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Competitiveness and export performance of CEE countries

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Abstract

Over the last two decades the share of CEE countries' exports of goods in world exports more than doubled, despite considerable appreciation of their real effective exchange rates. Inspired by this observation, we set out to establish which factors had impact on their export performance. For that purpose, we run a series of panel regressions in which export market shares are explained by various measures of price/cost competitiveness, technological advancement and institutional environment. We make two important contributions to the subject literature. We show that technological factors, specifically innovative outputs (patent applications), had the most significant positive impact on export performance and that was in addition to their impact through the economic potential. Moreover, we verify the impact of the quality of the institutional environment on exports. Specifically, we show that improvements in the overall regulatory quality were conducive to increasing export market shares. The results regarding price/cost competitiveness are less robust and depend on the measure used. Hence, we conclude that further gains in non-price competitiveness should be considered for the region to compete successfully in international markets in the long run.

JEL codes: F14, F15, R10

Keywords: Central and Eastern Europe, open economy, trade, export market shares, price/cost competitiveness, technological competitiveness, institutional environment

1. Introduction

We start our discussion by defining competitiveness as 'the degree to which, under free and fair market conditions, a country can produce goods and services which meet the test of foreign competition while simultaneously maintaining and expanding the real income of its people' (OECD, 1992). Hence, competitiveness relates both to the country's trade performance (which can be referred to as international competitiveness) and to the economic welfare of the country's citizens. In this paper we focus on the first meaning of the term, in particular, the determinants of export performance.

Competitiveness covers price and cost competitiveness on the one hand and non-price competitiveness on the other. Changes in price/cost competitiveness depend on movements in nominal exchange rates as well as costs and prices at home and abroad. According to a standard export demand equation, the appreciation of the country's real effective exchange rate should lead to a fall in demand for its goods.

We concentrate on two components of non-price competitiveness, namely technological and structural competitiveness (institutional environment, in particular). Technological competitiveness can be defined as the capacity to innovate, as well as to increase efficiency and reduce costs (ECB, 2012). The ability of a country to innovate and provide differentiated products in international markets constitutes an important source of competitive advantage. Spending more on innovation-spurring activities allows firms to improve the quality of their products and climb up the quality ladder. Technological advancements can lead to process or product innovations: process innovation results in a product being manufactured in a more efficient way, thereby reducing the costs of production, while product innovation results in a new commodity or a higher quality good (ECB, 2005). Hence, process innovations influence the intensive margin of export volumes via their impact on export prices. In turn, product innovations affect the extensive margin of exports through their impact on export offer.

Structural competitiveness can be defined as a set of characteristics of an economy, including human capital, infrastructure, labour and product market regulations, the legal and institutional framework (ECB, 2005). Institutions form an important element of the general environment that influences competitiveness by shaping the incentives of economic actors. These incentives determine resource accumulation and utilisation, technology development, internationalisation of business activities, etc. An unstable or unreliable institutional environment, for example, creates uncertainty and distorts longer-term (e.g. investment) decisions. Institutional constraints, such as monopoly rights and quotas, can reduce innovation potential, while strong intellectual rights protection can strengthen it. Finally, product and labour market regulations have impact on price/cost competitiveness (Hämäläinen, 2003). Weaknesses in structural competitiveness can thereby hinder technological advancement and hurt price/cost competitiveness.

In this paper we analyse export performance and (price/cost and non-price) competitiveness of the CEE countries[1] over the last two decades. We make a number of interesting contributions to the literature. We use a simple model of exports to derive a novel empirical specification, linking countries' export market shares with their relative costs, technological advancement and quality of institutional environment. We then estimate this model using a large dataset that contains data on exports (including the division of exports into different categories depending on their technological intensity), various measures of price/cost competitiveness and technological advancement and a wide selection of institutional indices. The paper particularly contributes to the subject literature by: (i) demonstrating the positive impact of technological advancement on export performance, in addition to its impact through the economic potential and (ii) verification of the positive impact of the quality of the institutional environment on export performance.

[1] The term 'CEE countries' in this paper refers to CEE-6, i.e. Bulgaria, the Czech Republic, Hungary, Poland, Romania and Slovakia.

Regarding technological competitiveness, our results are suggestive of greater importance of innovative outputs (patent applications) than e.g. innovative inputs (R&D outlays) in boosting export performance. Concerning institutional factors, we find that the higher overall regulatory quality, rather than the general institutional environment or the quality of either product or labour market regulation, was conducive to increasing export market shares.

The reminder of this paper is structured as follows. In section 2 we review the theoretical and empirical literature on the impact of various aspects of competitiveness on export performance. In section 3 we present stylised facts on CEE countries' export and their competitiveness. In section 4 we present an econometric model, quantifying the importance of price/cost- and non-price factors for the region's export performance. Section 5 concludes with the summary of our findings and recommendations for the future.

2. Literature overview

2.1. Theoretical approach

Trade models developed before World War I were based on the principle of comparative advantage. In early trade models, countries would specialize in the production of goods they have the comparative advantage in; trade would occur due to differences between countries. Such models, therefore, have difficulties explaining modern patterns of trade, i.e. trade between countries with similar relative factor endowments and trade in similar products (Krugman et al., 2012). Indirectly, these models underline the importance of price/cost competitiveness in achieving the comparative advantage (Hämäläinen, 2003).

The majority of models developed after World War II turned to emphasizing economies of scale, rather than comparative advantage, as the source of trade. Economies of scale provide an incentive for countries to specialize in production of a limited number of varieties of goods and to import other varieties from abroad. These models, using concepts of monopolistic competition and product differentiation, allow for trade in similar products and for trade between similar countries with no comparative advantage differences between them (Krugman et al., 2012). According to the technology gap theory, technological change can provide stimulus to exports not only through the reduction in production costs (the intensive margin), but also through introducing new goods (the extensive margin). The technologically advanced country enjoys monopoly in the production of new goods until other countries learn to produce them (Krugman, 1983; Gandolfo, 1998).

The "new" new trade theory, developed in the 21st century, emphasizes heterogeneity between firms, rather than sectors or countries, as a driver of international trade. This theory can therefore also explain trade in similar products. According to this approach, an individual firm chooses to export (or to set up subsidiaries abroad by outward FDI), depending on its productivity and cost structure. Since FDI and exports entail additional costs relative to servicing only the

domestic market, only the most productive firms engage in FDI, the firms with medium productivity levels choose to export, while the least productive firms remain domestically oriented (Melitz, 2003; Helpman et al., 2004).

Although not a formal theory, Porter (1990) diamond presents an interesting approach, emphasizing the importance of a broader environment for trade. A closer investigation of the competitive success of ten leading trading nations led Porter to the identification of a number of factors relevant for competitive advantage in trade. The model implies that a country's competitiveness depends on factor endowments, domestic demand conditions, relating and supporting industries as well as firm strategy, structure, and rivalry. The importance of factor endowments goes back to the traditional trade theories, although the model distinguishes between basic factors (e.g. natural resources) and advanced factors (e.g. technological know-how), the latter being more important for competitive advantage. The other three factors support the country's crucial source of competitiveness: the capacity of its industry to innovate and upgrade, through stimulating and supporting innovation and efficiency (Hämäläinen, 2003; Hill, 2009).

To summarize, theoretical literature on international trade departed from relying on cost-price differences between countries and moved on to emphasizing other factors (e.g. technology or innovation). In doing so, proponents of various approaches attempted to provide explanation for the observed developments in international trade, including globalisation, intra-industry trade and FDI. More practical approaches stressed the importance of a number of factors, in fact the entire environment in which firms operate.

2.2. Empirical evidence

The traditional models of trade indicate that exports depend positively on foreign demand and price/cost competitiveness. As indicated above, these two factors explain only part of export performance. Kaldor (1978) analysed 12 countries over

the period 1963-1975 and found that for some of these countries, the relation between growth in relative unit labour costs and growth in market shares for exports, when measured in value, seemed to be positive, or the opposite of what is commonly assumed (Fagerberg, 1988). This finding (the so called "Kaldor paradox") points to the importance of non-price competitiveness. On the supply side, exports are increasingly influenced by the globalisation and fragmentation of the production process as well as rapid technological progress, while on the demand side consumers are becoming more and more demanding as far as quality is concerned.

Among non-price factors, the role of variables reflecting technological change is crucial in explaining export performance. Amable and Verspagen (1995) report a significant, negative impact of a measure of unit labour costs and a significant, positive impact of the patenting variable (representing the effects of innovation) on export market shares, while the impact of the investment variable (representing the effects of new capital equipment) is positive but insignificant. However, as pointed by Amable and Verspagen (1995), there seem to be important differences between sectors and countries concerning the importance of the explanatory factors. According to Montobbio and Rampa (2005), the relation between the technological variable and export dynamics is affected by differences in the technological content of sectors. Moreover, as pointed by Madsen (2008), stock as opposed to flow of technology may be the relevant measure of export potential and external patents can have a substantially higher impact on exports than domestic ones.

Apart from price/cost and technological competitiveness, structural competitiveness may also be important for export performance. Carlin et al. (2001) show that both costs and embodied technology have an effect on export market shares, but neither can fully explain changing export positions. They suggest that successful export performance might be associated with 'relatively deep-seated features of a nation's institutions'. These institutional variables include human

capital formation, disembodied technical progress (as reflected in aggregate business sector total factor productivity growth) and the structure of corporate ownership. Bournakis and Tsoukis (2013) also attempt to uncover some of the deep institutional determinants of export performance. Apart from confirming the significant effect of traditional variables, relative unit labour costs and the share of R&D expenditures in GDP, on export performance, they show that product market rigidities such as barriers to entrepreneurship, barriers to competition and barriers to FDI impact negatively export performance via their adverse effect on the effectiveness of R&D. Bournakis and Tsoukis (2013) also find a negative impact of social expenditure (which is non-productive in its nature) on export performance. Finally, they show that there is a non-linear (hump-shaped) effect of tax-GDP ratio on export activity.

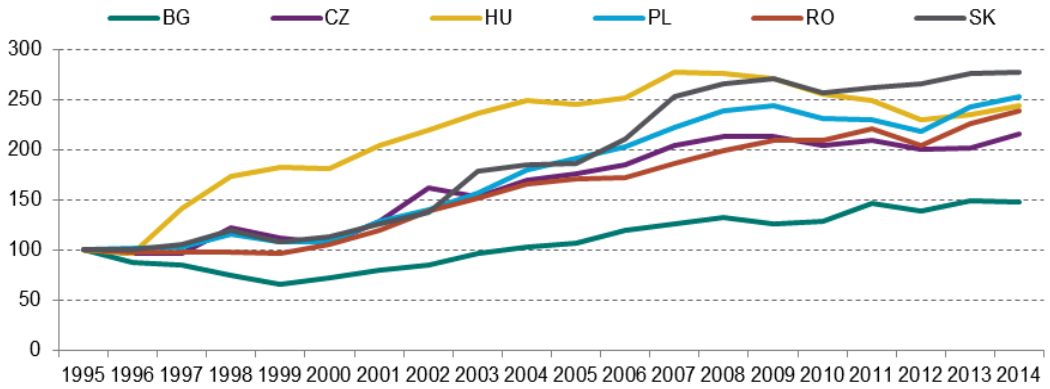
To summarize, empirical evidence suggests that price/cost competitiveness is not the only factor to explain export market shares. In the long run export performance depends also on non-price factors: technological and structural competitiveness.

3. CEE countries' exports and competitiveness: stylised facts

3.1. Characteristics of exports

Over the last two decades the CEE countries have increased their presence in the international markets. This trend can be partly explained by the expansion of multinational corporations' activity into their territories. Relatively low labour costs and direct proximity of the largest European markets spurred foreign capital inflows and resulted in the inclusion of the CEE countries in the European and global value chains (GVCs), leading to a significant increase in the share of the CEE countries' exports in world exports (see NBP, 2014a). Between 1995 and 2014 the share of the CEE countries' exports in world exports of goods more than doubled, increasing from 1.5% to 3.6% (Figure 1)[2].

Figure 1 Share in world exports of goods, 1995=100



Source: UNCTAD data, own calculations.

The CEE countries have mainly operated as manufacturers of intermediate goods within the GVCs, hence the share of manufacturing products in their exports of goods and services increased from 80% in 1999 to 85% in 2013. Given the relatively low share of services in exports, in the analysis below we focus on exports of goods.

[2] Between 1995 and 2014 the share in world exports increased from 0.1% to 0.2% for Bulgaria, from 0.4% to 0.9% for the Czech Republic, from 0.2% to 0.6% for Hungary, from 0.4% to 1.1% for Poland, from 0.2% to 0.4% for Romania and from 0.2% to 0.5% for Slovakia.

The CEE countries' exports are concentrated on EU markets. Notwithstanding the increasing role of multinational corporations in the region's exports, the share of geographically distant (non-European) markets in its export market structure has remained low. Due to the participation in GVCs, the CEE countries export their value added (VA) to distant markets through the input in products originating from Western Europe, mainly Germany, which has become an intermediary in the region's exports (see NBP, 2014). In 2014 Germany, the CEE countries' largest export market, accounted for over a quarter of the region's exports, whereas the share of the EU-28 reached nearly 80%. The CEE countries' low export market diversification and close proximity of export markets could suggest low non-price competitiveness[3].

The global process of fragmentation of production has led not only to a higher share of value added generated in the CEE in the exports of other countries, but it also contributed to an increase of the foreign VA in the CEE countries' exports. According to OECD-WTO Trade in Value Added database (October 2015), in 2011 the average share of foreign VA in the region's gross exports of manufactures was equal to 46.9%.

The intra-regional trade is of increasing importance. Between 1995 and 2014 there has been a significant increase of exports to other NMS[4] for Bulgaria, Hungary, Poland and Romania (Table 1). A decrease was observed for the Czech Republic and Slovakia, where the share of other NMS in export markets exceeded the region's average already in 1995. Following the break-up of Czechoslovakia in 1993, the share of Slovakia in Czech exports decreased from 14% in 1995 to 8% in 2014. At

[3] In 2014 the share of the US and China in the CEE countries' exports was equal to 2.3% and 1.4% respectively, while it was equal to 8.5% and 6.6% respectively for Germany and 5.9% and 2.8% respectively for Austria.

[4] The term 'new member states' (NMS) refers to those 13 countries which joined the EU from 2004 onwards, i.e. Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia.

the same time, the share of the Czech Republic in Slovak exports dropped from 35% to 13%. It was a consequence of tight production and trade links in former Czechoslovakia which had been loosened after the split into two countries.

Table 1 Geographic structure of exports (%)

	EU-15			NMS			CIS			Other advanced			RoW		
	1995	2005	2014	1995	2005	2014	1995	2005	2014	1995	2005	2014	1995	2005	2014
BG*	39.1	51.5	46.6	4.6	10.1	15.5	18.9	3.2	5.2	5.7	7.1	6.2	31.7	28.1	26.5
CZ	61.0	66.2	61.8	23.0	19.9	20.4	4.6	3.1	4.4	6.2	5.9	6.6	5.2	4.8	6.8
HU	63.3	65.4	55.9	12.5	16.8	22.2	10.5	3.7	5.2	6.4	6.3	7.2	7.3	7.8	9.5
PL	70.2	65.1	59.4	7.8	13.9	17.2	10.2	8.7	8.0	6.3	6.6	7.4	5.5	5.6	7.9
RO	54.1	59.6	54.8	5.3	11.7	16.1	5.7	3.5	6.4	8.7	7.2	5.8	26.2	18.0	16.9
SK	37.4	57.2	52.6	47.2	30.3	31.4	6.9	3.2	4.1	3.1	5.2	5.3	5.4	4.0	6.5
AT	63.5	58.5	50.5	11.8	15.9	16.7	1.8	2.6	3.6	13.2	15.2	16.2	9.6	7.8	13.0
DE	58.3	54.7	45.5	6.2	9.9	12.3	1.9	3.1	3.5	21.4	19.4	19.9	12.1	12.9	18.8

* Data for 1996 (instead of 1995) for Bulgaria.

** Country classification in line with the IMF. EU15 includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom. CIS includes Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. Other advanced economies include Australia, Canada, Hong Kong SAR, Iceland, Israel, Japan, Korea, Macao SAR, Monaco, New Zealand, Norway, San Marino, Singapore, Switzerland, Taiwan and the United States. RoW stands for the Rest of the World.

Source: UNCTAD data, own calculations.

The product structure of the CEE countries' exports reflects the concept of the GVCs (fragmentation of the production process on a global scale) and the position of the region in the GVCs as mainly the supplier of machinery and transport equipment. As a result, between 1995 and 2014 the average share of exports of machinery and transport equipment in total exports in the CEE economies increased from 20.2% to 44.3% (Table 2).

Table 2 Product structure of exports according to SITC classification (% of the total)

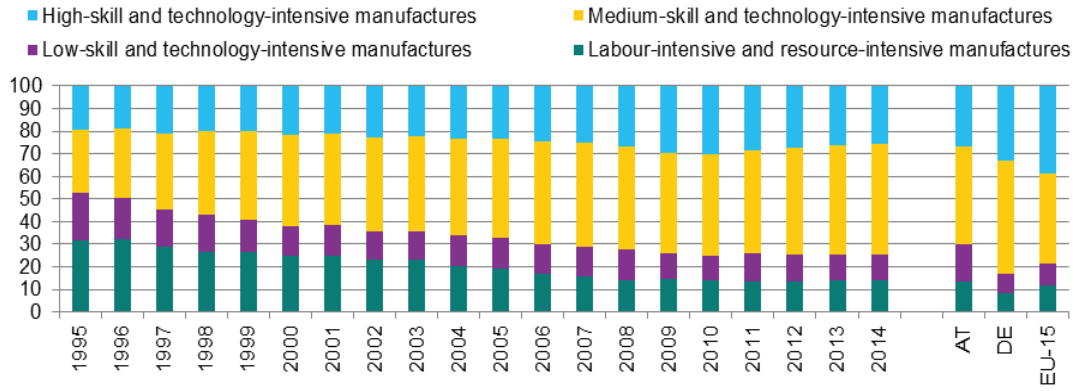
	BG	CZ	HU	PL	RO	SK	AT	DE
Food and live animals								
1995	8.5	4.8	18.1	9.1	5.1	5.0	3.2	4.1
2005	6.8	3.2	5.4	8.6	2.2	4.0	4.2	3.6
2014	10.6	3.6	6.8	10.7	6.8	3.4	5.7	4.6
Beverages and tobacco								
1995	8.8	0.8	2.1	0.7	0.4	0.9	0.7	0.7
2005	1.9	0.6	0.2	0.6	0.1	0.3	1.9	0.7
2014	2.0	0.8	0.5	1.6	1.5	0.2	1.3	0.8
Crude materials, inedible, except fuels								
1995	5.0	5.2	4.8	4.5	3.7	4.9	4.0	1.9
2005	6.4	2.4	1.7	2.2	4.8	3.0	2.6	1.6
2014	7.2	2.5	2.0	2.4	4.9	2.0	2.5	1.7
Mineral fuels, lubricants and related materials								
1995	6.5	4.3	3.1	8.2	7.9	4.2	1.1	1.0
2005	10.4	3.0	2.6	5.1	10.7	5.9	4.6	2.2
2014	12.6	2.7	3.5	4.1	6.0	4.7	2.4	2.7
Animal and vegetable oils, fats and waxes								
1995	0.4	0.2	0.4	0.1	1.0	0.1	0.1	0.3
2005	0.3	0.1	0.2	0.1	0.3	0.2	0.1	0.2
2014	1.0	0.3	0.6	0.3	0.3	0.2	0.2	0.2
Chemicals and related products, not elsewhere specified								
1995	18.3	9.2	11.5	7.7	10.7	12.6	7.8	13.4
2005	7.6	6.1	7.9	6.7	5.7	5.5	8.7	13.9
2014	8.9	6.4	10.4	9.1	5.0	4.8	12.5	14.9
Manufactured goods classified chiefly by material								
1995	26.3	32.2	17.3	27.5	25.9	40.8	29.1	16.5
2005	26.3	21.4	9.9	22.1	20.8	24.6	21.1	13.9
2014	22.1	16.6	10.4	19.8	16.0	16.9	21.2	12.2
Machinery and transport equipment								
1995	12.4	29.3	26.1	21.1	13.1	19.0	38.8	46.5
2005	14.2	50.2	59.7	38.6	25.4	44.2	41.1	50.2
2014	18.9	55.2	53.7	38.3	41.7	57.9	39.2	47.2
Miscellaneous manufactured articles								
1995	11.1	12.4	16.6	20.8	31.7	12.4	13.9	9.9
2005	22.3	11.2	8.7	13.9	29.3	10.6	11.7	9.8
2014	13.5	11.7	9.5	13.6	14.7	9.7	11.2	10.2
Commodities and transactions not classified elsewhere in the SITC								
1995	2.6	1.6	0.0	0.2	0.4	0.0	0.5	5.8
2005	3.9	1.9	3.6	2.1	0.6	1.9	4.1	3.9
2014	3.2	0.2	2.7	0.1	3.1	0.2	3.8	5.6

* Nomenclature used here reflects the trade classification maintained by the United Nations, i.e. Standard International Trade Classification (SITC), rev. 3.

Source: UNCTAD data, own calculations.

The participation of the CEE countries in the GVCs has contributed to changes in the technological intensity of manufacturing exports. Between 1995 and 2014, the technological intensity increased, with medium-tech manufacturing exports replacing mainly labour and resource -intensive ones (Figure 2). In terms of technological intensity, the composition of manufacturing exports is now a lot more similar to the one in Germany or the EU-15. Still, the share of high-tech exports in total exports from the region remains more than 10 p.p. lower than in more advanced EU countries, with the notable exception of Hungary which has achieved a relatively high share, comparable to that of Germany and the EU-15.

Figure 2 Technological intensity of manufacturing exports in CEE (shares, %)



* Data for AT, DE and EU-15 are for 2014.

Source: UNCTAD data, own calculations.

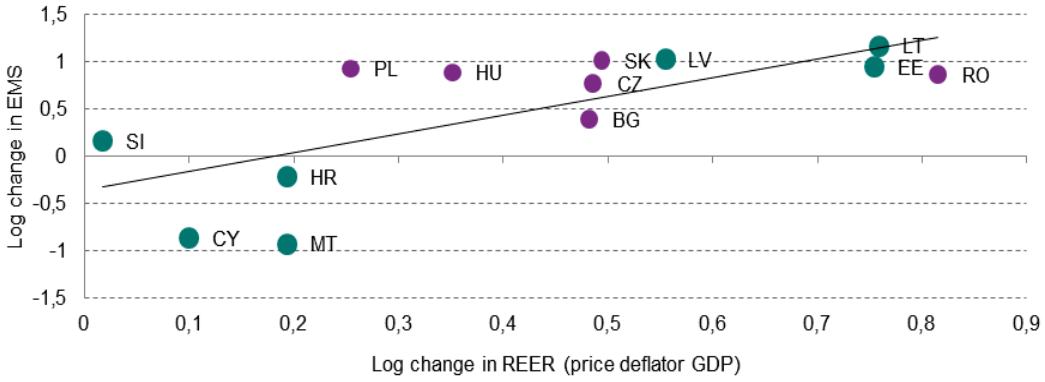
To summarise, export performance of the CEE region has improved markedly over the last two decades, largely due to the participation in GVCs. This has significantly influenced the geographical and product composition of the region's exports. Persistently low share of non-European markets in the CEE countries' exports, however, could suggest low non-price competitiveness, and so is the relatively low share of high-tech manufacturing exports.

3.2. Determinants of exports

International competitiveness should not be exclusively associated with price/cost factors, as suggested by the Kaldor paradox. Trends observed in the CEE countries

over the last two decades are reminiscent of the Kaldor paradox (Figure 3). Between 1995 and 2014 the six analysed countries experienced substantial increases in export market shares (EMS) and considerable appreciation of their real effective exchange rates (REERs). It can be explained by the fact that the increase in the CEE countries' exports contributed to their GDP growth, leading to an appreciation of their real exchange rates. This is to some extent an automatic result in catching-up economies.

Figure 3 The relationship between changes in share of exports in world exports and changes in REER* between 1995 and 2014



* An increase stands for appreciation.

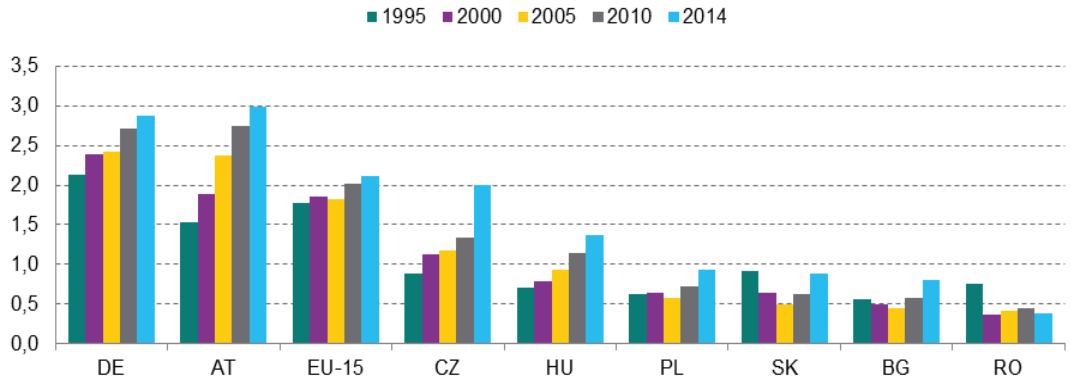
Source: UNCTAD and EC data, own calculations.

Technological competitiveness can be approximated by e.g. R&D expenditure and the number of patents. R&D outlays are interpreted as measuring technology 'input' while the number of patent applications/grants measures technology 'output' (Soete, 1981; Van Hove, 2009).

R&D activity is crucial for a country to become a knowledge-based economy, with competitive advantage no longer consisting in cost reduction, but in production of innovative, differentiated goods of high quality. Patents reflect the country's ability to exploit knowledge and transform it into potential economic gains.

Over the analysed period, the level of technological competitiveness of most CEE countries has increased (measured both by intramural R&D expenditure and patent applications). Still, in 2014 the region was still lagging behind Germany and Austria in terms of intramural R&D outlays (Figure 4) as well as patent applications (Table 3).

Figure 4 Total intramural R&D expenditure (% of GDP)



Source: Eurostat.

Table 3 Patent applications to the European Patent Office (EPO) and to the United States Patent and Trademark Office (USPTO) (per million population)

	BG	CZ	HU	PL	RO	SK	AT	DE
Patent applications to the EPO								
1995	1.0	1.7	5.4	0.4	0.3	1.3	84.5	159.6
2005	3.0	10.6	13.4	3.4	1.3	5.8	185.8	291.6
2014	6.6	25.3	22.5	16.0	5.1	8.7	230.2	256.0
Patent applications to the USPTO*								
1995	0.7	1.4	6.8	0.5	0.3	1.3	77.9	145.4
2005	7.5	7.9	13.0	2.7	0.8	3.0	127.3	250.5
2015	10.3	45.0	31.6	13.3	8.3	11.6	292.0	369.7

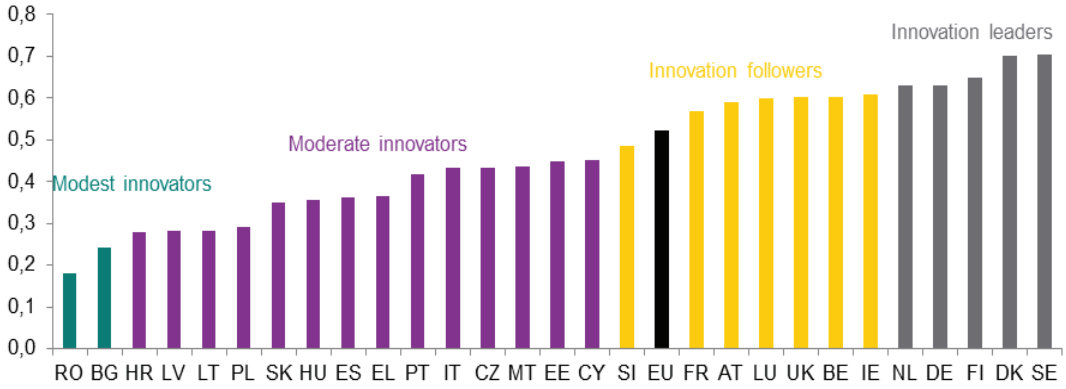
* Only utility patent applications are included.

Source: Eurostat and USPTO data, own calculations.

Innovation performance can also be measured by the European Commission's Summary Innovation Index. Its average value for the CEE countries is around half

of that for Germany[5]. The Czech Republic, Hungary, Slovakia and Poland are classified as "Moderate innovators" while Bulgaria and Romania as "Modest innovators" (Figure 5). Regarding the average annual growth rates of the Index calculated over the years 2008–2015, Bulgaria has been one of the growth leaders among the EU countries (Figure 6). Slovakia, Czech Republic and Poland have also seen their Summary Innovation Index scores improve on average, albeit only for Slovakia at a rate considerably higher than for the EU as a whole. At the same time Romania has recorded a decline in its innovation score, in particular since 2012.

Figure 5 Summary Innovation Index 2015 for the EU member states according to the European Innovation Scoreboard 2016

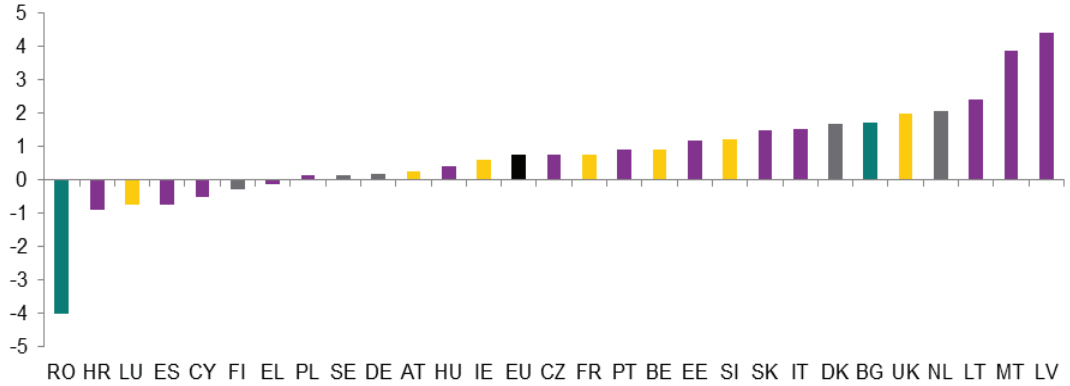


* Average performance is measured using a composite indicator building on data for 25 indicators going from a lowest possible performance of 0 to a maximum possible performance of 1.

Source: EC (2016).

[5] According to the European Innovation Scoreboard 2016 (EC, 2016), Summary Innovation Index 2015 (relative to Germany) was equal to 38% for Bulgaria, 69% for the Czech Republic, 56% for Hungary, 46% for Poland, 28% for Romania and 55% for Slovakia (the CEE countries' average was 49%).

Figure 6 The average annual growth rates of the Summary Innovation Index for the EU countries in 2008–2015 (%)



Source: EC (2016) data, own calculations.

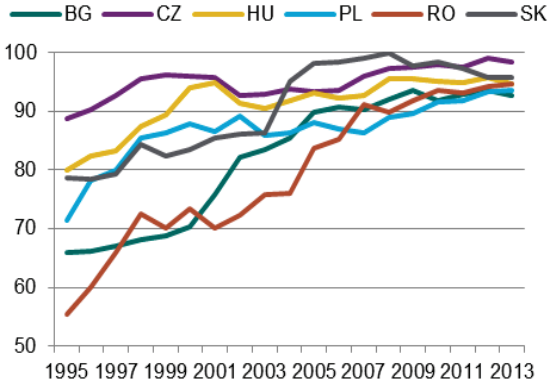
The institutional environment[6] of the CEE countries has improved since 1995, as illustrated by significant increases in the various indicators measuring the quality of institutions. In terms of the general institutional environment, the larger the original distance from the benchmark (assumed to be Germany), the longer was the convergence process, potentially with an additional boost around 2004, i.e. the year of the EU accession. The speed of convergence flattened out as the quality of institutions approached a 'developed-economy' level (Figure 7).

In terms of the general institutional environment, regulatory quality and absence of impediments to international trade, all countries have largely caught up with the benchmark (Figure 7, Figure 9 and Figure 10). The area where the region still appears to lag behind the benchmark is the legal system, covering such aspects as judicial independence, impartiality of courts, protection of property rights, integrity of the legal system and legal enforcement of contracts (Figure 8). This seems to illustrate the impact of the EU legal framework and its varying degree of harmonisation. The CEE countries were obliged to and hence did achieve full convergence in areas subject to the EU harmonisation, such as institutions related to

[6] See Appendix A for a review of the approaches to measuring quality of institutions.

international trade or competition policy, while the less harmonised areas have been lagging behind.

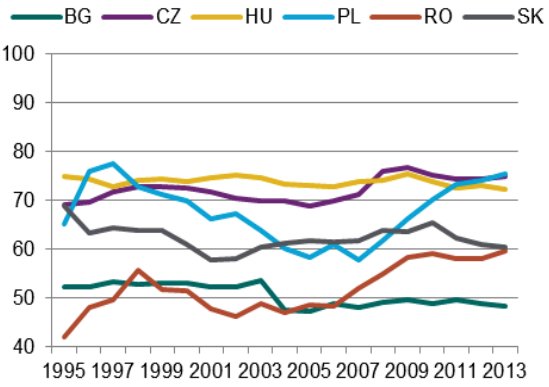
Figure 7 Convergence in terms of the general institutional environment



* The scores are averages of two indices (Fraser Institute's Economic Freedom of the World (EFW) index and Heritage Foundation's Index of Economic Freedom (IEF)), scaled relative to the score for Germany in a given year. Missing observations were filled by linear interpolation.

Source: Fraser Institute and Heritage Foundation data, own calculations.

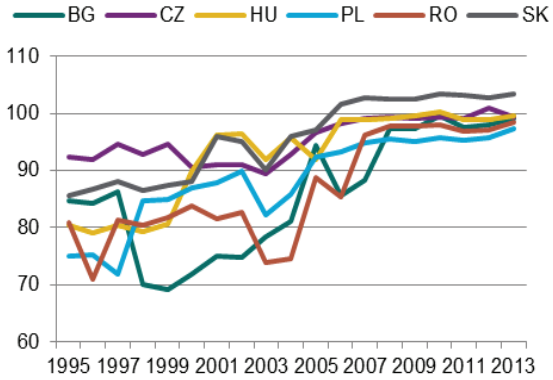
Figure 8 Convergence in terms of the quality of the legal system



* The scores are averages of available indices, scaled relative to the score for Germany in a given year. Missing observations were filled by linear interpolation.

Source: Fraser Institute and Heritage Foundation, own calculations.

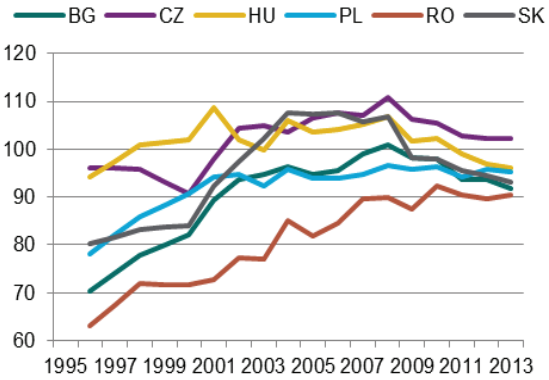
Figure 9 Convergence in terms of institutions related to international trade



* See Figure 8 for notes.

Source: Fraser Institute and Heritage Foundation data, own calculations.

Figure 10 Convergence in terms of the overall regulatory quality



* See Figure 8 for notes.

Source: Fraser Institute and World Bank data, own calculations.

To summarise, over the analysed period the CEE countries have experienced increases in export market shares despite appreciating real exchange rates. At the same time, non-price competitiveness has mostly improved, both as regards technological capacity and the institutional environment, albeit in some aspects it still remains underdeveloped.

4. Empirical analysis

The aim of this section is to determine which factors determine export market shares of EU countries. For that purpose we run a series of panel regressions on data for 28 EU member states between 1995 and 2014. Given the short time span of available series for the CEE countries, it is preferable not to restrict the model to the 6 CEE countries discussed in detail earlier. The adopted methodology follows broadly Carlin et al. (2001). We attempt to face the challenge set by Carlin et al. (2001), namely to unfold some of the institutional determinants of countries' export developments.

4.1 The model

According to the simple export equation, exports depend positively on foreign demand and price/cost competitiveness. We take this approach and extend it to include other relevant factors: technological advancement, institutional environment and economic potential. Hence, the specification of the export equation for each individual country *i* in period *t* is as follows:

$$\ln X_{it} = \alpha_i + \beta_1 \ln P_{it} + \beta_2 \ln T_{it} + \beta_3 \ln I_{it} + \beta_4 \ln Y^P_{it} + \beta_5 \ln Y^W_t + \varepsilon_{it}, \quad (1)$$

where X denotes exports, P - a measure of price/cost competitiveness, T – a measure of innovativeness/technological capability, I – a measure of institutional environment, Y^P – a measure of economic potential and Y^W – global demand, α – the individual constant and ε - an error term.

Similarly, assuming homogeneity of the parameters for all countries, the specification of the export equation for the EU is the following:

$$\ln X_{EU,t} = \alpha_{EU} + \beta_1 \ln P_{EU,t} + \beta_2 \ln T_{EU,t} + \beta_3 \ln I_{EU,t} + \beta_4 \ln Y^P_{EU,t} + \beta_5 \ln Y^W_t + \varepsilon_{EU,t}. \quad (2)$$

Subtracting the two equations from each other, we obtain the following simple equation in relative terms:

$$\tilde{x}_{it} = \delta_i + \beta_1 \tilde{p}_{it} + \beta_2 \tilde{t}_{it} + \beta_3 \tilde{i}_{it} + \beta_4 \widetilde{y_{it}^P} + \epsilon_{it}, \quad (3)$$

where each variable is defined as: $\tilde{z}_{it} = \ln\left(\frac{z_{it}}{z_{EU,t}}\right)$, $\epsilon_{it} = \varepsilon_{it} - \varepsilon_{EU,t}$ and $\delta_i = \alpha_i - \alpha_{EU}$.

There are a few reasons for preferring the relative specification (3). Firstly, by such relativisation, we are able to exclude the impact of external factors that influence exports of all EU countries (such as the opening of the Chinese economy). Secondly, what matters for export market share is not the absolute but the relative strength of factors that influence it. For example, if technological capability improved in all countries, there would be a global effect but little expected effect on the export market share of an individual country. Hence, a change in e.g. the technological capability is hypothesized to influence the export market share only to the extent that other countries' technological capabilities do not change by the same amount. Finally, the EU (average/aggregate) seems to be a natural benchmark due to the geographical situation of the analysed group of countries.

4.2 Econometric methodology

Our baseline specification is a simple panel data model with country fixed effects (FE). The assumption of country fixed effects is made for two reasons: firstly, we want to account for any persistent differences between countries that explain their export market shares (such as, for example, the geographical orientation of their exports); secondly, we analyse all member states of the EU, hence the sample does not constitute a random draw from some underlying population.

The analysis is carried out in three steps. Firstly, the model is estimated in a restricted form, encompassing only a measure of price/cost competitiveness. Secondly, the model is augmented with measures of technological competitiveness. From this step onwards, we control for the economic potential. Thirdly, the model is extended with measures of institutional quality.

4.3 The data

In accordance with the above specification, the variables in our model are all expressed relative to the EU-28 aggregate. Export performance is therefore measured as the log difference between manufactured goods' exports of country *i* and the sum of exports of all 28 countries of the EU (export market share). In the baseline specification, price/cost competitiveness is measured by relative real ULC, calculated as the log difference between the real ULC for each country and the real ULC for the EU-28. In robustness checks, we also use (relative) real effective exchange rates.

Being the main interest and contribution of this paper, technological competitiveness and institutional environment are each measured by a number of (relative) variables. Those related to technological capability include variables measuring innovativeness in various aspects and at various stages of technological advancement process: innovative inputs (R&D expenditure as a ratio to GDP), innovative outputs (patent applications to the EPO scaled by the size of the population), the measure of capital deepening (investment rate, defined as a ratio of gross fixed capital formation to GDP) and technological transfer from abroad (foreign direct investment, inward flows and stock, as a ratio to GDP). Among the many indicators measuring quality of institutions (see Appendix A), we use indices measuring the quality of the general institutional environment, the quality of the legal system, overall regulatory quality, product market regulation and labour market regulation. The baseline specification includes the indicators from Fraser Institute, due to their highest availability in terms of scope as well as time and country coverage; in robustness checks, we also use data from Heritage Foundation. Missing observations within the sample were filled in by linear interpolation. Finally, our methodology also controls for the effect of the economic potential of each country. The economic potential is measured by relative potential GDP.

In order to provide the maximum possible coverage, we use data from various sources. In general, data for exports and FDI comes from UNCTAD, technological and macroeconomic variables come from Eurostat and AMECO and institutional indices are obtained from Fraser Institute and Heritage Foundation (see

Table 4).

Table 4 Data sources

Code of the variable	Short description	Data source
X	Manufactured goods' exports (US dollars)	UNCTAD
ULC	Real unit labour cost	Own calculations based on data from Eurostat and AMECO[7]
REER-CPI	Real Effective Exchange Rate (deflator: consumer price indices - 42 trading partners; index, 2005=100). An increase stands for appreciation.	Eurostat
REER-ULC	Real Effective Exchange Rate (deflator: unit labour costs in the total economy - 37 trading partners; index, 2005=100). An increase stands for appreciation.	Eurostat
FDI	Foreign direct investment inward flows and stock as a share of GDP	UNCTAD
INV	Gross fixed capital formation as a share of GDP (in current prices)	Own calculations based on data from Eurostat
TRD	Total intramural R&D expenditure by sectors of performance (all sectors) as a share of GDP (in current prices)	Own calculations based on data from Eurostat
PAF	Patent applications to the EPO per million population	Own calculations based on data from Eurostat
POT	Potential GDP (at 2010 reference levels)	Own calculations based on data on potential GDP in national currency and 2010 ECU-EUR exchange rates (annual averages) from AMECO
IT	General institutional environment	Fraser Institute (baseline specification), Heritage Foundation (robustness check)
LEG	Legal system	Fraser Institute (baseline specification), Heritage Foundation (robustness check)
REG	Overall regulatory quality	Fraser Institute (baseline specification), Heritage Foundation (robustness check)
BF	Product market regulation/Business freedom	Fraser Institute (baseline specification), Heritage Foundation (robustness check)
LM	Labour market regulation	Fraser Institute (baseline specification), Heritage Foundation (robustness check)

[7] Real ULC is calculated using the following formula: ULC = [(compensation of employees/employees)/(GDP at current prices/total employment)].

4.4 Empirical results

First, we address the question of the impact of price/cost competitiveness on export performance. Our results indicate that the impact (using ULC as the price/cost competiveness measure) has been positive[8]. Table 5 presents the short- and long-run elasticities of export market shares with respect to ULC. Time lags (on both production and consumption side) in adjustment of exports to the relative price change (see e.g. Krugman et al., 2012) imply that the reaction of exports need not be immediate. Thus, we allow for a possible lag in the impact of changes in price/cost competitiveness on export market share. The chosen maximum lag length is three years, based on the general-to-specific approach to specification (while testing lags up to five years, as employed by Carlin et al., 2001). Our analysis shows that both short- and long-run elasticity of export market shares with respect to ULC is negative, but statistically significant only in the long run.

Second, we augment the model with measures of technological competitiveness and the potential GDP of each country (POT; this is done to control for the supply side of the economy). Again, we allow for contemporaneous as well as a lagged effect of changes in technology on export performance. We tested lags up to eight years (the maximum lag length applied by Carlin et al., 2001) and again chose the maximum lag length using the general-to-specific approach to specification (three years for patents and investment and five years for R&D expenditure). Our findings confirm the theoretical and empirical results that technological competitiveness has a significant effect on export market shares. However, not all aspects of technological capability are equally important. Our results attest to greater importance of innovative outputs (patent applications, PAF) in increasing the export market share than e.g. innovative inputs (R&D expenditure, TRD). The estimated coefficients for patent applications are positive and highly statistically significant, both at the short- and long-term horizon. The coefficients for R&D

[8] By higher price/cost competitiveness we mean lower ULC.

expenditure are also positive, albeit less statistically significant. In turn, the impact of investment (INV) is negative and statistically significant. This puzzling result appears to be due to a distortionary effect of a significant positive correlation of investment, contemporaneous and/or lagged, with potential output for a number of countries in the sample (this hypothesis is confirmed by the fact that when potential output is removed from the estimated equation, both the short- and the long-term elasticity of investment is no longer statistically significant). As regards inward FDI, we again allowed for both the short- and long-term effect, by simultaneously including inward flows and stocks of FDI. The results are qualitatively similar to those for domestic capital accumulation: the impact of technological transfer from abroad is negative (again, FDI stock exhibits an often statistically significant correlation with potential output in many countries; when potential output is removed from the estimated equation, the impact of inward FDI flows and stocks is no longer statistically significant). Our findings confirm that measures of innovative outputs such as patents may be superior to measures of innovative inputs such as R&D outlays, because what matters for product quality is not the inputs to innovation but whether the research is successful (Carlin et al., 2001). Given that the estimated coefficients are highly statistically significant even when the potential output is controlled for (which in itself is increased by innovativeness), we can conclude that the innovative outputs improve export performance over and above their impact through the economic potential.

Finally, we further extend the preferred specification of the model (with patent applications) with various indices of institutional quality. Our findings confirm the theoretical argument that high institutional quality should be beneficial for export performance. The institutional factor that is particularly relevant is the overall regulatory quality (REG), covering the overall regulation of credit, labour and business markets in a particular country. Its impact is positive and statistically significant, contrary to the impact of the general institutional environment (IT), the

legal system (LEG) and the sub-indices measuring separately the regulation of product and labour markets (BF and LM, respectively).

In order to check whether our baseline results do not suffer from the problem of endogeneity, we have re-estimated all specifications with all explanatory variables lagged by one year. The results carry through qualitatively, especially as regards the long-term significance of innovative outputs and the significance of the overall regulatory quality for export performance.

Table 5 Baseline results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ST ULC	-0.373	-0.601**	-0.598**	-0.349	-0.751***	-0.595**	-0.636**	-0.462*	-0.555**	-0.579**
	(0.502)	(0.014)	(0.013)	(0.130)	(0.004)	(0.026)	(0.012)	(0.052)	(0.022)	(0.014)
LT ULC	-1.899**	-0.897*	-0.980**	-1.452***	-1.169**	-0.974	-1.080**	-0.600	-0.906**	-0.960**
	(0.026)	(0.069)	(0.036)	(0.002)	(0.019)	(0.134)	(0.022)	(0.197)	(0.036)	(0.027)
ST TRD		0.291**								
		(0.015)								
LT TRD		0.280*								
		(0.083)								
ST PAF			0.107***			0.107***	0.109***	0.103***	0.107***	0.108***
			(0.002)			(0.001)	(0.002)	(0.003)	(0.004)	(0.003)
LT PAF			0.262***			0.262***	0.258***	0.242***	0.228***	0.228***
			(0.000)			(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
ST INV				-0.225**						
				(0.047)						
LT INV				-0.464**						
				(0.023)						
ST FDI					-0.014					
					(0.130)					
LT FDI					-0.133**					
					(0.022)					
POT		1.505***	1.041**	2.154***	2.095***	1.038**	1.158**	1.015**	1.185**	1.208**
		(0.000)	(0.040)	(0.000)	(0.000)	(0.046)	(0.023)	(0.032)	(0.013)	(0.012)
IT						0.011				
						(0.988)				
LEG							-0.367			
							(0.188)			
REG								0.697**		
								(0.019)		
BF									-0.018	
									(0.950)	
LM										-0.103
										(0.552)
Constant	-4.609***	2.308	0.477	5.049**	4.796**	0.465	0.982	0.364	1.072	1.171
	(0.000)	(0.179)	(0.822)	(0.029)	(0.015)	(0.830)	(0.642)	(0.854)	(0.584)	(0.553)
Obs.	448	267	336	390	363	336	336	336	280	280
No. of countries	28	28	28	28	28	28	28	28	28	28
F-statistic	3.58	21.37	44.98	28.55	13.74	44.66	31.32	31.40	16.72	17.68
R-squared (within)	0.10	0.35	0.60	0.48	0.51	0.60	0.61	0.63	0.52	0.53

Notes: The table presents baseline results from the FE estimation with clustered errors (i.e. robust to heteroscedasticity and aurocorrelation). LT elasticities (except for FDI, see the main text) are calculated as sums of contemporaneous and lagged regression coefficients. In brackets, we report p-values (for LT elasticities, except FDI, these are p-values for the test that the sum of the coefficients is different from zero). Asterisks ***, **, * denote the 1%, 5%, 10% significance levels, respectively. For descriptions of variables, see Table 4.

Source: Own calculations.

4.5 Robustness checks

In order to check the robustness of our baseline results, which are given by specifications (1), (3) and (8) in Table 5, we have carried out three types of tests. They are as follows:

1. Econometric tests: estimations of models (1), (3) and (8) using different methods;
2. Economic tests: estimations of model (8) using the baseline methodology with other price/cost competitiveness measures (REER-CPI and REER-ULC) and other institutional indicators (from Heritage Foundation) and explaining different export categories depending on their technological intensity (labour-intensive and resource-intensive, low-skill and technology-intensive, medium-skill and technology-intensive as well as high-skill and technology-intensive manufactures); estimation of model (8) with lagged dependent variable, allowing for a possibly heterogeneous impact of price/cost competitiveness on exports;
3. Coefficient stability tests: estimations of the preferred model (8) skipping one country at a time and rolling 10-year estimations.

We first estimate models (1), (3) and (8) using a number of other methods. The models considered are of two types: the ones similar to the baseline specification, without the autoregressive component and the ones with the lagged dependent variable (in which we do not include lagged explanatory variables and use the coefficient on the lagged dependent variable to calculate long-run elasticities). Within the first group we report the results for a standard FE model and a GLS estimation allowing for a presence of AR(1) autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels. As regards the models with the lagged dependent variable, we report the results for the baseline FE model with clustered errors, the GLS model robust to autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels, the

bias-corrected LSDV estimation for the autoregressive panels (both using the Anderson-Hsiao and the Arellano-Bond estimators to initialize the bias correction) as well as the Arellano-Bond linear dynamic panel-data estimation with robust standard errors.

Irrespective of the model/method of estimation, higher technological competitiveness (patent applications, PAF) and better institutional environment (overall regulatory quality, REG) have a positive, in most cases significant, impact on export performance (see Table B 2-Table B 3 in Appendix B). Similarly for the results concerning price/cost competitiveness (ULC).

The results concerning higher technological competitiveness (patent applications) and better overall regulatory quality carry through also when alternative measures of price/cost competitiveness and institutional quality are used (see Table 6 and Table 7 below). Their impact remains positive and consistently significant for export performance. As regards price/cost competitiveness, when it is measured by the real effective exchange rate (REER), it appears that increases in export market shares of the EU countries were associated with increases of the relative REERs (albeit the estimated coefficients are not always statistically significant). These results should however be viewed with some caution as relative REERs are less clean measures of price/cost competitiveness than relative ULC (expressed in the same currency), since, by construction, they are affected by differences in countries' geographical trade composition.

Table 6 Robustness to different measures of price/cost competitiveness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline with ULC			With REER-ULC			With REER-CPI		
ST ULC	-0.373	-0.598**	-0.462*						
	(0.502)	(0.013)	(0.052)						
LT ULC	-1.899**	-0.980**	-0.600						
	(0.026)	(0.036)	(0.197)						
ST REER-ULC				0.385	0.130	0.078			
				(0.133)	(0.372)	(0.554)			
LT REER-ULC				1.141***	0.430**	0.356*			
				(0.003)	(0.038)	(0.056)			
ST REER-CPI							0.688***	0.199	0.165
							(0.000)	(0.169)	(0.261)
LT REER-CPI							1.661***	0.692***	0.593***
							(0.000)	(0.000)	(0.001)
ST PAF		0.107***	0.103***		0.107***	0.099***		0.108***	0.100***
		(0.002)	(0.003)		(0.006)	(0.008)		(0.005)	(0.007)
LT PAF		0.262***	0.242***		0.295***	0.263***		0.272***	0.247***
		(0.000)	(0.000)		(0.001)	(0.000)		(0.001)	(0.000)
POT		1.041**	1.015**		0.819*	0.842**		0.682	0.708*
		(0.040)	(0.032)		(0.075)	(0.044)		(0.111)	(0.064)
REG			0.697**			0.775***			0.707***
			(0.019)			(0.002)			(0.004)
Constant	-4.609***	0.477	0.364	-4.516***	-0.407	-0.346	-4.525***	-1.058	-0.969
	(0.000)	(0.822)	(0.854)	(0.000)	(0.831)	(0.841)	(0.000)	(0.553)	(0.542)
Obs.	448	336	336	476	336	336	476	336	336
No. of countries	28	28	28	28	28	28	28	28	28
F-statistic	3.58	44.98	31.40	7.14	33.51	34.71	29.49	44.49	48.50
R-squared (within)	0.10	0.60	0.63	0.24	0.61	0.64	0.45	0.63	0.65

Notes: LT elasticities are calculated as sums of contemporaneous and lagged regression coefficients. In brackets, we report p-values (for LT elasticities these are p-values for the test that the sum of the coefficients is different from zero). Asterisks ***, **, * denote the 1%, 5%, 10% significance levels, respectively. For descriptions of variables, see Table 4.

Source: Own calculations.

Table 7 Robustness to different measures of institutional environment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ST ULC	-0.595**	-0.636**	-0.462*	-0.555**	-0.579**	-0.580**	-0.597**	-0.508**	-0.598**	-0.541**
	(0.026)	(0.012)	(0.052)	(0.022)	(0.014)	(0.013)	(0.012)	(0.044)	(0.014)	(0.027)
LT ULC	-0.974	-1.080**	-0.600	-0.906**	-0.960**	-0.890*	-0.983**	-0.445	-0.943**	-0.594
	(0.134)	(0.022)	(0.197)	(0.036)	(0.027)	(0.053)	(0.034)	(0.393)	(0.047)	(0.215)
ST PAF	0.107***	0.109***	0.103***	0.107***	0.108***	0.108***	0.110***	0.106***	0.108***	0.108***
	(0.001)	(0.002)	(0.003)	(0.004)	(0.003)	(0.001)	(0.004)	(0.005)	(0.001)	(0.009)
LT PAF	0.262***	0.258***	0.242***	0.228***	0.228***	0.263***	0.265***	0.225***	0.265***	0.225***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
POT	1.038**	1.158**	1.015**	1.185**	1.208**	1.012**	1.048**	1.069**	1.050**	1.036*
	(0.046)	(0.023)	(0.032)	(0.013)	(0.012)	(0.039)	(0.039)	(0.040)	(0.037)	(0.069)
IT	0.011									
	(0.988)									
LEG		-0.367								
		(0.188)								
REG			0.697**							
			(0.019)							
BF				-0.018						
				(0.950)						
LM					-0.103					
					(0.552)					
IT2						0.186				
						(0.610)				
LEG2							-0.060			
							(0.712)			
REG2								0.594*		
								(0.056)		
BF2									0.089	
									(0.633)	
LM2										0.147
										(0.312)
Constant	0.465	0.982	0.364	1.072	1.171	0.359	0.510	0.580	0.526	0.424
	(0.830)	(0.642)	(0.854)	(0.584)	(0.553)	(0.860)	(0.809)	(0.790)	(0.802)	(0.861)
Obs.	336	336	336	280	280	336	336	224	336	224
No. of countries	28	28	28	28	28	28	28	28	28	28
F-statistic	44.66	31.32	31.40	16.72	17.68	37.84	40.41	11.45	47.82	11.03
R-squared (within)	0.60	0.61	0.63	0.52	0.53	0.60	0.60	0.46	0.61	0.45

Notes: LT elasticities are calculated as sums of contemporaneous and lagged regression coefficients. In brackets, we report p-values (for LT elasticities these are p-values for the test that the sum of the coefficients is different from zero). Asterisks ***, **, * denote the 1%, 5%, 10% significance levels, respectively. For descriptions of variables, see Table 4.

Source: Own calculations.

The results for different categories of exports depending on their technological intensity in most cases corroborate the importance of technological competitiveness (patent applications; see Table B 4 in Appendix B). Interestingly, higher technological competitiveness has a significant positive long-term impact on export performance not only in the most technology-intensive sectors. The long-term impact of patent applications on export performance increases with technological intensity. As regards the institutional environment (overall regulatory quality), the results confirm that its impact on export performance is positive, albeit statistically significant only in the case of the medium-skill and technology-intensive manufactures – the largest category in the EU manufacturing exports. Given that averages of the elasticities estimated for different categories of exports are close to the elasticities estimated for total exports, the results also indicate that pooling across different categories of exports is not problematic.

The literature points to a possibly heterogeneous impact of price/cost competitiveness on exports (see e.g. Christodoulopoulou and Tkačevs, 2014). Hence we test whether our results remain robust to allowing for a country-specific impact of ULC on export markets shares. To maintain parsimony, we carry out this robustness check estimating the FE model with clustered errors with the lagged dependent variable, rather than the baseline specification incorporating a number of lagged explanatory variables. Again the results concerning the significant positive impact of higher technological competitiveness (patent applications) and better overall regulatory quality (the latter in the long run) carry through (see Table B 5 in Appendix B). Given that averages of country-specific ULC elasticities and the estimated pooled elasticities are very close to those in the completely pooled model (reported in column (4) in Table B 3), the results also indicate that neglecting the possibly heterogeneous impact of price/cost competitiveness on exports should not bias the baseline results.

Coefficient stability tests confirm that the results are robust to changes in country sample, meaning that none of the countries drives the results (see Figure B 1 in Appendix B). As regards the stability of the estimated coefficients over time, the elasticities of export market shares with respect to ULC and patent applications have been broadly stable (see Figure B 2 in Appendix B). The elasticity with respect to overall regulatory quality, on the other hand, appears to have declined substantially over time, which may be explained by growing convergence of regulatory standards among the EU countries.

To summarize, our empirical analysis confirms that technological competitiveness has a significant impact on export performance. However, not all aspects of technological capability appear equally important. Our analysis proves greater importance of innovative outputs (patent applications) in increasing export market shares, relative to e.g. innovative inputs (R&D expenditure). Moreover, innovative outputs appear to be beneficial for export performance, over and above their positive impact through the economic potential. The significant positive impact of innovative outputs on export market shares turns out to be a highly robust result. The results concerning price/cost competitiveness are less robust, the estimated coefficients are not always statistically significant and depend on the measure of price/cost competitiveness used. Our findings confirm that high institutional quality is also conducive to better export performance. Again, not all aspects of institutional environment may be equally important. The institutional factor that is particularly relevant is the overall regulatory quality, which is the only institutional variable that is consistently (and often significantly) beneficial to export performance, contrary to the general institutional environment as well as separate measures of product or labour markets regulation.

5. Conclusions

Export performance of the CEE region has improved markedly since the fall of the socialist system. Over the last two decades the share of the region's exports in world exports of goods more than doubled. This trade expansion is related to the inclusion of the CEE countries in the European and global value chains, due to two factors: their price/cost competitiveness (relatively low labour costs) and direct proximity of the largest European markets. Participation in the GVCs has significantly influenced the geographical and product composition of the region's exports. Exports are dominated by intra-GVC trade (within Europe) and the share of non-European markets remains low. Product composition of exports reflects the concept of the GVCs (the international division of the production process) and the position of the region in the GVCs as the supplier of mainly machinery and transport equipment (medium-tech goods), with the share of high-tech manufacturing exports remaining low.

The increase in the CEE countries' share in world exports over the last two decades took place despite appreciation of their real effective exchange rates. Price/cost factors therefore cannot be the only determinants of the region's improved export performance. Indeed, our empirical analysis shows that improvements in technological competitiveness, in particular in terms of innovative outputs (patent applications), had a significant positive impact on export performance. This was, moreover, in addition to their positive impact through the economic potential. Concerning institutional environment, improvements in the overall regulatory quality also significantly contributed to better export performance. Hence, our results are in line with both the theory and earlier empirical literature showing that price/cost competitiveness is not the only important determinant of success in international markets.

The positive impact of technological competitiveness and institutional environment on export market shares implies that further improvements in these areas should

help the CEE countries compete successfully in international markets. In the future most of the CEE countries should enter the euro area. Adopting the common currency implies the loss of independent exchange rate policy[9]. Hence, maintaining price/cost competitiveness would be possible only through internal devaluations (price and labour cost cuts). Taking this fact into account, improving non-price competitiveness is all the more important for the region.

[9] With the exception of Bulgaria which has had a fixed exchange rate regime, namely a currency board, since 1997.

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Appendix A. Measuring institutions

By a country's institutions we will understand the regulatory and institutional environment in which private companies operate and which affects their performance. The notion can be viewed in different ways, starting from a very broad sense of an 'economic freedom' to carry out economic activity and exchange, all the way to a narrow notion of regulations in particular markets. The need to measure countries' institutions and economic freedom came with the need to empirically verify theories stating that greater economic freedom should contribute to both a higher level and stronger growth of income (Hall and Lawson, 2014).

A number of indices have been proposed for the quantification and comparison of the institutional environment across countries. They are usually designed to capture the friendliness of the institutions to economic activity. They can be divided in (at least) three ways:

- Specific indices measuring selected aspects of institutions (e.g. OECD's indicators of Product Market Regulation and of Employment Protection) vs. broad indices measuring the overall institutional environment or the 'economic freedom' of a country (e.g. the Fraser Institute's Economic Freedom of the World index and the Heritage Foundation's Index of Economic Freedom);
- Indices based on 'objective' information, e.g. reading of laws or statistical data, capturing the factual state of institutions (e.g. the OECD indicators) vs. indices based on 'subjective' information, derived from surveys, capturing the perceptions of the functioning of institutions (e.g. the World Economic Forum Global Competitiveness Index)[10];

[10] The former indicators have the advantage of being objective and allow for differences in indicator values across time and countries to be traced back to changes or differences in regulatory settings. The latter indicators, on the other hand, may to a larger extent capture other relevant institutional aspects, such as differences in the enforcement (Conway et al., 2005; Koske et al., 2015; Kaufman et al., 2010).

- Original indices (e.g. the OECD indicators, the World Bank Doing Business index and the World Economic Forum Global Competitiveness Index) vs. indices aggregating in-formation from other sources (e.g. the World Bank Worldwide Governance Indicators).

The methodology for constructing the indices is rather standard, involving aggregation of detailed indicators into higher-order indices. For example, the longest available index capturing the institutional environment, the Fraser Institute's Economic Freedom of the World (EFW) index, is based on 24 detailed indicators, which are aggregated into five intermediate indices regarding: size of government, legal system and property rights, sound money, freedom to trade internationally, and regulation. The sub-indices are then aggregated into the overall EFW Index.

In this paper we will look at a number of institutional indices (and their sub-indices):

- Fraser Institute's Economic Freedom of the World (EFW) index,
- Heritage Foundation's Index of Economic Freedom (IEF),
- OECD indicators of Employment Protection Legislation (EPL),
- OECD indicators of Product Market Regulation (PMR),
- World Bank Doing Business (DB) index,
- World Bank Worldwide Governance Indicators (WGI),
- World Economic Forum Global Competitiveness Index (GCI).

Given the profile of this paper, we will specifically focus on the (sub-)indices measuring: the general institutional environment, the legal system, the overall regulatory quality, product market institutions, labour market institutions and regulations regarding international trade. Table B.1 below presents the overview of the (sub-)indices related to these five areas and their historical availability.

Table A 1 Overview of indices measuring institutions

Institutional aspect (Sub-)index	Availability
1. General institutional environment	
Economic Freedom of the World index	1970, 1975, 1980, 1985, 1990, 1995 and 2000–2013
Index of Economic Freedom	1995–2016
World Bank Doing Business	2004–2016
2. Legal system	
Economic Freedom of the World index – Legal system and property rights	1970, 1975, 1980, 1985, 1990, 1995 and 2000–2013
Global Competitiveness Index – Institutions/Public institutions	2005–2015
Index of Economic Freedom – Rule of law	1995–2016
World Bank Worldwide Governance Indicators – Rule of law	1996, 1998, 2000, 2002–2014
3. Overall regulatory quality	
Economic Freedom of the World index – Regulation	1970, 1975, 1980, 1985, 1990, 1995 and 2000–2013
Index of Economic Freedom – Regulatory efficiency	2005–2016
World Bank Worldwide Governance Indicators – Regulatory Quality	1996, 1998, 2000, 2002–2014
4. Product market institutions	
Economic Freedom of the World index – Business regulations	1970, 1975, 1980, 1985, 1990, 1995 and 2000–2013
Global Competitiveness Index – Domestic competition	2005–2015
Index of Economic Freedom – Business freedom	1995–2016
Product Market Regulation indicator (economy-wide)/ Barriers to entrepreneurship	1998, 2003, 2008, 2013
World Bank Doing Business – Complexity and cost of regulatory processes	2004–2016
5. Labour market institutions	
Economic Freedom of the World index – Labour market regulations	1970, 1975, 1980, 1985, 1990, 1995 and 2000–2013
Employment Protection Legislation indicators	1985–2013
Global Competitiveness Index – Labour market efficiency	2005–2015
Index of Economic Freedom – Labour freedom	2005–2016
World Bank Doing Business – Labour market regulation	2004–2016
6. International trade	
Economic Freedom of the World index – Freedom to trade internationally	1970, 1975, 1980, 1985, 1990, 1995 and 2000–2013
Global Competitiveness Index – Foreign competition	2005–2015
Index of Economic Freedom – Trade freedom	1995–2016
Product Market Regulation – Barriers to trade and investment	1998, 2003, 2008, 2013

Source: Own elaboration.

Appendix B. Robustness checks

Table B 1 Robustness to different estimation methods – model (1)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	**FE**	**GLS**	**Baseline with L.X**	**GLS with L.X**	**LSDVC (AH)**	**LSDVC (AB)**	**ABOND**
L.X				0.931***	0.918***	0.981***	0.966***	0.935***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ST ULC	-0.373	-0.373	-0.584***	-0.150*	-0.212***	-0.092	-0.102	-0.232*
	(0.502)	(0.357)	(0.000)	(0.090)	(0.000)	(0.300)	(0.215)	(0.067)
LT ULC	-1.899**	-1.899***	-1.453***	-2.181*	-2.574***	-4.755	-3.022	-3.552
	(0.026)	(0.000)	(0.000)	(0.074)	(0.000)	(0.316)	(0.160)	(0.178)
Constant	-4.609***	-4.609***	-7.854***	-0.306***				-0.298***
	(0.000)	(0.000)	(0.000)	(0.002)				(0.001)
Country FE/ dummies	YES	YES	YES	YES	YES	YES	YES	NO
Obs.	448	448	448	532	532	532	532	504
No. of countries	28	28	28	28	28	28	28	28
F-statistic	3.58	10.95		1289.30				
R-squared (within)	0.10	0.10		0.92				

Notes: LT elasticities in columns (1)-(3) are calculated as sums of contemporaneous and lagged regression coefficients and in columns (4)-(8) using the contemporaneous coefficient on the explanatory variable and the coefficient on the lagged dependent variable. In brackets, we report p-values (for LT elasticities these are p-values for the appropriate test that the calculated elasticity is different from zero). Asterisks ***, **, * denote the 1%, 5%, 10% significance levels, respectively. For descriptions of variables, see Table 4.

Source: Own calculations.

Table B 2 Robustness to different estimation methods – model (3)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	FE	GLS	Baseline with L.X	GLS with L.X	LSDVC (AH)	LSDVC (AB)	ABOND
L.X				0.784***	0.789***	0.854***	0.860***	0.813***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ST ULC	-0.598**	-0.598**	-0.467***	-0.152	-0.209***	-0.112	-0.086	-0.197
	(0.013)	(0.022)	(0.000)	(0.126)	(0.000)	(0.433)	(0.424)	(0.160)
LT ULC	-0.980**	-0.980***	-0.705***	-0.706*	-0.994***	-0.765	-0.616	-1.054
	(0.036)	(0.000)	(0.000)	(0.094)	(0.000)	(0.395)	(0.390)	(0.162)
ST PAF	0.107***	0.107***	0.093***	0.046**	0.055***	0.039	0.036**	0.052**
	(0.002)	(0.000)	(0.000)	(0.032)	(0.000)	(0.104)	(0.022)	(0.048)
LT PAF	0.262***	0.262***	0.218***	0.214**	0.263***	0.264*	0.254**	0.280**
	(0.000)	(0.000)	(0.000)	(0.016)	(0.000)	(0.074)	(0.035)	(0.027)
ST POT	1.041**	1.041***	1.036***	0.141	0.135***	0.017	0.002	0.064
	(0.040)	(0.000)	(0.000)	(0.331)	(0.000)	(0.903)	(0.986)	(0.679)
LT POT				0.653	0.641***	0.118	0.016	0.340
				(0.298)	(0.000)	(0.901)	(0.986)	(0.668)
Constant	0.477	0.477	0.935	-0.271	-0.060			-0.481
	(0.822)	(0.525)	(0.263)	(0.639)	(0.441)			(0.419)
Country FE/ dummies	YES	YES	YES	YES	YES	YES	YES	NO
Obs.	336	336	336	336	336	336	336	308
No. of countries	28	28	28	28	28	28	28	28
F-statistic	44.98	50.60		519.70				
R-squared (within)	0.60	0.60		0.87				

Notes: LT elasticities in columns (1)-(3) are calculated as sums of contemporaneous and lagged regression coefficients and in columns (4)-(8) using the contemporaneous coefficient on the explanatory variable and the coefficient on the lagged dependent variable. In brackets, we report p-values (for LT elasticities these are p-values for the appropriate test that the calculated elasticity is different from zero). Asterisks ***, **, * denote the 1%, 5%, 10% significance levels, respectively. For descriptions of variables, see Table 4.

Source: Own calculations.

Table B 3 Robustness to different estimation methods – model (8)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	**FE**	**GLS**	**Baseline with L.X**	**GLS with L.X**	**LSDVC (AH)**	**LSDVC (AB)**	**ABOND**
L.X				0.770***	0.770***	0.843***	0.846***	0.803***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ST ULC	-0.462*	-0.462*	-0.401***	-0.100	-0.163***	-0.072	-0.059	-0.080
	(0.052)	(0.072)	(0.000)	(0.367)	(0.000)	(0.596)	(0.593)	(0.614)
LT ULC	-0.600	-0.600***	-0.535***	-0.437	-0.709***	-0.459	-0.383	-0.405
	(0.197)	(0.010)	(0.000)	(0.356)	(0.000)	(0.576)	(0.577)	(0.614)
ST PAF	0.103***	0.103***	0.085***	0.046**	0.055***	0.038*	0.036**	0.051*
	(0.003)	(0.000)	(0.000)	(0.027)	(0.000)	(0.099)	(0.022)	(0.056)
LT PAF	0.242***	0.242***	0.212***	0.198***	0.238***	0.242*	0.232**	0.259**
	(0.000)	(0.000)	(0.000)	(0.007)	(0.000)	(0.073)	(0.035)	(0.021)
ST POT	1.015**	1.015***	0.975***	0.143	0.141***	0.020	0.012	0.010
	(0.032)	(0.000)	(0.000)	(0.303)	(0.000)	(0.883)	(0.921)	(0.947)
LT POT				0.621	0.613***	0.126	0.081	0.052
				(0.274)	(0.000)	(0.880)	(0.920)	(0.946)
ST REG	0.697**	0.697***	0.437***	0.184*	0.186***	0.140	0.119	0.342**
	(0.019)	(0.000)	(0.000)	(0.091)	(0.000)	(0.292)	(0.235)	(0.034)
LT REG				0.802**	0.808***	0.892	0.771	1.740*
				(0.047)	(0.000)	(0.252)	(0.231)	(0.058)
Constant	0.364	0.364	0.482	-0.322	-0.336***			-0.754
	(0.854)	(0.618)	(0.633)	(0.567)	(0.000)			(0.216)
Country FE/ dummies	YES	YES	YES	YES	YES	YES	YES	NO
Obs.	336	336	336	336	336	336	336	308
No. of countries	28	28	28	28	28	28	28	28
F-statistic	31.40	49.83		377.06				
R-squared (within)	0.63	0.63		0.87				

Notes: LT elasticities in columns (1)-(3) are calculated as sums of contemporaneous and lagged regression coefficients and in columns (4)-(8) using the contemporaneous coefficient on the explanatory variable and the coefficient on the lagged dependent variable. In brackets, we report p-values (for LT elasticities these are p-values for the appropriate test that the calculated elasticity is different from zero). Asterisks ***, **, * denote the 1%, 5%, 10% significance levels, respectively. For descriptions of variables, see Table 4.

Source: Own calculations.

Table B 4 Robustness to different categories of manufactures' exports

	(1)	(2)	(3)	(4)	(5)
	Baseline (total manufactures)	Labour-intensive and resource-intensive	Low-skill and technology-intensive	Medium-skill and technology-intensive	High-skill and technology-intensive
ST ULC	-0.462*	-0.382	-0.224	-0.574**	-0.695
	(0.052)	(0.284)	(0.611)	(0.050)	(0.172)
LT ULC	-0.600	-0.858	-0.142	-0.899	-0.714
	(0.197)	(0.271)	(0.741)	(0.130)	(0.381)
ST PAF	0.103***	0.127**	0.185***	0.133***	0.081
	(0.003)	(0.027)	(0.008)	(0.007)	(0.240)
LT PAF	0.242***	0.111**	0.295***	0.343***	0.340***
	(0.000)	(0.026)	(0.000)	(0.000)	(0.007)
POT	1.015**	0.005	0.181	1.448**	2.051**
	(0.032)	(0.993)	(0.680)	(0.028)	(0.014)
REG	0.697**	0.627	0.079	1.378**	0.760
	(0.019)	(0.219)	(0.815)	(0.030)	(0.156)
Constant	0.364	-4.151*	-3.141	2.175	4.940
	(0.854)	(0.079)	(0.105)	(0.430)	(0.153)
Obs.	336	336	336	336	336
No. of countries	28	28	28	28	28
F-statistic	31.40	7.28	4.64	17.55	31.45
R-squared (within)	0.63	0.15	0.35	0.60	0.61

Notes: LT elasticities are calculated as sums of contemporaneous and lagged regression coefficients. In brackets, we report p-values (for LT elasticities these are p-values for the test that the sum of the coefficients is different from zero). Asterisks ***, **, * denote the 1%, 5%, 10% significance levels, respectively. For descriptions of variables, see Table 4.

Source: Own calculations.

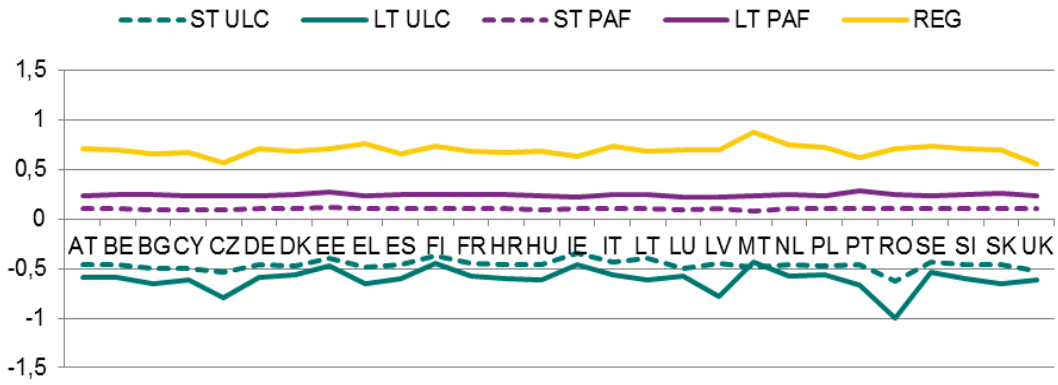
Table B 5 Robustness to heterogeneous impact of price/cost competitiveness

	ST ULC	p-value	LT ULC	p-value
AT	-0.059	(0.864)	-0.222	(0.865)
BE	-0.014	(0.916)	-0.050	(0.914)
BG	-0.050	(0.578)	-0.187	(0.565)
CY	0.405	(0.168)	1.513	(0.102)
CZ	-0.101	(0.719)	-0.376	(0.717)
DE	-0.430	(0.103)	-1.608**	(0.040)
DK	-0.205	(0.188)	-0.768	(0.132)
EE	-0.839***	(0.006)	-3.136***	(0.000)
EL	0.022	(0.887)	0.081	(0.884)
ES	-0.416	(0.145)	-1.553*	(0.090)
FI	-1.397***	(0.000)	-5.221***	(0.000)
FR	-0.474**	(0.015)	-1.771***	(0.000)
HR	0.891***	(0.001)	3.329**	(0.027)
HU	0.366	(0.125)	1.368	(0.151)
IE	-0.207	(0.360)	-0.773	(0.291)
IT	-0.294	(0.447)	-1.098	(0.423)
LT	-0.406***	(0.000)	-1.517***	(0.001)
LU	-0.273	(0.394)	-1.020	(0.404)
LV	-0.153	(0.330)	-0.572	(0.297)
MT	-0.325	(0.380)	-1.214	(0.338)
NL	1.157***	(0.000)	4.326***	(0.000)
PL	0.010	(0.959)	0.036	(0.958)
PT	0.150	(0.712)	0.562	(0.701)
RO	0.167	(0.205)	0.626	(0.157)
SE	-1.573***	(0.000)	-5.879***	(0.000)
SI	-0.568	(0.119)	-2.125	(0.180)
SK	0.347	(0.607)	1.299	(0.585)
UK	-2.203***	(0.000)	-8.234***	(0.000)
ST PAF	0.065*			
	(0.056)			
LT PAF	0.244**			
	(0.012)			
ST POT	0.206			
	(0.312)			
LT POT	0.769			
	(0.279)			
ST REG	0.220			
	(0.159)			
LT REG	0.822*			
	(0.098)			
Constant	-0.192			
	(0.814)			
Obs.	336			
No. of countries	28			
F-statistic				
R-squared (within)	0.88			

Notes: LT elasticities are calculated using the contemporaneous coefficient on the explanatory variable and the coefficient on the lagged dependent variable. In brackets, we report p-values. Asterisks ***, **, * denote the 1%, 5%, 10% significance levels, respectively. For descriptions of variables, see Table 4.

Source: Own calculations.

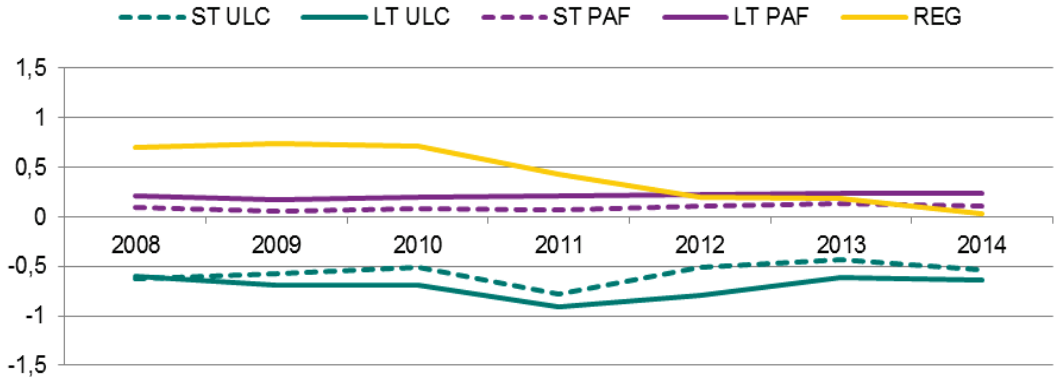
Figure B 1 Stability of export market shares' elasticities for different country samples*



* The figure presents the results of estimations using data for 27 out of 28 countries. The X-axis denotes the country that is excluded from the particular estimation.

Source: Own calculations.

Figure B 2 Stability of export market shares' elasticities over time*



* The figure presents the results of rolling estimations over a ten-year period. The X-axis denotes the end year of the ten-year rolling sample.

Source: Own calculations.

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