as a consequence of increased integration, these firms become more productive through increased competition, through learning by exporting, or by interacting as clients or suppliers with more productive multinational companies, and through the relaxation of technological constraints when more varied or better quality inputs become available. The analysis of firms' productivity dynamics, and their interactions with export patterns, as well as with FDI helps to understand whether the channels identified in the literature between productivity and integration are at work in Poland. If these are not, it helps to understand whether policy actions are required, and which in particular.

Third, as the exchange rate ceases to be an absorber to idiosyncratic shocks upon entry into the Euro zone, it is necessary to understand how sensitive firms' export are to the exchange rate, as well as which other factors impact on the export decision and intensity. Indeed, this

has been one of the main concerns from the point of view of the Government. The analysis of current account imbalances revealed no effect of real exchange rate changes on the current account balance, at the macro level. This result is puzzling and masks substantial heterogeneity at the firm level. Different firms react differently to real exchange rate shocks because their revenues and costs structures have different currency compositions. Hence the need to understand the role that real exchange rate shocks have on firms' decisions, how this role depends on firms' characteristics, and what other factors matter in this decision.

What do we learn from these results in terms of policy actions? How can Poland accelerate the path to resilience and to productivity and quality upgrading?

The discussion that follows provides some insights on the lessons learned form the results described above and proposes policy actions.

Supporting firm's internationalization and upgrading is the key

Factors shaping firms' internationalization performance can be classified into two related groups: those affecting conditions under which firms operate, and those affecting the conditions under which products or services are moved across borders. In turn, policy actions conducive to address these two broad factors can be classified into those that aim at improving market efficiency, and those that aim at addressing a market failure (see Table 1).

Table 1: Typology of Interventions

	Improve Market Efficiency	Address Market Failures
Conditions Under Which Firms Operate	Competition in input and output markets (access to finance, addressing labor market rigidities). Restrictions to foreign investment Appropriability of returns to investment	Asymmetric Information Informational Failures Deep uncertainty
Trade Costs Firms Face	Logistics, Trade Facilitation, Trade Policy	Coordination failures, Informational failures, Spillovers

Source: Authors' elaboration

Improving Market Efficiency

Input and output markets need to operate competitively. This allows firms to reallocate resources into its most productive uses and sets the right incentives as firms can appropriate the returns of their efforts. In this respect, however, Poland appears to be on the right track. Firm-level analysis

suggests that an important driver of aggregate productivity growth is due to more productive firms thriving and growing and less productive ones shrinking. Field interviews validate this result.

There is a need to support the dynamism of the private sector apart from ensuring that markets operate efficiently. Pervasive market failures impede that firms with potential to internationalize and grow actually do so. Three of them, in particular, emerged from the results of the data analysis and through the interviews conducted with the private sector during the preparation of this report. They are related to informational failures in the process of internationalization, to asymmetric information between borrowers and lenders, and to structural uncertainty around returns to long-term investments, including those associated with innovation and research and development.

Restrictions to foreign direct investment may prevent firms' productivity gains through spillovers if they are preventing relatively more sophisticated multinational firms from setting shop in Poland. Although Poland's regime to FDI is relatively liberal, there are some restrictions that still exist, particularly in the form of equity limits. It is important that these restrictions are re-evaluated in the light of the existing evidence on FDI spillovers documented in this report and elsewhere.

Addressing Market Failures

Before discussing specific policy recommendations aimed at addressing market failures, it is important to stress that governments considering interventions may need to consider three issues:

(1) **What is the specific market failure that has been diagnosed to justify the intervention?** For public intervention to be warranted, a market failure needs to be identified that prevents firms from reaching optimal solutions through market based mechanisms.
(2) **Is the policy remedy a good solution to the problem?** It is then important that the intervention addresses the root of the market failure, rather than the symptom.
(3) **Are the capabilities strong enough to carry out and implement the designed intervention?** Policies may be justified on the basis of market failure, but they may turn out to be counterproductive as governments themselves may fail to provide the right incentives, may be captured by specific groups within the public sector or manipulated. In addition, when agencies are not endowed or empowered, an otherwise effective policy intervention may fail due to implementation deficiencies.

Informational Failures

Results from chapters 1 and 2 of this study point to the importance of information for successful exporting. We found evidence of substantial fixed (sunk) costs when entering export markets, some of which are related with information search (identifying initial contacts and discovery costs), and of the importance of information sharing for improved survival chances in

international markets. These results are not exclusive of Poland. Several survey-based empirical studies on types of export barriers in the USA, Europe, and newly industrialized Asian countries show that lack of information is one of the most relevant ones, in terms of severity and frequency. Firms in Poland have been doing quite well at selling to other EU member countries, where internationalization costs have been falling due to the single market. However, difficulties may persist to move away from the region.

Information problems, typically more important for firms operating internationally than for those just serving the domestic market, have motivated public interventions usually under the name of "export promotion activities". From an economic point of view, these interventions are justified because it is difficult to exclude third parties from information, and because its use is one of non-rivalry. There is a potential for free riding on the successful searches of firms for foreign buyers (or information) as firms may learn from other firms through employee circulation, customs documents, customer lists or referrals (Volpe, 2011).

Export promotion agencies provide firms with diverse services to subsidize these searches and thus counter the disincentive arising from potential free riding. These services include counselling, and general information on targeted markets, arrangements of meetings with potential customers, and organization and sponsorship of participation in international events such as trade missions and fairs.

When designing export promotion activities it is important to look at other experiences, to learn from their successes and failures. The evidence on the impact of export promotion activities on export performance is heterogeneous (see Lederman et al, 2010). This is partially related to the fact that export promotion activities are heterogeneous themselves, and their effectiveness will also depend on the institutional attributes of the organizations, their incentive structures and the kinds of activities and instruments used (see a selection of cases in Table 2).

From an examination of the literature on export promotion activities we can learn the following:

1. Export promotion activities focusing on reducing costs associated with information search (e.g.: providing market research & trade intelligence and matching buyers with sellers) tend to have a positive effect on export diversification (mainly along the market dimension and weaker along the product dimension) while tend to have no effect on growth of exports of the same products to the same markets. This is reasonable as it is the process of diversification the one in which information is crucial.
2. Support for participation in trade fairs and trade missions show weak – if any – evidence of positive effects on export growth.
3. Counseling and export committees in which exporters exchange information and mentorship is provided tend to be effective in reducing information costs for firms and increasing participation in export markets.
4. Bundled services tend to perform better than isolated interventions.

5. The effects of export promotion activities decay relatively fast over time – after care services may be needed.

Some of the informational barriers that exporters face are subtler than finding buyers, or doing market research and may be related to the design of strategies to conceive, produce and market products that are fit for foreign markets. These strategies are not implemented as isolated improvements in the firm's operations but as coherent elements of a different approach to business. Artupolous et al (2011) dubbed these export related managerial practices "export business model" (EBM). The author provides evidence that firms that adopt drastic changes in their production and market methods are more successful in entering and in surviving in international markets. Informational barriers may prevent small firms in particular from adopting these managerial practices.

ICEX in Spain, and AusTrade in Australia, for example, have been providing training to SMEs on managerial international best practices. To date to the best of our knowledge, rigorous impact evaluations of these types of training activities on exporters have not been conducted. Two more recent similar activities, one taking place in Colombia and another planned for Argentina have been designed to allow for the evaluation of its impact, and will provide some additional information in the near future.

Table 2: Selected Evidence on Export Promotion Interventions and Its Estimated Impact

Country	Intervention	Effect	Documented by
Ireland	Grants to encourage investment in technology, training or physical capital, feasibility studies, technology acquisition - typically not exceeding 45-60% of capital cost, and paid in instalments subject to periodic reviews	Positive effect of grants on export intensity (among already exporters) when grants were large enough. No significant effect on turning non-exporters into exporters.	Gorg et al (2008)
USA	Export promotion expenditures at the state level (no information on the exact type of instrument)	Weak evidence of increased participation in global markets	Bernard and Jensen (2004)
Czech Republic	Public export credit guarantees against political and commercial risks, no thresholds on size or legal form of the exporter	Evidence of increased export flows in the short and longer run	Janda et al (2013)
Tunisia	Matching grants for export development (new products, new markets or export skills for first time exporters). Eligible activities needed to address informational constraints to enter export markets.	Increased the value of exports and expanded the extensive margin (helped diversify). They were found useful to encourage first-time exporters. Three years after receiving the grant, however, export performance of recipients was again on par with that of non-recipients of the grant	Cadot et al (2013)
Korea, Rep.	Network of Export Promotion Agency Offices abroad (78 offices with the mandate to provide information and bolstering the trade-investment infrastructure - business matchmaking, international exhibitions and marketing of IT and cultural industries.	Positive effect on export values at the macro level	Kang, K. (2011)
Canada	Trade missions co-financing (macro level)	No effect on exports	Head and Ries (2006)
Chile	Trade missions, Trade shows and exporter committees	No effect on exports from trade missions, trade shows. Positive effect from participation in exporter committees	Alvarez (2004)
Colombia	Counselling (training on export process, information on opportunities & target markets), participation in international trade fairs, support in setting up an agenda of commercial meetings	Positive effect of the combination of all interventions relative to participation in only one of them - effect is concentrated mainly on the extensive margin, and within it, on market diversification.	Volpe and Carballo (2010)
Egypt	Random assignment of export opportunities to handloomers producing rugs	Strong evidence of increased efficiency and quality	Atkin et al (2014)

Source: Authors' elaboration.

Asymmetric Information and Access to Finance

Access to finance remains a problem for Polish exporters, and in particular for small and medium enterprises. Our results suggest that substantial liquidity is needed to participate in export markets. Polish firms tend to finance 70 percent of their investments with own funds. This is higher than observed in Slovakia, Lithuania, Estonia, Slovenia or Turkey. Although this is not necessarily a problem, it is suggestive of Polish firms struggling to obtain external financing at competitive costs. Indeed, one indicator of external financing costs, the collateral as a portion of the debt, is also high in Poland when benchmarked against comparators. Why are firms struggling to obtain financing in a country with deep financial markets?

Even successful firms may struggle to obtain bank financing for innovative projects due to information asymmetries between lenders and creditors. When we asked a successful Polish entrepreneur how she financed her activities, she expressed that banks tend to be willing to fund activities with a well-established track record of success, but are reluctant to finance innovations. The entrepreneur operating in the motor vehicle sector expressed that banks had not perceived that developing hybrid technologies was going to be a promising activity. They had less information about the project than the entrepreneur did, and took a more risk adverse stance.

In the services sector, firms also struggle to get credit from financial markets due to the intangible nature of their assets (non-collateralizable). An entrepreneur in a small high-growth firm in the services sector mentioned that because their main assets are ideas, that cannot be offered as collateral, his firm, and in general many knowledge-intensive services firms struggled to borrow from banks. In the small segment of the market, it was argued, the gap for financing is large, particularly for angel investors and venture capital.

In Poland the depth of credit information and the coverage of the credit bureau registries are above the OECD average (Doing Business, 2015). So, how can these issues be addressed?

1. Training on financial skills among micro and small firms has been found to improve the quality of financial information that firms provide to banks, thus reducing the problem of asymmetric information.
2. Encouraging the regional clustering of firms that operate in a certain sector may increase the stock of information about the returns of relevant activities, and provide useful signals to the banking sector (e.g. Gliwice for car manufacturing). The evidence we uncover on local spillovers is likely associated with this mechanism, and suggests that firms may already be clustering endogenously. Incentives for these purposes may strengthen the process.
3. Funding for innovative export activities could be provided in the form of matching grants – typically allocated by export promotion agencies (see Table x for some evidence on their impact)
4. A system of incentives is needed to build a dynamic funding ecosystem for exporting start-ups and high-growth services firms. Angel investors and venture capitalists are key players

in this ecosystem, at different stages of the business development.[1] In Malaysia, for example, the government provides a tax incentive for individual angel investors in the form of a personal tax deduction after 2 years of shareholding. In addition to tax incentives, it is important also to encourage angel investors to network to raise awareness and promote that type of investment in the growth of early stage businesses.

Spillovers and Coordination Failures

Firms operating in Poland – domestic and foreign - benefit from the presence of multinational companies. The fact that we found evidence of vertical and horizontal spillovers means that firms operating in Poland benefit from better provision of inputs by multinationals (more varied, cheaper or better quality inputs), and that they also benefit from multinationals operating in the same sector – probably due to pro competition effects, and knowledge transfers. This evidence on productivity spillovers justifies public action.

Actively promoting Poland as an investment destination is the smart thing to do. The Government of Poland has been supporting investment attraction through tax vacations and financial support (in some cases from the EU). To allocate extra fiscal efforts into investment promotion, however, it is necessary to conduct a cost-benefit analysis. In addition, an important dimension in the investment attraction policy should be to diversify the sources of investment to reduce vulnerabilities to idiosyncratic shocks.

Encouraging firms' interactions with other firms, and in particular with multinationals, is likely to strengthen the observed positive productivity spillovers. Domestic Polish firms have been upgrading in competences, which means they can now serve more sophisticated clients than 15 years ago. For example, a large car multinational mentioned that while in 1998 they only had 5 local suppliers, today, they have 136 local companies that supply inputs to them. These companies receive training, and being certified as suppliers to this multinational, they obtain an intangible asset in the form of reputation, that is transferrable and can bring them further business opportunities with other clients. These types of spillovers (downstream) motivate public interventions in the form of support to suppliers' development programs that help address the coordination failures among firms. Here again, it is important that Poland's fiscal efforts in this respect are guided by rigorous impact evaluation and cost-benefit analyses.

It is important to strengthen firms' absorptive capabilities for spillovers to fully materialize. Our analysis revealed that not all firms benefit equally from spillovers. Firms with lower absorptive capabilities struggle to benefit from the presence of more advanced firms.

[1] Angel investors are typically important at the "pre-seed" and the "seed" stages (birth, conceptualization and proof of concept stages, and at the product and commercialization – market entry stages). Venture capitalists are typically needed at the enhancement and scaling up stages.

Uncertainty, the Exchange Rate, and Long Term Decisions

Firms need to plan ahead and invest if they are to internationalize and to upgrade. When we asked firms how real exchange rate changes affected their operations, most of them focused on the fact that it added to uncertainty and that it dis-incentivized long term investments. This is consistent with the international empirical evidence on how uncertainty negatively affects irreversible investment decisions.

How to reduce exchange rate uncertainty?

If Poland were to adopt the euro, that would be a first step to reduce exchange rate uncertainty. More than fifty percent of exports are oriented to countries in the euro-zone, while a larger portion is denominated in euro. Of course, many other factors determine the convenience of such a policy move, and this factor only should not be considered as decisive.

Policies to deepen the market for hedging instruments is the second step to be done in parallel to the first to avoid discouraging diversification away from the Euro zone. While firms mentioned that hedging instruments existed, most of the small and medium enterprises claimed that they used "natural hedging" – meaning borrowing or sourcing inputs in the same currency as their export revenues are denominated.

The importance of innovation in the long run

Innovation plays a crucial role for successful internationalization of firms in the long run. Export promotion together with the aforementioned set of policies to support productivity gains and ensure that firms access to finance will not likely lead to sustainable upgrading in the internationalization process. This is because, in the medium to long term, to upgrade in the global marketplace it is essential to innovate. If anything, promotion should be extended beyond exports and imports, to other modes – direct investment, outsourcing agreements and participation as suppliers in global value chains.

This is why innovation and internationalization policies should in fact be coordinated. In the absence of coordination we face the paradox of uncorrelated policies aimed at mostly correlated outcomes, as argued by Altomonte et al, 2013. Although this coordination may be challenging (most innovation policies are supra-national (designed by the European Commission), while most internationalization policies are designed and implemented at the national level) it is necessary to achieve the long term goals of growth and development.

Chapter 1

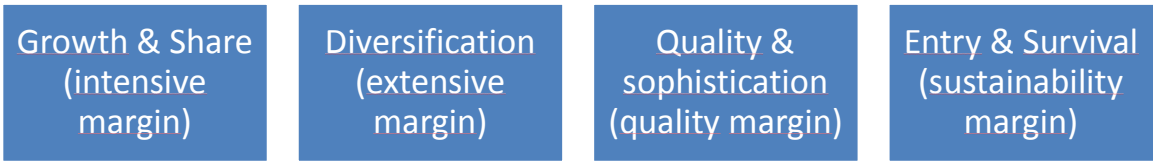
Poland's export performance through firm-level lenses

Over the last fifteen years, Poland has become an increasingly important player in the global economy. Through its integration into the European Union, Polish producers became increasingly integrated in the global marketplace. In 2000, for example, only half a dollar out of every 100 exported worldwide was originated in Poland. By 2014, this had more than doubled, to 1.2 out of every 100 dollars exported.

Poland's increased importance in the global economy, both through increased trade and investment attraction, is also visible in Poland's production structure. Over the last decade, Poland also received substantial inflows of foreign direct investment. During 1999-2001 Poland's exports represented 27.1 percent of GDP. In 2014 they reached 46.9 percent of GDP, closing the gap in the exports-to-GDP ratio with respect to other countries in the EU, such as Germany (45.6 percent) or Sweden (50.6 percent). At the same time, average FDI inflows as a percentage of GDP reached 3.15 since 1991, and 3.44% since 2000.[1] Increased integration has impacted not only on the structure of Polish firms' production baskets, but also on the way they do business, on their processes, and ultimately on their performance.

This report provides a thorough analysis of export performance, following the "Trade Competitiveness Diagnostic" framework developed by the World Bank (Reis and Farole (2012). It looks at export competitiveness along four dimensions (Figure 1): growth and shares (intensive margin), diversification (extensive margin), quality and sophistication (quality margin) and entry and survival (sustainability margin). The analysis allows to evaluate the dynamics of Poland's exports at the different margins of trade (intensive, extensive, quality, and sustainability) and to benchmark Poland's performance with that of other comparator countries.

Figure 1: The four margins of trade



Source: Authors' elaboration.

The analysis of competitiveness along these four dimensions is crucial. Export growth is an important element of competitiveness but if that growth is explained only by a handful of products or of market

[1] These ratios of exports to GDP use 'gross' measures of exports. Strictly speaking, and particularly given the importance of global value chains in Polish production, appropriate indicators of participation of Poland in global markets would consider the value added associated with exports, relative to GDP (which, in turn, is another 'value added' measure).

destinations, the economy will be vulnerable. Country specific or product specific shocks would have important consequences on export and income volatility. This is why diversification is important. It reduces the country's vulnerability to specific shocks. In addition, the extent of diversification reveals the diversity of skills and resources available in the economy and how efficiently these are used, so that they can be marketed internationally. Sophistication and quality also matter. Both elements, highly associated with the extent of innovation in the economy, have been found to be leading indicators of future growth. In addition, export quality upgrading is important to help create better paid jobs. Finally, export survival reflects the resilience of firms to adverse weather shocks. As fixed costs associated with exporting are high, it is important from an efficiency perspective that export flows remain active for long enough to ensure a steady flow of profits for firms to break even.

The analysis in this paper uses sector-level data from UN COMTRADE, to benchmark Poland's performance with other countries, and detailed data at the export transaction-level, thus allowing us to better understand firms' dynamics associated with export performance. [2]

Box 1: From Sectors to Firms in Trade Analysis

In the analysis of trade patterns, concepts of comparative advantage have been used to describe sectors in which a country is better positioned to compete in global markets, given their relative productivity advantage. When exposed to the increased competition that openness to trade brings about, those sectors with a comparative advantage are expected to expand, while the others are expected to shrink. Underlying this view is the assumption that within each sector, all firms will face the same circumstances.

With the emergence of a new literature on trade that draws on evidence from firm-level datasets, this view has been challenged. Firm-level and plant-level analyses reveal that internationalized firms (exporting, and firms that participate in different ways in international markets) exhibit a productivity premium. In any narrowly defined industry, firms differ widely in productivity, size, export intensity and propensity to invest and produce abroad. This has been documented, for example, by Clerides, et al (1998) for Colombia, Mexico and Morocco. Also, for the USA, Bernard and Jensen (1999) find evidence that new exporters are more productive than non-exporters. Since then, these results have been replicated for a large number of countries as comprehensively reviewed by Wagner (2005) and Greenaway and Kneller (2005).[3] The relationship between productivity and exposure to international trade runs in various directions. Also, part of the effects takes place at the firm level, and part of the effects take place at the economy-wide level.

At the firm-level, more productive firms are better positioned to compete in demanding international markets. They are better at facing the high fixed costs associated with searching for clients abroad, learning about their tastes, quality and safety standards, and adapting their products to match them. This suggests a process of selection into exporting. Still, there is also increasing evidence showing that exporting improves

[2] Statistics referring to overall trade volumes obtained using transaction-level data might not match those obtained using product-level data (UN Comtrade Data) since firm total annual transactions towards European countries that do not reach the threshold of 1.1 million PLN in 2014 are not included in the dataset. Another reason why trade volumes obtained using transaction-level data might not match those obtained using product-level data (UN Comtrade Data) may be that statistical offices use various methods of estimating non reported trade or, more generally, different methods of cleaning the dataset. Further cautionary issues are reported in the Appendix.

[3] As concerns European countries, evidence is available for Germany, France, Italy and Spain and increasingly for many smaller economies (e.g., Bernard and Wagner, 1997; Eaton et al., 2004; Castellani, 2002; Wagner, 2002; Geishecker et al., 2009).

firms' productivity (learning by exporting). Although the literature on learning by exporting is vast, one of the most compelling examples is presented by recent research conducted by Atkin, Donaldson and Osman (2014). The authors selected a number of textile producers in Egypt with similar characteristics in terms of size and performance, and randomly assigned to them exporting opportunities. Those that received that 'opportunity' showed systematic improvements in productivity and quality– not only on those products oriented to the export market, but also on those that were sold in the domestic market.

At the economy-wide level, part of the productivity gains associated with exposure to trade is related to what has been described as a process of Darwinian selection. With increased competition, those firms that are more productive tend to thrive and grow, while those that are less productive shrink. As resources are reallocated away from low-productivity firms (and activities) and into high-productivity firms, overall productivity increases.

For these reasons, the analysis of how exposure to trade has been contributing to growth and convergence requires looking at firm-level data. This report's main data inputs consist of two rich databases: Customs' export transaction database, and the F01's firm-level surveys. These datasets provide much richer insights than looking at more aggregated product-level data on trade, but they make international comparisons of performance difficult. Few countries have these data available, and for those that do, replicating the analysis is costly. This is why this report also draws on publicly available product-level data on trade, a better fit for international comparisons. Along the report, the reader will be switching from product-level insights that allow international benchmarking, to Poland-focused firm-level insights that allow more granularity.

Source: Authors' elaboration

Summary of findings

Poland performs well when benchmarked against relevant comparator countries.

1. It has increased participation in the international market and it has shown outstanding export growth both in times of boom and bust, well above European averages,
2. It has consolidated a well-diversified portfolio of exporters, products and destinations.
3. In terms of quality, Polish exports have been converging to the levels displayed by some mature EU members. This is evidenced by quantitative indicators that suggest steady increase in quality and sophistication, and by qualitative information gathered through field work that suggest improvements in the perceived reliability of Polish suppliers by multinational companies – crucial for integration in international production networks, and by the complexity of the production processes that are carried out in Poland.
4. Poland's export flows tend to remain active in international markets for longer than in other European countries including mature members such as Spain.
5. Polish exports are highly concentrated in a handful of export 'superstars'. Although this is typically found in other countries – including countries in the European setting, in Poland this tends to be more pronounced than in some selected high-income countries for which data are available to allow comparisons. However, the concentration of exports in a handful of large exporters is mildly declining over time.
6. The so-called "export superstars" account for a very large share of Polish exports (about 70 percent of total exports) but their contribution to growth has decreased over time. Export superstars are substantially more diversified both in terms of products and destinations. However, their contribution to overall export growth has been decreasing over time. They

accounted for about 80 percent of export growth in 2006, while their contribution dropped to 52 percent in 2013. This is not necessarily related to lack of dynamism of these types of firms, but to the fact that exports from smaller firms have been growing at relatively faster rates.

Polish exports are mainly oriented towards the European Union (about 36 percent of exporters accounting for 80 percent of total exports) and associated countries.

1. Still, the number of exporters to EU destinations has been decreasing over time (from 50 percent in 2005 to 36 percent in 2013). However, among firms exporting at least 100 thousand PLN annually, the decrease was from 71% to 61% (see appendix on data issues). Moreover, exports to the EU in values have continued to expand, resulting in larger export flows per firm.
2. The most frequent destinations are Germany (13 percent of exporters and 26 percent of exports), receiving a stable number of exporters over time but with increasingly larger orders; and Ukraine reached by 12 percent of the exporters that account for 3 percent of exports). The number of exporters to the Ukraine is increasing over time but their size is getting smaller.

The number of Polish firms that participate in export markets has increased substantially in the last decade (from about 32,000 in 2005 to 44,000 in 2013). Increasingly, smaller firms are entering the export market.

1. Small firms are becoming increasingly internationalized. Their ability to access export markets has increased over time, which suggests that the fixed costs associated with exporting has decreased.

2. Still, sunk costs associated with exporting remain substantial. These are related to establishing new marketing channels and accumulating information on demand sources, in particular to achieve new export destinations. These high costs are likely to constitute a barrier for small firms from gaining further market shares and diversify exports to mitigate risks.

3. The presence of other actors in the same markets, however, tends to alleviate these costs since the accumulated knowledge stock tends to spill over to new firms. In particular, we find that firms are more likely to survive if they export to more popular destinations. On the other hand, while firms benefit from accumulated knowledge about destination markets, they also suffer from competition from other firms exporting similar products.

4. As observed in other countries, small firms are able to grow faster and are more likely to export high quality products by responding to the demand of high-quality niche markets. Firms exporting high-quality products in Poland tend to export fewer products, reach fewer destinations, and focus on less popular products. The relative small size of their businesses allows them to better respond to client needs. The median size of an export flow has decreased from 380 thousands PLN in 2005 to 177 thousands PLN in 2013.

5. The growth in the number of exporters has been notable in the two most important sectors: Transport Equipment (from almost 5,000 in 2005 to 12,000 in 2013) and Machinery (from

almost 11,000 to almost 14,000). These sectors are characterized by a highly concentrated market dominated by larger exporters. Here the top 5 exporters account for 21 and 49 percent of total exports, respectively. Their dominance, however, is decreasing over time, as these sectors are experiencing a decrease in average export size. Their contribution to overall export growth is decreasing (from 45 percent in the period 2004-2006 to 25 percent in the period 2011-2013) and firms in these sectors show the lowest levels of survival among exporters.

6. From an economic convergence perspective, the increase in the number of internationalized firms, and the fact that increasingly smaller firms enter export markets is 'good news'. It makes the gains from integration accrue to a wider set of firms. As evidence suggests that firms learn by exporting, that they upgrade their products and processes, more widespread internationalization will positively affect overall productivity growth.

Poland performs well in terms of diversification both along the product and destination dimensions. This reduces the country's vulnerability to product and country specific shocks.

1. **At the aggregate level Poland has achieved substantial diversification.** Its exports span more than 3700 products, and reach more than 200 markets. This places Poland's diversification performance above Slovakia or Lithuania, and on par with Spain. In addition, every sector of the economy shows high levels of diversification along the destination dimension, suggesting that competitiveness is not restricted to a handful of products or sectors.

2. **Diversification is important for export growth and for resilience, and its contribution to growth has increased over time.** Diversification in terms of number of firms, products and destinations has contributed to 20 percent of export growth in the period 2005-2007 and about 40 percent in the period 2010-2013. Diversification was also found to help firms remain in the export market for longer as it facilitates the process of re-orientation of exports following a demand shock.

3. **It is large exporters that are diversified, both at the product and destination levels.** Small firms, instead tend to focus on one export product and on one destination only, increasing their vulnerability. Firms reach on average 4 destinations and export on average 8 products. Nevertheless, an increasing percent of firms are focusing only on one product and destination as smaller firms are entering the export market. Firms that are able to diversify their exports, in fact, are substantially larger than other firms.

4. **A large portion of small firms remain vulnerable to shocks.** About 27 percent of firms in 2005 were exporting only one product to only one destination. The percentage has increased to 35 percent in 2013. By having their export basket concentrated in one destination they are more vulnerable to country or product specific shocks. It is worth mentioning that these small firms accounted for only one percent of export values.

The survival probability of product-destination flows is higher than that observed in other countries including Spain.

1. From an efficiency point of view, relatively robust survival rates is a positive development. As mentioned above, firms pay high fixed costs when entering export markets. Low survival rates would imply that profit flows associated with exports may not be persistent enough to compensate for those costs.

2. Survival is highest in the Food sector, where Poland has a strong comparative advantage, and lowest in the Transport and Machinery sectors, the two most important sectors for Polish exports. This is in line with international evidence suggesting that exports of relatively more differentiated products tend to survive less than homogeneous goods, as they are more difficult to re-orientate in the case of shocks.

The results have implications for Euro Adoption

1. At the aggregate level, Poland's export performance displays convergence along growth, diversification, quality and survival rates with more mature members of the EU.

2. Relatively high levels of export diversification is crucial for the reduction of vulnerability to real shocks. To strengthen this process, in addition to taking advantage of the attractive EU market, Polish exporters may explore dynamic, extra region destinations.

3. The increase in participation of small firms in the global marketplace is a positive development for real convergence. As firms tend to learn by exporting, which contributes to their productivity upgrading, increased export exposure among small firms is an important vehicle for overall productivity gains.

Growth and Shares (intensive margin)

How have Polish exports grown over the last 15 years? How has their structure changed over the years?

Summary

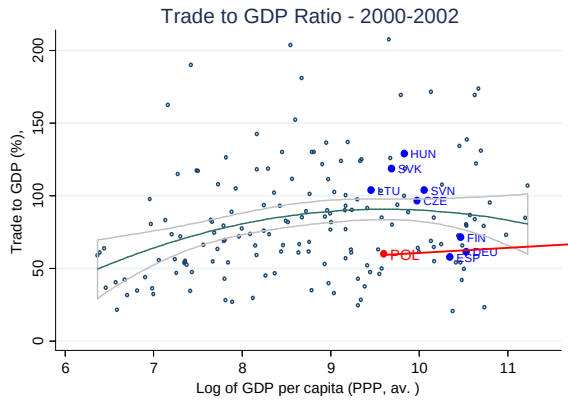
Polish firms have dramatically increased their participation in the global marketplace over the last 15 years. The number of exporters has increased by 36 percent during the last decade, while their average size has decreased. The largest expansion in terms of number of exporters has occurred in the Transport and Machinery sectors, which are the most important sectors for Poland's exports. The substantial increase in the number of exporters has been accompanied by a decrease in the median exporter size, indicating that an increasing number of **small firms** are able to access the export market.

Overall we observe outstanding growth performance of Polish exports. When compared to European peers, Poland has outperformed them both in times of economic expansion and recession. Polish exports have grown at an average rate of 15 percent over the period 2004-2013, compared to 7 percent for EU27 countries. Looking at transaction-level data, exporters that grow faster are **smaller** and achieve high growth through diversification in products and in markets.

Participation in the global marketplace

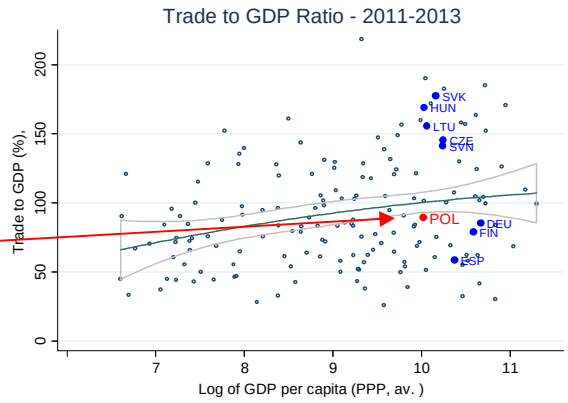
Over the last 15 years Poland has increased its participation in the global marketplace. An indicator of openness to foreign trade and economic integration is the trade-to-GDP ratio. It weighs the combined importance of exports and imports of goods and services in an economy, and gives an indication of dependence of domestic producers on foreign demand and of domestic consumers and producers on foreign supply. Trade, both in merchandise and in services has expanded faster than GDP, leading to an increase in the ratio of trade to GDP from 0.61 in 2000-2002 (Figure 2) to 0.90 in 2011-2013 (Figure 3). The period is unique for Poland, given that the country acceded the EU in 2004. In fact many other acceding countries experienced spectacular increases in trade to GDP ratios over the same period, such as Slovakia (from 1.1 in 2000 to 1.8 in 2013) or Czech Republic (from 0.98 to 1.48). If we focus on merchandise exports, for example, in 2013 the ratio of exports to GDP reached 37.5%, up from 21% in 2000. This is comparable to Germany's ratio of exports to GDP (38.5%), and 6 percentage points above the average in the European Union.

Figure 2: Trade to GDP Ratio (2000-2002)



Source: Authors' calculations based on WDI.

Figure 3: Trade to GDP Ratio (2011-2013)

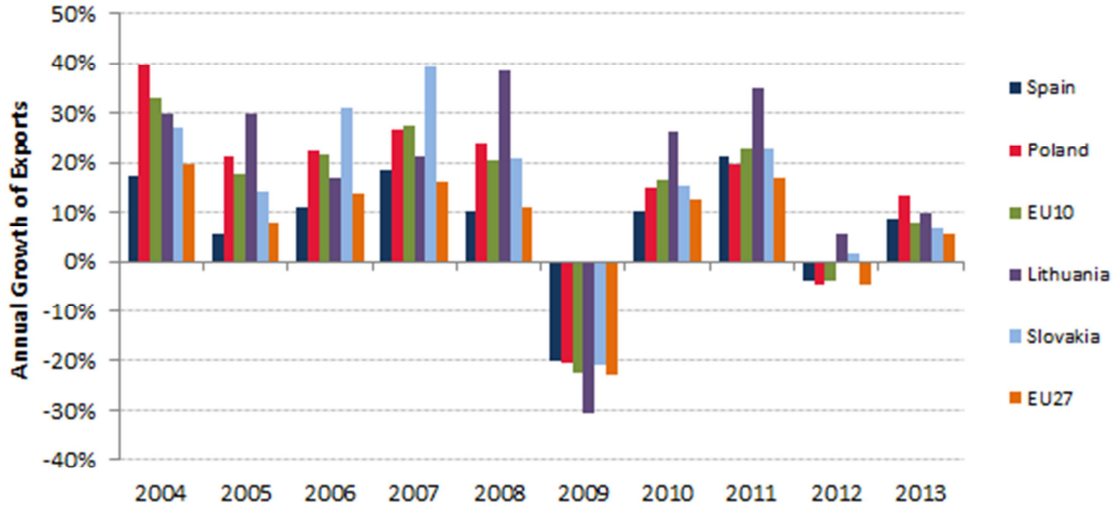


Source: Authors' calculations based on WDI.

Growth performance

Poland's export growth has been impressive. Polish exports have recorded growth rates above world and EU-27 averages that are aligned with other good export performers in the EU such as Lithuania and Slovakia (Figure 4). Figure 4 reports export growth rates for Poland, the EU and the world average. Poland has performed better also during the recession, and in its aftermath. Poland's export growth in 2004 reached a peak of 40 percent, way above European and World averages, while achieving on average 20 percent during the years leading to the 2009 financial crisis where export growth dropped to -20 percent (still above European and world averages). An initial good recovering has been followed by a negative performance in 2012, as in the rest of the world. However, while in 2013 the European export market still shows no sign of recovery, Poland exports have grown at a rate of 10 percent.

Figure 4: Export growth – Poland and Peers



Source: Authors' calculations based on UN Comtrade.

Has this rapid export growth resulted in increased market shares in the global marketplace? Zooming in, Polish exporters have gained market shares in all of their top ten destinations, when looking at the period 2003-2013. Figure 5 plots the annual average growth of total exports of Poland in the vertical axis, against the annual average growth of exports of the world to the same destination in the horizontal axis. The size of the bubble reflects the share of the export value to that destination in total exports in 2003, to inform on the importance of each destination for Poland. When the bubble is above the red line, that implies that Polish exports to that destination have grown faster than world exports to that destination, which means that Poland has increased market share in that destination (and the converse is true as well). When we focus on products, instead, Polish exporters have gained market shares in some electrical machinery products (transmission apparatus) and transport equipment products (car parts, small vehicles), while losing market shares in others such as engines and vessels (Figure 6).

Figure 5: Growth Orientation - Markets

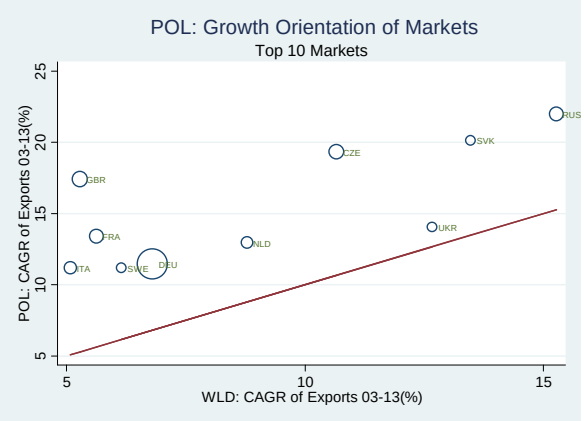
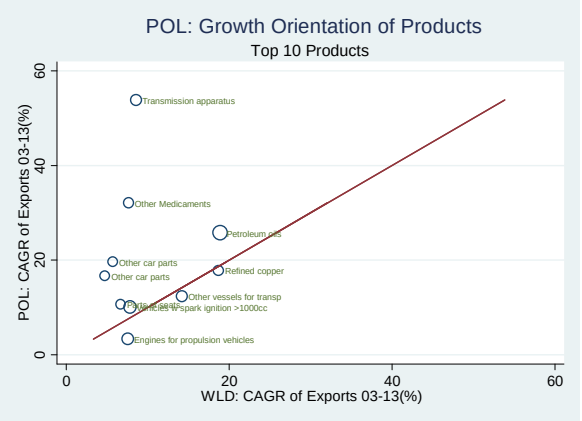


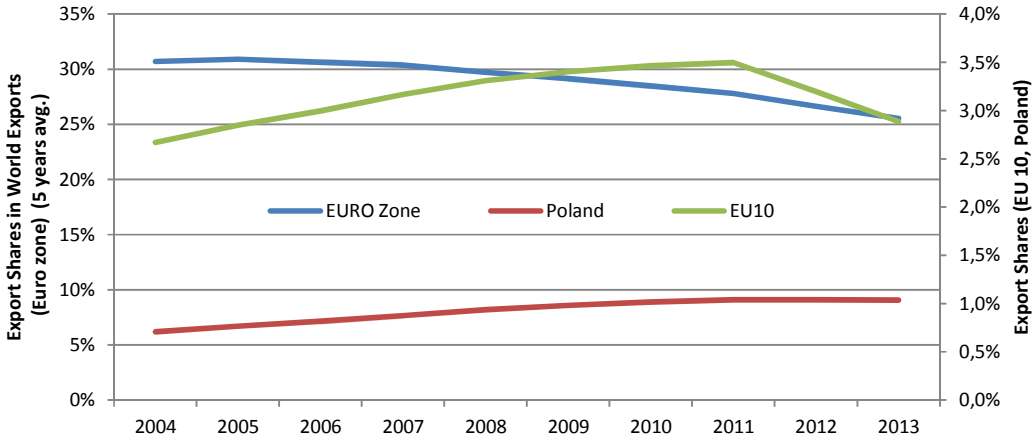
Figure 6: Growth Orientation - Products



Source: Authors' calculations based on UN Comtrade.

As a result of a rapid expansion, Poland has been gaining market shares in world exports. In 2004, for every 1000 dollars exported worldwide, Polish exports accounted for 7 of them (Figure 7). In 2013, they accounted for 10 (and increased to 12 in 2014). This pattern compares to a sizable market share decline for the Euro zone as a whole, as well as for the group of EU-10 (EU-11 excluding Poland) after 2011.

Figure 7: Export shares in world markets

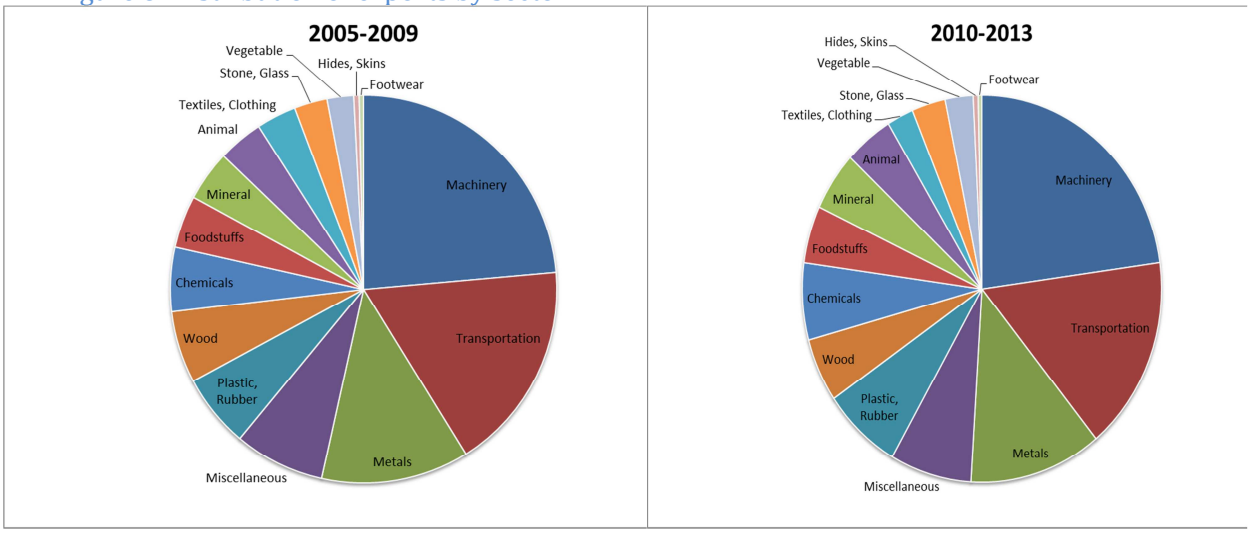


Source: Authors' calculations based on UN Comtrade.

Sectoral Structure

Machinery and transport equipment are the largest sectors in terms of exports, followed by the Metals sector. In the period 2010-2013, Machinery and transport equipment accounted for 39 percent of Poland's exports. When including the third largest sector, Metals, together they account for more than 50 percent of total exports (Figure 8). Interestingly, the relative importance of these three sectors did not change substantially when comparing 2005-2009 with 2010-2013.

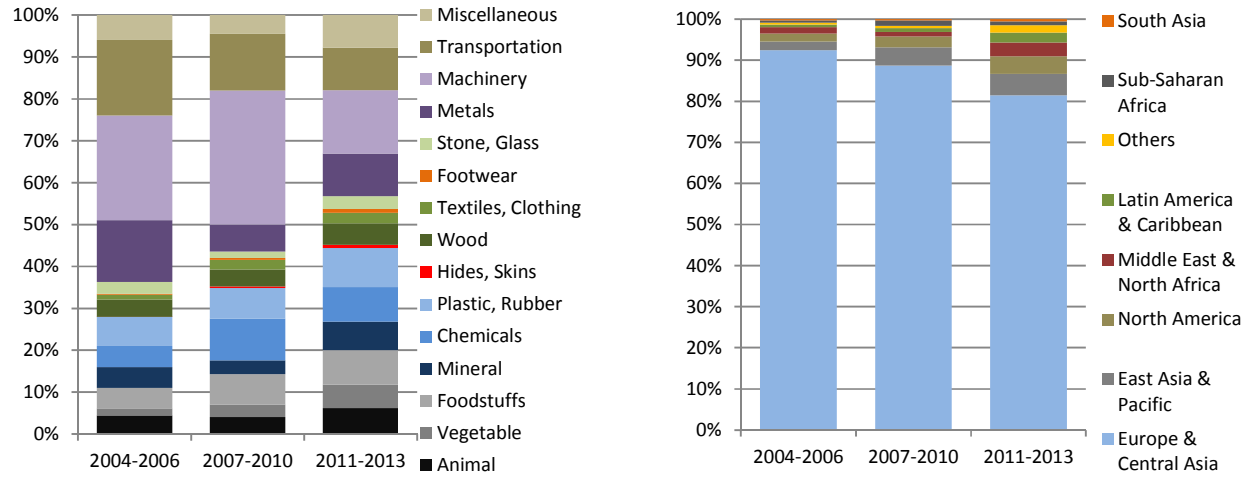
Figure 8: Distribution of exports by sector



Source: Authors' calculations based on UN Comtrade.

The growth of Polish exports has been more diversified in terms of sectors and destinations in recent years (Figure 9). While in the period 2004-2010 the Machinery and Transport sectors accounted for about 45 percent of total export growth, their contribution has decreased to 25 percent in the recent years. Some sectors such as agriculture-related sectors, plastic and rubber industries have, instead, increased their contribution to growth. Furthermore, Polish exporters have been more successful in accessing distant markets, especially those in the Middle East, North Africa, North America, and Latin America. Non EU and Central Asia destinations accounted for less than 10 percent of total exports growth in the period 2004-2006, while their contribution has increased to 20 percent in the period 2011-2013, on the back of substantial growth of non-traditional markets relative to EU growth.

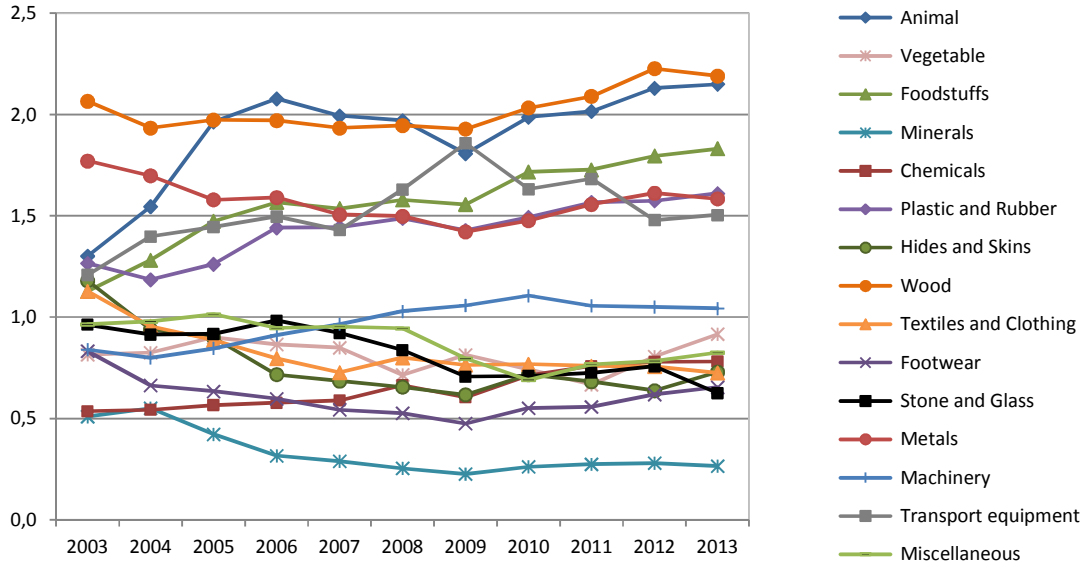
Figure 9: Export growth by sectors (left) and destination (right)



Source: Authors' calculations based on UN Comtrade.

Over time, Poland has consolidated its strong comparative advantage in the Wood, Animal and Food sectors, while it has been decreasing its export shares in the Transport sector. Poland's exports in the Animal, Food and Wood sectors notably exceed the global export share of these products. The animal sector, where Poland has a revealed comparative advantage, has slightly increased its share of exports over the period. On the other hand, the export share of the transport sector, where Poland also has a comparative advantage, has been declining over time, in particular since 2009. This is indicated in Figure 10, which reports the Revealed Comparative Advantage index for each sector across all years. Despite the large share of exports accounted for the machinery sector, Poland did not have a comparative advantage in this sector until 2008-2010. To a lesser extent, this is also observed for plastic and rubber, metals and transportation sectors.

Figure 10: Revealed Comparative Advantage by Sector



Source: Authors' calculations based on UN Comtrade.

Focus on firm-level data

In this section we analyze transaction-level data to explore the distribution of exporters across sectors.[4] **The number of exporters in Poland has been increasing over time since its accession to the EU,** with the exception of 2009, (Table 3). Overall, the number has increased by 36 percent after since 2005, with smaller firms entering the export market. Indeed, the median exporter size has declined over time. This suggests that the fixed costs associated with entering export markets have decreased. These fixed costs, however, remain high and related to, for example, establishing new marketing channels and accumulating information on demand sources, in particular to achieve new export destinations.

Comparatively, Polish firms are highly internationalized. The number of exporters compares favorably to those operating in Mexico and is almost double those in Norway. Compared to Poland (525 billion USD), Norway has a similar GDP (512 billion USD) while Mexico has a larger GDP (1,260 billion USD). The ratio between exporters and GPD has remained stable over time. Table 4 reports exporters to GDP ratios for some comparator countries.[5] In terms of exporters per dollar value added created in the economy, Poland has similar or more exporters than other comparator countries, such as Spain and Turkey, with the exception of Bulgaria and Estonia that show substantially higher ratios.

[4] Transaction-level data refers to merchandise exports, but includes firms with affiliations both to the manufacturing and to the services sector (which may also export merchandise). The analysis reported in this report is based on the entire sample of firms unless specified. If results differ substantially when excluding the firms affiliated to services sector (most likely to be intermediary trading firms), we report both sets of results.

[5] Statistics based on transaction-level data are provided by Cebeci et al. (2012) and are only available for a limited number of countries.

The increase in the number of internationalized firms in Poland, and the fact that increasingly smaller firms enter export markets, is a positive development as it makes the gains from integration accrue to a wider set of firms. By exporting, firms learn about meeting the requests of demanding international clients, upgrade their products and processes, and become more efficient, leading to economic growth.

Table 3: Number of exporters and ratio of GDP over time

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Exporters	32,457	34,557	35,105	33,170	32,017	32,886	37,695	42,286	44,225
Median size	381	308	355	455	402	349	233	191	177
Total destinations	218	211	218	221	225	219	221	223	231
Total products	4838	4858	4739	4723	4713	4740	4774	4882	4882
Exporters/GDP (million USD)	0.11	0.10	0.08	0.06	0.07	0.07	0.07	0.09	0.08

Source: Authors' calculations from export transactions database and World Development Indicators.

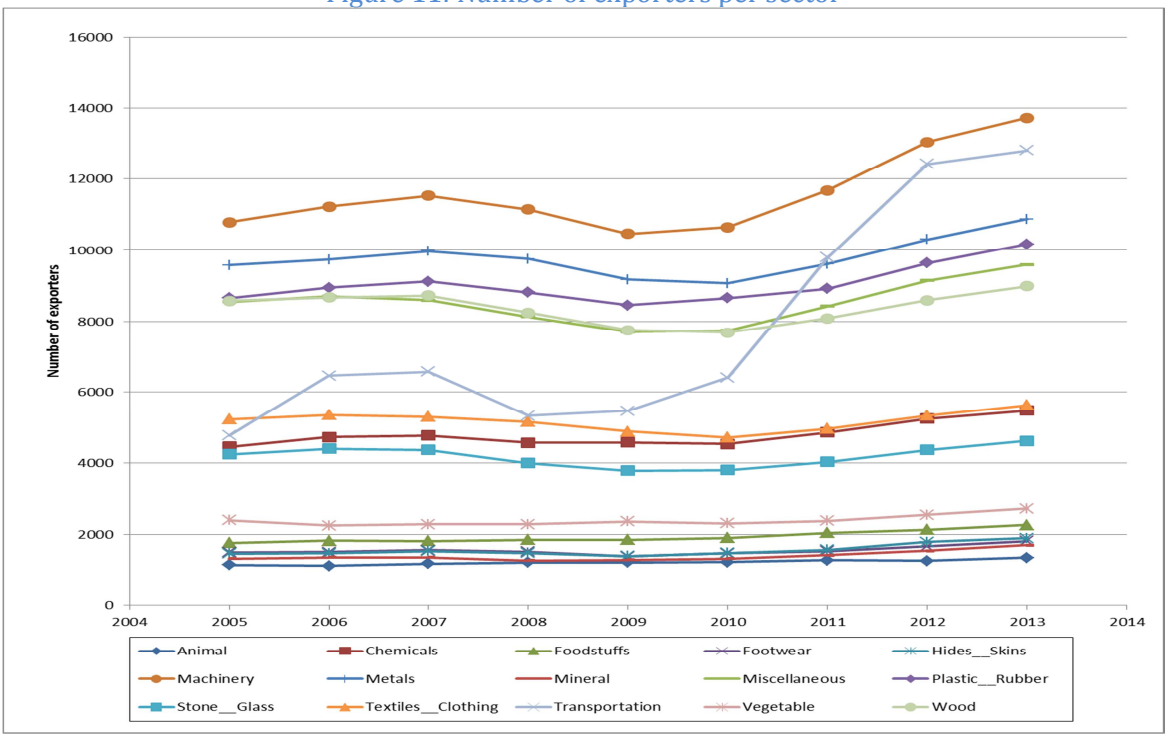
Table 4: Exporters/GDP Ratio in Other Countries (for comparison)

Country	Year	N/GDP	Country	Year	N/GDP	Country	Year	N/GDP	Country	Year	N/GDP
Belgium	2010	0.04	Estonia	2009	0.27	Norway	2006	0.05	Sweden	2006	0.07
Bulgaria	2006	0.41	Mexico	2009	0.04	Portugal	2005	0.08	Turkey	2010	0.07
Chile	2009	0.04	New Zealand	2010	0.09	Spain	2009	0.06			

Source: Cebeci et al. (2012) and World Development Indicators

The transport equipment and machinery sectors have led the way in terms of increase in the number of exporting firms, likely associated with a process of integration into regional production networks. The number of exporters in the transport sector has increased substantially by more than 100 percent since 2009. A notable increase is also observed in the machinery sector. The sector went from about 5,000 exporters in 2009 to more than 12,000 in 2013 (Figure 11). This is confirmed in Table 2, which reports top products in terms of number of exporters. It shows that, since 2010, transportation vehicles and road tractors have rapidly climbed up the ranking and have become the top-10 products in terms of number of exporters. They do not appear as top products in terms of value exported (Table 5). This suggests that, while the number of exporters of vehicles below five tonnes and parts of vehicles has been increasing over time, average order size is getting smaller as the ranking of these products in terms of value are stable or declining over time. To a lesser extent, the machinery sectors also experienced a significant increase in the number of exporters since 2009, going from about 10,000 exporters in 2009 to almost 14,000 in 2013.

Figure 11: Number of exporters per sector



Source: Authors' calculations from export transactions database.

Among the top products in terms of number of exporters, we find articles of plastic, followed by articles of iron and steel. These two products have dominated Polish exports since 2005 in terms of number of exporters (Table 5). On the other hand, the wooden furniture sector is gradually moving down the ranking both in terms of exporters and value exported (Table 6). After a decline in the number of exporters from 2005 to 2010, there was a slight increase after 2010. The increase was not enough to keep up with other top products.

Table 5: Number of exporters of most important products by year

HS6 code	short description	Ranking based on number of exporters								
		2005	2006	2007	2008	2009	2010	2011	2012	2013
392690	Various articles of plastics	1	1	1	1	1	1	1	1	1
732690	Various articles of iron or steel	2	2	2	2	2	2	2	3	2
870421	Transportation vehicles, below 5 tonnes	50	12,5	12,5	67	41	19	3	2	3
870120	Road tractors	-	16	16	15	9	4	6	5	4
441520	Pallets and other load boards of wood	3	3	3	3	3	3	4	6	5
871639	Trailers and semi-trailers	12	4	4	6	15	8	5	4	6
730890	Structures of iron or steel	4	5	5	4	4	6	7	7	7
491110	Advertising material	6	6	6	5	5	5	8	8	8
731815	Threaded screws	8	9	9	9	7	9	10	10	9
401693	Gaskets, washers and other seals	11	11	11	8	6	7	9	9	10
392590	Building elements of plastics	9	8	8	7	8	10	11	13	11
761699	Articles of aluminium	15	15	15	13	11	12	12	11,5	12

848180	Appliances for pipes	13	14	14	12	12	11	13	11,5	13
870422	Transportation vehicles, from 5 to 20 tonnes	-	-	-	-	-	-	-	-	14
940360	Wooden furniture	5	7	7	10	10	13	14	14	15
401699	Articles of vulcanised rubber	18	19	19	18	18	14	16	15	16
392190	Articles of plastics	14	17	17	17	16	18	19	16	17
870899	Various parts for motor vehicles	26,5	24	24	25	21	21	20	19	18
442190	Various articles of wood	7	12,5	12,5	14	14	15	18	17	19
940390	Parts of furniture	10	10	10	11	13	17	17	20	20

Source: Authors' calculations from export transactions database.

Table 6: Total exports value most important products by year

HS6 code	short description	Ranking based on value exported								
		2005	2006	2007	2008	2009	2010	2011	2012	2013
271019	Medium oils (petrochemical prod.)	18	13	15	15	18	12	6	3	1
852872*	Reception apparatus for television	4	2	1	1	1	1	1	1	2
870322	Cars with spark ignition	2	5	3	3	2	2	2	2	3
840820	Diesel or semi-diesel engines	1	1	2	3	3	3	3	4	4
851712	Mobile telephones	-	-	-	-	-	-	-	20	5
890190	Vessels	7	9	17	17	7	13	9	9	6
740311	Copper	9	4	7	7	5	4	4	5	7
940190	Parts of seats	8	6	6	6	6	8	8	6	8
300490	Medicaments in measured doses	-	-	-	-	12	7	11	12	9
870332	Cars with compression ignition	3	3	4	4	4	5	7	8	10
940360	Wooden furniture	5	10	5	5	9	11	12	11	11
870829	Parts of bodies (vehicles)	15		16	16	13	14	13	14	12
730890	Structures of iron or steel	12	11	8	8	11	15	15	10	13
940161	Upholstered seats	6	8	9	9	8	10	10	13	14
270400	Coke and semi-coke of coal	11	12	10	10	14	6	5	7	15
870899	Various parts for motor vehicles	16	7	12	12	10	9	14	17	17
870421	Transportation vehicles, below 5 tonnes	14	14	14	14	19	17	17	15	18
854449	Electronic conductors	-	-	11	11	-	-	-	-	-
270119	Coal	10	18	-	-	-	-	-	-	-
854430	Wiring sets for vehicles	13	17	13	13	-	-	-	-	-

Source: Authors' calculations from export transactions database.

The observed growth in the number of exporters in the transport and machinery sectors has been accompanied by a decrease in the average exporter size. Table 7 shows the average size of exporters in these sectors. In the machinery sector, the median export value has decreased from 70.2 in 2005 to 58.2 in 2013. Similarly, the median value has decreased from 31 in 2005 to 23.4 in 2013 in the transportation sector. It is also apparent that the contribution of the top 5 exporters to total exports is decreasing over time. In particular, the share of the top 5 exporters in the machinery sector has fallen from 21 percent in 2005 to 14 percent in 2013, while it has dropped from 49 percent in 2005 to 39 percent in 2013 in the transportation sector. The level of concentration in the transport sector remains, however, well above the country average of 27 percent for the period 2010-2013. This indicates that increasingly more small firms are able to enter the export market

and are transforming the machinery and transportation sectors into a less concentrated market where big exporters play a less important role. This is again suggesting that fixed costs associated with exporting may be falling.

Table 7: Exporter Size in Machinery and Transport Sector

Year	Machinery				Transport			
	Share top 5	Average destinations	Mean value (deflated)	Median value (deflated)	Share top 5	Average destinations	Mean value (deflated)	Median value (deflated)
2005	21.36	2.95	5867.2	70.2	49.5	2.0	10098.9	31.0
2006	23.59	3.06	6727.2	72.3	49.8	1.9	8535.7	22.8
2007	19.21	3.18	7467.0	77.5	48.4	1.9	8782.2	28.5
2008	16.85	3.35	7678.8	86.4	48.3	2.2	11857.4	37.2
2009	21.66	3.52	7232.5	69.5	50.5	2.3	11168.0	32.2
2010	19.02	3.68	7985.7	70.8	50.5	2.2	9238.6	28.1
2011	16.31	3.77	7495.3	66.3	48.7	2.0	6760.5	23.9
2012	15.38	3.78	6896.4	60.5	42.7	2.0	4993.0	23.8
2013	13.69	3.88	6999.0	58.7	39.7	2.0	5247.9	23.4

Source: Authors' calculations from export transactions database. Mean and median in thousands PLN.

What are the characteristics of dynamic exporters?

Younger exporters grow at a substantially higher growth rate than older exporters. Table 8 reports export growth by incumbents (firms that have been in the market for at least two consecutive years), entrants (firms that were not exporting in the previous years), and exiters (firms that will stop exporting in the following year).

Table 8: Export Growth by Incumbents, Entrants and Exiters

Year	Incumbents		Entrants		Exiters	
	Mean	Median	Mean	Median	Mean	Median
2007	25.8	4.1	89.3	60.5	12.3	-34.9
2008	10.3	-10.7	79.6	37.4	19.5	-45.6
2009	11.7	-10.4	83.2	46.6	8.7	-50.8
2010	24.7	1.8	83.1	45.6	8.0	-42.2
2011	32.8	11.5	91.2	66.9	11.6	-39.5
2012	28.8	5.3	90.3	57.8	17.1	-28.8
2013	21.7	0.9	74.4	36.5	28.1	
Average	22.3	0.38	84.44	50.17	15.04	-40.30
Average (excluding 2008-2009)	26.8	4.7	85.7	53.4	15.4	-29.1

Source: Authors' calculations from export transactions database.

Incumbents' exports grew at an average rate of 22 percent.[6] The median growth rate is close to zero. In fact, about 50 percent of incumbents experience negative or zero growth over the period. On the other hand, young exporters grew faster and expanded at an average rate of 84 percent with

[6] The calculations exclude firms with extreme growth rates (top and bottom 5%). The average growth rate reaches 27 percent when we exclude intermediary traders while the median growth rate is 2% .

a median growth rate of 50 percent.[7] Finally, exiters' growth rates reveal that their exports slowed down in the year preceding their exit. The average growth rate is 15 percent (3 percent excluding intermediary traders) and the median growth rates are negative in all years.

Firm growth is concurrent with diversification, both at the market and the product dimensions. Table 9 reports firms' characteristics according to growth performance. We define fast growers as those firms with growth rates in the top quartile of the growth distribution in a given year. These fast growers are smaller, with median exports being below those of non-fast growers. This is more evident for the period 2009-2013.

Despite being small, fast growers are more likely to have expanded their product and destination portfolio in the past year. Indeed, in 2009-2013, 53 percent of fast growers were also market diversifiers, while only 39 percent of non-fast growers were market diversifiers. Similarly, 65 percent were product diversifiers, compared with only 52 percent of the non-fast growers.[8] This indicates that as firms grow fast, they also diversify. We will explore in more detail the characteristics of market and product diversifier in the next section.

Table 9: Characteristics of fast grower and other exporters

	Growth>75pt	Growth < 75pt	Growth>75pt	Growth < 75pt	Growth>75pt	Growth < 75pt
	Median exports (Thousands PLN)		**Average Products**		**% of diversifiers (markets)**	
2006-2009	987	1021	7.5	7.7	54%	41%
2009-2013	750	1324	6.9	8.4	53%	39%
	Average exports (Thousands PLN)		**Average Destinations**		**% of diversifiers (products)**	
2006-2009	11,444	15,285	4.0	5.0	69%	56%
2009-2013	10,467	21,866	4.2	5.8	65%	52%
	Median exports (Thousands PLN) (excluding services)					
2006-2009	1675	1689				
2009-2013	1682	2556				

Source: Authors' calculations from export transactions database.

Export Diversification

How do Polish exporters perform in terms of diversifying their export bundles, both along the product and destination dimensions?

Summary

In terms of country reach and firm-level diversification, Poland's performance is on par with European and high-income peers. Poland's exports reach more than 200 destinations, although

[7] To account for issues related to entrants exporting for only few months in their first year, we computed the average growth rates in t+1 and t+2 to exclude the year of entry. The average growth rate of entrants is 73% excluding intermediary traders while the median growth rate is 65%.

[8] A product diversifier is a firm that started exporting a "new" product that it has never exported before while a market diversifier is a firm that started exporting to a "new" destination it has never reached before.

their export flows are concentrated in EU and CIS markets**.** More than 80 percent of firms export either to the EU or the CIS countries (or to both). Polish exporters are well diversified both along the product and destination dimensions. Each exporter reaches on average about 4 countries and exports on average about 8 products.

The most frequent destinations are Germany and the Ukraine. The number of exporters to Germany has been stable over time but average orders got larger, similarly, but to a lesser extent, to other two top destinations: Czech Republic and Lithuania. On the contrary, the number of exporters to Ukraine has increased but their average size has been decreasing over time.

Diversification is important for export growth and its contribution to growth is increasing over time. Product and market diversification contributed to 16 percent of exports growth in the period 2005-2007. Its contribution increased to 27 percent in the period 2010-2013.

Polish exporters are very heterogeneous, with larger exporters being more diversified and playing a dominant role in the export market. There are huge differences among exporters. Very large exporters have a portfolio of about 18 products and export on average to 10 countries. On the other hand, very small exporters focus on fewer than two products and reach only one destination, on average. The number of small exporters focusing on one destination and one product has been increasing over time.

Exports concentration is slightly higher than in other comparator and varies notably across sectors. Concentration is found to be higher than what is found in some selected high-income countries for which data are available. The top 5 exporters account for 11 percent of overall exports and top 5 percent of exporters account for 80 percent of exports. Exporters are more concentrated in the Mineral and Transport equipment sectors.

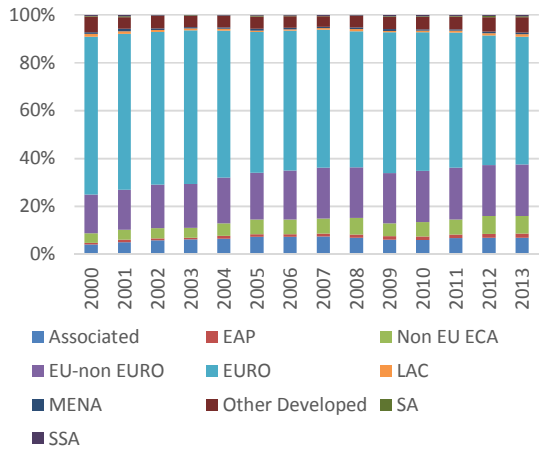
Smaller firms are increasing in number and are starting to play an important role in the international market. "Exports superstars" (the top percentile of exporters) are the main driver of export growth and diversification but their contribution to export growth has been decreasing over time. Because smaller firms grow faster and are increasing in number, their contribution to overall export growth is also increasing. This again suggests that, following the accession to the EU, the fixed costs associated with entering export markets have decreased allowing small firms to contribute to expansion of Polish exports.

Diversification along the destination dimension

Polish exporters reach a high number of countries, although exports tend to be concentrated among the EU and the CIS markets. More than 80 percent of Polish exports go to the EU or associated countries (such as Albania, Iceland, the Western Balkans, Turkey, etc). Within the EU, slightly more than half of exports are destined to countries in the Euro zone. This share has been declining from 66 percent in 2000 to 53 percent in 2013 (Figure 12). Despite this high concentration in EU markets, Poland's exporters have been diversifying markets. They reach over two hundred destinations, which is comparable with the country reach of more mature EU members such as Spain, and well above the 184 destinations reached by the average EU-10, by the

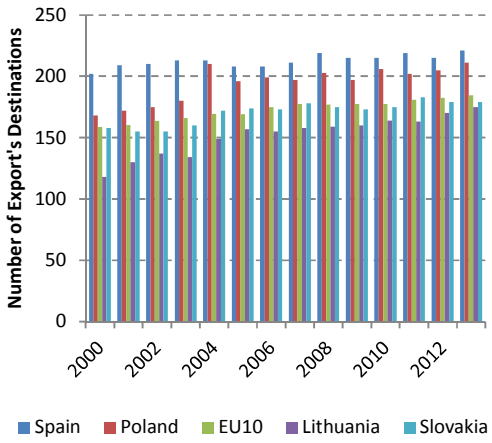
179 reached by Slovakian exporters and by the 175 reached by the Lithuanian exporters (Figure 13).

Figure 12: Export Shares by Destination



Source: Authors' calculations based on UN Comtrade.

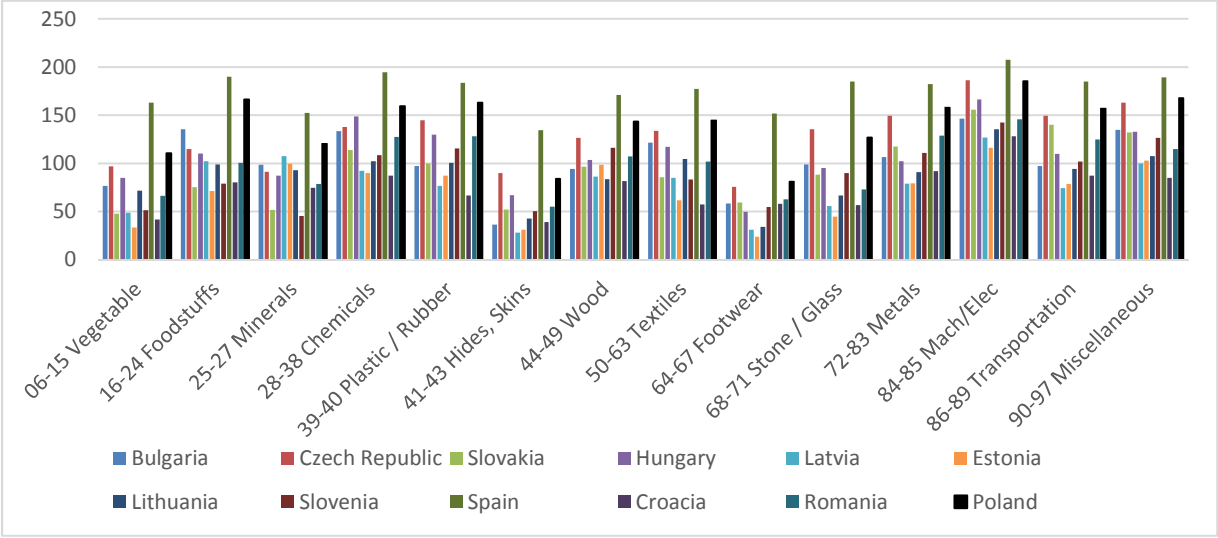
Figure 13: Number of Destinations Reached



Source: Authors' calculations based on UN Comtrade.

Polish exporters tend to reach a well-diversified set of markets in most sectors of activity. Figure 14 shows the average number of destinations by sector in 2010-2013 for Poland and comparators. For Poland, the sector with the smaller number of export markets reached is footwear in which exporters reach about 100 markets. Machinery, on the other hand is the most diversified in terms of destinations as exporters reach almost 200 countries. Interestingly, after Spain, Poland is the country with the smallest variation in market reach across sectors, suggesting a well-diversified structure of destinations across all products, and ultimately, a relatively high level of competitiveness.

Figure 14: Average number of destination by sector – Poland and Comparators 2010-2013

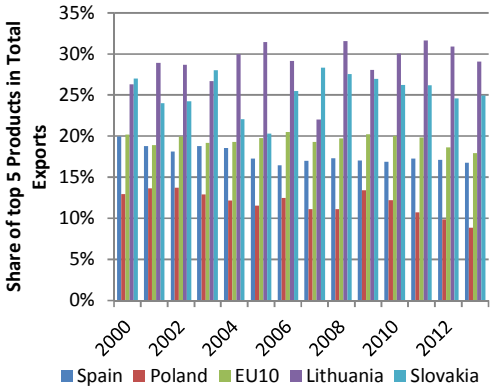


Source: Authors' calculations

Diversification along the product dimension

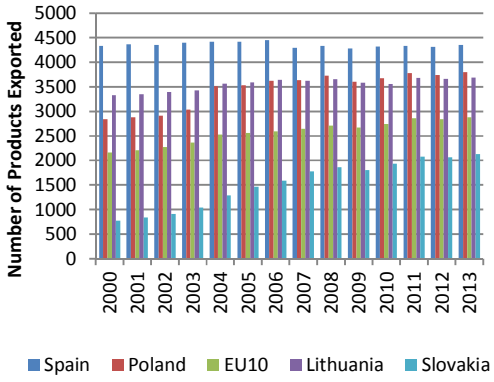
At the product level, concentration is relatively low and it is also decreasing over time. The top 5 products exported explain less than 10 percent of export revenues, substantially less than what they do in Lithuania (29 percent) or Slovakia (25 percent) as shown in Figure 15. This reduces the vulnerability of Polish export earnings to product-specific shocks. In addition, the product scope has been increasing. The number of product varieties exported increased to 3800 in 2013, comparable with the level of diversification experienced by Spain, and leapfrogging Lithuania (Figure 16).

Figure 15: Export Concentration Index (Product)



Source: Authors' calculations based on UN Comtrade.

Figure 16: Export product scope



Source: Authors' calculations based on UN Comtrade.

Focus on firm-level data

Destination Dimension

European destinations are the most popular among Polish exporters, followed by countries of the Commonwealth of Independent States (CIS). Table 10 reports the share of exports for these two regions and towards Ukraine and Belarus (major trading partners) based on transaction-level data.

Table 10: Share of Exporters by region of destination

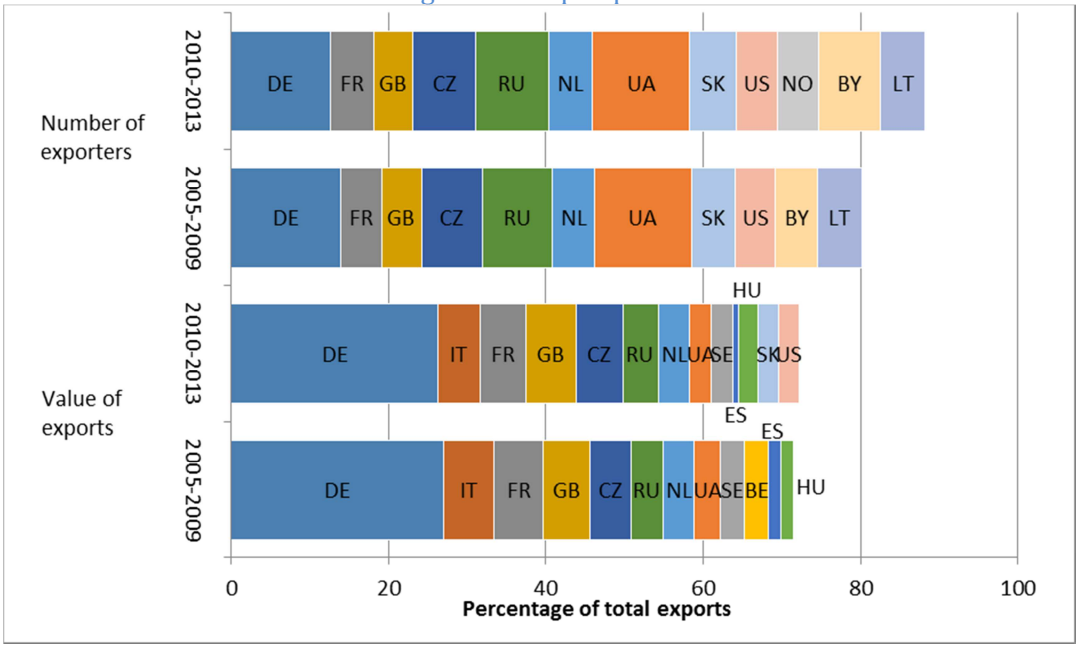
year	Percentage of exporters that export to			% of exporters to CIS that export also to the EU	% of exporters to UKR and BLR that export also to the EU
	EU	CIS	Ukraine & Belarus		
2005	50%	46%	33%	31%	50%
2006	44%	49%	29%	27%	44%
2007	46%	50%	30%	29%	46%
2008	49%	47%	34%	32%	49%
2009	48%	44%	35%	33%	48%
2010	44%	46%	32%	30%	44%
2011	40%	50%	27%	26%	40%
2012	37%	52%	25%	24%	37%
2013	36%	52%	24%	24%	36%

Source: Authors' calculations from export transactions database.

The percentage of exporters to CIS countries has increased over time, from 46 percent in 2005 to 52 percent in 2013. However, less exporters are focusing on Ukraine and Belarus, as their share is falling from 33 percent in 2005 to 24 percent in 2013. In 2005, 31 percent of exporters to CIS countries were also exporting to the EU. This percentage felt to 24 percent in 2013. A very similar pattern applied to exporters to Ukraine and Belarus. The share of exporters to Ukraine, Belarus and EU countries is decreasing over time, from 50 percent in 2005 to 36 percent in 2013.

Germany is by far the most frequent destination by Polish exporters followed by Ukraine, Russia and Czech Republic. Figure 17 shows a detailed decomposition of top export destinations, in terms of number of exporters and value exported. Germany accounts for about 25 percent of total value of exports and 13 percent of exporters. In terms of number of exporters, Germany is followed by Ukraine, Russia and Czech Republic. In terms of exports value, in turn, the next in ranking are Italy, France, UK and Czech Republic. In terms of exporters, Ukraine (UA) accounts for 12 percent of exporters. On the other hand, exports to Ukraine involve relatively small orders, about 3 percent of total value exported. We can observe that the top 10 destinations account for about 71 percent of total value exported. Similarly, top 10 destinations accounted for about 80 percent of total exporting firms before 2009 and about 88 percent in the period 2010-2013.

Figure 17: Top Export Destinations

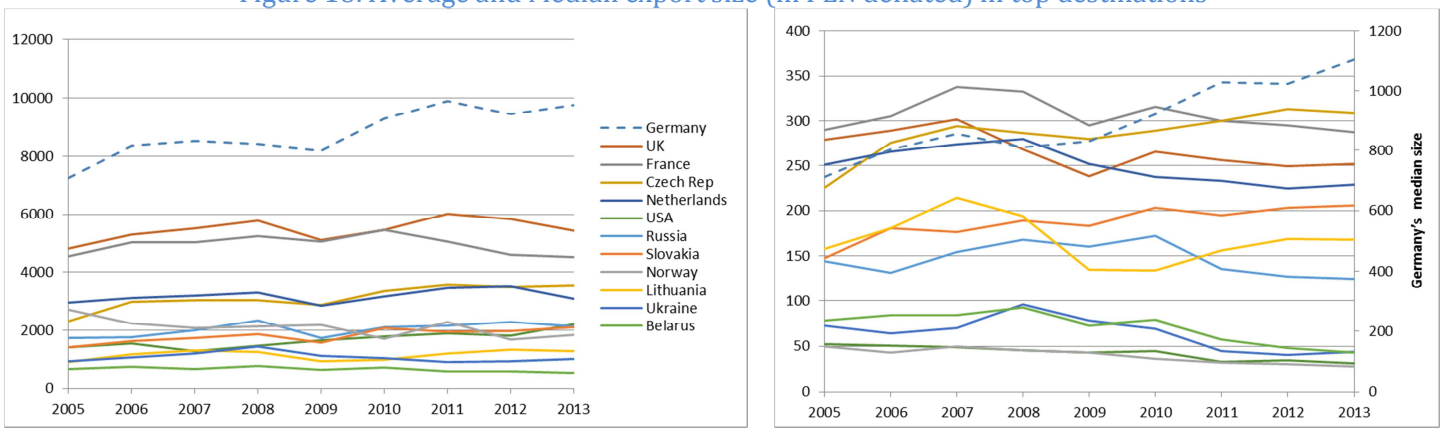


Source: Authors' calculations from export transactions database.

The median size of exporters towards all top destinations but Germany, Czech Republic and Lithuania has been decreasing over time. Figure 18 shows the average and median size of orders to each top destination from 2005 and 2013. It reveals that the average size of exporters to Germany, the most important destination, is steadily increasing over time; the median size is increasing even more steeply. In 2013, the average exporter size was almost 10,000 PLN whereas the average size of exporters to other destinations was below 6,000 PLN. Also, for most of the other

destinations, the average size remains stable or decreasing over time. In particular, the median size of exporters towards Ukraine and Belarus has decreasing notably since 2008.

Figure 18: Average and Median export size (in PLN deflated) in top destinations



Source: Authors' calculations from export transactions database.

Table 11: Average Number of Destinations per firm

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Average destinations	3.65	3.67	3.80	4.04	4.16	4.25	4.16	4.11	4.19

Source: Authors' calculations from export transactions database.

Polish exports are well diversified in terms of number of destinations per sector and exporter. Table 11 reports the average number of destinations of Polish exporters. Exporters reach on average 3-4 destinations, which is in line with other high-income countries[9]. Moreover, the average number of destination per firm has been increasing over time from 3.65 in 2005 to 4.19 in 2013.

Product Dimension

Polish firms are well diversified along the product dimension. As shown in Table 12, firms export on average 8 products. The average of a sample of 44 countries, which include both developed and developing countries, is 5 (6.7 for the sub-sample of high-income countries). [10] Average product diversification has been slightly decreasing over time, most likely due to the entrance of increasingly smaller firms in the export market.

Table 12: Average Number of Products per firm

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Average products	8.48	8.28	8.29	8.38	8.36	8.32	7.85	7.71	7.81

Source: Authors' calculations from export transactions database.

[9] Similar statistics are available for a limited number of countries. High-income countries include: New Zealand (3.1) Portugal (3.5) Norway (3.4) Belgium (6.8) Sweden (4.3), Spain (4) Chile (3.4) and Estonia (2.7).
[10] High-income countries include: New Zealand (3.1) Portugal (3.5) Norway (3.4) Belgium (6.8) Sweden (4.3) , Spain (4) Chile (3.4) and Estonia (2.7).

There are, however, large differences among firms in terms of average number of product varieties and destinations. While large firms are well diversified, small firms are less able to mitigate risk through product and market diversification. Table 13 shows the number of products and destinations by firm size. In 2013, the group of exporters at the top quartile of the distribution of exports value reached 10 markets and sold 18 products, on average. On the other hand, firms in the bottom quartile of the distribution reached on average one destination and exported less than 2 product varieties. Moreover, the average number of export products for the top 25 percentile firms has increased from 17.5 to 18.2 in 2013, while it has slightly decreased for the bottom 25 percentile firms from 2 to 1.6 products in 2013. The average number of destinations has also increased from 8.3 in 2005 to 10.4 for the top 25 percentile firms, while remaining unchanged for the bottom 25 percentile firms. This suggests that as smaller firms are entering the market they are also more vulnerable to product- and country-specific shocks.

Table 13: Number of Products and Destinations By Firm Size

	Average products				Average destinations			
	Top 25 percentile	Excluding intermediary traders	Bottom 25 percentile	Excluding intermediary traders	Top 25 percentile	Excluding intermediary traders	Bottom 25 percentile	Excluding intermediary traders
2005	17.5	12.4	2.0	1.7	8.3	10.0	1.1	1.3
2006	17.7	12.2	1.8	1.6	8.6	10.6	1.1	1.2
2007	17.7	12.4	1.8	1.6	8.9	11.1	1.1	1.2
2008	17.7	12.7	1.9	1.7	9.4	11.5	1.2	1.3
2009	17.7	12.7	1.9	1.7	9.7	12.0	1.1	1.3
2010	18.1	12.8	1.8	1.7	10.2	12.7	1.1	1.3
2011	17.8	13.2	1.6	1.6	10.2	13.3	1.1	1.3
2012	18.0	13.6	1.6	1.6	10.2	13.7	1.1	1.3
2013	18.2	13.8	1.6	1.5	10.4	14.2	1.1	1.2

Source: Authors' calculations from export transactions database.

The number of small firms specializing in only one destination and product has been increasing over time. Table 14 provides more evidence on firm heterogeneity in export performance. It reports the share of exporters serving given combinations of products/destinations, for 2005 (top panel) and for 2013 (bottom panel), in terms of number of exporters (left panel) and of export value (right panel). In 2005, about 27 percent of exporters served only one destination and sold only one product. These firms tended to sell very small orders, since they accounted for only 2 percent of the total export value, as shown on the right panel. In 2013 the share of exporters in this category increased to 35 percent, still selling very small orders (1 percent of total exported value). Firms reaching more than ten destinations and selling more than ten products accounted for 5 percent in 2005 and 6 percent in 2013. These are large firms that accounted for more than 60 percent of total export revenue.

Table 14: Firm Heterogeneity in Number of Products

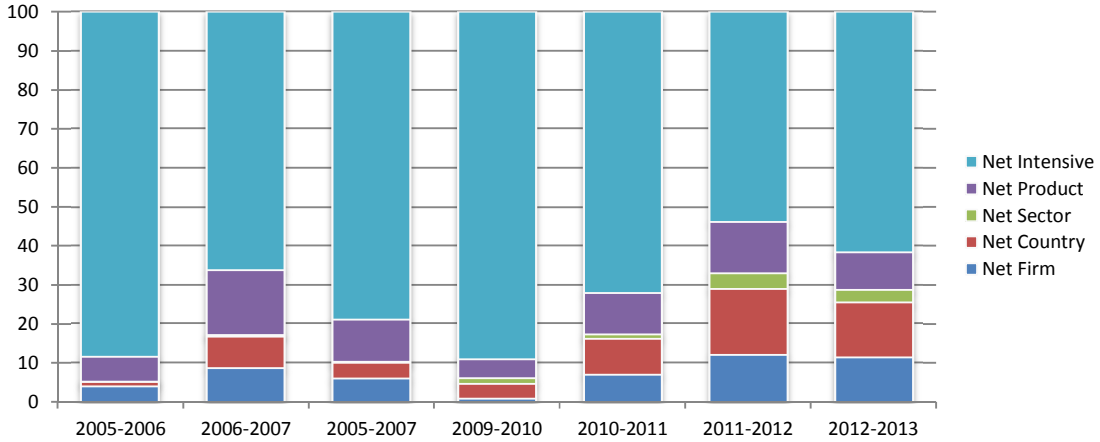
2005	Number of Products					Number of Products				
Number of destinations	Exporters (%)	1	2-5	6-10	>10	Export value (%)	1	2-5	6-10	>10
	1	27	16	4	4	1	2	2	1	2
	2-5	5	15	6	6	2-5	2	5	3	5
	6-10	1	3	2	3	6-10	1	3	2	6
	>10	0	1	2	5	>10	0	7	5	58
2013										
Number of destinations	Exporters (%)	1	2-5	6-10	>10	Export value (%)	1	2-5	6-10	>10
	1	35	13	3	3	1	1	1	1	1
	2-5	5	15	4	4	2-5	1	4	2	3
	6-10	1	3	2	3	6-10	1	2	2	6
	>10	0	2	2	6	>10	0	5	6	63

Source: Authors' calculations from export transactions database.

Diversification and export growth

Diversification has been an important driver of export growth over the last 10 years. Using transaction-level data, it is possible to decompose overall growth into 5 components (Figure 20) (see box 2 for the methodology). Looking at Figure 19 we see that during the period 2012-2013, almost 10 percent of export growth was explained by the net entry of new Polish firms into the export market (net firm contribution), about 15 percent of export growth was explained by firms selling to new markets, and about 10 percent was explained by firms exporting new products. Sixty percent of export growth during that period was explained by more exports from the same old firms, of the same old products, to the same old destinations (net intensive). The contribution of overall diversification (extensive margin at firm, product and destination level) to export growth has increased from 20 percent in the period 2005-2007 to about 40 percent in the period 2010-2013. The fact that diversification along the market destination is the main driver of growth can be attributed to the role of top exporters as we will discuss below.

Figure 19: Decomposition of Export Growth into Extensive and Intensive Margins



Source: Authors' calculations from export transactions database.

Box 2: Export growth decomposition

To obtain the contribution to overall annual export growth in the period 2005-2013 of each of the margins of trade, and within each margin we further decompose the contribution of entries separated from exits. Export growth is computed using the so called "mid-point growth rate" (Davis and Haltiwanger).

Mid-Point Growth Rates are computed as follows. For a firm *i* exporting a value *x* to a country *c* of product *k* at year *t*, the mid-point growth rate is defined as:

$$g_{ickt} = \frac{x_{ickt} - x_{ick(t-1)}}{\frac{1}{2}\left(x_{ickt} + x_{ick(t-1)}\right)}$$

Similarly, the weight attributed to each flow g_{ickt} is given by the relative share of the flow in total exports, where total refers to the exports of the whole population of a country's firms:

$$s_{ickt} = \frac{x_{ickt} + x_{ick(t-1)}}{\left(\sum_c \sum_i \sum_k x_{ickt} + x \sum_c \sum_i \sum_k x_{ick(t-1)}\right)}$$

Finally, the year-on-year growth rate of the total value of Polish exports is given by summing each individual flow g_{ickt} weighted by s_{ickt}:

$$G_t = \sum_c \sum_i \sum_k s_{ickt} * g_{ickt}$$

The G measure is monotonically related to the conventional growth rate measure, and it represents a good approximation of the latter for small growth rates. For bigger growth rate the two growth measures are linked by the following identity:

$$G_t \approx \frac{2g_t}{(2 - g_t)}$$

The main advantage of this type of growth rate is that while at the aggregate level the index approximates well standard measures of growth rate, unlike other methods, it allows computing the contribution of the extensive margin to export growth. Other methodologies only allow a static assessment of the extensive margin.

Firms that are able to diversify exports, in particular along the destination dimension, are substantially larger. The analysis is presented in box 3. Diversification is likely to be associated with the presence of sunk costs related, for example, to establishing new marketing channels and accumulating information on demand sources. Our analysis reveals the presence of sunk costs in particular for reaching a new destination as firms that are able to expand their country reach are substantially larger.

Box 3: Characteristics of product and market diversifiers

Transaction-level data allows us to analyze the characteristics of product and market diversifiers. We define as product diversifiers those firms that started exporting a "new" product that they had never exported before (since 2005)[11]. Similarly a market diversifier is a firm that started exporting to a "new" destination it has never reached before.

Table 15: Size of market and product diversifier

	Median exports (Thousands PLN)				Average exports (Thousands PLN)			
	Do not diversify	Exported new product	Reached new market	New product and market	Do not diversify	Exported new product	Reached new market	New product and market
2006-2009	497	1,321	1,999	2,437	5,148	19,871	25,055	30,679
2010-2013	462	1,234	1,619	2,001	7,786	25,270	28,854	36,575

Source: Authors' calculations from export transactions database.

Firms that are able to export a new product are almost 3 times larger (considering median export size) than firms that do not diversify (Table 15). Diversification along the destination dimension is experienced by even larger firms (4 times larger). However, the gap has decreased over time as market diversifiers are 3.5 times larger than non-diversifiers in the period 2010-2013. The large difference in firm size indicates the potential presence of sunk costs related, for example, to establishing new marketing channels and accumulating information on demand sources. Sunk costs seem to be higher for reaching a new destination than for starting exporting a new product.

Table 16: Market and product diversifier

		Product diversifier	
		Yes	No
Market diversifier	Yes	32 %	13%
	No	25 %	30 %

Source: Authors' calculations from export transactions database. Consider only firms that exported for at least two years.

About 30 percent of Polish exporters (that have exported for at least two years) have exported the same products to the same destinations for the entire period while a similar share (32 percent) has increased the range of products and destinations over the period (Table 16). Therefore, expanding the portfolio of products or destinations is a strategy adopted by about 70 percent of Polish exporters.

Export concentration and export superstars

Polish exports appear to be more concentrated than in other selected high-income countries. We assess the level of concentration of exports across sectors using the Herfindahl Index (Table 17), higher levels of the index indicate higher concentration. The Herfindahl index for

[11] For this analysis we consider only firms that have exported for at least two years in the period (2005-2013). First time exporters (the first time a firm appears in the dataset) are also excluded. This explains why the median size of non-diversifier is higher than the overall median as this is a selected sample of exporters.

Polish exporters averages at 0.031 in the period 2005-2009 and at 0.030 in the period 2010-2013. This is above that of most comparator countries (Cebeci et al., 2012) as shown in Table 18.

Table 17: Herfindhal index by sector

Herfindahl Index (HI)*	2005-2009	2010-2013
Animal	0.010	0.011
Vegetable	0.006	0.006
Foodstuffs	0.014	0.012
Mineral	0.115	0.104
Chemicals	0.024	0.023
Plastic, Rubber	0.017	0.016
Hides, Skins	0.081	0.047
Wood	0.018	0.018
Textiles, Clothing	0.005	0.009
Footwear	0.024	0.026
Stone, Glass	0.032	0.064
Metals	0.031	0.040
Machinery	0.014	0.010
Transport	0.064	0.051
Miscellaneous	0.014	0.017
Overall	**0.031**	**0.030**

Source: Authors' calculations from export transactions database.

Table 18: Herfindahl index in comparator countries

Country	Year	HI	Country	Year	HI	Country	Year	HI	Country	Year	HI
Belgium	2010	0.008	Estonia	2009	0.005	Norway	2006	0.015	Sweden	2006	0.014
Bulgaria	2006	0.016	Mexico	2009	0.006	Portugal	2005	0.007	Turkey	2010	0.004
Chile	2009	0.056	New Zealand	2010	0.066	Spain	2009	0.004			

Source: Cebeci et al. (2012). Data are available only for a limited number of countries

The level of concentration varies substantially across sectors and over time. Concentration is higher in the mineral sector as confirmed also in Table 19, which reports the share of exports of top 5 and 5 percent exporters by sector. In this sector, about 64 percent of exports can be attributed to the top 5 exporters and up to 96 percent to the top 5 percent of exporters. This is not surprising as the mineral sector is characterized by very high fixed costs and is often dominated by few very large firms. As mentioned above, concentration has decreased in the last decade in the top exporting sectors (machinery and transport equipment) and also in other sectors such as food, hides and skins and wood. The opposite is observed in the textile and footwear sectors.

The top 5 percent of exporters contribute, overall, to more than 80 percent of total exported value and this share has remained largely unchanged over time. Figure 20 shows, the contribution of the top five and top 5% exporters over time. The top 5 exporters accounted for about 11 percent of total exports in 2005. During the financial crisis, top exporters gained additional market share reaching 12 percent of total exports. Since 2009, there has been a slow

decline in the share of the top five exporters, which accounted for 8.8 percent of exports in 2013. This again is not surprising, as more developed economies tend to be characterized by more concentrated exports than developing economies. The level of concentration, however, is in line with a selected number of high-income countries for which similar data are available, including Norway, Belgium, Sweden and Spain (Cebeci et al, 2012).

Table 19: Share of exports of top exporters

	Share of top 5 exporters		Share of top 5% exporters	
	2005-2009	2010-2013	2005-2010	2009-2013
Animal	15.4	16.1	58.47	60.15
Vegetable	12.0	12.0	56.18	54.60
Foodstuffs	20.1	17.0	67.99	67.81
Mineral	66.4	63.6	96.51	96.02
Chemicals	28.8	28.1	89.93	89.28
Plastic, Rubber	23.8	23.0	85.36	86.29
Hides, Skins	48.1	39.3	86.40	84.95
Wood	24.0	22.9	86.22	86.30
Textiles, Clothing	10.3	16.5	68.48	74.31
Footwear	25.2	27.7	71.54	73.04
Stone, Glass	29.2	39.7	91.03	94.21
Metals	28.3	28.9	83.08	83.05
Machinery	20.5	16.1	90.39	90.35
Transportation	49.3	45.4	95.67	96.48
Miscellaneous	20.6	22.1	84.26	86.86

Source: Authors' calculations from export transactions database.

Figure 20: Share of Top Exporters

Source: Authors' calculations from export transactions database.

Export superstars

"Export superstars" are the main drivers of export growth and diversification but their contribution to export growth has been decreasing over time. Export superstars are defined considering the cumulative amount of exports during the entire period 2005-2013 and represent the top percentile of the distribution of cumulated exports. Table 20 presents the average characteristics of export superstars, showing that they accounted for 70 percent of total exports in 2013. Superstars are the main drivers of export growth. In 2011 they represented more than 70 percent of the overall export growth, while in 2012 and 2013 their contributions decreased to about 50% of overall growth. The number of superstars has been stable over time, their average size being 80 times that of an average exporting firm.

Superstars are multi-product (37 products against 7 in 2012) and reach far more markets (13 against 4) than other firms in 2005. Their level of diversification it terms of both products and destinations has been increasing steadily over time, while other firms have only slightly expanded their range of products and destinations. This suggests that the average increase in the number of destinations per firm observed above is mostly driven by export superstars expanding their country reach. This high degree of concentration of total exports in the hands of a small number of multi-product multi-destination exporters is in line with the findings of the academic literature (Bernard, Redding, and Schott, 2011). Economists have modeled the behavior of firms, in the context of a multi-product and multi-destination environment, where firms face fixed costs to export each product and serve each market. The model shows that only larger firms are able to generate variable profits to cover those fixed costs and thus supply a wider range of products to each market.

Table 20: Characteristics of export superstars

Years	Number of exporters	Share of value	Share of growth	Average # product varieties			Average size (thousands PLN)			Average # of destinations		
				Superstars	Non-Superstars	Ratio	Superstars	Non-Superstars	Ratio	Superstars	Non-Superstars	Ratio
2005	306	68.5		32.9	7.5	4.4	442,083	5,312	83.2	18.2	3.2	5.6
2006	316	69.8	80.6	33.3	7.3	4.5	523,653	5,991	87.4	18.9	3.2	5.8
2007	331	70.7	77.1	33.2	7.4	4.5	569,565	6,649	85.7	19.4	3.4	5.8
2008	333	71.7	-	33.4	7.5	4.5	588,427	6,735	87.4	19.9	3.6	5.6
2009	337	72.3	-	33.0	7.5	4.4	591,281	6,851	86.3	20.3	3.6	5.6
2010	338	73.5	84.0	34.5	7.4	4.7	658,456	7,686	85.7	20.9	3.7	5.6
2011	337	72.4	71.5	36.4	7.0	5.2	779,631	8,864	88.0	21.9	3.7	5.9
2012	335	69.9	46.1	37.4	6.9	5.4	796,516	9,380	84.9	22.6	3.7	6.2
2013	329	68.4	52.0	38.9	7.1	5.5	828,728	9,883	83.9	23.4	3.8	6.2

Source: Authors' calculations from export transactions database.

Export Quality and Sophistication

In this section we assess how Polish exporters perform on the quality and sophistication dimension.

Summary

Poland's export quality has been converging to the quality levels displayed by some mature EU members. Poland performs well also in terms of export sophistication, matching the average trend experienced by EU10 countries. This is revealed by the data analysis and confirmed by field interviews. Perceptions of the quality of Polish products have increased dramatically over the last fifteen years.

Firms that export high quality products are smaller, focus on fewer products, and destinations, but grow faster than other firms. These are most likely successful small businesses that are able to serve high-quality niche markets. The relative small size of their businesses is likely to help them respond more quickly to customer demands and provide tailored products.

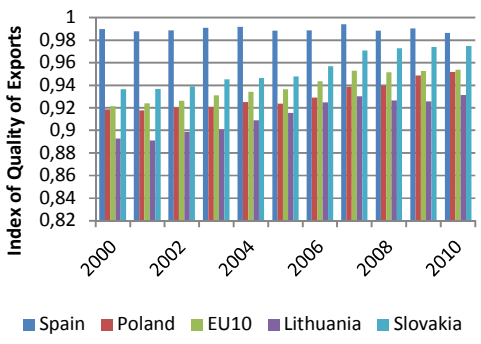
Evidence suggests that the process of quality upgrading is concurrent to (likely a consequence of) the process of diversification along the market and product dimensions. That is, firms improve their quality standards when faced with more demanding needs of a new client. This mechanism has been validated during the fieldwork, through several anecdotes of specific firms.

Quality upgraders export primarily to EU27, followed by Europe and Central Asia and Other developed countries.

Quality of Poland's exports

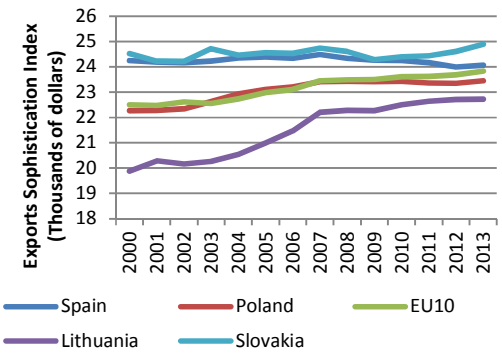
Poland's export quality has been converging to the quality levels displayed by a mature EU member. To capture trends in quality levels over time we construct an indicator of quality based on the prices that export products obtain in international markets. This indicator is shown in Figure 21 and reveals that Poland's export quality has been converging to the quality levels displayed by mature EU members such as Spain.

Figure 21: Export Quality



Source: IMF

Figure 22: Export Sophistication



Source: Authors' calculations based on WDI and UN Comtrade

Poland's export sophistication has also been on the rise and is in line with the EU10 average. We measure export sophistication by employing the Hausmann, Hwang and Rodrik's (2006) EXPY indicator (Figure 22). Goods that embody greater value addition in terms of ingenuity, skills, and technology, fetch higher prices in world markets. Furthermore, countries producing goods that are more sophisticated than what their income levels would suggest tend to grow at faster rates. According to Haussman, Hwang and Rodrik (2006), the upgrade of product quality can thus be a secure source of both export and economic growth. To construct the EXPY, one needs first to associate each export product with the average per capita income level of the countries that produce that good. That initial average is called PRODY. Then, one needs to average the PRODYs for the export bundle of the relevant country (for a detailed description of the methodology see Box 4). Poland's EXPY is currently at 23,400 USD, roughly on par with its level of income per capita. More mature members such as Spain, show more sophisticated export bundles in the first half of 2000. Nevertheless, Poland sophistication is in line with the EU10 averages and has been increasing over time.

Box 4: Measuring Export Sophistication

Calculating export sophistication, denoted by EXPY, is a two-stage process. The first stage is to measure the income level associated with each product in the world, termed "PRODY". The PRODY of a particular product is the GDP per capita of the typical country that exports that good. Typical GDP is calculated by weighting the GDP per capita of all countries exporting the good. The weight given to each country is based on "revealed comparative advantage", defined as the share of its exports that comes from that good relative to the "average" country. The PRODY for a single product is calculated by weighting the GDP per capita of all countries exporting that product. Therefore, a product that typically makes up a large percentage of a poor country's export basket will have stronger weights towards poor countries' GDP per capita. This will be less the case for a product that makes up a small percentage of a poor country's exports but is a significant component of many rich countries' export baskets.

The second stage is to measure the income associated with a country's export basket as a whole; this is its EXPY. From the first stage, each product that a country exports will have a PRODY. The EXPY is calculated by weighting these PRODY by the share that each good contributes to total exports. If butter makes up 15 per cent of a country's exports, its PRODY will be given a weight of 0.15. Countries whose export baskets are made up of "rich-country goods" will have a higher EXPY, while export baskets made up of "poor-country goods" will have a lower EXPY.

$$PRODY_k = \sum_j \frac{\left(\frac{x_{jk}}{X_j}\right)}{\sum_j \frac{x_{jk}}{X_j}} Y_j \qquad and \qquad EXPY_i = \sum_k \left(\frac{x_{ik}}{X_i}\right) PRODY_k$$

Focus on firm-level data

High quality exporters are smaller and focus on fewer products and destinations. We define a firm as a 'high quality exporter' when two conditions hold. First, the firm exports a product variety that fetches prices in the upper quartile of the distribution of all prices for that product, and second, that that high-price variety accounts for a sizable portion of that firm's exports (at least 50 percent). Table 19 shows that high-quality exporters are different from other exporters. The table indicates that high-quality exporters are smaller than other firms; median exports are about 130 thousand PLN for high-quality exporters in 2010-2013 versus 350 thousand PLN of others. They are also less diversified, along both the product and the destination dimension. They tend to focus on fewer products, 5 versus 6.4, and destinations (3 versus 4.4). Nevertheless, they grow faster than other exporters. High-quality exporters grew at an average annual rate of 46% in the period 2010-2013 while other exporters grew at an average rate of 35%.

Table 21: Performance of high quality exporters

	High-quality* exporters	Others	High-quality exporters	Others
Years	**Median exports (Thousand PLN)**		**Average products**	
2006-2009	146	533	5.2	6.5
2010-2013	128	345	5.0	6.4
	Average exports (Thousand PLN)		**Average destinations**	
2006-2009	4893	11619	2.7	4.0
2010-2013	6441	14736	3.0	4.4
	Quality upgrader*		**% of diversifiers (markets)****	
2006-2009	12%	7%	43%	46%
2010-2013	14%	8%	43%	45%
	Average annual Growth (%)		**% of diversifiers (products)****	
2006-2009	39.1	29.1	62%	59%
2010-2013	46.6	35.3	58%	55%

Source: Authors' calculations from export transactions database. Quality upgraders experience an increase in price above the 75 percentile of the price growth distribution. Average number of products and destinations differ from the overall average as the table refers to a sub-sample of firms that exported for at least two consecutive years.

Small exporters are able to achieve very high prices by targeting few niche markets. These markets tend to have low price elasticities, which give them greater pricing power. The relative small size of their businesses is likely to help them respond more quickly to customer demands and to offer tailored products. This ultimately results in higher export growth. According to Lindell and Karagozoglu (1997), the competitive advantage of successful small businesses is in niche markets, serving a small number of customers who buy quality tailored products and are willing to pay a premium for them.

Quality upgrading

Quality upgraders tend to be smaller and less diversified than other exporters both in terms of products and destinations. The analysis is reported in box 5. We define quality-upgraders those firms that experience notably high grow rates in prices for a large share of their exported products. Specifically, for each firm we identify products whose prices have experienced growth rates above the 75 percentile of the distribution of growth rates by product. We then compute the weighted share of upgraded products based on the corresponding export value. We define quality upgraders as those firms having a weighted share of upgraded products above 0.5.

Box 5: Who are the Quality Upgraders?

To understand the characteristics of the quality upgraders, we estimate a linear probability model where a binary variable identifying quality upgraders is related to firm and sector level characteristics.[12] The regressions include year and sector fixed effects and control for the effect that exchange rate depreciations have on the export prices express in Zloty.

The results in Table 22 reveal that quality upgraders tend to be smaller and less diversified than other exporters both in terms of products and destinations. As suggested in Lindell and Karagozoglu (1997) some successful small firms are driven by their motivation to constantly seek out new opportunities. This results in new product development and entrepreneurship that allow them to achieve substantial improvement in product quality.

Do the presence of other firms exporting similar products or to similar destinations affect firms' ability to upgrade? We constructed two variables indicating, for each firm, the total number of firms reaching its destinations and exporting its products. The results show that quality upgraders are more likely to export towards more frequent destinations probably benefitting from informational spillovers from other exporters towards their same destination. On the other hand, they are less likely to export popular products (i.e. fewer firms export their same product) indicating that greater competition pressure on the product dimension may reduce their margins by increasing input costs, and reduce their ability to upgrade.

Table 22: Quality upgrading – comparison between firms – linear probability model

Dep. variable: upgrader (Yes= 1)	(1)	(2)	(3)	(4)
Export value (log)	-0.015***	-0.010***	-0.011***	-0.010***
	(0.001)	(0.001)	(0.001)	(0.001)
Number of products (log)		-0.012***	-0.012***	-0.012***
		(0.001)	(0.001)	(0.001)
Number of destinations (log)		-0.007***	-0.005***	-0.006***
		(0.001)	(0.002)	(0.002)
Weighted Real Exchange Rate (log)			-0.003***	-0.003***
			(0.001)	(0.001)
TFP by sector (log)			0.000	0.000
			(0.000)	(0.000)
Exporters at destination (log)				0.003**

[12] Despite the binary nature of the dependent variable, we employ a linear probability model as it provides good estimates of the partial effects for average values of the explanatory variables, allows for the inclusion of firm fixed effects, and the coefficients provide a straightforward interpretation of the effects (Angrist, 2008; Wooldridge, 2002).

				(0.001)
Exporters within product (log)				-0.012***
				(0.002)
Year fixed effects	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes
Observations	93315	93315	79347	79347

Source: Authors' calculations from export transactions database. The sample excludes firms operating in the services sector. *** significance at 1%, ** at 5% and * at 10%. Robust standard errors in parenthesis.

Box 6: Estimating Total factor Productivity

Since the seminal work of Solow (1957), total factor productivity (TFP) has been one of the most commonly used performance measure for firms. TFP is defined as the portion of output not explained by the amount of inputs used in the production process. Its value represents how efficiently and intensely the inputs are used in production. Productivity is often estimated as the deviation between observed output and output predicted by a Cobb-Douglass production function estimated by ordinary least squares (OLS). However, econometric issue arise in this context because there is a correlation between unobservable productivity shocks (embedded in the error tem of the regression) and the firm choice of input level, leading to bias estimates. Olley and Pakes (1996) and Levinsohn and Petrin (2003), among others, have proposed solutions to overcome this problem, which includes the use of an instrumental variable to control for this unobservable productivity shock.

To estimate productivity, we used the F01 dataset for the period 2005-2013. We implemented the Levinsohn and Petrin (2003) methodology Firm-level estimates were then aggregated at sector level. To guarantee the comparability of total factor productivity estimates across sectors, we estimated one homogenous product function across sectors.

Quality upgraders are able to achieve a substantial increase in prices by exporting a new product and reaching a new destination. They are also more likely to operate in more dynamic sectors. Quality upgrading is mildly associated with product diversification. The relatively small effects could be due to the fact that the level of product disaggregation available might not be sufficient to identify niche "new product", typically the target of small high quality firms. Firms are able to achieve substantial quality upgrades by reaching new destination; however this does not translate into a greater portfolio of countries. This might suggest that quality upgraders are relatively small firms and can face some capacity/logistic constraints on the distribution side that may prefer to keep a reduced destination scope (Box 7).

Box 7: Quality upgrading – determinants, performance over time & some evidence from the field

The results reported above do not take account of the potential unobserved heterogeneity that might affect the estimates.[13] Therefore, in Table 23 we include firm-level fixed effects that substantially reduce the scope for this problem. This allows us to better understand quality performance over time.

Table 23: Quality upgrading – linear probability model with firm fixed effects

Dep. variable: upgrader (Yes= 1)	(1)	(2)	(3)	(4)
Quantity (log) t-1	0.002***	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Product diversifier (Yes = 1); t-1	0.006*		0.004	0.003
	(0.003)		(0.004)	(0.004)
Destination diversifier (Yes = 1); t-1	0.006*		0.010***	0.011***
	(0.003)		(0.004)	(0.004)
Number of products (log) t-1		0.005*	0.006	0.005
		(0.003)	(0.004)	(0.004)
Number of destinations (log) t-1		-0.006*	-0.010**	-0.010**
		(0.003)	(0.005)	(0.005)
Weighted Real Exchange Rate (log); t-1				-0.002
				(0.002)
TFP by sector; t-1				0.000**
				(0.000)
Year fixed effects	Yes	Yes	Yes	Yes
Observations	80325	100000	80325	73211
Firms	18267	22026	18267	16736

Source: Authors' calculations from export transactions database. The sample excludes firms operating in the services sector. *** significance at 1%, ** at 5% and * at 10%. Robust standard errors in parenthesis.

Once we control for firm heterogeneity, export growth (in terms of quantity) is positively associated with the probability of upgrading. Quality upgraders are also more like to operate in more dynamic sectors that have experienced an increase in productivity, probably, benefitting from technological spillovers.

Exporting to a "new" destination (never reached before) is also positively associated with quality upgrading while the effect is not so strong when considering the export of a "new" product (never exported before).[14]

Nevertheless, the results indicate that firms are able to achieve a substantial increase in prices by reaching a new destination. This, however, is not reflected in an increase in the overall number of destinations reached (column 2, 3, and 4). This might indicate that quality upgrading is achieved by diverting exports to some of the current destinations to fewer newer markets.

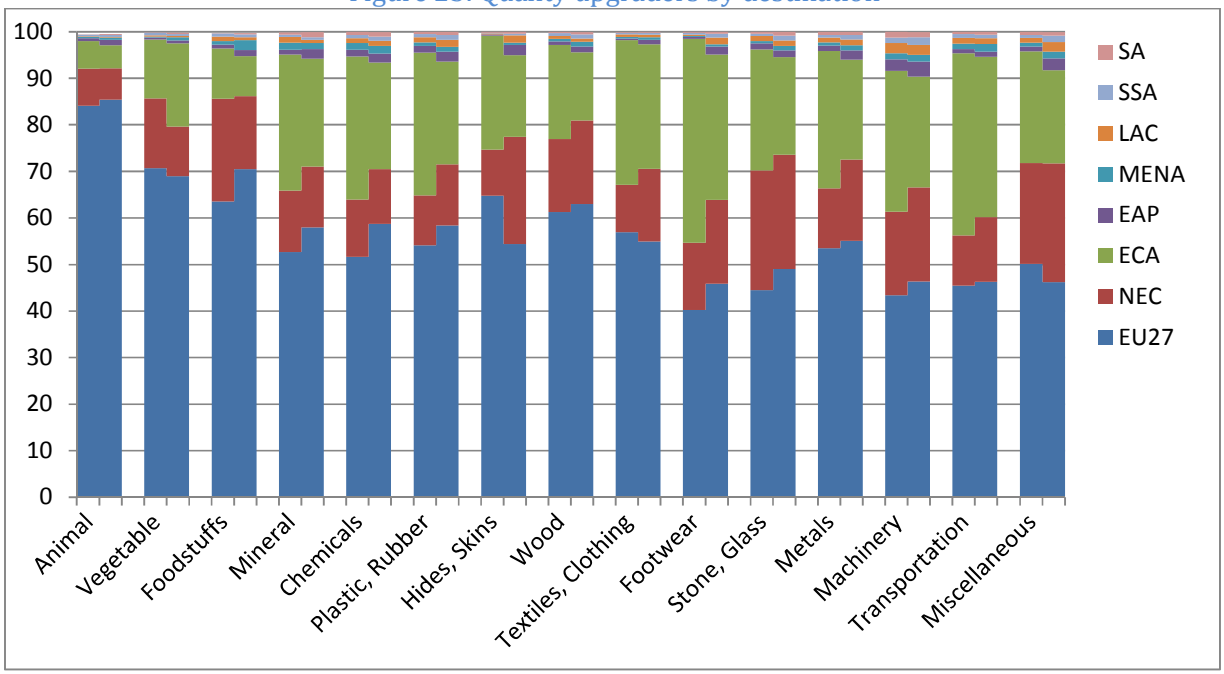
[13] Firms that experience an upgrade might be inherently different from other firms in a way that cannot be observed by the researcher. The inclusion of firm-level fixed effects allows us partial out these differences.

[14] Note that while we can reasonably measure the extent of market diversification, the use of a product classification at six-digit level, the highest level of disaggregation available, might not be sufficient to identify niche "new product", typically the target of smaller firms.

Some evidence from the field
Field interviews help to shed some light on the underlying mechanisms at work within the channels identified through the analysis of firm-level data. For example, a producer in the transport equipment sector emphasized how quality upgrading was linked with diversification at the product and market dimensions. And in this respect, the demand conditions are key. Clients in new markets typically have different requirements in terms of product design, and as one moves upwards in the client sophistication ladder, these new requirements imply product upgrading and sometimes diversification, both of which are rewarded by increases in the prices paid for the product. In this case, for example, demand from France induced the firm to start producing a new product that incorporated hybrid technologies. Demand from Scandinavia, on the other hand, induced them to improve specifications to reduce vehicles' vibration and inside noise.
Difficulties sometimes arise in financing innovations that lead to new or better products.

The majority of quality upgraders export to the EU followed by Europe-Central Asia and other rich economies such as the US and Canada. Figure 23 decomposes the share of upgraders by sector and destinations. The percentage of exporters to EU27 is largest in the Animal sector and smallest in the Footwear, Machinery and Transport sectors. In these latter sectors the second largest destination for upgraders is Europe and Central Asia, mainly Ukraine, Russia and Belarus. In the Machinery sector a large share of upgraders also reach other developed economies, mainly the United States, Norway and Switzerland. Although we observe some variations over time, the EU27 remains by far the dominant destination for quality upgraders.

Figure 23: Quality upgraders by destination



Source: Authors' calculations from export transactions database. Graph shows percentage of upgraders by region. For each sector the first column refers to 2006 and the second to 2013.

Export Survival

This section looks at how Polish exports flows have performed along the sustainability margin and are able to maintain presence in the international market. For countries to achieve fast export growth and diversification, both successful entry into export markets and survival of export flows are crucial. Exporting is an extremely hazardous activity (Besedes and Prusa (2004), Brenton et al (2010)). From a policy perspective, understanding whether the main challenges to export survival are related, for example, to difficulties in specific markets, or with specific products, is key to promote growth and ensure diversification.

Summary

The survival probability of product-destination flows is higher than that observed in other countries including Spain. There are some variations in survival rates across sectors. Survival is highest in the Food sector, where Poland has a strong comparative advantage, and lowest in the Transport and Machinery sectors, the two most important sectors for Polish exports.

There are larger variations in survival rates across destinations. Survival is highest towards EU27, in particular Czech Republic and Slovakia. The lowest survival rates are observed towards South Asia.

Firms that are able to survive longer are larger and more diversified both in terms of products and destinations.

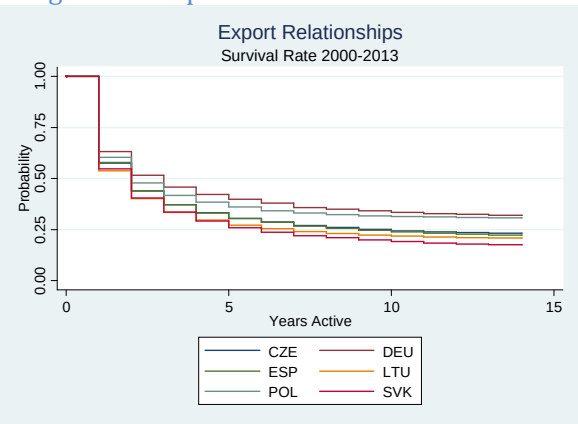
Firms benefit from accumulated knowledge about destination markets but suffer from competition from other firms exporting similar products. The more competitive a product market is, the lower is the probability of survival.

Product survival

The chances of Polish exports of a given product to a given destination remaining active past the first year is substantially higher than for Czech Republic, Slovakia and Spain. We use product level data to compare the duration of Polish export flows and its probabilities of survival with that of comparator countries. As important as it is to enter export markets, it is crucial to survive in these markets so that firms can secure a sustainable profit flow. The chances of Polish exports of a given product to a given destination remaining active past the first year is around 60 percent. This is substantially higher than the probability of survival of exports from Czech Republic, Slovakia, Lithuania or even Spain, and only lower than exports from Germany –the frontier in terms of export survival (Figure)[15]. We do not observe great variation across sectors (Figure 25)

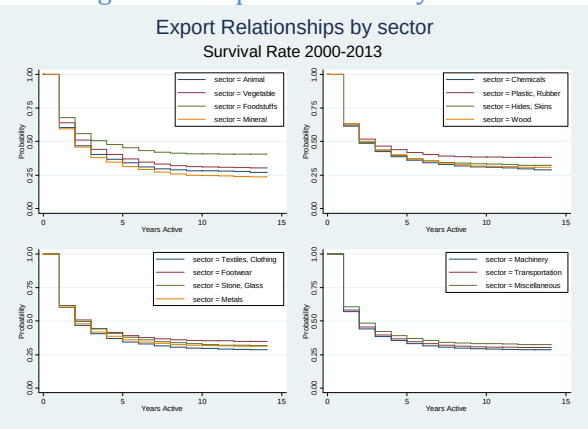
[15] To calculate the duration of export spells, and the associated survival probabilities we use survival analysis, and Kaplan-Meier survival functions. The Kaplan-Meier estimates the survival function from life-time data. It can be used to measure the length of time an export relationship remains active. A plot of the Kaplan-Meier estimate of the survival function is a series of horizontal steps of declining magnitude which, when a large enough sample is taken, approaches the true survival function for that population. An important advantage of the Kaplan-Meier curve is that the method can take into account some types of censored data, particularly right-censoring, which occurs if an export relationship outlives the sample period under analysis. When using product level data, the unit of analysis for an export spell is the pair 'product-destination', where the product is defined as one HS category at 6 digits of disaggregation. When using firm/transaction

Figure 24: Export Survival – Peer Countries



Source: Authors' calculations based on UN Comtrade.

Figure 25: Export Survival by Sector



Source: Authors' calculations based on UN Comtrade.

Firm survival

Survival probabilities are highest in the food sector and lowest in the transport and machinery sector. At the firm level we observe that the average survival probability to the next year of export flows (the unit of analysis is the firm-product-destination triplet) is close to 52 percent for the entire period 2005-2013. It decreases over time and reaches 14 percent in the ninth years. Transaction-level data reveal some variations across sectors. Export flows in the Food sector show the highest survival probability, close to 63 percent chance of surviving one year (Table 24). The probability of exporting for two consecutive years is also higher than in other sectors (47 percent compared to 37 percent on average). On the other hand, the Transport and Machinery sectors show the lowest probability of surviving (45 and 47 percent for one year and 32 percent for two years).

Table 24: Survival rates by sector

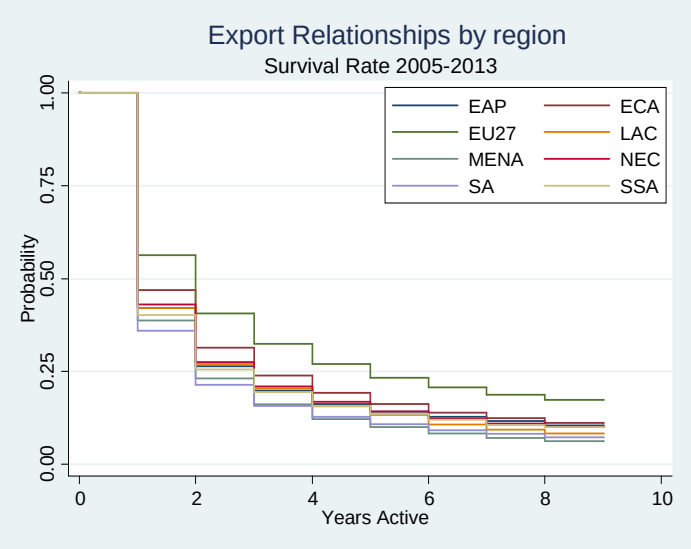
Years Active	1	2	3	4	5	6	7	8	9
Animal	0.56	0.39	0.29	0.24	0.19	0.17	0.14	0.13	0.13
Vegetable	0.54	0.37	0.29	0.23	0.19	0.17	0.14	0.12	0.12
Food	**0.63**	**0.47**	0.39	0.33	0.29	0.26	0.24	0.22	0.22
Mineral	0.54	0.38	0.3	0.25	0.22	0.19	0.16	0.15	0.15
Chemicals	0.56	0.4	0.32	0.26	0.23	0.2	0.18	0.16	0.16
Plastic, Rubber	0.54	0.39	0.31	0.26	0.23	0.2	0.18	0.17	0.17
Hides, skin	0.51	0.35	0.27	0.21	0.18	0.16	0.14	0.12	0.12
Wood	0.51	0.34	0.27	0.22	0.18	0.16	0.14	0.13	0.13
Textiles, Clothing	0.50	0.33	0.25	0.19	0.16	0.14	0.12	0.11	0.11
Footwear	0.54	0.39	0.3	0.24	0.19	0.17	0.13	0.12	0.12
Stone, Glass	0.51	0.35	0.27	0.22	0.19	0.16	0.15	0.14	0.14
Metals	0.51	0.36	0.28	0.23	0.2	0.18	0.16	0.15	0.15
Machinery	**0.47**	**0.32**	0.25	0.21	0.18	0.16	0.14	0.13	0.13
Transport	**0.45**	**0.30**	0.24	0.21	0.18	0.16	0.15	0.14	0.14
Miscellaneous	0.51	0.36	0.28	0.23	0.2	0.18	0.16	0.15	0.15
AVERAGE	0.53	0.37	0.29	0.24	0.20	0.18	0.16	0.14	0.14

Source: Authors' calculations from export transactions database.

level data, the unit of analysis is the triplet "firm-product-destination". Export flows lower than one thousand PLN are dropped.

There is great variation in terms of survival across destinations. Survival probabilities are higher towards EU countries and lower towards South Asia countries. Figure 26 reports survival rates by region. Higher survival probabilities are observed for exports towards EU27 countries (0.56). Among the top destinations, survival is higher for export flows towards Slovakia (0.59) and Czech Republic (0.59). Lowest levels of survival are instead observed for exports towards South Asia (0.36) followed by the Middle East (0.38). Among the top destinations survival is lowest for exports towards the USA and Ukraine.

Figure 26: Survival rates by region



Source: Authors' calculations from export transactions database.

Larger firms are less likely to exit the export market. Table 25 compares the size and degree of diversification along both the product and destination dimension for exporters that survive a different number of years. The median size of firms increases with the length of survival. Firms that survive at least 5 years are 10 percent larger than those surviving at least 4 years (in 2006) and double the size (80 percent larger when excluding services) of those surviving at least 1 year. Firms that survive longer export on average more products and reach more markets. For example, firms that survive at least 5 years export on average 10 products while firms that survive at least 1 year export less than 8 products on average. Similarly, firms that survive for 5 years reach, on average, about 1.5 more destinations than firms surviving for at least one year.

Table 25: Characteristics of survivors

	Survive for at least:						Survive for at least:				
Median exports	1 year	2 years	3 years	4 years	5 years	Destinations	1 year	2 years	3 years	4 years	5 years
2006	944	1322	1680	1950	2144	2006	3.6	4.1	4.6	4.9	5.2
2007	1155	1641	1956	2181	2347	2007	3.7	4.4	4.8	5.1	5.3
2008	1266	1647	1900	2102	2260	2008	4.0	4.6	4.9	5.2	5.5
2009	1227	1564	1771	1963		2009	4.2	4.7	5.0	5.3	
2010	1096	1431	1678			2010	4.2	4.6	5.0		
2011	998	1468				2011	4.0	4.6			
2012	1003					2012	4.0				

Products											
2006	7.6	8.4	9.1	9.5	9.9						
2007	7.9	8.8	9.3	9.7	10.0						
2008	8.0	8.7	9.2	9.5	9.7						
2009	7.9	8.5	8.9	9.2							
2010	7.8	8.4	8.8								
2011	7.6	8.4									
2012	7.8										

Source: Authors' calculations from export transactions database.

Firms that are able to continue exporting in the following year grow faster and are able to diversify products and destinations. In Table 26 we compute the average annual growth rate for firms that survive a different number of consecutive years. We observe that survivors grow faster than exiters. Firms that survive to the following year grow at an average rate of 32 percent while those that export for only one year grow at a rate of 6 percent. Firms that have exported for 5 years but do not export in the next year show growth rates that are, on average, 12 percentage points lower than those that keep on exporting. Survivors are more likely to be firms that have started exporting a "new" product never exported before. About 57 percent of firms that are able to keep exporting in the following year have exported a "new" product while only 40 percent of firms that did not survive exported a "new" product. The role of diversification is more evident along the destination dimension. Survivors are more likely to be firms that are able to reach new markets. About 49 percent of firms that will keep exporting in the following year have exported to a "new" destination (never reached before) against 28 percent for non-survivors.

Table 26: Growth and diversification performance of survivors

	Average Annual Growth		% of Diversifier (markets)***		% of Diversifier (products)***	
At least:*	Survive	Do not survive**	Survive	Do not survive	Survive	Do not survive
1 year	31.6	6.2	49%	28%	57%	40%
2 years	32.2	13.4	52%	30%	59%	43%
3 years	31.0	16.7	54%	31%	60%	44%
4 years	30.7	18.7	56%	33%	63%	46%
5 years	35.0	23.3	59%	35%	65%	49%

Source: Authors' calculations from export transactions database. This table compares firms that survive at least 1 (or 2,3,4 and 5) years to those that export for less than 1 (or 2,3,4 and 5) years. This is independent of when a firm started exporting.

Export flows exhibit better survival outlooks when more export-relevant information is available for exporters about a destination. Accumulated experience with exporting to a particular destination has beneficial effects on the probability of surviving. The presence of exporters, in particular very large exporters, with experience in foreign markets produces positive spillovers in terms of knowledge sharing and accessibility.

Competition among firms for the export of similar products reduces the probability of survival. The number of exporters of similar products and the level of competition among them are negatively associated to the probability of export-flows to survive to the next year.

Box 8: What determines export survival?

We estimate a probability model where the dependent variable is the probability of export-flow to survive to the next year, which is related to firm and sector level characteristics. Table 27 reports the results. The results confirm our previous findings that diversification along both the product and destination dimensions increase survival probability. Export flows exhibit better survival outlooks when more export-relevant information is available for exporters about a destination. Accumulated experience (proxied by the number of exporters to a destination) with exporting to a particular destination is positively associated with the probability of surviving. We observe the opposite as far as the number of exporters of the same product is concerned. Considering the coefficients of the Herfindahl index, while a more competitive market within a destination increases survival probabilities, the opposite is observed for competition among firms exporting the same product. Finally, we observe that firms in sectors that have a greater competitive advantage have greater chances to survive similarly to export flows towards the EU as opposed to other regions.

Table 27: Growth and diversification performance of survivors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Number of exporters to destination	0.017***		0.017***	0.017***	0.012***	0.011***	0.011***		0.010***
	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)		(0.001)
Number of exporters of product		0.010***	-0.000	-0.000	-0.000	-0.000	-0.000		-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)
Initial value (log)	0.206***	0.206***	0.206***	0.205***	0.210***	0.228***	0.228***	0.229***	0.229***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
RCA (Revealed Competitive Advantage)				0.024***	0.025***	0.056***	0.056***	0.048***	0.048***
				(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Number of destinations reached					0.013***	0.010***	0.010***	0.010***	0.010***
					(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of products exported						0.003***	0.003***	0.004***	0.004***
						(0.000)	(0.000)	(0.000)	(0.000)
Herfindahl Index destination (Higher = greater concentration)								0.070***	0.070***
								(0.002)	(0.002)
Herfindhal index product (High values = greater concentration)								-0.005*	-0.005*
								(0.002)	(0.002)
EU dummy	0.534***	0.534***	0.534***	0.533***	0.518***	0.501***	0.501***	0.505***	0.505***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1491263	1491263	1491818	1491263	1491263	1491263	1491263	1491263	1491263

Source: Authors' calculations from export transactions database. The table reports the changes in log odds (the coefficients) obtained using a Logit model associated to each variable. Robust standard errors in parenthesis. *** Significance at 1%, ** at 5% and * at 10%.

Chapter 2

The Role of Exchange Rate and Non-Exchange Rate Related Factors in Polish Firms' Export Performance

Over the last fifteen years, firms in Poland have become increasingly internationalized. New firms have entered export markets, and firms already exporting have increased the intensity of their exposure to foreign markets. The decrease in trade costs that resulted from the association with the EU, and the formal accession to that enlarged market were important drivers of this process. What were the underlying factors that, at the firm level, facilitated this internationalization? Why have some firms thrived and grown while others have struggled to compete?

This chapter focuses on price and non-price determinants of export performance. It examines the factors affecting export market participation and export intensity. A key price-related determinant of export performance is the real exchange rate. Another one is the level and the dynamics of productivity. Understanding the role that these factors play in external competitiveness is crucial for Poland as the prospects of euro adoption are being evaluated.

Conceptually, large real exchange shocks, for example, may have long-lasting, firm-level composition effects if they irreversibly impact on entry and exit into and from export markets (Baldwin and Krugman, 1989). Such an impact depends on the characteristics of the economy at large and of the individual firms populating it – for example, the currency mismatches firms have in their balance sheets. Exporting firms that source all of their inputs domestically are more likely to see their profit margins increase after a depreciation of the domestic currency than firms that are highly integrated into regional or international production networks and that import substantial portions of their intermediates, that borrow in foreign currency, or that have wage setting schemes indexed to foreign currency

Productivity, on the other hand, has been identified as one of the most important factors underlying the fuzzy concept of "competitiveness" (e.g.: Krugman, 1994; Porter, 1990).[1] Firms' productivity levels, at the heart of the income convergence process of a country, interact in complex ways with their degree of internationalization, including foreign ownership, and participation in export and import markets. More productive firms are better positioned to face the highly demanding international markets, and in turn they become more productive by facing increased competition and by learning from sophisticated competitors and clients. In this report, we put particular attention to productivity dynamics, both at the firm and aggregate levels. We decompose aggregate total factor productivity (TFP) growth into four components to understand how market relocations, within-firm productivity growth, and entries and exits have contributed to the overall observed pattern.

[1] For example, Porter (1990) argues that "the only meaningful concept of competitiveness at the national level is productivity". Then, Krugman (1994) argues that "competitiveness" would turn out to be a funny way to saying productivity.

The chapter also looks at non-price determinants of competitiveness such as liquidity and R&D expenditure, as well as at spillovers. The methodology explores detailed information about firms' characteristics and takes into account the dual decision process that firms face when participating in the global marketplace: (i) whether to participate, and (ii) the intensity with which they participate.

The remainder of the chapter is structured as follows. Section 2 presents the highlights of the report. Section 3 examines in detail the productivity dynamics. Section 4 looks at the drivers of the firm decision to export, exploring price and non-price related factors. Section 5 presents the analysis of the drivers of the intensity with which firms participate in global markets, given that they have decided to participate.

Summary

We investigated the evolution of firm total factor productivity (TFP) for the whole economy and by sectors and the determinants of export participation and intensity, through the use of regression analysis, using a representative sample of Polish firms in the manufacturing sector.

Productivity

- The average increase in TFP over the period 2005-2013 has been of 5 percent per year.
- Productivity gains have been heterogeneous by sector. Largest improvements in TFP are observed in the Computer and Electronics sector (9 percent) and in the Furniture, Other Transport Equipment and Wearing Apparel (8 percent).
- Firm entry and exit have contributed little to total productivity growth, overall productivity growth can instead be almost equally attributed to more productive firms gaining market share and firms increasing their productivity.
- The 2009 economic crisis, which of course hit the hardest sectors more exposed to the international market and in particular the EU, also helped reallocating resources into more productive activities. In fact during 2009 and 2010 allocative efficient contributed twice as much as the average of the entire 2006-2013 period to aggregated productivity gains.

Export Participation

- Exporters are on average larger, more productive, and are more likely to be foreign owned.
- Firms face high sunk costs for entering the export market, which make firms that exported in the previous year 50 percent more likely to export also in the following year (after we tackle endogeneity issues). The returns of having paid these sunk costs, however, depreciate rapidly over time meaning that firms rapidly lose the benefits of the initial investments if they exit export markets.
- We also find strong, significant and positive local spillovers indicating that proximity between exporters in the same sector reduces entry costs. This could be due to lower cost of production given by an increased availability of specialized capital or/and labour inputs, or due to the increased availability of market information, which reduces search costs.

- Real exchange rate shocks affect firms' revenues and costs. A depreciation of the Polish zloty, for example, increases the export revenues expressed in Zloty, while it also increases the imported input bill of the firm expressed in the same currency. Given the level of import penetration in the intermediate inputs market across sectors, we estimate that firms in the Motor vehicles sector are more likely to be relatively hedged against a depreciation of the Polish Zloty. The opposite is expected for firms in the Furniture, Wood, Printing and media, Other non-metallic mineral, Food and beverages sectors that rely mostly on domestic inputs.
- Qualitative evidence based on interviews conducted with selected firms suggest that changes in profits associated with real exchange rate shocks are perceived as 'noise' by most firms, affecting their ability to conduct long term investment and innovation.
- Liquidity plays an important role by facilitating entry in the export market. It is more liquid firms that are more likely to export, suggesting that access to finance is an import factor determining export success.
- We found no robust relationship between R&D expenditure and participation in export markets – it is worth mentioning, however, that the portion of firms reporting R&D expenditures is extremely low, which may prevent us from picking up on any effect., and which in turn suggests that firms exporting are not particularly intensive in the type of innovation that requires R&D expenditures.

Export Intensity

- Total factor productivity growth impacts export growth, although the effect is small from an economic point of view – a 10 percent increase in TFP leads to less than a 1 percent increase in export values, all else equal.
- Real exchange rate shocks have no significant impact on export volumes. There is some unsystematic evidence, however, that depreciations may positively affect export intensity to those firms that do not use imported intermediates intensely.

Total factor productivity dynamics

In this section we analyze total factor productivity dynamics of Polish firms. Aggregate overall and sector-level productivity is a weighted average of productivity at the firm level. Its dynamics can be broken down into four components (for details on the methodology, see Box 9):

1. Changes in firm-level productivity, given firms' market shares.
2. Changes in market shares, given firm-level productivity.
3. Entry of firms
4. Exit of firms

Box 9: Decomposing Productivity Growth
We decompose overall growth by employing the dynamic Olley-Pakes decomposition with entry and exit (DOPD) method proposed by Melitz and Polanec (2014). This method was proposed as an extension of the previous OP decomposition method (Olley and Pakes, 1996) to take into account the contributions of entry and exit. It tracks individual firms over time to analyse the

pattern of market share reallocations across firms and its consequences for aggregate productivity. Total factor productivity, Φ, in two periods (1 and 2) can be defined as follows:

$$\Phi_1 = S_{S1}\Phi_{S1} + S_{X1}\Phi_{X1} = \Phi_{S1} + S_{X1}(\Phi_{X1} - \Phi_{S1}),$$
$$\Phi_2 = S_{S2}\Phi_{S2} + S_{X2}\Phi_{X2} = \Phi_{S2} + S_{X2}(\Phi_{X2} - \Phi_{S2}),$$

where S is the market share of survivors (S), entrants (E) and exiters (X). It follows that aggregate productivity change can be decomposed according to the following relationship:

$$\Delta\Phi = (\Phi_{S2} - \Phi_{S1}) + S_{E2}(\Phi_{E2} - \Phi_{S2}) + S_{X1}(\Phi_{S1} - \Phi_{X1}).$$

Aggregate TFP is, therefore, decomposed into components for the three groups of firms: survivors, entrants, and exiters. The survivors' component can be further decomposed using the OP decomposition :

$$\Delta\Phi = \Delta\varphi_S + \Delta COV_S + S_{E2}(\Phi_{E2} - \Phi_{S2}) + S_{X1}(\Phi_{S1} - \Phi_{X1}).$$

The first component is separated to distinguish the contribution of surviving firms into one induced by a shift in the distribution of firm productivity (the unweighted mean change in the productivity of surviving firms φ_S) and another one induced by market share reallocations (the covariance change between market share and productivity for surviving firms COV_S).

Data and Summary statistics

The analysis is based on F01 database of Polish firms over the period 2005-2013. We consider only firms in the manufacturing sector given the lack of aggregate trade data for service sectors. Moreover, this allows us to benchmark our results with the findings of the academic literature that focuses only on manufacturing firms. The sample comprises about 21,000 manufacturing firms. The data have an unbalanced structure, with an average of about 5 observations per firm. Table 28 reports the number of firms by number of years.

Table 28: Manufacturing firms by number of years recorded in the dataset

Number of years	Number of firms
1	3122
2	2260
3	2078
4	1618
5	1736
6	1465
7	1271
8	1172
9	6254
Total	20976

Source: Authors' calculations from F01 dataset

The average increase in TFP over the period 2005-2013 has been of 5% per year. TFP growth by sector is reported in Table 29. Largest improvements in TFP are observed in the computer and electronics sector (9%) and in the furniture, other transports and wearing

apparel sectors (8%). The worst performance is observed in the coke and refined petroleum sector which, however, shows very volatile TFP levels across years.

Table 29: TFP growth by sector

Sector	TFP growth (2005 – 2013)	Sector	TFP growth (2005 – 2013)
Food	4%	Pharmaceutical	0%
Beverages	5%	Rubber and plastic	4%
Tobacco	1%	Other non-metallic mineral	4%
Textiles	7%	Basic metals	-1%
Wearing apparel	8%	Fabricated metal	5%
Leather	6%	Computer, electronic and optical	9%
Wood	5%	Electrical equipment	6%
Paper	4%	Machinery	5%
Printing and media	4%	Motor vehicles	7%
Chemicals	3%	Other transport	8%
		Furniture	8%
		Other	4%

Source: Authors' calculations from F01 dataset

Results of TFP growth decomposition

More productive firms are managing to gain market shares and driving aggregate productivity growth. The decomposition analysis for overall TFP is reported in Table 3 for each year and for the entire period 2006-2013. Considering the average TFP growth for the entire period 2005-2013, about half of total growth (2.2%) is due to more productive firms gaining market share (Between-firm effect). This result suggest that market mechanisms are at work and that resources are reallocated away from less productive and into more productive uses, which tends to be a powerful vehicle for growth and convergence.

In only two instances, in 2007 and 2012, the growth-enhancing 'Darwinian' selection mechanism was interrupted. Looking at annual growth rates, we observe that the between-firm effect, due to more productive firms gaining market shares, has been sometimes positive and sometimes negative. It has been particularly negative in 2012 so to drive down overall TFP growth. In particular, it was mainly in the computing, electronic, basic metals and beverages sectors that more productive firms were losing market shares.

The 2009 financial crisis induced a temporary decrease in firm-level productivity in major exporting sectors. The effect of the crisis was felt also in the subsequent year (within-firm effect). It was mainly driven by a decrease in productivity of firms in the two major exporting sectors: Motor vehicles and Machinery. Other sectors that were also particularly affected were other Non-metallic and Fabricated metal sectors. The crisis also helped reallocating resources into more productive activities. During 2009 and 2010 allocative efficient contributed twice as much as the average of the entire 2006-2013 period to aggregated productivity gains.

The net effect of entrants and exiters is positive with entrants being more productive, on average, then exiters. Their contribution to overall growth is, however, very small, accounting

for less than 1 percent of the productivity growth observed during the period 2006-2013 (Table 30).

Table 30: Overall TFP growth decomposition using DODP

Year	Overall change in TFP $\Delta\Phi$	Within-firm effect $\Delta\varphi_S$	Between-firms effect ΔCOV_S	Entrants $S_{E2}(\Phi_{E2} - \Phi_{S2})$	Exiters $S_{X1}(\Phi_{S1} - \Phi_{X1})$.
2006	0.089	0.058	0.030	0.0014	-0.0008
2007	0.067	0.077	-0.011	0.0013	-0.0013
2008	0.072	0.045	0.027	0.0015	-0.0009
2009	0.022	-0.021	0.041	0.0031	-0.0018
2010	0.035	-0.007	0.042	0.0012	-0.0010
2011	0.058	0.023	0.035	0.0011	-0.0013
2012	-0.021	0.008	-0.030	0.0015	-0.0012
2013	0.090	0.048	0.042	0.0015	-0.0006
2006-2013	0.051	0.029	0.022	0.002	-0.001

Source: Authors' calculations from F01 dataset. .

Poland's performance in allocative efficiency is high when compared tot eh international experience. Table 31 reports the results from TFP decomposition for other countries based on available empirical studies. It shows that TFP growth is mostly explained by within-firm growth. Similarly to what we found for Poland, entry and exit have little effect on aggregated productivity growth.

Table 31: TFP growth decomposition for other countries

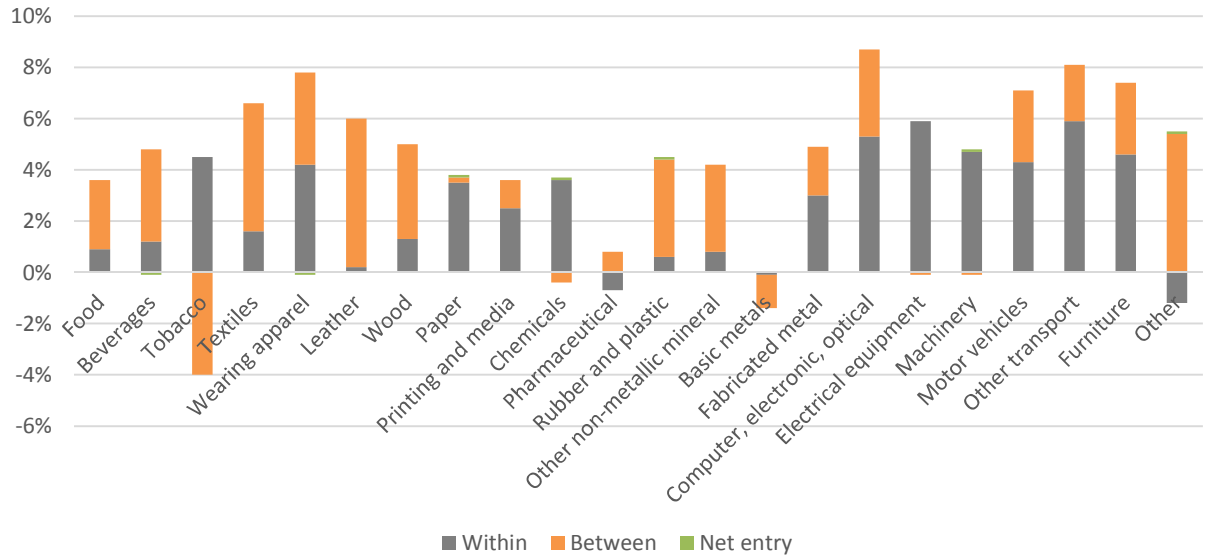
Country	*Period*	*Within*	*Between*	*Entry*	*Exit*	*TFP growth*	*Study*
Portugal	1997-2000	0.0096	0.0008	0.0005	-0.0002	0.0107	Carreira & Teixeira (2009)
France	1991-2006	0.0390	-0.0133	0.0013 (net)		0.0229	Osotimehin (2013)
Slovenia	1996-2000	0.208	0.041	0.0132	-0.0003	0.2621	Melitz & Polanec (2015)
Tunisia	1996-2008	0.0288	0.0014			0.0302	Marouani & Mouelhi (2013)
China	1998-2007	0.0305	0.0056	0.0026	0.0013	0.0399	Du, Liu & Zhou (2014)
Colombia	1982-1998	0.0108	0.0038	0.0001 (net)		0.0147	Eslava et al. (2006)
Belgium	1996-2003	0.01037	0.0003			0.0104	Van Beveren (2010)

Note: firm coverage differs across studies, so comparisons should be done with caution.

Figure 27 reports the decomposition for each manufacturing sector for the average of the period 2006-2013. The net contribution of entrants and exiters is negligible across all sectors. The increase in aggregate TFP in the Leather sector and the decrease in the Metals sector are entirely accounted for more productive firms gaining and losing market share, respectively. On the other hand, the increased TFP experienced by the Paper sector is largely explained by existing firms increasing their productivity. The largest increase in productivity experienced by Computer and Electronic sector is due to both an increase in firm productivity (60 percent of it) and a market reallocation towards most productive firms (39 percent of it). Finally, the very

large decrease in aggregate productivity in the Coke and petroleum sector is almost entirely explained by most productive firms losing market shares.

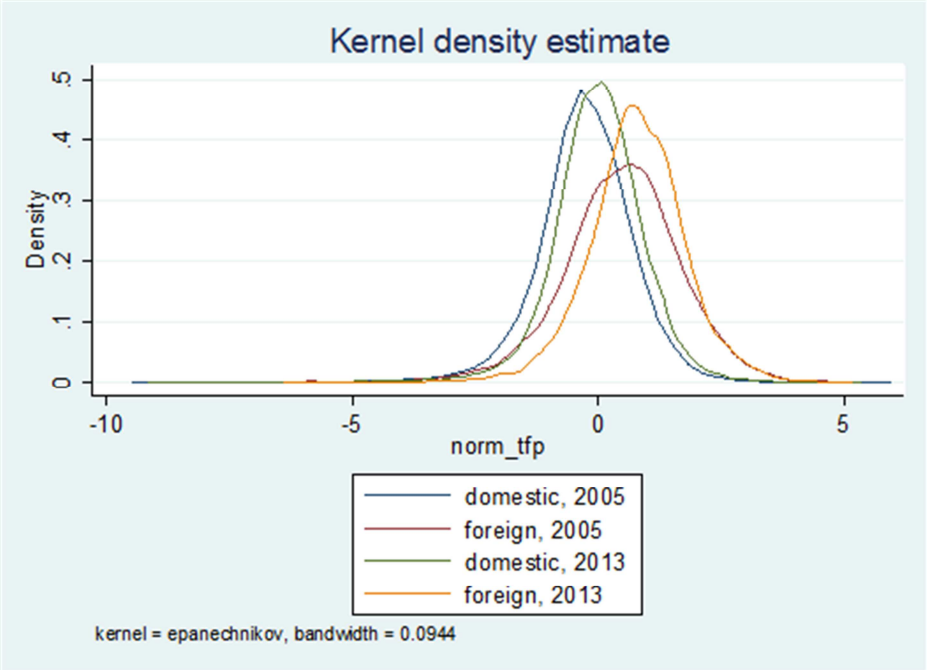
Figure 27: Decomposition of TFP Growth by Sector



Source: Authors' calculations from F01 dataset.

Foreign owned firms are more productive but domestic firms have shown greater improvements over the period. Figure 28 shows the distribution of TFP for both domestic and foreign firms in 2005 and 2013. Domestic firms have increased their productivity over the period. Improvements have been experienced at all levels of productivity shifting the entire distribution towards the more productive foreign firms. Foreign firms have also, on average, increased their productivity but improvements have mainly be experienced by less productive firms.

Figure 28: Distribution of TFP for domestic and foreign firms



Source: Authors' calculations from F01 dataset.

Decision to export

What drives a firm's decision to participate in export markets? This section of the report looks at different factors that may affect a firm's propensity to export in Poland. Starting with the characteristics of the firm itself, we explore whether size, ownership structure, R&D expenditure and past performance are important for export decisions. Next we consider four main factors that might matter for entry into foreign markets: sunk costs, real exchange rates, geographical and sectoral spillovers, and liquidity constraints (see Box 10 for the methodology).

The role of sunk costs in preventing participation in the export market has been extensively addressed in the literature (Dixit, 1989; Baldwin and Krugman, 1989). The high fixed costs associated with exporting are important barriers, in particular for small and medium enterprises to participate in the global marketplace. Following Bernard and Jensen (2004), we test for the presence of entry costs by looking at the effects of exporting in period t-1 on exporting in period t.

Second, we look at the role of real exchange shocks on the decision to export. We construct sector-level exchange rates, which takes account of the destination composition of each sector, and estimate the participation response to positive RER changes (i.e.: depreciations of the domestic currency). Real exchange rate depreciations increase the zloty-denominated revenues associated with export flows, but also make the inputs they import more expensive. Following Greenaway et al. (2010) we account for different exposures to changes in the price of imported-inputs at the firm level by considering the ratio between imported and total intermediates used.

Third, activities of neighbouring firms may affect a firm's entry costs into export markets due to spillovers. For example, a cluster of firms in a given location may increase the supply of necessary skills for a particular activity, improve infrastructure or increase the stock of information about foreign markets that may be available to other firms. On the other hand, a high concentration of firms in a specific location may push input prices upwards through increased demand, which may affect other firms negatively. For these reasons the sign of the effect is a priori ambiguous and warrants an empirical investigation. We explore the role of location and sectorial spillovers on firms' export decisions. In particular we look at the effects of activities of other firms in the same sector or region.

Fourth, we explore whether a firm's financial conditions affect the decision to enter export markets. A priori, given the high fixed costs associated with exporting, and the fact that production takes time and there is a lag between the moment in which input are purchased and the moment in which revenues are cashed, exporting firms have particularly high financial needs (see Greenaway et al. (2007)).

Box 10: Methodology for the estimation of the determinants of the decision to export
Following Bernard and Jensen (2004), we initially estimate the following reduced form model: $$d_{ist} = \beta X_{it} + \gamma Z_{st} + v_t + u_i + \varepsilon_{ist}, \quad (1)$$ Where d_{ist} is a dummy indicating whether firm i in sector s exported in year t. X_{it} are plant

level characteristics while Z_{st} are sector-level variables such as the real exchange rate. We estimate the model using a linear probability framework (i.e. the error term, ε_{ist} , is assumed to be normally distributed) that allows us to control for time-invariant unobserved heterogeneity by including firm fixed effects, u_i. Despite the binary nature of the dependent variable, a linear probability model is preferred because the inclusion of firm fixed effects does not bias the estimates (Angrist, 2008). Linear probability models provide good estimates of the partial effects for average values of the explanatory variables and the coefficients allow for a straightforward interpretation of the effects (Wooldridge, 2002). We also include time dummies, v_t, to control for common shocks such as changes in the business cycle, trade liberalization across all industries and overall changes in demand that affect all firms. All regressors are logged and lagged one period to reduce possible simultaneity problems. Because one of our variables of interest is the lagged dependent variable we also implement the system GMM estimator (Blundell-Bond, 1998) that deals with endogeneity concerns by instrumenting with lagged first-differences of the explanatory variables.

Source: Authors' elaboration

Summary statistics

Table 32 reports the share of exporters by sector. About 70% of the firms in the sample have exported at least in one year. The share ranges between 0.45 in the Food industry and 0.83 in the Motor vehicles and other transport sectors.

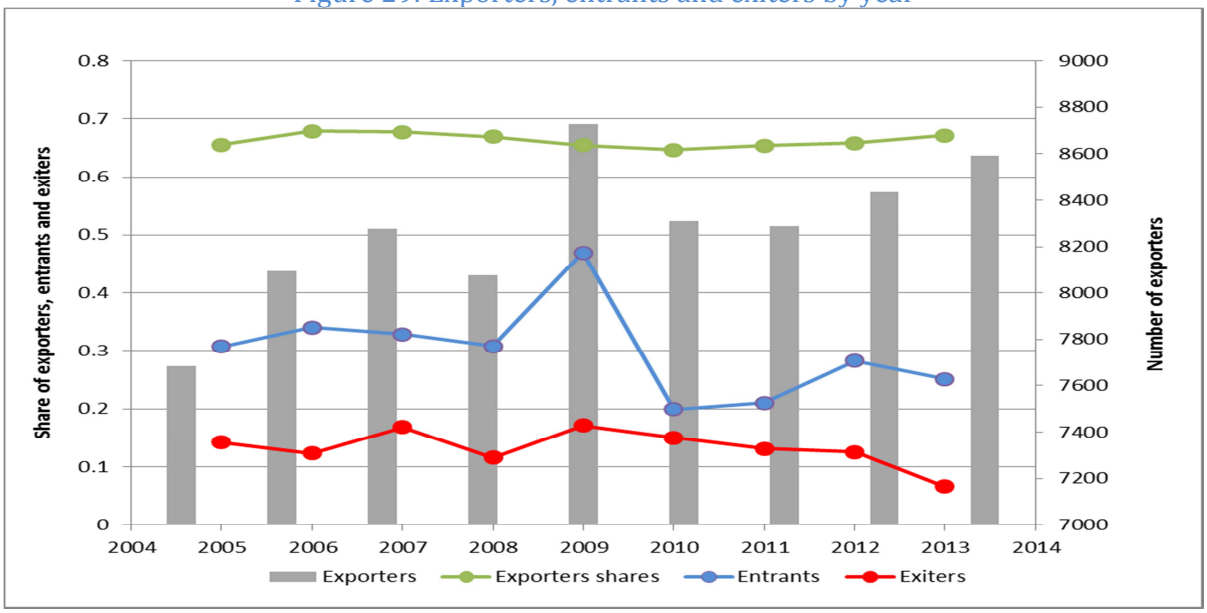
Table 32: Share of exporters by sector

Sector	Share of exporters	Sector	Share of exporters
Food	0.46	Rubber and plastic	0.77
Beverages	0.54	Other non-metallic mineral	0.50
Tobacco	0.82	Basic metals	0.80
Textiles	0.78	Fabricated metal	0.67
Wearing apparel	0.71	Computer, electronic and optical	0.70
Leather	0.75	Electrical equipment	0.72
Wood	0.73	Machinery	0.74
Paper	0.66	Motor vehicles	0.83
Printing and media	0.52	Other transport	0.83
Coke and refined petroleum	0.74	Furniture	0.81
Chemicals	0.76	Other	0.77
Pharmaceutical	0.66		

Source: Authors' calculations from F01 dataset

Figure 29 shows the share and the total number of exporters by year as well as the fraction of exporters that stopped exporting and the share of non-exporters that started exporting. The peak in the number of exporters observed in 2009 is mainly due to a rise in entrants, while the increasing trends in exporters observed since 2011 is due to both an increase in entrants and a decrease in exiters. The share of exiters has been stable overtime, averaging around 11% of exporters, and only since 2010 has it started to decrease. On the other hand, the fraction of entrants is more volatile and averages around 30% of non-exporters. Overall the figure highlights that exporting is not a once-and-forever phenomenon since year- to- year transition rates are notable.

Figure 29: Exporters, entrants and exiters by year



Note: Authors' calculations from F01 database. The green line indicates the share of exporters over the total number of firms. The blue (and red) line indicates the share of firms that entered (exit) the export market in a given year.

Firms that export are larger than those that do not, they are more productive and pay higher wages. Table 33 compares the average characteristics of exporters and non-exporters. Results confirm what we typically find in the literature (see for example Bernard and Jensen, 2004 and Greenaway and Kneller, 2004), Furthermore, foreign owned firms are more likely to export, 26% of exporters are foreign owned again 5% of non-exporters. Considering TFP, we can see that exporters are 12% more productive than non-exporters. The ratios for exporters/non-exporters on employees, wages and productivity are roughly in line with what is found in the literature for other European economies (see Figure below). Descriptive statistics by sector are reported in the Appendix.

Table 33: Characteristics of exporters and non-exporters

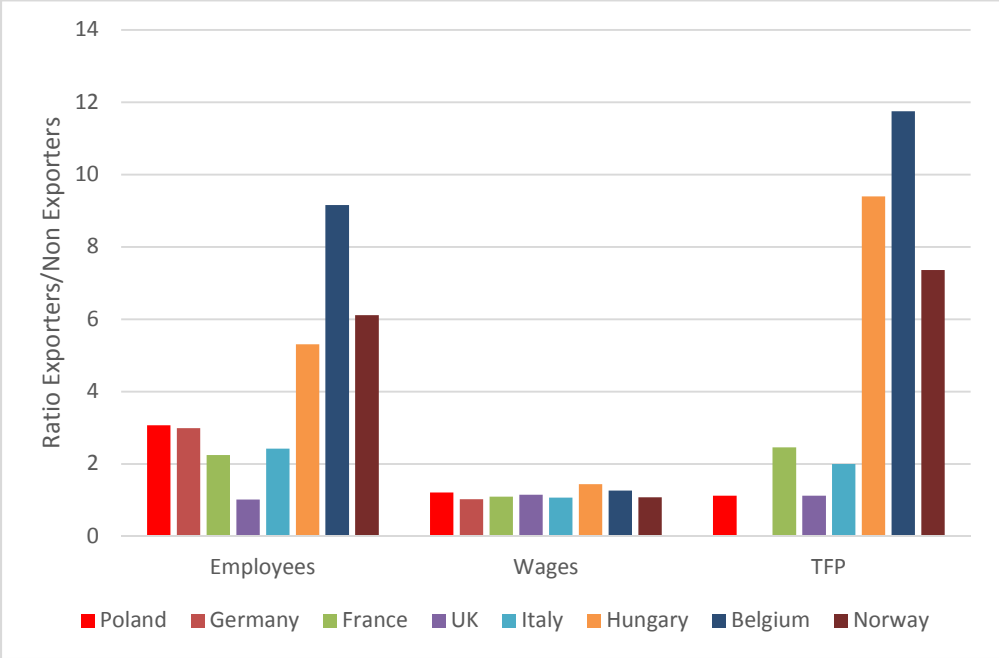
Variable	Exporters	Non-exporters
Employees	177.86	58.02
	(379.10)	(95.37)
Wage	35	29
	(89)	(91)
TFP	4.68	4.17
	(0.88)	(0.87)
Foreign	0.26	0.05
	(0.44)	(0.22)
Observations	74479	37898

Source: Authors' calculations from F01 database. Tables reports sample averages and standard deviations in parentheses. Wages are in thousands PLN.

Figure 30 shows the ratio of wages, employees and productivity of exporters over non-exporters for Poland and a selected number of countries. Polish exporters are about 3 times larger than non-exporters, similarly to Germany (2.99) and above France (2.24) and Italy (2.42). The wage premia for exporters (20 percent) is similar to what is observed in the UK (15

percent) and Belgium (26 percent) and is much larger than in Germany (2 percent), France (9 percent) and Italy (7 percent). While in Poland exporters are 12 percent more productive than non-exporters, as in the UK (12 percent), firms in Germany and Italy show greater productivity differential, 145 percent and 200 percent more respectively. The productivity premia is substantially higher in Hungary, Belgium and Norway where, however, exporters are also substantially larger than non-exporters.

Figure 30: Benchmarking against other European Countries



Source: Authors' elaboration based on Mayer & Ottaviano (2007).
Note: comparisons across countries should be read as rough indicators and interpreted with caution as these ratios are constructed for different periods.

Descriptive Statistics on Main Drivers of Export Decision

Spillovers

To estimate the effect of spillovers from the activities of other firms in the same sector or region we follow Bernard and Jensen (2004) and construct three different measures of geographic and sectoral spillovers. Region-specific spillovers are captured by export activity in the region but outside the three-digit (NACE Rev2) sector. Sector-specific spillovers refer to activities in the same sector but outside the region where the firm is located. Finally, local spillovers are captured by export activity in the same sector and region as the firm. Spillovers are computed both in terms of number of exporters and value of exports. Table 34 provides a detailed description of our measures of spillovers.

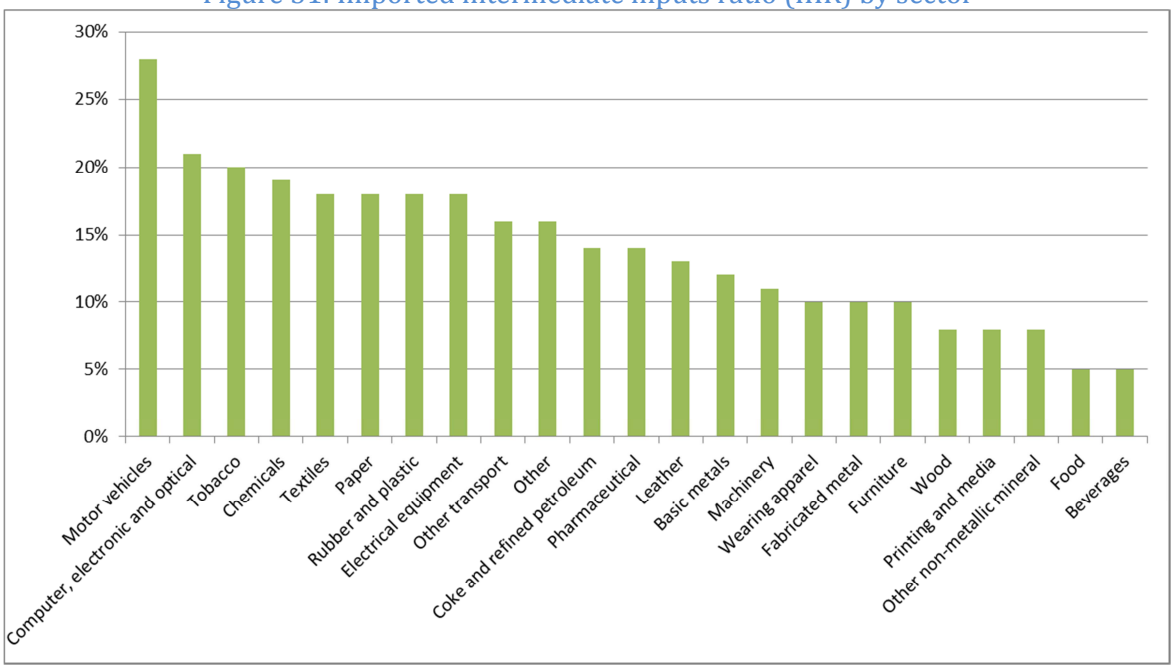
Table 34: Variables used to measure spillovers

Variable	Description
Exporter (region)	(Exporting firms)/(total firms) for firms in the region and outside the Nace 3 digit sector
Exporter (sector)	(Exporting firms)/(total firms) for firms in the Nace 3 digit sector and outside the region
Exporter (region-sector)	(Exporting firms)/(total firms) for firms in the region and in the Nace 3 digit sector (excluding firm in question)
Exports (region)	Exports/(total shipments) from firms in the region and outside the Nace 3 digit sector
Exports (sector)	Exports/(total shipments) from firmsin the Nace 3 digit sector and outside the region
Exports (region-sector)	Exports/(total shipments) from firms in the region and in the Nace 3 digit sector (excluding firm in question)

Real Exchange Rate

To analyse the role of the exchange rate on the probability of exporting we construct sector level (3 digit NACE rev2) real effective exchange rates (REER). Following Bernard and Jensen (2004) we construct export-weighted averages of real exchange rate where weights are average export shares of the partner country during the entire period. Data on nominal exchange rates and national deflators were taken from the World Bank Development Indicators. Data on bilateral trade were obtained from Comtrade through WITS. In order to assess the potential offsetting effect of imported intermediates we follow Greenaway et al. (2006) and construct the ratio of imported intermediate to total intermediates (IIIR). Figure 31 reports average IIIR by sector while the evolution of the REER over time by sector is reported in the Appendix. Largest fluctuations in the REER are observed in the chemicals, coke and refined petroleum products, fabricated metals, other transport and tobacco sectors.

Figure 31: Imported intermediate inputs ratio (IIIR) by sector



Source: Authors' calculations from F01 database.

Firms in the motor vehicles, Computer, electronic and optical sector tend to rely more on imported intermediates. About 28 percent of intermediate costs in the motor vehicles sector are due to imports of material. The lowest share is found in the beverages and food sector.

Financial Conditions & R&D Expenditure

Considering the financial factors variables (Table 35), liquidity is defined as the firm's current assets minus current liabilities over total assets, while leverage is defined as the firm's ratio of short-term debt to current assets. Current assets are those reasonably expected to be converted into cash within one year (cash, accounts receivable, inventories, marketable securities, etc). The higher its liquidity ratio and the lower its leverage ratio, the better the firm's financial health. The table shows that exporters are characterized by a higher liquidity ratio (0.15 on average) than non-exporters (-0.12 on average), while non-exporters display a higher average leverage ratio (1.41 on average) compared to exporters (0.89 on average). The difference is persistent over time. This descriptive evidence, therefore, suggests a link between firms' financial health and export status.

Table 35: Financial status of exporters and non-exporters over time

Year	Liquidity		Leverage		R&D	
	Exporters	Other	Exporters	Other	Exporters	Other
2005	0.10	0.02	0.93	1.31	11.43	1.46
	(0.59)	(1.02)	(1.48)	(5.03)	(200.80)	(26.18)
2006	0.13	0.02	0.90	1.38	18.06	1.59
	(0.65)	(1.54)	(1.52)	(7.57)	(409.88)	(63.62)
2007	0.15	0.02	0.85	1.21	53.27	0.55
	(0.49)	(2.88)	(1.92)	(5.10)	(3092.72)	(14.95)
2008	0.14	0.00	0.93	1.28	38.15	1.10
	(0.71)	(5.00)	(4.42)	(9.65)	(1672.41)	(28.45)
2009	0.16	0.08	0.85	1.26	38.42	1.33
	(0.52)	(0.94)	(1.34)	(5.72)	(1658.95)	(28.99)
2010	0.16	0.07	0.87	1.14	93.79	0.80
	(0.50)	(1.58)	(2.48)	(3.54)	(6058.12)	(19.67)
2011	0.18	-0.06	0.82	1.26	75.83	3.48
	(0.43)	(9.22)	(1.98)	(9.87)	(3161.43)	(124.26)
2012	0.18	-1.43	1.02	2.69	55.46	2.17
	(0.54)	(102.11)	(19.73)	(102.20)	(1691.74)	(74.77)
2013	0.15	0.11	0.83	1.12	76.76	3.10
	(3.55)	(1.10)	(3.95)	(4.00)	(2623.64)	(100.73)

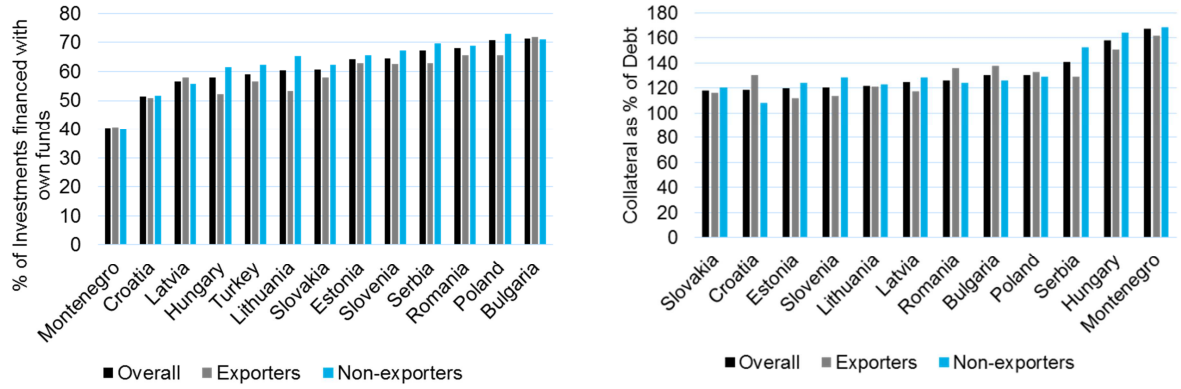
Source: Authors' calculations from F01 database. Tables reports sample averages and standard deviations in parentheses.

Access to finance has been identified as a constraint for innovation (among various sectors), and for business operations (for services). Banks do not finance projects on which they do not have priors of returns. Even successful firms may struggle to obtain bank financing for innovative projects due to information asymmetries between lenders and creditors. Field interviews reveal that banks tend to be willing to fund activities with a well-established track record of success, but are reluctant to finance innovations. The entrepreneur operating in the motor vehicle sector, in particular, indicated that banks had not perceived that developing

hybrid technologies was going to be a promising activity. They had less information about the project than the entrepreneur did, and took a more risk adverse stance.[2]

Banks do not finance "non-collateralizable" ideas. In the services sector, firms struggle to get credit from financial markets due to the intangible nature of their assets (non-collateralizable). During our fieldwork, an entrepreneur in a small high-growth firm mentioned that because their main assets are ideas, which cannot be offered as collateral, his firm, and in general many knowledge-intensive services firms struggled to borrow from banks. In the small segment of the market, it was argued, the gap for financing is large, particularly for angel investors and venture capital.

Figure 32: Access to Finance in Poland and Benchmarks



Source: World Bank enterprise surveys.

Figure 32 provides a comparison of firms' ability to access financing in Poland and other countries. Polish firms tend to finance 70 percent of their investments with own funds. Although this should not necessarily be a source of concern, it may be a symptom of firms not being able to access external financing, and may be restricting the type of investments that are actually conducted. This ratio is higher than observed in Slovakia, Lithuania, Estonia, Slovenia or Turkey. In addition, if we look at one indicator of external financing costs, such as the collateral as a portion of the debt, we observe that it is also high in Poland (130 percent) when benchmarked against comparators such as Slovakia (120 percent) and Lithuania (122 percent).

Results

Our first baseline results are reported in Table 36. It reports the coefficients on plant characteristics on the probability of exporting from the linear probability model. The first column, which reports pooled OLS estimates, confirms our initial findings. Foreign, larger and more productive firms have higher probabilities of exporting. Columns (2) – (5) report results in which firm-level fixed effects are added. Adding firm-level effects is useful to control for unobserved plant characteristics that may be correlated with the regressors and with the dependent variable at the same time. In this case, adding fixed effects reduces the scope of biases in the estimates. However, by adding fixed effects we are less likely to identify the specific effects of firm-level characteristics that show little variation over time.

[2] Evidence from the World Bank Enterprise Survey confirms that access to finance is a source of concern in Poland, with more than 30 percent of firms identifying that as an obstacle or a major obstacle for operations, higher than in most countries in the region.

Indeed, when we control for plant fixed-effects much of the effects of the firm-level characteristics are swept away. Total factor productivity and real wages are no longer significant and the foreign effect is no longer distinguishable from the firm fixed effect. This is reasonable if real wages, productivity and foreign ownership do not vary substantially over time at the level of the firm. An increase in size, however, still shows a strongly significant relationship with the probability of exporting. A 1% increase in employment at the firm level leads to a 6 percentage-point increase in the probability of exporting.

Table 36: Determinants of the decision to export - Baseline results

	(1)	(2)	(3)	(4)	(5)
Lag Log of Number of employees	0.121***	0.071***	0.063***	0.063***	0.056***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lag Log of real wages	0.060***	0.004	-0.002	-0.002	-0.001
	(0.000)	(0.508)	(0.734)	(0.728)	(0.817)
Lag Log of TFP	0.033***	0.003	0.003	0.003	0.003
	(0.000)	(0.277)	(0.275)	(0.275)	(0.298)
Lag REER at 3 digit	-0.003	-0.010	-0.007	-0.007	-0.014
	(0.773)	(0.140)	(0.304)	(0.303)	(0.125)
Lag Dummy: Foreign ownership	0.128***	0.004	0.002	0.002	0.003
	(0.000)	(0.698)	(0.795)	(0.796)	(0.741)
Lag Dummy exporter			0.137***	0.139***	0.135***
			(0.000)	(0.000)	(0.000)
Exporter in t-2 but not in t-1				0.005	0.003
				(0.636)	(0.815)
Sector-Year	Yes	Yes	Yes	Yes	Yes
Sector	Yes	No	No	No	No
Region	Yes	No	No	No	No
Observations	82443	82443	82443	82443	76806
Firms		16479	16479	16479	15887

Robust standard errors clustered at the firm level in parentheses. *** indicates significant at 1%, ** at 5% and * at 10%. Last column excludes outliers identified has observations with studentized residuals above 3 and below -3.

Sunk costs

Sunk costs are important determinants of the decision of exporting. This evidenced by the fact that having exported in the previous period significantly affects the decision of exporting in the current period, increasing the probability of exporting by 12 percentage points. Nevertheless, estimates are smaller than those found in Bernard and Jensen (2004) for the US and Greenaway et al (2007) for the UK. It is likely that given the single market conditions in the EU, and the portion of exports that are directed to that market, the sunk costs associated with exporting are relatively lower than those faced by US firms, or even by UK firms that have a more diversified market scope. Moreover, we do not find any positive effects of having last exported two years ago, indicating that sunk costs rapidly depreciate over time.

Table 37: GMM estimates

	(1)	(2)	(3)
Lag of Dummy exporter	0.474***	0.523***	0.382***
	(0.000)	(0.000)	(0.000)
Exporter in t-2 but not in t-1	0.291	0.071	0.123*
	(0.118)	(0.229)	(0.083)
Lag of Log of Number of employees	0.029***	0.025***	0.029***
	(0.006)	(0.008)	(0.004)
Lag of Log of real wages	-0.018	-0.024**	-0.016
	(0.101)	(0.017)	(0.102)
Lag of Log of TFP	0.000	0.001	0.001
	(0.895)	(0.809)	(0.871)
Lag of RER at 3 digit	-0.014	-0.008	-0.014
	(0.326)	(0.561)	(0.284)
Lag of Dummy: Foreign ownership	-0.006	-0.006	-0.003
	(0.658)	(0.695)	(0.854)
Year	Yes	Yes	Yes
Observations	64839	64839	53517
Firms	14106	14106	13011
Hansen Degrees of Freedom	23	34	23.000
Hansen test (p-value)	0.220	0.144	0.182
AR 1 Test	0.019	0.000	0.000
AR 2 Test	0.606	0.147	0.926

Robust standard errors clustered at the firm level in parentheses. *** indicates significant at 1%, ** at 5% and * at 10%. The first column uses all lags starting from the third as instruments. Column 2 consider also the second lag. Last column excludes outliers identified has observations with studentized residuals above 3 and below -3.

Table 37 reports the results using the Arellano-Bond estimator that deals with the endogeneity of the lag dependent variable. The lag dependent variable is instrumented with its third and fourth lag. The coefficient of the lag dependent variable becomes larger and confirms the presence of sunk costs in entering the export market. Having exported in the previous year increases the probability of exporting today by 50 percentage points. These costs, however, depreciate rapidly over time as previously found.

Export Spillovers

We now turn our attention to the role of the spillovers between the activities and locations of other firms and export behaviour. Table 38 reports the coefficients of our three measures of spillovers: region-specific spillovers, sector-specific spillovers and local spillovers. As discussed above, we consider two specifications, one based on the number of firms and another based on the value exported at the region, sector, and region-sector levels. Columns 1,2 and 4 consider the ratio of exporting firms to total firms in the category while columns 3 and 5 consider the ratio of total exports by value to total shipments in the category.

Table 38: The impact of activities spillovers on export decision

	(1)	(2)	(3)	(4)	(5)
Lag Log of Number of employees	0.062***	0.055***	0.070***	0.048***	0.054***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lag Log of real wages	0.004	-0.002	0.005	-0.000	0.001
	(0.545)	(0.743)	(0.463)	(0.939)	(0.926)
Lag Log of TFP	0.002	0.002	0.003	0.002	0.003
	(0.397)	(0.398)	(0.280)	(0.457)	(0.291)
Lag REER at 3 digit	-0.015**	-0.012*	-0.003	-0.005	0.001
	(0.033)	(0.083)	(0.606)	(0.440)	(0.925)
Lag Dummy: Foreign ownership	0.009	0.007	0.007	0.008	0.005
	(0.373)	(0.422)	(0.465)	(0.390)	(0.589)
Exporter (region)	0.162	0.142		0.107	
	(0.234)	(0.273)		(0.438)	
Exporter (sector)	-0.024***	-0.022***		-0.024***	
	(0.001)	(0.001)		(0.000)	
Exporter (region-sector)	1.353***	1.329***		1.390***	
	(0.000)	(0.000)		(0.000)	
Lag Dummy exporter		0.120***		0.117***	0.132***
		(0.000)		(0.000)	(0.000)
Exports (region)			0.117		0.043
			(0.213)		(0.641)
Exports (sector)			0.001		-0.024
			(0.983)		(0.379)
Exports (region - sector)			0.051***		0.046***
			(0.000)		(0.001)
Sector-Year	Yes	Yes	Yes	Yes	Yes
Observations	82443	82443	82443	76806	76133
Firms		16479	16479	15886	15806

Robust standard errors clustered at the firm level in parentheses. *** indicates significant at 1%, ** at 5% and * at 10%. Last column excludes outliers identified has observations with studentized residuals above 3 and below -3.

We find strongly significant positive local spillovers effects (both when measuring them in terms of firms and value exported). This might indicate that proximity between exporters in the same sector reduces entry costs. There are several mechanisms at work within this channel. First, it could be that the local presence of other exporters in the same sector lowers the cost of production by increasing the availability of specialized capital or/and labour inputs (Bernard and Jensen, 2004). Second, the presence of other exporters in the same sector are likely to increase the stock of knowledge about exporting specific products, and this knowledge may be more readily available for other firms to profit. Interestingly, firms generally do not benefit from the proximity to other exporters if these do not operate in their same sector.[3] Moreover, surprisingly, we find a negative coefficient for the sector-specific spillover, when considering the ratio of exporting firms to total firms in the sector. This indicates that the presence of other exporters in the same sector reduces the probability of exporting, likely due to competition pressures.

Real Exchange Rate

The results reported in table 39 focus on the role of the exchange rate. The real effective exchange rate (REER) is defined in terms of units of foreign currency for a unit of Polish Zloty.

[3] This, however, might be driven by the fact that because we use a firm-level not a plant-level dataset, the majority of firms have headquarters in Warsaw.

Therefore, an increase indicates an appreciation of the Polish Zloty. The results reported in the column 1 reveal no overall average impact of exchange rate variations on export decisions.

Table 39: The impact of the exchange rate on export decision

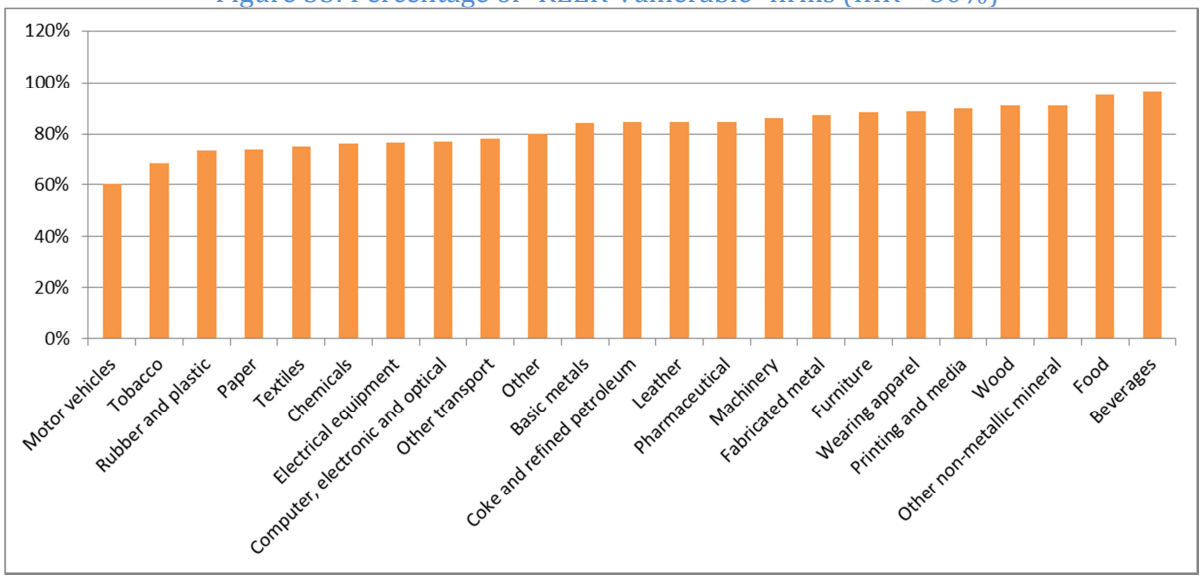
	(1)	(2)	(3)	(4)
Lag Log of Number of employees	0.071***	0.073***	0.064***	0.063***
	(0.000)	(0.000)	(0.000)	(0.000)
Lag Log of real wages	0.004	0.003	-0.003	-0.001
	(0.508)	(0.591)	(0.660)	(0.885)
Lag Log of TFP	0.003	0.003	0.003	0.003
	(0.277)	(0.295)	(0.302)	(0.407)
Lag REER at 3 digit	-0.010	-0.022***	-0.019**	-0.019**
	(0.140)	(0.007)	(0.017)	(0.047)
(Lag REER) X (Lag IIIR)		0.057**	0.057**	0.064**
		(0.022)	(0.028)	(0.035)
Lag IIIR		0.001	-0.002	-0.006
		(0.890)	(0.818)	(0.522)
Lag Dummy exporter			0.137***	0.105***
			(0.000)	(0.000)
Year	Yes	Yes	Yes	Yes
Observations	82443	82443	82443	69592
Firms	16479	16479	16479	15331

Robust standard errors clustered at the firm level in parentheses. *** indicates significant at 1%, ** at 5% and * at 10%. Last column excludes outliers identified has observations with studentized residuals above 3 and below -3.

However, when we condition the effect of the REER on the ratio of imported intermediate inputs on overall input costs (IIIR) (reported in columns 2-4), we find the expected results. In particular, we find evidence of a two-sided effect of the real exchange rate on firms' export decision. On one hand, a depreciation of the Polish Zloty increases the zloty-denominated revenues from export orders, thus encouraging market participation. In addition, the ratio of imported intermediates on total input costs is capturing the broader concept of participation in international production networks, which also mediates the effect between RER and exports (see Box 12).

When we control for the IIR, the REER carries a negative and significant coefficient, implying that appreciations (depreciations) of the domestic currency reduce (increase) the probability of participating in export markets. On the other hand, such appreciation (depreciation) makes imported inputs cheaper (more expensive) and reduces production costs, allowing firms to overcome the sunk costs of exporting and increase participation in the export market. Additionally, it may reduce (increase) financial costs if firms borrow in foreign currency. Considering the results reported in column 3, on average, firms that import less than 30 percent of their inputs are more likely to suffer from an appreciation of the Zloty, while those with imported inputs above that threshold are likely to be relatively hedged. This latter group of firms are more likely to be found in the Motor vehicles sector where the average IIIR ratio is close to the threshold at 0.28. Firms most likely to suffer from appreciations of the Zloty are found in the Furniture, Wood, Printing and media, Other non-metallic mineral, Food and beverages sectors that rely mostly on domestic inputs.

Figure 33: Percentage of "REER-vulnerable" firms (IIIR < 30%)



Source: Authors' calculations from F01 database.

What portion of firms do not use imported inputs very intensively, and then are likely to be affected by real exchange changes?

More than 80 percent of firms can be considered to show some responsiveness to exchange rate shocks as their share of imports in the total import bill is relatively low. Figure 33 shows the portion of firms that import less than 30 percent of their imports for each sector considered. In the Motor vehicles sector about 60 percent of the firms import less than 30 percent of their inputs as opposed to more than 95 percent in the Food and Beverage sectors.

Box 11: **Focus on the impact of exchange rate movements and volatility on export performance**

To gain a deeper understanding of the impact of exchange rate movements on export performance we employ export transaction data. These data offer little information on firm characteristics but are very detailed regarding the destinations reached by firms. This information is particularly useful when studying the impact of exchange rate movements on export performance. Here we follow Heericourt and Poncet (2013) and define export performance in terms of total sales to a destination at the firm level (intensive margin) and the decision to begin exporting to a market (extensive margin). The latter indicator takes the form of a binary variable that takes value 1 when a firm exports to country j at time t but did not at time t-1. The estimating equation is the following:

$$Y_{ijt} = \beta ER_{jt} + \theta Z_{jt} + u_{ij} + d_t + \varepsilon_{ijt},$$

where Y is one of the two measures of export performance mentioned above. The vector Z includes a set of control variables at destination level such as GDP and the real effective exchange rate (World Development Indicators) to account for destination's market size and price index. Moreover, to control for country j's demand for goods, we control for total imports of country j (Comtrade). We also include firm-destination fixed effects, u_{ij}, and time dummies, d_t. Both models are estimated using a linear estimator with fixed effects. However, given the binary nature of the export decision variable we also report conditional logit estimates. The variable ER captures exchange rate effects and represents both real exchange rate movements and exchange rate volatility. The latter is computed as the standard deviation of monthly log differences in the nominal exchange rate.

Extensive margin

Table 40 reports the results of estimating the above equation when the dependent variable is the decision to start exporting to a destination. The first two columns employ a linear probability model and show that an appreciation of the Polish Zloty has a negative impact on the decision to export. The impact is still negative but not statistically significant when employing a conditional logit model (column 3).

Table 40 – Exchange rate movement and export decision

Dep. var: export decision	(1) OLS	(2) OLS	(3) Logit	(4) OLS
Log Real exchange rate (RER)	-0.006	-0.010*	-0.026	-0.264***
	(0.006)	(0.006)	(0.017)	(0.053)
GDP (log)	0.194***	0.124**	0.278*	0.125**
	(0.051)	(0.053)	(0.161)	(0.053)
Real effective exchange rate	0.001***	-0.000	0.001	-0.000
	(0.000)	(0.000)	(0.001)	(0.000)
Total imports (log)		-0.025***	-0.076***	-0.026***
		(0.009)	(0.025)	(0.009)
(RER) X (medium-small)				0.171***
				(0.056)
(RER) X (medium-large)				0.241***
				(0.053)
(RER) X (large)				0.276***
				(0.053)
Firm -destination fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Firm-destination pairs	360105	352740	323795	352740
Observations	168728	165994	137053	165994

Standard errors clustered at firm-destination level in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. In column 4 the omitted interaction term is with small firms.

The last column shows that the impact is negative only for small firms while exchange rate movements do not affect the decision to export of large firms. Considering the last column, for small firms a 1% appreciation of the Polish Zloty decreases the probability of exporting by 0.3 percentage points.

Table 41 – Exchange rate volatility and export decision

Dep. var: export decision	(1) OLS	(2) OLS	(3) Logit	(4) OLS
ER volatility (ERV)	-0.194*	-0.149	-0.464	-0.815***
	(0.106)	(0.123)	(0.351)	(0.293)
GDP (log)	0.216***	0.111**	0.240	0.111**
	(0.051)	(0.053)	(0.162)	(0.053)
Real effective exchange rate	0.001***	0.000	0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.000)
Total imports (log)		0.001	-0.005	0.001
		(0.009)	(0.027)	(0.009)
(ERV) X (medium-small)				0.498
				(0.352)
(ERV) X (medium-large)				0.731**
				(0.315)
(ERV) X (large)				0.797***
				(0.299)
Firm -destination fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Firm-destination pairs	359556	352221	323269	352221
Observations	168481	165761	136813	165761

Standard errors clustered at firm-destination level in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. In column 4 the omitted interaction term is with small firms.

Table 41 considers the impact of exchange rate volatility on export decision. The volatility of the exchange rate also negatively impacts export decision (column 1). The effect, however, becomes less precise when controlling for total imports of destination country. The last column explore heterogenous effects across firm size and shows that, again, small firms are more negatively affected by exchange rate volatility. Large firms are also negatively affected but the impact is notably smaller and very close to zero.

Source: Authors' elaboration

Box 12: GVCs, RER and exports

To what extent do changes in the real exchange rate affect firms' export competitiveness?
International economic theory tells us that when domestic currencies depreciate in real terms against a basket of foreign currencies, domestic versions of a given good become relatively cheaper than foreign substitutes**.** This is why following real depreciations of a domestic currency, we expect to see increases in demand for exports in the country in which the currency has depreciated, as foreign consumers substitute away from their more expensive varieties, and analogously, a contraction in demand for imported goods.

The effects of real depreciations on the structure of the economy could potentially last longer than the depreciation itself. It has been argued in the literature that a large enough depreciation may induce reallocations of resources into tradable sectors, through a temporary boost in that sector's profitability that allows firms to pay the fixed costs of entry. Once the depreciation fades away the production structure may not revert to the original one (Baldwin and Krugman (1989)). Rodrik (2008), for example, argues that relatively depreciated real exchange rates are "good" for growth because they encourage investments in the tradable sector of the economy, which is, in his view, a better escalator for growth and development due to its dynamism. The author argues that market failures in developing countries discourage these investments in the first place, due to coordination failures and asymmetric information, and thus, a depreciated real exchange rate provides the extra incentive needed.

Recent research has shown a decline in the sensitivity of net exports to currency movement over time. For example, Ahmed, Appendino and Ruta (2015) report that the elasticity of real gross exports to the real exchange rate has declined from -0.81 in 1996-2003 to -0.13 in 2004-2012. A well-established explanation for part of this decline has been the emergence of international production networks underlying increasingly larger portions of worldwide trade (see, for example, Ahmed, Appendino and Ruta, (2015)). For example, following the enlargement of the EU in 2004, German value chains expanded to Poland, Hungary, Czech Republic and Slovakia (IMF, 2014). Since then, the exchange rate elasticity of these countries' exports has declined, in contrast to what has happened for other Central and Eastern European countries that participate less in these value chains.

Why do GVCs reduce the sensitivity of gross exports to the real exchange rate? There are two mechanisms underlying this effect. The first one relates to the fact that the effect of the RER on exports acts through value added. When production networks become international, and production processes become fragmented, more and more trade flows embed larger portions of imported intermediates, and then, the portion of domestic value added in each trade flows decreases. Say, it is likely a FSO Polonez exported in 1981 from Poland to Spain had more domestic value added incorporated than an Opel Astra Generation II exported in 2015. This is because technical change and decreases in transport costs shaped the geography of production according to comparative advantage rather than ensuring physical proximity of inputs to the main manufacturing plant. Nowadays, gross exports are a poor indicator of value added exports. But there's more to GVCs than that. The second mechanism at work in a world of GVCs is that more and more trade is 'business-to-business' (B2B) rather than 'business-to-consumer' (B2C). Price elasticities of demand tend to be higher for B2C than to B2B because firms need to have stronger relationships with suppliers than with consumers, to ensure production continuity. Because the costs of

switching suppliers are higher for firms than they are for consumers, firms tend to accept a temporary increase in input costs due to a real exchange rate shock, to avoid facing the costs of building a new relationship with a potentially cheaper supplier.

Qualitative based evidence tends to support these findings. Field interviews with selected firms were conducted to help in understanding two important issues, namely: (1) how firms react to exchange rate shocks and how they envision the possibility of euro adoption, (2) how the characteristics of the firm affect this reaction. The main lessons learned from the interviews are the following:

- Firms systematically expressed views that their business was not on exchange rate speculation, and that likely, euro adoption will be a positive development conditional on the zloty/euro parity at which it happens (most mentioned 4 zloty/euro). Exporting firms' reactions to exchange rate shocks are heterogeneous and depend on:
    - *The type of product exported*. For example, for firms from a service sector with highly customer-tailored products (IT systems, for example), re-orientation is not viable option and thus exchange rate shocks are perceived as a noise that affects their business decisions. This tends to be the case in B2B type of businesses. For firms exporting mass products directly to the consumer, re-orientation after exchange rate shocks is less costly, and may benefit firms' margins – in line with literature on irreversible investment and RER uncertainty.
    - *The currency mismatches of firms' balance sheets.* Given that most exporting firms have a large portion of their revenues coming from euro denominated exports and a large portion of their costs (import) denominated in euro the effects of shocks in the price of the zloty/euro are mitigated (in line with the literature on trade effects of exchange rates and global value chain participation).
    - *The size of the firm, and in particular, their ability to hedge using available financial instruments.* Only large firms hedge (the rest use "natural hedging" implying matching the currency in which they source inputs with the currency in which they get revenues). This is despite the fact that, according to anecdotal evidence, the market for hedging instruments is deep.

Source: Authors' elaboration

Liquidity and R&D

Results concerning financial factors and R&D expenditure are reported in Table 42. We follow Greenaway et al. (2007) in the choice of the two measures of financial constraints: liquidity and leverage. The higher the liquidity ratio and the lower the leverage ratio, the better the firm financial health. These measures have been widely used in the financing constraints literature. Liquidity has a positive and strongly significant effect of export market participation. On the other hand, the coefficient of leverage is small and not significantly different from zero.

Firms in Poland are known to face credit constraints. Many of them are unable to borrow (as argued before, 30 percent of Polish firms in the World Bank Enterprise Survey claimed that access to finance was an obstacle or a major obstacle).

Liquidity is particularly important in export activities. This is confirmed also in our findings since liquidity is an important factor to cover the sunk costs of entering the export market. This suggests that a sizable number of firms that are struggling to access external financing and that may have feasible export projects may be excluded from export markets due to liquidity constraints.

The export market is not being a platform for Polish producers with high R&D intensity. R&D expenditure does not play a significant role in affecting the probability of exporting. The empirical analysis reveals that producers with high R&D content in their cost structures do not seem to be predominantly exporting, in addition only very few firms do conduct R&D in the sample (about 300 per year). This is to some extent confirmed by the field interviews. When we asked some apparently sophisticated firms whether they were conducting R&D investments, the managers generally mentioned that they had "competence centers" or "design centers" – which were one step below R&D centers. One caveat of this analysis is that firms may not have any incentive to declare R&D expenditures. This is because by declaring them they do not receive incentives but their operative costs may increase due to more questionnaires being sent by statistical offices. The extent to which this is a significant cost that may induce firms not to declare expenses is unclear.

Table 42: The impact of liquidity and R&D on export decision

	(1)	(2)	(3)	(4)	(5)	(6)
Lag Log of Number of employees	0.062***	0.055***	0.062***	0.055***	0.055***	0.062***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lag Log of real wages	0.004	-0.002	0.004	-0.002	-0.002	-0.000
	(0.508)	(0.780)	(0.545)	(0.743)	(0.780)	(0.952)
Lag Log of TFP	0.002	0.002	0.002	0.002	0.002	0.002
	(0.474)	(0.462)	(0.397)	(0.398)	(0.462)	(0.636)
Lag REER at 3 digit	-0.015**	-0.012*	-0.015**	-0.012*	-0.012*	-0.013*
	(0.033)	(0.083)	(0.033)	(0.083)	(0.082)	(0.096)
Lag Dummy: Foreign ownership	0.009	0.008	0.009	0.007	0.008	0.007
	(0.365)	(0.415)	(0.373)	(0.422)	(0.415)	(0.420)
Lag Liquidity	0.004***	0.004***			0.004***	0.014**
	(0.000)	(0.004)			(0.004)	(0.041)
Lag Dummy exporter		0.120***		0.120***	0.120***	0.105***
		(0.000)		(0.000)	(0.000)	(0.000)
Lag Leverage			-0.000	-0.000		
			(0.840)	(0.838)		
Lag Log of R&D					0.000	0.000
					(0.983)	(0.784)
Sector-Year	Yes	Yes	Yes	Yes	Yes	No
Observations	82443	82443	82443	82443	82443	69592
Firms	16479	16479	16479	16479	16479	15331

Robust standard errors clustered at the firm level in parentheses. *** indicates significant at 1%, ** at 5% and * at 10%. Include controls for spillovers.

Export intensity

Once firms have decided to enter export markets, what drives the intensity with which they participate in them? This section focuses on factors affecting export intensity at the firm level. The literature has found that some sector and firm-level characteristics can impact on both the decision to export and export intensity (see for example Campa, 2004 and Greenaway et al 2007). While the previous section has considered the main factors affecting the probability of exporting, in this section we explore their importance through exports adjustments conditional on market participation.

In particular, we focus on the role of the exchange rate by considering its double effect through export and imported intermediate prices described above.

Box 13: Methodology for the Estimation of the Drivers of the Export Intensity

We investigate the relationship between export intensity and firm and sector level characteristics as represented by the following equation:

$$exp_{ist} = \beta X_{it} + \gamma Z_{st} + v_t + u_i + \varepsilon_{ist}, \quad (2)$$

Where exp_{ist} is the log value of exports of firm i in sector s in year t. X_{it} are plant level characteristics while Z_{st} are sector-level variables such as the real exchange rate. Because export intensity in only available for firms that have chosen to export we need to deal with potential problem of selection bias. Therefore, we implement a two-stage approach where firms firstly choose whether to export or not (selection equation), and secondly decide how much to export (export intensity equation). Following Wooldridge (1995) we first estimate the selection equation below for each t using a probit model:

$$d_{ist} = \theta d_{ist-1} + \beta X_{it} + \gamma Z_{st} + v_t + u_i + \varepsilon_{ist}, \quad \text{for each } t \quad (3)$$

The equation is similar to the one estimated in the previous section where past export status is consider as predictor of for whether a firm is currently exporting. For each equation we compute the invers Mills ratio (λ_{it}). In the second stage we estimate the following export intensity equation conditional on selection:

$$exp_{ist} = \beta X_{it} + \gamma Z_{st} + \psi\lambda_{it} + \phi\lambda_{it} v_t + v_t + \varepsilon_{ist}, \quad (4)$$

where we include the Mills ratios and their interactions with time dummies. This equation is estimated using Pooled OLS controlling for time averages of all time-varying firm variables in equation to capture unobserved firm effects. We report robust standard errors clustered at the firm level to deal with general heteroskedasticity and serial correlation.

Source: Authors' elaboration

Results

Conceptually the drivers of export intensity (i.e. of how much firms export) are similar to those of export participation (i.e. of the decision of whether to export or not) discussed in the previous section. We now turn to the determinants of export intensity.[4] The results of estimating equation 4 are reported in table 43. The first column reports the results of a linear model with firm fixed effects while the remaining columns deal with sample selection by including the inverse mills ratios from a set of probit estimations. We find that firms that have experienced an increase in total factor productivity are more likely to export greater volumes. The result is consistent across all specifications. The number of employees is also positively correlated with export intensity. The overall impact of the exchange rate is again insignificant. In column 4, we include the imported intermediates input ratio (IIIR) and its interaction with

[4] The results for the first-stage regression of export participation (equation 3) are reported in the appendix.

the exchange rate. We find that firms that increase their share of imported intermediates are more likely to experience an increase in exports. Appreciations of the exchange rate do not have a negative effect on export intensity even when firms import zero inputs. Therefore, we do not find evidence of a negative effect exchange rate effect. Finally, we do not find any significant effect of liquidity and investment in R&D on exports value.

Table 43: Determinants of export intensity

	(1) FE	(2) OLS	(3) OLS	(4) OLS	(5) OLS
Lag Log of Number of employees	0.808***	0.753***	0.753***	0.741***	0.740***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lag Log of real wages	0.119***	0.018	0.029	0.022	0.022
	(0.000)	(0.675)	(0.485)	(0.606)	(0.603)
Lag Log of TFP	0.082***	0.074***	0.073***	0.075***	0.075***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lag RER at 3 digit	-0.000	0.000	0.000	0.000	0.000
	(0.274)	(0.626)	(0.496)	(0.507)	(0.509)
Lag Dummy: Foreign ownership	0.111**	0.053	0.061	0.058	0.058
	(0.026)	(0.333)	(0.260)	(0.285)	(0.287)
Lag IIIR			0.102**	0.102**	0.102**
			(0.048)	(0.048)	(0.048)
(Lag REER) X (Lag IIIR)			-0.001	-0.001	-0.001
			(0.434)	(0.433)	(0.434)
Lag Liquidity				0.018	0.018
				(0.600)	(0.598)
Lag Log of R&D					0.000
					(0.777)
Sector	No	Yes	Yes	Yes	Yes
Region	No	Yes	Yes	Yes	Yes
Time-averages of time variant variables	No	Yes	Yes	Yes	Yes
Observations	57159	49991	49991	49991	49991

Standard errors clustered at the firm level in parentheses. *** indicates significant at 1%, ** at 5% and * at 10%. Control variables include Mills ratios generated from equation 3.

Box 14: **Focus on the impact of exchange rate movements and volatility on exports**

Intensive margin

Following the methodology presented in Box 11 we estimate the impact of exchange rate volatility on firm's exports. Table 44 reports the results of estimating the above equation when the dependent variable is the log of total sales towards a given destination. The first two columns consider the impact of exchange rate movements and find no significant impact on sales both when considering the contemporaneous (column 1) and lagged effect (column 2). Given the lack of firm-level information we cannot explore whether this is the result of a two-sided effect as we have done using the F01 dataset. The remaining columns consider the impact of exchange rate volatility and find a significant and negative impact on the intensive margin. The impact, however, is very small and non-statistically different from zero when controlling for total imports of destination country. The lagged effect is instead stronger and persists when including the additional control (column 6).

Table 44 – Exchange rate movements and volatility on exports value

Dep. var: export value (log)	(1)	(2)	(3)	(4)	(5)	(6)
Log of Real exchange rate (RER)	0.003					
	(0.007)					
Log of RER – lagged		0.009				
		(0.007)				
ER volatility (ERV)			-0.384***	-0.096		
			(0.138)	(0.149)		
ER volatility (ERV) lagged					-1.029***	-0.480***
					(0.162)	(0.171)
GDP (log)	0.748***		0.736***	0.517***		
	(0.069)		(0.069)	(0.074)		
Real effective exchange rate	0.002***		0.002***	0.002***		
	(0.000)		(0.000)	(0.000)		
Total imports (log)				0.117***		
				(0.015)		
GDP (log) lagged		0.800***			0.865***	0.771***
		(0.089)			(0.084)	(0.089)
REER		-0.001***			-0.002***	-0.002***
		(0.001)			(0.001)	(0.001)
Total imports (log) lagged		0.058***				0.056***
		(0.016)				(0.017)
Firm -destination fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm-destination pairs	940589	560814	938418	905655	578969	559714
Observations	302561	161513	301816	292177	165434	161291

Standard errors clustered at firm-destination level in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Chapter 3
Vertical & Horizontal FDI Spillovers in Polish Manufacturing

Summary

Poland has received substantial FDI inflows over the period 1995-2013, at an average rate of 3.38 percent of GDP per annum. While this is higher than the average for the EU, for high-income countries, and for all ECA countries, it lags behind the record of some new member states that have been top performers in attracting FDI such Czech Republic, Lithuania, Estonia or Slovakia.

Despite the fact that Poland has made fiscal efforts to incentivize the attraction of FDI, the country still maintains some restrictions to FDI. These restrictions are mainly in terms of equity limits that foreign operators may hold, and affect some select sectors. Restrictions of these types make the economy more restrictive than some of the aforementioned top performer neighboring countries.

There is evidence of spillovers from FDI in upstream sectors into the productivity of manufacturers in downstream sectors. We find that increased FDI stocks in upstream markets account for between 5 and 30 percent of the TFP gains observed during the period 2005-2013 in most sectors, suggesting that the spillovers are not only significant statistically, but also economically.

These vertical spillovers accrue to a greater extent to medium and large firms. It is likely that these firms interact more frequently with foreign companies in upstream sectors, and this may increase the scope for spillovers.

There is also evidence of positive horizontal spillovers that seem to accrue to more productive firms. These firms are likely to have stronger capabilities to absorb new technologies, and to innovate and adapt in the face of stronger competition.

Introduction

This chapter examines the extent to which foreign direct investment in upstream sectors in Poland affected the performance of downstream manufacturers during the period 2006-2013. In the context of preparation to Euro Adoption, it is important to understand the extent to which FDI in Poland has contributed to productivity convergence and competitiveness. This is because Poland has received substantial FDI inflows over the last decades, and because international evidence points to FDI as an important conduit for technological upgrading and knowledge transfers to domestic economies.

We address this issue in two alternative ways. First we look at how changes in policy restrictions on foreign direct investment (FDI) in terms of equity, hiring personnel, screening procedures and other licensing procedures impacted on downstream manufacturers' total factor productivity (vertical spillovers through forward linkages). Second, we replicate the

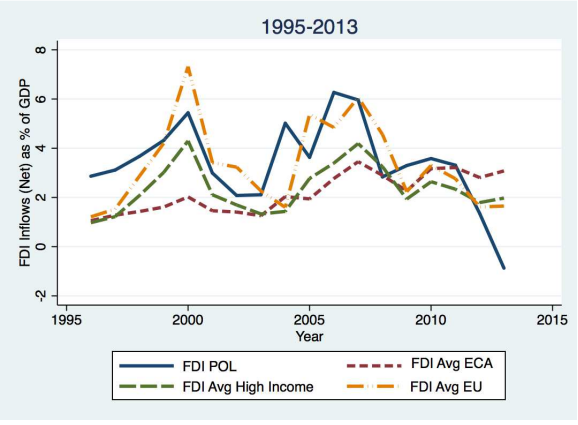
analysis using actual TFP stocks in upstream sectors, using data for 2010-2013 (vertical spillovers through forward linkages). In both cases, we also look at whether the presence of multinationals in a given sector affects the productivity of firms operating in the same sector (horizontal spillovers).

This chapter instead *does not* look into the role that outward FDI from Poland has had in improving domestic firms' competitiveness. We do not explore this issue due to lack of data on outward FDI flows. However, this issue demands further analysis as there is evidence that Polish firms are becoming increasingly internationalized through investments abroad, in addition to through exporting. By opening subsidiaries abroad they secure access to resources, and to markets that are more difficult to serve from distance. Internationalization through cross-border investment is signalling the increase in sophistication in many Polish firms and its effect on domestic competitiveness is worth further analysis.

The rest of the chapter is structured as follows. Next section shows the patterns of FDI attraction by Poland in comparison to other benchmark countries, and describes the extent of restrictiveness to FDI in the country. The following section discusses the potential gains from FDI spillovers, both vertical and horizontal, and the literature that documents the presence or absence of these spillovers. The next section presents results from estimating a model of vertical and horizontal spillovers on Polish manufacturing firms' TFP.

How much FDI has Poland been attracting?

Figure 34: Evolution of FDI inflows in Poland and Comparator Groups

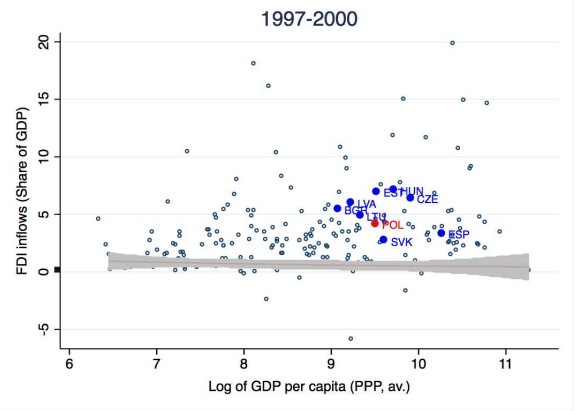


Over the last decades Poland has been attracting substantial FDI inflows. Since 1995, Poland has secured net inflows of FDI by 3.38 percent of GDP per year, on average. This is higher than the average for EU countries during the same period (3.33 percent of GDP), higher than the average for ECA (2.17 percent of GDP), and higher than the average for high-income countries (2.35 percent of GDP). Net flows dropped, however, after 2010 (Figure 34, 35 and 36).

Source: Authors' calculations based on WDI

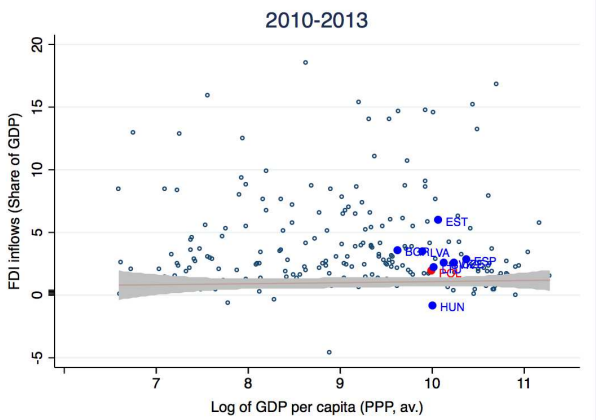
Other new member states have received substantially higher FDI inflows than Poland. Examples are the cases of Estonia, Czech Republic, Lithuania or Latvia, and this was particularly true in the most recent years (2010-2013). Interestingly, Poland maintains more restrictions to FDI inflows, particularly in the form of equity restrictions, than Estonia, Latvia, Lithuania, Czech Republic or Slovakia (Figure 36)

Figure 35: FDI inflows and Level of Development - Poland and Comparator Countries 1997-2000



Source: Authors' calculations based on WDI

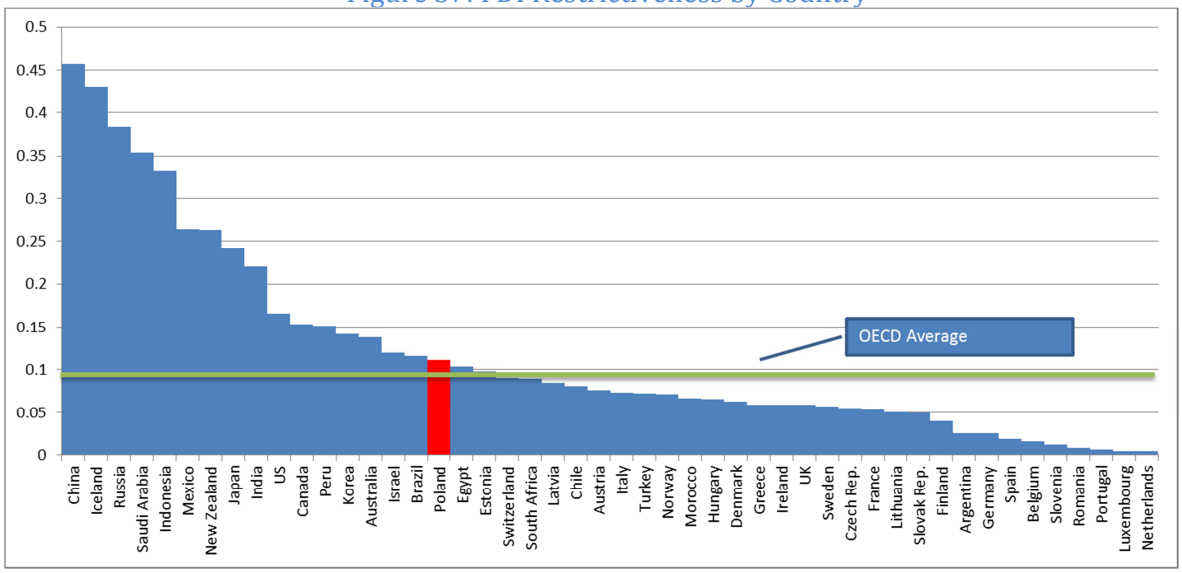
Figure 36: FDI inflows and Level of Development - Poland and Comparator Countries 2010-2013



Source: Authors' calculations based on WDI

Poland maintains a liberal FDI regime when compared to emerging markets such as China, Russia, Mexico, or Indonesia. Still, restrictiveness to FDI as measured by the OECD FDI restrictiveness indicator is slightly above the OECD average, and above that maintained by other countries comparator countries (Figure 37). FDI restrictions pertain mostly to equity restrictions in almost all sectors. Exceptions are food products and wood and wood products where other restrictions related to business licensing play a more important role.

Figure 37: FDI Restrictiveness by Country



Source: OECD

The process of FDI attraction has been fuelled by the use of fiscal incentives, as it is done in many countries, under the *assumption* that FDI inflows create positive spillover effects. Their presence in the market may benefit other firms in the economy through external effects that are not fully captured by prices paid in market transactions. For example, they may spur efficiency gains in other firms competing with them; they may transfer knowledge when interacting as suppliers or as clients, or through training of workers than then circulate in the labor market. In addition, some multinational companies may become the first mover in a

particular location or activity, and help create a dynamic cluster around them, boosting economic activity and diversification.

What's the Evidence for FDI Spillovers?

The large investment that GM Opel carried out in the Special Economic Zone (SEZ) of Gliwice seems to be a good example. It received public support from the Government of Poland in the form of tax holidays, and from the EU in the form of grants for the support of innovation related investments. In fact, this firm was the first one in set up shop in the SEZ in Gliwice creating a 'chain reaction' in the region, according to anecdotal evidence. The SEZ has now 80 plants, many of them supplying to Opel, but also to other carmakers in Poland and abroad. Once small and medium enterprises become accredited suppliers of GM Opel (which involves some training and supervision by GM Opel), they acquire the intangible asset of reputation or a demonstration effect (a "stamp of quality" as claimed by one of the entrepreneurs we interviewed) that is transferrable and boost firms' business opportunities with other clients. The multinational also interacts substantially with regional universities, from where it sources interns that obtain training and may stay working for the company or may circulate among other firms later.

To what extent is this anecdote representative of the impact that multinationals have on local economies? The literature that examines empirically the impact of FDI on domestic firms' productivity typically falls under the following categories:

1. **Horizontal spillovers** – the effect of FDI in a given sector on the productivity of domestic (or other foreign) firms operating in the same sector (although it could also be other outcome, such as exports). Effects are assumed to materialize through increased competition, technology & knowledge transfers and workers' circulation.
2. **Vertical spillovers through forward linkages** – the effect of FDI in upstream sectors on the productivity of domestic (or other foreign) firms operating in downstream sectors. Effects are assumed to materialize through improved provision of inputs (more varied, cheaper or better quality), and through technology and knowledge transfers via, for example, training of clients.
3. **Vertical spillovers through backward linkages** – the effect of FDI in downstream sectors on the productivity of domestic (or other foreign) firms operating in upstream sectors. Effects are assumed to materialize through training of suppliers, and through sophistication of inputs demanded. Some evidence for backward spillovers in Poland for the period 1995-2008 was found by Hagemejer & Kolasa (2011).

The evidence on horizontal spillovers tends to be mixed and suggests that interactions and absorptive capacities matter. A recent study has undertaken a meta-analysis of the literature (looking at more than 1200 estimates) and concludes that horizontal spillovers are on average zero, and that the sign and size of these spillovers depend both on the characteristics of the domestic firms and domestic environment as well as on the characteristics of the foreign investors. They find that spillovers are higher when foreign investors form joint ventures, and when the technological gap of the investor with respect to the host economy is relatively

narrow (suggesting that domestic firms will have the absorptive capabilities to learn from the multinationals) (see Irzova & Havranek, 2013).

The evidence on vertical spillovers (both through backward and forward linkages) tends to be more conclusive, suggesting a positive effect of FDI, with the gains accrue heterogeneously to different types of firms.

Through Backward Linkages

In the context of Indonesia, for example, Blalock and Gertler (2008) found evidence of positive vertical spillovers from increased FDI in downstream activities of the manufacturing sector. Specifically, they found strong evidence of TFP gains, greater competition and lower prices among local firms in markets that supply foreign entrants. In a related piece, Blalock and Simon (2009) found that the vertical spillovers from increased FDI in Indonesia accrued disproportionately to firms with greater absorptive capacities (i.e.: better trained workers, more investments in R&D). Closer to home, in Lithuania, Javorcik (2004) provides evidence of positive productivity spillovers from FDI taking place through interactions between foreign affiliates and their local suppliers in upstream sectors. The same author finds evidence of vertical spillovers through backward linkages also in the cases of Czech Republic and Latvia through multiple channels.

Through Forward Linkages

Most recent literature on vertical spillovers through forward linkages has concentrated on how FDI in upstream services sectors affected the productivity of downstream manufacturers. In Czech Republic, for example, Arnold et al (2007) found sizable effects on productivity of increased foreign entry into upstream services. Fernandes and Paunov (2008) used data from Chilean manufacturers combined with FDI stocks in upstream services sector, and found that those manufacturing firms furthest from the technology frontier had most to gain in terms of productivity improvements as a result of service sector liberalization. For Indonesia, Duggan et al (2013) found the contrary: it was the better performing manufacturers that benefited the most from upstream FDI in services. These authors found that FDI specific upstream sectors mattered the most for manufacturers. These sectors were telecom and transport (a similar result was found for the case of India by Arnold et al (2010).

In conclusion, the evidence tends to support the fact of that FDI typically has positive spillover effects, but that these effects are neither inevitable, nor automatic. Domestic technology investments, and in general, building up absorptive capabilities are necessary.

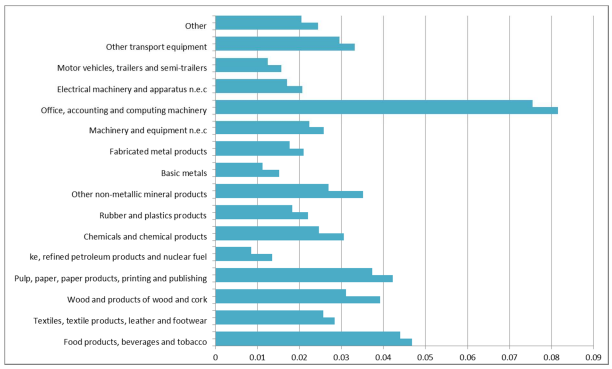
Measuring FDI stocks and restrictions upstream

For each manufacturing sector, we constructed an index of FDI restrictiveness in the relevant upstream sectors, by combining information on restrictiveness on each sector, and the input-output coefficients that tell us the relative importance of each upstream sector for a given downstream activity, and decomposed it in the different types of restrictions in place (see Box for details) (Figures 38 and 39). We constructed an analogous index using FDI stocks in the relevant upstream sectors instead of FDI restrictiveness indices. This is plotted in Figure 39.

There is sector heterogeneity in upstream restrictiveness to FDI. Office, accounting and computing machinery sector has by large the highest level of restrictiveness toward FDI in upstream sectors, followed by the food, beverage and tobacco sector.

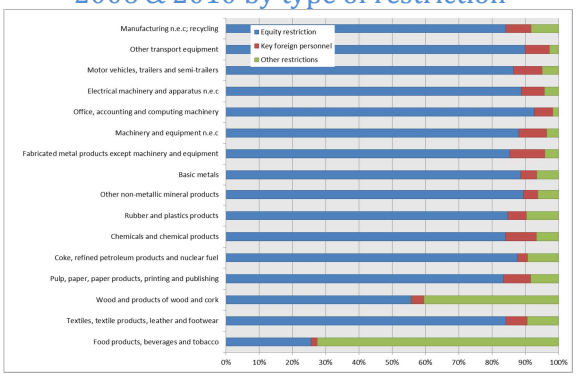
Restrictiveness toward FDI has been falling over time. All sectors show a decrease in restrictiveness from 2006 to 2010. The largest decrease is observed in wood and wood products, and in other non-metallic mineral sectors. The food sector experienced one of the smallest decreases in restrictiveness (preceded only by the textile sector).

Figure 38: Upstream FDI Restrictiveness 2006 & 2010



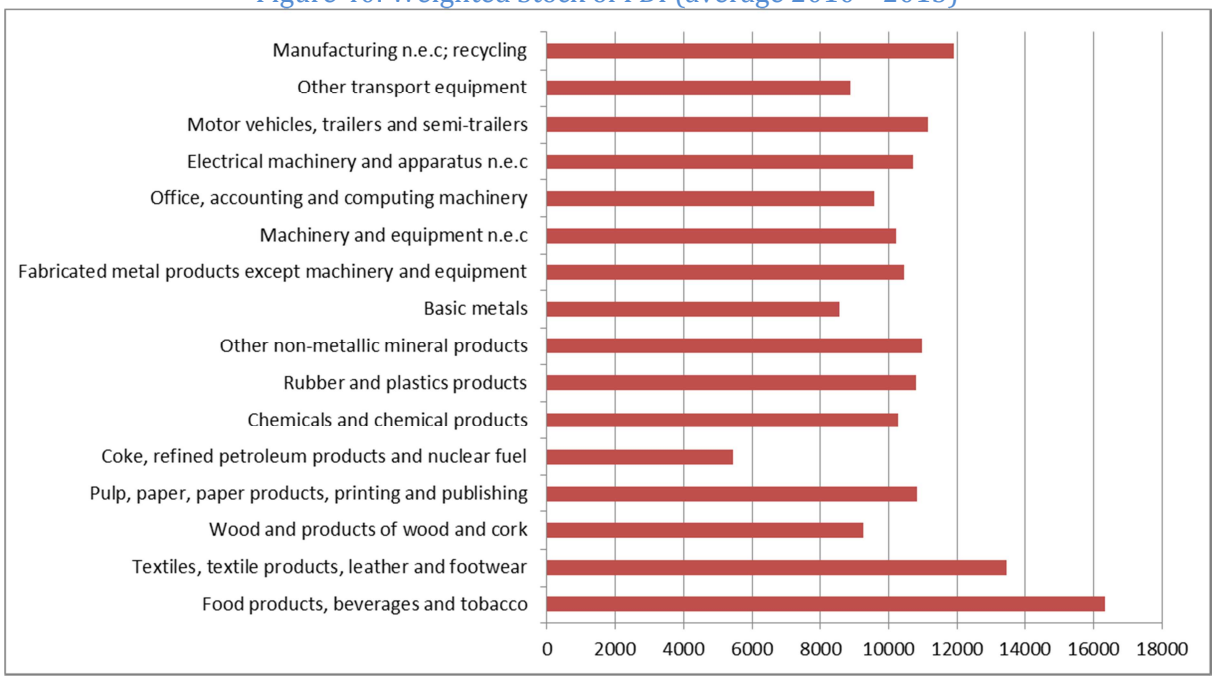
Source: OECD Input-output table for early and mid-2000 and OECD FDI restrictiveness index. For each sector the column on top refers to 2010 and the one at the bottom refers to 2006.

Figure 39: Upstream FDI Restrictiveness 2006 & 2010 by type of restriction



Food products, beverage and tobacco show the highest stock of FDI in relevant upstream sectors. When we look at upstream sectors' FDI stocks rather than restrictiveness (Figure 40), for the period 2010-2013, it is possible to see that it is in the upstream sectors relevant for food and food products where most of the FDI stocks are, followed by textiles. FDI stocks in upstream sectors relevant to coke and refined petroleum show are the lowest.

Figure 40: Weighted Stock of FDI (average 2010 – 2013)

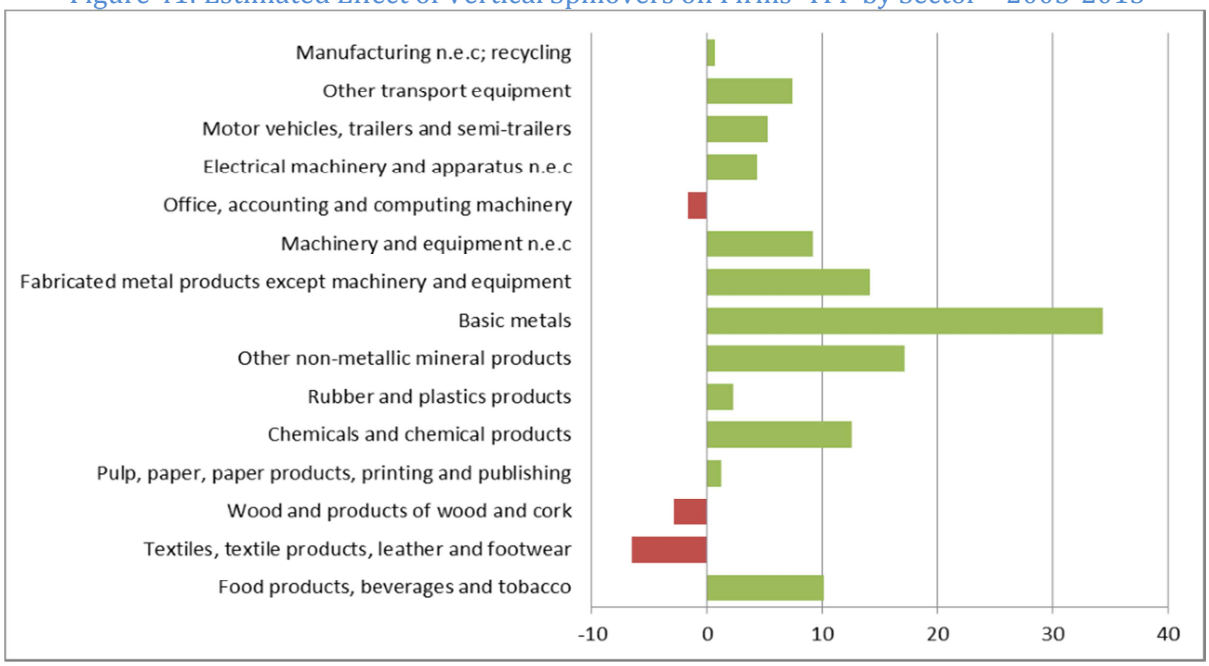


Source: Authors' elaboration based on OECD Input-output tables and Eurostat (FDI stock).

Results

Polish firms have gained from FDI in upstream sectors. The increase in FDI in upstream sectors has led to increases in productivity in sectors downstream. The effects are robust to controls for the presence of FDI in the same sector of activity (horizontal spillovers).

Figure 41: Estimated Effect of Vertical Spillovers on Firms' TFP by Sector – 2005-2013



Source: Authors' calculations.

Vertical spillovers through forward linkages account for a substantial share of productivity gains observed during the period of analysis. These spillovers have had not only a statistically significant effect on firms' productivity, but also an economically significant effect. A back of the envelope calculation based on the estimated coefficients, the evolution of productivity by sector over the period and the evolution of the stock of FDI in upstream sectors shows substantial heterogeneity in the effects (see Figure 41). It is, by far, in basic metals where most of the TFP gains can be attributed to positive vertical spillovers through forward linkages (explaining one third of total TFP gains). This is because it is in this sector where FDI stocks increased the most during the period. Gains have also been substantial in fabricated metals, non-metallic minerals and chemicals and chemical products. Instead, for textiles, wood and wood products, and office, accounting and computing machinery, a decrease in FDI stocks during the period implied a TFP loss for firms in that sector.

Box 15: Measuring Vertical spillovers of FDI through forward linkages on manufacturers' TFP

We look at vertical spillovers from FDI through forward linkages in two alternative ways: using a policy variable – the policy restrictiveness to FDI inflows in the form of equity restrictions, restrictions to hiring personnel, screening and discriminatory business licensing, and by using an outcome variable – the stock of FDI in each relevant sector.

To assess the impact that restrictive policies towards foreign direct investment in upstream sectors may have on the performance of the manufacturing sector, we rely on the OECD's FDI restrictiveness index, on input-output tables for the Polish economy, and on firm-level data, containing detailed data for all medium and large manufacturing firms (above 10 employees), over the 2005-2013 period.

We proceed in two stages. First, we use input-output tables to get a sense of the importance that each upstream sector has for the input costs of each manufacturing sector. The restrictiveness (rest) that each sector in manufacturing faces is calculated as the weighted average of each upstream sector's restrictiveness index, where the weights are given by the share in the total input bill of a given manufacturing sector 's' accounted for the upstream sector 'j'. Formally, we proceed as in equation (1):

$$rest_{s,t} = \sum_{j=1}^{J} w_{t,s,j} OECDr_{j,t} \quad (1)$$

where 'rest' is the *weighted* restrictiveness index faced by manufacturing sector 's' at time t, 'w' is the share of the input bill of manufacturing sector 's' accounted for the upstream sector 'j' at time 't', and 'OECDr' is the OECD restrictiveness index of the upstream sector j at time t. The weights obtained from Polish input-output tables are the average for the early 2000 and mid 2000 input-output tables available from OECD, disaggregated at the 2 digit level of the 3rd revision of the International Standard Industrial Classification (a total of 18 sectors), while the upstream sector OECD restrictiveness indices used are available for 2006 and 2010 for the same sector classification.[1]

To establish whether there exists a causal relationship between manufacturing firm performance in Poland, and how restrictive policies are toward FDI in the upstream sectors, in the second stage, we regress the productivity of manufacturing firms on the restrictiveness measure 'rest' as calculated above.[2] Formally, we estimate equation (2):

$$\overline{\ln TFP}_{i,t+1,t+2,t+3} = \alpha_i + \alpha_t + \beta rest_{s,t} + X_{s,t}\Pi + \varepsilon_{i,t} \quad (2)$$

where $\overline{\ln TFP}$ is the average of firm's 'i' log TFP over the years t, t+1, t+2 t+3, , α_i are firm fixed effects, that capture unobserved heterogeneity, such as firm location, size, specificities related to products produced by the firm, and other time-invariant factors that may affect firm's performance, α_t are year fixed effect, that capture economy-wide shocks such as technological advances, across-the-board business climate changes and other macro shocks that may affect firm's performance.

We allow for a lagged effect of restrictiveness in upstream sectors on manufacturing TFP, and we have two non-overlapping periods on which the model is estimated. In the first period, the matching data are the restrictiveness index for 2006 with firms' productivity averages for 2006, 2007, 2008 and 2009. In the second, the restrictiveness index for 2010 with firms' productivity averages for 2010, 2011, 2012 and 2013.

We then use the values of FDI stocks in upstream sectors instead of policy restrictiveness in upstream sectors. The methodology is analogous.

[1] We use the average input-output coefficient to avoid endogeneity problems. For example, a firm may change technologies to substitute away from one input into another input if the latter is more efficiently provided by new multinational companies operating in the upstream sector.

[2] Our approach follows that of Duggan et al (2013).

We consider variations of our baseline specification above, to obtain answers to the following specific questions:

(1) Is the vertical spillover effect on firm's TFP different for domestic and for foreign firms? For this, we estimate equation (2) on the subset of domestic firms only. Is it different for exporting and non-exporting firms? For small, medium and large firms?
(2) Is the vertical spillover effect the same for more productive firms than for less productive firms?

Source: Authors' elaboration.

Restrictiveness to FDI in upstream sectors also impacts on manufacturing firms' productivity. The effects however are heterogeneous at different levels of productivity of the manufacturing firm. For the median firm, restrictiveness to FDI in upstream sectors affects its productivity negatively (Table 45). At lower levels of productivity, however, the effect is not significantly different from zero, while the top performers seem to gain from restrictiveness toward FDI in upstream sectors – which is at odds with the finding when using FDI stocks. These results need to be interpreted with caution, since there is not much variation in the OECD restrictiveness indicators for Poland over the period considered, as the FDI regime is already relatively liberal. For this reason, in what follows, the focus will be placed on the results from using FDI stocks in upstream sectors rather than FDI restrictiveness indices.

Table 45: Upstream Restrictiveness Spillovers on Manufacturers' TFP – Quantile Regression

Dependent var: tfp	(1)	(2)	(3)
	q25	q50	q75
Upstream restrictiveness	2.653	-11.407***	18.760***
	(0.138)	(0.000)	(0.000)
FDI share	0.119***	0.162***	0.041
	(0.001)	(0.000)	(0.261)
Period fixed effects	Yes	Yes	Yes

Standard errors clustered at the firm level in parentheses. *** indicates significant at 1%, ** at 5% and * at 10%. The sample excludes the top and bottom percentile of the distribution of TFP. Variables are expressed deviations from mean as it provides equivalent estimates as a model with firm-level fixed effects.

FDI in upstream sectors tends to affect firms with different levels of productivity in the same way. We found no significant differences in the effect of FDI in upstream sectors on firms' TFP when we explored the effects at the median firm, at the firm at the first quartile of the distribution, and at the firm at the third quartile of the TFP distribution (Table). It is medium and larger firms that tend to benefit more from vertical spillovers through forward linkages, within each quartile of productivity (Table 46 & 47).

The benefits from horizontal spillovers seem to accrue to more productive firms. These firms are likely to have stronger capabilities to absorb new technologies, and to innovate and adapt in the face of stronger competition (Table 46). This result is strengthened when we look at whether the effects of horizontal spillovers vary by firm size, exporting condition and ownership type. Within a given quartile of productivity, horizontal spillovers accrue to foreign firms more intensely than to domestic firms, and to exporters more intensely than to non-

exporters. In terms of the size, we find that size differences in the benefits from horizontal spillovers only become significant for relatively more productive firms, and it seems to be medium and small firms relative to large firms (Table 47).

Table 46: Upstream FDI stocks Spillovers on Manufacturers' TFP – Fixed Effects & Quantile Regression

	All samples	p25	p50	p75
FDI position in upstream sectors	0.019***	0.019***	0.014***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)
FDI share in same sector	0.022	0.023	0.077***	0.073***
	(0.275)	(0.289)	(0.000)	(0.000)
Firm fixed effects	Yes	No	No	No
Deviations from time mean	No	Yes	Yes	Yes
Observations	94327			
Firms	19186			

Standard errors clustered at the firm level in parentheses. *** indicates significant at 1%, ** at 5% and * at 10%.

Table 47: Upstream FDI stocks Spillovers on Manufacturers' TFP – By Type of Firm

	(1) Non exporters	(2) Exporters	(3) Domestic	(4) Foreign	(5) Small	(6) Medium	(7) Large
q25							
FDI position in upstream sectors	0.016***	0.021***	0.018***	0.021***	0.011***	0.016***	0.023***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FDI share in same sector	0.036	0.008	-0.025	0.203***	0.036	0.012	0.026
	(0.390)	(0.692)	(0.262)	(0.000)	(0.542)	(0.784)	(0.472)
q50							
FDI position in upstream sector	0.017***	0.017***	0.016***	0.016***	0.012***	0.013***	0.020***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FDI share in same sector	0.061	0.067***	0.025	0.237***	0.093**	0.085**	0.032
	(0.125)	(0.000)	(0.131)	(0.000)	(0.046)	(0.014)	(0.220)
q75							
FDI position in upstream sector	0.013***	0.020***	0.016***	0.023***	0.010***	0.013***	0.024***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FDI share in same sector	0.068	0.060*	0.029	0.235***	0.121**	0.084**	0.044
	(0.225)	(0.072)	(0.235)	(0.000)	(0.018)	(0.048)	(0.125)
Observations	31294	64926	77736	18484	23170	33197	39853

Standard errors clustered at the firm level in parentheses. *** indicates significant at 1%, ** at 5% and * at 10%. The sample excludes the top and bottom percentile of the distribution of TFP. Variables are expressed as deviations from mean as it provides equivalent estimates as a model with firm-level fixed effects.

Appendix

Appendix to Chapter 1

Data issues. The export transaction dataset used in this study is based on two sources: one covers trade with non-EU countries (Extrastat) and the other contains data on deliveries to the EU member states (Intrastat). In the former case every lawful dispatch needs to be recorded as it passes through customs. In the latter case, instead exporters notify the customs office *ex post*, only for statistical purposes. In order to limit the paperwork burden on firms, there are two thresholds for the Intrastat system. A firm should start reporting once the total value of its annual exports to the EU exceeds the first threshold (in particular, if the threshold was exceeded in a preceding year). If a firm exceeds the second threshold, it should provide a detailed declaration, which includes terms of delivery and an estimate of statistical value.

This is a common feature for all European countries, although thresholds vary across countries. Therefore, any study using official European export data (not from survey) encounters the same limitations. For Poland the first threshold increased from 0.5 million PLN in 2004 to 1.1 million PLN in 2014. The second threshold is at 76 million PLN in 2014. The statistical value is the net domestic value of a product when it crosses a border. It excludes costs of further transportation and insurance.

There are some additional shortcomings. First, as reporting to the Intrastat system is not compulsory (the penalties for negligence are not tough) some firms fail to report intra-EU trade diligently, this also apply to other European countries. Second, our analysis is hampered by the lack of reliable statistical value. Although in most of observations there is a variable labeled as statistical value, it seems that exporters do not submit accurate estimates (the statistical value equals the invoice value in many cases when the terms of delivery imply that these two should actually differ). Third, there are some missing data. In 7.8% of all observations the exporter ID is missing and in some other cases ID is incorrect. In 3.5% observations the quantity of products is missing or equals zero. The country of destination is not revealed in about 1% observations.

Appendix to Chapter 2

Descriptive statistics by sector

Table A1 reports means and standard deviations of the established relevant firms' characteristics employed in the analysis.

Table A1: Descriptive statistics of firms' characteristics by sector

Sector	Employment		Average wage		TFP		Foreign firms	
Food	129.52	(266.09)	25.93	(34.20)	4.15	(0.82)	0.10	(0.29)
Beverages	172.99	(391.53)	38.72	(35.91)	4.42	(1.16)	0.21	(0.41)
Tobacco	543.83	(464.26)	53.33	(37.04)	5.09	(1.35)	0.64	(0.48)
Textiles	118.42	(199.72)	26.84	(23.14)	4.13	(0.77)	0.25	(0.43)
Wearing apparel	107.48	(156.11)	23.63	(221.55)	3.85	(0.68)	0.16	(0.37)
Leather	103.57	(136.91)	27.29	(112.40)	3.98	(0.76)	0.14	(0.35)
Wood	100.41	(167.70)	24.86	(61.07)	4.04	(0.73)	0.14	(0.35)
Paper	114.44	(173.28)	32.91	(45.99)	4.41	(0.81)	0.22	(0.41)
Printing and media	82.31	(185.11)	36.38	(38.46)	4.39	(0.71)	0.11	(0.31)
Coke and refined petroleum	368.79	(832.43)	58.28	(29.96)	5.38	(1.08)	0.13	(0.33)
Chemicals	157.23	(349.45)	42.05	(27.92)	5.28	(0.99)	0.25	(0.43)
Pharmaceutical	233.49	(323.28)	56.61	(82.60)	5.61	(0.96)	0.21	(0.41)
Rubber and plastic	109.58	(230.20)	31.14	(20.40)	4.49	(0.75)	0.24	(0.43)
Other non-metallic mineral	130.96	(229.94)	37.16	(109.23)	4.57	(0.86)	0.18	(0.39)
Basic metals	247.82	(820.56)	37.80	(64.97)	4.65	(0.84)	0.19	(0.40)
Fabricated metal	92.86	(136.61)	35.47	(55.77)	4.53	(0.72)	0.19	(0.39)
Computer, electronic and optical	174.18	(395.62)	41.59	(75.15)	5.11	(0.85)	0.26	(0.44)
Electrical equipment	200.23	(473.16)	37.22	(45.39)	5.18	(0.87)	0.27	(0.44)
Machinery	125.42	(234.08)	38.51	(28.93)	5.13	(0.77)	0.20	(0.40)
Motor vehicles	348.07	(719.54)	37.04	(137.88)	5.33	(0.95)	0.44	(0.50)
Other transport	315.40	(661.78)	47.56	(112.80)	5.07	(0.91)	0.28	(0.45)
Furniture	185.99	(435.18)	29.86	(219.30)	4.22	(0.74)	0.17	(0.38)
Other	94.84	(162.42)	34.37	(132.73)	4.43	(0.93)	0.22	(0.41)

Source: Authors' calculations from F01 database. Tables reports sample averages and standard deviations in parentheses. Wages are in thousands PLN.

The average number of employees (a proxy for average firm size) ranges between 82 in the Printing and media sector and 368 in the Coke and refined petroleum sector. The average wage is computed as the ratio between the firm's total wage bill and its number of employees. The lowest wages are found in the Wearing apparel sector (26,000 PLN) while the highest are again in the Coke and refined petroleum sector (about 58,000 PLN). Foreign is a dummy equal to 1 if a firm shows some form of foreign ownership, and 0 otherwise. The largest share of foreign owned firms is found in the Tobacco sector (64%) followed by the Motor vehicle sector (44%). Regarding our measure of productivity, which was calculated using the Levinsohn and Petrin (2003) method, the Pharmaceutical sector tops the list while the Wearing apparel sector shows the lowest level of total factor productivity.

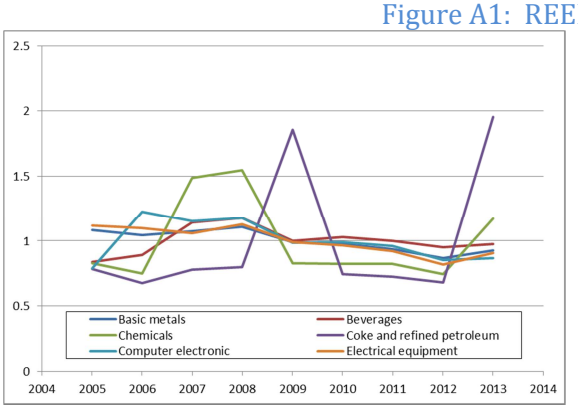
Table A2: REER and Imported intermediate inputs ratio (IIIR) by sector

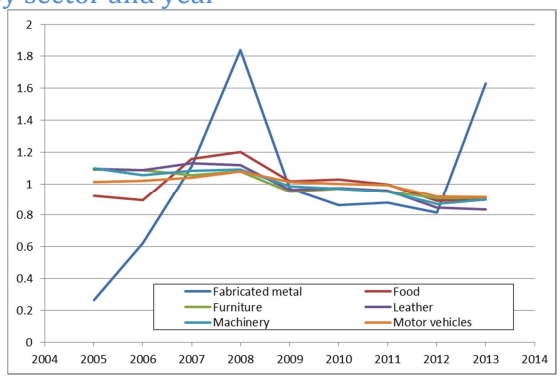
Sector	REER		IIIR	
	Mean	Sd	Mean	Sd
Food	32.88	(20.58)	0.05	(0.13)
Beverages	12.75	(1.44)	0.05	(0.10)
Tobacco	38.09	(15.37)	0.20	(0.22)
Textiles	15.31	(6.67)	0.18	(0.23)
Wearing apparel	6.44	(0.50)	0.10	(0.35)
Leather	18.15	(15.26)	0.13	(0.21)
Wood	9.25	(2.78)	0.08	(0.16)
Paper	15.78	(1.01)	0.18	(0.24)
Printing and media	22.10	(0.75)	0.08	(0.19)
Coke and refined petroleum	8.53	(4.70)	0.14	(0.22)
Chemicals	28.15	(14.30)	0.19	(0.23)
Pharmaceutical	46.81	(16.30)	0.14	(0.25)
Rubber and plastic	16.50	(0.98)	0.18	(0.24)
Other non-metallic mineral	20.96	(8.26)	0.08	(0.15)
Basic metals	17.18	(5.55)	0.12	(0.26)
Fabricated metal	15.83	(47.86)	0.10	(0.20)
Computer, electronic and optical	27.07	(24.57)	0.21	(0.81)
Electrical equipment	21.89	(7.43)	0.18	(0.25)
Machinery	49.12	(21.13)	0.11	(0.22)
Motor vehicles	9.92	(0.69)	0.28	(0.32)
Other transport	12.96	(6.82)	0.16	(0.24)
Furniture	4.24	(0.29)	0.10	(0.17)
Other	19.16	(5.26)	0.16	(0.26)

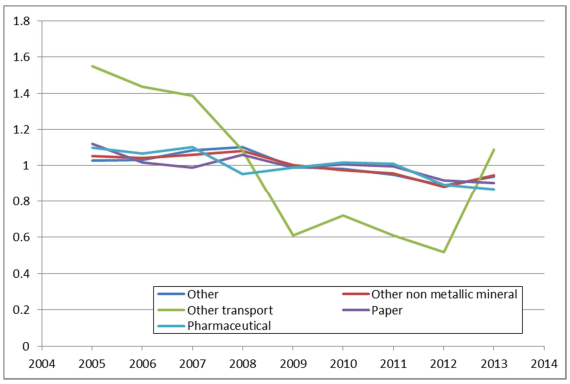
Source: Authors' calculations from F01 database. Tables report sample averages and standard deviations in parentheses.

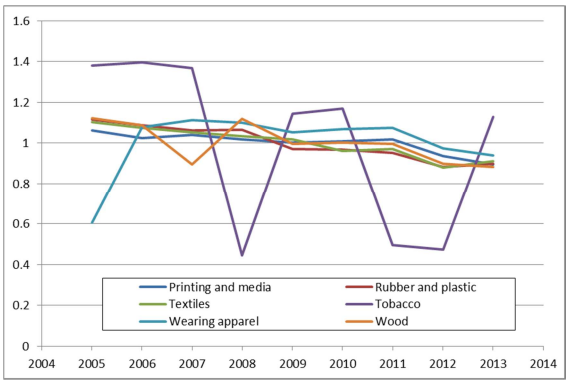
Table A2 reports average REER and IIIR by sector while Figure A1 plots the sector-level exchange rate over time. The series have been normalized to have mean 1 over the period 2005-2013. The largest fluctuations are observed in the following sectors: chemicals, coke and refined petroleum products, fabricated metals, other transport and tobacco.

Figure A1: REER by sector and year









Source: Authors' calculations from WDI (exchange rate) and Comtrade (bilateral trade flows by sector). The exchange rate series have been normalized to have mean one.

Export participation (selection) estimations

The results for the first-stage regression of export participation (equation 3) are reported presented in table A3 for each year. We only report the most comprehensive specification. Consistent with the literature and with our previous findings we find that firms that export are more likely to be bigger, more productive, and foreign owned (see for example, Greenaway and Kneller, 2007). These variables are significantly correlated with the probability of entering the export market in all years. Liquidity is also positively correlated with export participation in 5 out of 8 specifications. Similarly to our previous findings, exchange rate fluctuations do not have an overall effect on entry as the negative effect through higher export prices is compensated by a positive effect through lower input costs. The interaction effect, however, is only visible in one specification as this specification lacks the time dimension that allows a better identification of such effect. Finally, there is also some limited evidence that firms with higher R&D expenditure are more likely to participate in the export market. These regressions are used to generate the inverse Mills ratios for each period that will be included in the estimation of the export intensity equation to control for selection into the export market.

Table A3: Annual probit models for export participation (selection equation)

	(1) 2006	(2) 2007	(3) 2008	(4) 2009	(5) 2010	(6) 2011	(7) 2012	(8) 2013
Dep. variable: Dummy Exporter, Yes = 1								
Lag Dummy exporter	2.310***	2.379***	2.340***	2.271***	2.170***	2.307***	2.398***	2.510***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lag Log employees	0.253***	0.259***	0.315***	0.325***	0.294***	0.267***	0.354***	0.253***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lag Log of real wages	0.068	-0.037	0.027	-0.022	0.056	0.073	-0.012	0.067
	(0.191)	(0.474)	(0.594)	(0.662)	(0.251)	(0.161)	(0.828)	(0.218)
Lag Log of TFP	0.082**	0.046	0.049	0.040	0.124***	0.038	0.107***	0.098***
	(0.018)	(0.194)	(0.174)	(0.238)	(0.000)	(0.230)	(0.001)	(0.004)
Lag REER at 3 digit	0.067	0.050	0.053	0.006	-0.001	0.004	0.005	0.002
	(0.883)	(0.230)	(0.221)	(0.376)	(0.796)	(0.249)	(0.466)	(0.673)
Lag IIIR	1.113***	0.869***	0.616***	1.072***	0.814***	0.313	0.617***	0.742***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.135)	(0.003)	(0.000)
(Lag REER) X (Lag IIIR)	-0.008	0.004	0.007	0.003	0.006	0.020**	0.007	-0.002
	(0.418)	(0.636)	(0.211)	(0.492)	(0.479)	(0.037)	(0.425)	(0.793)
Lag Foreign ownership	0.398***	0.318***	0.431***	0.285***	0.241***	0.125**	0.334***	0.265***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.040)	(0.000)	(0.000)
Lag Liquidity	0.042	0.165***	0.072	0.231***	0.077*	0.096**	0.031	0.084**
	(0.240)	(0.001)	(0.193)	(0.000)	(0.062)	(0.025)	(0.502)	(0.040)
Lag Log of R&D	0.008	0.015	0.016	0.004	0.018**	0.017*	0.008	0.003
	(0.409)	(0.156)	(0.118)	(0.615)	(0.047)	(0.098)	(0.420)	(0.753)
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9851	10118	10004	10157	10735	10311	10458	10566

Standard errors in parentheses. *** indicates significant at 1%, ** at 5% and * at 10%. The table reports coefficients from separate probit models (not marginal effects) for each year.

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