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### **Margins of Trade**

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## WORKING PAPER SERIES 12

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Kamil Galuščák, Ivan Sutóris  
Margins of Trade: Czech Firms Before, During and After the Crisis

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# Margins of Trade: Czech Firms Before, During and After the Crisis

Kamil Galuščák and Ivan Sutóris\*

## Abstract

We investigate the extensive and intensive margins of trade of Czech firms in periods before, during and after the crisis of 2008–2009. The intensive margin explains most of the aggregate export growth in 2006–2014, which corroborates previous findings for other countries. The contribution of the extensive margin is smaller, explaining on average 39% of the aggregate export growth in 2006–2007 and around 25% to 30% of that in the post-crisis period. The lower contribution of the extensive margin may signal a lower rate of convergence of the Czech economy. The results indicate that the crisis had a more severe impact on small exporting firms and that exports to countries outside the EU gained more prominence in the post-crisis years. Our results are similar to findings from previous studies on the impact of participation in global value chains on firms' trade. Specifically, a more negative impact of the crisis was observed for exports with higher import intensity. Overall, our results point to the importance of using disaggregated data in the analysis of countries' export performance.

## Abstrakt

Zkoumáme extenzivní a intenzivní obchodování českých podniků v období před, během a po krizi z let 2008–2009. Intenzivní obchodování vysvětluje většinu růstu agregátního vývozu v období 2006–2014, což potvrzuje předchozí výsledky za jiné země. Příspěvek extenzivního obchodování je menší a vysvětluje v průměru 39 % růstu agregátního vývozu v letech 2006–2007 a kolem 25 až 30 % v období po krizi. Nižší příspěvek extenzivního obchodování může signalizovat nižší tempo konvergence české ekonomiky. Výsledky ukazují, že krize silněji zasáhla malé vývozce a že v období po krizi nabyl na významu vývoz do zemí mimo EU. Naše výsledky jsou také podobné zjištěním jiných předchozích studií o dopadech participace podniků v globálních produkčních řetězcích na jejich vývoz. Konkrétně byl výraznější nepříznivý dopad krize pozorován u vývozu s vyšší dovozní náročností. Naše výsledky celkově poukazují na důležitost využívání dezagregovaných údajů v analýze exportní výkonnosti zemí.

**JEL Codes:** F02, F20, G01.

**Keywords:** Exports, firms' heterogeneity, global crisis, intensive and extensive margins, production chains.

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## **Nontechnical Summary**

In this paper we explore the margins of trade of Czech firms before, during and after the 2008–2009 crisis. We investigate which margins are important in explaining aggregate export growth and what impact the crisis had on margins. We expect extensive margins to make a significant contribution as the Czech economy converges to the EU in terms of per-capita income. Furthermore, we investigate the margins with regard to specific characteristics such as destinations, product types and firm size as well as the role of participation of firms in global value chains. In line with the previous literature for other countries, we expect a more negative impact of the crisis on exports of firms involved in international production chains.

Following Bricongne et al. (2012), we use quarterly Czech firm-level trade data in 2005–2014 on exports by firm, product and destination and compute mid-point growth rates which account for entries and exits in firm-destination-product combinations. We define the extensive margin along three dimensions: the firm extensive margin as firm entries and exits, the country extensive margin as new and lost destinations of continuing exporters, and the product extensive margin as entries and exits of products for continuing firm-destination relationships. The intensive margin is the contribution of the continuing firm-destination-product relationships. Then we investigate which destinations, product types and firm characteristics explain the growth rate of elementary export flows using shift-share decomposition. We also examine the role of international production linkages using the import intensity of exports as a proxy for participation in global value chains.

Our results suggest that the intensive margin explains most of the aggregate export growth in 2006–2014. The importance of the intensive margin in driving export dynamics corroborates previous findings for other countries, including those of Bernard et al. (2009) and Amador and Opromolla (2013). The role of the extensive margin is smaller, but not negligible. It explains on average 39% of the aggregate export growth in 2006–2007 and around 25% to 30% of that in the post-crisis years. The lower contribution of the extensive margin in the post-crisis recovery may signal a lower rate of convergence of the Czech economy. The results indicate that the crisis had a more severe impact on small exporting firms and that exports to countries outside the EU gained more prominence in the post-crisis years. Our results are in line with other studies on the impact of participation in global value chains on firms' trade. Specifically, a more negative impact of the crisis was observed for exports with higher import intensity. In sum, our results point to the importance of using disaggregated data in the analysis of countries' export performance.

## 1. Introduction

Recent literature on international trade highlights the importance of firms' extensive margins in explaining the dynamics of aggregate trade. Distinguishing intensive and extensive margins of trade is important for several reasons. First, the evidence suggests that exporters are more productive because more productive firms are able to bear the costs associated with entering international markets. For example, Das et al. (2007) estimate that for Colombian firms the sunk costs of entry into export markets represent between 18% and 41% of the annual value of firms' exports, while the fixed costs associated with the continuation of their exporting activity are much smaller at around 1% of the value of exports. The presence of fixed costs associated with entry into international markets implies that when facing negative demand shocks, firms usually respond by reducing sales in existing export relationships rather than by terminating those relationships.

Second, emerging economies diversify their product portfolio as they catch up with advanced economies. This argument is developed in Imbs and Wacziarg (2003), who study the evolution of sectoral concentration along the per-capita income development path. They find that sectoral diversification increases as an economy converges, while the concentration of sectoral distribution of production starts prevailing at a higher level of per-capita income. Beltramello et al. (2012) corroborate this by finding that the extensive margin of trade is higher for emerging economies and for countries of Central and Eastern Europe due to their integration into the European Union. The relationship between GDP per capita and diversification is reconsidered in Mau (2016). He finds that countries continuously diversify their production and exports and that the causality goes from diversification to GDP per capita.

Margins of trade are also important for understanding the adjustment of current account imbalances. Corsetti et al. (2013) revisit the relationship between current account imbalances and exchange rate adjustment (Obstfeld and Rogoff, 2005) by showing that a transfer of the size of the U.S. current account in the pre-crisis period requires only moderate trend real currency depreciation. The key attenuating adjustment channel in their simulation is the extensive margin of trade. As Krugman (1989) put it, the expansion of varieties (the extensive margin) need not be associated with terms of trade deterioration, as consumers love new varieties. The adjustment of current account imbalances with firm heterogeneity is studied in Pappadà (2011) and with its implications for the euro area in di Mauro and Pappadà (2014).

In this paper we take the example of the Czech Republic as a small open economy<sup>1</sup> and investigate the role of the extensive and intensive margins in aggregate export dynamics, focusing on the periods before, during and after the crisis of 2008–2009. We explore which margins are important in explaining aggregate export growth and what impact the crisis had on the contribution of specific margins. As the Czech economy converges to the EU, we expect extensive margins to make a significant contribution to export growth.

The previous literature yields mixed results on the significance of margins of trade. Using U.S. firm-product-destination data, Bernard et al. (2009) show that the intensive margin is important at one-year intervals, while the extensive margin becomes important over longer horizons spanning

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<sup>1</sup> In 2015, the ratio of exports and imports to GDP was 162%.



five to ten years. Furthermore, the variation in imports and exports across countries is mainly due to extensive margins. Bricongne et al. (2012) use a dataset of French exporters and examine the margins of trade before and during the 2008–2009 crisis. Their results, based on quarterly data, show that the net extensive margin explains 55% of the export dynamics in 2000–2007 and 11% during the crisis years of 2008–2009. Amador and Opromolla (2013) find that in Portugal over 1996–2005, both the extensive and intensive margins are important at the firm level in manufacturing in explaining the year-on-year variation in aggregate exports. Some other studies find a much lower contribution of the extensive margin. For example, Silgoner et al. (2013) explore the competition on the EU-15 market stemming from CESEE-10 and China. Their results show that the extensive margin of CESEE-10 countries accounts for less than 10% of export growth in 2003–2005.<sup>2</sup>

Recent studies on international trade highlight the growing importance of global value chains in the international organisation of production, manifesting itself *inter alia* in a high proportion of imported intermediate goods in the export value of goods.<sup>3</sup> For example, Beltramello et al. (2012) investigate the export performance of 39 countries since 1995 by distinguishing the production of intermediate inputs (upstream activities along the value chain) and the final assembly of products (downstream activities). They find that the extensive margin is higher in emerging economies and in countries of Central and Eastern Europe, particularly in intermediate goods. In the Czech Republic alone, the extensive margin accounts for about 60% of total export growth in 1995–2007. Furthermore, Beltramello et al. (2012) find that most of the 2007–2009 trade collapse occurred at the intensive margin for most countries, being much larger in intermediates, while some countries experienced still positive growth in final consumption goods. The faster response of trade in intermediates during adverse shocks has been labelled in the literature as a “bullwhip” effect of global value chains. Altomonte et al. (2012) confirm its existence using transaction-level French data in 2007–2009, distinguishing intra-group and arm’s length trade as two alternative organisational modes of global value chains. In particular, the intra-group trade in intermediates exhibited a faster drop followed by a faster recovery than the arm’s length trade, as multinational groups better optimise inventories and do not suffer from large information asymmetries during adverse shocks.

Following Bricongne et al. (2012), we use the quarterly Czech firm-level trade data in 2005–2014 on exports by firm, product and destination and compute mid-point growth rates which account for entries and exits in firm-destination-product combinations. We define the extensive margin along three dimensions: the firm extensive margin as firm entries and exits, the country extensive margin as new and lost destinations of continuing exporters, and the product extensive margin as entries and exits of products for continuing firm-destination relationships. The intensive margin is the contribution of the continuing firm-destination-product relationships. We explore specific contributions to the margins such as destinations, product types and firm size. In the next part, we investigate which destinations, product types and firm characteristics explain the growth rate of elementary export flows using shift-share decomposition. We also investigate the role of international production linkages using the import intensity of exports as a proxy for participation

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<sup>2</sup> A small contribution of the extensive margin is also found in Cheptea et al. (2014) for the EU-27 in 1995–2010 and in Besedeš and Prusa (2011) for manufacturing exports of 46 countries between 1975 and 2003.

<sup>3</sup> Amador and Cabral (2014) describe the emergence of global value chains and discuss policy implications. Measures of participation in production chains are discussed and applied, for example, in Los et al. (2012), Antras et al. (2012), Johnson and Noguera (2012), Timer et al. (2013) and Amador et al. (2015).

in global value chains. In line with the previous literature for other countries, we expect a more negative impact of the crisis on exports of firms involved in international production chains.

Our results suggest that the intensive margin explains most of the aggregate export growth in 2006–2014. The importance of the intensive margin in driving export dynamics corroborates previous findings for other countries, including those of Bernard et al. (2009) and Amador and Opromolla (2013). The role of the extensive margin is smaller, but not negligible. It explains on average 39% of the aggregate export growth in 2006–2007 and around 25% to 30% of that in the post-crisis years. The lower contribution of the extensive margin in the post-crisis recovery may signal a lower rate of convergence of the Czech economy. The results indicate that the crisis had a more severe impact on small exporting firms and that exports to countries outside the EU gained more prominence in the post-crisis years. Our results are in line with other studies on the impact of participation in global value chains on firms' trade. Specifically, a more negative impact of the crisis was observed for exports with higher import intensity. In sum, our results point to the importance of using disaggregated data in the analysis of countries' export performance.

The rest of the paper is organised as follows. The next section outlines the methodology, focusing on mid-point growth rates and the decomposition method. Section 3 describes the data that we use and Section 4 presents the results. The last section concludes.

## 2. Methodology

Export dynamics consist of continuous export relationships by firm, product and destination (the intensive margin) as well as entries into and exits from these export flows (the extensive margin). In order to account properly for both margins, we define the mid-point growth rates of export flows by a firm  $i$  to a given destination (country)  $c$  of product group  $k$  in period (quarter)  $t$  (see Davis and Haltiwanger, 1992; Bricongne et al., 2012):

$$g_{ickt} = \frac{x_{ickt} - x_{ick(t-4)}}{\frac{1}{2}(x_{ickt} + x_{ick(t-4)})}. \quad (1)$$

The flows defined in (1) corresponding to an entry equal +2, while exits have a value of -2. Changes in the existing flows by firm, destination and product (the intensive margin) have values between -2 and +2.

For the purpose of aggregation of the elementary trade flows from (1), we define weights as the relative share of the flow in total exports of the whole population of exporting firms:

$$w_{ickt} = \frac{x_{ickt} + x_{ick(t-4)}}{\sum_c \sum_i \sum_k x_{ickt} + \sum_c \sum_i \sum_k x_{ick(t-4)}}. \quad (2)$$

The year-on-year growth rate of the total value of exports is then given as a weighted sum of the elementary flows:

$$G_t = \sum_c \sum_i \sum_k g_{ickt} w_{ickt}. \quad (3)$$

Following Bricongne et al. (2012), we aggregate the elementary flows using (3) into several contributions. First, the firm extensive margin captures entries and exits of firms into and from exporting activity. Second, the country extensive margin accounts for individual country entries and exits by those firms which export in both periods. Third, the product extensive margin captures entries and exits of products in the continuing firm-destination relationships. The intensive margin is then defined as exports in continuing relationships by firm, destination and product.

Using year-on-year growth rates in (1) removes seasonality. Bricongne et al. (2012) point to the fact that using higher frequency data may lead to overestimation of the extensive margin in trade flows, as firms may not export in all consecutive periods. On the other hand, Berthou and Vicard (2013) show that using yearly data in the estimation of firms' export growth yields significant downward biases, as some new exporters start exporting later during the year. In our approach, we focus on comparing the contribution of particular margins over time, assuming the size of potential biases remains unchanged.

In the next part we apply shift-share decomposition to investigate the impact of specific factors on export growth rates: destinations, product groups, firm size and import intensity. While standard decomposition depends on the ordering of the effects, we apply an econometric method which allows us to estimate fixed effects and their statistical significance. A similar decomposition is presented in Bricongne et al. (2012), Cheptea et al. (2014), Gaullier et al. (2013), Beltramello et al. (2012), Tiffin (2014) and ECB (2012). This approach allows us to estimate *ceteris paribus* effects of the determinants of export growth rates, while the decomposition of mid-point growth rates presented in the previous part explains contributions to aggregate export growth.

Suppose we have data on export flows from two consecutive periods representing particular products and destinations by a particular firm. Denote by  $g_f$  the growth rate between the two periods of a particular flow  $f$  (defined in equation 1), and  $w_f$  its corresponding weight determined by the level of exports (defined in equation 2). For each elementary flow we observe some discrete characteristics, such as destination type  $d_f \in \{1, \dots, N_d\}$ , product type  $p_f \in \{1, \dots, N_p\}$ , firm size category  $s_f \in \{1, \dots, N_s\}$  and import intensity  $J_f \in \{1, \dots, N_j\}$ .

We estimate a weighted regression

$$g_f = \alpha + \sum_{j=1}^{N_d} \beta_j \cdot \mathbb{I}[d_f = j] + \sum_{j=1}^{N_p} \gamma_j \cdot \mathbb{I}[p_f = j] + \sum_{j=1}^{N_s} \delta_j \cdot \mathbb{I}[s_f = j] + \sum_{j=1}^{N_j} \theta_j \cdot \mathbb{I}[J_f = j] + \epsilon_f \quad (4)$$

i.e. we regress growth rates on dummies for various categories, using  $w_f$  as observation weights. To identify all coefficients, we impose that their weighted sum across each characteristic equals zero, so that

$$\sum_{j=1}^{N_d} w_j^d \cdot \beta_j = 0, \quad \sum_{j=1}^{N_p} w_j^p \cdot \gamma_j = 0, \quad \sum_{j=1}^{N_s} w_j^s \cdot \delta_j = 0, \quad \sum_{j=1}^{N_j} w_j^j \cdot \theta_j = 0 \quad (5)$$

where  $w_j^d = \sum_{\{f:d_f=j\}} w_f$  is the sum of the weights for the  $j$ -th destination, and similarly for product, size and import intensity.

We estimate equation (4) by constrained linear regression, imposing the restrictions described in equation (5). This approach allows us to obtain estimates and standard errors for all the coefficients without having to choose a base category normalised to zero.

The coefficient estimates can be interpreted as effects by destination type, product type, size and import intensity in the sense that the predicted growth for a particular flow is equal to a constant plus the sum of the respective coefficient estimates for each characteristic. The weighted average of the coefficients for each category is zero, so that the constant in (4) can be interpreted as an aggregate export growth rate.

### **3. Data**

We use quarterly datasets of individual firms exporting goods from the Czech Republic in 2005–2014. The datasets are provided by the Czech Statistical Office. The unit of observation is the value of exports by firm, product and destination. Products are reported by 8-digit Combined Nomenclature groups. We aggregate the product groups into 6-digit classes which correspond to the Harmonised System groups (HS6). In order to account for revisions in the HS6 classification, we apply correspondence tables. We drop from the dataset the 2-digit HS group of 97 (works of art). We aggregate the HS6 products into categories of the System of National Accounts (SNA). The main SNA categories are capital goods, intermediate goods and consumption goods. The remaining classes are passenger motor cars, motor spirit and goods not elsewhere specified. Among destination types, we retain three main trading partners of the Czech Republic: Germany, Slovakia and Poland, and aggregate the remaining destinations into the rest of the euro area, consisting of euro area countries as of 2014, the remaining EU countries and the rest of the world. Since trade is concentrated among large firms, we provide results by firm size. We rank firms by export value in each broad 2-digit HS product class and time period and define the size using the percentiles of the distribution (see Bricongne et al., 2012).

We address several measurement issues. The intra-EU export data are for firms whose yearly exports exceed CZK 4 million until 2008 and CZK 8 million since 2009. Due to the increase in the reporting threshold in 2009 we exclude firms from our sample in those years in which their yearly exports are lower than CZK 8 million. Next, as of 2009 firms are allowed to fill in joint reports on their exports. The introduction of exporting groups affects our results, as it increases firm exits and entries starting in 2009. In order to mitigate this problem, we exclude from our dataset firms which are denoted as groups.

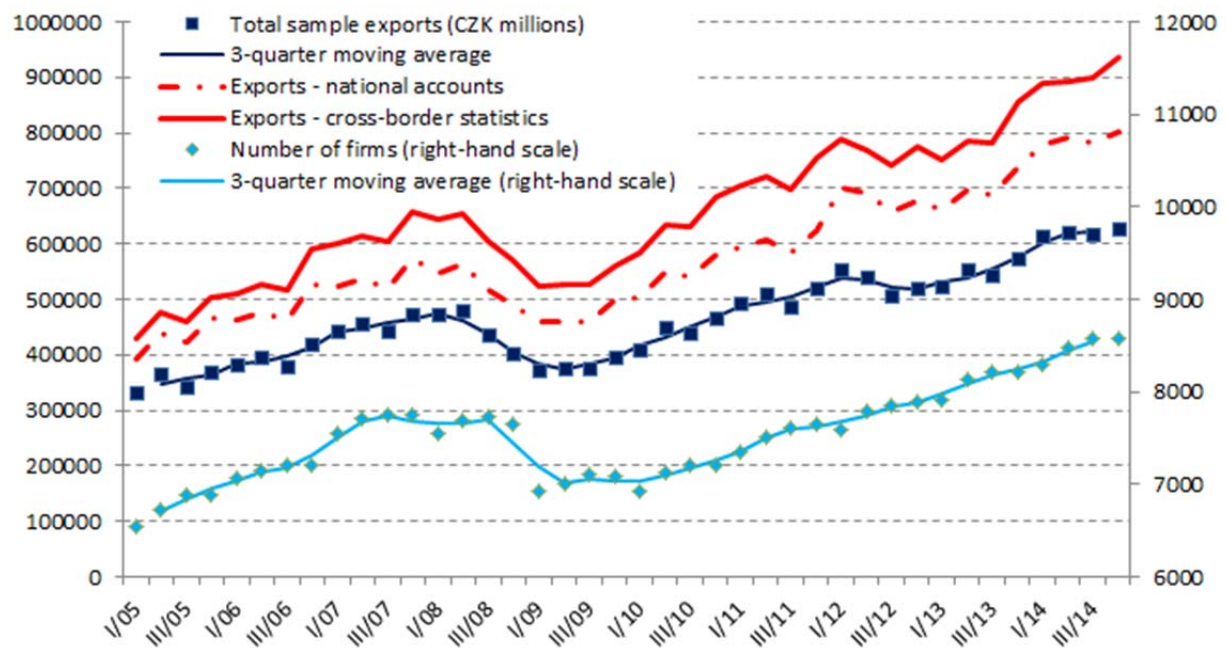
Figure 1 shows the sample value of exports and the number of exporters. The total sample export value has been increasing since 2005 with the exception of late 2008 and 2009, when the export dynamics were negatively affected by the global crisis, and also with the exception of 2013. Our total sample exports lie below the export values reported by the Czech Statistical Office both in the national accounts definition and in the cross-border statistics. The number of exporters decreased due to the crisis, reaching a minimum in 2009. These observations can be matched with the key macroeconomic indicators in Table 1. In particular, the total sample export value corresponds to the changes in gross domestic product, industrial production and export growth, particularly in 2009 and 2013.

Although the aggregates obtained from our data in Figure 1 correspond well with the official statistics shown in Table 1, there are important methodological differences. While our datasets contain all cross-border flows of goods which are above specific thresholds, the export growth rates in Table 1 include services, are consistent with ownership changes, and include below-the-threshold estimates.

Additional information on the sample is provided in the Appendix. Figure A1 shows exports by destination. It reveals that the 2008–2009 crisis affected exports to all destinations. Figure A2 displays exports by the three main SNA categories. Exports of intermediate and capital goods declined sharply due to the 2008–2009 crisis and recovered quickly in 2010. On the other hand, exports of consumption goods declined only mildly during 2008–2009 and then exhibited robust growth, particularly from 2013 onwards.

In Table A1 we report export shares. It seems that firm size matters a lot. About three quarters of exports are realised by the top 5% of exporters and this ratio is relatively stable over time. While Germany remains the largest destination, the overall share of exports to the EU, except for Slovakia and Poland, which are stable, has decreased slightly, from 66% before the crisis to 62% in the post-crisis recovery period. This decrease was offset by a rising share of exports to the rest of the world. Large firms are more likely to export to the EU, excluding Slovakia and Poland, while small firms export disproportionately more to Slovakia. Exports of intermediate goods dominate, accounting for about 60% of exports, with the overall structure of exported goods remaining roughly stable over time. Small firms export more capital and consumption goods, while large firms dominate in exports of other goods, especially passenger cars. The share of exports by firms with high import intensity has been decreasing slightly over time, from about 45% before the crisis to 40% in the post-crisis period.

**Figure 1: Exports and the Number of Exporters**



**Note:** Total sample exports, number of firms and 3-quarter moving averages. Exports according to national accounts and cross-border statistics (f.o.b.) published by the Czech Statistical Office (red lines).

**Table 1: Key Macroeconomic Indicators (year-on-year changes in %)**

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
GDP*	6.8	7.1	5.5	2.5	-4.7	2.1	2.0	-0.8	-0.5	2.0
Industrial production*	3.9	8.3	10.6	-1.8	-13.6	8.6	5.9	-0.8	-0.1	5.0
Exports of goods and services*	11.9	14.8	11.0	3.8	-9.5	14.4	9.3	4.5	0.0	8.9

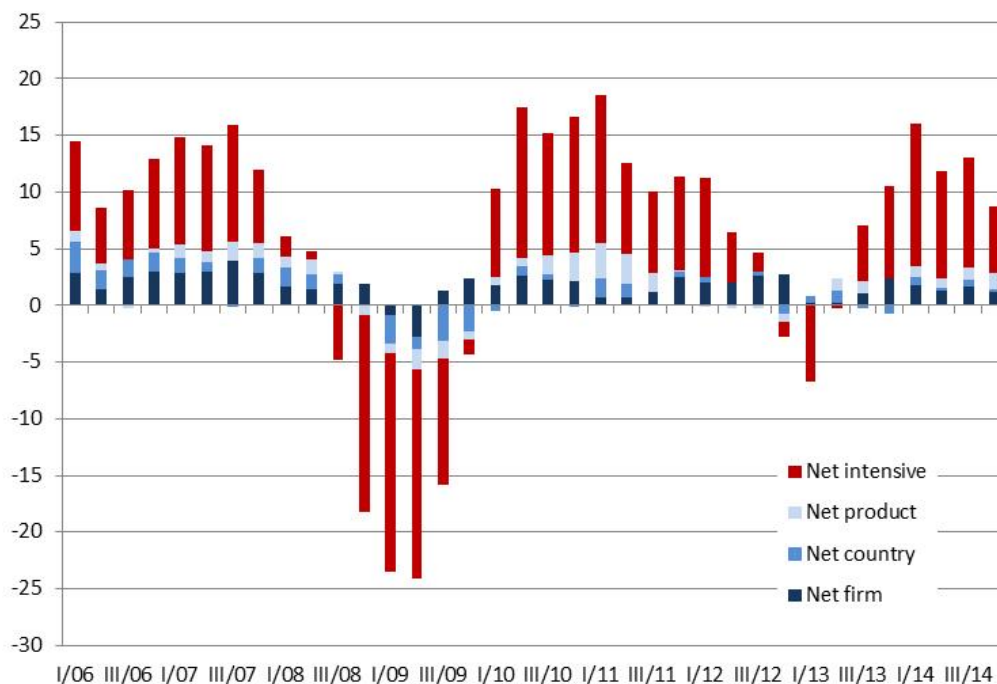
*Note:* \* real terms

*Source:* Czech Statistical Office

#### 4. Results

Figure 2 shows the contributions of net margins to mid-point growth rates. The intensive margin explains most of the aggregate export growth in 2006–2014. This is similar to previous findings for other countries, including those of Bernard et al. (2009) and Amador and Opromolla (2013). The role of the extensive margin is much smaller, but not negligible. During the crisis period of 2008–2009, the intensive margin was negative as from the second half of 2008, while the country and product net margins turned negative at the end of 2008 and at beginning of 2009 respectively.

**Figure 2: Contributions of Net Margins to Mid-point Growth Rates**



We compute the averages of the quarterly mid-point growth rates for three periods: pre-crisis (2006–2007), crisis (2008–2009) and post-crisis (2010–2014). The results for the total sample and across firm size are reported in Table 2. While most net margins turned negative in 2008–2009,

the net firm extensive margin remained positive at 0.9%.<sup>4</sup> The total extensive margin was slightly negative at -0.2% in 2008–2009. Comparing the pre-crisis and post-crisis periods, we observe a much lower net country contribution at 0.3% in 2010–2014, while the contribution of the net product extensive margin returned to the pre-crisis level of 0.9%. Looking at the results by firm size, the lower net country contribution after the crisis is driven by large firms, while large firms also contributed significantly to the positive firm extensive margin in 2008–2009. In sum, the net extensive margin explained on average 39% of the aggregate export growth in 2006–2007, 25% in 2009 and 2010, 30% in 2011 and 25% in 2014, suggesting that the contribution of the extensive margin declined in the post-crisis period. This may signal a lower rate of convergence of the Czech economy.

**Table 2: Contributions to Mid-point Growth Rates**

	size: all			size: 0–95%			size: 95–100%		
	2006– 2007	2008– 2009	2010– 2014	2006– 2007	2008– 2009	2010– 2014	2006– 2007	2008– 2009	2010– 2014
overall growth	12.8	-8.9	9.8	2.0	-4.3	1.0	10.8	-4.6	8.7
net intensive	7.8	-8.7	6.9	0.2	-3.9	-0.1	7.6	-4.8	7.0
intensive positive	23.7	18.1	23.5	5.0	3.9	4.6	18.6	14.2	18.9
intensive negative	-15.9	-26.8	-16.7	-4.8	-7.8	-4.8	-11.1	-19.1	-11.9
net extensive	5.0	-0.2	2.9	1.7	-0.4	1.2	3.3	0.2	1.7
net firm	2.8	0.9	1.7	0.9	-0.1	0.7	1.9	1.0	0.9
firm entry	6.4	5.7	5.6	2.6	2.1	2.5	3.8	3.6	3.2
firm exit	-3.6	-4.8	-4.0	-1.6	-2.2	-1.7	-2.0	-2.6	-2.3
net product	0.9	-0.4	0.9	0.3	-0.2	0.2	0.6	-0.2	0.8
product entry	5.8	4.8	5.2	2.2	1.9	2.0	3.6	2.9	3.3
product exit	-5.0	-5.2	-4.3	-2.0	-2.1	-1.8	-3.0	-3.0	-2.5
net country	1.4	-0.7	0.3	0.5	-0.1	0.3	0.9	-0.6	0.1
country entry	5.0	5.1	4.1	1.9	1.7	1.7	3.0	3.4	2.5
country exit	-3.6	-5.7	-3.8	-1.4	-1.8	-1.4	-2.2	-4.0	-2.4

**Note:** Firm size is based on the ranking by export value and HS2 product group in each period. Size groups are denoted up to the 95<sup>th</sup> percentile and the top 5% of exporters.

In Table 3 we delve into investigating the factors behind the observed net extensive margins. The positive net firm margin in 2008–2009 is driven mainly by large firms, by exports out of the EU and to Germany and by exports of low import intensity. In the post-crisis period, the net firm margin is lower than in 2006–2007 due to exports to the euro area as well as exports of intermediate and capital goods. Among the product types, the higher contribution to the net firm margin in 2010–2014 relative to 2006–2007 is due to exports of consumption goods.

<sup>4</sup> In Figure 1 we observe a drop in the number of firms in 2009. The positive net firm margin in 2009 means that the export value of firm entries is higher than that of firm exits even though the number of entries is lower than the number of exits.

The other columns in Table 3 show the contributions to the net country and net product margins. The net country margin is lower after than before the crisis, mainly due to much lower contributions of large firms, exports to European countries except for Poland and Slovakia, and exports of capital and intermediate goods. The overall net product margin is the same in 2010–2014 as in 2006–2007, but the contributions of exports by large firms, exports to Germany and intermediate goods are higher. In terms of product categories, the exception from the usual pattern was consumption goods, for which the net product margin was around zero in all periods.

**Table 3: Contributions to Net Extensive Margins**

	<u>net firm margin</u>			<u>net product margin</u>			<u>net country margin</u>		
	2006– 2007	2008– 2009	2010– 2014	2006– 2007	2008– 2009	2010– 2014	2006– 2007	2008– 2009	2010– 2014
<i>overall</i>	2.8	0.9	1.7	0.9	-0.4	0.9	1.4	-0.7	0.3
<i>size</i>									
0–95%	0.9	-0.1	0.7	0.3	-0.2	0.2	0.5	-0.1	0.3
95–100%	1.9	1.0	0.9	0.6	-0.2	0.8	0.9	-0.6	0.1
<i>destination</i>									
DE	0.5	0.3	0.2	0.1	0.0	0.3	0.2	-0.2	-0.1
PL	0.4	0.0	0.2	0.0	0.0	0.0	0.0	-0.1	0.0
RoEA	0.9	0.0	0.3	0.2	-0.1	0.2	0.4	0.0	0.0
RoEU	0.2	0.0	0.2	0.2	0.0	0.1	0.3	0.1	0.0
RoW	0.4	0.4	0.5	0.2	-0.2	0.2	0.6	-0.2	0.4
SK	0.4	0.1	0.2	0.1	0.0	0.0	0.0	-0.2	0.0
<i>product</i>									
capital	0.6	0.4	0.3	0.4	-0.3	0.2	0.4	0.0	0.1
interm.	1.6	0.2	0.7	0.3	-0.2	0.6	0.6	-0.9	0.1
consum.	0.3	0.1	0.5	0.0	0.0	0.0	0.2	0.1	0.0
other	0.2	0.2	0.1	0.1	0.0	0.2	0.1	0.2	0.1
<i>import intensity</i>									
low (<0.5)	1.2	0.7	0.9	0.9	-0.2	0.7	1.0	0.4	0.4
high (>0.5)	1.6	0.1	0.8	0.0	-0.2	0.2	0.4	-1.0	0.0

**Note:** Firm size is based on the ranking by export value and HS2 product group in each period. Size groups are denoted up to the 95<sup>th</sup> percentile and the top 5% of exporters. The destinations are Germany (DE), Poland (PL), Slovakia (SK), rest of the euro area (RoEA), rest of the EU (RoEU) and rest of the world (RoW). System of National Accounts product groups: capital, intermediate, consumption and other goods. The import intensity of exports is less than 50% (low) and 50% or more (high).

In the next part, we conduct a shift-share decomposition of the firm-product-destination export growth rates by estimating constrained linear regressions to investigate the factors of export adjustment. We estimate equation (4) with the condition for their parameters in (5) separately for each quarter in 2006–2014, using mid-point growth rates as the dependent variable. The estimation yields coefficient estimates of dummies for destination types, product groups, firm size and import intensity groups. In each group of characteristics the sum of the estimates is zero. A



positive (negative) estimate thus means that the model predicts a higher (lower) impact relative to other characteristics. In other words, a positive (negative) coefficient can be interpreted as an increasing (decreasing) relative contribution. The aggregate export growth rate is captured by the intercept.

The results in Figure 3 suggest that in terms of destinations, Germany fared better than other destinations during the crisis, while exports to Poland and the rest of EU were affected more severely. After the recovery started, exports to the rest of the euro area were below the average while exports to the rest of the world were growing faster.

The next panel in Figure 3 shows the estimates for the SNA product groups. Capital and intermediate goods export growth was hit hard during the crisis, while consumption and other goods performed better. The fall in capital goods exports seems to have arrived a couple quarters later than the drop in intermediate goods. On the other hand, the relative contribution of exports of consumption goods was positive in 2009.

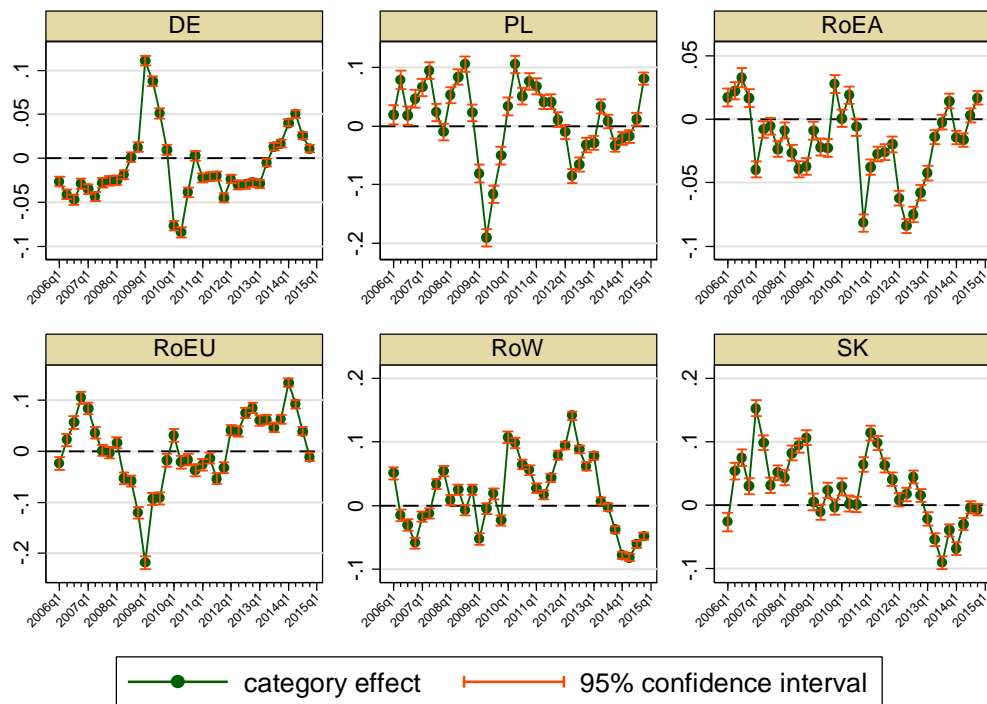
Next, the results in Figure 3 indicate that the contribution of small firms to total exports was negative in the whole period of 2006–2014, while the negative contribution was more pronounced during the crisis. The relative contribution of the top 1% of exporting firms was positive, particularly in 2009–2010. The trough in the contribution of small firms up to the 80th percentile of the size distribution is observed at the end of 2009, which suggests that the negative impact of the crisis lasted longer among smaller firms, while exports of large firms recovered faster.

We include in our regressions the import intensity of exports, which is a proxy for participation of firms in global value chains. The estimates in Figure 3 suggest that firms with lower import intensity fared better during the crisis than firms with higher import intensity. This indicates that firms involved in international production chains were hit harder by the crisis.

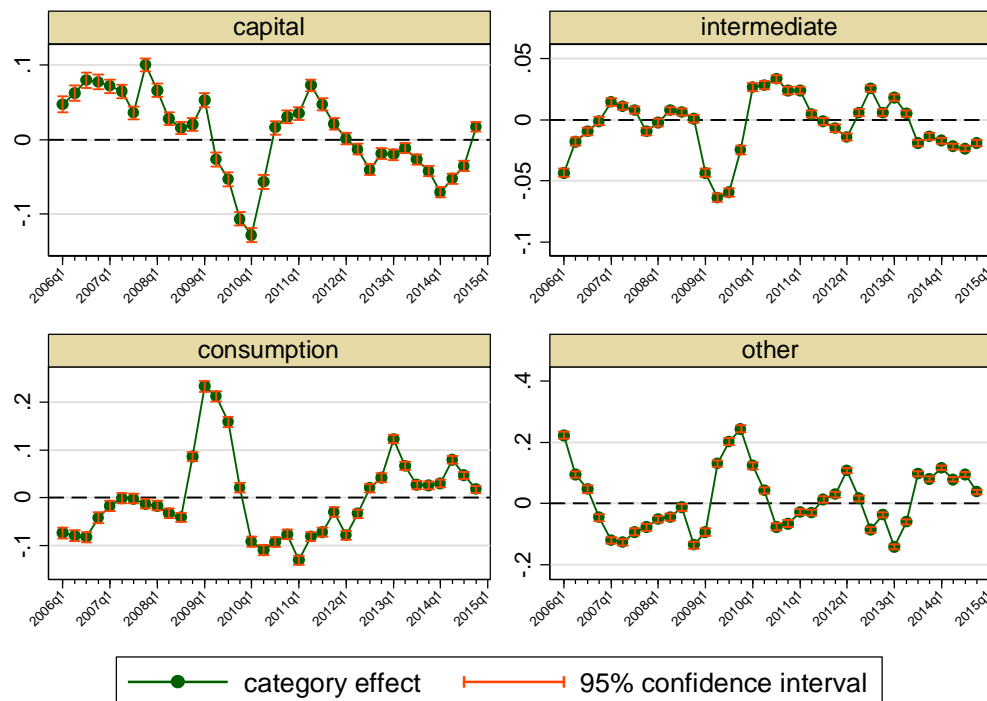
Our results may be affected by measurement issues. In particular, intra-EU exports are reported in our datasets if yearly firm exports were higher than CZK 4 million until 2008 and more than CZK 8 million since 2009. Another change was the introduction of joint export declarations in 2009, which could have affected firm entries and exits starting in 2009. We dealt with these measurement issues in preparing the dataset when we removed from the dataset exports of firms with below-the-threshold exports as well as firm groups. While deleting the below-the-threshold exports addresses the problem of the increased threshold, removing firm groups from the sample may lead to under-representation of large firms starting in 2009. There is no information in the dataset on which firms exited their exports due to the creation of firm groups. As this may still impact on our results, we repeated all the calculations on a sample including firm groups. The results, available upon request, indeed show a higher net firm contribution in 2009, which is due to higher firm entry mainly among large firms. More importantly, the other results on the margins of trade and from the decomposition analysis remain the same. In particular, the extensive margin explains the same proportion of the post-crisis export growth as in our baseline results. Hence, the introduction of joint export declarations in 2009 does not affect our main results.

Figure 3: Decomposition of Export Growth Rates

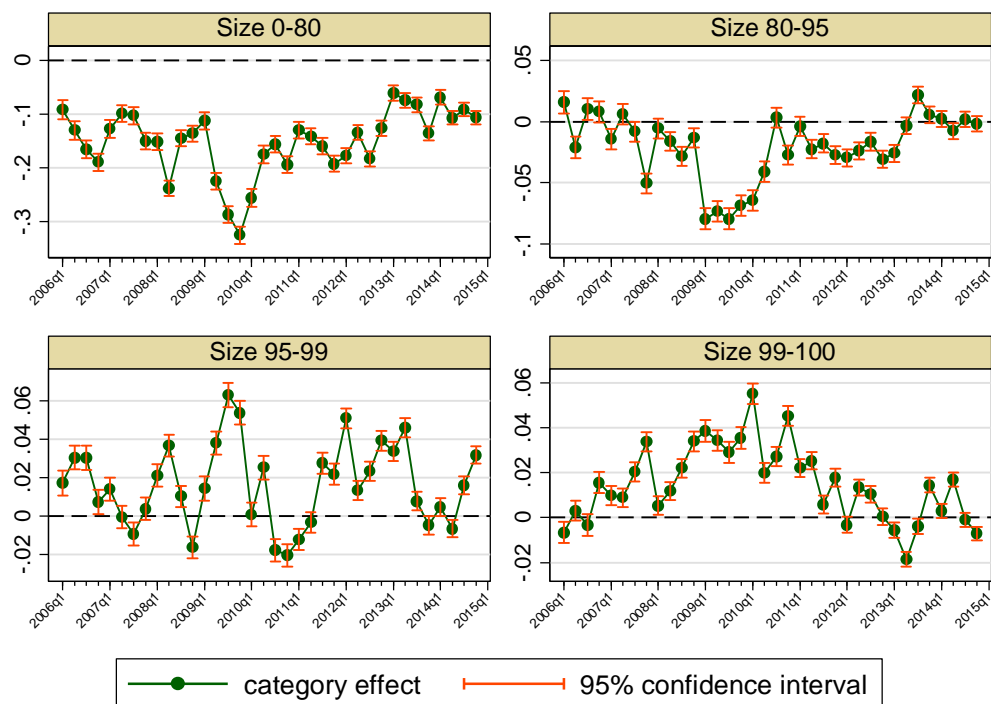
(i) destinations



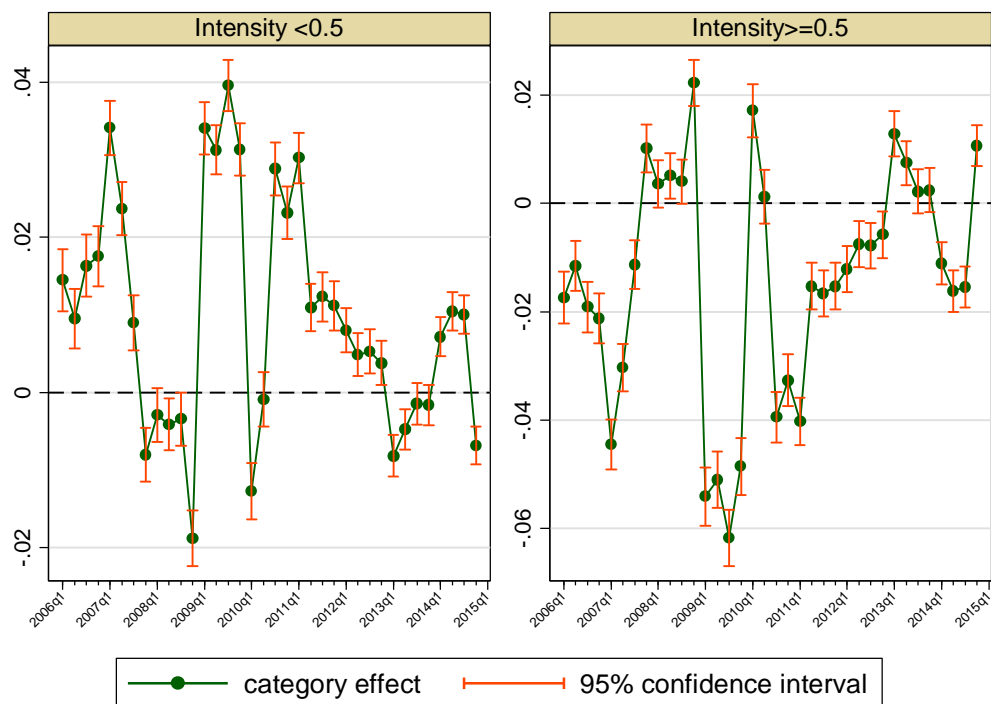
(ii) SNA product groups



(iii) firm size



(iv) import intensity



**Note:** The destinations are Germany (DE), Poland (PL), Slovakia (SK), rest of the euro area (RoEA), rest of the EU (RoEU) and rest of the world (RoW). System of National Accounts product groups: capital, intermediate, consumption and other goods. Firm size is based on the ranking by export value and HS2 product group in each period. Size groups are denoted up to the 80<sup>th</sup> percentile, the 80<sup>th</sup> to the 95<sup>th</sup> percentile, the 95<sup>th</sup> to the 99<sup>th</sup> percentile and the top 1% of exporters. The import intensity of exports is less than 50% and 50% or more. Intercept estimates are not reported.

## 5. Conclusions

In this paper we investigate the role of trade margins in explaining aggregate export growth in the Czech Republic in 2006–2014. We find that the intensive margin explains most of the aggregate export growth, which corroborates findings in the previous literature for other countries. The contribution of the net extensive margin, i.e. entries and exits in export relationships by firm, destination and product, declined in the post-crisis period in comparison with 2006–2007. This may signal a lower rate of convergence of the Czech economy. Our results also suggest that small firms were hit harder by the crisis of 2008–2009 and that exports to countries outside the EU have gained more relevance in the post-crisis years.

Our results are in line with other studies on the impact of participation in global value chains on firms' trade. Although our dataset does not provide direct information on the participation of firms in global value chains, we use the import intensity of exports as a proxy. The results suggest that firms involved in production chains were hit harder by the crisis. Overall, our results point to the importance of using disaggregated data in the analysis of countries' export performance.

In our analysis we had to address measurement issues due to an increase in the reporting threshold and to the introduction of joint export declarations, both as of 2009. Our results are not significantly affected by the introduction of joint export declarations, but part of the firm extensive margin may still be due to changes in firms' identification. Information on firms' organisational changes is unfortunately not available in our datasets.

Our results point to the importance of participation of firms in global value chains. However, we rely on the import intensity of exports as an indirect measure. Direct measures of involvement in production chains would be desirable, as the adjustment patterns are likely to be different under adverse shocks.

We define the extensive margin as no exports in the preceding or next period, or, more precisely, exports not exceeding the reporting threshold. It is worth analysing, in line with other literature on margins of trade, the dynamics of exporting firms in terms of their ability to enter and remain on international markets for several consecutive periods. Future research could focus on questions such as how small exporting firms thrive on international markets and what their prospects are in terms of ability to grow and move downstream along the production chain. This is important because, as our results suggest, exports of consumption goods are less responsive to adverse shocks.

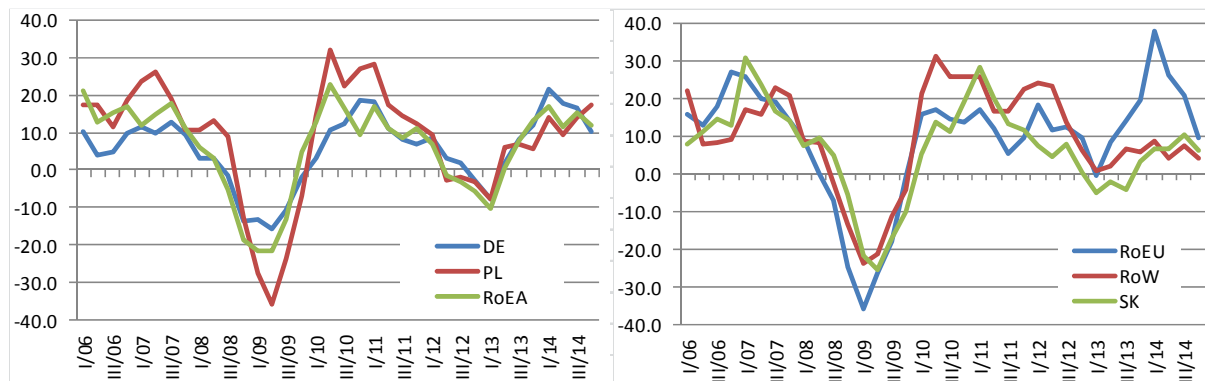
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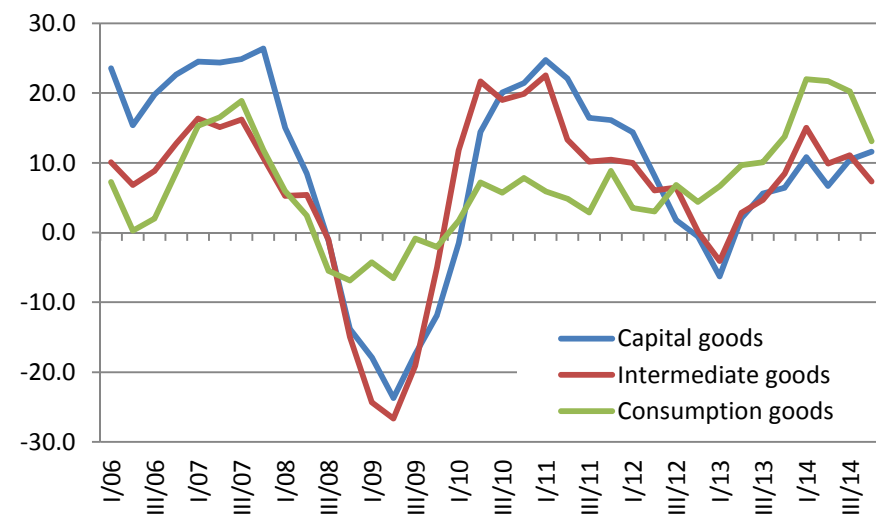
## Appendix: Additional Tables and Figures

**Figure A1: Exports by Destination (y-o-y changes in %)**



**Note:** The destinations are Germany (DE), Poland (PL), Slovakia (SK), rest of the euro area (RoEA), rest of the EU (RoEU) and rest of the world (RoW).

**Figure A2: Exports by Main SNA Category (y-o-y changes in %)**



**Table A1: Export Share**

	<u>2006–2007</u>			<u>2008–2009</u>			<u>2010–2014</u>		
size:	0–95%	95–100%	all	0–95%	95–100%	all	0–95%	95–100%	all
<i>size</i>									
0–95%	100%	0%	24%	100%	0%	25%	100%	0%	24%
95–100%	0%	100%	76%	0%	100%	75%	0%	100%	76%
<i>destination</i>									
DE	30%	32%	31%	28%	32%	31%	26%	31%	30%
PL	6%	7%	6%	6%	7%	7%	7%	6%	7%
RoEA	20%	26%	24%	20%	25%	24%	19%	24%	22%
RoEU	8%	11%	10%	8%	10%	10%	8%	10%	10%
RoW	19%	19%	19%	21%	19%	20%	24%	22%	22%
SK	17%	7%	9%	17%	7%	10%	16%	7%	9%
<i>product</i>									
capital	21%	14%	16%	22%	16%	17%	22%	15%	17%
interm.	60%	61%	61%	58%	59%	59%	57%	58%	58%
consum.	18%	10%	12%	19%	10%	13%	18%	10%	12%
other	1%	15%	12%	1%	15%	11%	3%	16%	13%
<i>import intensity</i>									
low (<0.5)	48%	58%	55%	52%	60%	58%	53%	62%	60%
high (>0.5)	52%	42%	45%	48%	40%	42%	47%	38%	40%

**Note:** Firm size is based on the ranking by export value and HS2 product group in each period. Size groups are defined up to the 95<sup>th</sup> percentile and the top 5% of exporters. The destinations are Germany (DE), Poland (PL), Slovakia (SK), rest of the euro area (RoEA), rest of the EU (RoEU) and rest of the world (RoW). System of National Accounts product groups: capital, intermediate, consumption and other goods. The import intensity of exports is less than 50% (low) and 50% or more (high).



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