

# The Evolving Composition of Intra-EU Trade

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## Executive summary

*Global trade in goods was growing rapidly before the crisis, but was severely hit by the economic crisis in 2008, which initiated a pronounced but short-lived collapse. Until 2011 trade flows recovered relatively quickly, but since then global trade in goods has been rather anaemic. This development is partly also the result of the low dynamics of intra-EU trade and relatively weak dynamics of EU-28 imports from the rest of the world. This generally holds for trade in services as well, which developed even slightly more dynamically before the crisis and underwent a less severe slump compared to goods trade. However, after the crisis, global services flows appear to be even more anaemic than global flows in goods.*

*The share of intra-EU-28 trade in global trade amounted to about 20% in 2014. Trade with other EU countries is still by far the most important component, accounting for about 60% of trade across EU Member States on average though there are marked differences across countries.*

*The process of EU integration before the crisis and differentiated growth patterns of goods and services exports implied that exporting activities became slightly less concentrated across countries. This was particularly observable for goods trade. Overall, specialisation dynamics however implied an increasing geographic clustering and specialisation of goods and services exports across Europe. The changes in the geographical patterns of intra-EU trade activities were mostly driven by changes in the patterns of trade in the medium-quality segment which can be interpreted as a 'climbing up' phenomenon of less advanced countries which gained in medium-quality segments at the expense of (some of) the advanced countries. These developments were accompanied by a strong increase in overall bilateral trade intensities. Results generally suggest a structural break of these trends after the crisis.*

*EU integration triggered an intensification of bilateral exporting relationships in both goods and services. This led to a particular pattern of specialisation across Europe, characterised by the concentration and clustering of exporting activities of goods and services in subsets of countries. This integration dynamics have most likely come to a standstill in the aftermath of the global crisis.*

*Applying a gravity approach it has been tested whether the changes in the dynamics of intra-EU trade have been due to the sluggish overall growth of the EU economy after the crisis or whether the relationship between GDP and export growth has changed. Results point towards significantly lower trade-to-GDP elasticities after the crisis for intra-EU trade. Thus, the slowdown in exports results not only from lower GDP growth but also from significantly lower elasticity of exports to GDP. For extra-EU trade significant however even show that the response of trade to partner countries' GDP of non-EU countries even increased, pointing towards the stronger role of extra-EU trade. These results are similar though less pronounced for services.*

*Another aspect of the increasing trade intensity is the role and magnitudes of intra-firm trade and potential determinants thereof. As evidence is scarce, various databases have been used to investigate this important aspect. Results from EFIGE data point to a low degree of production internationalisation among European firms. Firms that do internationalise their production activities predominantly*

*internationalise through direct investments instead of contracts and arms' length agreements. For these firms intra-firm trade is generally of substantial size, with imports of intermediates and final products of most importance. Internationalised production activities of European firms predominantly serve the production of finished and semi-finished products or components while other activities such as R&D, engineering and design services or other business services abroad matter only little.*

*Results based on FATS data indicate that intra-firm trade is of fundamental importance, accounting for 59% of EU exports to the United States in 2012 and 42% on the import side. Thus, taken together, intra-firm trade flows were responsible for more than half (52%) of total trade between the EU and the US in 2012. Results also suggest that intra-firm trade has been more resilient to the trade crisis despite the more difficult global environment for foreign direct investment and export activities. The EU Member States which are the major EU FDI investors and hence also those with the most prominent MNE activities, notably Germany and the UK, are also characterised by a higher share of intra-firm trade, amounting to 62% of country-level goods trade in both cases.*

*Finally, based on detailed firm data for Ireland, it is shown that intra-firm trade in Ireland accounts for 30% of exports and 25% of imports. Over time, the scale of intra-firm exports has increased while it has declined for intra-firm imports. During the financial crisis, intra-firm exports were resilient, while intra-firm imports declined sharply but rebounded in 2009. The lion's share in this respect is taken by the United States, accounting for about 70% of the total number of intra-firm flows and 72% of the total number of intra-firm import flows, which is explained by the large number of US multinationals located in Ireland. Germany and the United Kingdom are the next most important trading partners, followed by Japan, France, Switzerland and the Netherlands. Ireland's intra-firm trade is of particular importance in industries producing intermediate goods, capital goods, as well as consumer non-durable goods. Results indicate that the top 10 products traded intra-firm are predominantly chemicals and pharmaceuticals, medical devices and electronics, reflecting the specialisation of multinational enterprises located in Ireland.*

Keywords: EU trade, trade slowdown, trade specialisation and concentration, intra-firm trade

JEL classification: F14, F15

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# 1. Introduction

The financial and economic crisis marked a change in the trends of GDP growth and related trade flows. GDP growth rates since the crisis have been generally lower than before the crisis and also more diverse across countries. This is not only the case world-wide but also for the EU Member States where – apart from sluggish growth in general – some countries recovered relatively quickly whereas some others are still characterised by weak growth rates though the recent situation looks less gloomy. Similarly, growth rates of trade flows at the global level have been – after a quick recovery after the crisis – rather unimpressive, marking an era of a ‘global trade slowdown’. Triggered by the financial and economic crisis, global merchandise trade dropped by 12% in 2009, more than five times as much as world output, and rebounded by more than 14% the following year – again much more than the volume of output. One of the issues discussed is of course how and whether these two trends are related to each other.

A similar trend is observed at the European level. EU trade was no exception in this regard: after an initial sharp fall, extra-EU exports partly rebounded and for several years after the crisis formed the backbone of the economic recovery of the EU. An important EU trend in that respect – partly predating the crisis-related trade shock – is the evolution of intra-EU trade flows of goods and services partly as a result of the accession and closer economic integration of thirteen new Member States. The process of EU integration in the past 20 years or so may also have intensified driven by international development towards longer and more fragmented global value chains, often involving different EU Member States at different points, which should lead to more intensified (bilateral) trade flows between EU Member States. Further, these trends may have been accompanied by a drive towards more pronounced specialisation patterns within the EU, as regards extra-EU as well as intra-EU trade. With respect to the crisis and after-crisis developments, another aspect which is of particular interest to this study is the slowdown in intra-EU trade following the crisis. Intra-EU trade in goods remains subdued at volumes similar to those in late 2010, and the gap between intra-EU and extra-EU trade growth has widened since the crisis.

The main purpose of this study is to document and analyse the changing patterns of trade before and after the crisis, focusing on intra-EU trade (though in some instances compared to developments in global and extra-EU trade). The central questions tackled are therefore whether integration has led to more or less specialisation of (intra-EU) exports across the EU Member States, whether a trend towards more concentration and clustering of export activities is observed and whether there is an intensification of bilateral trade flows; all these aspects are also analysed with respect to the potential effects and structural breaks triggered by the crisis.

In addition to this, shifts in the role of multinational companies, patterns of FDI and patterns of outsourcing, offshoring and reshoring have impacted and will continue to impact on intra-firm trade, which might play a more prominent role in world trade without necessarily being reflected in data. Shedding more light on the role of intra-firm trade is therefore the second objective of this study. As information on intra-firm trade is limited, the study proposes and compares various measures including a case study based on Irish firm data.

The study is therefore structured in two main parts. In Section 2 the developments in trade and intra-EU trade before, over, and after the crisis are presented. The guiding questions are, first, whether there is an indication that the crisis in 2008 marked a break in the trends of how trade flows developed before the crisis hit in general and in relation to patterns of GDP growth. This is argued (Section 2.3) to be the case for global trade flows which is to some extent driven by the anaemic growth of GDP and trade in Europe. Second, the pre-crisis period was characterised by strong integration of Europe in line with the Single Market. Especially some smaller countries (in particular EU-CEE economies) gained weight in intra-EU goods exports driven by an export-driven growth model which has led to a concentration of exports (relative to GDP) and a clustering of export activities in the 'EU manufacturing core'. These patterns are less pronounced for imports which showed up in growing intra-EU imbalances. The integration process also manifested itself in an increase in the intensity of bilateral trade flows between EU Member States. Basically, the crisis marked a structural break in these trends. These patterns and developments, however, partly differ across industries (Section 2.4) and end-use categories (Section 2.5) which need to be discussed in more detail. Further, Section 2.6 points towards an increasing specialisation across EU Member States, mostly driven by changes in market shares in the medium unit-value segment of exports, thus pointing towards a 'climbing-up' dynamics within Europe. With respect to services trade (Section 2.7), the dynamics of overall trade before, over, and after the crisis is similar. However, a less pronounced pattern as concerns concentration of services (relative to GDP) is observed. Nonetheless, one finds an increasing geographic clustering of services export activities and a strong increase in bilateral trade intensities for services. Again, the crisis generally marked a break in these trends. Section 3 points out that intra-firm trade accounts for a significant part of intra- and extra-EU trade. Unfortunately, due to lack of data this issue can only be addressed in a limited way using specific data or detailed case studies. Nonetheless, the results indicate that intra-firm trade accounts for a sizeable part of trade of 30% to 50%.

## 2. Trends in intra-EU trade

### 2.1. INTRODUCTION

This section focuses on the developments in patterns of intra-EU trade over the period 2000-2014. It compares these developments to global trade patterns and extra-EU trade of the EU-28 as a whole and its individual Member States both for trade in goods and services. This section first indicates the shifts that have taken place in global trade patterns, focusing on the particular role of intra- versus extra-EU trade. In doing so, four different time periods are differentiated: 2000-2008, 2008-2009, 2009-2011 and 2011-2013/2014, and developments in world trade are compared with those in the patterns of intra- and extra-EU trade both for goods and services. The guiding question is, what are the similarities and differences between the composition and characteristics of goods and services traded bilaterally between Member States (i.e. intra-EU trade), whether one finds concentration and specialisation patterns in trade in goods and services in intra-EU trade, and whether the bilateral trade has intensified.

### 2.2. RELATED LITERATURE

The patterns of trade integration across European Member States and the potential effects on growth and trade have been central question with respect to the EU Single Market agenda. Therefore in this review of the literature the focus will be on the expectations and outcomes of the introduction of the Single Market and issues which emerged after the crisis period in this respect.

In this section this issue will again be addressed with regard to trade flows across Europe. It will be analysed whether one finds respective specialisation and clustering patterns. On the one hand, economic integration and the Single Market may lead to a more balanced pattern of trade flows across Europe (when controlled for size of economies); on the other hand, agglomeration forces and scale effects may result in more concentration and clustering of specific activities in particular countries. This will be addressed by considering various indicators of specialisation, concentration and clustering of intra-EU trade across EU Member States.

#### 2.2.1. Introduction

The European Single Market, launched in 1992 is an extension of the Common Market concept which aims at eliminating remaining obstacles to trade (physical barriers like frontier inspections, technical barriers of all sorts, fiscal barriers such as differences in indirect taxes and excise duties and national biases in public procurement) among Member States of the European Union. The ultimate objective of the initiative was and continues to be the boost of economic growth by spurring competition, exploiting economies of scale and forcing companies to step up innovation and productivity. The European Single Market project must in this context be seen as a response to the perceived economic threats to Europe posed by the growing US and Japanese dominance in high technology and the successes of newly industrialising countries (NICs) in assembly industries during the first half of the 1980s.

While most would agree that the Single Market remains an unfinished project (Aussiloux et al., 2011), among the 'four freedoms' so far most progress has been achieved in the realm of the trade in goods. It is this part of the four freedoms that this literature review will focus on, whereby both macroeconomic (GDP growth) effects and trade effects will be covered. In an additional section trade in services will be discussed.

Although important, the short overview in this section will not deal with the changes in the economic environment which are doubtlessly important for the Single Market such as the growing importance of services trade, the creation of the European Monetary Union and the introduction of the Euro and the EU enlargement all of which have a large body of literature of its own.

The structure will be chronologically, starting with studies before the completion of the Single Market Programme in 1992 but putting more emphasis on ex-post evaluations of the effects of the Single Market. A third section will deal with the Single Market project in times of crisis which covers the period after the great trade collapse in the winter months of 2008-2009.

### **2.2.2. Ex Ante Evaluations of the Single Market: The Cecchini Report**

The most prominent and influential report on the expected benefits from the Single Market was the Cecchini Report (Cecchini et al., 1988). The report was commissioned by the European Commission and, combining a microeconomic and a macroeconomic analysis, comes to the conclusion that the Single Market will boost GDP in the EU by 4.25% to 6.5% in the medium term (after 5-6 years). The additional growth in the study comes about through gains from the removal of trade barriers (0.2%-0.3%), gains from market access in general (2%-2.4%), gains from the exploitation of economies of scale (2.1%) and gains from intensified competition (1.6%). The projected GDP growth is also associated with a 6% decline in prices which will add to additional consumer welfare and would lead to the creation of an additional 2 million jobs. It is worth mentioning that all these gains are static in nature, i.e. they result from a one-off change in the economic environment and come about by a more efficient reallocation of resources. The Cecchini Report deals with the Community wide impact of the Single Market and does not contain results for individual Member States. Hence, it offers no insights into the distributional consequences across countries of the Single Market project though it alludes to the issue of distribution by stating that out of experience no detrimental effects on distribution are to be expected.

The shortcoming of the Cecchini report, i.e. that it only deals with static effects, is remedied by Baldwin (1989) who simulates the economic integration foreseen by the Single Market based on the growth model introduced by Romer (1989). His calibrations suggest static effects from resource reallocation about twice the size of those in the Cecchini Report, i.e. in the range 5%-13% spread over the next 10 years following the completion of the Single Market. More importantly, the Romer-type growth model let expect a permanent effect on the EU's growth rate, shifting it up by between 0.25%-0.9%. As stressed by Baldwin, this effect, which comes about inter alia by more investment in R&D following trade opening and standardised regulations, is quantitatively much more important than the static gains from trade.

Another often cited study which appeared after 1992 but which can still be considered to be ex ante as it is based on data preceding the Single Market is Harrison et al. (1994). The authors employ a multi-sector general equilibrium model to estimate the effects of completion of the internal market in the EC on



trade, production and market structure. The market integration comes about through the reduction of border costs (a uniform reduction of 2.5% across all sectors is assumed) and cost reductions due to the harmonisation of standards. In addition to gains of harmonisation of standards stemming from improved economies of scale in increasing returns to scale industries, the study also takes into account the impact of harmonised standards on the increasing ability and willingness of buyers to substitute among the products of producers in different countries. The latter effect is modelled as a change in the elasticity of substitution of consumers in EU countries for the varieties of output of other EU firms. The outcome is a 1.2% (static gains) respectively 2.6% (dynamic gains) increase in EU wide GDP which is however unequally distributed across the (then) nine Member States. The fact that this studies differentiates between EU 'regions' (i.e. Member States) also allows an assessment of the changes in trade flows. What Harrison et al. (1994) et al. find in this respect is a strong increase in trade among the EU countries, and a modest decline in trade between EU countries and the rest of the world. This pattern is in line with the predictions of regional trade integration which will lead to trade creation among insiders and trade diversion from outside regions (see Viner, 1950). However, in some cases the estimated trade effects are unrealistically high. For example, in the German food industry exports to EU partners would increase by 118% while imports increase by 792% (see Harrison et al. 1994, Table A2).

### **2.2.3. Post 1992 Evaluations: Declining border effects and growing internal trade**

The ex post studies on the Single Market Programme are too numerous to be reviewed here in detail. Therefore the focus is on a few influential studies with an emphasis on the Single Market effects on trade and trade patterns. In this respect a first interesting contribution is by Fontagne et al. (1997) who – six years into the completion of the Single Market – analyse in depth intra-EU trade flows, carefully differentiating between inter-industry trade, intra-industry trade (IIT) in varieties (horizontal IIT) and intra-industry trade involving products of different quality (vertical IIT). A key result is that, as predicted, IIT has grown strongly inside the Single Market. However, this surge in IIT was not primarily due to increasing trade in varieties – which was the experience with the realisation of the Common Market and which would have had the advantage of limited adjustment costs – but rather due to the expansion of IIT of goods of different quality. Moreover, the importance of vertical IIT increases with economic distance, i.e. differences in per capita income. The general conclusion that the authors draw from these results is that the Single Market has neither fulfilled the optimistic expectations of a Single Market-induced surge on horizontal IIT, nor has it lead to a more pronounced specialisation of European members potentially associated with cohesion costs. Growth of trade in goods following European integration has taken place above all within industries which in their view suggests a qualitative division labour in Europe (e.g. Germany are specialised on up-market products and Southern Member States are specialised on the low- and medium-quality segments).

A considerable methodological improvement in the analysis of the Single Market was the use of 'border effects' as a measure of fragmentation and hence the 'Cost of Non-Europe'. Head and Mayer (2002) thus evaluate the success of Europe's Single Market Programme with the help of border effects which they define as a situation in which 'firms have greater access to domestic consumers than to consumers in other nations' (p. 284). Estimating industry-level border effects over the period well before and after the Single Market Programme allows them track the evolution of the border effects. They find that the border effect has indeed declined from an imports-from-self to imports ratio of 21 in the late 1970s to a

ratio of 13 in the period 1993-1995. However, the decline in the border effect is mainly attributable to the period before 1986. Since then little movement in the border effect is discernible. Moreover, the cross-industry variation in the border effect, according to Head and Mayer (2002) cannot be explained by the non-tariff barrier (NTBs) suspected to cause the market fragmentation in the EU (different standards, government procurement bias, customs burdens).

One explanation of this result is that the border effect is not so much caused by NTBs but by differences in consumer preferences (tilted towards national products) as has been suggested by Geroski (1991). This is in contrast with the later results by Delgado (2006) who find that the border effect continued to decline throughout the second half of the 1990s and that this decline came to a halt at the beginning of the new millennium (i.e. much later than found by Head and Mayer, 2002).

While upholding that the Internal Market is a powerful instrument to promote economic integration and to increase competition within the EU, also the European Commission stated that the Single Market (despite boosting incomes by an additional 2.2% between 1992 and 2006) did not bring about all the hoped for effect (see Ilzkovitz et al., 2007). In particular, the initial expectations that a European market integration would lead to a more dynamic and innovative economy did not materialise. With regards to the development of trade flows, also the European Commission finds, based on the evolution of intra-EU and extra-EU trade flows, a dying out of the trade-creation effect of the Single Market as of the year 2000 which coincides with the abating of the decline in the border effect in Delgado (2006). Straathof et al. (2008) use gravity estimates to investigate the contribution of the Single Market to trade (and FDI) expansion. With regards to trade they find that the Single Market boosted bilateral exports and imports of goods by Member States by about 8%. In their model this trade-enhancing effect of the Single Market translated into a 2%-3% higher per capita income throughout Member States until 2005.

While one may expect that the integrative force of the Single Market comes to a halt at some stage (as NTBs decline and intra-EU trade is already at an elevated level), there is general agreement that the remaining obstacles to trade still provide for a substantial potential for trade creation (e.g. Ilzkovitz et al., 2007; Aussiloux et al., 2011). This is mainly because the implementation of the Single Market remains far from complete, especially but not only in the domain of services trade. The work by Aussiloux et al. (2011) suggests that an ambitious programme that eliminates all remaining barriers to trade in the Single Market would boost national incomes in the EU-27 by 14% after a period of 10 years. In addition, intra-EU trade would almost double.

#### **2.2.4. Reviving the Single Market in Times of Crisis**

The perception that not all gains from the Single Market were reaped so far – the remaining obstacles to trade in goods were estimated to amount to 45% of the production value on average (De Sousa et al., 2012) – gained importance after the Great Recession of 2008/2009 and the associated trade collapse for at least two reasons. First of all, there was the fear that the recession and the following period of subdued growth may reinforce the ‘integration fatigue’ (Monti, 2010) and re-ignite economic nationalism in Member States to the detriment of past achievement in terms of economic integration. Secondly, the high debt burdens and an environment of low growth suggest the Single Market project to be a candidate for an alternative source of growth (Kommerskollegium, 2015). Based on the suggestions of a report by Mario Monti (2010), the ‘Single Market Act’ was adopted in April 2011. The Single Market Act

contains twelve priority actions for stimulating growth and restoring the belief in the benefits of an integrated European market.

This initiative was complemented with a Single Market Act II in 2012. Hence, the new initiatives to proceed with the Single Market project coincided with the 20th anniversary of the (de jure) completion of the Single Market of 1992 which lead to numerous reports that try to assess the effects of market integration of the past 20 years (e.g. Vetter, 2013; Bertelsmann et al., 2014). In one of these publications, Vetter (2013) comes to the assessment that there is general agreement that the Single Market project contributed significantly to the increase in trade flows. For example, between 1992 and 2012, intra-EU trade intensity rose from about 12% to 22% of GDP. The fact that extra-EU trade grew faster than intra-EU trade during that period does not point towards a failure of the Single Market but rather signals that growth and the general economic conditions were stronger outside the EU. This points to an important issue which is that in times where several changes occur at the same time (e.g. EU enlargement, globalisation, the rise of China,...) it is challenging to clearly identify the impact of the Single Market (Vetter, 2013).

As a result, ex post evaluations of the Single Market remain difficult even 20 years after its initial completion. Moreover, the author argues that there is general consensus that the Single Market has stimulated income growth though the growth effects, in his view, fall short of the initial high expectations raised for example by the Checchini report. The explanations for this are manifold. One aspect in this is methodological. Most methodologies employed for studying the effects of trade integration did (and still do) emphasise the benefits of liberalisations while disregarding potential downsides such as adjustment costs. Another factor is the plausibility of the scenario analysis. For example, the above cited study by Aussiloux et al. (2011) assumes that NTBs are removed in its entirety. Since this is unlikely to happen, the actual effects must be smaller than the predicted ones, even if the methodology was otherwise fully adequate.

Moreover, relatively little attention (at least outside the regional economics literature) has been paid to the fact that the gains from integration are unevenly distributed with a tendency for higher gains accruing to highly competitive countries (or regions) and comparatively smaller gains for less competitive countries (or regions). That manufacturing production seems to be increasingly concentrated in a number of Central European countries has also been identified by the IMF in its analysis of the German-led Central European supply chain (IMF, 2013). Along the same lines, Stöllinger (2016) shows econometrically that integration in global value chains – which is not directly related to the Single Market but is still part of the European Commission's policy objectives – supports the manufacturing sector only in the Central European Manufacturing Core countries while it tends to accelerate the deindustrialisation process in other Member States. Concentration tendencies like this acts as a strain on European cohesion and can be expected to have contributed – for right or for wrong – to the integration fatigue. Still the potential for further benefits from a revived Single Market initiative which is supposed to focus on areas such as a digital Single Market, integrated networks, mutual recognition of qualifications and public procurement.

Meanwhile recent studies on the trade effects of further deregulation in the Single Market continue to predict very large trade effects. In a study Fournier et al. (2015) focus on the OECD product market regulation (PMR) indicators. Their scenario is a deregulation that would bring the PMR indicators of OECD-EU Member States down to half of the top half of the best performers (i.e. a massive

deregulation). Such a deregulation drive is estimated to increase exports by 13%. Whether the attempted further developments of the Single Market will materialise, and if so, if it will really be a game changer as predicted by some (e.g. Fournier, 2016) remains to be seen.

### 2.2.5. Services trade and the services directive

Integration effects have also been expected in and with services trade. However, though the treaty establishing the European Community guarantees freedom of establishment of service companies and freedom to provide services on the territory of another EU Member State, discriminatory barriers to services trade remained quite significant as national regulatory regimes continued to segment services markets. Kox and Lejour (2007) argue that the EU Member States are still characterised by quite heterogeneous regulations. This heterogeneity of regulations has significant impacts on services trade. In January 2004, the European Commission made a proposal for a Directive on Services in the Internal Market, which was finally adopted by the European Parliament and the Council in December 2006 and had to be transposed by the Member States by the end of 2009. This directive was intended to remove discriminatory barriers, cut red tape, modernise and simplify the legal and administrative framework and improve information exchange and cooperation of Member States.

Although the majority of EU Member States have transposed the Directive, its full transposition is not yet completed (see Monteagudo, Rutkowski and Lorenzani, 2012). In addition, its legal transposition does not ensure that the full potential offered by the Directive would be fully materialised, as from the onset a large degree of heterogeneity of implementation was expected from across Member States. Following a strong debate in a number of countries, the initially envisaged 'country of origin' principle that implies mutual recognition of regulatory standards was removed from the Directive (Bruijn, Kox and Lejour, 2008). Some countries also still impose an economic needs test in regulated sectors – the test requires a foreign firm to prove that the market entry of foreign competitors is economically desirable (Vetter, 2013).

The EU Commission peer review on the implementation of the Services Directive (EC, 2013) confirms that there are still many obstacles to intra-EU services trade. Though Member States screened their legislations as part of the 2010 Mutual Evaluation and several relaxed their rules, the peer review showed that they do not seem to have carried out a thorough proportionality assessment of legal form and shareholding requirements. Also, fixed tariffs, in general, and compulsory minimum tariffs, in particular, are serious restrictions to the establishment of service providers. They also negatively influence consumers' choice and reduce competition on a market.

Fournier (2014) analyses Product Market Regulation (PMR) indicators of the OECD and comes to the conclusion that the Directive has had little impact so far on reducing barriers to services trade as the PMR indicators hardly changed between 2008 and 2013, and even seem to have deteriorated in several EU countries. Still, the EU has achieved the most advanced services trade liberalisation among existing regional trade agreements (Francois and Hoekman, 2010). The EU has been the only group of countries to conduct multilateral services policy reforms (other countries normally carry out unilateral reforms, and the contribution of the GATS to services reform has been negligible).

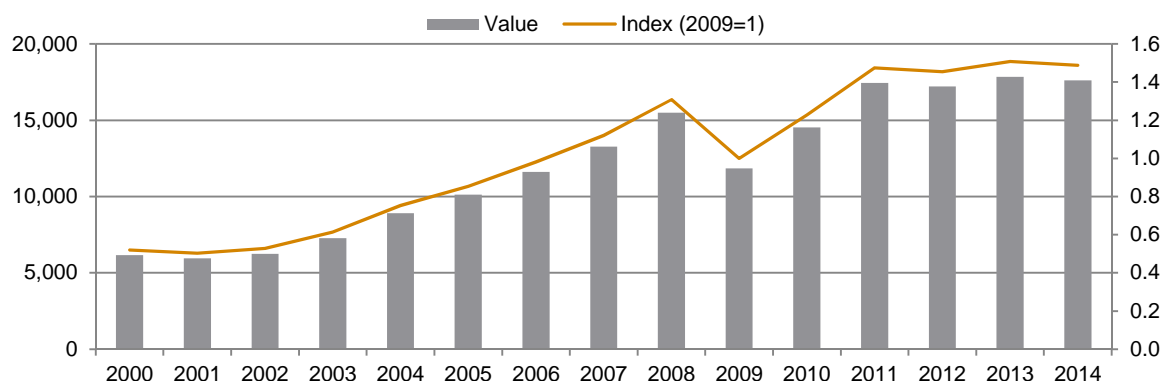
Several studies attempted to estimate the economic effects of the Services Directive using different types of computable general equilibrium (CGE) modelling. All the studies expect that Services Directive will bring significant benefits to all the Member States. For example, Badinger et al. (2008) estimate, that the Directive will bring 400 thousand new jobs and additional 1% of GDP through trade and FDI channels. According to Copenhagen Economics (2005) estimates, the Services Directive will bring an increase in the private consumption by 0.6% (EUR 37 billion), rise in value added by EUR 33 billion, creation of about 600 thousand new jobs, intensification of intra-EU services trade, and fall in services prices due to the rising competition. Brujn, Kox and Lejour (2008) come up with an estimate of 0.3-0.6% additional growth in EU GDP, and 0.7-1.2% growth in consumption provided the Directive is implemented in full. When leaving out the 'country of origin' principle cuts the production and consumption effects by about a third. Monteagudo, Rutkowski and Lorenzani (2012) from DG ECFIN estimate that the implementation of the Services Directive could boost GDP by 0.8% during the first five years, though with country-specific differences (from 0.3% for Bulgaria to 1.8% for Cyprus). In a more optimistic scenario, in which nearly all barriers were to be removed, additional growth could be as much as 1.6%.

### 2.3. OVERALL PATTERNS OF EU TRADE IN GOODS

In the following an analysis of changes in global trade flows over the period 2000-2014 (and later on for services up to 2013, depending on data availability) is presented. This period will be divided into the years before the crisis (2000-2008), the crisis with the global trade slowdown (2008-2009), the recovery period after the crisis (2009-2011) and the years since then (2011-2014). In the first part some global trends will be described, but the focus will be on the relative importance of intra- versus extra-EU trade flows for the EU-28 as a whole and its individual Member States. A particular focus will be how country ('regional') specialisation, concentration and clustering have emerged over the period considered. The main question will be whether European integration has led to a 'flatter' Europe or whether it implied more concentration and regional clustering of exports. Further, the question whether the crisis in 2008 marked a break in the trend of these developments will be discussed. Second, an analysis of the evolving bilateral trade relations of within-EU trade will be conducted.

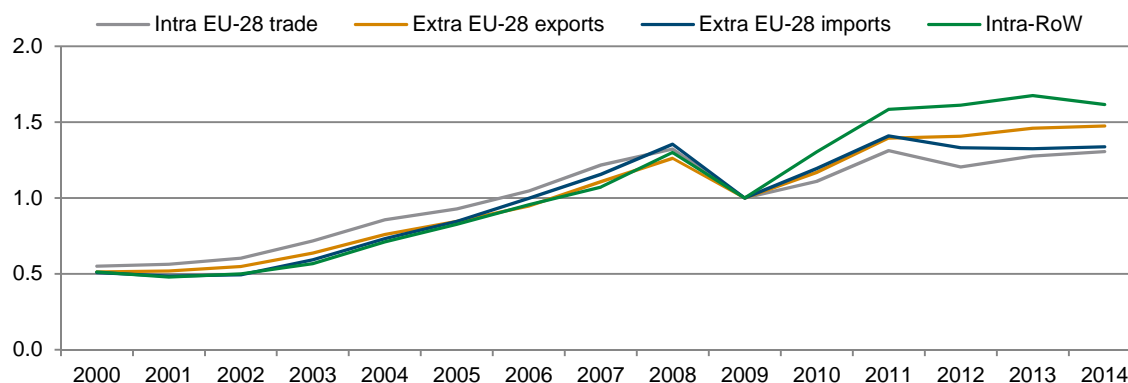
#### 2.3.1. Overall trends

As a starting point, this section provides some important broad patterns of trade over the period 2000-2014 concerning the role of extra- and intra-EU trade. Figure 2.3.1 shows the global trade values (global exports = global imports) over the period 2000-2013 in billion USD. It demonstrates that global trade has strongly increased, particularly since 2002, reaching a value of almost USD 15 trillion in 2008. The economic crisis marked a sharp drop in global trade flows down to about USD 10 trillion. Thereafter, global trade recovered quickly, almost reaching the pre-crisis volume of trade in 2010 and further increasing to about USD 17 trillion in 2011. However, since then the global trade volume has remained more or less constant at this level. From the EU-28 perspective, one can distinguish the trade flows within the EU-28, the flows between the EU-28 and the world, i.e. both exports to and imports from the world, and the trade flows in the world not including the EU-28. The dynamics of these four categories are presented in Figure 2.3.2.

**Figure 2.3.1 / Global trade volume (in billion USD) and index**

Source: BACI; own calculations.

Prior to the crisis, intra-EU trade had developed even faster than world trade, pointing towards the strong integration among European countries in this period. This pattern, however, has changed dramatically since the trade slump in 2009: From then on intra-EU trade developed much more slowly than the other components and in 2011 came to a standstill, or even declined. A similar pattern is observed for exports of non-EU countries to the EU-28, i.e. EU-28 imports. Both trends reflect low growth and the corresponding sluggish demand in Europe as compared to other economies (though global growth itself has in fact slowed down). Trade flows outside the EU have recovered much faster, to a level 60% higher than in the year of the trade slump in 2009, but there is a clear sign of lower growth since 2011. The EU-28 countries' exports to the world basically followed this trend though at a slower pace until 2011; since then exports to the world have grown at similar rates.

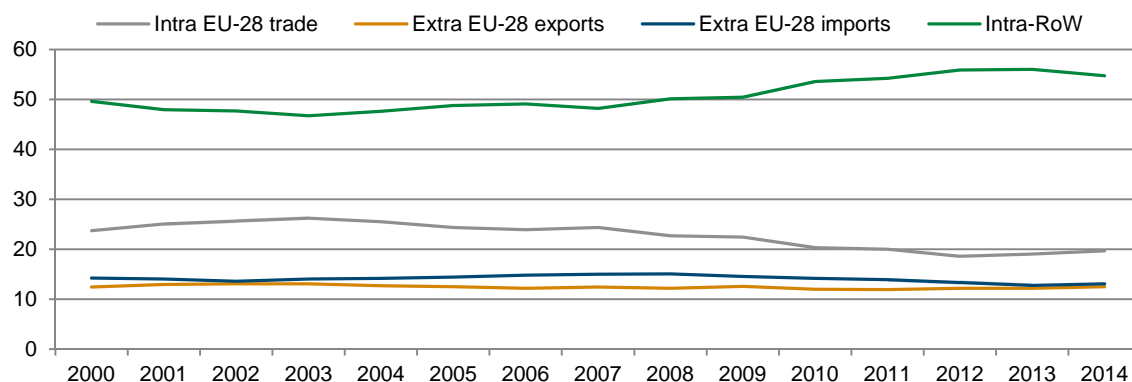
**Figure 2.3.2 / Export dynamics by region, 2009 = 1**

Source: BACI; own calculations.

These trends are also reflected in the development of the shares of intra-EU trade in world trade flows (see Figure 2.3.2). Intra-EU trade flows accounted for about a quarter of global trade flows before the crisis; this share dropped to about 22% in 2013. The share of EU-28 exports to the world has even slightly increased since 2000, and remained stable since the crisis. However, the share of EU imports from the world declined from almost 14% before the crisis to slightly less than 12% in 2013. This implies that trade flows outside Europe have grown in importance with the respective shares increasing from 47% in 2000 to about 52% in 2013. This suggests that at least a part of the global trade slowdown is

explained by trade flows within the EU and EU imports from the world. Nonetheless, about half of global trade involves EU-28 Member States.

**Figure 2.3.3 / Shares of trade of EU-28 and world, in % of global trade flows**



Source: BACI; own calculations.

The trends just described are also reflected at the level of the individual EU Member States. As shown in Table 2.3.1, the share of exports to other EU-28 countries in the countries' total exports declined in all countries (with the exception of Romania). However, there is still a large variation across countries with respect to their shares of intra-EU exports, ranging from about 80% in Slovenia to rates below 50% in the United Kingdom, Greece, Cyprus and Malta.

**Table 2.3.1 / Shares of intra-EU trade (in % of total trade flows)**

	Share of exports to EU-28					Share of imports from EU-28				
	2000	2008	2009	2011	2014	2000	2008	2009	2011	2014
Austria	72.6	69.7	68.0	67.8	66.1	77.9	76.6	75.9	74.4	73.4
Belgium-Luxembourg	77.6	74.8	74.3	72.2	71.0	73.7	69.9	70.9	69.1	66.3
Bulgaria	60.9	58.1	64.0	62.3	61.1	54.6	51.2	54.5	58.4	60.1
Croatia	67.8	60.2	60.6	59.2	61.6	72.4	65.0	63.6	62.9	75.0
Cyprus	51.5	63.2	65.1	54.9	56.0	47.6	48.2	58.9	49.6	65.3
Czech Republic	84.8	83.5	83.1	81.5	79.9	76.5	68.2	68.0	65.6	68.3
Denmark	65.0	64.7	62.5	63.4	60.3	73.8	73.1	71.0	70.3	70.0
Estonia	74.4	61.7	58.2	57.8	62.9	51.5	65.7	63.3	60.5	62.9
Finland	60.1	55.2	53.4	54.8	55.7	59.8	54.1	57.6	61.2	58.3
France	63.9	62.3	59.9	59.2	58.0	63.6	62.2	62.1	60.8	61.1
Germany	62.8	61.9	60.5	57.5	56.3	59.3	58.4	58.3	58.2	59.6
Greece	60.2	62.4	60.0	54.5	47.7	60.8	56.9	58.7	53.3	49.1
Hungary	80.0	77.4	77.9	74.9	75.7	66.9	66.2	65.4	67.5	73.5
Ireland	59.5	58.8	59.0	57.6	55.8	59.6	66.5	62.7	66.5	65.1
Italy	59.4	57.8	55.8	54.0	52.7	62.8	56.2	58.0	53.9	56.5
Latvia	71.4	67.0	65.5	67.0	66.4	62.7	66.1	60.2	60.4	72.4
Lithuania	71.1	61.6	63.7	62.4	53.2	52.7	57.4	57.1	56.1	62.0
Malta	51.1	36.9	43.2	33.7	30.1	51.3	45.0	43.1	39.9	42.1
Netherlands	77.7	76.2	75.6	73.9	74.9	54.7	47.9	50.1	48.2	48.8
Poland	81.0	76.5	77.8	76.2	74.9	70.0	64.6	64.3	62.6	62.0
Portugal	80.0	72.8	72.1	71.1	66.8	76.3	71.6	75.7	71.6	73.9
Romania	72.1	66.3	70.2	68.3	66.7	70.7	69.6	73.2	72.3	73.9
Slovakia	88.2	83.0	84.0	82.1	81.2	71.9	66.9	67.0	64.9	64.6
Slovenia	78.9	76.1	75.1	76.1	75.1	81.3	74.3	73.8	71.8	70.3
Spain	71.8	69.5	68.4	65.6	62.8	65.8	56.9	59.3	53.9	53.5
Sweden	57.3	59.3	57.0	57.3	59.3	68.7	70.2	69.2	69.4	70.4
United Kingdom	56.6	55.8	54.4	54.1	47.2	52.6	52.6	52.3	50.7	55.3

Source: BACI; own calculations.

Table 2.3.2 presents the shares of each EU Member State in total intra-EU and extra-EU exports, respectively, over the period 2000 to 2014, and the changes in these shares in percentage points over this period. It is clearly visible that some countries performed relatively better, leading to an increasing contribution to EU-28 intra- and extra-EU exports. This group of countries comprises particularly the Eastern European countries together with Austria, Germany and the Netherlands, i.e. countries which are argued to be part of the so-called 'EU manufacturing core' which has emerged in the last decade or so (see Stehrer and Stöllinger, 2015, for example). Countries with lower growth rates of exports – though still positive ones as can be seen in Table 2.3.2 – lost shares in overall EU exports. This is particularly the case for Italy, France and the United Kingdom. Further, the changes in contributions to EU exports also indicate that the performance with respect to intra- and extra-EU trade is highly correlated.

**Table 2.3.2 / EU Member States' contributions to intra-EU trade, in % of trade flow**

	Shares in intra-EU exports					Shares in intra-EU imports					Change in shares in ppt (2000-2014)	
	2000	2008	2009	2011	2014	2000	2008	2009	2011	2014	Exports	Imports
Austria	2.8	3.1	3.1	3.1	3.1	3.5	3.7	3.8	3.8	3.6	0.3	0.1
Belgium-Luxembourg	7.3	8.0	7.9	7.9	7.8	8.7	9.3	9.4	9.1	8.6	0.5	-0.1
Bulgaria	0.2	0.4	0.4	0.5	0.5	0.2	0.5	0.5	0.5	0.6	0.3	0.4
Croatia	0.2	0.2	0.3	0.2	0.2	0.4	0.6	0.5	0.4	0.5	0.0	0.1
Cyprus	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.2	0.2	0.0	0.0
Czech Republic	1.7	3.1	3.3	3.5	3.7	1.7	2.7	2.6	2.8	3.0	2.0	1.3
Denmark	1.9	1.9	1.9	1.9	1.7	2.2	2.2	2.1	1.9	2.0	-0.2	-0.2
Estonia	0.2	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.4	0.1	0.2
Finland	1.9	1.6	1.3	1.3	1.2	1.4	1.4	1.2	1.4	1.2	-0.6	-0.2
France	12.6	10.5	10.6	9.8	9.5	13.2	12.1	12.5	12.1	11.5	-3.1	-1.7
Germany	22.4	23.7	23.5	22.9	22.8	17.8	17.2	17.8	19.1	19.4	0.4	1.6
Greece	0.4	0.5	0.5	0.5	0.5	1.3	1.4	1.5	0.9	0.9	0.0	-0.4
Hungary	1.6	2.2	2.2	2.2	2.3	1.5	1.9	1.8	1.9	2.1	0.7	0.6
Ireland	3.1	2.5	3.0	2.6	2.3	2.1	1.6	1.5	1.3	1.4	-0.8	-0.7
Italy	9.2	8.5	8.2	7.8	7.7	9.9	8.5	8.8	8.4	7.6	-1.5	-2.3
Latvia	0.1	0.2	0.2	0.2	0.3	0.2	0.3	0.2	0.3	0.4	0.1	0.2
Lithuania	0.2	0.4	0.4	0.5	0.5	0.2	0.5	0.4	0.5	0.6	0.3	0.4
Malta	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.0	0.0
Netherlands	9.8	9.9	9.9	10.8	11.3	6.9	7.0	7.1	7.7	7.8	1.5	0.8
Poland	1.7	3.4	3.6	3.9	4.4	2.4	3.8	3.6	3.8	3.9	2.7	1.5
Portugal	1.3	1.1	1.1	1.2	1.2	2.1	1.8	1.9	1.7	1.7	-0.1	-0.4
Romania	0.6	0.9	1.0	1.2	1.4	0.6	1.6	1.4	1.5	1.6	0.8	1.0
Slovakia	0.7	1.5	1.6	1.7	1.8	0.6	1.3	1.3	1.4	1.5	1.1	0.8
Slovenia	0.5	0.6	0.6	0.6	0.7	0.6	0.7	0.6	0.6	0.6	0.2	0.0
Spain	5.4	5.3	5.4	5.3	5.4	6.9	6.6	6.3	5.5	5.3	0.0	-1.6
Sweden	3.4	3.0	2.7	3.0	2.7	3.3	3.2	3.0	3.3	3.1	-0.7	-0.1
United Kingdom	10.4	7.2	7.0	6.9	6.4	11.9	9.5	9.6	9.5	10.6	-3.9	-1.3

Source: BACI; own calculations.

Summarising these trends, global trade in goods developed quite dynamically before the crisis; it was severely hit by the economic crisis in 2008, but recovered quickly until 2011. From this year on, global expansion of trade in goods has been rather low partly driven by the low dynamics of intra-EU trade and relatively weak dynamics of EU-28 imports from the rest of the world. This has also led to a decline in the share of intra-EU-28 in global trade flows to about 20%. Nevertheless, trade of EU countries with other EU countries is still by far the most important component accounting for about 60% of trade across EU Member States; however, there are significant differences across countries.



### 2.3.2. Has the EU become flatter?

The general question with respect to intra-EU trade flows is, first, whether the process of economic integration implied a concentration of export activities across countries. Second, as observed above, the crisis impacted in a specific way concerning the overall expansion of trade and perhaps also the composition of it. Thus, it may be of interest whether the trends observed before the crisis have continued thereafter or whether there was a structural break in these. To investigate these issues, several measures of concentration, specialisation and clustering taken from the literature on regional developments (e.g. Hallet, 2000) will be presented in the following.

As a measure of concentration, first the *Herfindahl index* with respect to EU Member States' contributions to intra-EU trade flows is calculated. If exports have become more concentrated in a few countries, this index is expected to increase; by way of contrast, if intra-EU exports have become more balanced across EU Member States, this index is expected to decrease.

The second indicator is an *index of specialisation*: (i) In the context of total trade this measures whether each country's ratio of (intra-EU) exports to GDP has converged to the EU average, in which case countries would have become more similar with respect to the 'export intensity' of their activities. If it is increasing, countries become more diverse in this respect. (ii) In the context of industry specialisation (discussed in the following section) this index will be used to see whether countries have converged or diverged with respect to their intra-EU export specialisation across industries or end-use categories.

Third, a measure of *relative concentration* is presented which investigates whether trade activities of countries across the EU (i.e. their relative contribution to intra-EU exports) have evolved similarly to the evolution of GDP shares. This measure therefore indicates whether intra-EU exports have become more or less concentrated as compared to GDP.

Fourth, a *measure of clustering* is analysed which shows whether export activities take place in countries with lower geographical distance to each other. An increase in this number would indicate that export activities become regionally more clustered.

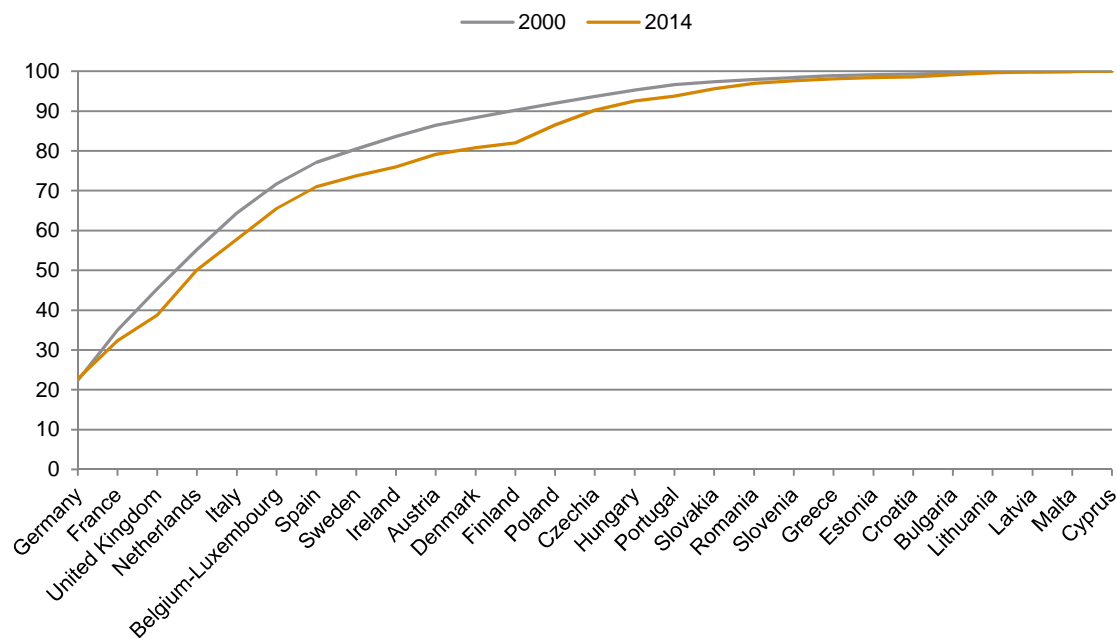
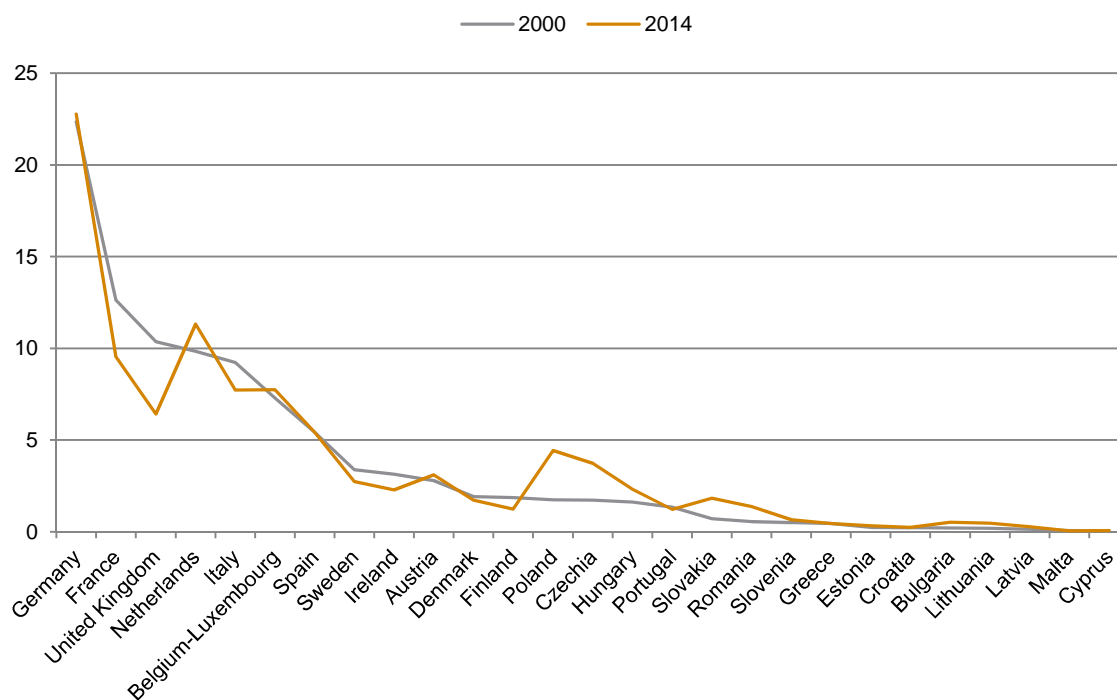
Finally, fifth, a *measure of bilateral trade intensities* is developed which provides insights on whether bilateral trade relative to the partner countries' GDP has increased or decreased.

#### *Herfindahl index*

A first question that arises is whether EU integration has led to a tendency of concentration of intra-EU exports in a few countries. However, this is not the case as indicated in Figure 2.3.4 which plots the cumulated shares of the individual Member States in selected years over the period 2000 to 2014 (with the ranking of 2000). As one can see, the line has shifted inwards indicating that exports have become less concentrated across Member States. Though some countries have lost shares (France, United Kingdom, etc.), a number of smaller countries – in particular the Eastern European countries – have gained shares, driving this result.<sup>1</sup>

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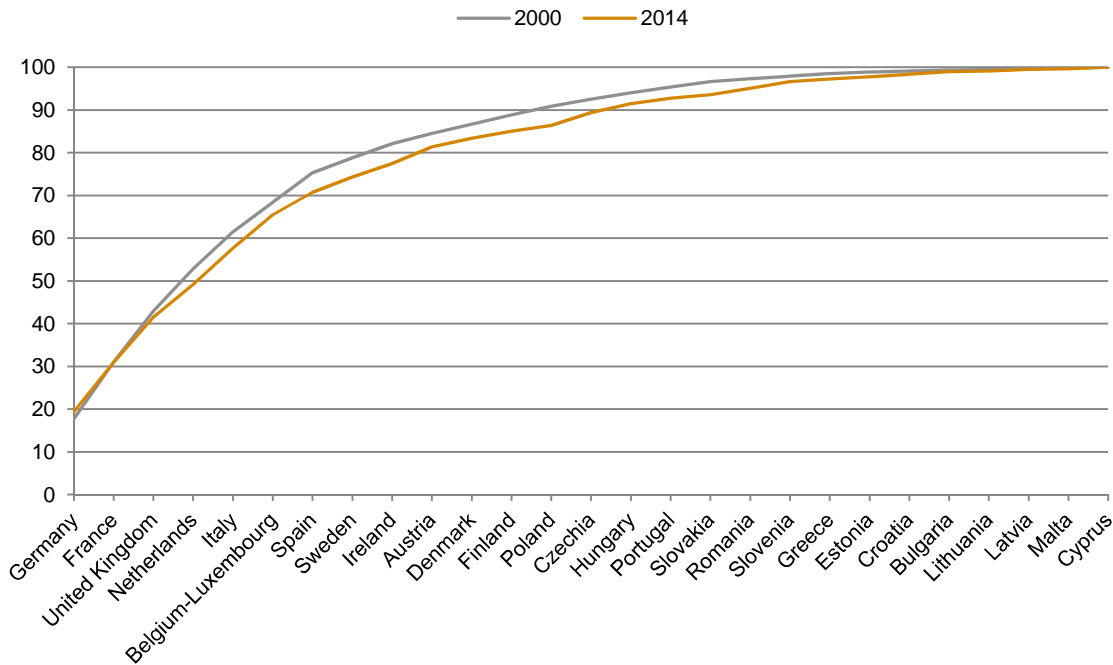
<sup>1</sup> Similar, though less pronounced patterns are found for extra- and intra-EU-28 trade.

**Figure 2.3.4a / Concentration of intra-EU exports****Cumulative shares of contributions to intra-EU exports****Contributions to intra-EU exports, in %**

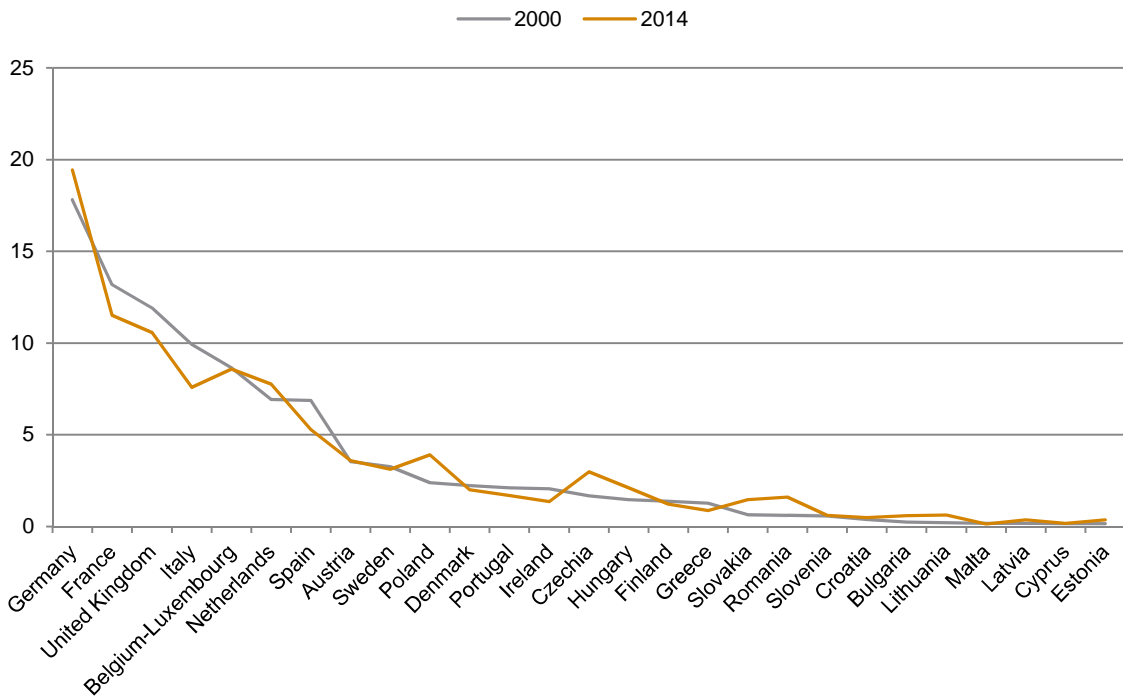
Source: BACI; own calculations.

**Figure 2.3.4b / Concentration of intra-EU imports**

**Cumulative shares of contributions to intra-EU imports**



**Contributions to intra-EU imports, in %**



Source: BACI; own calculations.

**BOX 2.1 / HERFINDAHL INDEX**

A measure of concentration is the Herfindahl index defined as

$$H = \sum_c (s_x^c)^2$$

with a maximum of 1 (if exports were concentrated in one country) and a minimum of  $(1/N)$  if all countries have a share of  $(1/N)$  of total EU exports.  $N$  is the number of countries considered; as the number of countries included is  $N=27$  the minimum is given by 0.037.

Table 2.3.3 presents the index over time and for the three categories of exports and GDP. It highlights that intra-EU exports are characterised by less concentration (in line with results in Figure 2.3.4). A similar tendency is found for intra-EU imports. Furthermore, the figures suggest that most of this dynamic occurred before the crisis, as also suggested by the numbers presented in Table 2.3.3. Concentration in GDP was strongly declining between 2000 and the start of the crisis (as mostly the smaller EU-CEE countries tended to grow faster), but since then has started to increase again as some smaller countries experienced a less favourable development.

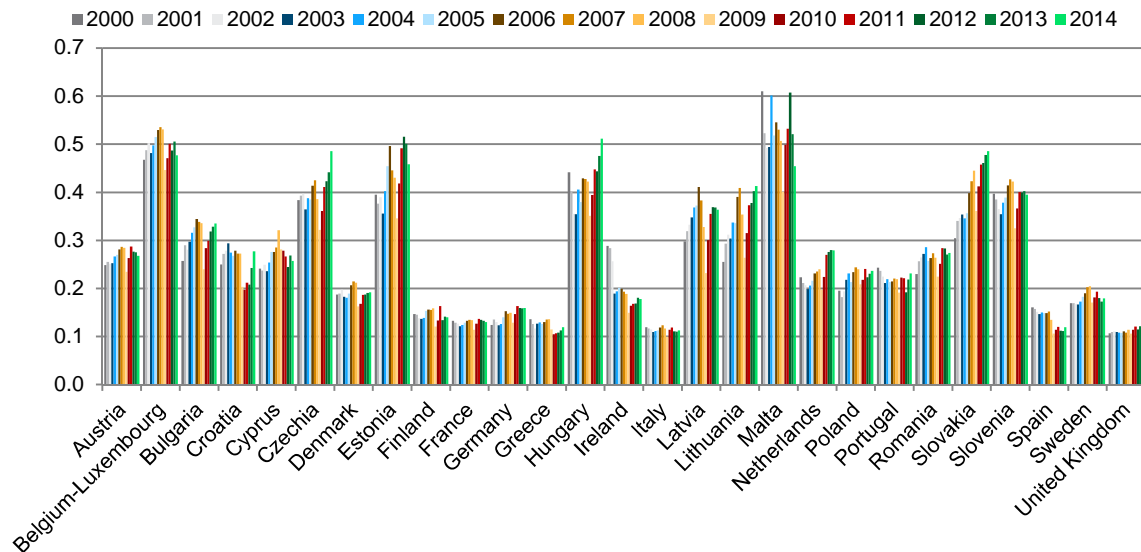
**Table 2.3.3 / Herfindahl index**

	Intra-EU exports	Intra-EU imports	GDP
2000	0.110	0.095	0.132
2001	0.109	0.096	0.130
2002	0.109	0.094	0.128
2003	0.109	0.092	0.126
2004	0.110	0.089	0.125
2005	0.109	0.090	0.122
2006	0.107	0.089	0.120
2007	0.109	0.085	0.118
2008	0.107	0.084	0.115
2009	0.106	0.088	0.116
2010	0.104	0.089	0.116
2011	0.103	0.090	0.116
2012	0.103	0.091	0.118
2013	0.102	0.090	0.118
2014	0.102	0.090	0.119

Source: BACI; own calculations.

### *Export ratios*

For later explanation it is useful to consider the developments of export ratios – the ratio of (manufacturing) exports to GDP – which are presented in Figure 2.3.5. As one can see, these have been strongly increasing in some countries, particularly so for some of the EU-CEE countries plus some others and particularly before the crisis, also pointing towards an ‘export-driven’ growth model prevalent in this period. For most of the other countries, this ratio has been rather stable or even slightly declining as in Ireland or Spain.

**Figure 2.3.5 / Manufacturing exports-to-GDP ratios**

Source: BACI, WDI; own calculations.  
Relative concentration measures

The results based on the Herfindahl index measuring concentration of export activities together with the developments of the exports-to-GDP ratios lead to the question whether export activities have been concentrating relatively more strongly than overall activity (measured by GDP). One indicator to describe this is the relative concentration measure as outlined in Box 2.2. The index – in this context – is likely to be lower than one as smaller countries generally tend to have higher export shares (see Figure 2.3.5). Therefore the most interesting issue is the dynamics. Furthermore, concentration in terms of intra-EU imports tends to be lower due to production specialisation patterns. Table 2.3.4 reports the components of this measure as well as the measure itself.<sup>2</sup>

### BOX 2.2 / RELATIVE CONCENTRATION MEASURE

Another measure to capture whether certain activities have become more concentrated in a certain region or countries like exports in relation to GDP is the relative concentration measure, defined as:

$$C = \frac{\frac{1}{\bar{s}_X} \sqrt{\frac{1}{N} \sum_c (s_X^c - \bar{s}_X)^2}}{\frac{1}{\bar{s}_{GDP}} \sqrt{\frac{1}{N} \sum_c (s_{GDP}^c - \bar{s}_{GDP})^2}}$$

Thus,  $s_X^c$  denotes the share of country  $c$ 's intra-EU exports in the EU intra-EU exports and  $\bar{s}_X$  is the mean of these shares. An analogous interpretation holds for the shares in GDP. The measure therefore relates the coefficient-of-variation in export shares to the coefficient-of-variation in GDP shares. It indicates whether intra-EU exports have become more or less concentrated as compared to GDP.

<sup>2</sup> The standard deviation is multiplied by 100.

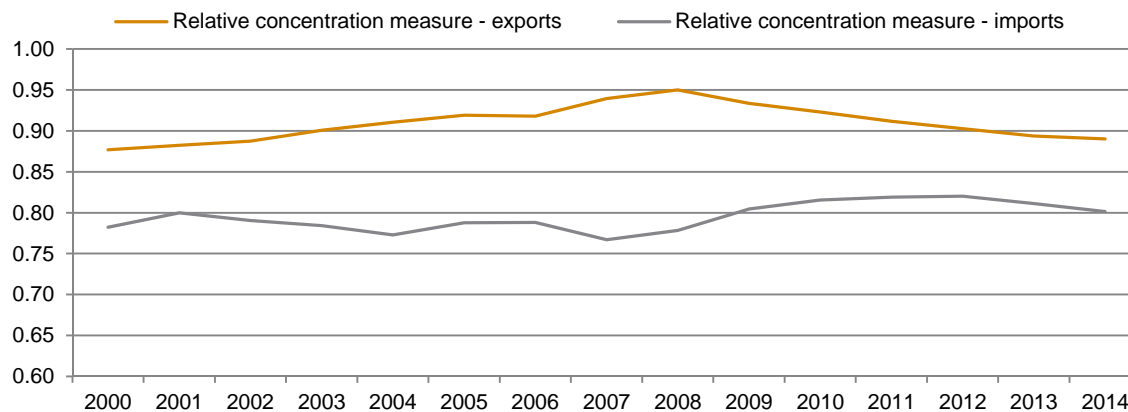
**Table 2.3.4 / Concentration measure of intra-EU trade**

	Intra-EU exports					Intra-EU imports				
	Standard deviation of export shares	Standard deviation of GDP shares	Covariance of exports	Covariance of GDP	Relative concentration measure	Standard deviation of import shares	Standard deviation of GDP shares	Covariance of imports	Covariance of GDP	Relative concentration measure
2000	5.294	6.037	1.429	1.630	0.877	4.723	6.037	1.275	1.630	0.782
2001	5.270	5.973	1.423	1.613	0.882	4.776	5.973	1.290	1.613	0.800
2002	5.248	5.913	1.417	1.597	0.888	4.673	5.913	1.262	1.597	0.790
2003	5.265	5.845	1.421	1.578	0.901	4.583	5.845	1.237	1.578	0.784
2004	5.283	5.802	1.427	1.567	0.911	4.484	5.802	1.211	1.567	0.773
2005	5.255	5.717	1.419	1.544	0.919	4.504	5.717	1.216	1.544	0.788
2006	5.194	5.657	1.402	1.527	0.918	4.458	5.657	1.204	1.527	0.788
2007	5.253	5.592	1.418	1.510	0.939	4.289	5.592	1.158	1.510	0.767
2008	5.198	5.471	1.404	1.477	0.950	4.259	5.471	1.150	1.477	0.778
2009	5.137	5.502	1.387	1.486	0.934	4.426	5.502	1.195	1.486	0.804
2010	5.084	5.507	1.373	1.487	0.923	4.492	5.507	1.213	1.487	0.816
2011	5.040	5.527	1.361	1.492	0.912	4.526	5.527	1.222	1.492	0.819
2012	5.030	5.572	1.358	1.505	0.903	4.571	5.572	1.234	1.505	0.820
2013	4.986	5.580	1.346	1.507	0.894	4.526	5.580	1.222	1.507	0.811
2014	5.011	5.629	1.353	1.520	0.890	4.511	5.629	1.218	1.520	0.801

Note: Indicators reported for intra-EU trade.

Source: BACI; own calculations.

First, the standard deviation of export shares slightly decreased over the whole period in line with the findings reported for the Herfindahl index above. However, the standard deviation of GDP shares decreased even more strongly until 2008, but from then on started to increase. Consequently, exports became more concentrated (relative to GDP) between 2000 and 2008, suggesting that higher-growth countries experienced an even better export growth performance (reflected also in an increase in the exports/GDP ratio). This trend was reversed from 2009 onwards, perhaps marking a change in the growth model of some countries (which is less export-driven). The resulting relative concentration measure is reported in Figure 2.3.6. The relative concentration of imports remained roughly stable until 2008, but started to increase again thereafter, mostly driven by the differentiated dynamics of GDP.

**Figure 2.3.6 / Relative concentration of intra-EU export activities**

Source: BACI; own calculations.

Clustering measure

**BOX 2.3 / CLUSTERING MEASURE**

The clustering measure is defined as

$$C = \frac{\sum_{r,s} \frac{S_X^r S_X^s}{d^{rs}}}{\sum_{r,s} \frac{S_{GDP}^r S_{GDP}^s}{d^{rs}}}$$

and relates the product of contributions to exports between two countries relative to its distance to the GDP shares again relative to distance. A higher value indicates that export activities relative to GDP are clustering in countries with lower geographical distance to each other.

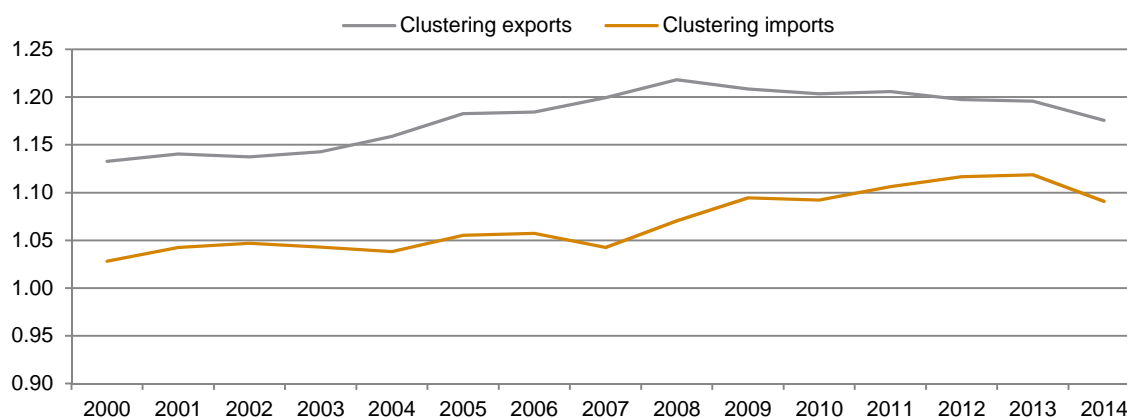
**Table 2.3.5 / Clustering measure**

	Intra-EU exports			Imports	Intra-EU imports	
	Exports	GDP	Clustering		GDP	Clustering
2000	0.218	0.193	1.133	0.198	0.193	1.028
2001	0.218	0.191	1.140	0.199	0.191	1.042
2002	0.216	0.190	1.137	0.199	0.190	1.047
2003	0.214	0.188	1.143	0.196	0.188	1.043
2004	0.216	0.186	1.159	0.194	0.186	1.038
2005	0.218	0.184	1.183	0.194	0.184	1.055
2006	0.217	0.183	1.184	0.193	0.183	1.057
2007	0.217	0.181	1.199	0.189	0.181	1.043
2008	0.217	0.178	1.218	0.191	0.178	1.070
2009	0.217	0.179	1.209	0.196	0.179	1.094
2010	0.216	0.180	1.203	0.196	0.180	1.092
2011	0.218	0.180	1.206	0.200	0.180	1.106
2012	0.218	0.182	1.197	0.203	0.182	1.117
2013	0.218	0.182	1.196	0.204	0.182	1.119
2014	0.216	0.184	1.176	0.201	0.184	1.091

Source: BACI; own calculations.

A related question is whether specific activities (like exporting) are carried out in close distance to each other. A measure relating the activities to distance is the clustering index defined in Box 2.3. Table 2.3.5 reports these results showing that until 2008, exporting activities were increasingly taking place in countries with lower distance to each other (i.e. the 'EU manufacturing core countries'). After the crisis, this trend has slowed down or even reversed.

Summarising, these results suggest that export activities have become slightly less concentrated as relatively small countries – the EU-CEE in particular – were gaining shares in intra-EU trade flows. As in these countries the ratio of (manufacturing) exports to GDP also increased relatively strongly (whereas for other countries it remained stable or even declined) there has been an increase in relative concentration of intra-EU exports – i.e. export activities becoming relatively more concentrated than overall activity measured by GDP – together with a clustering of these activities in the European core.

**Figure 2.3.7 / Clustering measures**

Source: BACI; own calculations.

### 2.3.3. Developments of bilateral gross trade

Related to this is the question whether bilateral trade across Member States has become stronger and whether this has been uniform across countries. A simple way to illustrate this is to calculate a measure of bilateral trade flows relative to the country's GDP, referred to as 'Bilateral gross trade intensity'.<sup>3</sup> Figure 2.3.8 reports the (unweighted) means by country.<sup>4</sup> On average this indicator increased from about 4 in 2000 to about 5 in 2008 (i.e. by 25%); after a drop to about 4.3 in 2008 it increased to 5.3 in 2011; from then on only a slight increase to 5.4 is observed.

Prior to the crisis, these intensities were generally increasing albeit with a few exceptions. The trade slump marked a short-lived dip, though most countries had already returned to the pre-crisis levels in 2011. A few countries, however, performed even better in that respect, such as Bulgaria, the Czech Republic, Hungary, Lithuania and Latvia, the Netherlands, Poland, Romania and Slovakia.

#### BOX 2.4 / BILATERAL GROSS TRADE INTENSITY

Formally, this is calculated as

$$BGTI^{rs} = \frac{X^{rs} + X^{sr}}{GDP^r + GDP^s} \times 1000$$

with  $X^{rs}$  denoting the exports of r to s. For 28 EU Member States there are therefore 756 bilateral intensities.<sup>5</sup> This measure is symmetric in the sense that  $BGTI^{rs} = BGTI^{sr}$ .

<sup>3</sup> Helpman (1987) develops this indicator from a monopolistic competition trade framework; see also the discussion in Feenstra (2003, Chapter 5).

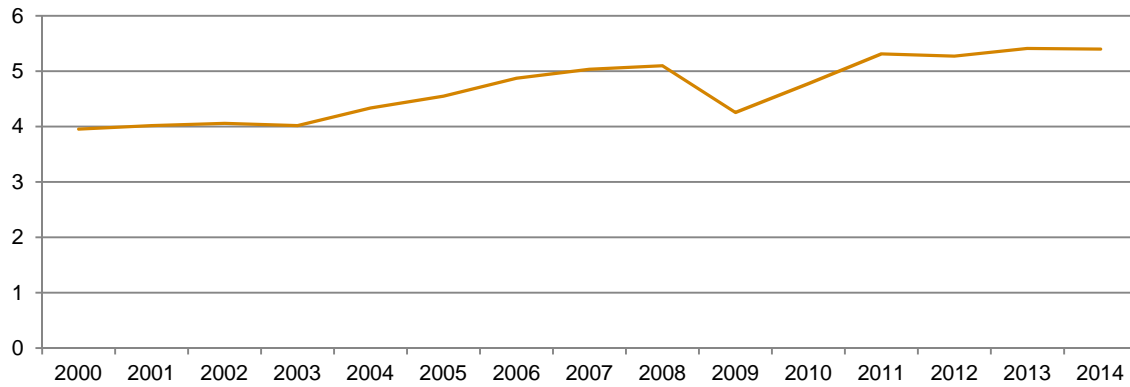
<sup>4</sup> The ratio is multiplied by 1000 for ease of reporting.

<sup>5</sup> In the BACI data only 27 countries are reported as Luxembourg is missing; therefore the number of observations is 702.

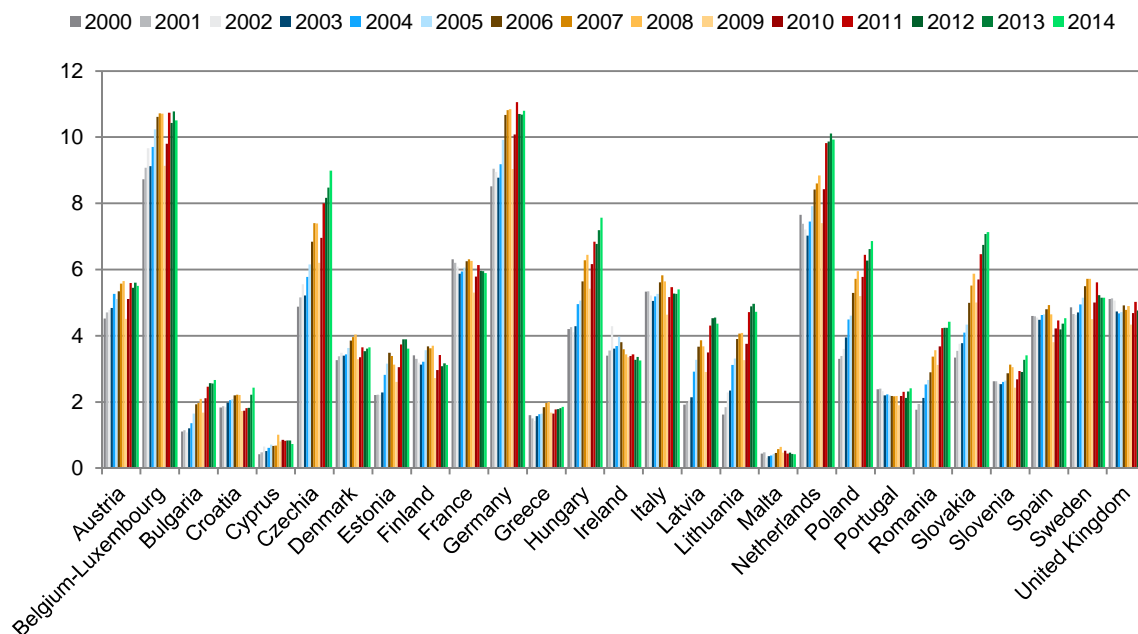


Figure 2.3.8 / Bilateral gross trade intensity (means)

Overall mean

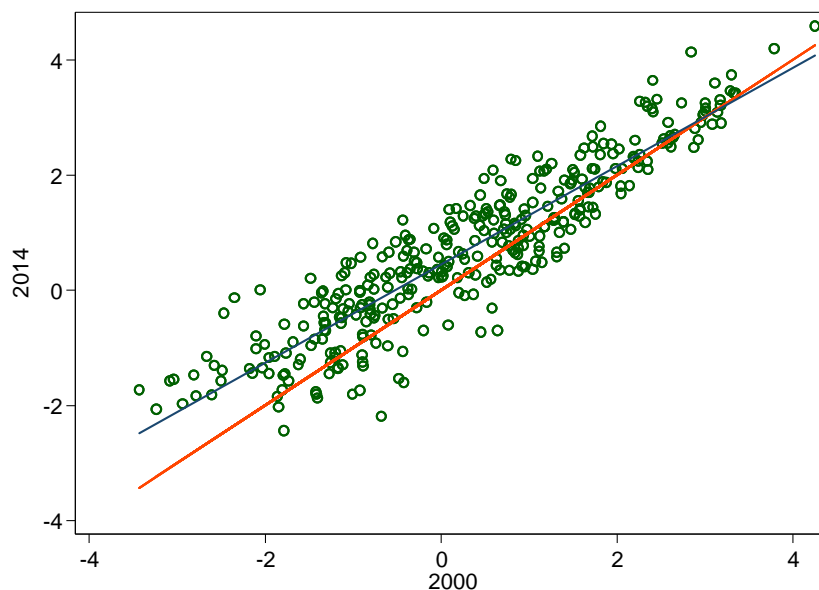


Means by country



Source: BACI and WDI; own calculations.

Figure 2.3.9 plots the evolution of these intensity measures between 2000 and 2014 in log terms. Each dot represents the  $\ln(\text{BGTI}^{\text{TS}})$  in these two years; dots above the 45 degree line (red) indicate that trade between two countries has intensified which is commonly the case, though not for all countries. The fitted line (blue) indicates that on average this has been significantly so.

**Figure 2.3.9 / Bilateral gross trade intensity in log, 2000 and 2014**

Source: BACI and WDI; own calculations.

As one can see, bilateral gross trade intensities increased over the whole period. This increase has been proportionally higher for country-pairs which started with relatively lower intensities. How has that evolved in the sub-periods considered? An easy way to summarise this is to regress the measure in year  $t$  on the measure in the first year of the period considered. A slope coefficient larger than one would indicate a proportional increase in the bilateral export relationship relative to GDP (therefore also the  $t$ -test of whether this coefficient is significantly different from one is presented). A positive constant indicates that the average bilateral intensities have increased. Results of this regression for various sub-periods are presented in Table 2.3.6.

**Table 2.3.6 / Regression results**

	(1)	(2)	(3)	(4)	(5)
	2000-2014	2000-2008	2008-2009	2009-2011	2011-2014
BGTI	1.280*** (0.0210)	1.211*** (0.0155)	0.828*** (0.00307)	1.296*** (0.00650)	0.998*** (0.00426)
Constant	0.339** (0.168)	0.315** (0.124)	0.0364 (0.0314)	-0.206*** (0.0553)	0.0979** (0.0468)
Observations	702	702	702	702	702
R-squared	0.841	0.897	0.990	0.983	0.987
BGTI=1	0.000	0.000	0.000	0.000	0.672

Standard errors in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Source: BACI and WDI; own calculations.

The results in the first column indicate that there has been an overall increase in trade intensity over the whole period (consistent with Figure 2.3.7) by a factor of about 1.3 (together with a general small increase of about 0.4 as suggested by the constant). This increase was first taking place over the period

2000-2008, it declined by a similar magnitude in the crisis period (2008-2009) but recovered from then until 2011. Remarkably, these trade intensities have remained constant from 2011 onwards.<sup>6</sup>

**Table 2.3.7 / Regression results by EU Member States**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	2000-2014	AT	BE	BG	CY	CZ	DE	DK	ES	EE	FI	FR	UK	EL
BGTI2000	1.280*** (0.0210)	1.213*** (0.0640)	1.328*** (0.0469)	2.578*** (0.153)	2.358*** (0.152)	1.541*** (0.0707)	1.194*** (0.0842)	0.987*** (0.0531)	0.889*** (0.0497)	1.588*** (0.112)	0.950*** (0.0538)	0.933*** (0.0476)	0.883*** (0.0504)	1.407*** (0.227)
Constant	0.339** (0.168)	0.181 (0.455)	-0.798 (0.802)	-0.0427 (0.282)	-0.309** (0.117)	1.503** (0.711)	0.814 (1.070)	0.362 (0.319)	0.659 (0.407)	0.144 (0.623)	-0.0761 (0.299)	0.172 (0.537)	0.285 (0.455)	-0.398 (0.506)
Observations	702	26	26	26	26	26	26	26	26	26	26	26	26	26
R-squared	0.841	0.937	0.971	0.922	0.909	0.952	0.893	0.935	0.930	0.893	0.928	0.941	0.928	0.616
BGTI=1	0.000 (15)	0.003 (16)	0.000 (17)	0.000 (18)	0.000 (19)	0.000 (20)	0.030 (21)	0.815 (22)	0.035 (23)	0.000 (24)	0.362 (25)	0.171 (26)	0.0297 (27)	0.085 (28)
	HU	HR	IE	IT	LT	LV	MT	NL	PL	PT	RO	SK	SI	SE
BGTI2000	1.709*** (0.242)	1.186*** (0.0423)	1.055*** (0.112)	0.870*** (0.0466)	3.449*** (0.103)	2.341*** (0.215)	0.616*** (0.134)	1.364*** (0.0421)	2.064*** (0.125)	1.077*** (0.0486)	2.385*** (0.204)	1.574*** (0.0986)	1.202*** (0.0287)	0.995*** (0.0386)
Constant	0.456 (1.530)	0.362 (0.231)	-0.440 (0.645)	0.852** (0.391)	-0.902** (0.412)	-0.0530 (1.208)	0.195** (0.0912)	-0.106 (0.694)	-0.0409 (0.577)	-0.0787 (0.231)	0.229 (0.593)	1.959** (0.910)	0.363** (0.170)	0.267 (0.306)
Observations	26	26	26	26	26	26	26	26	26	26	26	26	26	26
R-squared	0.675	0.970	0.788	0.936	0.979	0.832	0.468	0.978	0.919	0.953	0.851	0.914	0.987	0.965
BGTI=1	0.007	0.000	0.625	0.010	0.000	0.000	0.009	0.000	0.000	0.128	0.000	0.000	0.000	0.899

Note: Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: BACI and WDI; own calculations.

However, at the level of the individual Member State, significant differences become apparent (see Table 2.3.7 and Figure 2.3.8). For the period as a whole (2000-2014), the BGTI index increased significantly in 17 Member States, turned out insignificant in 7 Member States (Denmark, Finland, France, Greece, Ireland, Portugal and Sweden), and declined significantly in the remaining Member States (Spain, United Kingdom and Italy). This suggests that intra-European trade integration has been driven by a specific group of countries, comprising the EU-CEE together with Austria, Belgium and Luxembourg, Germany and the Netherlands.

More or less the same pattern is found for the period 2000-2008. The only difference is that the coefficient for Italy is insignificant. In the crisis period 2008-2009, all countries (with the exception of Ireland) experienced strong declines in their bilateral trade intensities. However, this crisis-related drop in bilateral trade intensities was short-lived and had already reversed in the subsequent period (2009-2011). This is indicated by coefficients that are again significantly above one for most countries (except for Cyprus, Ireland and Malta), basically suggesting that trade intensities returned to their pre-crisis levels. However, since 2011, some remarkable differences are observable: For a number of countries the coefficients are not significantly different from one, suggesting no further increase in bilateral trade intensities. In contrast, for other countries – such as Belgium and Luxembourg, Cyprus, Denmark, Estonia, Finland, France, United Kingdom, Ireland, Italy and Malta – the results point to coefficients significantly below one.<sup>7</sup>

<sup>6</sup> Qualitatively the same results are found when including reporter or partner dummies or both.

<sup>7</sup> Results are available upon request.

Thus, the general result suggests that before the crisis bilateral trade intensities generally increased (though proportional to already existing linkages). This development was temporarily interrupted by the crisis in 2008, after which however trade relations recovered until 2011. Since 2011, a more diverse picture emerges, with stable bilateral trade intensities among EU-CEE together with Austria, Germany and some other countries like Spain, Greece, the Netherlands, Portugal and Sweden, but declining ones for the remaining countries.

### **Summary**

These results presented here are in line with other studies (e.g. Vetter, 2013) showing that EU integration and the Single Market agenda contributed to an increase in intra-EU trade flows despite strong extra-EU trade growth due to favourable economic developments outside the EU. It remains however difficult to assess quantitatively to which extent the Single Market agenda as such has driven these overall increase in intra-EU trade and (via this) impacted on the EU external competitiveness position. A couple of other factors contributed to this pre-crisis performance as well (though not being independent of these EU policies), particularly the integration of the 'new EU Member States' into the European production systems (thus allowing to exploit gains from specialisation in European value chains and economies of scale) spurred by the relatively well educated workforce in these countries and corresponding FDI flows and technology transfers which themselves have been fostered by various policy measures (e.g. reduction of NTMs, reduction of barriers in services trade, etc.).

The results however also show that this European integration process has not been even across Europe and led to a stronger relative concentration and spatial clustering of exporting (and manufacturing) activities – an outcome which have got less attention in studying the effects of European integration and the Single Market agenda (see Stöllinger, 2016). However, the increases in bilateral relations were only significant for a subset of countries, amongst them the EU-CEE economies and Austria and Germany together with Belgium and Luxembourg and the Netherlands. For the other countries, bilateral trade intensities have increased less significantly or even remained more or less constant over the whole period.

The results also point towards the fact, that the crisis in general stopped further increases in the intra-EU bilateral trade relations or even reverted some of these trends (particularly when compared to GDP developments as done with the indicators presented above); it is therefore concluded that the crisis marked a structural break in the trends in general for reasons outside the EU policy area (as e.g. the Single Market regulations have even been intensified). Again, these structural breaks – particularly with respect to bilateral trade intensities – have further increased for some countries even after the crisis. This might imply a tendency for further concentration of manufacturing production and exporting activities which – together with slow growth overall – might contribute to the 'integration fatigue' of some countries. These tendencies need to be considered in further policy designs and evaluations of them.

## 2.4. PATTERNS AND TRENDS AT INDUSTRY LEVEL

Following the outline and structure above for trade at the total level (Section 2.3), this section presents results broken down by NACE Rev. 2 2-digit industries to shed light on particular patterns and trends at the industry level.

### 2.4.1. Global trends

Table 2.4.1 shows the structure of world trade by industry between 2000 and 2014. During the whole period under consideration, there was a dominance of a few industries only: Computer, electronic and optical products (NACE 26), Machinery and equipment n.e.c. (NACE 28), Chemicals and chemical products (NACE 20) and Motor vehicles, trailers and semi-trailers (NACE 29) were the most important industries with world trade shares of 9% and higher. Throughout the period under consideration, Computer, electronic and optical products (NACE 26) was the single most important industry, accounting for a fifth of world trade in 2000 and around a sixth of world trade from 2008 onwards. Generally, with only a few exceptions, the industry-specific structure of world trade remained fairly stable over time. Notable exceptions are Motor vehicles, trailers and semi-trailers (NACE 29) which, together with Computer, electronic and optical products (NACE 26), lost the most in terms of world trade shares. Furthermore, non-negligible losses in world trade shares are also apparent for Textiles (NACE 13), Wearing apparel (NACE 14) and Paper and paper products (NACE 17). In contrast, world trade shares increased the most – by more than 1ppt in 2000-2014 – in Coke and refined petroleum products (NACE 19), Basic metals (NACE 24), Pharmaceutical products (NACE 21) and Food products (NACE 10). It needs to be emphasised that these figures reports shares calculated from trade data in current US-dollars; thus price changes can play an important role which is reflected e.g. in the declining share of trade in Computer, electronic and optical products and the increasing shares (up to 2011) for Coke and refined petroleum products and basic metals.

The share of intra-EU trade (in % of total global trade) is shown in Table 2.4.2. Printing and reproduction of recorded media (NACE 18) and Tobacco products (NACE 12) are the two single most important industries in this respect. However, while intra-EU trade shares of the former industry seem to have stabilised around 50% in 2008, those of the latter have been on the decline since 2009 and approached slightly above 40% in 2014. Generally, between 2000 and 2014, the shares of intra-EU trade dropped in all but a few industries (among them the two industries just mentioned – Printing and reproduction of recorded media (NACE 18) and Tobacco products (NACE 12)). However, this generally observable downward trend appears to be a side-product of the global financial crisis. Up until the onset of the crisis, many industries saw their intra-EU trade shares increase: In addition to Printing and reproduction of recorded media (NACE 18) and Tobacco products (NACE 12), intra-EU trade shares increased the most in Wood products (excl. furniture), etc. (NACE 16), Pharmaceutical products (NACE 21), Paper and paper products (NACE 17), Food products (NACE 10) and Electrical equipment (NACE 27). Nevertheless, between 2009 and 2014, the share of intra-EU trade declined in all industries.

**Table 2.4.1 / Structure of world trade (in % of global trade by industry)**

	2000	2008	2009	2011	2014
10 Food products	5.1	5.6	6.3	6.1	6.2
11 Beverages	0.7	0.7	0.8	0.7	0.7
12 Tobacco products	0.3	0.2	0.2	0.2	0.2
13 Textiles	2.8	1.8	2.0	1.9	1.9
14 Wearing apparel	3.8	2.9	3.3	2.9	3.0
15 Leather and related products	1.5	1.3	1.3	1.3	1.5
16 Wood products (excl. furniture), etc.	1.2	0.9	0.8	0.8	0.9
17 Paper and paper products	2.3	1.7	1.8	1.6	1.6
18 Printing and reproduction of recorded media	0.0	0.0	0.0	0.0	0.0
19 Coke and refined petroleum products	3.2	6.4	5.3	7.1	6.6
20 Chemicals and chemical products	9.0	9.8	9.8	10.3	9.6
21 Pharmaceutical products	2.4	3.6	4.7	3.9	4.0
22 Rubber and plastic products	2.7	2.8	3.0	3.0	3.0
23 Other non-metallic mineral products	1.4	1.3	1.4	1.2	1.3
24 Basic metals	5.9	9.3	7.5	9.0	8.0
25 Fabricated metal products (excl. M&E)	2.5	2.7	2.8	2.8	2.6
26 Computer, electronic and optical products	21.1	15.1	16.3	15.4	16.3
27 Electrical equipment	6.2	5.2	5.8	5.2	5.7
28 Machinery and equipment n.e.c.	9.4	10.8	10.2	10.1	9.6
29 Motor vehicles, trailers and semi-trailers	11.0	10.0	8.8	9.2	9.7
30 Other transport equipment	4.1	4.0	4.2	3.7	3.9
31 Furniture	0.9	1.0	0.9	0.9	0.8
32 Other manufacturing	2.5	2.8	2.9	2.5	2.8

Source: BACI; own calculations.

**Table 2.4.2 / Share of intra-EU trade (in % of global trade)**

	2000	2008	2009	2011	2014
10 Food products	30.8	33.2	33.2	29.5	29.7
11 Beverages	37.9	37.4	36.5	33.6	32.0
12 Tobacco products	37.1	51.0	51.3	47.5	41.6
13 Textiles	23.0	20.4	18.6	16.7	15.8
14 Wearing apparel	17.4	17.4	16.9	16.0	15.6
15 Leather and related products	21.3	20.1	20.3	20.0	19.6
16 Wood products (excl. furniture), etc.	27.2	31.2	30.7	28.6	26.4
17 Paper and paper products	36.4	39.1	38.5	36.3	35.5
18 Printing and reproduction of recorded media	40.9	50.2	53.3	51.3	52.5
19 Coke and refined petroleum products	20.6	17.8	17.1	16.6	15.7
20 Chemicals and chemical products	31.0	29.6	28.7	26.4	26.2
21 Pharmaceutical products	34.9	38.2	36.3	32.5	33.5
22 Rubber and plastic products	33.9	34.8	33.4	31.4	29.6
23 Other non-metallic mineral products	32.5	31.4	30.3	27.2	24.6
24 Basic metals	25.0	22.8	19.7	19.3	17.0
25 Fabricated metal products (excl. M&E)	30.0	31.6	29.0	28.5	25.8
26 Computer, electronic and optical products	15.7	15.2	13.7	12.5	10.9
27 Electrical equipment	22.5	24.6	23.6	22.6	21.0
28 Machinery and equipment n.e.c.	25.2	25.6	23.2	21.2	21.7
29 Motor vehicles, trailers and semi-trailers	36.4	38.4	38.9	33.9	31.4
30 Other transport equipment	19.1	17.3	20.6	17.6	19.1
31 Furniture	31.8	32.0	30.4	28.9	25.0
32 Other manufacturing	17.9	16.5	19.2	18.0	17.3

Source: BACI; own calculations.

Table 2.4.3 reports industry-level shares of intra-EU exports (in % of total EU exports) and shows that intra-EU exports are of particular importance – with shares consistently above 70% in 2000-2014 – in the case of Food products (NACE 10), Tobacco products (NACE 12), Wearing apparel (NACE 14), Paper and paper products (NACE 17), Printing and reproduction of recorded media (NACE 18) and Rubber and plastic products (NACE 22) while they are only of relatively little importance in Other transport equipment (NACE 30), Beverages (NACE 11) and Machinery and equipment n.e.c. (NACE 28). Furthermore, between 2000 and 2014, almost all industries experienced a decline in their intra-EU export shares. This pattern is again, to a large extent, a result of the crisis: Between 2000 and 2008, many industries experienced a decline in intra-EU export shares, most notably Coke and refined petroleum products (NACE 19), Electrical equipment (NACE 27), Motor vehicles, trailers and semi-trailers (NACE 29) and Other manufacturing (NACE 32). In the aftermath of the crisis, intra-EU export shares expanded in only two industries: Chemicals and chemical products (NACE 20) and Printing and reproduction of recorded media (NACE 18) and only to a very limited extent, while they dropped in all remaining industries, most dramatically so in Motor vehicles, trailers and semi-trailers (NACE 29), Tobacco products (NACE 12) and Basic metals (NACE 24).

**Table 2.4.3 / Share of intra-EU exports (in % of EU total exports)**

	2000	2008	2009	2011	2014
10 Food products	73.9	78.6	78.3	75.9	74.8
11 Beverages	53.3	54.7	54.3	50.0	49.4
12 Tobacco products	72.4	77.6	79.3	72.8	71.1
13 Textiles	69.7	68.0	67.7	67.1	66.7
14 Wearing apparel	74.3	72.7	73.9	72.6	72.9
15 Leather and related products	62.7	65.0	65.1	63.4	63.9
16 Wood products (excl. furniture), etc.	72.3	69.9	70.0	68.6	65.5
17 Paper and paper products	75.0	73.4	73.2	71.6	71.6
18 Printing and reproduction of recorded media	69.4	71.1	72.2	72.2	72.6
19 Coke and refined petroleum products	68.2	61.8	61.3	60.8	58.9
20 Chemicals and chemical products	64.1	65.9	63.8	64.8	64.6
21 Pharmaceutical products	54.9	58.4	57.6	53.8	54.0
22 Rubber and plastic products	75.4	74.7	74.9	73.7	72.0
23 Other non-metallic mineral products	63.1	66.3	66.2	64.5	62.0
24 Basic metals	71.1	70.3	67.3	68.2	59.7
25 Fabricated metal products (excl. M&E)	68.1	67.8	64.7	65.7	63.1
26 Computer, electronic and optical products	63.2	63.0	63.2	61.4	60.6
27 Electrical equipment	64.7	60.9	59.8	60.1	59.4
28 Machinery and equipment n.e.c.	54.5	52.8	49.4	48.1	48.6
29 Motor vehicles, trailers and semi-trailers	75.1	72.0	72.9	66.1	63.2
30 Other transport equipment	46.9	46.3	47.3	45.4	45.0
31 Furniture	67.7	73.2	70.9	71.2	65.8
32 Other manufacturing	54.9	52.3	57.1	55.1	53.7

Source: BACI; own calculations.

Table 2.4.4 sheds light on the structure of intra-EU exports between 2000 and 2014. Those are dominated by a few industries, namely Chemicals and chemical products (NACE 20), Computer, electronic and optical products (NACE 26), Machinery and equipment n.e.c. (NACE 28) and Motor vehicles, trailers and semi-trailers (NACE 29). This pattern is consistent with the pattern and structure of world trade presented in Table 2.4.1 above. Motor vehicles, trailers and semi-trailers (NACE 29) were the single most important industry in the period under consideration, with shares between 14% and 16%.

In contrast to the world trade structure, which remained fairly stable between 2000 and 2014 (see Table 2.4.1), the structure of intra-EU exports underwent more pronounced changes. For instance, intra-EU export shares dropped the most – by about 5ppts – in Computer, electronic and optical products (NACE 26), followed by Motor vehicles, trailers and semi-trailers (NACE 29) dropping by around 2ppts, and Textiles (NACE 13) and Paper and paper products (NACE 17) falling by about 1ppt each. The losses in intra-EU export shares in these industries all occurred during the early years, between 2000 and 2008, and shares remained fairly stable thereafter. In contrast, intra-EU export shares increased the most in Pharmaceutical products (NACE 21), Food products (NACE 10) and Coke and refined petroleum products (NACE 19). Again, these gains in intra-EU export shares were concentrated in the early years of the 2000s.

**Table 2.4.4 / Structure of intra-EU exports, in %**

	2000	2008	2009	2011	2014
Food products	6.3	7.2	8.4	7.9	8.5
Beverages	1.0	1.0	1.2	1.0	1.1
Tobacco products	0.4	0.4	0.5	0.4	0.4
Textiles	2.6	1.5	1.5	1.4	1.4
Wearing apparel	2.7	2.0	2.3	2.0	2.2
Leather and related products	1.3	1.0	1.1	1.1	1.3
Wood products (excl. furniture), etc.	1.3	1.1	1.0	0.9	1.0
Paper and paper products	3.4	2.6	2.8	2.6	2.6
Printing and reproduction of recorded media	0.0	0.0	0.0	0.0	0.0
Coke and refined petroleum products	2.7	4.5	3.6	5.2	4.8
Chemicals and chemical products	11.1	11.2	11.3	11.9	11.6
Pharmaceutical products	3.3	5.3	6.8	5.5	6.2
Rubber and plastic products	3.6	3.8	4.0	4.1	4.2
Other non-metallic mineral products	1.8	1.6	1.7	1.5	1.5
Basic metals	5.8	8.2	6.0	7.7	6.3
Fabricated metal products (excl. M&E)	3.0	3.3	3.2	3.5	3.1
Computer, electronic and optical products	13.1	8.9	9.0	8.4	8.1
Electrical equipment	5.5	5.0	5.5	5.2	5.5
Machinery and equipment n.e.c.	9.4	10.7	9.5	9.5	9.6
Motor vehicles, trailers and semi-trailers	15.8	14.9	13.7	13.8	14.0
Other transport equipment	3.1	2.7	3.5	2.9	3.5
Furniture	1.1	1.3	1.1	1.2	1.0
Other manufacturing	1.7	1.8	2.2	2.0	2.2

Source: BACI; own calculations.

## 2.4.2. Specialisation, concentration and clustering

Similar to the case of total intra-EU trade, one may consider the contributions of each EU Member State to intra-EU exports by industry and in relation to GDP. This is done through the summary measures introduced above.<sup>8</sup> Before that it is however interesting to analyse whether the integration process has led to further specialisation of export activities in particular industries or more diversification of exports in each country.

<sup>8</sup> Discussion in this and the next section concentrates on intra-EU exports.



*Index of specialisation*

The measure considered to tackle this question is the index of specialisation discussed in Box 2.5. Table 2.4.5 reports this index of specialisation for each country separately between 2000 and 2014.

**BOX 2.5 / INDEX OF SPECIALISATION**

This index is defined as

$$S^c = 0.5 \sum_i |s_{Xi}^c - \bar{s}_{Xi}|$$

where  $s_{Xi}^c$  denotes the share of exports in industry  $i$  in total intra-EU exports of country  $c$ , i.e.  $s_{Xi}^c = X_i^c / \sum_i X_i^c$ .  $\bar{s}_{Xi}$  denotes the average across all EU countries. The larger the indicator, the more different is the export structure of the respective country as compared to the EU average.

**Table 2.4.5 / Specialisation index**

	2000	2008	2009	2011	2014
Austria	0.35	0.36	0.33	0.36	0.36
Belgium-Luxembourg	0.40	0.43	0.40	0.44	0.44
Bulgaria	0.49	0.41	0.39	0.37	0.37
Croatia	0.34	0.33	0.32	0.31	0.27
Cyprus	0.40	0.45	0.43	0.46	0.46
Czech Republic	0.37	0.45	0.44	0.45	0.43
Denmark	0.38	0.37	0.39	0.38	0.39
Estonia	0.44	0.33	0.33	0.37	0.38
Finland	0.52	0.50	0.47	0.48	0.46
France	0.40	0.38	0.39	0.39	0.39
Germany	0.43	0.41	0.39	0.39	0.39
Greece	0.42	0.42	0.40	0.43	0.46
Hungary	0.48	0.49	0.50	0.47	0.47
Ireland	0.63	0.63	0.65	0.64	0.64
Italy	0.27	0.30	0.28	0.30	0.31
Latvia	0.55	0.38	0.35	0.39	0.38
Lithuania	0.42	0.44	0.41	0.48	0.40
Malta	0.54	0.55	0.55	0.47	0.47
Netherlands	0.45	0.47	0.45	0.47	0.47
Poland	0.32	0.38	0.36	0.36	0.34
Portugal	0.35	0.24	0.24	0.26	0.24
Romania	0.42	0.35	0.37	0.37	0.36
Slovenia	0.32	0.40	0.38	0.39	0.38
Slovakia	0.39	0.45	0.44	0.45	0.46
Spain	0.40	0.40	0.40	0.40	0.40
Sweden	0.43	0.44	0.41	0.42	0.42
United Kingdom	0.43	0.42	0.41	0.41	0.39

Source: BACI; own calculations.

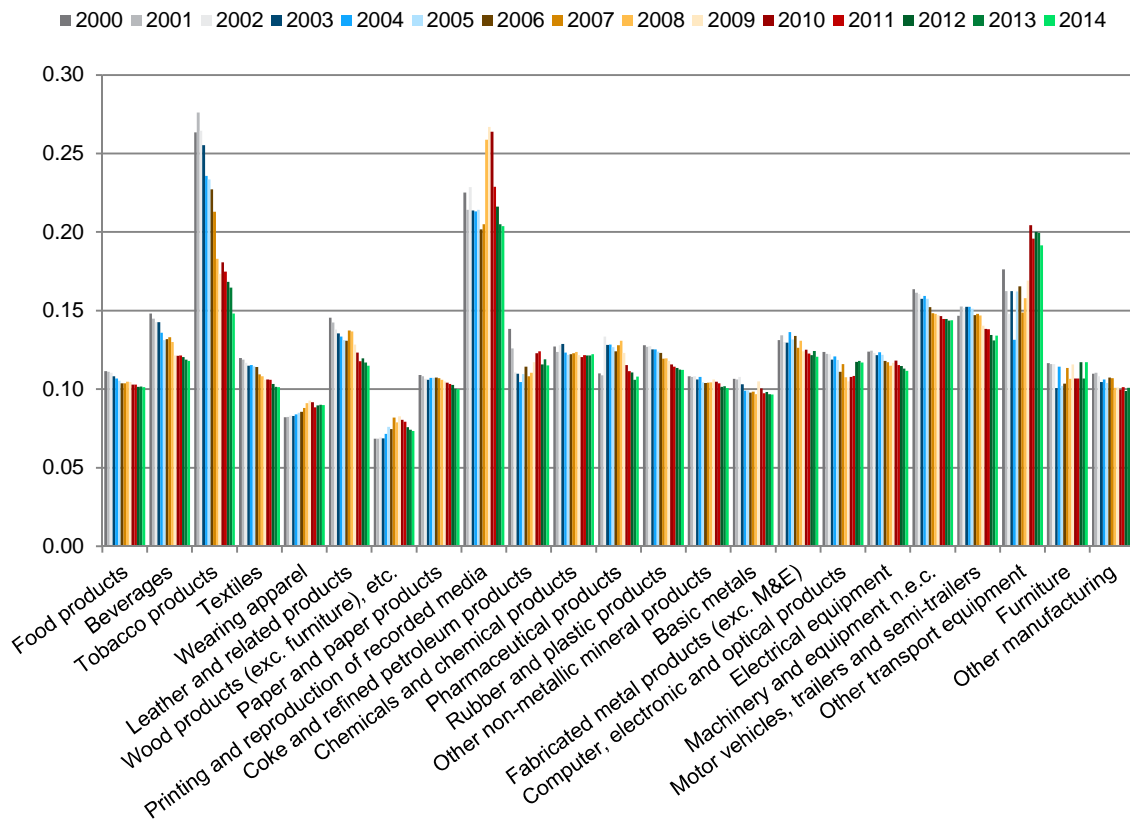
The results indicate that specialisation is generally highest in Ireland, followed by Malta, Hungary and Finland, but lowest in Portugal and Italy. Before the crisis in 2008, countries like Bulgaria, Estonia, Portugal and Romania experienced strong declines in their specialisation patterns compared to the EU average whereas the opposite was the case for Cyprus, the Czech Republic, Poland, Slovenia and Slovakia. Furthermore, between 2008 and 2014, specialisation was continuously decreasing in Bulgaria,

Croatia, Finland and the UK but increasing in Belgium and Luxembourg, Cyprus, Greece and Italy. In the remaining countries it remained fairly stable.

### Concentration by industry

Considering the Herfindahl index (see Box 2.1) it is found that – similar to patterns for total trade – concentration has been slightly decreasing in most industries. This has been more significant in beverages and tobacco products. In some cases an increasing concentration (as measured by the Herfindahl) is observable such as in wearing apparel and wood products. Since the crisis in 2008, these trends have either slowed down or even reversed as in the case of the wood industry. However, in the transport equipment industry the concentration of exports increased strongly after the crisis.

**Figure 2.4.1 / Herfindahl index by industry**



Source: BACI; own calculations.

### Relative concentration

Table 2.4.6 reports the relative concentration index by industry (see Box 2.2<sup>9</sup>) and shows that intra-EU exports are most concentrated in printing and reproduction of recorded media (NACE 18), followed by tobacco products (NACE 12) and other transport equipment (NACE 30) but least concentrated in wood

<sup>9</sup> For a better exposition 1 is subtracted. Thus, an indicator below 1 indicates that exporting activities in this industry are less concentrated than overall GDP.

products (excl. furniture) etc. (NACE 16) and wearing apparel (NACE 14). Furthermore, between 2000 and 2014, relative concentration increased strongly in other transport equipment (30) and fell dramatically in tobacco products (NACE 12) but only slightly in machinery and equipment n.e.c. (NACE 28). Relative concentration underwent interesting dynamics in printing and reproduction of recorded media (NACE 18) and motor vehicles, trailers and semi-trailers (NACE 29), where, up until the crisis, concentration had increased remarkably but then dropped again to the initial level of 2000.

**Table 2.4.6 / Relative concentration index by industry**

	2000	2008	2009	2011	2014
Food products	-0.11	-0.07	-0.07	-0.09	-0.12
Beverages	0.08	0.09	0.04	0.03	-0.01
Tobacco products	0.55	0.37	0.32	0.32	0.16
Textiles	-0.06	-0.04	-0.06	-0.07	-0.12
Wearing apparel	-0.31	-0.17	-0.16	-0.19	-0.20
Leather and related products	0.07	0.13	0.08	0.01	-0.03
Wood products (excl. furniture), etc.	-0.42	-0.27	-0.24	-0.27	-0.34
Paper and paper products	-0.13	-0.06	-0.07	-0.09	-0.13
Printing and reproduction of recorded media	0.41	0.69	0.71	0.55	0.42
Coke and refined petroleum products	0.03	-0.03	0.01	0.05	-0.03
Chemicals and chemical products	-0.02	0.05	0.04	0.03	0.02
Pharmaceutical products	-0.12	0.10	0.05	-0.03	-0.07
Rubber and plastic products	-0.02	0.03	0.01	-0.01	-0.04
Other non-metallic mineral products	-0.13	-0.07	-0.06	-0.08	-0.12
Basic metals	-0.14	-0.12	-0.07	-0.13	-0.15
Fabricated metal products (excl. M&E)	0.00	0.10	0.05	0.04	0.01
Computer, electronic and optical products	-0.04	-0.05	-0.07	-0.05	-0.01
Electrical equipment	-0.04	0.00	0.01	-0.01	-0.05
Machinery and equipment n.e.c.	0.16	0.19	0.18	0.16	0.14
Motor vehicles, trailers and semi-trailers	0.08	0.19	0.15	0.13	0.09
Other transport equipment	0.21	0.25	0.30	0.41	0.37
Furniture	-0.08	-0.05	0.00	-0.06	-0.01
Other manufacturing	-0.12	-0.09	-0.10	-0.10	-0.12

Source: BACI; own calculations.

### *Clustering measure*

Finally the clustering measure (see Box 2.3) shows whether export activities of a specific industry take place in countries with lower geographical distance to each other indicated by a lower number. Table 2.4.7 reports the clustering index by industry and shows that clustering is highest in tobacco products (NACE 12), printing and reproduction of recorded media (NACE 18), coke and refined petroleum products (NACE 19) and chemicals and chemical products (NACE 20). In contrast, it is lowest in wearing apparel (NACE 14) and furniture (NACE 31). Between 2000 and 2014, the clustering of industries underwent interesting changes: On the one hand, between 2000 and 2008, clustering increased in the majority of industries. Notable exceptions are food products (NACE 10), tobacco products (NACE 12) and coke and refined petroleum products (NACE 19). On the other hand, after 2008, clustering decreased in the majority of industries – most pronounced in printing and reproduction of recorded media (NACE 18) – but increased in industries such as coke and refined petroleum products (NACE 19), computer, electronic and optical products (NACE 26) and other transport equipment

(NACE 30). All in all, tobacco products (NACE 12) underwent the most dramatic drop in clustering between 2000 and 2014.

**Table 2.4.7 / Clustering index by industry**

	2000	2008	2009	2011	2014
Food products	0.41	0.41	0.40	0.39	0.33
Beverages	0.04	0.10	0.09	0.07	0.05
Tobacco products	1.82	1.16	1.01	0.82	0.30
Textiles	0.09	0.14	0.14	0.09	0.05
Wearing apparel	-0.25	-0.12	-0.08	-0.10	-0.10
Leather and related products	-0.14	-0.03	0.00	-0.04	-0.04
Wood products (excl. furniture), etc.	-0.16	0.00	-0.01	-0.03	-0.06
Paper and paper products	-0.07	0.01	0.01	0.00	-0.03
Printing and reproduction of recorded media	0.34	1.11	1.09	0.80	0.70
Coke and refined petroleum products	0.70	0.59	0.67	0.70	0.64
Chemicals and chemical products	0.47	0.63	0.57	0.60	0.56
Pharmaceutical products	0.16	0.38	0.35	0.35	0.39
Rubber and plastic products	0.17	0.20	0.20	0.15	0.11
Other non-metallic mineral products	0.03	0.09	0.10	0.08	0.04
Basic metals	0.19	0.23	0.25	0.20	0.13
Fabricated metal products (excl. M&E)	0.08	0.12	0.14	0.11	0.08
Computer, electronic and optical products	0.28	0.36	0.36	0.36	0.44
Electrical equipment	0.03	0.04	0.05	0.03	-0.01
Machinery and equipment n.e.c.	0.15	0.21	0.22	0.19	0.14
Motor vehicles, trailers and semi-trailers	0.14	0.18	0.14	0.13	0.10
Other transport equipment	0.06	0.13	0.15	0.22	0.16
Furniture	-0.13	-0.08	-0.08	-0.11	-0.13
Other manufacturing	0.11	0.26	0.28	0.26	0.27

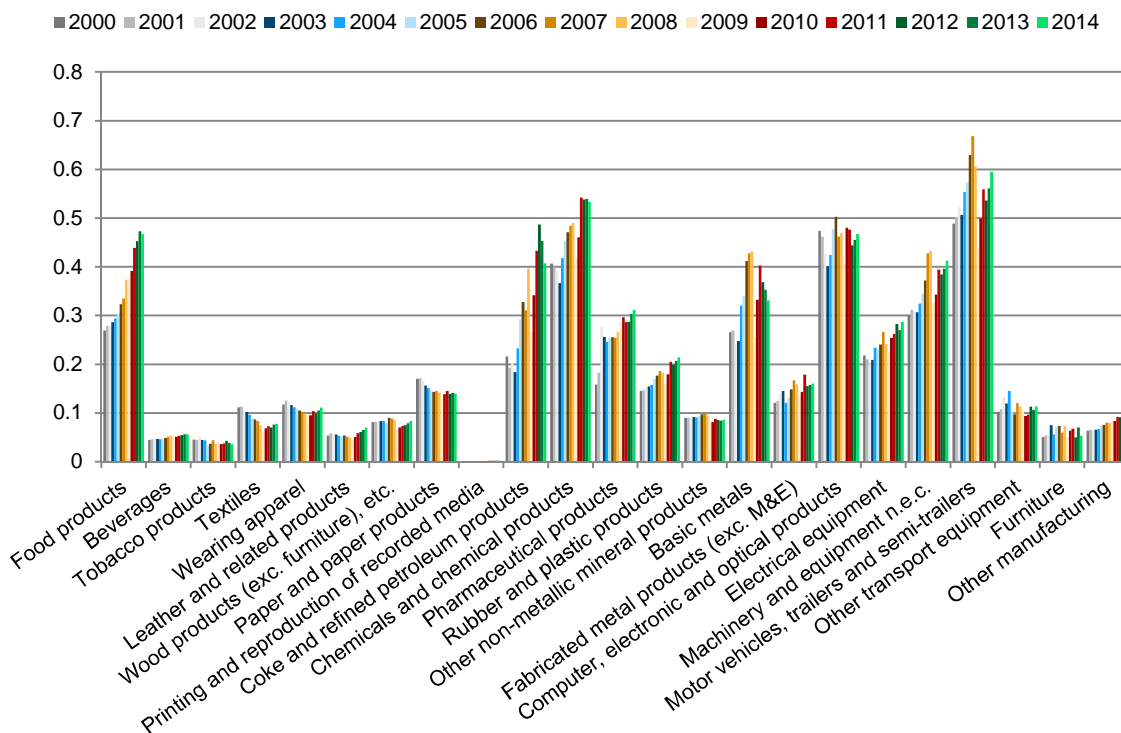
Source: BACI; own calculations.

#### *Bilateral gross trade intensity by industry*

Finally, bilateral gross trade intensities are also calculated by industry. Figure 2.4.2 depicts the (unweighted) means for each industry individually from 2000 to 2014 and highlights that, generally, bilateral gross trade intensities are particularly high in Motor vehicles, trailers and semi-trailers (NACE 29), Computer, electronic and optical products (NACE 26), Chemicals and chemical products (NACE 20), Coke and refined petroleum products (NACE 19) and Food products (NACE 10). The latter two industries initially showed relatively low bilateral gross trade intensities but rapidly converged to the group of industries characterised by high bilateral gross trade intensities. In contrast, bilateral gross trade intensities are particularly low in Beverages (NACE 11), Tobacco products (NACE 12), Leather and related products (NACE 15) and Furniture (NACE 31). Furthermore, between 2000 and 2014, gross trade intensities increased the most in Food products (NACE 10), Coke and refined petroleum products (NACE 19) and Chemicals and chemical products (NACE 20) and dropped the most in Textiles (NACE 13), followed by Paper and paper products (NACE 17) and Wearing apparel (NACE 14). Over the same time, gross trade intensities remained fairly stable in industries like Beverages (NACE 11), Tobacco products (NACE 12), Wood products (excl. furniture), etc. (NACE 16), Other non-metallic mineral products (NACE 23), Other transport equipment (NACE 30), Computer, electronic and optical products (NACE 26) and Furniture (NACE 31); they increased the most in Food products (NACE 10), Coke and refined petroleum products (NACE 19) and Chemicals and chemical products (NACE 20). In

addition, in some industries, the crisis had a pronounced effect on bilateral gross trade intensities, most strongly in Motor vehicles, trailers and semi-trailers (NACE 29), Basic metals (NACE 24), Coke and refined petroleum products (NACE 19) also in Chemicals and chemical products (NACE 20), Computer, electronic and optical products (NACE 26) and Machinery and equipment n.e.c. (NACE 28). Table 2.4.8 shows regression results regressing the BGTI in 2014 on the BGTI in 2000.

**Figure 2.4.2 / Bilateral gross trade intensities by industry**



Source: BACI; own calculations.

Thus, the tendency of decreasing concentration of export activities is observed for most industries. Exceptions are wearing apparel, wood products and other transport equipment which have been characterised by an increasing concentration of intra-EU exporting. Concentration in some other industries (e.g. chemicals) did not change over the period considered. Only a few industries' export activities are also concentrated in relative terms to GDP; these are printing and reproduction of recorded media, tobacco products and other transport equipment. Apart from the latter one, there is a tendency of either less concentration or relative concentration remaining stable. Further, clustering of exporting activities increased for most industries from 2000-2008, but from then on remained stable or even declined. Notable exceptions to this are the computer, electronic and optical products industry and other transport equipment where clustering declined only from 2011 onwards. Bilateral gross trade intensities significantly increased for a few industries only: food products, coke and refined petroleum, chemicals and chemical products, basic metals, machinery and motor vehicles, trailers and semi-trailers. After the crisis, this trend seems to have been broken in most industries.

**Table 2.4.8 / Regression results by industry**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All	10	11	12	13	14	15	16	17	18	19	20
BGTI	1.101*** (0.00728)	1.609*** (0.0244)	1.207*** (0.0287)	0.527*** (0.0317)	0.647*** (0.0131)	0.762*** (0.0230)	1.117*** (0.0322)	1.000*** (0.0375)	0.708*** (0.0139)	0.854*** (0.161)	2.021*** (0.0556)	1.279*** (0.0171)
Constant	0.0460*** (0.00381)	0.0569*** (0.0160)	0.0107*** (0.00319)	0.0170*** (0.00447)	0.00674** (0.00269)	0.0226*** (0.00554)	0.0147*** (0.00365)	0.00491 (0.00646)	0.0295*** (0.00471)	0.00154*** (0.000454)	0.0352 (0.0368)	0.0259 (0.0164)
Observations	13,630	654	540	234	656	672	614	598	612	196	486	676
R-squared	0.627	0.869	0.766	0.543	0.789	0.622	0.663	0.544	0.810	0.127	0.732	0.893
BGTI=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.996	0.000	0.365	0.000	0.000
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
	21	22	23	24	25	26	27	28	29	30	31	32
BGTI	2.359*** (0.0480)	1.296*** (0.0264)	0.938*** (0.0145)	1.135*** (0.0203)	1.125*** (0.0209)	0.523*** (0.0325)	0.997*** (0.0333)	1.107*** (0.0212)	0.856*** (0.0306)	1.220*** (0.0361)	0.818*** (0.0233)	1.448*** (0.0261)
Constant	-0.0249 (0.0188)	0.0380*** (0.00818)	0.00921*** (0.00299)	0.0529*** (0.0123)	0.0303*** (0.00550)	0.231*** (0.0330)	0.0789*** (0.0140)	0.0853*** (0.0126)	0.223*** (0.0356)	-0.00476 (0.0103)	0.0149*** (0.00264)	0.0165*** (0.00364)
Observations	604	656	614	600	660	680	674	690	632	612	606	664
R-squared	0.800	0.787	0.872	0.839	0.814	0.276	0.571	0.799	0.554	0.652	0.671	0.823
BGTI=1	0.000	0.000	0.000	0.000	0.000	0.000	0.924	0.000	0.000	0.000	0.000	0.000

Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Summarising, these results are generally in line with the findings in Section 2.3 but also show in addition that the trends mentioned there has been particularly strong mostly in higher-tech industries which are further characterised by stronger integration in European value chains. Thus, in addition to the uneven developments of EU trade and production integration there has also been an uneven development across industries leading not only to more geographic specialisation but also to industrial specialisation of these countries in higher-tech industries. Reasons for that are in line with those mentioned above including the well-educated workforce in some countries (particularly with respect to skills needed for production processes in high-tech industries), FDI patterns and value chain integration fostered by Single Market agenda and geographical nearness. Furthermore, most of these higher-tech industries have experienced an increase in the bilateral trade intensities after the crisis underpinning the tendency of further agglomeration and industry specialisation in a part of Europe.

## 2.5. PATTERNS AND TRENDS BY USE CATEGORIES

In this section the bilateral trade flows between Member States are analysed with respect to end use categories. For this, various use categories can be distinguished: intermediates, final goods and goods for gross fixed capital formation (though the differentiation can be blurred).

**Table 2.5.1 / Broad end-use categories**

BEC code	Description
100	Food and beverages
...110	...Primary
.....111	.....Mainly for industry
.....112	.....Mainly for household consumption
...120	...Processed
.....121	.....Mainly for industry
.....122	.....Mainly for household consumption
200	Industrial supplies not elsewhere specified
...210	...Primary
...220	...Processed
300	Fuels and lubricants
...310	...Primary
...320	...Processed
.....321	.....Motor spirit
.....322	.....Other
400	Capital goods (except transport equipment), and parts and accessories thereof
...410	...Capital goods (except transport equipment)
...420	...Parts and accessories
500	Transport equipment and parts and accessories thereof
...510	...Passenger motor cars
...520	...Other
.....521	.....Industrial
.....522	.....Non-Industrial
...530	...Parts and accessories
600	Consumer goods not elsewhere specified
...610	...Durable
...620	...Semi-durable
...630	...Non-durable
700	Goods not elsewhere specified

Source: UN.

The differentiation into use categories is based on a correspondence between the HS 6-digit trade data and the BEC codes provided by the UN which, for example, differentiates seven main categories (see Table 2.5.1) with each having some subcategories. In this section, these 2-digit categories are used to study the flows of intra-EU versus extra-EU patterns in some detail.

**Table 2.5.2 / Structure of world trade**

	2000	2008	2009	2011	2014
Food and beverages - Primary	0.6	0.5	0.6	0.5	0.6
Food and beverages - Processed	4.4	4.9	5.6	5.3	5.4
Industrial supply n.e.s. - Primary	0.4	0.3	0.4	0.4	0.4
Industrial supply n.e.s. - Processed	27.5	30.8	29.1	30.8	29.5
Fuels and lubricants - Primary	0.0	0.0	0.0	0.0	0.0
Fuels and lubricants - Processed	3.2	6.3	5.1	7.0	6.5
Capital goods (except transport equipment)	17.3	15.8	16.2	15.8	15.8
Capital goods - Parts and accessories	15.4	11.5	12.2	11.7	12.1
Passenger motor cars	5.7	5.0	4.4	4.5	4.7
Other transport equipment	3.8	4.1	3.6	3.6	3.4
Transport equipment - Parts and accessories	6.5	6.1	6.0	6.1	6.3
Consumer goods - Durable	3.8	3.7	4.1	3.6	3.9
Consumer goods - Semi-durable	6.9	5.9	6.5	5.7	6.0
Consumer goods - Non-durable	4.3	4.9	6.0	5.1	5.2
Goods n.e.s.	0.1	0.1	0.2	0.1	0.1

Source: BACI; own calculations.

The structure of world trade by use categories is presented in Table 2.5.2. This shows that with almost a third of world trade, Industrial supply n.e.s. – Processed is the single most important category, followed by Capital goods (except transport equipment) with about 16% and Capital goods – Parts and accessories (12%). In general, the structure of world trade remained fairly stable between 2000 and 2014. Some notable exceptions are Capital goods (except transport equipment) whose world trade share dropped by around 3ppts and Capital goods (except transport equipment) whose world trade share dropped by around 1.4ppt. However, both already dropped during the initial years of the 2000s. In contrast, between 2000 and 2014, world trade shares increased in some categories, most importantly in Fuels and lubricants – Processed (though eventually driven by price developments), Industrial supply n.e.s. – Processed, or Food and beverages – Processed by between 2 and 1ppts.

**Table 2.5.3 / Share of intra-EU trade in total world trade, in %**

	2000	2008	2009	2011	2014
Food and beverages - Primary	21.8	30.6	28.4	27.9	25.1
Food and beverages - Processed	34.1	35.4	35.4	31.4	31.6
Industrial supply n.e.s. - Primary	23.9	25.6	25.0	24.0	24.3
Industrial supply n.e.s. - Processed	28.8	27.1	26.1	24.3	23.4
Fuels and lubricants - Primary	15.0	18.9	14.5	8.7	42.7
Fuels and lubricants - Processed	20.7	17.9	17.2	16.6	15.7
Capital goods (except transport equipment)	21.4	20.0	18.4	16.5	16.0
Capital goods - Parts and accessories	16.7	19.6	17.3	16.5	14.6
Passenger motor cars	36.0	36.5	40.2	33.2	30.6
Other transport equipment	26.0	23.5	21.3	21.1	21.6
Transport equipment - Parts and accessories	30.5	35.0	33.9	31.7	29.9
Consumer goods - Durable	23.7	24.9	24.1	20.9	18.9
Consumer goods - Semi-durable	20.0	20.5	20.1	19.2	18.5
Consumer goods - Non-durable	31.5	36.9	35.9	32.5	30.6
Goods n.e.s.	11.2	13.6	11.5	11.2	10.7

Source: BACI; own calculations.

Table 2.5.3 sheds light on the importance of intra-EU trade in total world trade by end-use category between 2000 and 2014. The share of intra-EU trade is particularly high (consistently above 25%) in Food and beverages – Primary, Food and beverages – Processed, Industrial supply n.e.s. – Primary, and Passenger motor cars, Transport equipment – Parts and accessories, and Consumer goods – Non-durable. In contrast, it is of least importance in Consumer and Capital goods – Parts and accessories. Furthermore, the shares of intra-EU trade changed over time. Before the onset of the crisis, the share of



intra-EU trade increased in the majority of categories (except for Fuels and lubricants – Processed, Industrial supply n.e.s. – Processed, Capital goods (except transport equipment), Other transport equipment). However, as a result of the crisis, the share of intra-EU trade dropped or remained fairly stable in all categories. More specifically, it dropped the most in Consumer goods – Non-durable (by more than 6ppts), followed by Consumer goods – Durable and Passenger motor cars (by almost 6ppts each) and the least in Industrial supply n.e.s. (by around 1.3ppts).

**Table 2.5.4 / Share of intra-EU exports (in % of total EU exports)**

	2000	2008	2009	2011	2014
Food and beverages - Primary	84.6	88.4	87.8	87.5	85.4
Food and beverages - Processed	68.6	73.2	73.4	70.1	69.3
Industrial supply n.e.s. - Primary	68.1	65.4	64.1	64.4	66.0
Industrial supply n.e.s. - Processed	68.0	68.0	66.4	66.7	64.3
Fuels and lubricants - Primary	62.0	80.5	83.7	85.2	86.3
Fuels and lubricants - Processed	67.8	61.4	60.9	60.5	58.6
Capital goods (except transport equipment)	58.5	53.7	52.1	50.0	51.3
Capital goods - Parts and accessories	59.3	58.0	55.9	56.6	55.2
Passenger motor cars	70.6	69.3	72.2	61.7	57.8
Other transport equipment	60.4	55.4	49.4	52.2	50.0
Transport equipment - Parts and accessories	69.7	70.0	68.5	66.5	63.9
Consumer goods - Durable	66.3	69.9	70.3	66.2	61.3
Consumer goods - Semi-durable	69.5	71.4	72.2	70.1	69.4
Consumer goods - Non-durable	64.3	64.2	63.1	60.0	58.6
Goods n.e.s.	31.1	32.0	29.3	30.9	28.0

Source: BACI; own calculations.

The shares of intra-EU exports by end-use category are provided in Table 2.5.4. With consistently above 80%, the share of intra-EU exports is particularly high in food and beverages – primary. Furthermore, between 2000 and 2014, the shares of intra-EU exports dropped in all use categories but Food and beverages – Primary and Food and beverages – Processed where minor increases are observable. This general downward trend is not the result of the crisis: already in the early 2000s, the shares of intra-EU exports dropped in all categories except a few categories. However, the crisis further amplified this downward trend and resulted in particularly pronounced losses in intra-EU exports shares in passenger motor cars, goods n.e.s. as well as other transport equipment.

**Table 2.5.5 / Structure of intra-EU exports**

	2000	2008	2009	2011	2014
Food and beverages - Primary	0.6	0.6	0.7	0.7	0.7
Food and beverages - Processed	5.9	6.8	8.0	7.3	7.9
Industrial supply n.e.s. - Primary	0.4	0.3	0.4	0.4	0.4
Industrial supply n.e.s. - Processed	31.4	32.3	30.6	32.8	31.9
Fuels and lubricants - Primary	0.0	0.0	0.0	0.0	0.0
Fuels and lubricants - Processed	2.6	4.4	3.5	5.1	4.7
Capital goods (except transport equipment)	14.6	12.3	12.0	11.5	11.7
Capital goods - Parts and accessories	10.2	8.8	8.5	8.5	8.1
Passenger motor cars	8.1	7.1	7.2	6.6	6.7
Other transport equipment	3.9	3.8	3.1	3.3	3.4
Transport equipment - Parts and accessories	7.8	8.2	8.1	8.5	8.7
Consumer goods - Durable	3.5	3.6	4.0	3.3	3.4
Consumer goods - Semi-durable	5.5	4.6	5.3	4.8	5.1
Consumer goods - Non-durable	5.4	7.1	8.6	7.3	7.3
Goods n.e.s.	0.1	0.1	0.1	0.1	0.1

Source: BACI; own calculations.



*Index of specialisation*

This index – calculated as defined above – shows a relatively more even pattern across countries as compared to the industry level. For most countries this index is between 0.4 and 0.5. Before the crisis a tendency towards convergence to the EU average is observed (indicated by a generally declining index); after the crisis patterns have again become slightly more diverse.

**Table 2.5.6 / Index of specialisation**

	2000	2008	2009	2011	2014
Austria	0.47	0.47	0.46	0.48	0.47
Belgium-Luxembourg	0.42	0.42	0.43	0.42	0.43
Bulgaria	0.55	0.48	0.47	0.47	0.47
Croatia	0.44	0.44	0.38	0.40	0.40
Cyprus	0.39	0.42	0.40	0.40	0.48
Czech Republic	0.48	0.47	0.47	0.49	0.48
Denmark	0.45	0.43	0.45	0.43	0.45
Estonia	0.49	0.38	0.38	0.41	0.42
Finland	0.63	0.62	0.60	0.58	0.59
France	0.38	0.36	0.36	0.36	0.36
Germany	0.46	0.41	0.41	0.41	0.41
Greece	0.54	0.51	0.48	0.52	0.53
Hungary	0.41	0.46	0.47	0.45	0.44
Ireland	0.56	0.57	0.59	0.59	0.58
Italy	0.39	0.37	0.38	0.40	0.41
Latvia	0.58	0.43	0.40	0.39	0.39
Lithuania	0.51	0.52	0.47	0.53	0.48
Malta	0.51	0.46	0.43	0.42	0.48
Netherlands	0.45	0.46	0.46	0.48	0.46
Poland	0.41	0.36	0.36	0.36	0.38
Portugal	0.40	0.36	0.37	0.41	0.39
Romania	0.51	0.45	0.36	0.39	0.39
Slovak Republic	0.40	0.43	0.39	0.42	0.40
Slovenia	0.40	0.43	0.38	0.37	0.40
Spain	0.40	0.40	0.41	0.41	0.41
Sweden	0.48	0.43	0.44	0.44	0.46
United Kingdom	0.44	0.38	0.38	0.38	0.38

Source: BACI; own calculations.

*Relative concentration*

The relative concentration (see Table 2.5.7), again calculated as shown in Box 2.2, indicates that – apart from fuels and lubricants – (primary), trade in passenger motor cars, other transport equipment, and transport equipment – parts and components are very concentrated whereas food and beverages, industrial supply goods and consumer goods are less concentrated than GDP.

Generally, a tendency towards less concentration is observed over time. Between 2000 and 2008, relative concentration generally increased in all end-use categories but Fuels and lubricants – Primary and Food and beverages – Primary. Conversely, between 2008 and 2014, relative concentration decreased in the majority of end-use categories with the exception of Passenger motor cars. Overall, Fuels and lubricants – Primary underwent interesting changes in relative concentration over time: It was highest in 2000, halved between 2000 and 2008, and halved further as a result of the crisis in 2009, before it started to rebound in 2011, almost reaching its initial all-time high of 2000 in 2014.

**Table 2.5.7 / Index of relative concentration**

	2000	2008	2009	2011	2014
Food and beverages - Primary	-0.06	-0.06	-0.07	-0.09	-0.15
Food and beverages - Processed	-0.14	-0.09	-0.10	-0.11	-0.13
Industrial supply n.e.s. - Primary	-0.19	0.00	0.01	-0.06	-0.12
Industrial supply n.e.s. - Processed	-0.16	-0.08	-0.08	-0.10	-0.12
Fuels and lubricants - Primary	0.92	0.65	1.07	0.29	0.94
Fuels and lubricants - Processed	0.04	-0.02	0.02	0.06	-0.02
Capital goods (except transport equipment)	-0.02	0.01	-0.01	-0.01	-0.01
Capital goods - Parts and accessories	-0.02	0.11	0.09	0.09	0.07
Passenger motor cars	0.15	0.37	0.31	0.35	0.28
Other transport equipment	0.17	0.20	0.26	0.30	0.35
Transport equipment - Parts and accessories	0.06	0.08	0.07	0.02	-0.01
Consumer goods - Durable	-0.17	-0.23	-0.24	-0.24	-0.23
Consumer goods - Semi-durable	-0.29	-0.13	-0.13	-0.17	-0.21
Consumer goods - Non-durable	-0.16	-0.01	-0.04	-0.10	-0.16
Goods n.e.s.	0.07	-0.03	0.00	-0.12	0.07

Source: BACI; own calculations.

### *Regional clustering*

Finally, the regional clustering measure (by end-use categories) is presented in Table 2.5.8: Clustering is highest in Fuels and lubricants – Primary and Fuels and lubricants – Processed, while it is lowest in Consumer goods – Semi-durable. Between 2000 and 2014, clustering changed in all end-use categories. Initially, between 2000 and 2008, clustering increased in almost all end-use categories, most notably in Industrial supply n.e.s. – Primary and Industrial supply n.e.s – Processed. The only exception was Fuels and lubricants where clustering dropped sharply. However, between 2008 and 2014, clustering decreased for all end-use categories but Other transport equipment and Fuels and lubricants (Primary and Processed): in the latter two industries clustering either rebounded, after another pronounced drop during the crisis, to the initial level of 2000 (in the case of Fuels and lubricants – Processed) or remained fairly stable (in the case of Fuels and lubricants – Primary). Overall, between 2008 and 2014, clustering decreased the most in Goods n.e.s.

**Table 2.5.8 / Index of relative clustering**

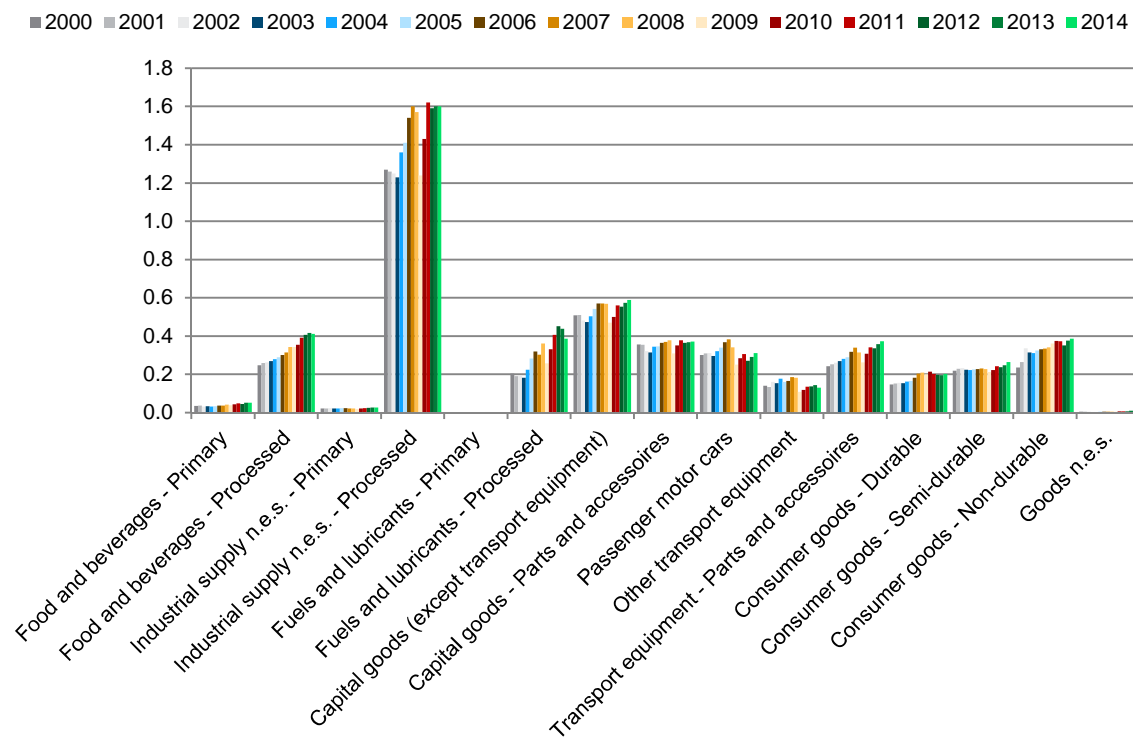
	2000	2008	2009	2011	2014
Food and beverages - Primary	0.40	0.44	0.40	0.41	0.29
Food and beverages - Processed	0.29	0.32	0.32	0.30	0.26
Industrial supply n.e.s. - Primary	0.12	0.26	0.28	0.21	0.19
Industrial supply n.e.s. - Processed	0.15	0.27	0.26	0.26	0.23
Fuels and lubricants - Primary	0.81	0.70	0.73	0.29	0.55
Fuels and lubricants - Processed	0.72	0.61	0.69	0.73	0.65
Capital goods (except transport equipment)	0.19	0.26	0.27	0.25	0.26
Capital goods - Parts and accessories	0.18	0.22	0.24	0.22	0.18
Passenger motor cars	0.23	0.30	0.25	0.25	0.22
Other transport equipment	0.18	0.21	0.16	0.23	0.24
Transport equipment - Parts and accessories	0.04	0.09	0.09	0.06	0.03
Consumer goods - Durable	-0.04	0.02	0.04	0.02	0.02
Consumer goods - Semi-durable	-0.13	0.01	0.03	-0.01	-0.02
Consumer goods - Non-durable	0.12	0.26	0.24	0.19	0.14
Goods n.e.s.	-0.05	0.11	0.20	-0.09	-0.06

Source: BACI; own calculations.

### Bilateral gross trade intensities by use categories

Furthermore, bilateral gross trade intensities are also calculated by end-use category. Figure 2.5.2 depicts the (unweighted) means by end-use category and shows that bilateral gross trade intensities are particularly high in Industrial supply n.e.s. – Processed and lowest in primary goods. Between 2000 and 2014 bilateral gross trade intensities increased in almost all end-use categories. More specifically, bilateral gross trade increased the most in Industrial supply n.e.s. – Processed and Food and beverages – Processed. In contrast, bilateral gross trade intensities dropped after 2011 in Other transport equipment and passenger motor cars. Corresponding regression results – regressing the level of BGTI 2014 on the level of BGTI in 2000 – are reported in Table 2.5.9.

**Figure 2.5.2 / Bilateral gross trade intensities by end-use category**



Summarising, when considering end-use categories one finds a generally decreasing concentration in all product types indicating that exporting activities are more evenly spread across countries – similar to the finding for total trade. Specialisation by end-use categories is relatively similar across countries and relatively stable over time. Compared to GDP, the most concentrated exports by end-use categories are trade in passenger motor cars, other transport equipment and transport equipment – parts and components, but there is a slight tendency towards less concentration (though mostly driven by differentiated GDP growth). This is in line with above mentioned trends of integration leading to agglomeration and specialisation of a few countries in these industries which are characterised by stronger value chain and production integration. The most regionally clustered exporting activities are food and beverages (apart from fuels and lubricants). Generally one finds a slight tendency towards less clustering over time. Bilateral gross trade intensities are high in industrial supplies n.e.s., food and

beverages and capital goods (except transport equipment). In these categories the bilateral trade intensities increased before the crisis with, in general, no clear trends thereafter. Only in the category food, bilateral intensities were continuously increasing.

**Table 2.5.9 / Regression results by end-use category**

	(1) All	(2) 11	(3) 12	(4) 21	(5) 22	(6) 31	(7) 32	(8) 41
BGTI	1.084*** (0.00740)	1.621*** (0.0378)	1.620*** (0.0253)	1.241*** (0.0254)	1.214*** (0.0228)	2.456*** (0.0848)	1.740*** (0.0396)	0.651*** (0.0193)
Constant	0.318*** (0.0247)	0.208*** (0.0612)	0.126*** (0.0364)	0.316*** (0.0703)	0.551*** (0.157)	-0.333** (0.152)	0.0422 (0.0887)	0.476*** (0.0712)
Observations	8,036	390	658	500	694	28	488	692
R-squared	0.728	0.826	0.862	0.827	0.804	0.970	0.799	0.624
BGTI=1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(13) 42	(14) 51	(15) 52	(16) 53	(17) 61	(18) 62	(19) 63	(20) 70
BGTI	0.913*** (0.0261)	0.824*** (0.0364)	0.961*** (0.0278)	0.942*** (0.0260)	0.935*** (0.0286)	0.955*** (0.0258)	1.206*** (0.0194)	0.479*** (0.0262)
Constant	0.389*** (0.0707)	0.311*** (0.0495)	0.548*** (0.109)	0.544*** (0.0882)	0.455*** (0.0821)	0.296*** (0.0688)	0.245*** (0.0548)	0.233*** (0.0614)
Observations	682	466	550	638	630	692	670	258
R-squared	0.643	0.524	0.685	0.674	0.629	0.665	0.853	0.567
BGTI=1	0.001	0.000	0.165	0.027	0.024	0.080	0.000	0.000

Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 2.6. PATTERNS OF EXPORTS BY PRODUCT AND QUALITY DIMENSION

Having presented a set of results concerning intra-EU trade flows at the total, industry and end-use level, this section delves into an analysis at the detailed product level allowing one to differentiate traded products by quality segments, more concretely how market shares in intra-EU trade have developed by quality segments. Has there been a general quality upgrading or could one observe a differentiation of export structures with respect to quality segments in which EU Member States trade? Second, how much of EU countries' exports are concentrated in specific products is addressed. To answer these questions, the HS 6-digit products are classified into three types using the information about unit values of exports to each destination market served by the EU countries: products belonging to the high unit-value range, those that belong to the medium unit-value range and those that are classified in the low unit-value range.<sup>10</sup>

### 2.6.1. Intra-EU exports by quality segment

Thus, exports of a product to a specific market are classified as belonging to a specific unit-value segment differentiating three classes: high UV, medium UV and low UV segments. Corresponding to the calculations of contributions to intra-EU exports as in Sections 2.3-2.5, one can calculate these shares by quality segment. These shares for the years 2000 and 2014 are presented in Table 2.6.1. To give an impression on the distribution of these shares, Figure 2.6.1 presents the cumulated shares of these three segments with countries ranked according to the high-quality segment. As one can see, trade in

<sup>10</sup> This follows the procedure as outlined in Stehrer et al. (2015).

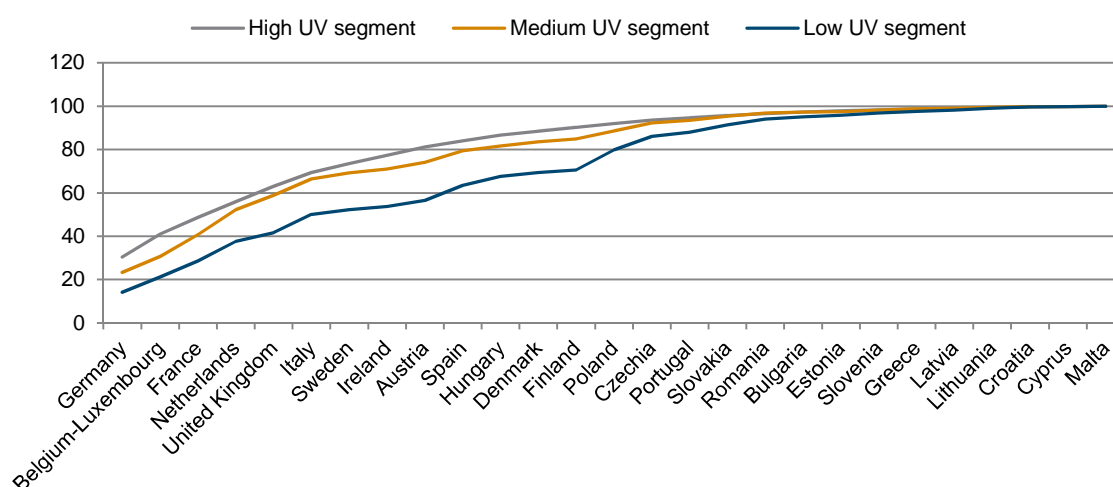
the high-quality segment is most concentrated; trade in the medium-quality segment is slightly less concentrated; while trade in the low-quality segment is the least concentrated. This indicates a certain 'division of labour' in the provision of high-unit value goods across Europe.

**Table 2.6.1 / Contributions to intra-EU exports in %, 2000 and 2014**

	High UV segment	2000 Medium UV segment	Low UV segment	High UV segment	2014 Medium UV segment	Low UV segment
Austria	4.5	2.4	2.0	3.8	3.0	2.9
Belgium-Luxembourg	6.5	7.0	7.9	10.6	7.3	7.1
Bulgaria	0.1	0.2	0.7	0.8	0.5	1.0
Croatia	0.4	0.3	0.5	0.2	0.2	0.6
Cyprus	0.1	0.1	0.1	0.2	0.1	0.1
Czech Republic	0.6	1.5	4.4	1.6	3.6	6.3
Denmark	2.3	2.1	1.8	1.8	1.9	1.7
Estonia	0.2	0.3	0.7	0.6	0.3	0.8
Finland	2.8	2.1	2.8	1.8	1.4	1.3
France	10.9	12.6	10.3	7.7	10.1	7.4
Germany	25.8	23.3	13.7	30.4	23.4	14.1
Greece	0.5	0.5	0.8	0.4	0.5	0.7
Hungary	2.1	1.6	3.2	2.5	2.2	4.1
Ireland	3.5	2.3	3.6	3.9	1.8	1.4
Italy	6.4	9.3	9.8	6.3	7.5	8.5
Latvia	0.1	0.2	0.7	0.3	0.3	0.6
Lithuania	0.1	0.2	0.6	0.3	0.5	1.0
Malta	0.4	0.2	0.3	0.1	0.1	0.2
Netherlands	9.8	9.1	8.4	7.3	11.5	9.0
Poland	1.4	1.5	4.8	1.7	3.7	9.3
Portugal	1.7	1.5	1.9	1.1	1.2	1.9
Romania	0.4	0.6	2.1	0.8	1.4	2.6
Slovakia	0.8	0.7	1.9	1.0	1.9	3.3
Slovenia	0.7	0.6	1.1	0.5	0.8	1.1
Spain	3.3	5.4	6.9	2.8	5.3	6.9
Sweden	5.7	3.5	2.8	4.1	2.8	2.2
United Kingdom	8.7	10.9	6.3	7.0	6.7	4.0

Source: BACI; own calculations.

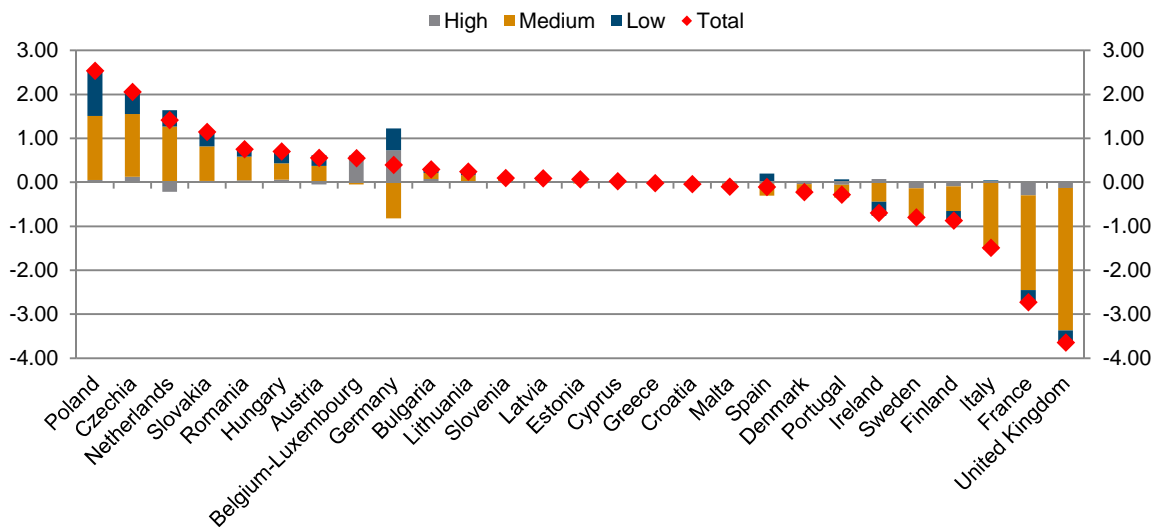
**Figure 2.6.1 / Cumulated shares in intra-EU trade by quality segments**



Source: BACI; own calculations.

Has this pattern changed over time? In order to answer this question one can calculate the market shares by quality segment in total intra-EU trade by quality segment and country, and the corresponding changes in these shares in percentage points, as presented in Figure 2.6.2. The countries which gained overall market shares have done so by gaining market shares mainly in the medium- and low-quality segments. Some significant changes in high-quality market shares are only observed for Belgium-Luxembourg and Germany. Accordingly, countries with overall losses in market shares did so in the medium unit-value segment as well.<sup>11</sup>

**Figure 2.6.2 / Changes in contributions to intra-EU exports in %, 2000-2014**



Source: BACI; own calculations.

Summarising, this implies that the overall shift in the geographical patterns of intra-EU trade as described in Section 2.3 has happened almost entirely in the medium-quality segment of traded products and, to a smaller degree, in the low-quality segments. The shares in the high-quality segments are almost unchanged (with two exceptions). This means that a kind of 'climbing up' phenomenon occurred with less advanced countries gaining in medium-quality segments which were lost by (some of) the advanced countries. This again underpins the trends of industrial specialisation of some core European countries in specific industries and particularly the integration of Eastern European Member States in the respective value chains.

## 2.6.2. Concentration in products traded

Second, one might ask to which extent these trade patterns were driven by only a few products. Hence, in this section, we take a closer look at the size distribution of trade by product. A striking result is that exports – considered at the very detailed product level – are highly concentrated. It appears from Table 2.6.2<sup>12</sup> that 100 products out of a total of 4,700 6-digit products being exported by the EU to the whole

<sup>11</sup> One has to further note that over time there has been a small increase in the overall share of trade in the high-unit value segment.

<sup>12</sup> For the sake of clarity, the numbers reported in the table sum up the whole cumulative distribution of EU exports through values of total exports for the top1, top5, top10, top15, top50, top100, top200, top1000 and top3000 most exported products in the EU. The calculations are done separately for total EU trade, intra- and extra-EU-28 trade.



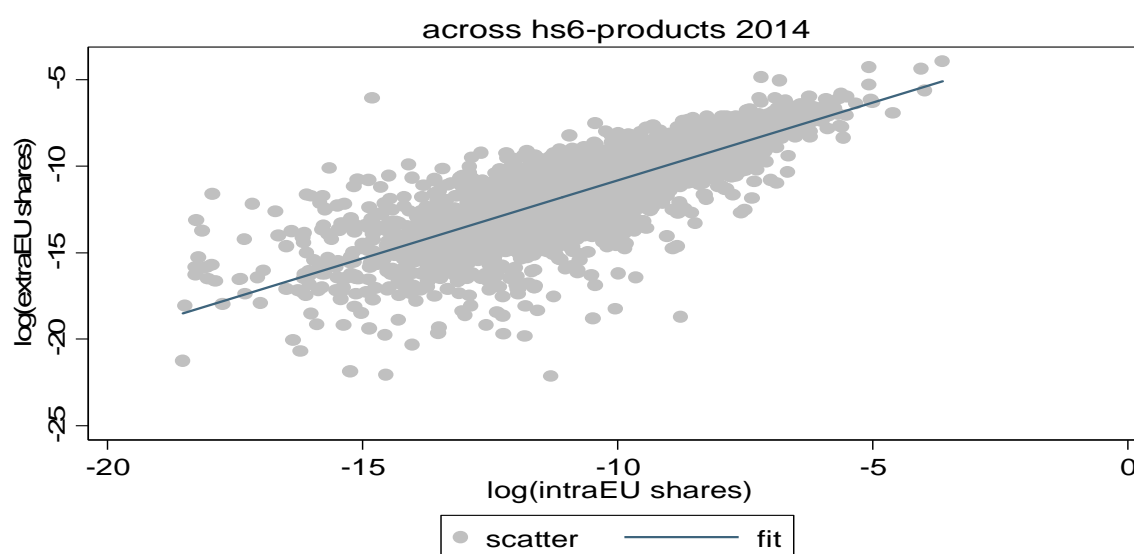
world account for about 40% of EU total exports. This concentration appears to be relatively similar when only intra-EU trade is considered, as shown in the second panel of Table 2.6.2: 15 products account for almost a quarter of total EU exports to the EU market and the top 200 ones (about 4% of all products exported) account for more than 50% of total exports to EU destinations. One should note that this also applied during the crisis years, which suggests no apparent impact of the crisis on the structure of export concentration inside or outside the EU.

**Table 2.6.2 / Concentration of total EU countries' exports by product**

	Total exports											
	Top 1	Top 5	Top 10	Top 15	Top 50	Top 100	Top 200	Top 500	Top 1000	Top 2000	Top 3000	Top 4000
2000	3.3	11.6	18.0	21.8	34.0	42.4	53.1	70.1	83.7	94.7	98.6	99.8
2008	4.0	12.8	17.1	20.0	31.6	41.3	52.8	71.2	85.0	95.4	98.8	99.9
2009	4.2	12.5	16.5	19.1	31.1	40.7	52.7	71.3	85.2	95.5	98.9	99.9
2011	4.6	13.0	17.2	19.9	31.8	41.6	53.4	71.7	85.4	95.5	98.9	99.9
2014	4.2	12.6	17.0	20.0	32.6	42.3	54.1	72.2	85.7	95.7	98.9	99.9
	Intra-EU exports											
	Top 1	Top 5	Top 10	Top 15	Top 50	Top 100	Top 200	Top 500	Top 1000	Top 2000	Top 3000	Top 4000
2000	4.2	12.9	18.8	22.4	34.7	44.4	54.7	70.7	83.9	95.1	98.8	99.9
2008	5.8	14.0	17.5	20.6	32.5	43.3	55.0	72.3	85.4	95.7	99.0	99.9
2009	4.9	13.5	17.2	20.3	32.8	43.8	55.6	73.2	85.9	95.9	99.1	99.9
2011	6.5	15.8	19.6	22.5	34.7	45.0	56.5	73.6	86.0	96.0	99.2	99.9
2014	5.3	16.4	21.0	24.1	36.8	46.7	58.0	75.0	86.9	96.4	99.3	100.0
	Extra-EU exports											
	Top 1	Top 5	Top 10	Top 15	Top 50	Top 100	Top 200	Top 500	Top 1000	Top 2000	Top 3000	Top 4000
2000	3.6	11.1	17.1	21.2	33.5	41.9	52.3	69.0	82.6	94.3	98.4	99.8
2008	4.6	12.6	16.6	19.2	30.9	40.7	52.1	70.0	83.9	94.9	98.6	99.9
2009	4.4	12.4	15.9	18.4	30.2	40.3	52.1	70.2	84.1	95.1	98.7	99.9
2011	5.3	13.5	17.2	19.8	31.8	41.8	53.2	70.7	84.4	95.1	98.7	99.9
2014	4.6	13.0	17.5	20.5	32.8	42.7	54.1	71.5	84.9	95.3	98.8	99.9

Source: BACI; own calculations.

**Figure 2.6.3 / Correlation between shares in intra- and extra-EU trade, 2014**

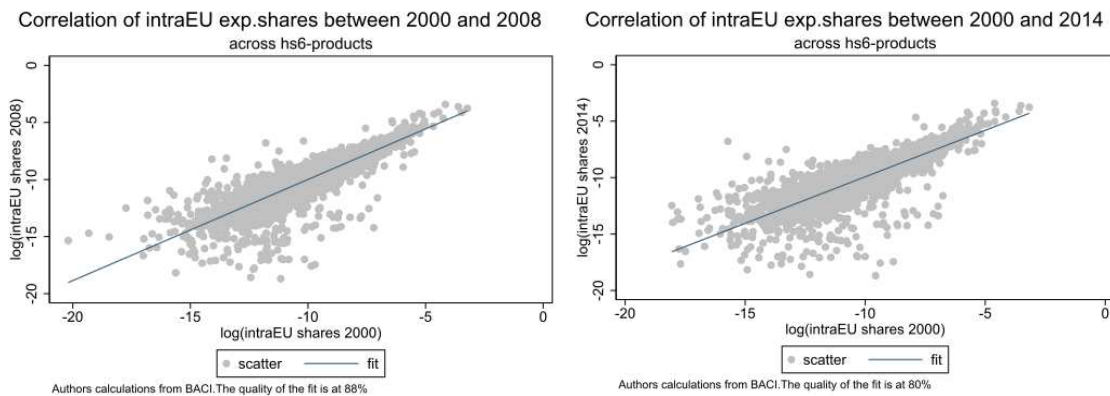


Authors calculations from BACI. The quality of the fit is at 80%

Figure 2.6.3 indicates a high cross-product correlation between the shares of products exported within the EU and the corresponding shares to non-EU destinations. The correlation is around 80% in 2014.

These shares are also rather stable over time<sup>13</sup> which indicates that, more or less, the same products account for the bulk of intra- and extra-EU trade. This can be seen in Figure 2.6.4 which shows the correlation of intra-EU shares by product between 2000 and 2008 and 2000 and 2014, respectively.

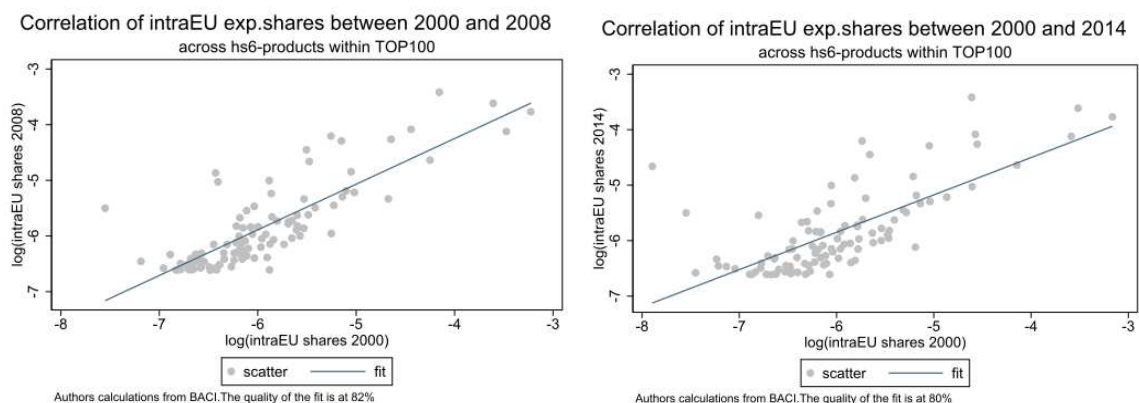
**Figure 2.6.4 / Correlation of intra-EU-28 shares over time**



Source: BACI; own calculations.

A similar pattern also holds for the individual top-segments. Figure 2.6.5 presents, as an example, the correlation of the Top 100 products in 2000 and 2008 and 2000 and 2014, respectively, with correlations around 0.8 in both cases.<sup>14</sup>

**Figure 2.6.5 / Correlation of intra-EU-28 shares over time**



Source: BACI; own calculations.

This immediately leads to the question as to which products are these 'top-exported products' to the world and to the EU? A closer look at the data indicates that these top exported products, (quite closely

<sup>13</sup> The correlation for all years since 2000 takes values between 0.79 and 0.85.

<sup>14</sup> These correlations are somewhat smaller when considering, e.g., the Top 50 products only. In this case the correlation of shares between 2000 and 2008 is about 0.6, whereas the correlation between 2000 and 2014 is slightly below 0.5.

correlated with the top ones exported to the EU), belong mostly to the automotive and transport sector, energy and chemical and pharmaceutical products. Further, there is little change over time as it is noted that most of the products in the top 50 in 2000 are still in the top ranking in 2014, though some have been withdrawn (e.g. some products from the textile industry).

Analogous figures can be computed for each individual European country: As expected (due to specialisation) concentration appears to be even higher. Table 2.6.3 reports similar patterns for all EU countries in 2001 and 2014. The patterns observed for the four countries above are actually representative of the bigger and more advanced countries. For the smaller and less developed EU countries, the specialisation appears to be even higher with the Top 5 products representing as much as 30% to 40% of the total exports of these countries. Again, changes in the respective distributions over time are rather small.

**Table 2.6.3 / Distribution of exports by country, in % of total exports**

	Top 1	Top 5	Top 10	Top 15	Top 50	Top 100	Top 200	Top 500	Top 1000	Top 2000	Top 3000
Austria	1.8	8.0	12.8	16.4	31.8	44.3	59.1	79.8	91.9	98.4	99.8
Belgium-Luxembourg	8.9	22.7	28.9	31.7	43.1	52.6	64.7	81.3	91.5	98.0	99.6
Bulgaria	10.0	24.7	32.0	36.0	50.0	61.3	73.8	88.0	95.5	99.3	99.9
Croatia	8.9	15.2	20.3	24.5	42.4	57.7	73.2	89.3	96.8	99.7	100.0
Cyprus	10.4	30.6	43.0	49.1	66.0	75.6	85.0	95.1	99.0	100.0	
Czech Republic	4.6	15.1	21.8	27.2	46.5	58.1	70.2	85.4	94.1	98.9	99.9
Denmark	4.2	14.7	22.2	26.8	43.3	54.7	68.0	85.0	94.1	99.0	99.9
Estonia	6.0	25.1	31.7	36.1	53.2	64.3	75.7	88.9	96.0	99.5	100.0
Finland	10.7	20.6	28.2	32.4	50.3	63.4	76.3	91.0	97.2	99.7	100.0
France	6.0	15.8	21.8	26.4	40.7	50.9	62.2	78.4	89.7	97.4	99.5
Germany	4.0	14.5	20.0	24.0	36.4	46.0	57.6	75.6	88.2	97.0	99.4
Greece	33.1	40.9	46.9	51.2	64.4	73.0	82.5	92.9	97.4	99.6	100.0
Hungary	6.1	17.8	25.9	31.2	50.1	62.6	75.5	89.9	96.7	99.5	100.0
Ireland	13.2	26.4	36.2	43.7	67.4	78.3	87.0	94.7	98.2	99.8	100.0
Italy	3.5	10.7	14.8	17.7	30.9	41.6	54.5	73.4	87.4	97.0	99.5
Latvia	8.7	23.3	32.0	38.3	55.8	65.2	75.7	89.1	96.1	99.5	100.0
Lithuania	17.1	25.1	29.7	32.9	47.7	58.2	69.8	85.2	93.9	98.9	99.9
Malta	38.0	68.9	76.0	79.8	88.4	92.5	96.2	99.2	99.9	100.0	
Netherlands	12.5	23.2	28.5	32.5	45.1	55.1	66.2	81.3	91.2	97.8	99.6
Poland	2.1	8.3	14.6	19.6	36.5	48.7	62.5	81.9	92.9	98.6	99.8
Portugal	5.5	14.3	21.5	26.9	44.7	55.7	67.5	83.3	93.1	98.8	99.9
Romania	5.0	15.5	22.9	28.6	48.9	62.3	75.0	89.6	96.6	99.6	100.0
Slovakia	8.4	23.5	34.4	40.4	57.0	67.9	78.8	91.0	96.8	99.5	100.0
Slovenia	7.6	19.0	25.4	29.7	47.2	58.6	71.3	87.6	95.7	99.4	100.0
Spain	4.8	17.3	23.4	26.8	40.0	50.0	61.3	78.0	89.4	97.4	99.5
Sweden	7.5	16.0	22.0	27.1	45.0	56.9	69.2	85.1	94.3	99.1	99.9
United Kingdom	7.1	24.7	33.4	38.5	51.5	60.8	70.8	83.9	92.5	98.1	99.7

Source: BACI; own calculations.

These results suggest that the distribution of exports by products is highly skewed with between 50 products (for relatively smaller countries) to 100 products (for larger countries) accounting for about 50% of exports.

## 2.7. SERVICES TRADE

Now, developments in bilateral intra-EU services trade are analysed in an analogous way to the goods trade above. Accordingly, first an analysis of changes in global trade flows over the time period 2000-2013<sup>15</sup> is presented, again further dividing this period into the years before the crisis (2000-2008),

<sup>15</sup> Figures for 2014 are not yet available; figures for 2013 are partly imputed.

the crisis with the global trade slowdown (2008-2009), the recovery period after the crisis (2009-2011) and the years since then (2011-2013).

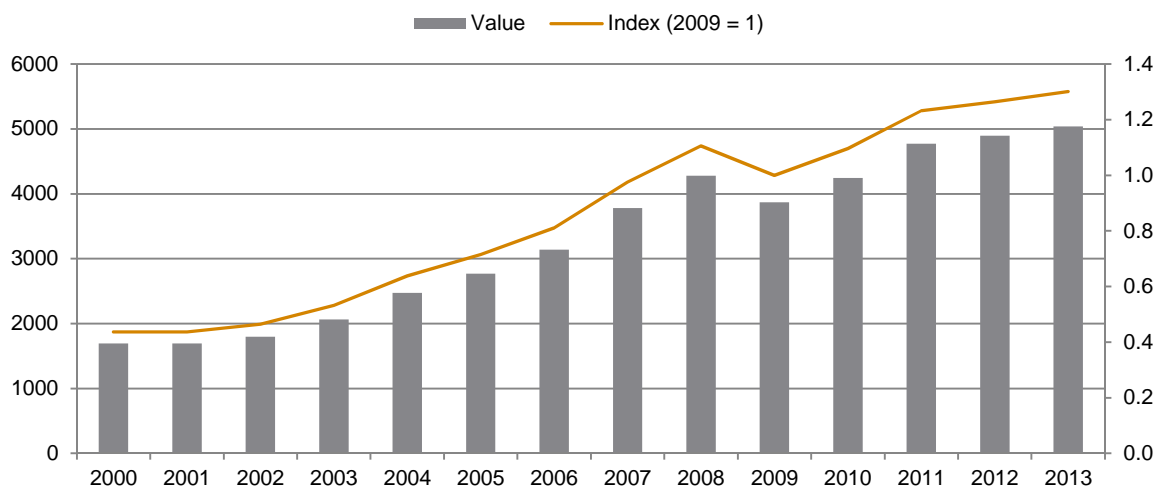
The underlying data source for this exercise is the UN Services Trade Database covering Mode 1 (cross border) trade and Mode 2 (consumption abroad) trade (i.e. commercial presence (Mode 3) and presence of natural persons (Mode 4) are not covered by this). These bilateral services trade figures collected from the UN require further adjustments (adjustment for mirror, flows, imputations of flows, reconciliation of aggregates to match overall totals, etc.).

The section starts with a discussion of overall trends in global services trade with a focus on the relative importance of intra- versus extra-EU trade flows for the EU-28 as a whole and its individual Member States. This is followed by an analysis of the guiding questions concerning concentration, specialisation patterns and clustering in intra-EU trade and how these developed over time in comparison to the developments in goods trade as analysed in Section 2.3. Finally, the analysis is broken down into more detailed balance of payments (BoP) categories, providing a more detailed picture concerning the development of the composition of intra-EU trade. In all cases, an analysis of the evolving bilateral trade relations of intra-EU trade, i.e. the bilateral gross trade intensity (BGTI), is presented.

### 2.7.1. Overall trends

Starting with the overall trends in global services, Figure 2.7.1 presents the evolution of global services trade over the period considered. Similar to the developments in goods trade, one finds a strong increase in the global trade flows in services from about USD 2,000 billion in the year 2000 to almost USD 5,000 billion in the year 2008. The crisis year, 2008, saw a drop – though slightly less pronounced than the collapse in goods trade – and from which services trade recovered as well relatively quickly to above USD 5,500 billion in 2011. From 2011 onwards, one also observes a ‘peak trade phenomenon’, i.e. sluggish growth of global trade in services.

**Figure 2.7.1 / Global trade volume in services (in billion USD) and index**



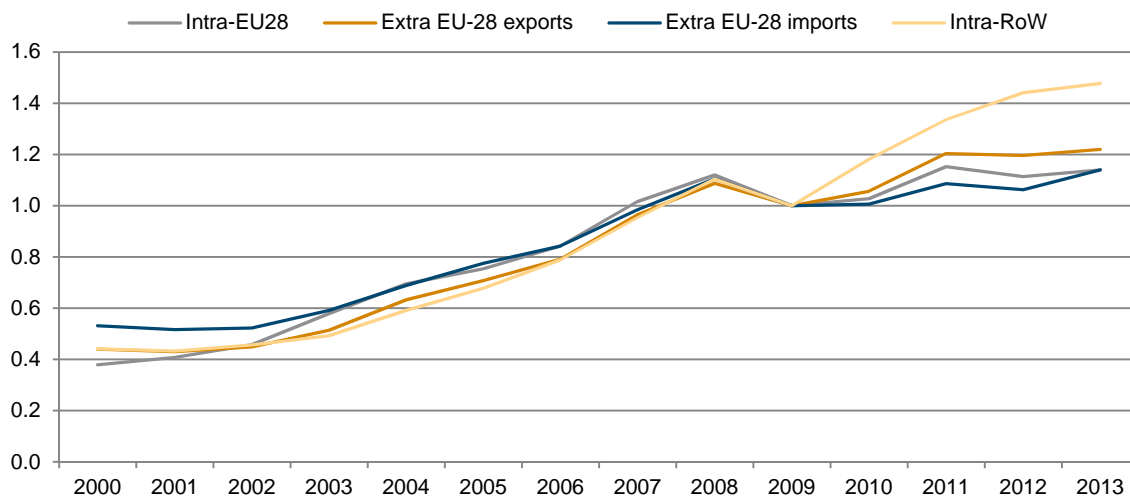
Source: UN (adjusted by wiiw); own calculations.

Splitting these global trade flows into intra-EU trade, trade of the EU with the world and trade flows outside Europe (see Figure 2.7.2), one finds that services trade developed relatively similarly before the crisis, although a bit slower for EU-28 imports from the rest of the world. Generally, trade in services developed even more dynamically than trade in goods (see Figure 2.3.2). As already mentioned, the global crisis had a relatively less severe impact on services trade; nonetheless, a decline of about 10% occurred in the crisis.

However, in the period following the crisis, services trade – particularly for Europe – recovered less strongly than that of the goods trade and growth has been particularly sluggish (increasing by about 20% for EU-28 exports and even less so for EU-28 imports and intra-EU trade flows).

Since 2011, intra-EU trade flows as well as EU-28 imports from the rest of the world have been relatively stagnant. As already mentioned, EU-28 exports to the rest of the world had shown a slightly more dynamic recovery up to 2011 which has, however, flattened since 2011. Trade flows outside Europe picked up much more strongly. This suggests that the sluggish GDP growth in the EU contributed to the sluggish dynamics of intra-EU-services trade and contributed to the overall lower dynamics in services trade globally. Thus, services trade after the crisis is even more anaemic than that of the goods trade.

**Figure 2.7.2 / Export dynamics by region, 2009 = 1**



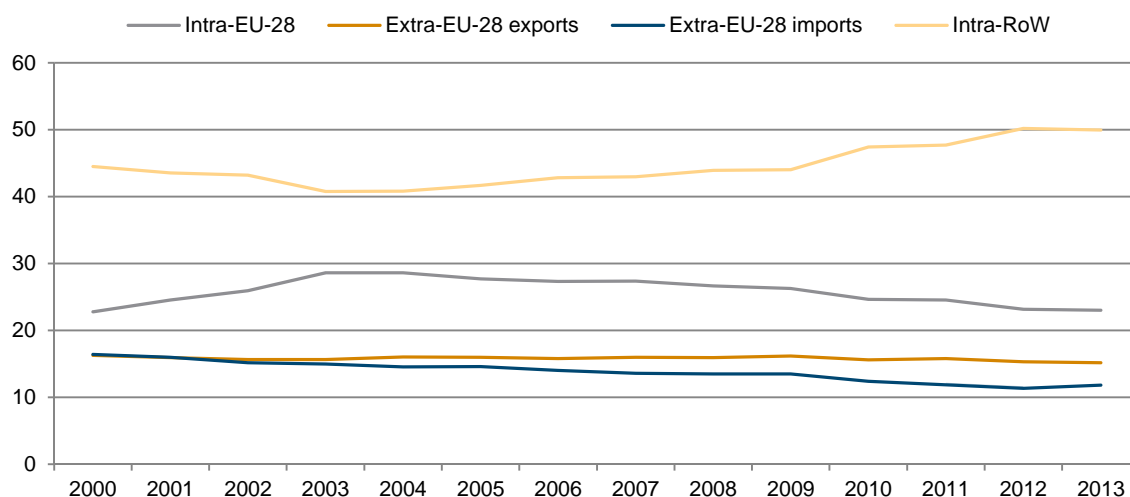
Source: UN (adjusted by wiiw); own calculations.

Accordingly, the shares of services trade flows related to the EU-28 (in percentages of total global services trade flows) declined particularly strongly after 2009, as shown in Figure 2.7.3. The share of intra-EU services trade stands at about 23% of global flows (a decline from almost 30% in 2002) but is still higher than the one for goods trade (20%). Similarly, the share of EU-28 imports from the rest of the world declined to about 12%, whereas the share of EU-28 exports remained more stable and accounted for about 15% of global flows, which are shares rather similar to the ones found for goods trade (see Figure 2.3.3).

From the individual country's perspective, intra-EU trade accounts for the major part of services trade (see Table 2.7.1): On average, about two-thirds of services are exported to other EU-28 Member States

and the share of services imports from other EU-28 Member States, as a percentage of total services imports, is even a bit higher at about 70%. These numbers are slightly higher than those observed for goods trade which had average shares of 62% and 64% respectively (see Table 2.3.1).

**Figure 2.7.3 / Shares of trade of EU-28 and world, in % of global trade flows**



Source: UN (adjusted by wiiw); own calculations.

**Table 2.7.1 / Shares of intra-EU trade (in % of total trade flows)**

	Exports					Imports				
	2000	2008	2009	2011	2013	2000	2008	2009	2011	2013
Austria	84.9	81.6	81.6	80.1	80.5	75.3	80.4	79.9	80.9	81.9
Belgium	71.1	71.4	69.8	70.1	71.4	77.4	76.2	75.9	80.2	78.2
Bulgaria	35.2	67.7	69.7	67.5	64.7	37.0	75.1	76.8	79.8	80.0
Croatia	82.4	86.5	85.3	84.2	82.4	59.5	56.0	59.9	57.7	70.8
Cyprus	81.9	57.6	55.8	48.9	46.4	54.5	78.4	78.8	75.5	76.5
Czech Republic	58.1	81.6	82.8	80.1	76.9	63.3	66.5	66.7	67.0	62.9
Denmark	55.6	48.1	49.7	49.3	47.9	54.4	58.9	58.9	60.5	58.9
Estonia	54.1	73.0	71.7	71.8	65.3	59.6	70.1	71.4	71.6	69.5
Finland	58.6	48.3	43.4	45.3	47.9	53.6	77.7	75.8	79.2	81.1
France	57.3	57.3	52.4	55.5	57.1	64.4	71.5	71.7	72.2	70.6
Germany	58.0	58.8	60.0	58.9	60.7	61.4	65.5	64.2	65.0	65.3
Greece	50.8	55.8	57.1	54.7	55.0	50.0	57.1	57.3	58.1	58.9
Hungary	50.1	73.2	72.1	72.3	73.2	40.5	58.9	61.0	59.2	60.6
Ireland	46.8	62.0	62.1	55.6	50.7	74.6	79.9	75.4	80.3	76.2
Italy	58.4	67.4	66.6	64.2	61.9	47.6	74.6	74.0	75.9	74.9
Latvia	43.3	58.8	59.8	55.9	53.8	34.2	55.9	54.9	56.7	53.3
Lithuania	53.6	62.7	64.9	56.8	46.7	49.9	64.9	64.8	67.7	68.0
Luxembourg	49.1	81.0	81.0	77.4	63.7	57.4	67.5	64.5	65.5	66.5
Malta	81.1	82.0	80.5	80.3	74.0	62.5	71.7	68.5	71.5	70.9
Netherlands	60.8	65.6	66.6	64.8	68.7	56.2	74.0	74.4	76.1	79.6
Poland	48.6	79.5	79.6	77.3	75.0	54.0	75.3	75.0	82.6	73.6
Portugal	74.9	72.3	71.4	67.7	63.2	63.1	67.5	67.0	67.0	68.1
Romania	69.5	81.3	79.4	79.8	81.0	44.3	79.1	79.6	80.1	74.4
Slovenia	78.7	79.7	80.5	82.2	66.8	71.5	81.4	80.8	81.7	82.8
Slovakia	57.9	81.4	83.5	85.1	83.0	42.7	80.6	79.6	83.7	78.2
Spain	77.3	76.3	74.5	72.8	68.8	61.5	87.8	89.7	91.5	90.8
Sweden	48.5	52.9	58.1	60.7	52.6	83.5	83.1	82.0	82.7	80.4
United Kingdom	46.9	47.8	47.6	46.0	48.9	62.7	67.2	66.1	69.6	67.2

Source: UN (adjusted by wiiw); own calculations.

However, there are some significant differences across countries. The shares for exports range from about 50% (e.g. Cyprus, Finland, Ireland, Sweden, and the United Kingdom) to more than 80% (e.g. Austria, Croatia, Romania and Slovakia). A similar pattern is observed with respect to imports.

**Table 2.7.2 / EU Member States' contributions to intra-EU trade, in % of trade flows**

	Exports					Imports					Change 2000-2013 in ppt	
	2000	2008	2009	2011	2013	2000	2008	2009	2011	2013	Exports	Imports
Austria	5.1	4.5	4.4	4.2	4.5	3.4	3.3	3.2	3.2	3.4	-0.6	0.1
Belgium	6.4	5.7	6.0	5.9	6.7	6.8	6.2	6.2	6.7	7.1	0.4	0.3
Bulgaria	0.2	0.5	0.5	0.4	0.4	0.2	0.4	0.4	0.3	0.3	0.2	0.2
Croatia	0.2	1.1	1.0	0.9	0.8	0.2	0.4	0.3	0.3	0.3	0.5	0.0
Cyprus	0.7	0.5	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.4	-0.3	0.2
Czech Republic	1.0	1.6	1.6	1.6	1.6	0.8	1.3	1.3	1.4	1.4	0.6	0.6
Denmark	3.4	3.1	2.7	2.8	3.0	3.1	3.5	3.3	3.3	3.5	-0.5	0.4
Estonia	0.2	0.3	0.3	0.3	0.4	0.1	0.2	0.2	0.3	0.4	0.1	0.2
Finland	1.2	1.3	1.2	1.1	1.2	1.6	2.1	2.1	2.0	2.0	0.0	0.4
France	12.0	8.3	9.8	11.1	12.4	10.1	8.9	11.4	11.7	14.1	0.4	4.0
Germany	12.5	13.2	14.1	13.7	13.5	23.6	18.8	18.7	18.7	18.6	1.0	-5.1
Greece	2.5	2.4	2.1	1.9	1.5	1.2	1.4	1.3	1.1	0.7	-1.1	-0.5
Hungary	0.8	1.3	1.3	1.4	1.4	0.6	1.3	1.2	1.2	1.2	0.6	0.5
Ireland	2.0	5.4	5.7	5.4	5.2	2.7	5.9	6.1	6.1	5.3	3.1	2.7
Italy	8.5	6.8	6.2	5.9	6.2	7.5	8.0	7.4	7.3	7.1	-2.4	-0.4
Latvia	0.1	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.1
Lithuania	0.1	0.3	0.2	0.3	0.3	0.1	0.3	0.2	0.2	0.3	0.2	0.2
Luxembourg	2.5	4.8	4.6	4.7	4.0	2.2	2.7	2.5	2.8	2.8	1.4	0.5
Malta	0.2	0.3	0.3	0.3	0.3	0.1	0.2	0.2	0.2	0.2	0.1	0.1
Netherlands	8.2	7.3	7.5	7.6	7.6	9.1	7.3	7.8	7.6	7.5	-0.6	-1.6
Poland	1.3	2.5	2.2	2.5	2.5	1.1	2.3	2.0	2.4	2.2	1.2	1.1
Portugal	1.8	1.7	1.6	1.5	1.2	1.4	1.3	1.2	1.2	0.8	-0.5	-0.5
Romania	0.3	0.9	0.8	0.7	0.8	0.2	0.9	0.9	0.8	0.7	0.5	0.4
Slovakia	0.3	0.6	0.5	0.5	0.5	0.3	0.8	0.7	0.6	0.5	0.2	0.2
Slovenia	0.4	0.5	0.5	0.5	0.4	0.3	0.4	0.4	0.4	0.3	0.0	0.0
Spain	10.5	9.6	9.1	8.9	7.8	5.4	7.1	6.8	6.4	5.5	-2.7	0.1
Sweden	2.7	3.2	3.2	3.7	3.2	4.1	3.4	3.2	3.5	3.4	0.5	-0.7
United Kingdom	14.6	12.0	12.1	11.6	12.1	13.4	11.1	10.5	9.9	9.9	-2.5	-3.5

Source: UN (adjusted by wiiw); own calculations.

The individual country's contributions to intra-EU services trade flows are reported in Table 2.7.2. One finds again that the larger countries are the main exporters and importers of intra-EU services (i.e. the United Kingdom, France and Germany). Over time, the United Kingdom lost about 2.5 and 3.5 percentage points in contributions to intra-EU exports and imports respectively, while Ireland experienced significant increases (3.1 and 2.7 percentage points respectively).

Summarising, services trade developed a bit more dynamically before the crisis and underwent a less severe trade slump compared to goods trade. However, after the crisis global services flows were even more anaemic than global flows in goods. Thus the notion of a 'global trade slowdown' applies as well – or even more so – for services trade. Similar to goods trade, intra-EU flows and EU trade with the rest of the world in services trade has underperformed compared to global developments.

## 2.7.2. Has the EU become 'flatter'?

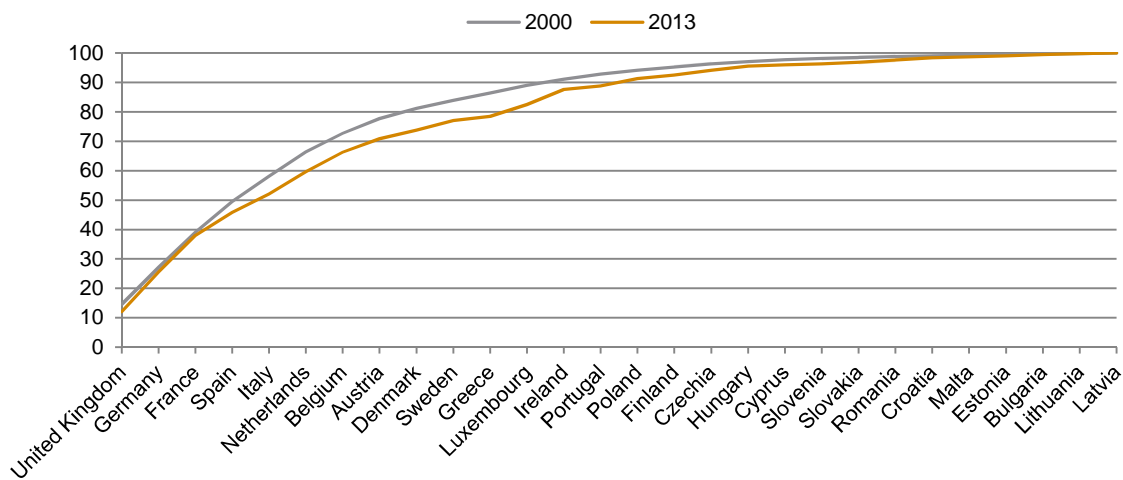
In the light of the above evidence, the question arises again as to whether European integration has led to a 'flatter' Europe as was already discussed in the context of goods trade. The same set of indicators is used to discuss this and related questions in this section.

### Concentration: Herfindahl index

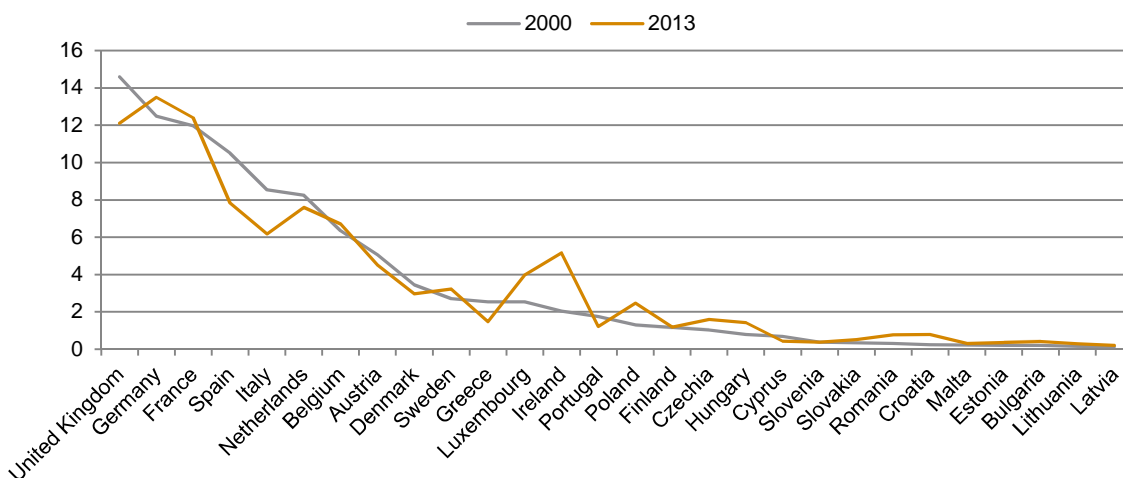
Starting with the contributions to intra-EU trade, the Herfindahl index – reported in Table 2.7.3 – provides a measure indicating whether there has been a tendency towards more or less concentration of services trade across Member States. Similar to goods trade, concentration had slightly declined for both intra-EU exports and intra-EU imports until the crisis year, 2008; however, this indicator of concentration has been relatively stable since 2009. In comparison, the Herfindahl index for GDP increased relatively more strongly due to large differences in GDP growth rates indicating that concentration in services trade activities across European countries has been slightly less significant when compared to the overall level of activities.

**Figure 2.7.3a / Concentration of intra-EU-28 exports (in %)**

#### Cumulative shares of contributions to intra-EU exports



#### Contributions to intra-EU-28 exports, in %



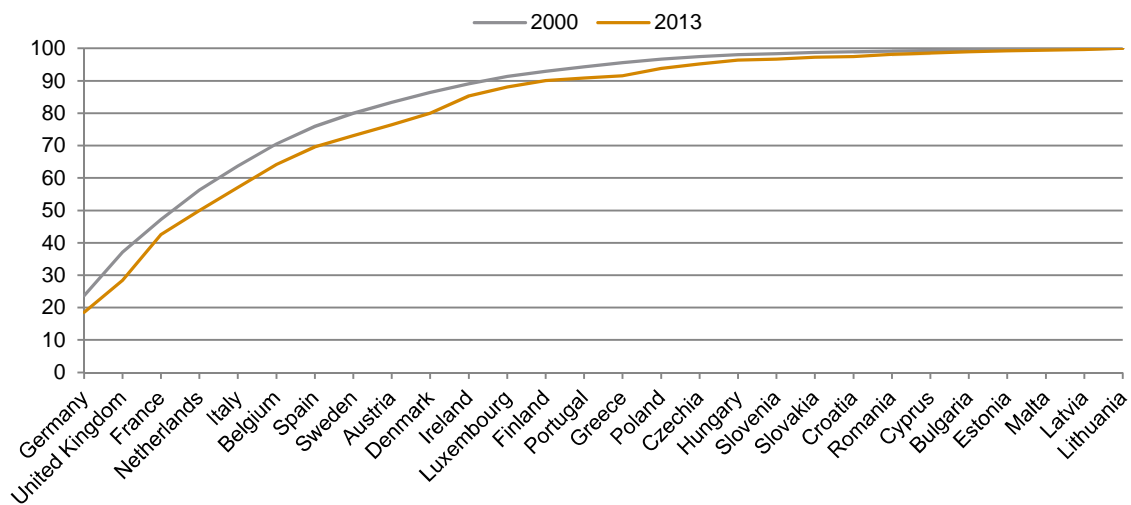
Source: UN (adjusted by wiiw); own calculations.



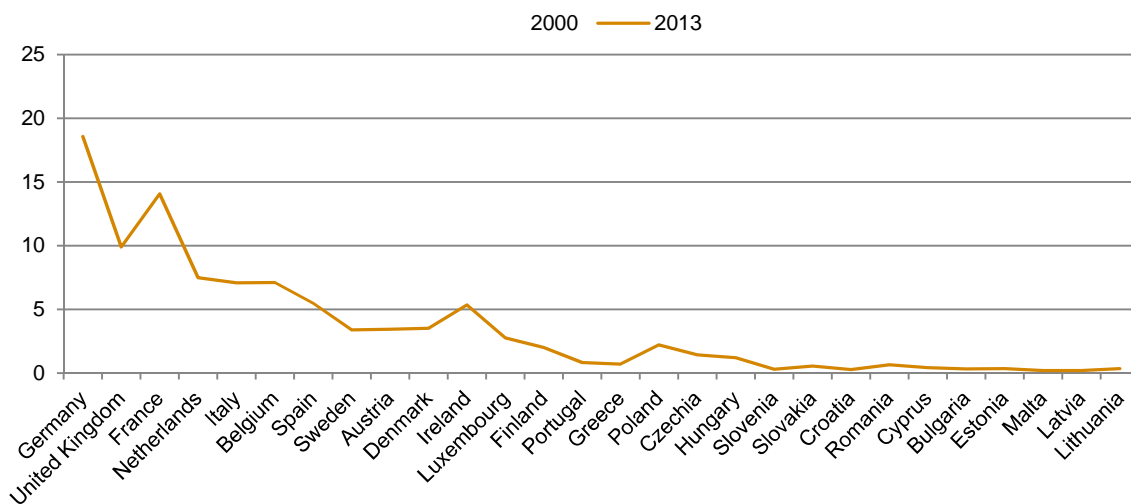
Figures 2.7.3a and 2.7.3b provide some further insights into the performance of individual countries. Considering exports, the big losers are the United Kingdom, Spain, Italy and Greece, whereas Ireland and Luxembourg, as well as some of the EU-CEE countries, have gained in shares. This is a very similar pattern to the one found for goods trade (Figure 2.3.4) where, however, gains for the EU-CEE economies were even more pronounced. Changes with respect to intra-EU imports are less pronounced, again a finding similar to goods trade.

**Figure 2.7.3b / Concentration of intra-EU-28 imports (in %)**

**Cumulative shares of contributions to intra-EU-28 imports**



**Contributions to intra-EU imports, in %**



Source: UN (adjusted by wiiw); own calculations.

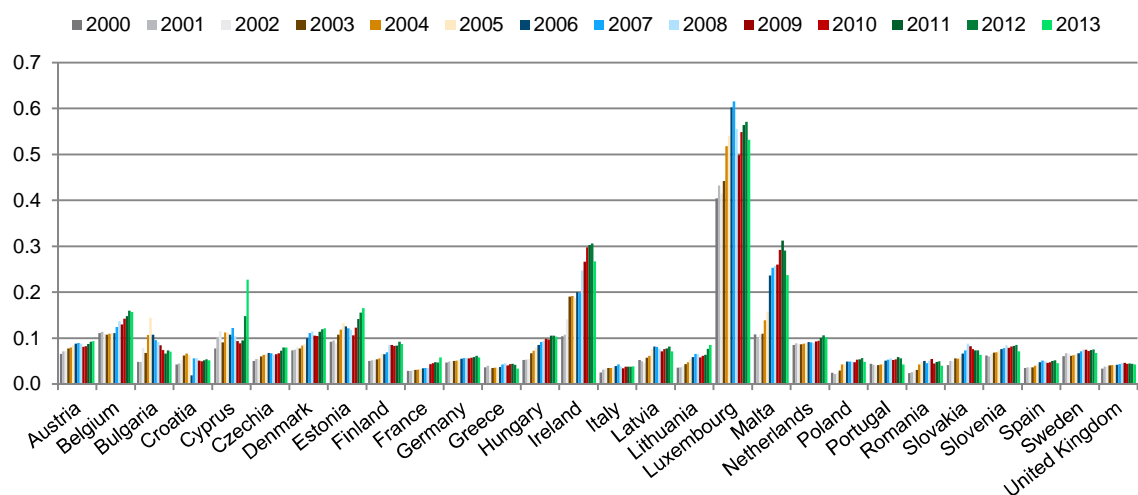
**Table 2.7.3 / Herfindahl index of contributions to intra-EU services trade**

	Exports	Imports	GDP
2000	0.088	0.111	0.131
2001	0.086	0.109	0.129
2002	0.084	0.106	0.127
2003	0.081	0.103	0.125
2004	0.079	0.098	0.124
2005	0.077	0.094	0.121
2006	0.077	0.092	0.120
2007	0.076	0.089	0.118
2008	0.073	0.086	0.114
2009	0.076	0.088	0.115
2010	0.076	0.088	0.115
2011	0.077	0.088	0.116
2012	0.077	0.088	0.117
2013	0.079	0.091	0.117

Source: UN (adjusted by wiiw); own calculations.

### Exports-to-GDP ratio

The exports-to-GDP ratio for services is presented in Figure 2.7.4. Apart from a few countries (Belgium, Ireland, Luxembourg and Malta), this ratio developed much less dynamically than that of the goods trade (see Section 2.3).

**Figure 2.7.4 / Services exports-to-GDP ratio**

Source: UN (adjusted by wiiw); WDI; own calculations.

### Relative concentration measures

The relative concentration measure depicted in Figure 2.7.5 (see Table 2.7.4 for components) indicates that intra-EU exports tend to have become less concentrated when compared to GDP, though this might have been driven by the dynamics in GDP which were larger in the EU-CEE countries, for example. The findings for this index are in line with those of the Herfindahl index (when combined with the

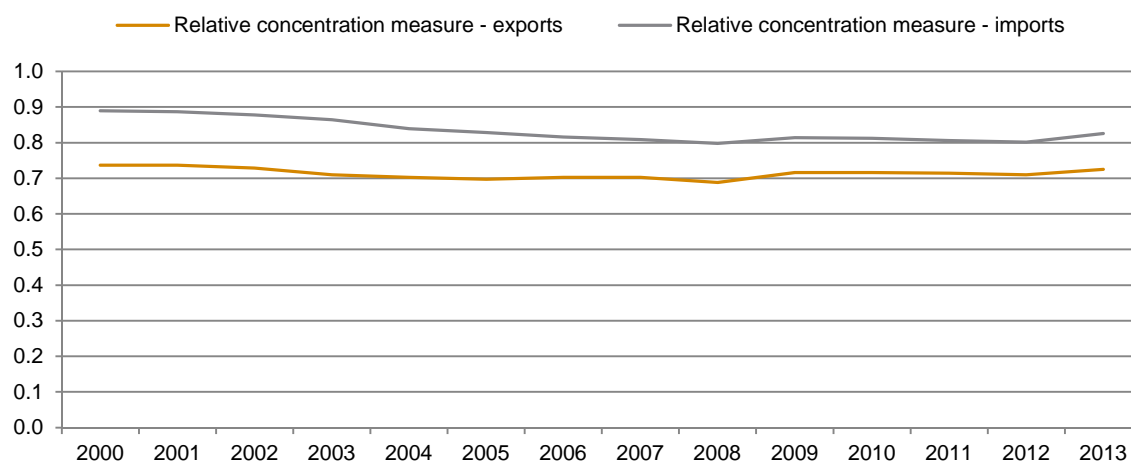
concentration in overall activity) as one finds that concentration declined only slightly between 2000 and 2008, and stabilised or increased only slightly thereafter, suggesting that services export activities concentrated slightly more after the crisis (as compared to GDP concentration).

**Table 2.7.4 / Relative concentration of intra-EU services trade**

	Standard deviation of export shares	Standard deviation of GDP shares	Covariance of exports	Covariance of GDP	Relative concentration measure	Standard deviation of import shares	Standard deviation of GDP shares	Covariance of imports	Covariance of GDP	Relative concentration measure
2000	4.380	5.946	1.226	1.665	0.737	5.291	5.946	1.481	1.665	0.890
2001	4.335	5.884	1.214	1.647	0.737	5.216	5.884	1.461	1.647	0.887
2002	4.244	5.826	1.188	1.631	0.729	5.113	5.826	1.432	1.631	0.878
2003	4.088	5.758	1.145	1.612	0.710	4.975	5.758	1.393	1.612	0.864
2004	4.014	5.717	1.124	1.601	0.702	4.795	5.717	1.343	1.601	0.839
2005	3.928	5.633	1.100	1.577	0.697	4.666	5.633	1.306	1.577	0.828
2006	3.918	5.574	1.097	1.561	0.703	4.549	5.574	1.274	1.561	0.816
2007	3.872	5.510	1.084	1.543	0.703	4.455	5.510	1.247	1.543	0.808
2008	3.710	5.392	1.039	1.510	0.688	4.304	5.392	1.205	1.510	0.798
2009	3.880	5.421	1.086	1.518	0.716	4.412	5.421	1.235	1.518	0.814
2010	3.885	5.426	1.088	1.519	0.716	4.405	5.426	1.233	1.519	0.812
2011	3.888	5.444	1.089	1.524	0.714	4.385	5.444	1.228	1.524	0.806
2012	3.893	5.487	1.090	1.536	0.709	4.396	5.487	1.231	1.536	0.801
2013	3.982	5.494	1.115	1.538	0.725	4.538	5.494	1.271	1.538	0.826

Source: UN; own calculations; wiiw adjustments and calculations.

**Figure 2.7.5 / Relative concentration of intra-EU services trade**



Source: UN; own calculations; wiiw adjustments and calculations.

### Clustering measure

The increase in the specialisation in services export activities particularly increased in countries which are geographically closer to each other. This is suggested by the development of the clustering measure (see Table 2.7.5 for components and Figure 2.7.6 for a graphical representation). For exports, this has been steadily increasing until 2010 from which on it stabilised. Thus services exports activities became regionally more concentrated as compared to GDP developments (in countries like United Kingdom, Belgium, Netherlands, etc.). This is oppositely the case with respect to imports which clustered less until

the crisis year 2008, from which on however increased again. The reason for this is the sluggish growth of GDP in the countries less specialised in services activities.

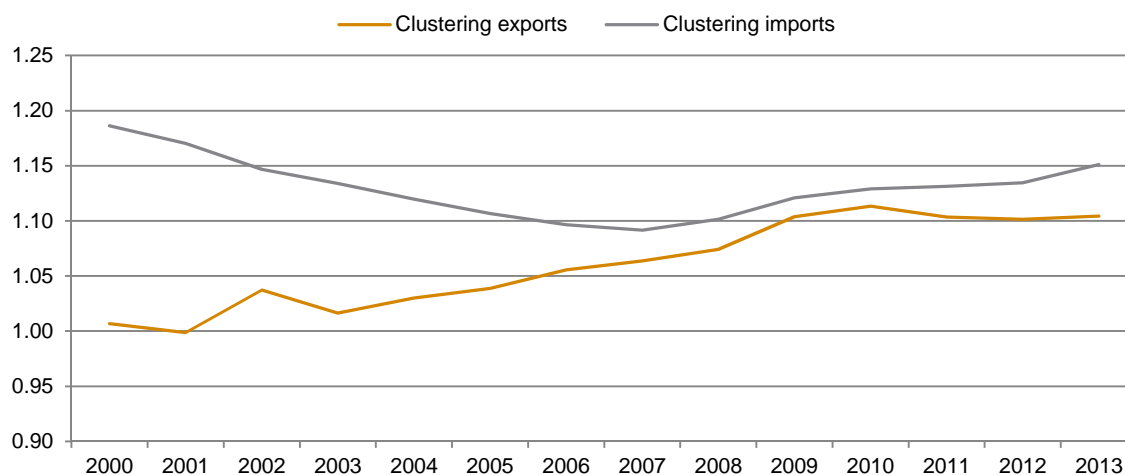
**Table 2.7.5 / Clustering of intra-EU services trade**

	Intra-EU exports			Intra-EU imports		
	Exports	GDP	Clustering	Imports	GDP	Clustering
2000	0.19	0.19	1.01	0.23	0.19	1.19
2001	0.19	0.19	1.00	0.22	0.19	1.17
2002	0.20	0.19	1.04	0.22	0.19	1.15
2003	0.19	0.19	1.02	0.21	0.19	1.13
2004	0.19	0.19	1.03	0.21	0.19	1.12
2005	0.19	0.18	1.04	0.20	0.18	1.11
2006	0.19	0.18	1.06	0.20	0.18	1.10
2007	0.19	0.18	1.06	0.20	0.18	1.09
2008	0.19	0.18	1.07	0.20	0.18	1.10
2009	0.20	0.18	1.10	0.20	0.18	1.12
2010	0.20	0.18	1.11	0.20	0.18	1.13
2011	0.20	0.18	1.10	0.20	0.18	1.13
2012	0.20	0.18	1.10	0.21	0.18	1.13
2013	0.20	0.18	1.10	0.21	0.18	1.15

Source: UN; own calculations; wiiw adjustments and calculations.

These results suggest that the concentration of export activities has been slightly decreasing, despite some countries having been relatively strongly specialised in services export activities (thus the GDP growth effect outweighed the specialisation effect). Nonetheless, the countries having more specialisation in services exports activities are regionally clustered. These trends are therefore similar to those for goods trade, though different regions are involved.

**Figure 2.7.6 / Clustering measure**

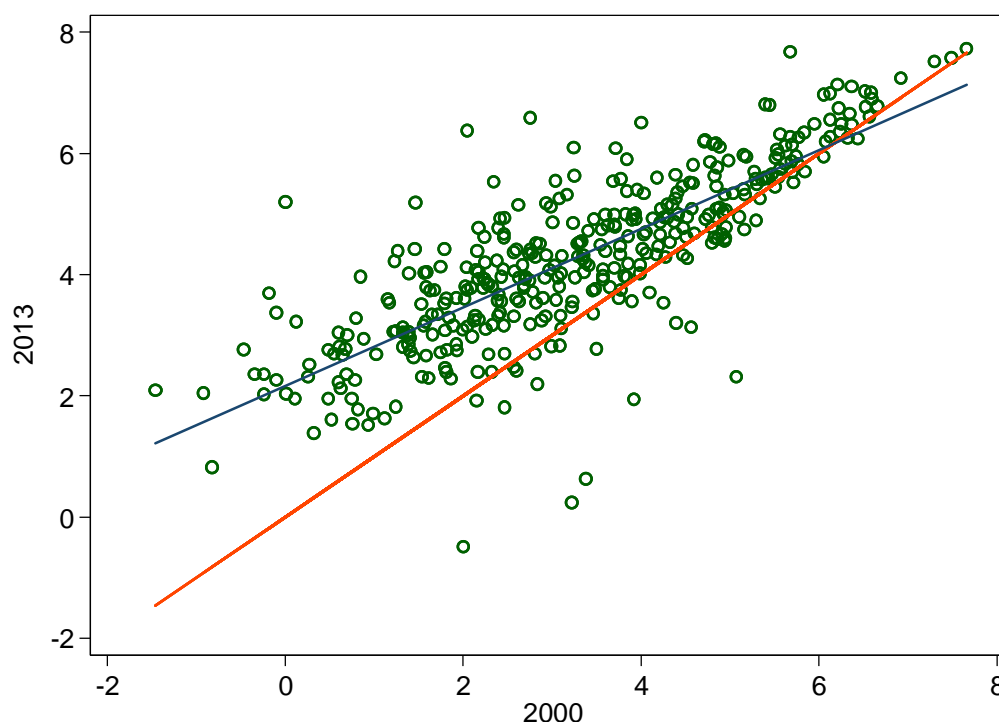


Source: UN; own calculations; wiiw adjustments and calculations.

### 2.7.3. Developments of bilateral gross trade intensities

This leads us to consider the intensity of bilateral gross trade flows amongst EU Member States for services trade and their evolution over time. As expected, from increasing integration one finds strong increases in these intensities as reported in Figures 2.7.7 (which shows all bilateral intensities in 2000 and 2014) and 2.7.8 which shows the means by country.

**Figure 2.7.7 / Bilateral gross trade intensities (in logs)**

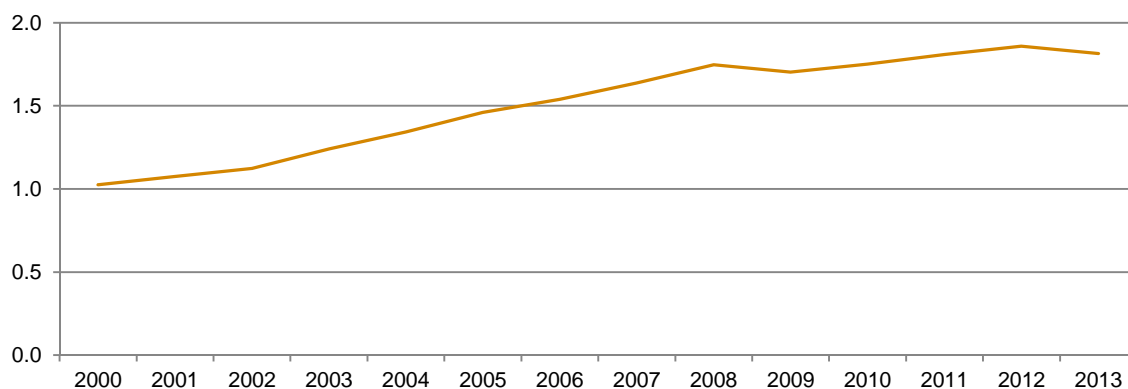
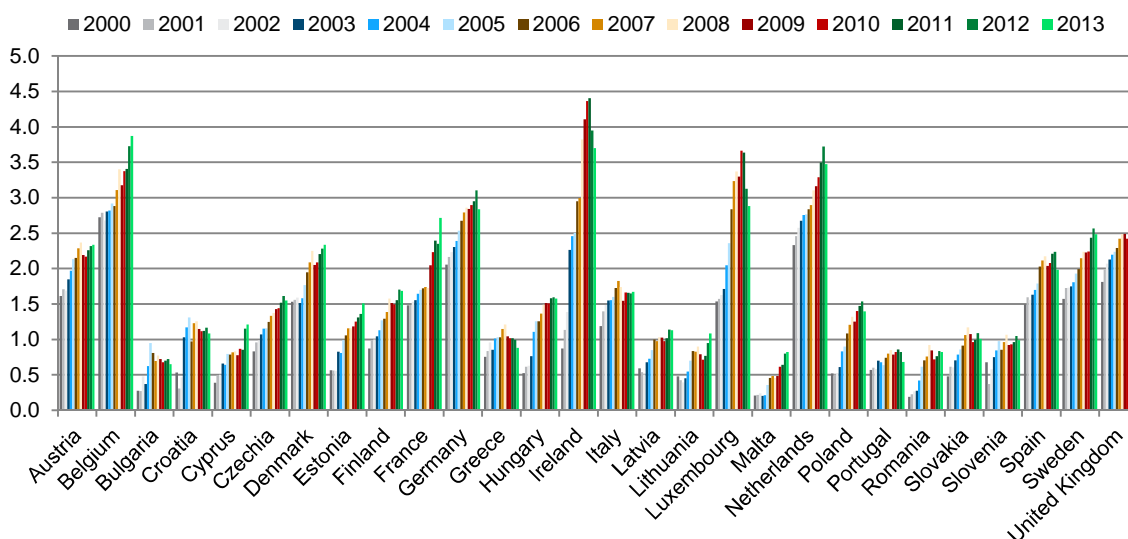


Source: UN; own calculations; wiiw adjustments and calculations.

As one can see, the bilateral intensities strongly increased over time for almost all countries. The intensities also increased after the crisis in most cases; with the exceptions of Bulgaria, Ireland and Luxembourg where intensities declined, and Croatia, Portugal, Romania, Slovakia and Slovenia where they remained stable.

This observation is also supported by the regression results presented in Table 2.7.6 which show that there was a significant increase in bilateral intensities between 2000 and 2008. In contrast to goods trade, these intensities remained stable in the crisis year (the slope coefficient is not significantly different from one; so the overall effect is small). However, it increased at a lower level (though significant) after the crisis. From 2011-2013 it even declined which was driven by a few countries (e.g. Bulgaria, Greece, Ireland, Luxembourg and Portugal) as can be seen in Figure 2.7.8.

In conclusion, these results suggest that Europe experienced strong increases in bilateral trade intensities before the crisis which, however, stopped after the crisis, thus marking a structural break in these trends. As for bilateral goods trade, the reasons behind this are not yet fully clear.

**Figure 2.7.8 / Bilateral gross trade intensities****Overall mean****Means by country**

Source: UN; own calculations; wiiw adjustments and calculations.

**Table 2.7.6 / Regression results**

	(1) 2000-2013	(2) 2000-2008	(3) 2008-2009	(4) 2009-2011	(5) 2011-2013
BGTI	1.213*** (0.0253)	1.118*** (0.0278)	1.003*** (0.00688)	1.035*** (0.00582)	0.868*** (0.0155)
Constant	0.573*** (0.0603)	0.602*** (0.0662)	-0.0490** (0.0233)	0.0466** (0.0199)	0.245*** (0.0557)
Observations	756	756	756	756	756
R-squared	0.752	0.682	0.966	0.977	0.806
BGTI=1	0.000	0.000	0.664	0.000	0.000

Note: Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## 2.7.4. Patterns and trends for balance of payments categories

How do these patterns hold at a more detailed level? In this section, the developments at the level of eleven broad BoP categories are outlined. The structure of this subsection follows those above, i.e. first discussing some global trends and then providing information on specialisation, concentration and clustering.

Table 2.7.7 indicates that the bulk of services trade (globally) is in transportation services (20%), travel (18%) and other business services (27%). Other important categories are computer and information services (8%) and royalties and licences (about 10%).

**Table 2.7.7 / Structure of world trade (in % of global trade by industry)**

	2000	2008	2009	2011	2013
205 Transportation	23.8	23.7	20.9	21.1	20.7
236 Travel	23.8	18.6	18.4	17.3	17.9
245 Communications services	1.6	1.7	1.7	1.7	1.1
249 Construction services	6.1	5.4	5.4	5.0	5.4
253 Insurance services	2.6	3.4	3.6	3.5	3.5
260 Financial services	2.9	4.1	4.1	4.0	4.0
262 Computer and information services	4.2	6.0	6.3	6.9	7.6
266 Royalties and licence fees	7.3	8.5	9.4	9.8	9.8
268 Other business services	23.7	25.7	27.3	28.1	27.4
287 Personal, cultural, and recreational services	1.3	1.0	1.0	1.0	1.0
291 Government services, n.i.e.	2.8	1.8	1.9	1.6	1.6

Source: UN; own calculations; wiiw adjustments and calculations.

The shares of intra-EU trade in global trade flows range from more than 30% (e.g. travel and computer and information services) to low numbers of about 7% (e.g. in construction services) as indicated in Table 2.7.8. These shares generally increased until the crisis years and then went into decline in line with the results reported for total trade above.

The shares of intra-EU exports (Table 2.7.9) range from more than two-thirds (travel and financial services) to about 40% (construction services). These generally declined after the crisis indicating the extra-EU trade had become more important.

Finally, Table 2.7.10 presents the structure of intra-EU trade (exports) which follows similar patterns as those already reported for world trade. Transportation, travel and other business services account for almost 70% of total intra-EU exports.

With regard to the concentration of intra-EU services exports by BoP category, the Herfindahl index (Figure 2.7.9) indicates that concentration strongly increased in insurance services, financial services and computer and information services until about 2006, whereas for other categories one finds slight decreases of concentration or relative stability. These patterns reversed after the crisis. For example, concentration in other business services increased whereas those for insurance services stabilised and concentration in computer and information services further decreased.

**Table 2.7.8 / Share of intra-EU trade (in % of global trade)**

	2000	2008	2009	2011	2013
205 Transportation	20.9	25.4	25.4	24.5	23.5
236 Travel	32.6	39.3	38.1	35.7	33.9
245 Communications services	34.4	43.8	43.1	41.3	25.2
249 Construction services	10.4	11.9	11.9	9.7	7.5
253 Insurance services	21.0	19.8	20.5	17.4	19.7
260 Financial services	31.7	40.1	36.6	34.5	35.0
262 Computer and information services	16.7	26.4	26.7	22.9	21.6
266 Royalties and licence fees	8.1	13.6	17.0	14.2	11.8
268 Other business services	23.7	24.9	24.1	23.6	22.3
287 Personal, cultural, and recreational services	25.7	27.9	28.6	30.2	29.1
291 Government services, n.i.e.	7.2	10.0	10.3	8.7	7.8

Source: UN; own calculations; wiiw adjustments and calculations.

**Table 2.7.9 / Share of intra-EU exports (in % of EU total exports)**

	2000	2008	2009	2011	2013
205 Transportation	51.5	56.7	56.4	56.6	56.9
236 Travel	67.3	72.9	71.3	69.8	68.4
245 Communications services	71.7	73.5	72.8	71.0	63.1
249 Construction services	38.6	50.2	50.0	45.4	38.0
253 Insurance services	48.1	52.0	50.0	48.7	55.9
260 Financial services	55.0	71.0	69.2	68.2	66.8
262 Computer and information services	59.1	65.9	66.5	63.6	62.2
266 Royalties and licence fees	44.3	52.8	57.6	52.4	48.2
268 Other business services	63.0	61.5	60.3	60.6	60.7
287 Personal, cultural, and recreational services	59.9	58.6	58.6	59.4	59.9
291 Government services, n.i.e.	27.0	33.7	33.3	31.0	34.8

Source: UN; own calculations; wiiw adjustments and calculations.

**Table 2.7.10 / Structure of intra-EU exports (trade) (in % of EU total intra-exports)**

	2000	2008	2009	2011	2013
205 Transportation	21.8	22.6	20.2	21.1	21.1
236 Travel	34.0	27.4	26.7	25.1	26.4
245 Communications services	2.5	2.7	2.8	2.8	1.2
249 Construction services	2.8	2.4	2.4	2.0	1.8
253 Insurance services	2.4	2.6	2.8	2.5	3.0
260 Financial services	4.0	6.3	5.7	5.6	6.1
262 Computer and information services	3.0	6.0	6.4	6.4	7.1
266 Royalties and licence fees	2.6	4.3	6.0	5.7	5.0
268 Other business services	24.6	24.1	25.1	27.0	26.6
287 Personal, cultural, and recreational services	1.4	1.0	1.1	1.3	1.3
291 Government services, n.i.e.	0.9	0.7	0.7	0.6	0.5

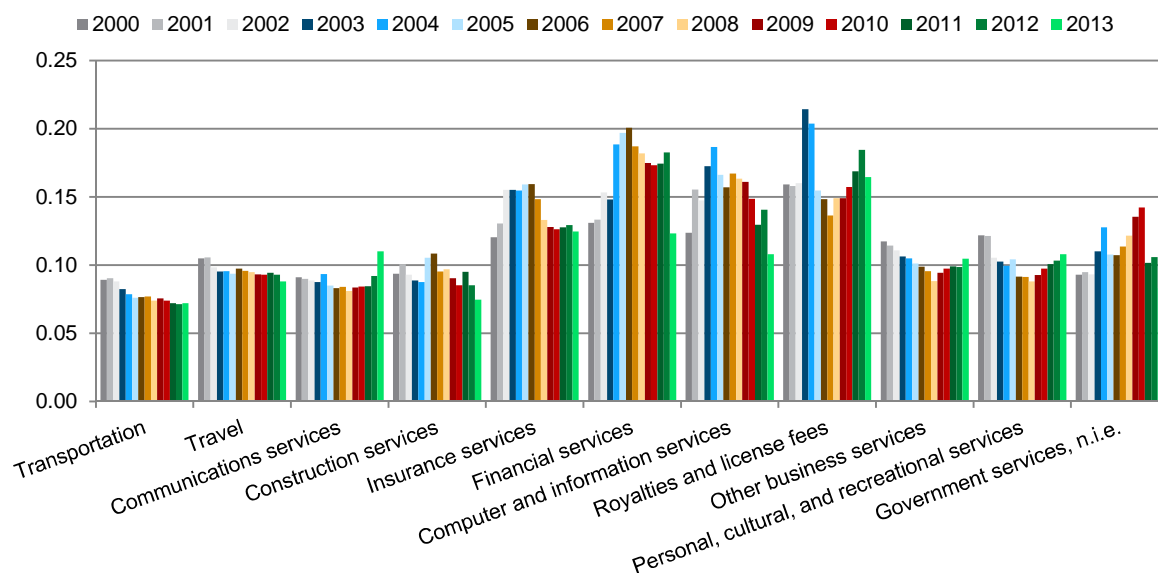
Source: UN; own calculations; wiiw adjustments and calculations.

With respect to overall specialisation in the various services categories (see Table 2.7.11) one finds that Ireland, Luxembourg, Malta, Sweden and the United Kingdom are relatively close to the EU average whereas Greece, Croatia, Spain and Portugal deviate more due to travel. The overall changes with



respect to relative specialisation are rather diverse across countries and do not follow a common pattern.

**Figure 2.7.9 / Herfindahl measure by BoP category**



Source: UN; own calculations; wiiw adjustments and calculations.

**Table 2.7.11 / Specialisation index**

	2000	2008	2009	2011	2013
Austria	0.54	0.56	0.56	0.58	0.60
Belgium	0.50	0.52	0.50	0.51	0.49
Bulgaria	0.55	0.58	0.52	0.51	0.52
Croatia	0.61	0.68	0.66	0.67	0.67
Cyprus	0.58	0.48	0.51	0.53	0.51
Czech Republic	0.61	0.57	0.52	0.57	0.50
Denmark	0.59	0.60	0.56	0.58	0.60
Estonia	0.62	0.54	0.54	0.53	0.54
Finland	0.52	0.43	0.44	0.46	0.48
France	0.56	0.56	0.51	0.51	0.50
Germany	0.51	0.45	0.43	0.46	0.47
Greece	0.65	0.66	0.65	0.64	0.63
Hungary	0.56	0.50	0.49	0.51	0.52
Ireland	0.38	0.44	0.47	0.40	0.40
Italy	0.61	0.53	0.53	0.52	0.54
Latvia	0.52	0.56	0.56	0.54	0.54
Lithuania	0.55	0.61	0.61	0.61	0.60
Luxembourg	0.42	0.43	0.42	0.42	0.38
Malta	0.46	0.42	0.41	0.38	0.40
Netherlands	0.50	0.48	0.48	0.49	0.50
Poland	0.57	0.60	0.59	0.56	0.57
Portugal	0.62	0.61	0.60	0.61	0.61
Romania	0.49	0.46	0.45	0.47	0.52
Slovakia	0.55	0.54	0.53	0.57	0.57
Slovenia	0.65	0.59	0.60	0.59	0.60
Spain	0.68	0.66	0.65	0.65	0.65
Sweden	0.49	0.45	0.42	0.43	0.42
United Kingdom	0.49	0.43	0.42	0.46	0.46

Source: UN; own calculations; wiiw adjustments and calculations.

In looking at relative concentration, Table 2.7.12 indicates that transportation, travel, communication and construction services exports are less concentrated than GDP. This is also the case for exports in other business services and personal and cultural services. Financial services and computer and information services are however more concentrated than GDP. More interestingly, most of the export activities are spatially clustered (Table 2.7.13) with financial services being particularly so. Here, however, no specific trend can be seen.

**Table 2.7.12 / Relative concentration index by industry**

	2000	2008	2009	2011	2013
205 Transportation	-0.25	-0.30	-0.29	-0.32	-0.33
236 Travel	-0.15	-0.13	-0.15	-0.14	-0.20
245 Communications services	-0.24	-0.24	-0.22	-0.22	-0.04
249 Construction services	-0.22	-0.12	-0.17	-0.14	-0.31
253 Insurance services	-0.06	0.11	0.08	0.07	0.04
260 Financial services	0.00	0.36	0.32	0.32	0.04
262 Computer and information services	-0.04	0.28	0.26	0.08	-0.06
266 Royalties and licence fees	0.14	0.20	0.19	0.29	0.26
268 Other business services	-0.07	-0.18	-0.14	-0.11	-0.08
287 Personal, cultural, and recreational services	-0.05	-0.18	-0.15	-0.10	-0.06
291 Government services, n.i.e.	-0.23	0.05	0.12	-0.09	-0.24

Source: UN; own calculations; wiiw adjustments and calculations.

**Table 2.7.13 / Clustering index by industry**

	2000	2008	2009	2011	2013
205 Transportation	0.099	0.043	0.062	0.020	0.021
236 Travel	-0.213	-0.170	-0.153	-0.146	-0.122
245 Communications services	0.235	0.044	0.071	0.080	0.155
249 Construction services	0.203	0.247	0.288	0.393	0.294
253 Insurance services	0.239	0.284	0.273	0.255	0.351
260 Financial services	1.920	3.786	3.399	3.519	1.670
262 Computer and information services	0.324	0.729	0.634	0.505	0.410
266 Royalties and licence fees	0.411	1.340	1.326	1.467	1.031
268 Other business services	0.252	0.183	0.213	0.203	0.270
287 Personal, cultural, and recreational services	0.401	0.184	0.184	0.170	0.335
291 Government services, n.i.e.	0.239	0.331	0.298	0.390	0.245

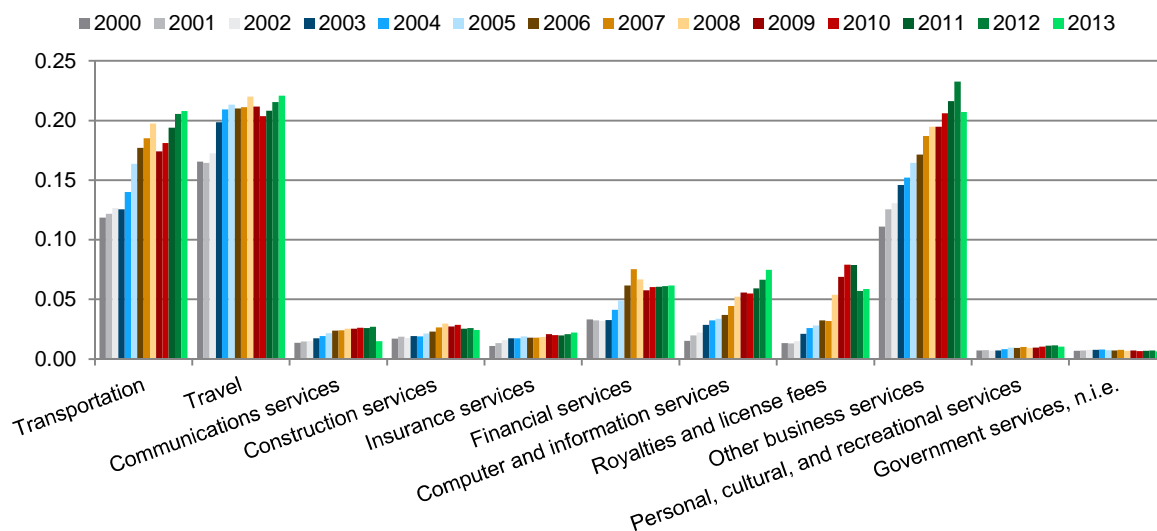
Source: UN; own calculations; wiiw adjustments and calculations.

Finally, Figure 2.7.10 shows the index of bilateral gross trade intensity by BoP category. These are relatively high in transportation (with a strong increase between 2000 and 2008), travel and also other business services, which experienced a strong increase over the period considered. These intensities are lower in the other categories though one also finds some strong increases for some of them (e.g. computer and information services).

Summarising, concentration strongly increased in insurance services, financial services and computer and information services until about 2006; however, after the crisis these patterns reversed. The overall tendency towards less concentration is driven by the trends in the large categories (transport, travel and other business services) which are characterised by a decline in concentration. However, relative concentration in business services increased again after the crisis. Bilateral trade intensities strongly increased in transport services and other business services. For the latter, this trend also continued after the crisis whereas it flattened e.g. in transportation services in the same period. This latter aspect points

towards an increasing integration of the European services market and potentially a general positive impact of the Services Directive – though not yet fully completed (see Section 2.2.5) – particularly in other business services. However, it is difficult to quantitatively assess from this analysis to which extent policies or other factors are driving these outcomes. It is interesting to note that for business services – and services trade compared to goods trade in general – has been more resilient to the crisis. However, again there is need for awareness that the levels of trade intensities are rather different across countries pointing again towards patterns of agglomeration and specialisation in Europe. Reasons for this are not fully clear but most likely issues of education, economies of scale of services provision, as well as structural lock-in effects might play a role. Again, the potential impacts of further liberalisation steps – which are found to be positive on overall GDP (e.g. Monteagudo et al., 2012) – have to be evaluated also with respect to this aspect to circumvent ‘integration fatigue’.

**Figure 2.7.10 / Bilateral gross trade intensity by industry**



Source: UN; own calculations; wiiw adjustments and calculations.

## 2.8. TRADE-TO-GDP ELASTICITIES AND MARKET SHARE DECOMPOSITION: A GRAVITY APPROACH

### 2.8.1. Introduction

The results of the analysis in the previous sections strongly pointed towards a change in the relationship between (bilateral) exports and GDP developments in the aftermath of the crisis. Further, it has been argued that the developments of intra-EU trade and EU-imports from the world have been particularly sluggish. Both of these aspects have already become prominent over the last few years under the heading of ‘peak trade’, i.e. how to explain the relatively sluggish growth of world trade volume (the ‘global trade slowdown’). Hoekman (2015) provides a series of articles on this issue tackling the question of whether the elasticities of the trade-to-GDP ratio declined (see Constantinescu et al., 2015,

for evidence<sup>16</sup>). It is argued that one needs to differentiate between the ‘China factor’ and ‘diminishing returns to GVC strategies’ as explanations for slower trade. Particularly, Ollivaud and Schwellnus (2015) even argue that the global trade slowdown can be explained by trade weakness of the euro area. In this section these aspects concerning the potential changes in the trade-to-GDP elasticities are tackled by means of gravity equations focusing on the intra-EU developments. The question is whether the slowdown of export dynamics is driven by slow GDP growth or whether there has been in addition a significant change in the relation between GDP and export growth.

### 2.8.2. Methodological approach

For this purpose, the employed gravity equation of exports is specified as follows:

$$\ln EXP_{ijt} = \alpha_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln POP_{it} + \beta_4 \ln POP_{jt} + \sum_{k=1}^K \gamma_k D_k + \sum_{k=1}^K \delta_k D_k * \ln GDP_{it} + \sum_{k=1}^K \tau_k D_k * \ln GDP_{jt} + \varphi_{ij} + \epsilon_{ijt} \quad (2.8.1)$$

where  $\ln EXP_{ijt}$  denotes the logarithm of exports from country  $i$  to country  $j$  at time  $t$ . Furthermore,  $\ln GDP_{it}$  and  $\ln GDP_{jt}$  refer to the logarithm of real GDP (in US-\$) of country  $i$  and  $j$ , respectively.  $\ln POP_{it}$  and  $\ln POP_{jt}$  are the logarithm of the population of country  $i$  and  $j$ , respectively.  $D_k$  are dummy variables for four different time periods, where  $D_1$  refers to the pre-crisis period between 2000 and 2008 (as reference period),  $D_2$  refers to the crisis-year of 2009,  $D_3$  to the period between 2010 and 2011, while  $D_4$  refers to the period between 2012 and 2014.  $D_k * \ln GDP_{it}$  and  $D_k * \ln GDP_{jt}$  are interaction terms between either of the  $k$  different time dummies  $D_k$  and the logarithm of real GDP of countries  $i$  and  $j$ , respectively. Hence,  $\beta_1$  and  $\beta_2$  in equation (1) measure the elasticities of exports to own (exporter) and foreign (importer) GDP for the reference period 2000 to 2008, respectively. In contrast,  $\delta_2$  to  $\delta_4$  and  $\tau_2$  to  $\tau_4$  measure the change in the elasticities of exports to own and foreign GDP, respectively, relative to the pre-crisis period and capture whether, how and how permanently export elasticities have changed during and in the aftermath of the crisis. Finally,  $\varphi_{ij}$  refers to time-invariant country-pair fixed effects while  $\epsilon_{ijt}$  is the error term.

Alternatively, to also determine the *joint* effects of real GDP, population as well as the change in export elasticities to GDP, the following specification is estimated:

$$\ln EXP_{ijt} = \alpha_0 + \beta_1 \ln(GDP_{it} * GDP_{jt}) + \beta_2 \ln(POP_{it} * POP_{jt}) + \sum_{k=1}^K \gamma_k D_k + \sum_{k=1}^K \delta_k D_k * \ln(GDP_{it} * GDP_{jt}) + \varphi_{ij} + \epsilon_{ijt} \quad (2.8.2)$$

where  $\ln(GDP_{it} * GDP_{jt})$  is the logarithm of country pairs’ combined real GDP (in US-\$),  $\ln(POP_{it} * POP_{jt})$  is the logarithm of country pairs’ combined population and  $D_k * \ln(GDP_{it} * GDP_{jt})$  are interaction terms between either of the  $k$  different time dummies  $D_k$  and the logarithm of country pairs’ combined real GDP.

<sup>16</sup> See also Bussière et al. (2013) and Constantinescu et al. (2015) for further evidence.

### 2.8.3. Manufacturing trade

#### *Results at the country level*

Table 2.8.1 presents the results for the manufacturing sector for the period between 2000 and 2014 of the trade gravity models as specified in equation (2.8.1) (in columns (1) to (3)) and equation (2) (in columns (4) to (6)) for three different types of EU-28 manufacturing exports: columns (1) and (4) refer to total EU-28 manufacturing exports, columns (2) and (5) refer to extra-EU-28 manufacturing exports while columns (3) and (6) refer to intra-EU-28 manufacturing exports.<sup>17</sup>

In general, for the pre-crisis period from 2000 to 2008, columns (1) to (3) point to a consistently stronger foreign market effect of EU-28 manufacturing exports since, with between 0.5 and 0.6, the elasticities of exports to own GDP are generally lower than the elasticities of exports to foreign GDP, which range between 0.7 and 0.9. More specifically, the elasticity of exports to own GDP is lowest for intra-EU-28 exports, followed by total EU-28 exports, and is highest for extra-EU-28 exports. In contrast, the elasticity of exports to foreign GDP is lowest for extra-EU-28 exports, followed by total EU-28 exports, and is highest for intra-EU-28 exports. Hence, for intra-EU-28 manufacturing exports, the foreign-income elasticity of exports is almost twice as high as the domestic-income elasticity of exports while for both extra-EU-28 exports and total EU-28 exports, the discrepancy between foreign- and domestic-income elasticities is more muted. Furthermore, the combined GDP elasticity of trade partners is consistently around 0.7 (columns (4) to (6)).

As concerns the change in export elasticities to own GDP as a result of the crisis, a consistent and persistently deteriorating trend is apparent. Particularly, the home-income elasticity of manufacturing exports not only dropped during the crisis-period of 2009 (except for extra-EU-28 exports), but further deteriorated during the two subsequent periods. This drop in the home-income elasticity of manufacturing exports was strongest for intra-EU-28 exports: During the crisis-year of 2009, the export elasticity was 0.03 percentage points lower than in the pre-crisis period. During the periods from 2010 to 2011 and from 2012 to 2014, it was even 0.05 and 0.07 percentage points lower than in the pre-crisis period, respectively. By contrast, except for intra-EU-28 exports, during as well as following the crisis of 2009, foreign-income elasticities of manufacturing exports were significantly positive indicating that these continuously increased relative to the pre-crisis period. Hence, in contrast to intra-EU-28 exports, extra-EU-28 exports profited from a continuously growing foreign-GDP effect. Moreover, the change in the combined GDP elasticity of trade partners is mixed and insignificant for total EU-28 exports, significant and positive for extra-EU-28 exports for the period from 2010 to 2011 only but – except for the crisis-year – negative and significant for intra-EU-28 exports (columns (4) to (6)).

Furthermore, domestic population size and all three types of manufacturing exports (i.e. total, extra- and intra-EU-28 manufacturing exports) are consistently negatively related. By contrast, foreign population size is negatively related to intra-EU-28 manufacturing exports only but positively related to total EU-28 and extra-EU-28 manufacturing exports. However, with only around 0.1 and 0.2, these effects are relatively small. The combined population effects of trade partners are consistently negative, but with -1.1, highest for intra-EU-28 manufacturing exports (columns (4) to (6)).

<sup>17</sup>

To conserve space, coefficients of the time dummies  $D_k$  are not reported here but are available upon request.

**Table 2.8.1 / Gravity regression results: manufacturing sector, 2000-2014**

DepVar: lnexports	(1)	(2)	(3)	(4)	(5)	(6)
	Total EU-28 exports	Extra-EU-28 exports	Intra-EU-28 exports	Total EU-28 exports	Extra-EU-28 exports	Intra-EU-28 exports
lnGDP <sub>it</sub>	0.557*** (27.823)	0.573*** (24.793)	0.456*** (15.147)			
lnGDP <sub>jt</sub>	0.703*** (42.340)	0.665*** (35.794)	0.873*** (30.371)			
lnPOP <sub>it</sub>	-1.570*** (-11.226)	-1.648*** (-10.129)	-1.214*** (-7.031)			
lnPOP <sub>jt</sub>	0.148*** (2.936)	0.232*** (4.101)	-1.019*** (-6.155)			
ln(GDP <sub>it</sub> *GDP <sub>jt</sub> )				0.668*** (94.107)	0.664*** (77.504)	0.665*** (90.951)
ln(POP <sub>it</sub> *POP <sub>jt</sub> )				-0.299*** (-6.695)	-0.258*** (-4.974)	-1.117*** (-10.295)
D <sub>2</sub> *lnGDP <sub>it</sub>	-0.015* (-1.652)	-0.013 (-1.201)	-0.027** (-2.529)			
D <sub>3</sub> *lnGDP <sub>it</sub>	-0.045*** (-6.198)	-0.043*** (-5.162)	-0.052*** (-6.089)			
D <sub>4</sub> *lnGDP <sub>it</sub>	-0.064*** (-9.617)	-0.062*** (-8.097)	-0.070*** (-8.661)			
D <sub>2</sub> *lnGDP <sub>jt</sub>	0.011 (1.641)	0.018** (2.387)	0.017* (1.716)			
D <sub>3</sub> *lnGDP <sub>jt</sub>	0.026*** (5.253)	0.032*** (5.881)	0.010 (1.364)			
D <sub>4</sub> *lnGDP <sub>jt</sub>	0.030*** (6.707)	0.039*** (7.787)	-0.008 (-1.037)			
D <sub>2</sub> *ln(GDP <sub>it</sub> *GDP <sub>jt</sub> )				0.002 (0.384)	0.008 (1.280)	-0.005 (-0.619)
D <sub>3</sub> *ln(GDP <sub>it</sub> *GDP <sub>jt</sub> )				0.003 (0.715)	0.008* (1.664)	-0.021*** (-3.203)
D <sub>4</sub> *ln(GDP <sub>it</sub> *GDP <sub>jt</sub> )				-0.001 (-0.156)	0.006 (1.450)	-0.039*** (-6.470)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.101 (0.487)	1.201 (0.460)	14.227*** (4.173)	-14.437*** (-11.087)	-15.935*** (-10.825)	14.227*** (4.135)
No of observations	71,900	61,370	10,530	71,900	61,370	10,530
R <sup>2</sup>	0.933	0.915	0.977	0.933	0.914	0.977

Source: BACI; WDI; own calculations.

Note: Robust t-statistics in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

### *Results by industries*

Similarly, trade gravity models as specified in equation (2.8.1) are also estimated for each manufacturing industry individually. Tables A.2.8.1 to A.2.8.3 in the Appendix report results<sup>18</sup> for total EU-28 manufacturing exports, for extra-EU-28 manufacturing exports and intra-EU-28 manufacturing exports, respectively.<sup>19</sup>

At the individual manufacturing industry level, the GDP and population elasticities as well as the change in own and foreign GDP elasticities are more diverse. For instance, with respect to total EU-28 manufacturing exports, pre-crisis home-income elasticities of exports are generally positive but range between 0.1 only for Other non-metallic mineral products (NACE 23) and unity for Tobacco products (NACE 12) and Computer, electronic and optical products (NACE 26) (Table A.2.8.1). Similarly, except for Tobacco products (NACE 12), all pre-crisis foreign-income elasticities are positive but generally below unity. Furthermore, the persistently deteriorating trend in the home-income elasticities of manufacturing exports is restricted to a small number of industries only, namely Wood products (NACE 16), Computer, electronic and optical products (NACE 23), Machinery and equipment n.e.c. (NACE 28), Motor vehicles, trailers and semi-trailers (NACE 29) and Other manufacturing (NACE 32). This deteriorating trend in the home-income elasticities of manufacturing exports is less persistent in industries such as Chemicals and chemical products (NACE 20), Pharmaceutical products (NACE 21), Other non-metallic mineral products (NACE 23), Fabricated metal products (NACE 25) or Electrical equipment (NACE 27) and confined to the period between 2012 and 2014 only for Paper and paper products (NACE 17) and Printing and reproduction of recorded media (NACE 18). In contrast, home-income elasticities of manufacturing exports (continuously) improved in a small number of manufacturing industries, particularly in Wearing apparel (NACE 14), Other transport equipment (NACE 30) and Furniture (NACE 31). By contrast, the foreign-income elasticities of exports improved in almost all manufacturing industries.

With respect to extra-EU-28 manufacturing exports Table A.2.8.2 points to generally positive home- and foreign-income export elasticities before the onset of the crisis. Furthermore, similar to total-EU-28 exports, as a result of the crisis, only a small number of manufacturing industries experienced continuously deteriorating home-income elasticities of manufacturing exports, such as Wood products (NACE 16), Computer, electronic and optical products (NACE 26), Machinery and equipment (NACE 28), Motor vehicles, trailers and semi-trailers (NACE 29) and Other manufacturing (NACE 32). This deteriorating trend in the home-income elasticities of manufacturing exports is less persistent in industries such as Printing and reproduction of recorded media (NACE 18), Other non-metallic mineral products (NACE 23) or Fabricated metal products (NACE 25), while it is confined to individual periods in Pharmaceutical products (NACE 21) or Electrical equipment (NACE 27). By contrast, the foreign-income elasticities of exports improved in almost all industries.

As regards intra-EU-28 manufacturing exports, before the onset of the crisis, home- and foreign-income export elasticities are generally positive (Table A.2.8.3) and partly above unity. However, a different

<sup>18</sup> In these tables only the coefficients on GDP and their changes – i.e. the trade elasticities with respect to GDP – are presented together with an indication of significance (\*\*\*, \*\*, \* which indicates significance at the 1%, 5% and 10% level).

<sup>19</sup> These results are confirmed when estimating a gravity equation as specified in equation (2.8.2). Results are not reported for reasons of space constraints.

pattern emerges for changes in crisis-related home- and foreign-income export elasticities. In particular, as a result of the crisis, home-income elasticities of manufacturing exports deteriorated in the majority of industries, except for Wearing apparel (NACE 14), where a lasting improvement in the home-income elasticities of manufacturing exports is observable. Furthermore, foreign-income elasticities of manufacturing exports improved in the majority of industries, except for Food products (NACE 10) where the foreign-income elasticities of manufacturing exports persistently deteriorated, but also for Printing and reproduction of recorded media (NACE 18), Computer, electronic and optical products (NACE 26) or Wearing apparel (NACE 14) and Furniture (NACE 31), where the foreign-income elasticities of manufacturing exports deteriorated less persistently after the crisis.

#### *Results by end-use categories*

Trade gravity models as specified in equation (2.8.1) are also estimated for each end use category individually with Tables A.2.8.4 to A.2.8.6 in the Appendix reporting results analogously as for industry levels.

In general, as regards total EU-28 manufacturing exports, prior to the crisis, home- and foreign-income export elasticities were generally positive and below unity for all end-use categories. Furthermore, crisis- and post-crisis related changes in home-income export elasticities are rather coherent across individual end-use categories. In particular, as regards total EU-28 manufacturing exports, Table A.2.8.4 points to significant and continuously deteriorating home-income elasticities of manufacturing exports in all end-use categories but Food and beverages – Primary, Goods n.e.s. as well as Food and beverages – Processed, for which no significant crisis-related changes in the home-income elasticity are observable. In contrast, with very few exceptions only (such as Industrial supply n.e.s. – Primary, Fuels and lubricants – Processed, Capital goods – Parts and accessories and Consumer goods – Semi-durable), the foreign-income elasticities of exports significantly improved in all end-use categories.

With regard to extra-EU-28 manufacturing exports, Table A.2.8.5 stresses that prior to the crisis, home- and foreign-income export elasticities were generally positive and below unity in all end-use categories. However, during and following the crisis, home-income elasticities of manufacturing exports significantly and continuously deteriorated in all end-use categories but Food and beverages – Primary, Food and beverages – Processed and Goods n.e.s. In contrast, foreign-income elasticities of exports again significantly improved in all end-use categories but Industrial supply n.e.s. – Primary. Furthermore, the change in the combined GDP elasticity of trade partners is mixed and positive for Food and beverages – Primary, Food and beverages – Processed, Industrial supply n.e.s. – Processed, Other transport equipment, Consumer goods – Non-durable and Goods n.e.s. By contrast, it is negative and continuously deteriorated for Capital goods – Parts and accessories and negative but confined to individual periods only for Industrial supply n.e.s. – Primary, Fuels and lubricants – Processed, Passenger motor cars, Transport equipment – Parts and accessories and Consumer goods – Semi-durable.

With regard to intra-EU-28 manufacturing exports, prior to the crisis, home- and foreign-income export elasticities were again positive and below unity in the majority of end-use categories (Table A.2.8.6). However, during and following the crisis, home-income elasticities of manufacturing exports were continuously falling in all end-use categories but Food and beverages – Primary, where an increase during the crisis-period was more than offset by a drop during the period between 2012 and 2014. In



contrast, changes in foreign-income elasticities of exports were more diverse across end-use categories. In particular, foreign-income elasticities of exports were significantly negative and deteriorated in Food and beverages – Processed and Consumer goods – Durable but significantly negative and confined to individual periods only in Food and beverages – Primary, Industrial supply n.e.s. – Primary, Fuels and lubricants – Primary, Consumer goods – Semi-durables and Consumer goods – Non-durables. In contrast, foreign-income elasticities of exports were significantly positive and continuously improved in Passenger motor cars as well as Goods n.e.s. Similarly, foreign-income elasticities of exports were significantly positive but confined to individual periods only in Industrial supply n.e.s. – Processed, Other transport equipment and Transport equipment – Parts and accessories. Furthermore, elasticities were initially positive in the crisis-period but then deteriorated in the period between 2012 and 2014 in Capital goods (except transport equipment) and Capital goods – Parts and accessories.

#### 2.8.4. Services trade

##### *Export gravities at the country level*

An analogous exercise is undertaken for services trade (see Section 2.7). Similar to Table 2.8.1, Table 2.8.2 presents the results for the services sector for the period between 2000 and 2013 of the trade gravity models as specified in equations (1) and (2). Columns (1) and (4) again refer to total EU-28 services exports, columns (2) and (5) to extra-EU-28 services exports while columns (3) and (6) refer to intra-EU-28 services exports.

Generally, for the pre-crisis period between 2000 and 2008, columns (1) to (3) point to elasticities of exports to own GDP of almost unity, particularly for total and extra-EU-28 services trade. With 0.8, the elasticity of exports to own GDP is lowest for intra-EU-28 services trade. In contrast, elasticities of exports to foreign GDP are considerably lower at around 0.6 for total and extra-EU-28 services trade but with 1.2 above unity for intra-EU-28 services trade. Hence, for intra-EU-28 trade, there is a stronger foreign market effect while for total and extra-EU-28 services trade, the home market effect dominates the foreign market effect. The combined GDP elasticity of trade partners is between 0.7 and 0.8 for extra-EU-28 and total EU-28 trade, respectively, but unity for intra-EU-28 trade (columns (4) to (6)).

Similar to findings for manufacturing exports, during the crisis- and post-crisis periods, services export elasticities to own GDP were continuously deteriorating, particularly for intra-EU-28 services trade. For total and extra-EU-28 services trade, the continuous deterioration of services export elasticities to own GDP started after the crisis-year of 2009 only. In contrast, export elasticities to foreign GDP continuously increased for total and extra-EU-28 services trade but continuously decreased for intra-EU-28 services trade. Hence, for intra-EU-28 services trade, export elasticities to both own and foreign GDP deteriorated permanently as a result of the crisis, the overall effect was, however, stronger for the own-income elasticity of services exports. This is also reflected in the change in the combined GDP elasticity of trade partners (columns (4) to (6)).

**Table 2.8.2 / Gravity regression results: services sector, 2000-2013**

DepVar: Inexports	(1) Total EU-28 exports	(2) Extra-EU-28 exports	(3) Intra-EU-28 exports	(4) Total EU-28 exports	(5) Extra-EU-28 exports	(6) Intra-EU-28 exports
$\ln GDP_{it}$	0.959*** (62.689)	0.914*** (54.519)	0.810*** (19.775)			
$\ln GDP_{jt}$	0.632*** (42.837)	0.579*** (36.513)	1.200*** (27.046)			
$\ln POP_{it}$	2.892*** (28.788)	3.155*** (28.781)	0.425* (1.890)			
$\ln POP_{jt}$	0.412*** (7.907)	0.718*** (13.012)	-0.096 (-0.426)			
$\ln(GDP_{it} * GDP_{jt})$				0.779*** (129.941)	0.727*** (107.863)	1.005*** (92.346)
$\ln(POP_{it} * POP_{jt})$				0.785*** (17.985)	1.118*** (23.748)	0.165 (1.049)
$D_2 * \ln GDP_{it}$	-0.008 (-1.170)	-0.004 (-0.523)	-0.056*** (-4.728)			
$D_3 * \ln GDP_{it}$	-0.014*** (-2.672)	-0.010* (-1.755)	-0.059*** (-6.424)			
$D_4 * \ln GDP_{it}$	-0.046*** (-8.201)	-0.047*** (-7.684)	-0.066*** (-5.008)			
$D_2 * \ln GDP_{jt}$	0.035*** (8.652)	0.038*** (7.915)	-0.025** (-2.230)			
$D_3 * \ln GDP_{jt}$	0.038*** (12.028)	0.040*** (10.776)	-0.034*** (-3.921)			
$D_4 * \ln GDP_{jt}$	0.044*** (12.736)	0.047*** (12.177)	-0.068*** (-5.521)			
$D_2 * \ln(GDP_{it} * GDP_{jt})$				0.023*** (6.717)	0.023*** (5.948)	-0.040*** (-4.644)
$D_3 * \ln(GDP_{it} * GDP_{jt})$				0.023*** (8.735)	0.022*** (7.171)	-0.047*** (-6.984)
$D_4 * \ln(GDP_{it} * GDP_{jt})$				0.018*** (6.224)	0.015*** (4.743)	-0.067*** (-7.057)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-77.178*** (-45.970)	-83.940*** (-46.249)	-38.363*** (-7.926)	-48.230*** (-38.756)	-56.273*** (-42.485)	-38.363*** (-7.901)
No of observations	80,038	69,454	10,584	80,038	69,454	10,584
R <sup>2</sup>	0.954	0.944	0.952	0.954	0.943	0.952

Source: UN, WDI; own calculations.

Note: Robust t-statistics in parentheses. \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1.

In addition, domestic and foreign population size and exports are positively related with, however, generally stronger domestic than foreign population effects. The combined population elasticity of trade partners is around 0.8 for total EU-28 trade and with slightly above unity higher for extra-EU-28 trade. In contrast, no significant combined population effect is observable for intra-EU-28 services trade (columns (4) to (6)).

#### *Export gravities by BoP categories*

Tables A.2.8.7 to A.2.8.9 present the results for individual services (BoP) categories for the period between 2000 and 2013 of the trade gravity models as specified in equations (1) and (2). Generally, for total services EU-28 exports, during the pre-crisis period between 2000 and 2008, elasticities of exports to GDP were positive for all services categories and, with around or above unity, higher for own than foreign GDP (Table A.2.8.7). Furthermore, during as well as following the crisis, home-income elasticities of services exports continuously and permanently decreased in all services categories but Computer and information services as well as Royalties and licence fees, where the deterioration in home-income elasticities started later and was therefore less lasting and somewhat weaker. In contrast, foreign-income elasticities of services exports continuously improved in all categories but Communication services, where a deterioration is observable for the last period only, and Government services, n.i.e., where after a temporary improvement during the crisis-year of 2009 a lasting deterioration set in.

Similarly, for extra-EU-28 services exports, prior to the crisis, home- and foreign income elasticities were generally also positive and below unity in the majority of services categories (Table A.2.8.8). As a result of the crisis, however, home-income elasticities of services exports continuously and permanently decreased in all services categories but Communication services, Computer and information services and Royalties and licence fees. In contrast, except for Personal, cultural, and recreational services, for which no significant change is observable, as well as Travel, Construction services, Financial services and Government services, n.i.e., where changes were confined to individual periods only, foreign-income elasticities of exports continuously and permanently increased.

As regards intra-EU-28 services exports, prior to the crisis, home- and foreign income elasticities were generally positive and predominantly below unity for home-income elasticities but above unity for foreign-income elasticities (Table A.2.8.9). In contrast to total EU-28 and extra-EU-28 services exports, crisis- and post-crisis related changes in income elasticities follow a somewhat different trend. Home-income elasticities of exports also continuously and permanently decreased in almost all services categories (except for Royalties and licence fees and Personal, cultural, and recreational services). However, in contrast to total and extra-EU-28 services exports, foreign-income elasticities of exports also continuously and permanently decreased. The only notable exception is Royalties and licence fees, where a temporary improvement of the foreign-income elasticity is observable during the crisis-year of 2009 only.

All in all, results of the export gravity models point to some interesting results. First, before the onset of the global financial crisis, both home- and foreign-income elasticities of manufacturing and services exports were generally positive but below unity. The only exception is intra-EU-28 services exports, where foreign-income elasticities exceed unity for the majority of services categories. Second, prior to the crisis, foreign-income elasticities tend to exceed domestic-income elasticities for all types of

manufacturing exports which is indicative of a more dominant foreign market effect of manufacturing exports. In contrast, the reverse is observable for services exports, where, except for intra-EU-28 services exports, the home market effect tends to dominate. Third, the global financial crisis initiated a permanent decline in home-income elasticities of both manufacturing and services exports. This permanent break in home-income elasticities of exports is most consistent across services categories and manufacturing end-use categories and more mixed across manufacturing industries, particularly for total EU-28 and extra-EU-28 exports. Fourth, the global financial crisis also initiated a permanent increase in foreign-income elasticities of both manufacturing and services exports. The only exception is intra-EU-28 services exports which also experienced a consistent and permanent drop in foreign-income elasticities.

### 2.8.5. Decomposition of world market export shares

The gravity approach also allows for a decomposition analysis disentangling the role of structural change, heterogeneous dynamics of export destination markets and overall export performance. Following Cheptea et al. (2012), a shift-share decomposition based on a gravity equation is therefore conducted for manufacturing exports, which ultimately decomposes changes of each country's world market share into three terms, namely (1) a geographical structure effect which is determined by the destination of exports, (2) a sectoral effect which varies by the particular sectoral composition of exports, and (3) an exporter-performance effect. Thus (1) captures the effect whether countries have specialised towards markets with higher growth, (2) captures the effect to which extent the structure of exports has changed towards industries with higher growth while (3) picks up the overall performance effect of a country compared to others.

In this context, the decomposition is conducted separately for each year and then added up to determine cumulative effects. This allows for a comparison of changes in world market shares of different time periods. In particular, we compare total changes in world market shares of the pre-crisis period between 2000 and 2008 with those of the crisis year of 2009 as well as those of the two post-crisis periods 2010 to 2011 and 2012 to 2014.

#### *Results for manufacturing trade*

Results of the decomposition exercise are presented in Table 2.8.3 which reports the results of the decomposition with respect to industry as well as with respect to broad end-use categories (BEC).<sup>20</sup> The results highlight<sup>21</sup> that, between 2000 and 2014, the EU-28 continuously lost manufacturing world market shares (column (1)). In particular, over the pre-crisis period between 2000 and 2008, the total (cumulated) loss amounted to around 17%, during the crisis year the EU-28 lost another 4% and in the post-crisis periods of 2010 to 2011 and 2012 to 2014, it lost another 11% and 3%, respectively. The EU's continuous losses in manufacturing world market shares resulted from different sources though:

<sup>20</sup> Results by broad end-use categories provide slightly different values of overall changes in market shares which results from a slightly different country coverage (due to the correspondence between HS 6-digit data and NACE 2-digit industry and BEC). Further, due to the gravity (regression) based approach fixed-effects coefficients might be outliers (in case of small trade flows). To provide comparable results figures presented for decomposition by BEC have been normalised to overall market share changes by industry.

<sup>21</sup> The results are discussed for the industry dimension; an analogous interpretation holds for the decomposition by BEC as can be seen in Table 2.9.1.

during the pre-crisis period from 2000 to 2008, it only resulted from the negative performance effect (column (4)), since both geographical and sectoral effects were positive (columns (2) and (3), respectively). However, during the crisis-year of 2009, the 4% loss stemmed from both negative geographical as well as export performance effects while the sectoral effect was slightly positive. During the period from 2010 to 2011, the 11% loss stemmed from all three sources while during the period from 2012 to 2014, the 3% loss again resulted from negative geographical and export performance effects while the sectoral effect was zero.

**Table 2.8.3 / Changes in manufacturing world market shares – shift-share decomposition, 2000-2014**

Country	Period	Market share	Geographical	Sectoral	Export performance
			Decomposition by industry		
EU-28	2000-2008	-17.2	3.5	1.7	-21.3
	2009	-4.4	-3.0	0.4	-1.8
	2010-2011	-11.2	-4.6	-0.5	-6.4
	2012-2014	-3.1	-1.5	0.0	-1.6
			Decomposition by broad economic categories (BEC)*		
EU-28	2000-2008		2.2	0.9	-19.7
	2009		-4.9	-0.2	0.9
	2010-2011		-4.6	0.0	-7.0
	2012-2014		-1.3	0.0	-1.8

Note: Results for decomposition by BEC have been normalised to fit changes in market shares.

Source: BACI, WDI; own calculations.

#### *Result for services trade*

Analogously to above, Table 2.8.4 presents the decomposition results for services trade. Differently from the results for manufacturing – but in line with the trends reported in Section 2.2 – an increase in market shares in the pre-crisis period can be observed. This reflects both the increase in intra-EU trade as well as a relatively stronger growth of extra-EU exports. Even in the crisis period one observes an albeit small increase in overall market shares due to the fact that the trade collapse has been less service in services. After, the crisis however market shares declined mostly due to a weakening of intra-EU trade (which itself resulted from lower growth in the EU together with the changes in trade elasticities as reported in Section 2.8).

**Table 2.8.4 / Changes in manufacturing world market shares – shift-share decomposition, 2000-2014**

Country	Period	Market share (1)	Geographical (2)	Sectoral (3)	Performance effect (4)
EU-28	2000-2008	14.7	-2.0	2.9	13.8
	2009	0.8	-0.1	0.5	0.4
	2010-2011	-10.2	-6.2	1.0	-5.3
	2012-2013	-10.4	-1.4	0.8	-9.9

Source: UN, WDI; own calculations.

In all periods considered one observes a negative effect of the geographical export structure whereas the sectoral effect contributed positively. Further, the performance effect has been positive in the pre-crisis period however deteriorated after the crisis.

### 2.8.6. Summary

Summarising, the overall picture – though somewhat differentiated at the level of industries and by end-use categories – is that, after the crisis, trade-to-GDP elasticities for EU-28 exports have become significantly smaller when considering the exporters' GDP. These results are in line with related literature which finds that the trade-to-GDP elasticities significantly declined in the aftermath of the crisis. In contrast, trade-to-GDP elasticities have not changed or became even larger with respect to the importer's GDP. On top of that, when distinguishing between intra- and extra-EU-28 exports results suggest that these own-GDP elasticities declined more for intra-EU trade relations. Furthermore, whereas the elasticities to the partner countries' GDP increased for extra-EU-28 exports, they declined for intra-EU-28 exports which indicates that the slowdown of exports has not only resulted from a slowdown in GDP growth, but also from the lower elasticity between GDP and export growth, particularly for intra-EU-28 trade. These patterns seem to be even more pronounced for services trade compared to goods trade.

These results seem to point towards a breakdown of the 'intra-EU-28 export-driven growth model' which has dominated the dynamics before the crisis (e.g. because of increased integration of economies and production within the European Union), whereas the 'extra-EU-28 export-driven growth model' even gained importance.

Finally, the decomposition analysis shows that the geographical dimension (of export destinations) played a larger role in explaining the loss in world market shares the EU experienced over the period considered. Changes in the sectoral structures in general counteracted these trends. For the crisis period this again points towards the sluggish trade performance within the EU in line with the results of the gravity regressions above.

## 3. The importance of intra-firm trade

In this section the role and importance of intra-firm trade in bilateral trade flows between Member States are considered. This will be contrasted with its role and importance in extra-EU trade as far as is allowed by available data. Such trade is supposed to be particularly important in the presence of strong international supply chains and production links at a regional level (such as EU supply chains or East-West production links in Europe) and also related to the activities of multinational firms and outsourcing.

Unfortunately, data availability on intra-firm trade is poor. Therefore, the section starts with a literature survey to identify the already existing indicators and measurement issues in order to compensate for the lack of data. From this, various proxy indicators are presented which are based on different datasets including, for example, the EFIGE data, FATS data and detailed trade statistics.

The section concludes with a detailed case study for one country, Ireland, for which decent data are available allowing us to study intra-firm trade in detail.

### 3.1. LITERATURE REVIEW

#### 3.1.1. Theoretical background

Intra-firm trade is related to the organisation and the activities of multinational firms and consists of trade in goods and services between parent companies and their affiliates or among foreign affiliates (i.e. trade within the same enterprise group). Intra-firm trade has increased in recent years with the increase in foreign direct investments and the emergence of global value chains. Reviews of the recent literature on intra-firm trade and more broadly on the organisation of international production networks include Helpman (2006), Lanz and Miroudot (2011), Bernard et al. (2012), Yeaple (2013) and Antràs and Yeaple (2014).

Intra-firm trade, or vertical integration of multinational activity, was theoretically formalised by Antràs (2003), Antràs and Helpman (2004) and Grossman and Helpman (2002; 2005). These models highlight the role of contracting and its associated costs in the decisions of multinational firms to source inputs in-house or at arm's length and their choice of locations for activities at home and abroad. These models are novel in that they focus on traded intermediated goods and the cost of writing contracts for specialised inputs.

Grossman and Helpman (2002) examined a firm's choice between outsourcing and intra-firm vertical integration. In determining their organisational mode, firms, which are assumed to be equally productive, are faced with the trade-off between the costs of running a large and less specialised organisation versus the search and monitoring costs of an input supplier. The authors show that outsourcing is likely to be more prevalent in some industries than in others. Outsourcing is more likely to be viable in large firms and in large economies. Further, in competitive markets, outsourcing requires a high per unit cost

advantage for specialised input producers relative to integrated firms, while in markets with less competition, outsourcing depends on the comparison of the fixed costs between specialised producers and integrated firms.

Antràs (2003) demonstrated formally that *incomplete contracts* help to explain why some firms source input abroad via FDI (intra-firm trade) while others source them via outsourcing (arm's length trade). Combined with productivity differences across firms within industries, this approach predicts the relative prevalence of alternative forms of the international organisation of production as a function of sectoral characteristics and differences in features of the trading partners.

Antràs and Helpman (2004) theoretically formalised the decision of firms to engage in international markets either through foreign outsourcing or foreign direct investment (FDI). Their model predicts that in a vertically integrated industry, the most productive firms will source their intermediates from affiliates while less productive firms will outsource them from arm's length suppliers.

Nunn and Trefler (2013) constructed measures of industry characteristics from disaggregated US import data and found that an industry's skill, capital and R&D intensity predicted intra-firm trade shares as expected. Furthermore, they showed that the type of capital intensity matters: industries whose capital is not firm-specific do not have high levels of intra-industry trade. Further, industry R&D and capital intensity explain the share of international trade conducted within multinationals better than outsourcing (Bernard, Jensen, Redding and Schott, 2012).

Helpman (2006) reviewed the theoretical and empirical literature on trade, FDI and organisation choices of firms. He highlighted that productivity differences are linked to different production and distribution choices of the organisation. In this context, trade and FDI patterns are jointly determined with organisational structures such as sourcing and integration strategies. The theoretical models in international trade and investment focus on an individual firm's choices of engagement in activities across national borders linked to firm and industry characteristics and the returns from foreign trade and investment. Organisational choices, such as sourcing and integration strategies, are important in this context (Spencer, 2005).

### **3.1.2. Stylised facts on the importance of intra-firm trade across countries**

Empirical analysis of intra-firm trade highlighted the importance of product and country characteristics to explain the engagement of firms in intra-firm trade and its scale (see, for example, Yeaple, 2006; Defever and Toubal, 2007; Corcos et al., 2013; Nunn and Trefler, 2008; Bernard et al., 2009; Bernard et al., 2010; Lanz and Miroudot, 2011; Bernard et al., 2012).

*Intra-firm trade accounts for a large share of world trade and has increased over time.* Based on trade statistics, in 2009, Bernard et al. (2009) found that the US' intra-firm trade accounted for 46% of imports and 30% of exports. Further evidence on the extent of intra-firm trade from nine OECD countries based on AMNE statistics (Lanz and Miroudot, 2011) indicated that intra-firm trade accounted for about half of foreign affiliates' exports.



*The size of intra-firm trade varies greatly across countries and industries.* Evidence on intra-firm trade in the US provided by Bernard et al. (2010) indicated that while 46% of US imports are intra-firm, 74% of US imports from Japan were intra-firm. In contrast, only 2% of US imports from Bangladesh were intra-firm. With respect to intra-firm trade by industry, the same study found that the extent of intra-firm trade ranged from 70% of US imports of cars, medical equipment and instruments to only 2% of US imports of rubber and plastics, and footwear.

Further research for the US trade, reported by Bernard et al. (2009), found that the intensive margin was relatively more important for intra-firm trade than for arm's length trade.

Existing evidence discussed by Lanz and Miroudot (2011) indicated that *intra-firm trade is also sizeable in services and has increased over time*, in particular in services supporting the activities of multinational enterprises (MNEs).

*Intra-firm trade is important within global value chains* (it connects different production stages) as well as *for trade in final goods*. Evidence for the US reported by Lanz and Miroudot (2011) indicated that intra-firm transactions accounted for 46% of imports of intermediate goods and 27% of exports of intermediate goods. Furthermore, trade between related parties accounted for a significant share of trade in consumption and capital goods. This result suggests that multinationals play an important role in distribution networks, and not only in production networks. Further evidence on the importance of wholesale trade in the US intra-firm trade was provided by Zeile (2003).

*Intra-firm trade appears to have been more resilient to macroeconomic shocks compared to arm's length trade.* Bernard et al. (2009) showed that during the Asian crisis in 1997, the intra-firm trade in the US was more resilient than arm's length trade. This message is consistent with further evidence for the US with respect to the recent crisis over 2008-2009 reported by Lanz and Miroudot (2011). However, the more disaggregated analysis indicated heterogeneity at the country, industry and product levels.

Further evidence provided by Altomonte and Ottaviano (2009) found that the greater resilience of intra-firm trade to macroeconomic shocks is related to the less important inventory effects within vertically integrated global value chains. This result is linked to a reduction of uncertainty of demand in vertically integrated firms that leads to more similarity in the size of orders and inventories along the supply chain. Additional evidence for the US reported by Lanz and Miroudot (2011) indicated that the trade decline was less severe for intermediate inputs traded between related parties.

### **3.1.3. Empirical evidence on determinants of intra-firm trade**

Given the limited available data, there are only a few studies which analysed determinants of intra-firm trade. Bernard et al. (2012) reviewed recent available evidence for the US, France and Spain.

Nunn and Trefler (2008) found that the intensity of intra-firm trade in the US is positively linked to the importance of parent companies' investments (proxied by interactions between capital and skill intensity) and the quality of property rights in the foreign affiliates' host countries (proxied with a measure of rule of law). Additional evidence from the US was provided by Yeaple (2006). This evidence indicated that the

share of intra-firm trade in US imports is positively associated with industry capital intensity and R&D intensity, and the dispersion of productivity across firms within industries.

Bernard et al. (2010) analysed the extent and the intensity of intra-firm trade in the US as outcomes of interactions of product and country characteristics. The results indicated that factors associated with the engagement of firms in intra-firm trade are different from those associated with the intensity of intra-firm trade. At the extensive margin, a higher probability of intra-firm trade is associated with a higher quality of governance at the country level. At the intensive margin, intra-firm trade shares are high for capital-intensive products imported from capital-abundant countries while improvements in governance are associated with the largest reductions in intra-firm trade in low-contractibility products. Firms in industries with higher skill intensity are more likely to engage in intra-firm trade and they have higher shares of intra-firm trade, particularly in more skills-scarce countries. Greater county-level skill abundance is linked to a lower intensity of intra-firm trade and larger reductions in skill-intensive products.

Following on from Bernard et al. (2010), Corcos et al. (2013) provided evidence on the extensive and intensive margins of intra-firm trade in France. Their results indicated that intra-firm imports are more prevalent in more productive firms, in firms with higher capital and skills intensities, and from countries with better quality judicial institutions. In addition, they find that complex goods and inputs are more likely to be produced intra-firm.

Defever and Toubal (2007) analysed the implications of fixed costs for firms' choices between intra-firm trade (vertical integration) and outsourcing (arm's length trade) for French firms. They found that under high fixed costs of outsourcing, more productive multinationals are more likely to outsource their inputs while those less productive are more likely to engage in intra-firm trade.

Kohler and Smolka (2011) provided evidence on intra-firm trade in Spain. They found that more productive firms are more likely to engage in intra-firm trade than outsourcing. Further evidence on sourcing choices indicates that more productive firms are more likely to source inputs from foreign, rather than domestic, suppliers.

### **3.2. INTERNATIONALISATION OF PRODUCTION ACTIVITIES THROUGH DIRECT INVESTMENT (EFIGE)<sup>22</sup>**

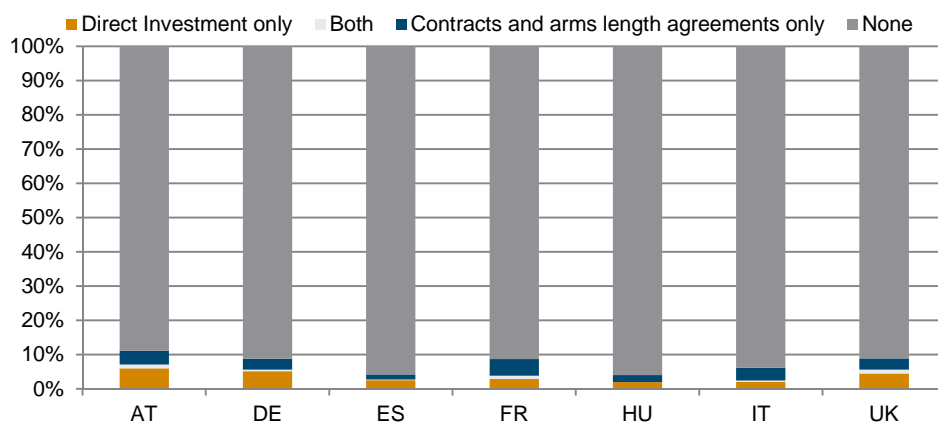
This dataset (which was compiled in 2008 and covered 7 EU Member States) provides an indication on the 'production activities through direct foreign investment' and 'production activities through contracts and arm's length agreements with local firms' (as percentages of 2008 turnover) and the region (8 regions) from where it comes. Further, the main destinations of these production activities (incl. destination 'imported into your own firm's home country') and the types of production activities carried out abroad are distinguished. Figure 3.2.1 to Figure 3.2.5 below use firm-level data for the year 2008 from the EFIGE (European Firms in a Global Economy: internal policies for external competitiveness) project which is particularly suitable for identifying and comparing firms across countries in terms of different modes of internationalisation.

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<sup>22</sup> Contracts and arm's length agreements with local firms are not considered here as strictly speaking they are not part of intra-firm trade.

Figure 3.2.1 depicts the frequency with which different internationalisation activities are carried out by firms in the sample. It differentiates between two types of internationalisation strategies, namely (i) production activities through direct investment and (ii) production activities through contracts and arm's length activities with local firms. The findings demonstrate that the majority of firms did not run any of their production activities in another country. In particular, only around 5% to 10% of firms were engaged in any internationalised production activities (these are weighted shares). With around 10%, the shares of firms with internationalised production activities were highest in Austria and the UK, and with around 5%, they were lowest in Hungary and Spain. Furthermore, Figure 3.2.1 shows that firms rarely pursued both internationalisation strategies jointly but predominantly only used direct investment to internationalise their production activities.

**Figure 3.2.1 / Frequency of different internationalised production activities**

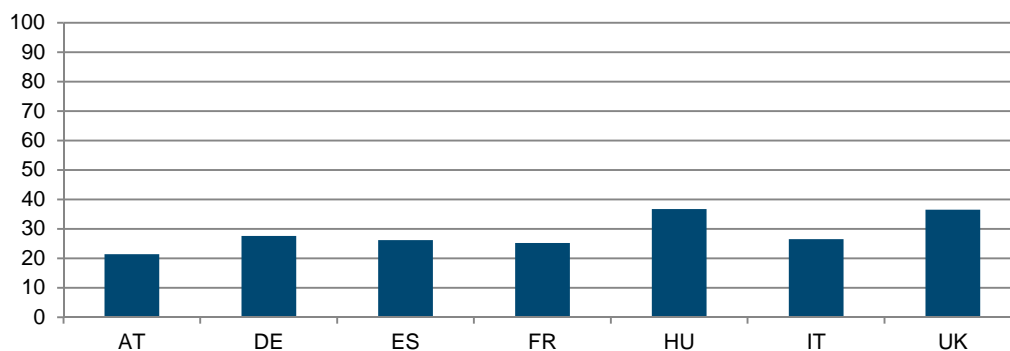


Note: Weighted shares are reported.

Source: EFIGE data.

The average returns from production activities through direct investment were rather moderate (Figure 3.2.2). The percentages of firms' 2008 turnovers from production activities through direct investment only ranged from around 40% in Hungary and the UK to 20% in Austria.

**Figure 3.2.2 / Turnover from production activities through direct investment in % of total turnover, 2008**

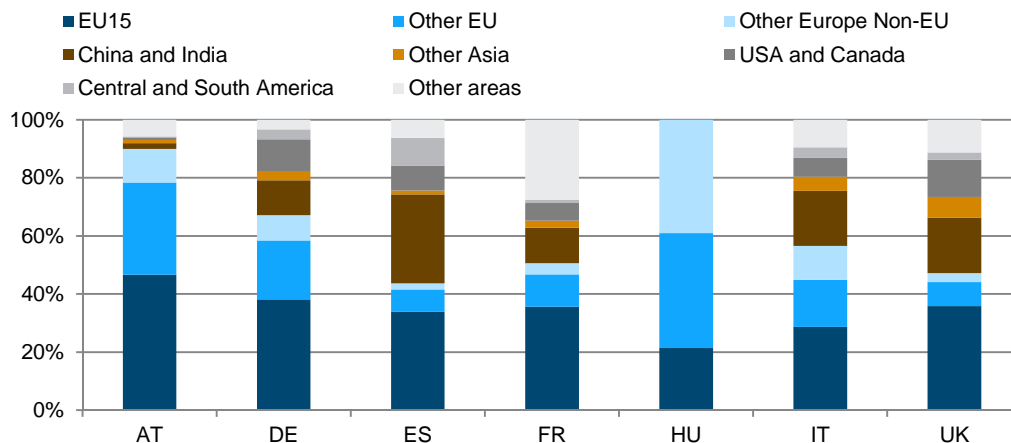


Note: Weighted shares are reported.

Source: EFIGE data.

Furthermore, Figure 3.2.3 highlights that, except for firms located in Spain and the UK, the lion's share of firms' 2008 turnovers came from production activities through direct investment in Europe. The importance of Europe as region of origin is strongest among Hungarian firms, whose return from international production activities through direct investment comes exclusively from production activities in Europe, particularly in other EU and non-EU European countries. This is followed by Austrian firms, whose share of the 2008 turnover from production activities through direct investment in Europe amounted to around 90%. In contrast to Hungarian firms, however, production activities of Austrian firms are more strongly concentrated in other EU-15 countries. Moreover, Europe becomes less important for firms located in the larger European economies, whose international production activities through direct investment are more geographically dispersed, and for which, Asia, USA and Canada or Central and South America play non-negligible roles. In particular, China and India are of particular importance for Spanish, British and Italian firms. Furthermore, the US and Canada are important for German and British firms while Central and South America are also of non-negligible importance for Spanish firms.

**Figure 3.2.3 / Turnover from production activities through direct investment by region of origin in %, 2008**

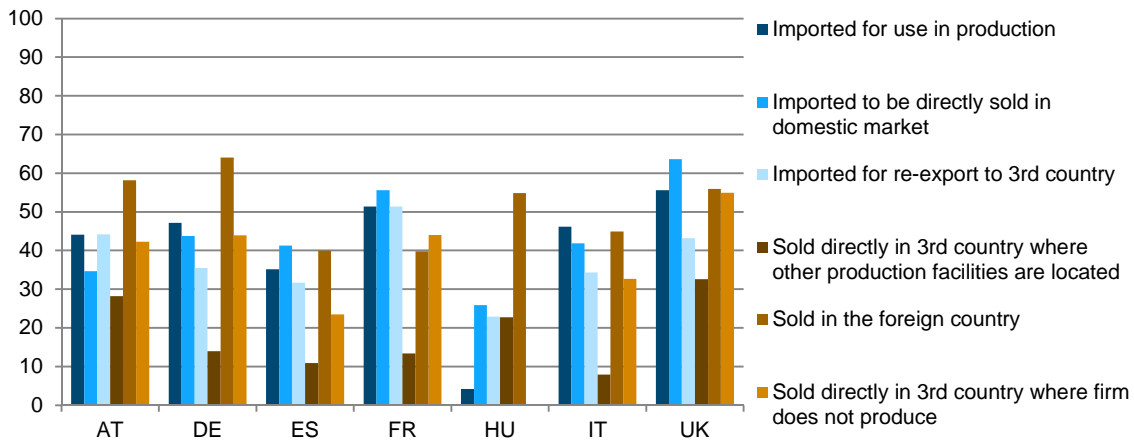


Note: Weighted shares are reported.

Source: EFIGE data.

Furthermore, cross-border intra-firm trade in terms of (i) imports (of either intermediates or final products), (ii) imports for re-exports or (iii) exports to a third country (where the firm also has other production facilities) is of the utmost importance for firms that carry out production activities abroad (through direct investment). Figure 3.2.4 highlights that with the exception of Hungarian firms whose intra-firm trade matters little but whose international production activities appear to be predominantly aimed at serving the country where the production also takes place ('market-seeking' motive of FDI), intra-firm trade is substantial. Intra-firm trade is most pronounced among British and French firms, followed by German, Italian and Austrian firms. Furthermore, among the four types of intra-firm trade, that is (i) imports for the use in production (intermediates trade), (ii) imports for the domestic market (final goods trade), (iii) imports for re-exports and (iv) direct exports to a third country (where the firm also has other production facilities), imports of intermediates and final products matter the most. Moreover, while intra-firm trade in intermediates is most important for Italian and German firms, intra-firm trade in final goods matters most for French, Spanish and British firms. Furthermore, imports for re-exports are also an important intra-firm trading strategy for Austrian firms.

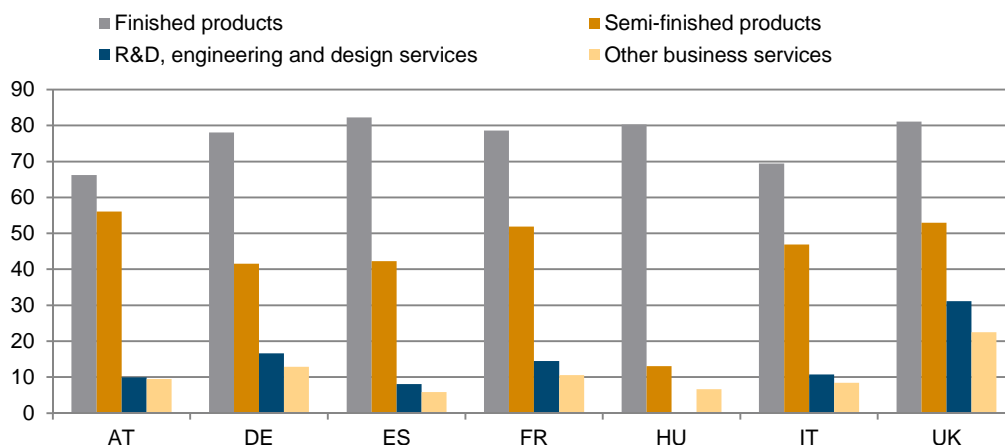
**Figure 3.2.4 / Main destinations of production activities carried out abroad, 2008**



Note: Share of firms with production activities through direct investment by main destination (multiple answers allowed); weighted shares are reported.  
Source: EFIGE data.

Finally, the main types of production activities that are carried out abroad are depicted in Figure 3.2.5. It highlights that, firstly, internationalised production activities of European firms predominantly serve in the production of finished products and semi-finished products or components while other activities (such as R&D, engineering and design services or other business services) are only of negligible importance. The only exceptions are British firms with internationalised production activities which also carry out R&D, engineering and design services or other business services abroad. Secondly, Figure 3.2.5 stresses that the production of finished products matters the most. This is particularly true for Hungarian firms whose international production activities almost exclusively aim at producing finished products. Furthermore, the production of finished products is also very important for German and Spanish firms while for Austrian firms, the production of finished and semi-finished products are of almost equal importance.

**Figure 3.2.5 / Main types of production activities carried out abroad, 2000**



Note: Share of firms with production activities through direct investment by type of production activity (multiple answers allowed); weighted shares are reported.  
Source: EFIGE data.

### Summary

In summary, the firm-data-based analysis highlights that only a very small share of firms run some part of their production activities in another country which generally points to a low degree of production internationalisation among European firms. However, those firms that do internationalise their production activities predominantly internationalise through direct investments instead of contracts and arms' length agreements. Furthermore, average returns from production activities through direct investments are (i) rather moderate and (ii) predominantly come from production activities in Europe (particularly for Hungarian and Austrian firms). In addition, intra-firm trade is generally of a substantial size, with imports of intermediates and final products of the most importance. Finally, internationalised production activities of European firms predominantly serve in the production of finished products and semi-finished products or components while other activities such as R&D, engineering and design services or other business services abroad are of little significance.

## 3.3. EVIDENCE FROM FATS DATA

Another potential source of information on the extent of intra-firm trade (both inward and outward) is the Activities of Multinational Enterprises (AMNE) from the OECD (the AMNE database). Data on this are however scarce (see Lanz and Miroudot, 2011). Therefore, in this study, US data on intra-firm trade are also used, the mirror statistics of which can be used to provide a proxy for EU intra-firm trade with the US. This way, the importance of intra-firm exports and imports of the EU Member States with an important extra-EU trading partner (the US) can be directly assessed. This intra-firm trade data includes the value of intra-firm goods exports and intra-firm goods imports of all industries in the economy except for the agricultural sector (NACE Rev. 2 A) and the Public Administration sector (NACE Rev. 2 O). Hence, intra-firm trade statistics includes the entire business economy (except agriculture) but is restricted to the exchange of goods (i.e. services are excluded).

Further, the study will explore a gravity model with the bilateral EU-US data to determine the most important determinants of intra-firm trade. Applying the estimated coefficients to EU Member States' data on firm sales (which are also available for almost all EU Member States) one can obtain a proxy for the size of bilateral intra-firm trade of EU Member States.

### 3.3.1. Introduction

This task will determine the importance of intra-firm trade in total trade flows between Member States and extra-EU trading partners based on FATS data. The most direct approach to address this question is to look at the value of intra-firm trade flows directly and to compare them with aggregate (country-level) trade data. In principle this can be done because along with other characteristics of foreign affiliates, the OECD's database on Activities of Multinational Firms (AMNE database) also contains the exports and imports of foreign affiliates. However, the reported data on intra-firm trade are scarce and only available for a very limited number of countries and years (see Lanz and Miroudot, 2011). Among EU Member States, only Italy is currently reporting global intra-firm trade of foreign affiliates in Italy

(i.e. inward AMNE) whereas Slovenia provides information on intra-firm trade of its Slovenian-owned foreign affiliates located abroad (i.e. outward AMNE), including a break-up by destinations.<sup>23</sup>

Given this scarcity of data, it is impossible to collect representative data for EU-wide intra-firm trade from Member States' AMNE data. Therefore we will rely on intra-firm trade data for the US which are comparatively comprehensive. For the year 2012, the US data provide information on intra-firm trade from both an outward and an inward perspective with eleven EU partners. In addition, an aggregate value for intra-firm trade between the US and the EU is available. Interpreting the US data as mirror statistics of the EU partner countries, it is possible to assess at least the importance of intra-firm trade in total trade with the US, which after all is an important trading partner. This is a first step to uncover the importance of intra-firm exports and imports in Member States' extra-EU trade flows. For this exercise, we have to use the data on Multinational Enterprises of the US Bureau of Economic Analysis (BEA) because it provides data covering a longer time period than that of the OECD AMNE database.

In a second step, the intra-firm trade of all EU Member States with extra-EU partners is estimated. For this purpose, a gravity model is employed. In this exercise we exploit the fact that, while no information on intra-firm trade is available for Member States, there are data on other characteristics of foreign affiliates, in particular sales. When taking the sales of foreign affiliates into account together with the aggregate trade flows and FDI stocks as well as GDP of the trading partners it is possible to estimate the relationship between these explanatory variables and the size of intra-firm trade flows based on US data. The obtained coefficients from the gravity model are then used to calculate extra-EU intra-firm trade of Member States along with its importance in total extra-EU trade.

This section therefore proceeds as follows. Section 3.3.2 explains the main methodological issues related to the intra-firm trade data from the AMNE database. Section 3.3.3 provides descriptive evidence on the role of intra-firm trade in bilateral trade relations between the US and the EU. In addition, intra-firm trade between the US and eleven EU Member States is analysed. Section 3.3.4 introduces the gravity model and discusses the results of the US intra-firm trade regression. Section 3.3.5 summarises the scarce actual data that is available for EU Member States' intra-firm trade. Section 3.3.6 presents the estimated results for overall intra-firm trade of EU Member States and its importance in extra-EU trade.

### 3.3.2. Conceptual issues relating to intra-firm trade

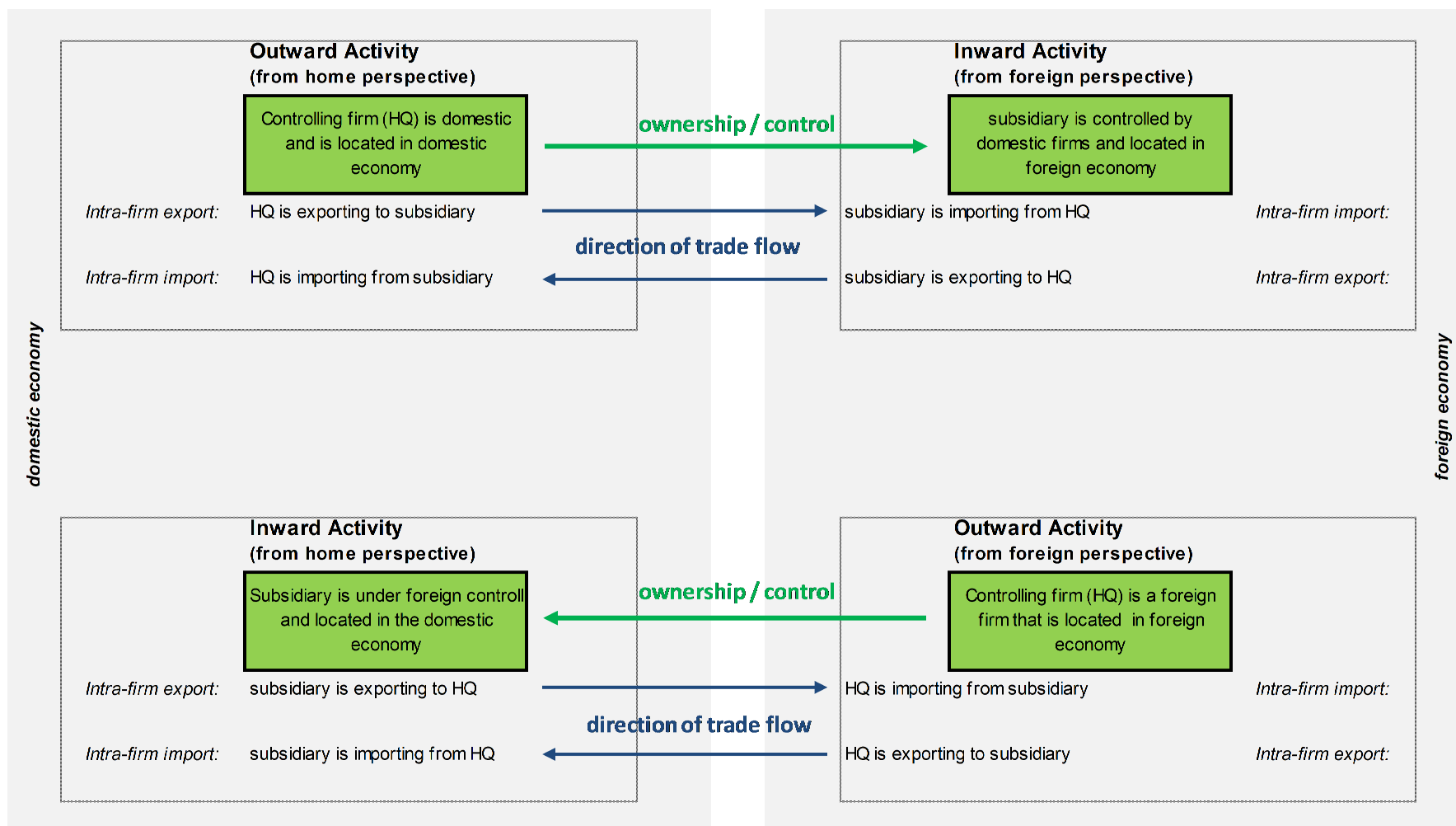
A first key criterion when dealing with foreign affiliates is the threshold for classifying a firm as foreign owned. For the US data in the AMNE database<sup>24</sup> this threshold is set at 50% so that foreign affiliates are firms which are majority-foreign owned.

A second aspect is the data coverage. While the reporting covers all business sectors, the reported data are – according to the BEA website – limited to goods trade. This means that when the relative importance of intra-firm trade in a country's overall trade is established, the base is country-level goods exports.

<sup>23</sup> In more distant years, the Netherlands, Poland and Sweden had been reporting inward AMNE data (see Lanz and Miroudot, 2011 for details).

<sup>24</sup> The original source of data is the Bureau of Economic Analysis (BEA) of the US Department of Commerce, see: <http://www.bea.gov/international/di1usdop.htm>.

Figure 3.3.1 / Concept of intra-firm exports and imports in the AMNE database



Source: wiiw.



Importantly, intra-firm trade has four dimensions of trade flows. In addition to imports and exports there are also the 'parent firm to affiliate' versus 'affiliate to parent firm' dimensions. To obtain all information, the outwards AMNE statistics and the inwards AMNE statistics are required. As usual, the outward statistics gives information on trade-flows by domestically owned subsidiaries located abroad. Hence, the intra-firm exports in the outward statistics are sales from the controlling (or parent) company located in the domestic economy to the foreign affiliate located abroad. This is depicted in (the left part of) Figure 3.3.1. Likewise, an intra-firm import in the outward statistics is an import by the parent company from its foreign affiliate.

The opposite logic applies to the inward statistics. In this context, the intra-firm exports represents exports from (a foreign-owned) subsidiary located in the home economy to this subsidiary's parent company located in the respective foreign country. Likewise, an intra-firm import in the inward statistics denotes an import from a foreign affiliate located in the domestic market to its parent company in the respective foreign economy.

This is very important to keep in mind, because it means that when the importance of intra-trade flows in country-level trade is calculated, both trade flows by domestically owned and foreign owned companies have to be considered.

For the purpose at hand, the mirror flows are required. This means that for example an intra-firm export by a US parent company to an affiliate in Germany is – from a German perspective – an import from a US-controlled affiliate located in Germany from its parent company (i.e. an inward activity). This is described in the right part of Figure 3.3.1.

### 3.3.3. Bilateral intra-firm trade between the EU and the United States

#### *Intra-firm trade between the EU and the US*

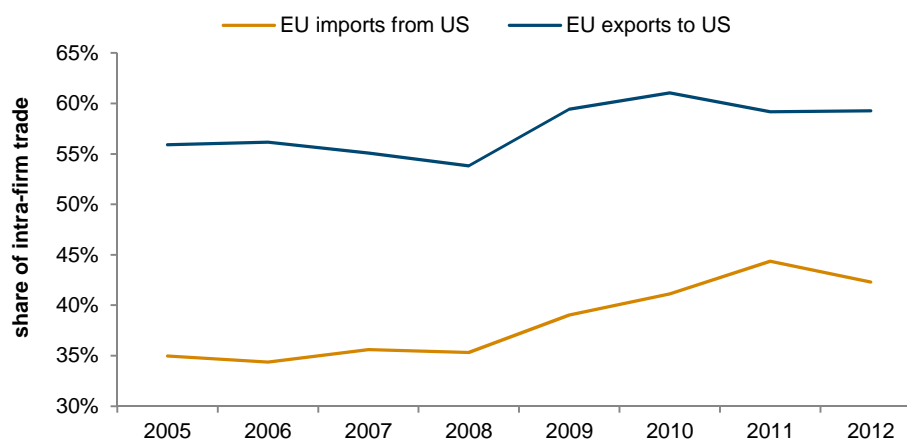
Making use of the methodology outlined in the previous section, Figure 3.3.2 gives a first order of magnitude for the importance of the foreign investment activities of multinational enterprises (MNEs) and the resulting trade flows in EU-US trade relations.

A first observation is that intra-firm trade is of fundamental importance. In 2012, intra-firm trade accounted for 59% of EU exports to the US. On the import side, the internal trade flows within MNEs represented 42%. This implies that, taken together, *intra-firm trade flows were responsible for more than half (52%) of total trade between the EU and the US in 2012*. This share of intra-firm trade is much higher than that estimated by Lanz and Miroudot (2011) for global imports and exports (about one-third). However, this is consistent with the observation by the same authors that the importance of intra-firm trade is much greater in trade between OECD countries.

Regarding the development of intra-firm trade over time, it is interesting to note that its share in total EU exports to and imports from the EU had not been growing until the crisis-related trade collapse towards the end of 2008 and early 2009. In the case of EU exports, the share of intra-firm trade had even declined slightly. Conversely, the trend has been reversed so that the relative share of intra-firm trade

grew strongly between 2008 and 2011. This suggests that *intra-firm trade was more resilient to the trade crisis* despite the more difficult global environment for foreign direct investment and export activities.

**Figure 3.3.2 / Share of intra-firm exports and imports in EU-US trade relations, 2005-2012**



Note: EU is EU-25 for 2005-2006; EU-27 for 2007-2012. EU trade flows based on goods trade reported by EU Member States (both exports and imports).

Source: BEA, OECD bilateral STAN, wiiw calculations.

Following the approach outlined in the previous section, Table 3.3.1 shows the development of bilateral intra-firm goods trade and country-level goods between the EU and the US over the period 2008-2012.

A first comment on the development of the trade figures, both for the country level and intra-firm trade, as shown in Table 3.3.1 is that in most cases there is a clear upward trend, as is usual in nominal gross trade figures due to the fact that the observation period includes the crisis year 2009.

**Table 3.3.1 / Bilateral EU-US trade relations, including intra-firm trade (million USD), 2005-2013**

year	EU total goods imports from US (1)	EU parent imports from its affiliate in the US (2)	US affiliate in the EU imports from US parent (3)	share of intra-firm trade in EU imports [(2) + (3)] / (1)	EU total goods exports to US (4)	EU parent exports to its affiliate in the US (5)	US affiliate in the EU exports to US parent (6)	share of intra-firm trade in EU exports [(5) + (6)] / (4)
2005	216,785	37,227	38,563	0.35	309,220	119,296	53,596	0.56
2006	248,193	43,788	41,476	0.34	338,783	134,658	55,639	0.56
2007	275,277	50,285	47,764	0.36	357,463	134,863	62,059	0.55
2008	305,989	58,061	50,041	0.35	367,107	138,059	59,437	0.54
2009	252,294	54,677	43,786	0.39	286,761	116,974	53,423	0.59
2010	264,074	62,683	45,955	0.41	324,279	139,950	57,996	0.61
2011	293,212	78,370	51,666	0.44	367,139	154,956	62,254	0.59
2012	302,010	81,809	45,946	0.42	380,457	165,559	59,960	0.59
2013	302,131	92,149			388,486	188,482		

Note: EU is EU-25 for 2005-2006; EU-27 for 2007-2012; EU-28 for 2013. Country-level trade flows based on goods trade reported by EU Member States (both exports and imports).

Source: BEA, OECD bilateral STAN, wiiw calculations.

On both the import side and the export side, intra-firm trade consists of the contributions of parent companies and the foreign affiliates. This is shown in Table 3.3.1. From an EU perspective, EU parent companies importing goods from affiliates located in the US (column 2) on the import side and US-controlled affiliates located in the EU importing from their parent company (column 3) are contributing to intra-firm imports. Similarly, EU parent companies exporting to their affiliates located in the US (column 5) and US-controlled affiliates located in the EU exporting to their parent company are part of EU exports to the US.

Another aspect of intra-firm trade found in EU-US trade relations, which is not entirely obvious, is that *EU parent companies seem to export more to their foreign affiliates than they import from them*. For the EU-controlled MNEs this means comparing column (2) with column (5) in Table 3.3.1. In 2012, EU controlling parent companies exported more than twice the value of goods to their foreign affiliates located in the US than they imported from them. The opposite pattern is found for US MNEs. US parent companies exported goods worth USD 46 billion to affiliates located in the EU (column 3) while the corresponding imports amounted to USD 60 billion. The US pattern, however, is not representative of internal MNE trade with EU Member States because in bilateral trade with all EU Member States (for which data are available), except for Ireland, exports by US parent companies to their affiliates exceed (or are similar in size to) the trade flows going in the other direction. Hence, the intra-firm trade pattern of US MNEs is entirely due to the very large exports of US affiliates located in Ireland to their US parent companies (see also Section 3.3.2 below).

The comparison of parent companies' intra-firm exports with their intra-firm imports from affiliates in the case of EU MNEs is not in line with the pattern one expects from vertical trade following offshoring activities. If EU MNEs offshore parts of their activities in the value chain to the US, keeping their headquarters in the EU, one would suggest higher trade flows from the affiliates (located in the US) to the parent company in the EU and not the other way round. Therefore, the EU data would correspond more to a pattern of market-seeking FDI activities with foreign affiliates still sourcing a significant amount of parts, components and other inputs from their parent company, while their output is destined mainly for the US market.

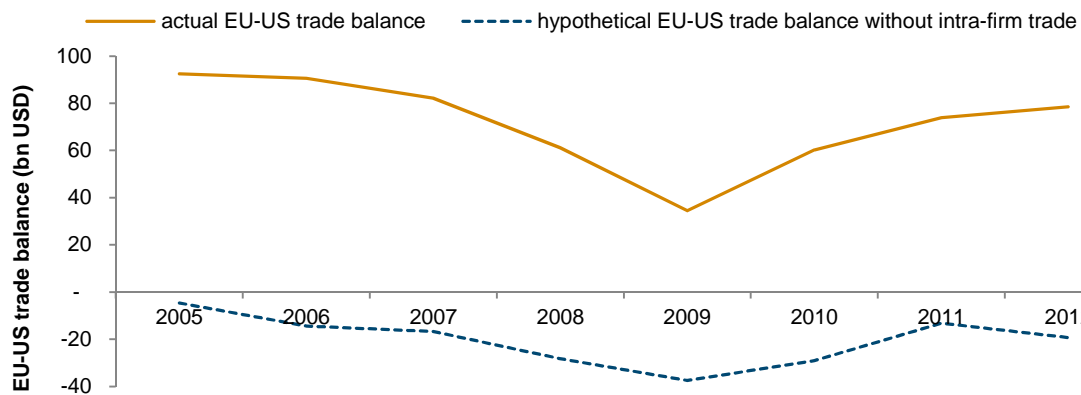
A rather obvious fact that emerges from Table 3.3.1 is that the EU has higher FDI engagement and hence more foreign affiliates in the US than vice versa. This gives rise to higher trade values within EU MNEs than within US MNEs. In 2012, the bilateral intra-trade flows by EU-controlled MNEs amounted to almost USD 250 billion (column 2 plus column 5), while the bilateral intra-trade flows by US-controlled MNEs stood at USD 106 billion (column 3 plus column 6).

This constellation has major implications for the bilateral trade balances between the EU and the US as shown in Table 3.3.2. As can easily be seen, the intra-firm trade surplus of the EU vis-à-vis the US reached USD 98 billion in 2012 – an amount that exceeds the country-level trade balances of the two trading partners. Hence, the EU's trade balance in arms' length trade with the US is actually negative. Put differently, *without the activities of MNEs and the resulting intra-firm trade, the EU would be running a trade deficit with the US* – at least according to the available intra-firm trade data (see Figure 3.3.3). In relative terms, this means that the EU's trade surplus, which amounted to 0.45% of GDP in 2012 (representing about a third of the EU's total trade surplus), turns into a trade deficit of 0.12% of GDP when only arms' length trade is considered. In this context it is worth mentioning that the trade flows of EU MNEs contributed much more significantly to the EU's trade surplus than their US counterparts.

**Table 3.3.2 / EU-US trade balances (million USD), 2005-2013**

year	country level (4) - (1)	intra-firm trade [(5)+(6)] - [(2)+(3)]	intra-firm trade of EU MNEs (5) - (2)	intra-firm trade of US MNEs (6) - (3)
2005	92,435	97,102	82,069	15,033
2006	90,590	105,033	90,870	14,163
2007	82,186	98,873	84,578	14,295
2008	61,118	89,394	79,998	9,396
2009	34,467	71,934	62,297	9,637
2010	60,205	89,308	77,267	12,041
2011	73,927	87,174	76,586	10,588
2012	78,447	97,764	83,750	14,014
2013	86,355		96,333	

Note: EU is EU-25 for 2005-2006; EU-27 for 2007-2012; EU-28 for 2013. Numbering of columns refers to that in Table 3.3.1. Country-level trade flows based on goods trade reported by EU Member States (both exports and imports). Source: BEA, OECD bilateral STAN, wiiw calculations.

**Figure 3.3.3 / EU-US trade balances and arms' length trade balances (billion USD), 2005-2012**

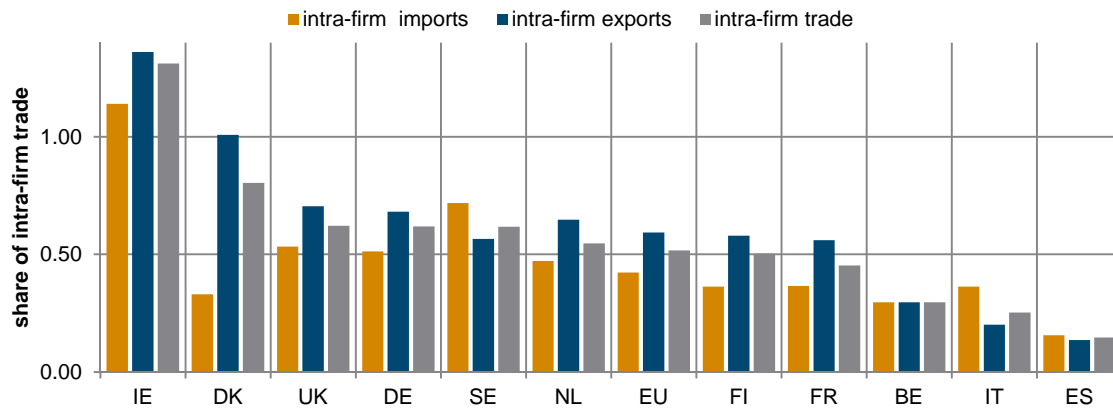
Note: EU is EU-25 for 2005-2006; EU-27 for 2007-2012. Country-level trade flows based on goods trade reported by EU Member States (both exports and imports).

Source: BEA, OECD bilateral STAN, wiiw calculations.

### 3.3.4. Intra-firm trade between selected EU Member States and the US

The US intra-firm trade flows are also available for a selected number of EU Member States. These are mainly those with relatively important FDI activities in the US or those in which the US has significant FDI holdings. While the picture is not entirely complete – because some Member States are missing – the data allow identification of the main contributing Member States to EU-US intra-firm trade. It has to be kept in mind, though, that the shares of intra-firm exports and imports is not representative for all Member States, especially not for the Central and Eastern European Member States which typically have less FDI activities (especially outward) and a lesser number of MNEs.

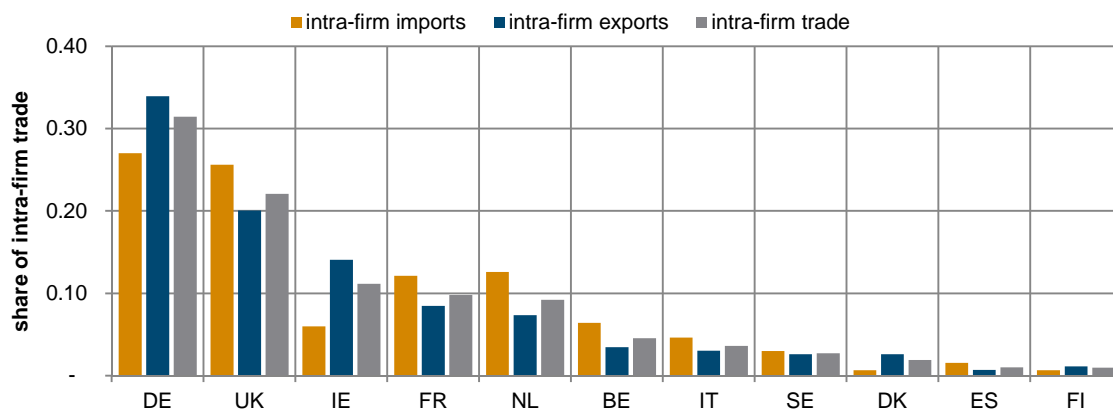
**Figure 3.3.4 / Share of intra-firm trade between EU Member States and the US in total bilateral imports and exports, 2012**



Note: 'EU parent imports from its affiliate in the US' for Denmark and Italy: 2011 values; 'US affiliate in EU imports from US parent' for Finland and Sweden: 2013 values. 'EU parent exports to its affiliate in the US' for Spain: 2011 values; for Italy 2010 values. Country-level trade flows based on goods trade reported by EU Member States (both exports and imports). Source: OECD AMNE database, OECD bilateral STAN, wiiw calculations.

Figure 3.3.4 shows the variation of the share of intra-firm imports, exports and trade (i.e. imports plus exports) in total bilateral trade relationships for goods. The *Member States which are the major EU FDI investors and hence also those with the most prominent MNEs activities, notably Germany and the UK, are also characterised by a higher share of intra-firm trade* amounting to 62% of country-level goods trade in both cases. For these markets, a high share of intra-firm trade is found both on the import and on the export side. Exceptions are Ireland and (with regards to intra-firm exports) Denmark which are both small open economies and their trade with the US is still dominated by intra-firm exports and, in the case of Ireland, imports too. The case of Ireland in particular also shows that intra-firm trade statistics seem to be plagued by some data issues because, according to the (US) MNE statistics, intra-firm trade between Ireland and the US exceeds the value of country-level trade flows.

**Figure 3.3.5 / Share of Member States in EU-wide intra-firm trade with the US, 2012**



Note: 'EU parent imports from its affiliate in the US' for Denmark and Italy: 2011 values; 'US affiliate in EU imports from US parent' for Finland and Sweden: 2013 values. 'EU parent exports to its affiliate in the US' for Spain: 2011 values; for Italy 2010 values. Country-level trade flows based on goods trade reported by EU Member States (both exports and imports). Source: OECD AMNE database, OECD bilateral STAN, wiiw calculations.

**Table 3.3.3a / EU-US intra-firm imports by Member States (million USD), 2012**

country	EU total goods imports from US (1)	EU parent imports from its affiliate in the US (2)	US affiliate in the EU imports from US parent (3)	intra-firm imports (2) + (3)	share of EU parent import in EU imports (2) / (1)	share of US affiliates in EU imports (3) / (1)	share of intra-firm trade in EU imports [(2) + (3)] / (1)
BE	27,660	2,347	5,850	8,197	0.08	0.21	0.30
DE	67,188	27,961	6,528	34,489	0.42	0.10	0.51
DK	2,541	506	334	840	0.20	0.13	0.33
ES	12,559	711	1,263	1,974	0.06	0.10	0.16
FR	42,364	11,153	4,327	15,480	0.26	0.10	0.37
UK	61,329	21,461	11,280	32,741	0.35	0.18	0.53
IE	6,714	2,170	5,483	7,653	0.32	0.82	1.14
IT	16,281	4,932	993	5,925	0.30	0.06	0.36
NL	34,073	8,847	7,235	16,082	0.26	0.21	0.47
FI	2,377	833	30	863	0.35	0.01	0.36
SE	5,293	3,661	141	3,802	0.69	0.03	0.72
AT	5,227		274			0.05	
CZ	3,004		175			0.06	
EL	735		25			0.03	
HU	1,891		132			0.07	
LU	2,019		1,004			0.50	
PL	4,996		507			0.10	
PT	1,685		22			0.01	
EU	302,010	81,809	45,946	127,755	0.27	0.15	0.42

Note: EU is EU-27. 'EU parent imports from its affiliate in the US' for Denmark and Italy: 2011 values; 'US affiliate in EU imports from US parent' for Finland and Sweden: 2013 values. Country-level trade flows based on goods trade reported by EU Member States (both exports and imports).

Source: OECD AMNE database, OECD bilateral STAN, wiiw calculations.

**Table 3.3.3b / EU-US intra-firm exports by Member States (million USD), 2012**

country	EU total goods exports to US (4)	EU parent exports to its affiliate in the US (5)	US affiliate in EU exports to US parent (6)	intra-firm exports (5) + (6)	share of EU parent exports in EU exports (5) / (4)	share of US affiliates exports in EU exports (6) / (4)	share of intra-firm trade in EU exports [(5) + (6)] / (4)
BE	26,457	3,696	4,143	7,839	0.14	0.16	0.30
DE	112,269	70,955	5,576	76,531	0.63	0.05	0.68
DK	5,859	5,537	371	5,908	0.95	0.06	1.01
ES	11,587	628	947	1,575	0.05	0.08	0.14
FR	34,114	16,006	3,134	19,140	0.47	0.09	0.56
UK	64,196	35,626	9,598	45,224	0.55	0.15	0.70
IE	23,322	3,804	27,928	31,732	0.16	1.20	1.36
IT	34,247	4,906	1,977	6,883	0.14	0.06	0.20
NL	25,550	13,358	3,174	16,532	0.52	0.12	0.65
FI	4,407	2,371	181	2,552	0.54	0.04	0.58
SE	10,362	5,479	388	5,867	0.53	0.04	0.57
AT	8,392		128			0.02	
CZ	3,554					0.00	
EL	1,325		2			0.00	
HU	2,453		362			0.15	
LU	402		1,280			3.18	
PL	3,604		232			0.06	
PT	2,399		35			0.01	
EU	380,457	165,559	59,960	225,519	0.44	0.16	0.59

Note: EU is EU-27. 'EU parent exports to its affiliate in the US' for Spain: 2011 values; for Italy 2010 values. Country-level trade flows based on goods trade reported by EU Member States (both exports and imports).

Source: OECD AMNE database, OECD bilateral STAN, wiiw calculations.

At the lower end of the scale indicating the significance of intra-firm trade – among the Member States for which data are available – are Italy (25%) and Spain (15%). In the latter case, one explanation may be that the FDI activities of Spanish MNEs are focused more on the South American than the North American market.

The available bilateral EU-US intra-firm data are summarised in Tables 3.3.3a (EU imports) and 3.3.3b (EU exports). In addition to the data for the countries displayed in the previous figures, Tables 3.3.3a and 3.3.3b also contain the Member States for which the information on intra-firm trade is incomplete. The purpose of these tables is to illustrate that for many of the smaller EU Member States, including basically all Central and Eastern European Member States, together with Greece and Portugal, the role of intra-firm trade is comparatively limited. For example, the share of intra-firm imports by US affiliates located in the Czech Republic and Hungary amounted to only 6% and 7% respectively (2012). In Portugal and Greece, these shares were even lower. The intra-firm exports of the US affiliates located in these markets tended to be even lower.

### 3.3.5. Estimation of EU intra-firm trade determinants using gravity

#### *General method*

To obtain a full picture, the global intra-firm trade (*ift*) flows of EU Member States will be estimated using available firm-level and country-level data. The estimations are based on US data on intra-firm trade which are used to estimate a gravity-type model. The key assumption is that, to a large extent, the magnitude of intra-firm trade is driven by the number and size of the foreign affiliates. This should hold for both US multinationals and multinationals of EU Member States. Therefore the sales of foreign affiliates, i.e. the proxy for the size of foreign affiliates in a particular market, should explain a large part of intra-firm exports and imports. This approach is feasible as data on sales of foreign affiliates (*FAS*) are available for (most) EU Member States from 2008 onwards.

In addition to this base model, some bilateral country-level information will be included in order to improve the fit of the model. These include goods exports and imports, country-level outward and inward FDI positions as well as the relative GDP of the trading partners involved. The regression model for explaining (bilateral) US intra-firm trade can be expanded by additional gravity variables such as distance, common border and common language. Hence, the estimation of global intra-firm trade of EU Member States will proceed in two steps. First, a gravity-type regression is estimated in order to obtain the coefficients for each determinant. This regression is based on firm-level data (sales) and country-pair information (US partner country). The estimated coefficients will be applied to get out-of-sample predictions for EU Member States. Given that the *FATS* data for EU Member States are only available at the global level (e.g. sales of German foreign affiliates located in all partner countries), the coefficient can only be used to predict global foreign affiliates' trade.

#### *Econometric specification and results*

Given the distinction outlined in Section 3.3.2 on the four dimensions of intra-firm trade (export-import and parent-affiliate), four gravity models are estimated. There will be two regressions for US intra-firm exports: one that explains exports by foreign-owned affiliates located in the US to their parents from

inward AMNE statistics (*Model 1*) and one that explains exports by US parent companies to their affiliates located abroad from outward AMNE statistics (*Model 4*).

Likewise, for US intra-firm imports there is one model explaining the imports by foreign-owned affiliates located in the US from their parent company from inward AMNE statistics (*Model 3*) and one model explaining the imports by US parent companies from their affiliates located abroad from outward AMNE statistics (*model 2*).

Naturally, the direction of trade flows (export vs. imports) and the direction of FDI stocks (inward vs. outward) varies over the specifications. More precisely, it is assumed that intra-firm exports (*ifx*) are partly explained by country-level exports (*x*) which contain the latter but which also reflect partner country characteristics. The same relationship is expected for intra-firm imports (*ifm*) and country-level imports (*m*). With regards to FDI stocks, the expectation is that both exports and imports by foreign-owned affiliates located in the US depend on the US inward FDI stock (*fdiin*). This is because more inward FDI in the US undertaken by multinational firms from a particular country should also result in higher activities (including trade) by the resulting affiliates. The same holds for US outward stocks: the higher US FDI outward stocks (*fdiout*) in a particular country, the higher the exports and imports by US foreign affiliates located in that particular country should be.

Finally, the model takes into account that – like trade flows in general – intra-firm trade also depends on the size of the two markets involved, here, the US and the respective trading partner *c*. In the specification, the two GDPs enter in multiplicative form ( $GDP_t^{US} \times GDP_t^c$ ). This term does not vary over the four models. All models are estimated in logarithmic form. The regression models therefore take the following form:

### **Intra-firm exports (*ifx*) out of the US**

*Model 1: ifx of foreign affiliates located in the US (from US inward AMNE)*

$$ifx_{c,t}^{US} = \alpha + \beta_1 \cdot FAS_{c,t}^{US} + \beta_2 \cdot X_{c,t}^{US} + \beta_3 \cdot fdiin_{c,t}^{US} + \beta_4 \cdot (GDP_t^{US} \times GDP_t^c) + \beta_5 \cdot gravity_{c,t}^{US} + \delta_t + \varepsilon_{c,t}$$

*Model 4: ifx of parents to US affiliates located abroad (from US outward AMNE)*

$$ifx_{c,t}^{US} = \alpha + \beta_1 \cdot FAS_{c,t}^{US} + \beta_2 \cdot X_{c,t}^{US} + \beta_3 \cdot fdiout_{c,t}^{US} + \beta_4 \cdot (GDP_t^{US} \times GDP_t^c) + \beta_5 \cdot gravity_{c,t}^{US} + \delta_t + \varepsilon_{c,t}$$

### **Intra-firm imports (*ifm*) to the US**

*Model 3: ifm of foreign affiliates located in the US (from US inward AMNE)*

$$ifm_{c,t}^{US} = \alpha + \beta_1 \cdot FAS_{c,t}^{US} + \beta_2 \cdot M_{c,t}^{US} + \beta_3 \cdot inFDI_{c,t}^{US} + \beta_4 \cdot (GDP_t^{US} \times GDP_t^c) + \beta_5 \cdot gravity_{c,t}^{US} + \delta_t + \varepsilon_{c,t}$$

*Model 2: ifm of US parents from their affiliates located abroad (from US outward AMNE)*

$$ifm_{c,t}^{US} = \alpha + \beta_1 \cdot FAS_{c,t}^{US} + \beta_2 \cdot M_{c,t}^{US} + \beta_3 \cdot FDIout_{c,t}^{US} + \beta_4 \cdot (GDP_t^{US} \times GDP_t^c) + \beta_5 \cdot gravity_{c,t}^{US} + \delta_t + \varepsilon_{c,t}$$

In all regressions, *c* indicates partner countries and *t* indicates years where the sample period spans from 2008 to 2012.  $\delta_t$  are time-fixed effects and  $\varepsilon_{c,t}$  is the error term. In additional specifications country fixed effects will also be included. The regression results for various specifications of the four models are shown in Tables 3.3.4a-d.



The main data source for this exercise is the OECD AMNE database, from which data on intra-firm trade (for US) and foreign affiliates' turnover are obtained. FDI stock data are taken from the OECD database for the US and from Eurostat for the EU. For trade data, information from UN Comtrade is exploited. GDP data are taken from the World Bank's World Development Indicators. Finally, the gravity variables are from CEPII's GeoDist database (see Mayer and Zignago, 2011).

Starting on the export side (Table 3.3.4a and Table 3.3.4b), one finds that the turnover of foreign affiliates is an important determinant of intra-firm exports (specifications M1.3 and M4.3). Throughout most specifications, this is robust to including additional explanatory variables, with a few exceptions for the ifx by US headquarters where US outward FDI stocks turn out to be the dominant explanatory factor. Note that because the regression includes both export flows and FDI stocks, a relatively large number of the usual gravity factors do not show up with the expected sign. This is particularly true for common language and a past colonial link, and even for distance in specification M1.8.

It is also noteworthy, that the ifx by foreign-controlled affiliates out of the US (model 1) do not positively correlate with the country-wide US exports. This may however, be also due to the fact that the ifx are, to a large extent, already explained by other factors. This may also explain the negative sign obtained for the combined GDP variable of the trading partners involved which is highly counterintuitive in a gravity perspective.

**Table 3.3.4a / Regression for explaining ifx by foreign-controlled affiliates located in the US (model 1) – various specifications (2008-2012).**

Dependent variable:	intra-firm exports by foreign-controlled affiliates located in the US							
	(M1.1)	(M1.2)	(M1.3)	(M1.4)	(M1.5)	(M1.6)	(M1.7)	(M1.8)
sales	1.2168*** (0.0422)	1.2141*** (0.0438)	1.2333*** (0.3608)	1.1483*** (0.0990)	1.1524* (0.5858)	1.0476*** (0.1060)	1.2459** (0.5897)	1.1742*** (0.0901)
x				-0.3695*** (0.0631)	-0.8218 (1.1853)	-0.4009*** (0.0755)	-0.9873 (1.1723)	-0.5664*** (0.1139)
fdiin				0.0313 (0.0748)	0.5358 (0.4774)	0.1176 (0.0762)	0.5825 (0.4785)	0.1799** (0.0729)
gdp <sup>US</sup> x gdp <sup>C</sup>				0.4124*** (0.0795)	0.2596 (2.6469)	0.4143*** (0.1264)	0.5889 (2.7865)	0.3414*** (0.1122)
tariffs <sub>faced</sub>						0.0480 (0.0442)	0.0836 (0.0497)	0.0802** (0.0362)
distance						-0.2543* (0.1430)		0.7088 (0.4746)
common border								2.3664** (1.0415)
common language								-0.4701*** (0.1672)
colony								-0.5265*** (0.1511)
constant	-6.1246*** (0.5053)	-6.2077*** (0.5093)	-6.4921 (3.9959)	-25.8127*** (4.0348)	-17.6626 (145.3328)	-23.3182*** (6.6499)	-36.8171 (153.3984)	-28.1504*** (7.5625)
time fixed effects	no	yes	yes	yes	yes	yes	yes	yes
country fixed effects	no	no	yes	no	yes	no	yes	no
Observations	106	106	106	104	104	103	103	103
R-sq.	0.8237	0.8267	0.9599	0.8715	0.9627	0.8801	0.9644	0.9125
R-sq. adj.	0.822	0.818	0.944	0.861	0.946	0.867	0.947	0.900
F	829.9	183.3	7.434	140.4	7.517	97.73	14.44	129.4

Note: Standard errors in parentheses. \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% level respectively.

**Table 3.3.4b / Regression for explaining ifx by US headquarter located in the US (model 4) – various specifications (2008-2012)**

Dependent variable: intra-firm exports by US headquarters located in the US								
	(M4.1)	(M4.2)	(M4.3)	(M4.4)	(M4.5)	(M4.6)	(M4.7)	(M4.8)
sales	1.2718*** (0.0668)	1.2732*** (0.0647)	0.7936** (0.3336)	0.9212*** (0.2344)	0.0624 (0.3824)	0.9674*** (0.2606)	0.0568 (0.3832)	1.0368*** (0.2514)
x				0.7389*** (0.0771)	0.5171 (0.3118)	0.6907*** (0.0887)	0.5469* (0.3160)	0.7421*** (0.0945)
fdiout				0.0693 (0.1231)	0.5521** (0.2098)	0.0361 (0.1315)	0.5052** (0.2240)	0.0284 (0.1284)
gdp <sup>US</sup> x gdp <sup>c</sup>				-0.3946*** (0.0686)	0.6084 (1.2378)	-0.3831*** (0.0722)	0.5917 (1.2703)	-0.4825*** (0.0773)
tariffs <sub>aced</sub>						-0.0106 (0.0220)	-0.0070 (0.0197)	-0.0150 (0.0246)
distance						-0.1951** (0.0987)		-0.1193 (0.1824)
common border								-0.0824 (0.4401)
common language								-0.4334** (0.1986)
colony								0.2684 (0.1804)
constant	-6.8796*** (0.7665)	-6.8568*** (0.7852)	-1.6122 (3.6032)	11.7202*** (3.1933)	-38.5932 (67.6039)	13.1730*** (3.5315)	-37.3697 (69.4225)	17.1056*** (3.7854)
time fixed effects	no	yes	yes	yes	yes	yes	yes	yes
country fixed effects	no	no	yes	no	yes	no	yes	no
Observations	221	221	221	221	221	217	217	217
R-sq.	0.7272	0.7274	0.9764	0.8318	0.9795	0.8317	0.9793	0.8395
R-sq. adj.	0.726	0.721	0.968	0.825	0.972	0.824	0.971	0.829
F	362.5	81.32	6.076	253.8	7.647	187.7	6.009	335.1

Note: Standard errors in parentheses. \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% level respectively.

**Table 3.3.4c / Regression for explaining ifm by foreign-controlled affiliates located in the US (model 3) – various specifications (2008-2012)**

Dependent variable: intra-firm imports by foreign-controlled affiliates located in the US								
	(M3.1)	(M3.2)	(M3.3)	(M3.4)	(M3.5)	(M3.6)	(M3.7)	(M3.8)
sales	1.0303*** (0.0616)	1.0234*** (0.0620)	1.4499*** (0.2754)	1.4331*** (0.2412)	1.6730*** (0.5494)	1.3965*** (0.2508)	1.6898*** (0.5420)	1.3913*** (0.2141)
m				0.1104 (0.0877)	0.4818 (0.3939)	0.1411 (0.1391)	0.4521 (0.4071)	0.0414 (0.1027)
fdiin				-0.4251* (0.2173)	-0.0344 (0.0440)	-0.4002* (0.2225)	-0.0564 (0.0387)	-0.3033 (0.1941)
gdp <sup>US</sup> x gdp <sup>c</sup>				0.0666 (0.1149)	-1.3704 (2.2913)	0.0190 (0.1634)	-0.9814 (2.0746)	0.0366 (0.1399)
tariffs <sub>imposed</sub>						0.0674 (0.0693)	-0.7326* (0.3897)	0.0684 (0.1112)
distance						-0.0517 (0.1683)		0.6166 (0.4736)
common border								1.8725 (1.1525)
common language								-0.7320*** (0.2284)
colony								-0.8025*** (0.2365)
constant	-2.7592*** (0.7131)	-2.8124*** (0.7294)	-7.5021** (3.0770)	-8.0505 (5.7132)	64.3348 (125.9634)	-5.2208 (7.3642)	44.5139 (114.2056)	-11.8364** (5.5438)
time fixed effects	no	yes	yes	yes	yes	yes	yes	yes
country fixed effects	no	no	yes	no	yes	no	yes	no
Observations	102	102	102	100	100	100	100	100
R-sq.	0.7199	0.7231	0.9810	0.7911	0.9822	0.7931	0.9830	0.8621
R-sq. adj.	0.717	0.709	0.974	0.773	0.974	0.770	0.975	0.841
F	279.7	55.30	6.850	51.02	14.19	49.05	13.16	54.76

Note: Standard errors in parentheses. \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% level respectively.

**Table 3.3.4d / Regression for explaining ifm by US headquarters located in the US (model 2) – various specifications (2008-2012)**

Dependent variable:	intra-firm imports by foreign-controlled affiliates located in the US							
	(M2.1)	(M2.2)	(M2.3)	(M2.4)	(M2.5)	(M2.6)	(M2.7)	(M2.8)
sales	1.4031*** (0.1031)	1.4150*** (0.1042)	1.4788** (0.5738)	2.0483*** (0.2301)	1.9367*** (0.5794)	2.0504*** (0.2272)	1.7650*** (0.5822)	2.0307*** (0.2352)
m				0.7084*** (0.0974)	0.4985 (0.4143)	0.6757*** (0.1054)	0.5045 (0.4174)	0.6938*** (0.1097)
fdiout				-0.3980*** (0.1431)	0.2915 (0.2760)	-0.4167*** (0.1500)	0.4234 (0.2663)	-0.4205*** (0.1605)
gdp <sup>US</sup> x gdp <sup>c</sup>				-1.0783*** (0.0977)	-3.0116** (1.2105)	-1.0377*** (0.0951)	-2.5490** (1.2645)	-1.0909*** (0.0977)
tariffs <sub>imposed</sub>						-0.0324 (0.0789)	0.2309*** (0.0786)	-0.0335 (0.1165)
distance						-0.1127 (0.1653)		0.0367 (0.3440)
common border								0.4586 (0.9526)
common language								-0.0125 (0.1515)
colony								0.5698*** (0.1445)
constant	-8.5495*** (1.1944)	-8.3304*** (1.1980)	-9.1809 (6.2212)	43.1974*** (4.9621)	149.3991** (63.1242)	42.4873*** (5.0082)	122.7594* (65.9692)	44.1857*** (5.7590)
time fixed effects	no	yes	yes	yes	yes	yes	yes	yes
country fixed effects	no	no	yes	no	yes	no	yes	no
Observations	199	199	199	199	199	199	199	199
R-sq.	0.6333	0.6438	0.9821	0.8014	0.9837	0.8023	0.9844	0.8064
R-sq. adj.	0.631	0.635	0.975	0.793	0.977	0.792	0.978	0.793
F	185.1	37.39	2.551	111.7	2.241	110.6	4.229	96.82

Note: Standard errors in parentheses. \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% level respectively.

The most important aspect in these regressions is their explanatory power because they will serve for out-of-sample predictions. Importantly, for both model 1 and model 4, a simple two-way fixed effects regression with sales as the only explanatory variable already has a very high explanatory power with an adjusted R-square of about 0.96 to 0.98.

The same qualitative results are obtained in the two models that explain intra-firm imports (Table 3.3.4c and Table 3.3.4d). Again, the sales by foreign affiliates in the US and by US affiliates located abroad are a very strong predictor for intra-firm imports. Additionally, in this case, there are several results that are not in line with standard gravity models. However, also on the import side, the explanatory power of the regressions is very high with the adjusted R-square exceeding 0.98 in the bivariate two-way fixed effects specification.

### 3.3.6. Actual intra-firm trade by EU Member States: Evidence from Italy and Slovenia

As mentioned in the introduction there is hardly any information on intra-firm trade by EU Member States. There are only two exceptions: Italy reports intra-firm trade associated with inward FDI, i.e. exports and imports of foreign affiliates located in Italy and Slovenia provides data on intra-firm trade related to Slovenian outward FDI. Before applying the estimated numbers for Member States' intra-firm trade resulting from the gravity model, these actual data is briefly presented.

In Table 3.3.5 the Slovenian intra-firm trade by industry is shown. A first observation here is that both on the import and on the export side, intra-firm trade is very low amounting to EUR 1.7 billion and EUR 2.4 billion respectively where both figures refer to the year 2012.

In this case it is also interesting to note that the manufacturing sector does not account for the overwhelming majority of intra-firm goods trade as one might expect. Rather, it is wholesale and retail trade industry that is accounting for the bulk of Slovenian intra-firm trade flows though the situation seems to have changed in 2012 at least on the export side where the values dropped by three-quarters to EUR 312 million. Moreover, the utilities sector, i.e. the sale of electricity, gas and steam exceeded the value of intra-firm trade in manufacturing products in 2012. Unfortunately, no comparison with other EU Member States is possible for outward activities.

**Table 3.3.5 / Intra-firm trade by Slovenian MNEs associated with outward FDI by industry (in million EUR)**

Declaring country Slovenia							
Partner country Rest of the World except Slovenia							
Industry	intra-firm exports (exports of Slovenian parent company to affiliate located abroad)			intra-firm imports (imports by Slovenian parent company from affiliate located abroad)			
	2010	2011	2012	2010	2011	2012	
C01-03: AGRICULTURE, FORESTRY AND FISHING	1	1	1	18	6	4	
C05-09: MINING AND QUARRYING	0	0	0	0	0	0	
C10-33: MANUFACTURING	437	540	568	312	378	425	
<i>C10-12: Food products, beverages and tobacco</i>	25	19	6	6	12	16	
<i>C13-15: Textiles, wearing apparel, leather</i>							
<i>C16-18: Wood; paper products; printing; reprod. of recorded media</i>	4	5	3	1	2	2	
<i>C19-22: Total petroleum, chemical, rubber and plastic products</i>	21	31	39	52	58	78	
<i>C23: Other non-metallic mineral products</i>							
<i>C24-25: Basic metals and fabricated metal products</i>	81	89	78	72	93	87	
<i>C26: Computer, electronic and optical products</i>	6	7	5	5	4	3	
<i>C27: Electrical equipment</i>							
<i>C28: Machinery and equipment n.e.c.</i>	12	14	13	40	30	43	
<i>C29-30: Transport equipment</i>	116	132	134	48	55	71	
<i>C31-33: Other manufacturing; repair/installation of machinery and eq.</i>							
<i>Missing and confidential in manufacturing industries</i>	172	243	290	88	124	125	
C35: ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	263	464	769	322	542	759	
C36-39: WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT	6	8	11	0	0	0	
C41-43: CONSTRUCTION	2	2	1	14	11	10	
C45-47: WHOLESALE AND RETAIL TRADE; REPAIR OF MOTOR VEHICLES	1097	1337	312	1094	1188	1130	
C49-53: TRANSPORTATION AND STORAGE	11	8	5	27	12	5	
C55-56: ACCOMMODATION AND FOOD SERVICE ACTIVITIES	1	1	1	1	0	0	
C58-63: INFORMATION AND COMMUNICATION	13	21	24	12	17	15	
C64-66: FINANCIAL AND INSURANCE ACTIVITIES	34	37	30	50	52	43	
C68: REAL ESTATE ACTIVITIES	0	1	0	1	1	2	
C69-75: PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	4	4	3	4	3	4	
C77-82: ADMINISTRATIVE AND SUPPORT SERVICE ACTIVITIES	18	14	21	16	6	10	
C85: EDUCATION	0	0	0	0	0	0	
C86-88: HUMAN HEALTH AND SOCIAL WORK ACTIVITIES	0	0	0	0	0	0	
C90-93: ARTS, ENTERTAINMENT AND RECREATION	0	0	0	2	2	2	
C94-96: OTHER SERVICE ACTIVITIES	1	0	1	0	0	2	
<b>C9999: TOTAL BUSINESS SECTOR (sec B to S excl. O)</b>	<b>1886</b>	<b>2437</b>	<b>1744</b>	<b>1856</b>	<b>2214</b>	<b>2407</b>	

Source: OECD AMNE database.

Note: Section O refers to Division 84 which is absent from the above table

**Table 3.3.6 / Intra-firm trade by Italian MNEs associated with inward FDI by industry (in million EUR)**

Industry	Declaring country		Partner country							
	Italy		World total except for the declaring country							
	Intra-firm exports					Intra-firm imports				
	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
C01-03: AGRICULTURE, FORESTRY AND FISHING										
C05-09: MINING AND QUARRYING	8	26	36	46	292	56	56	75	123	126
C10-33: MANUFACTURING	29770	26855	28681	33666	33886	29970	21617	28954	35025	36408
<i>C10-12: Food products, beverages and tobacco</i>	1858	1432	1641	2182	2489	2267	1639	1806	1232	1882
<i>C13-15: Textiles, wearing apparel, leather</i>	1267	1112	1333	1612	1793	124	174	191	239	212
<i>C16-18: Wood; paper products; printing; reprod. of recorded media</i>	410	304	348	401	282	518	333	419	520	507
<i>C19-22: Total petroleum, chemical, rubber and plastic products</i>	10271	11021	11767	15627	15357	17081	12090	16018	22350	23886
<i>C23: Other non-metallic mineral products</i>	644	244	340	420	455	509	311	469	510	360
<i>C24-25: Basic metals and fabricated metal products</i>	3123	2342	2728	1683	1467	2079	2172	3469	2411	2433
<i>C26: Computer, electronic and optical products</i>	1461	1381	701	1504	1294	866	541	1106	883	808
<i>C27: Electrical equipment</i>	2772	3571	3824	3214	3340	1287	706	961	1653	1288
<i>C28: Machinery and equipment n.e.c.</i>	5112	2526	3184	4247	4183	2102	1843	2402	2872	2768
<i>C29-30: Transport equipment</i>	2249	2492	2239	1539	2040	2190	1232	1580	1649	1381
<i>C31-33: Other manufacturing; repair/installation of machinery and eq.</i>	603	430	576	1237	1187	947	576	533	706	883
<i>Missing and confidential in manufacturing industries</i>	0	0	0	0	-1	0	0	0	0	0
C35: ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	1	0				780	1150			
C36-39: WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT	1	5	21	10	6	5	3	7	12	15
C41-43: CONSTRUCTION	6	6	4	19	15	22	53	236	211	183
C45-96: TOTAL SERVICES (sec G to S excl. O)	3200	4761	5356	5610	3754	57889	42560	43693	52540	43310
<i>C45-47: WHOLESALE/RETAIL TRADE; REPAIR OF MOTOR VEHICLES</i>	2918	4002	4495	5062	3213	56535	40971	41988	49670	40980
<i>Missing and confidential in services industries</i>	282	759	861	548	541	1354	1589	1705	2870	2330
<b>C9999: TOTAL BUSINESS SECTOR (sec B to S excl. O)</b>	<b>32986</b>	<b>31653</b>	<b>34098</b>	<b>39351</b>	<b>37954</b>	<b>88722</b>	<b>65439</b>	<b>72965</b>	<b>87911</b>	<b>80041</b>

Source: OECD AMNE database.

Note: Section O refers to Division 84 which is absent from the above table.

Similarly, intra-firm trade figures associated with inward FDI is available for Italy only. The Italian data shows that with regards to intra-firm exports, the manufacturing sector accounts for almost 90% of total exports with the combined petroleum, chemical, and rubber and plastics industries accounting for the largest share, followed by machinery and equipment industry. When it comes to intra-firm imports, however, the share of the manufacturing sector drops to less than half of the total (45% in 2012). In this case, i.e. imports by foreign affiliates located in Italy, imports of goods by the wholesale and retail sector turns out to be important accounting for between 51% and 64% between 2008 and 2012.

Slovenia also provides some information on its intra-firm trade (for outward FDI related trade) by partners. The break-up by major intra-EU and extra-EU partners is summarised in Table 3.3.7.

**Table 3.3.7 / Intra-firm trade by Slovenian MNEs associated with outward FDI by partner country (in million EUR) – total business sector, 2012**

	intra-firm exports (exports of Slovenian parent company to affiliate located abroad)		intra-firm imports (imports by Slovenian parent company from affiliate located abroad)
<b>intra-EU</b>	<b>635</b>	<b>intra-EU</b>	<b>592</b>
Greece	105	Germany	93
Bulgaria	99	Greece	90
Sweden	80	Austria	85
Romania	74	Poland	57
Austria	70	Italy	52
Czech Republic	59	Romania	52
Poland	50	Czech Republic	37
Germany	27	United Kingdom	28
Italy	22	Bulgaria	26
Hungary	21	Sweden	21
other EU-MS	28	other EU-MS	51
<b>extra-EU</b>	<b>1109</b>	<b>extra-EU</b>	<b>1815</b>
Serbia	422	Croatia	550
Croatia	329	Serbia	467
BiH	193	BiH	210
Macedonia	52	Russian Federation	163
Albania	50	Macedonia	130
China	29	United States	102
Ukraine	16	Albania	81
Russian Federation	6	Montenegro	31
Montenegro	3	Switzerland	30
Switzerland	2	Canada	15
other extra-EU	7	other extra-EU	36
<b>WORLD</b>	<b>1744</b>	<b>WORLD</b>	<b>2407</b>

Source: OECD AMNE database.

Note: extra-EU calculated as the difference between World and intra-EU. Other extra-EU calculated as difference between extra-EU and the available partner countries. Croatia is considered to be part of extra-EU trade.

BiH= Bosnia and Herzegovina.

Note first that in Table 3.3.7 Croatia is still considered to be an extra-EU partner as the data refers to the year 2012. This is important as Croatia, together with Serbia, is Slovenia's most important trading partner when it comes to intra-firm trade. In general, Slovenia's profile of intra-firm trading partners is strongly influenced by historical factors, in particular the fact that it was part of former Yugoslavia.

Together with geographic proximity this explains the prominence of Balkan countries among Slovenia's extra-EU trading partners. Nevertheless, given that Central and Eastern European Member States' FDI activities are typically concentrated on other Member States, i.e. intra-EU FDI dominates, the fact that 64% (export side) and 75% (import side) of intra-firm trade is done with third countries comes as a surprise.

With regards to intra-EU intra-firm trade, Slovenian parent companies' primary export destination is Greece (EUR 105 million), followed by Bulgaria (EUR 99 million). The ranking of intra-firm trading partner on the export side is rather different, revealing Germany (EUR 93 million) as the major trading partner from where Slovenian affiliated ship to their parent company.

Since Slovenia is the only EU country that reports (at least outward FDI related) intra-firm trade figures, it is difficult to differentiate between the developments of intra-EU and extra-EU trade when it comes to trade between related entities. First of all, it is always difficult to draw conclusions for the EU as a whole based on the experiences of a single Member State. In this particular case, the issue is further complicated by the fact that Slovenia is a small country with comparatively little outward FDI. Hence, intra-firm trade between Slovenian parent companies and its affiliates only plays a secondary role. The figures presented in Table 3.3.7 are based on the activities of only 1,566 affiliated of which almost half are located in Serbia and Croatia. In additions, as mentioned above, the FDI and trade orientation of Slovenian MNEs appears to be rather different from that of other EU Member States.

Due to the lack of alternative data sources which would allow for a distinction between intra-EU intra-firm trade and extra-EU intra-firm trade, Table 3.3.8 does this just for Slovenia. To state it once more, this need not be representative for the EU as a whole but it is all data there is to tackle the question.

A first observation regarding Slovenia's disaggregation of trade flows by destination is that the role of trade undertaken by MNEs in general and the role of intra-firm trade are larger in extra-EU trade than in intra-EU trade. Expressed in per cent of country level exports, intra-firm exports accounted for 4%-9% in intra-EU trade whereas in the case of extra-EU trade this ratio stood at 14%-17% between 2010 and 2012. On the import side this difference is even more pronounced. Whether this pattern would also be found is hard to tell. On the one hand, the fact that important EU investor countries such as Germany, the United Kingdom or Germany have heavy foreign direct investments in other EU markets raises some doubt about the representativeness. On the other hand, the literature on the determinants of intra-firm trade could not establish distance as a relevant factor (see Corcos et al., 2013 for France; Lakatos and Fukui, 2013 for EU-US trade). Moreover, the global intra-firm trade estimates in Section 3.3.7 suggest that the intra-firm trade share in global trade is much lower than the corresponding share in EU-US trade which is also in line with the pattern found in the Slovenian data.

Going one level deeper by looking at the importance of intra-firm trade in MNE trade, the Slovenian case suggests that intra-firm trade is more important in export activities of MNEs in intra-EU trade than in extra-EU trade. About two thirds to four fifth of Slovenian parent companies' intra-EU exports are with related affiliates whereas in extra-EU trade this ratio, though still high, is somewhat lower. The opposite, however, is true when it comes to Slovenian parent companies' imports.

**Table 3.3.8 / Portray of Slovenian country-level, MNE and intra-firm trade associated with outward FDI (in million EUR) – total business sector, 2010-2012****values in billion EUR**

	Exports			Imports				
		2010	2011	2012		2010	2011	2012
intra-EU trade	country-level	13,060	14,662	14,416	country-level	13,193	14,794	14,481
	by Slovenian MNEs	1,600	1,840	948	by Slovenian MNEs	1,587	1,874	856
	intra-firm	1,135	1,464	635	intra-firm	621	648	592
extra-EU trade	country-level	5,185	6,160	6,661	country-level	6,691	7,646	7,610
	by Slovenian MNEs	1,440	1,687	1,748	by Slovenian MNEs	1,761	2,079	2,212
	intra-firm	751	973	1,109	intra-firm	1,235	1,566	1,815
World	country-level	18,245	20,822	21,077	country-level	19,884	22,440	22,091
	by Slovenian MNEs	3,040	3,527	2,696	by Slovenian MNEs	3,348	3,953	3,068
	intra-firm	1,886	2,437	1,744	intra-firm	1,856	2,214	2,407

**shares in country-level exports**

	Exports			Imports				
		2010	2011	2012		2010	2011	2012
intra-EU trade	by Slovenian MNEs	0.12	0.13	0.07	by Slovenian MNEs	0.12	0.13	0.06
	intra-firm	0.09	0.10	0.04	intra-firm	0.05	0.04	0.04
extra-EU trade	by Slovenian MNEs	0.28	0.27	0.26	by Slovenian MNEs	0.26	0.27	0.29
	intra-firm	0.14	0.16	0.17	intra-firm	0.18	0.20	0.24
World	by Slovenian MNEs	0.17	0.17	0.13	by Slovenian MNEs	0.17	0.18	0.14
	intra-firm	0.10	0.12	0.08	intra-firm	0.09	0.10	0.11

**shares of intra-firm trade in MNE trade**

	Exports			Imports				
		2010	2011	2012		2010	2011	2012
intra-EU trade	intra-firm	0.71	0.80	0.67	intra-firm	0.39	0.35	0.69
extra-EU trade	intra-firm	0.52	0.58	0.63	intra-firm	0.70	0.75	0.82
World	intra-firm	0.62	0.69	0.65	intra-firm	0.55	0.56	0.78

**intra-EU and extra-EU shares in total trade**

	Exports			Imports				
		2010	2011	2012		2010	2011	2012
intra-EU trade	country-level	0.72	0.70	0.68	country-level	0.66	0.66	0.66
	by Slovenian MNEs	0.53	0.52	0.35	by Slovenian MNEs	0.47	0.47	0.28
	intra-firm	0.60	0.60	0.36	intra-firm	0.33	0.29	0.25
extra-EU trade	country-level	0.28	0.30	0.32	country-level	0.34	0.34	0.34
	by Slovenian MNEs	0.47	0.48	0.65	by Slovenian MNEs	0.53	0.53	0.72
	intra-firm	0.40	0.40	0.64	intra-firm	0.67	0.71	0.75

**growth rates of trade flows**

	Exports			Imports				
		2010	2011	2012		2010	2011	2012
intra-EU trade	country-level		12%	-2%	country-level		12%	-2%
	by Slovenian MNEs		15%	-48%	by Slovenian MNEs		18%	-54%
	intra-firm		29%	-57%	intra-firm		4%	-9%
extra-EU trade	country-level		19%	8%	country-level		14%	0%
	by Slovenian MNEs		17%	4%	by Slovenian MNEs		18%	6%
	intra-firm		30%	14%	intra-firm		27%	16%
World	country-level		14%	1%	country-level		13%	-2%
	by Slovenian MNEs		16%	-24%	by Slovenian MNEs		18%	-22%
	intra-firm		29%	-28%	intra-firm		19%	9%

Source: OECD AMNE database.

Note: extra-EU calculated as the difference between World and intra-EU Exports and imports by Slovenian firms are the overall exports and imports of Slovenian parent companies. Croatia is considered to be part of extra-EU trade.



An interesting issue fact is the rather low share of intra-EU intra-firm trade in Slovenia's total intra-firm trade. As was shown already in the ranking of Slovenia's intra-firm trade destinations, the share of intra-EU intra-firm trade is rather low compared to country-level trade. This is particularly true for the intra-firm imports by Slovenian MNEs but also on the export side the ratio dropped from 60% in 2010 and 2011 to only 36% in 2012. If that were a general pattern, applicable to other EU Member States, this would again suggest that intra-firm trade plays a greater role in extra-EU trade relations than in intra-EU trade relations. Moreover, the short time series available suggests that between 2010 and 2012, the share of extra-EU intra-firm trade gained in importance to the detriment of intra-firm intra-EU trade. On the import side, for example, the extra-EU intra-firm trade accounted for two-thirds in 2010 but for three-quarters in 2012. Whether this is a general trend is hard to tell as it may as well simply reflect bounce-back effects from the trade collapse after the year 2008/2009 but also the negative impact of the Euro crisis of 2010. In any case, the growing importance of extra-EU trade in intra-firm trade (which is less pronounced in country-level trade) would fit the finding in Lakatos and Fukui (2013) that intra-firm trade is relatively more demand driven than arm's length trade, if one takes into account that the EU's inferior (compared to the rest of the world) growth performance during that period.

### 3.3.7. Out-of-sample predictions for global intra-firm trade by the EU and individual Member States

The estimated coefficients from the regressions to explain bilateral intra-firm trade serve as the basis for predicting the values of intra-firm trade of Member States and the EU as a whole. Ideally, for this application, bilateral relationships would also be generated but the information on sales by foreign affiliates for Member States is broadly only available at the global level and not at the bilateral level. For this reason, the specifications including the gravity variables cannot be used for predicting intra-firm exports and imports by Member States. Given the high explanatory power, specification 3 for each model was selected to predict intra-firm trade for the EU (**Prediction A**). In addition, specification 4 was selected as a second model which, although it scores lower in terms of explanatory power, it includes more specific country characteristics (**Prediction B**). This turns out to be advantageous in the exercise because the coefficients obtained from a bilateral regression model (i.e. US to partner *c*) will have to be applied to global data (i.e. Member State to world).

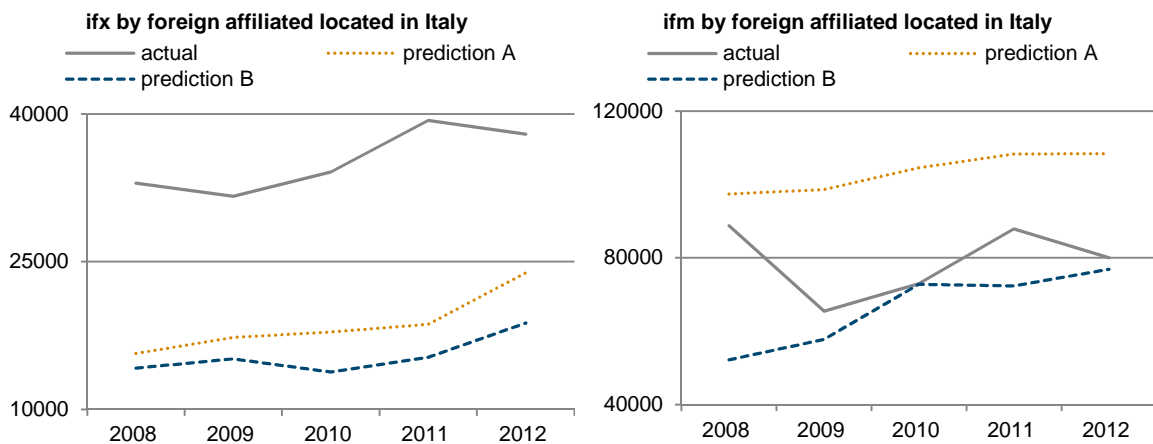
The results from this exercise for the EU as a whole are illustrated in Tables 3.3.9a and 3.3.9b. A first observation is that predictions B result in about 50% higher intra-firm exports and more than 30% higher intra-firm imports than predictions A. Moreover, the pattern regarding the relative size of exports by foreign affiliates and exports by EU parents in predictions B is in line with that observed in bilateral EU-US intra-firm trade. More precisely, the ratio of the latter to the former is in the order of 3. In contrast, regarding intra-firm imports the relative size of the two types of intra-firm imports suggested by EU-US intra-firm trade data are better captured by predictions A, where the intra-firm imports by EU parents exceed the imports by foreign affiliates located in the EU.

An important check for the quality of the predictions is the comparison with the intra-firm exports and imports of foreign affiliates located in Italy for which data are available for the period 2008-2012.

The comparison with the actual Italian data shows that both prediction models strongly underestimate the ifx by foreign affiliates located in Italy (Figure 3.3.6). For the intra-firm imports by foreign affiliates

located in Italy, the fit is somewhat better for prediction model B. Prediction model A very strongly overestimates these ifm in this case – apart from the year 2008.

**Figure 3.3.6 / Actual and predicted intra-firm trade by foreign affiliates located in Italy, 2008-2012, in EUR million**



Source: OECD AMNE database, wiiw estimates.

In general, however, the estimates seem to be rather low compared to the bilateral EU-US intra-firm trade data discussed in the previous section. Moreover, according to Lanz and Miroudot (2011), intra-firm exports of foreign affiliates alone already represented about 16% of exports in OECD countries.<sup>25</sup> This contrasts with a mere 3% in prediction model B. The reason behind this may be that, in particular for this type of intra-firm trade flows, the predictions of the models are very low.

Therefore, to arrive at final estimates for EU intra-firm trade, the following procedure is applied:

- › For exports and imports of parent companies, the higher estimate of the two models is selected. This is prediction B in the case of intra-firm exports by EU parent companies (model 4) and prediction A in the case of intra-firm imports by EU parent companies (model 2).
- › In the case of exports and imports by foreign affiliates located in the EU, the predictions which best fit the Italian data are selected. These are prediction A in the case of foreign affiliates' exports and prediction B in the case of foreign affiliates' imports. In addition, these estimates are scaled up to fit the Italian data.

These final rough estimates (or rather 'guestimates') for EU intra-firm trade result in a share of intra-firm exports of 14% of total EU exports and a share of intra-firm imports of 16% of total EU imports in the year 2012. Taken together, this gives an overall share of EU intra-firm trade of 15% of total EU trade (Table 3.3.10). This estimate is still considerably low and may be considered as the lower bound of intra-firm trade by EU Member States.

<sup>25</sup> This ratio, however, seems to refer to manufacturing exports. Trimming down the analysis to manufacturing exports for the period under investigation is not possible due to data limitations.

**Table 3.3.9a / Predicted EU intra-firm trade – Prediction A (bivariate two-way fixed effects regression)**

year	EU country-level exports	foreign affiliate in the EU exports to foreign parent	EU parent exports to foreign affiliates	intra-firm exports (ifx)	share EU ifx in total EU exports	EU country-level imports	foreign affiliate in the EU imports from foreign parent	EU parent imports from foreign affiliates	intra-firm imports (ifm)	share EU ifm in total EU imports	EU intra-firm trade (ifx + ifm)	share EU ift in total EU trade
	(1)	(2)	(3)	(4) = (2) + (3)	(5) = (4) / (1)	(6)	(7)	(8)	(9) = (7) + (8)	(10) = (9) / (6)	(11) = (4) + (9)	(12) = (11) / [(1) + (6)]
2008	7,938,915	230,553	62,076	292,629	3.7%	8,379,544	1,535,276	333,300	1,868,577	22.3%	2,161,205	13.2%
2009	6,464,095	223,569	61,611	285,180	4.4%	6,641,779	1,323,650	299,889	1,623,540	24.4%	1,908,719	14.6%
2010	7,651,366	243,279	76,843	320,122	4.2%	7,890,715	1,491,913	377,902	1,869,815	23.7%	2,189,936	14.1%
2011	8,510,602	272,322	79,498	351,820	4.1%	8,764,122	1,682,176	354,408	2,036,584	23.2%	2,388,404	13.8%
2012	8,792,821	367,628	83,473	451,101	5.1%	8,876,018	1,812,531	449,928	2,262,459	25.5%	2,713,560	15.4%

Note: Values in million EUR. In the case of outward AMNE data, no information is available on foreign affiliates' sales for Bulgaria, Denmark, Estonia and the Netherlands. These data have been completed using the assumption that in each year the share of these countries in intra-firm exports and imports resulting from outward foreign affiliates is equal to the share in intra-firm exports and imports resulting from inward foreign affiliates. For several countries information on foreign affiliates' sales is not available for the entire sample period. In these cases, it was assumed that the values of the preceding years were equal to the value of the last year for which information was available.

Source: wiiw estimates.

**Table 3.3.9b / Predicted EU intra-firm trade – Prediction B (OLS with time dummies and trade, FDistocks and combined GDP as controls)**

year	EU country-level exports	foreign affiliate in the EU exports to foreign parent	EU parent exports to foreign affiliates	intra-firm exports (ifx)	share EU ifx in total EU exports	EU country-level imports	foreign affiliate in the EU imports from foreign parent	EU parent imports from foreign affiliates	intra-firm imports (ifm)	share EU ifm in total EU imports	EU intra-firm trade (ifx + ifm)	share EU ift in total EU trade
	(1)	(2)	(3)	(4) = (2) + (3)	(5) = (4) / (1)	(6)	(7)	(8)	(9) = (7) + (8)	(10) = (9) / (6)	(11) = (4) + (9)	(12) = (11) / [(1) + (6)]
2008	7,938,915	190,046	444,533	634,580	8.0%	8,379,544	596,344	213,164	850,847	10.2%	1,485,426	9.1%
2009	6,464,095	179,866	432,386	612,252	9.5%	6,641,779	572,480	206,888	819,162	12.3%	1,431,414	10.9%
2010	7,651,366	171,460	552,509	723,969	9.5%	7,890,715	777,121	262,815	1,043,005	13.2%	1,766,975	11.4%
2011	8,510,602	202,334	591,114	793,448	9.3%	8,764,122	872,627	221,256	1,096,952	12.5%	1,890,400	10.9%
2012	8,792,821	262,932	642,045	904,978	10.3%	8,876,018	982,659	254,719	1,237,378	13.9%	2,142,356	12.1%

Note: Values in million EUR. In the case of outward AMNE data, no information is available on foreign affiliates' sales for Bulgaria, Denmark, Estonia and the Netherlands. These data have been completed using the assumption that in each year the share of these countries in intra-firm exports and imports resulting from outward foreign affiliates is equal to the share in intra-firm exports and imports resulting from inward foreign affiliates. For several countries information on foreign affiliates' sales is not available for the entire sample period. In these cases, it was assumed that the values of the preceding years were equal to the value of the last year for which information was available.

Source: wiiw estimates.

**Table 3.3.10 / Estimated EU intra-firm trade, 2008-2012**

year	EU country-level exports	foreign affiliate in the EU exports to foreign parent	EU parent exports to foreign affiliates	intra-firm exports (ifx)	share EU ifx in total EU exports	EU country-level imports	foreign affiliate in the EU imports from foreign parent	EU parent imports from foreign affiliates	intra-firm imports (ifm)	share EU ifm in total EU imports	EU intra-firm trade (ifx + ifm)	share EU ift in total EU trade
	(1)	(2)	(3)	(4) = (2) + (3)	(5) = (4) / (1)	(6)	(7)	(8)	(9) = (7) + (8)	(10) = (9) / (6)	(11) = (4) + (9)	(12) = (11) / [(1) + (6)]
2008	7,938,915	485,249	444,533	929,782	11.7%	8,379,544	1,013,824	333,300	1,347,124	16.1%	2,276,906	14.0%
2009	6,464,095	408,495	432,386	840,881	13.0%	6,641,779	648,102	299,889	947,991	14.3%	1,788,871	13.6%
2010	7,651,366	464,203	552,509	1,016,712	13.3%	7,890,715	779,058	377,902	1,156,960	14.7%	2,173,672	14.0%
2011	8,510,602	574,840	591,114	1,165,954	13.7%	8,764,122	1,060,195	354,408	1,414,604	16.1%	2,580,558	14.9%
2012	8,792,821	584,261	642,045	1,226,307	13.9%	8,876,018	1,023,276	449,928	1,473,203	16.6%	2,699,510	15.3%

Note: Values in million EUR. In the case of outward AMNE data, no information is available on foreign affiliates' sales for Bulgaria, Denmark, Estonia and the Netherlands. These data have been completed using the assumption that in each year the share of these countries in intra-firm exports and imports resulting from outward foreign affiliates is equal to the share in intra-firm exports and imports resulting from inward foreign affiliates. For several countries information on foreign affiliates' sales is not available for the entire sample period. In these cases, it was assumed that the values of the preceding years were equal to the value of the last year for which information was available.

Source: wiiw estimates.

There are several reasons why the estimates based on US data may be understating intra-firm trade by EU Member States. First of all, for the period 2008-2012, economy-wide data for intra-firm trade are only available at a bilateral level for the US. Hence, differences in industry structures, in particular a stronger service-orientation of the US compared to the EU, could imply that the relationship between intra-firm trade and firm sales is higher for EU Member States than predicted by US data. Secondly, EU multinationals could be more export-oriented than their US counterparts even within the same sector (though there is no empirical evidence for this).

### 3.4. INTRA-FIRM TRADE IN IRELAND<sup>26</sup>

#### 3.4.1. Introduction

Ireland is one of the most globalised economies<sup>27</sup> in the world with a high share of multinational enterprises in its economic activity. The results of the *International Sourcing Survey* conducted in 2012 in Ireland found that the majority of firms which engaged in international sourcing over the period 2009-2011 were foreign affiliates of multinational firms. Furthermore, the survey highlighted that 78% of firms engaged in international sourcing sourced business functions within their enterprise group. Over 54% of firms engaged in international sourcing sourced at least one business function to the UK and 50% sourced at least one business function to one of the other EU-15 countries. Other popular destinations for international sourcing were the EU-12, India, the United States and Canada.

This study analyses highly detailed firm-level data on merchandise trade (exports and imports) by product and country of destination/origin available for Ireland over the period 1994-2015. Firstly, the analysis identifies patterns and trends of intra-firm exports and imports. Secondly, it uncovers the importance of the extensive and intensive margins of intra-firm trade. Thirdly, the study identifies firm, industry and country characteristics that explain the engagement of firms in intra-firm trade and the intensity of intra-firm trade.

This section is structured as follows. The next subsection discusses the data used for the analysis. Section 3.4.3 reports the descriptive analysis of patterns of intra-firm exports and imports. Section 3.4.4 discusses empirical results from an econometric analysis of determinants of the extensive and intensive margins of intra-firm exports and imports. Key findings and related policy relevant messages are summarised in Section 3.4.5.

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<sup>26</sup> This research uses statistical data from the Central Statistics Office (CSO) of Ireland. The permission for controlled access to confidential micro data sets has been granted in line with the Statistics Act, 1993. The use of these statistical data does not imply the endorsement of the CSO in relation to the analysis or interpretation of the statistical data. We would like to thank Damian Malone, Cormac Halpin and Ben Berstock in the CSO for their support with the data.

<sup>27</sup> The 2016 KOF Globalisation Index, measuring economic, social and political globalisation, ranks Ireland second among 207 countries. With respect to the economic dimension of globalisation, Ireland ranks second after Singapore. The rankings are based on data for 2013. [http://globalization.kof.ethz.ch/media/filer\\_public/2016/03/03/rankings\\_2016.pdf](http://globalization.kof.ethz.ch/media/filer_public/2016/03/03/rankings_2016.pdf).

### 3.4.2. Data

The analysis is based on two linked data sets combining trade statistics by product and country of origin/destination (Intra-Stat, Extra-Stat), and firm-level accounting variables from the Census of Industrial Production. The data set covers merchandise trade over the period 1994-2015.<sup>28</sup>

#### *Trade statistics: Intra-Stat and Extra-Stat*

These data sets include trade statistics (exports and imports) of intra-EU and extra-EU merchandise trade collected monthly from all VAT registered traders (Intra-Stat) and from administrative data of Revenue Commissioners (Extra-Stat). The following data are collected: Company VAT number; Commodity code (CN); Transaction type (import, export); Invoice value; Net mass and/or supplementary units; Country of destination for exports; Country of origin for imports; Delivery terms; Statistical value; Nature of transaction.

#### *Census of industrial production*

This data set consists of structural information on accounting variables at firm-level including: ownership, the location and nationality of the parent company, turnover, exports, imports, sales of capital assets, employment and earnings. The survey includes all enterprises with three or more persons engaged in industrial production. Value added in industry accounted for 25.6% of Ireland's GDP over 2011-2015, down from 28.3% over 1996-2000.<sup>29</sup>

#### *Measures of intra-firm trade*

Following international evidence, intra-firm trade is identified as all trade between foreign affiliates in Ireland and the country where the headquarters of the parent company is located.

#### *Other data*

Additional country-level data from international sources are used in the econometric analysis. These include: GDP at constant prices, R&D intensity, capital intensity, an index for the rule of law, corporate tax rates, distance between Ireland and its trading partners and cultural and geographical proximity. Detailed definitions and data sources are given in the Appendix.

### 3.4.3. Patterns and trends in intra-firm trade between Ireland and other EU and non-EU countries

#### *The scale of intra-firm trade*

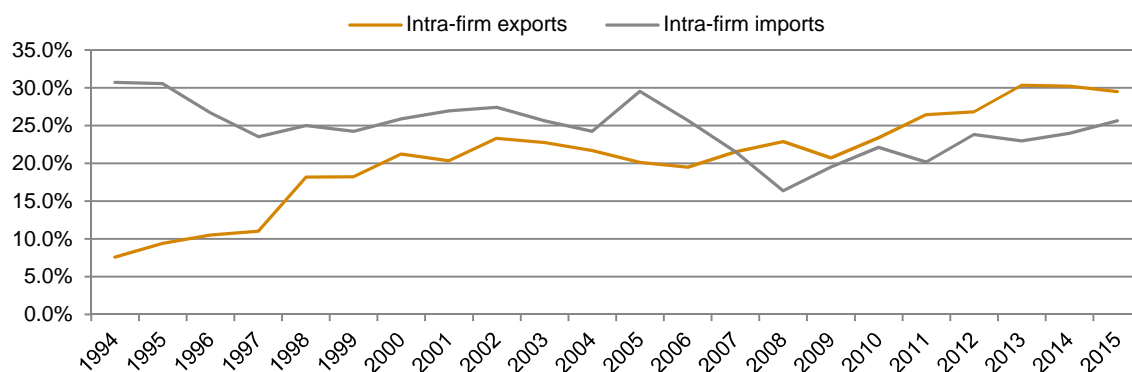
Figure 3.4.1 shows the importance of Ireland's intra-firm trade over the period 1994-2014. The scale of intra-firm imports was larger than the scale of intra-firm exports until 2007. It is worth noticing that during the financial crisis the share of intra-firm imports and the corresponding share on intra-firm exports had

<sup>28</sup> Statistics for trade in services are not available at the detail level required to identify intra-firm trade. Trade with goods accounted for 41% of Ireland's total trade in 2014.

<sup>29</sup> Data available from the World Bank (<http://data.worldbank.org>).

opposite trends. The share of intra-firm imports in total imports declined from 30.7% in 1994 to 16.4% in 2008 and increased in the aftermath of the financial crisis, reaching 25.7% in 2015. The share of intra-firm exports in total exports was much lower at the beginning of the analysed period at 7.6% and it increased over time reaching 30.4% in 2013. In 2015 the share of intra-firm exports in total exports was 29.4%.

**Figure 3.4.1 / Share of Ireland's intra-firm trade in total trade, 1994-2014**



Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

#### *Intra-firm trade by country*

**Table 3.4.1 / Count of intra-firm export flows, 1994-2015**

Destination country	Number of flows	Share (%)
USA	46655	69.60
Germany	5889	8.79
United Kingdom	5558	8.29
France	1966	2.93
Japan	1612	2.40
Netherlands	1372	2.05
Switzerland	1149	1.71
Canada	552	0.82
Denmark	494	0.74
Italy	432	0.64
Sweden	271	0.40
Belgium	243	0.36
Spain	194	0.29
Finland	123	0.18
Korea	96	0.14
Norway	83	0.12
Singapore	61	0.09
Turkey	51	0.08
Australia	43	0.06
Austria	34	0.05
India	35	0.05
Malta	36	0.05
Israel	26	0.04
Greece	16	0.02
Luxembourg	12	0.02
Russia	9	0.01
Saudi Arabia	5	0.01
Thailand	7	0.01
Bermuda	1	0.00
Iceland	3	0.00
Lichtenstein	1	0.00
<b>Total</b>	<b>67029</b>	<b>100.00</b>

Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

Considering intra-firm trade by country of destination and origin, Tables 3.4.1 and 3.4.2 indicate that – in line with international evidence – the importance of intra-firm trade varies greatly by country of export destination and import origin. The US dominates Ireland's intra-firm trade, accounting for 69.6% of the total number of intra-firm export flows and 71.9% of the total number of intra-firm import flows over the analysed period.<sup>30</sup> This dominance is explained by the presence of the US multinationals in Ireland. Germany and the United Kingdom are the next most important intra-firm trade partners, followed by Japan, France, Switzerland and the Netherlands. Germany accounts for 8.8% of the total number of intra-firm export flows and 7.5% of the total number of intra-firm import flows. The corresponding shares for the United Kingdom are 8.3% and 9.5%.

**Table 3.4.2 / Count of intra-firm import flows, 1994-2015**

Country of origin	Number of flows	Share (%)
USA	205883	71.92
United Kingdom	27307	9.54
Germany	21396	7.47
Japan	8937	3.12
France	6245	2.18
Netherlands	3518	1.23
Switzerland	3302	1.15
Canada	1577	0.55
Belgium	1486	0.52
Italy	1361	0.48
Denmark	1039	0.36
Sweden	996	0.35
Finland	618	0.22
Turkey	630	0.22
South Korea	497	0.17
Spain	352	0.12
Singapore	301	0.11
Norway	252	0.09
Austria	205	0.07
Australia	74	0.03
India	77	0.03
Luxembourg	76	0.03
Greece	48	0.02
Iceland	44	0.02
Russia	21	0.01
Israel	3	0.00
Malta	8	0.00
Panama	1	0.00
Saudi Arabia	1	0.00
Thailand	12	0.00
<b>Total</b>	<b>286267</b>	<b>100.00</b>

Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

Tables 3.4.3 and 3.4.4 show the extent of Ireland's intra-firm trade with its main trade partners in 2015. The figures highlight again the sizeable intra-firm trade between Ireland and the US. It appears that 82.5% of Ireland's exports to the US were intra-firm while 74% of Ireland's imports from the US were intra-firm. Other countries with sizeable intra-firm trade were Switzerland (77.3% of total exports; 50.9% of total imports), France (62.8% of total imports; 14.2% of total exports), Denmark (31% of total exports; 43.3% of total imports), Germany (21.5% of total imports; 10.1% of total exports) and Luxembourg (37.5% of total imports).

<sup>30</sup> The number of intra-firm trade flows is identified by counting the trade transactions between foreign affiliates and the country where the headquarters of the parent company is located.



**Table 3.4.3 / The value of intra-firm exports by country, 2015**

	Intra-firm exports (EUR)	Total exports (EUR)	Share intra-firm
<i>EU countries</i>			
Austria	604,871	153,491,111	0.39%
Belgium	51,100,984	12,416,203,030	0.41%
Germany	294,740,491	2,906,816,453	10.14%
Denmark	96,736,775	312,155,647	30.99%
Spain	2,780,598	986,980,691	0.28%
Finland	8,683,637	183,275,195	4.74%
France	275,840,619	1,936,497,749	14.24%
United Kingdom	592,527,697	6,729,495,199	8.80%
Italy	61,979,926	788,092,022	7.86%
Netherlands	7,761,844	1,911,945,796	0.41%
Sweden	2,003,042	433,867,737	0.46%
<i>non-EU countries</i>			
Canada	1,626,666	528,803,644	0.31%
Switzerland	4,093,031,197	5,297,083,552	77.27%
Japan	46,267,430	1,065,289,377	4.34%
Korea	142,543	274,157,535	0.05%
Saudi Arabia	73,823	168,911,055	0.04%
USA	10,929,651,083	13,242,476,372	82.53%

Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

**Table 3.4.4 / Value of intra-firm imports by country, 2015**

	Intra-firm imports (EUR)	Total imports (EUR)	Share intra-firm
<i>EU countries</i>			
Austria	8,260	118,765,776	0.01%
Belgium	10,434,747	386,093,487	2.70%
Germany	273,209,528	1,271,821,579	21.48%
Denmark	56,155,819	129,663,184	43.31%
Spain	923,601	162,068,037	0.57%
France	513,621,184	818,534,946	62.75%
United Kingdom	259,088,087	3,116,177,752	8.31%
Italy	43,863,408	287,567,536	15.25%
Luxembourg	6,045,034	16,141,570	37.45%
Netherlands	25,408,026	1,120,166,365	2.27%
Switzerland	5,749,386	158,334,924	3.63%
<i>non-EU countries</i>			
Canada	3,666,582	75,134,397	4.88%
Switzerland	283,997,828	557,864,308	50.91%
India	1,842,083	164,610,625	1.12%
Japan	83,467,988	975,187,147	8.56%
Norway	3,336,911	184,210,032	1.81%
Singapore	48,019	230,300,259	0.02%
Thailand	6,379,719	148,091,336	4.31%
USA	2,590,090,651	3,501,038,206	73.98%

Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

*Intra-firm trade by major industry categories*

Table 3.4.5 shows the share of intra-firm trade by major industry groups<sup>31</sup> over the analysed period. It appears that intra-firm trade is particularly important in industries producing intermediate goods, capital goods as well as consumer non-durable goods. In 2015, intra-firm trade in intermediate goods accounted for 41.5% of total exports and 30.25% of total imports while intra-firm trade in capital goods represented 20.8% of total exports and 21.7% of total imports.

**Table 3.4.5 / The extent of Ireland's intra-firm trade by major industry group, 1995-2015**

Major industry group category	1995	2000	2005	2010	2015
<i>Intra-firm exports</i>					
Other goods	3.50%	7.80%	6.40%	11.80%	19.90%
Capital goods	14.60%	17.80%	13.30%	27.30%	20.80%
Consumer durables	0.00%	0.00%	0.00%	10.00%	4.40%
Consumer non-durables	4.90%	15.40%	10.10%	23.60%	29.60%
Intermediate goods	4.20%	41.60%	48.40%	14.60%	41.50%
Energy	0.10%	0.30%	0.00%	0.00%	0.00%
<i>Intra-firm imports</i>					
Other goods	7.50%	12.60%	2.50%	5.00%	3.70%
Capital goods	37.10%	26.60%	34.90%	32.50%	21.70%
Consumer durables	0.00%	0.00%	0.00%	18.20%	7.90%
Consumer non-durables	22.40%	23.90%	25.80%	25.50%	27.20%
Intermediate goods	19.00%	32.40%	27.80%	14.10%	30.20%
Energy	0.00%	0.00%	0.00%	0.00%	0.20%

Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

Over the time period, the share of intra-firm exports of capital goods increased while the share of intra-firm imports of capital goods declined. The share of intra-firm trade with intermediates goods increased over time, with a sharp dip in 2010 which might be related to the financial crisis. These opposite developments for intra-firm exports and imports are consistent with the trends shown in Figure 3.4.1.

*Intra-firm trade by product*

Table 3.4.6 shows the top 10 products traded intra-firm. These are predominately chemicals, medical devices and pharmaceuticals, as well as electronics reflecting the specialisation of multinational firms located in Ireland. The figures shown indicate intra-firm exports are highly concentrated: the top 10 products exported intra-firm account for 66.9% of the intra-firm export sales. Intra-firm imports are less concentrated with the top 10 products imported intra-firm representing 39.3% of the intra-firm import value.

<sup>31</sup> This classification is based on the Eurostat NACE Rev. 2 industry classification and concordance tables with the UN product categories by end-use (BEC codes).

**Table 3.4.6 / Top 10 products traded intra-firm****Intra-firm exports**

HS6 Code	Trade share	Product
293490	0.175	Other heterocyclic compounds
300490	0.089	Other medicaments put up in packing for retail sale
293359	0.084	Other nitrogen compounds containing a pyrimidine ring or piperazine ring system
293390	0.069	Other heterocyclic compounds with nitrogen hetero-atom only
847330	0.043	Parts and accessories of the automatic data processing machines
901839	0.035	Medical, surgical, dental or vet inst, parts (other)
854213	0.024	Electronic integrated circuits & micro-assembled, parts (other)
300220	0.023	Vaccines for human medicine
902150	0.023	Pacemakers for stimulating heart muscles, excluding parts and accessories thereof
293799	0.022	Other hormones and their derivatives, other steroids used primarily as
293339	0.021	Other nitrogen compounds containing unfused pyridine ring system
292219	0.017	Other amino-alcohols, their ethers, esters, salts thereof
294190	0.016	Other antibiotics
293100	0.015	Other organic-inorganic compounds
854214	0.013	Electronic integrated circuits & micro-assembled, parts (other)

**Intra-firm imports**

HS6 Code	Trade share	Product
847330	0.084	Parts and accessories of the automatic data processing machines
300490	0.051	Other medicaments put up in packing for retail sale
293390	0.045	Other heterocyclic compounds with nitrogen hetero-atom only
854213	0.036	Electronic integrated circuits & micro-assembled, parts (other)
902190	0.031	Other appliances which are worn in the body, to compensate for a defect
847170	0.022	Automatic data process machines, computer hardware (other)
300390	0.022	Other medicaments
841112	0.017	Turbo-jets of a thrust exceeding 25kn
851790	0.015	Parts of Electrical Apparatus for Line Telephony or Line Telegraphy
841989	0.013	Other apparatus for treatment of materials by temperature
853400	0.012	Printed circuits
880240	0.012	Airplanes and other aircraft, of an unladen weight exceeding 15,000 kg
292429	0.012	Other cyclic amides and their derivatives, salts thereof
901839	0.011	Medical, surgical, dental or vet inst, no elec, parts (other)
291817	0.010	Phenyl glycolic acid (mandelic acid), its salts and esters

Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

*Intra-firm traders: summary statistics*

Tables 3.4.7 and 3.4.8 present summary statistics for intra-firm traders. Table 3.4.7 shows that average intra-firm exports sales per firm<sup>32</sup> increased over the period with the exceptions of declines in 2001, 2003, 2005 and 2009. Looking at the intensive margin, average intra-firm export sales per product increased, reaching a peak in 2008 and then declining until 2013. The figures for 2014 and 2015 indicate increases of intra-firm exports at the intensive margin. At the extensive margin, the average number of products exported intra-firm ranges between 4.4 and 8.4. These developments over time may be indicative of quality upgrading of products exported intra-firm and/or transfer pricing within the boundaries of multinational firms. These hypotheses could be examined in a further analysis.

<sup>32</sup> Export sales are in nominal euros.

**Table 3.4.7 / Summary statistics for intra-firm exporters, 1994-2015**

Year	Average intra-firm exports (EUR)	Average intra-firm exports per product (EUR)	Average number of intra-firm products	Average number of export destinations
1994	3,826,931	869,757	4.4	8.0
1995	6,338,943	1,267,789	5.0	9.0
1996	7,084,444	1,336,688	5.3	9.2
1997	7,948,835	1,472,006	5.4	9.5
1998	16,775,443	2,943,060	5.7	9.6
1999	23,351,234	3,958,853	5.9	9.9
2000	33,864,412	5,462,002	6.2	9.9
2001	33,490,966	5,581,828	6.0	9.8
2002	39,810,264	6,220,354	6.4	10.0
2003	37,209,420	6,644,539	5.6	10.2
2004	38,201,116	5,968,924	6.4	10.1
2005	36,771,816	5,329,249	6.9	10.2
2006	38,811,844	5,466,457	7.1	9.7
2007	46,975,044	7,576,620	6.2	9.9
2008	52,244,176	8,868,635	5.9	9.5
2009	46,977,604	7,962,306	5.9	9.9
2010	52,324,944	7,809,693	6.7	10.4
2011	60,067,616	7,800,989	7.7	10.4
2012	60,400,020	7,190,479	8.4	10.6
2013	61,420,452	7,059,822	8.7	10.4
2014	60,366,944	7,186,541	8.4	10.5
2015	62,606,680	7,924,896	7.9	10.4

Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

**Table 3.4.8 / Summary statistics for intra-firm importers, 1994-2015**

Year	Average intra-firm imports (EUR)	Average intra-firm imports per product (EUR)	Average number of products imported intra-firm	Average number of origin countries
1994	6,394,032	244,982	26.1	5.0
1995	7,985,388	308,316	25.9	5.0
1996	6,804,965	243,906	27.9	5.2
1997	7,038,659	242,712	29.0	5.3
1998	9,111,639	299,725	30.4	5.6
1999	9,104,210	257,910	35.3	6.1
2000	12,800,000	367,816	34.8	6.1
2001	11,400,000	372,549	30.6	6.1
2002	10,500,000	350,000	30.0	6.0
2003	9,856,730	329,233	28.5	6.2
2004	9,383,140	331,560	28.3	6.2
2005	12,500,000	423,729	29.5	6.2
2006	11,800,000	409,722	28.8	6.0
2007	11,200,000	395,760	28.3	5.6
2008	8,635,692	314,025	27.5	5.8
2009	7,774,739	302,519	25.7	5.9
2010	9,098,249	326,102	27.9	6.1
2011	9,361,486	334,339	28.0	6.2
2012	10,700,000	360,269	29.7	6.6
2013	11,000,000	364,238	30.2	6.7
2014	13,300,000	449,324	29.6	6.8
2015	14,000,000	501,792	27.9	6.8

Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

Table 3.4.8 shows summary statistics for intra-firm importers. Average intra-firm imports per firm<sup>33</sup> increased over the period with the exceptions of declines in 1996, 2001-2004, 2006-2009. At the extensive margin, the average number of products imported intra-firm is higher than the case of products exported intra-firm ranging between 25.9 and 35.3. At the intensive margin, in comparison to intra-firm exports, intra-firm imports appear much lower in value and more volatile, with more frequent declines of the average value of intra-firm imports per product. The developments over time discussed above are consistent with the scale and trends in Ireland's intra-firm trade shown in Figure 3.4.1.

Appendix Tables A.3.4.1-A.3.4.4 show further descriptive statistics for intra-firm traders. The statistics indicate that on average intra-firm traders are larger than foreign-owned traders. However, on average, foreign-owned traders are slightly more productive than intra-firm traders.

### 3.4.4. Determinants of intra-firm trade: econometric analysis

This section examines determinants of the engagement of firms in intra-firm trade and the intensity of intra-firm trade.

#### *Intra-firm trade: extensive and intensive margins*

We begin by looking at the decomposition of intra-firm trade by the extensive and intensive margins. As discussed above, intra-firm trade can be broken down by the number of products exported (extensive margin) and the average export sales per product (intensive margin).

The regression decomposition of intra-firm trade by product margins is based on the following model specification:<sup>34</sup>

$$\ln x_{it} = \ln p_{it} + \ln \bar{x}_{it} + \varepsilon_{it} \quad (1)$$

where  $x_{it}$  denotes the total intra-firm trade of firm  $i$  in year  $t$ ,  $p_{it}$  is the number of products traded intra-firm by firm  $i$  in year  $t$ ,  $\bar{x}_{it}$  indicates the average intra-firm sales per firm-product in year  $t$  and  $\varepsilon_{it}$  is the error term.

The results reported in Table 3.4.9 are obtained by regressing each trade margin ( $\ln p_{it}$ ,  $\ln \bar{x}_{it}$ ) on total intra-firm trade ( $\ln x_{it}$ ). These regression decompositions allow the quantification of the proportional contributions of the extensive and intensive margins to the variation of intra-firm trade across firms over the analysed period.

The estimates shown in Table 3.4.9 indicate that the intensive margin, the average intra-trade per product per firm, explains most of the intra-firm variation across firms while the extensive margin, the number of products traded intra-firm, plays a less important role. In the case of intra-firm exports, the intensive margin accounts for 86.7% of the variation of intra-firm exports while the extensive margin

<sup>33</sup> In nominal euros.

<sup>34</sup> This decomposition has been used in previous analyses of the extensive and intensive margins of trade at transaction level. Recent evidence is reviewed by Bernard et al. (2012).

accounts for much less at 13.3%. In the case of intra-firm imports, the contribution of the intensive margin also dominates although to a lesser extent at 71.3% while the contribution of the extensive margin is 28.7%. These results are consistent with the descriptive analysis of intra-firm trade discussed above showing more pronounced changes in the intra-firm trade values per product in comparison with changes in the number of products traded intra-firm.

**Table 3.4.9 / Regression decomposition of trade into extensive and intensive margins**

	Share	Std. err.	Obs.	R-sq.	Share	Std. err.	Obs.	R-sq.
<i>All firms</i>								
	<b>Exports</b>				<b>Imports</b>			
Product count by firm	0.197***	0.0023	27,288	0.4377	0.312***	0.0021	40,524	0.5898
Average exports by product by firm	0.803***	0.0023	27,288	0.8945	0.688***	0.0021	405,24	0.7939
<i>Intra-firm trade</i>								
	<b>Exports</b>				<b>Imports</b>			
Product count by firm	0.133***	0.005	6,049	0.227	0.287***	0.0052	7,798	0.4214
Average exports by product by firm	0.867***	0.005	6,049	0.887	0.713***	0.0052	7,798	0.7167

Notes: All regressions include firm and year fixed effects. \*\*\* Indicates statistical significance at the 1% level.

#### *Firm, industry and country determinants of intra-firm trade*

This section examines determinants of Ireland's intra-firm trade over 2009-2014. This analysis draws on the stylised facts and the international evidence discussed in Section 3.4.1.

The econometric analysis is based on a two-step Heckman selection model as follows:

#### *Selection equation*

$$\Pr(D_{ikjt} = 1 | \text{observable } s) = \phi\left(\sum_i \alpha_i F_{ikjt} + \sum_k \beta_k I_{ikjt} + \sum_j \delta_j C_{ikjt}\right) \quad (2)$$

The selection equation models the propensity of firms to engage in intra-firm trade. The dependent variable is a binary variable,  $D = 1$  if trading firm  $i$  in industry  $k$ , trading with country  $j$ , is engaged in year  $t$  in intra-firm trade; 0 otherwise.

$F$  is a vector of *firm characteristics*: productivity, size (proxied by employment) and location (region); and  $I$  is a vector of *industry characteristics*: technology intensity (high-tech industries; medium tech-industries; low-tech industries), primary product group (capital goods; consumer durables; consumer non-durables; intermediate goods; energy; other goods).  $C$  is a vector of *country characteristics*: market size (GDP), contract enforcement (rule of law index), R&D intensity, capital-intensity, bilateral distance, common language, common border. Given the dominance of the intra-firm trade a dummy variable equal to 1 for intra-trade firm with the US is included. All regressions include year-specific effects.

*Intensity equation*

$$\ln X_{ikjt} = \alpha + \beta_i F_{ikjt} + \delta_k I_{ijkt} + \gamma_f C_{ijkt} + \varepsilon_{ijkt} \quad (3)$$

The dependent variable in the intensity equation is the share of intra-trade firm at firm  $i$ , industry  $k$  traded with country  $j$  at time  $t$ . The explanatory variables in the intensity equation are the same as in the selection equation with the exception of the following variables which are excluded for identification purposes: firm size, market size, common language and common border. The regression analysis is carried out separately for intra-firm exports and intra-firm imports. Explanatory variables are lagged by one year with respect to the dependent variables to alleviate potential endogeneity related to possible reverse causality. Standard errors are clustered at firm-level to account for the fact that firm unobserved characteristics may be correlated across firms within industries and countries.

Table 3.4.10 shows the estimates for intra-firm exports obtained with a two-step Heckman model. A number of consistent messages emerge from the regressions shown in the table.

Relative to other exporters, intra-firm exporters are larger, are more likely to export intermediate goods, and are more likely to export to the US. Over and above these firm characteristics, characteristics of export market destinations are also conditions for the engagement of firms in intra-firm trade. Intra-firm exports are more likely with larger countries, geographically closer to Ireland, however not sharing borders with Ireland. These results are consistent with the descriptive statistics discussed in the previous section.

Other determinants are statistically significant in some but not in all models. For example, we find that intra-firm exports are more likely with English-speaking countries, in countries with strong contract enforcement (proxied by the rule of law index), with higher R&D intensity and with lower capital intensity. Taxation does not appear to play a role in the propensity of firms to engage in intra-firm exports. At the intensive margin, the share of intra-firm exports in total exports is higher in less productive exporters and exporters of capital goods and in medium tech-industries. Intra-firm export intensity is higher with the US and with other countries with higher corporate tax rates. Trade costs (proxied by distance to destination markets) reduce the intensity of intra-firm exports. The test for selection bias is statistically significant which indicates that the Heckman selection model is appropriate.

Table 3.4.11 shows the estimates for intra-firm imports. In contrast with intra-firm exports, and in line with international evidence, intra-firm importers are more likely to be more productive than other importers. The estimates also indicate that, similarly to intra-firm exporters, intra-firm importers are larger and they are more likely to import from the US and from larger countries. Other evidence, although not statistically significant in all model specifications, indicates that intra-firm imports are more likely from countries with strong contract enforcement and higher R&D intensity. At the intensive margin, the share of intra-firm imports in total imports is higher in less productive importers, in the case of imports with intermediate and capital goods. The intensity of intra-firm imports is higher from the US and from countries with higher corporate tax rates. The test statistics indicate that the Heckman selection model is appropriate in all regression models.

**Table 3.4.10 / Regression results for intra-firm exports**

Variables	Intensity	Selection	Intensity	Selection	Intensity	Selection	Intensity	Selection	Intensity	Selection	Intensity	Selection
Productivity	-0.896***	0.003	-0.874***	0.003	-0.932***	0.003	-0.915***	0.002	-0.886***	0.002	-0.868***	0.002*
	-0.159	-0.003	-0.147	-0.002	-0.143	-0.002	-0.142	-0.001	-0.144	-0.001	-0.144	-0.001
Size		0.017***		0.012***		0.001***		0.008***		0.008***		0.007***
		-0.003		-0.002		-0.002		-0.002		-0.001		-0.001
Hi-tech industry	-1.067	0.001	-1.063	0.003	-0.056	0.005	-0.081	0.004	0.071	0.004	0.171	0.003
	-0.679	-0.008	-0.651	-0.006	-0.634	-0.005	-0.627	-0.005	-0.631	-0.004	-0.643	-0.004
Medium-tech industry	3.102***	0.018	2.833**	0.013	3.617***	0.01	3.683***	0.009	4.015***	0.009	4.095***	0.008
	-1.186	-0.012	-1.233	-0.009	-1.251	-0.007	-1.228	-0.006	-1.15	-0.006	-1.169	-0.005
Intermediate goods	0.321	0.009**	0.207	0.006*	0.489**	0.007***	0.471**	0.006***	0.516**	0.005***	0.545**	0.005***
	-0.253	-0.004	-0.237	-0.003	-0.237	-0.002	-0.235	-0.002	-0.242	-0.002	-0.243	-0.002
Capital goods	0.855***	0.001	0.820***	0.002	1.102***	0.004	1.075***	0.003	1.115***	0.003	1.151***	0.002
	-0.269	-0.005	-0.249	-0.003	-0.245	-0.003	-0.243	-0.002	-0.249	-0.002	-0.25	-0.002
US	3.795***	0.402***	1.928***	0.086***	4.197***	0.072*	3.470***	0.047	2.861***	0.044	2.680***	0.025
	-0.549	-0.033	-0.606	-0.029	-0.864	-0.041	-0.921	-0.03	-0.883	-0.028	-0.811	-0.021
GDP				0.024***		0.021***		0.018***		0.017***		0.013***
				-0.003		-0.003		-0.003		-0.003		-0.003
Distance					-1.580***	-0.019***	-1.297***	-0.009**	-1.728***	-0.009**	-1.676***	-0.009***
					-0.295	-0.004	-0.328	-0.004	-0.295	-0.004	-0.351	-0.003
Common language						0.016		0.002		0.002		0.009
						-0.011		-0.009		-0.009		-0.009
Common border						-0.021***		-0.014**		-0.013**		-0.014***
						-0.004		-0.006		-0.005		-0.004
Rule of law							0.352	0.018***	0.88	0.018***	-0.475	0.004
							-0.482	-0.004	-0.621	-0.004	-0.972	-0.004
Corporate tax rate									5.053***	0.007	3.715**	0.001
									-1.482	-0.013	-1.659	-0.012
R&D intensity											2.223*	0.018***
											-1.264	-0.005
Capital intensity											-5.480***	-0.037***
											-1.708	-0.011
rho		1.164***		0.910***		0.955***		0.930***		1.028***		1.084***
		-0.091		-0.097		-0.092		-0.101		-0.089		-0.084
Insigma		1.610***		1.504***		1.511***		1.508***		1.537***		1.556***
		-0.053		-0.045		-0.045		-0.046		-0.046		-0.046
Observations	179,394	179,394	179,394	179,394	179,394	179,394	179,394	179,394	179,394	179,394	179,394	179,394

Notes: Marginal effects obtained with a Heckman two step estimator. The explanatory variables are lagged by one year with respect to the dependent variables. The following variables are in logarithms: productivity, size, GDP, distance, rule of law, corporate tax rate, R&D intensity, capital intensity. The rest of the variables are dummy variables. All intensity regressions include year-specific, industry-specific and region-specific effects. Standard errors are clustered at firm level. \*\*\*, \*\*, \* denote statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively



**Table 3.4.11 / Regression results for intra-firm imports**

Variables	Intensity	Selection	Intensity	Selection	Intensity	Selection	Intensity	Selection	Intensity	Selection	Intensity	Selection
Productivity	-0.403***	0.017**	-0.423***	0.017**	-0.456***	0.017**	-0.452***	0.017**	-0.432***	0.016**	-0.409***	0.016**
	-0.121	-0.007	-0.117	-0.007	-0.113	-0.007	-0.113	-0.007	-0.116	-0.006	-0.116	-0.006
Size		0.034***		0.034***		0.033***		0.033***		0.032***		0.031***
		-0.007		-0.007		-0.007		-0.007		-0.007		-0.006
Hi-tech industry	-1.614***	0.004	-1.586***	0.008	-1.372***	0.009	-1.401***	0.008	-1.355***	0.008	-1.401***	0.007
	-0.449	-0.021	-0.434	-0.021	-0.438	-0.021	-0.437	-0.021	-0.44	-0.02	-0.438	-0.02
Medium-tech industry	-0.273	0.023	-0.345	0.023	-0.184	0.017	-0.163	0.016	-0.183	0.016	-0.24	0.014
	-0.654	-0.022	-0.64	-0.022	-0.651	-0.019	-0.653	-0.019	-0.659	-0.019	-0.643	-0.018
Intermediate goods	0.518***	-0.003	0.487***	-0.005	0.489***	-0.005	0.478***	-0.006	0.472***	-0.006	0.457***	-0.007
	-0.161	-0.007	-0.156	-0.007	-0.154	-0.007	-0.154	-0.007	-0.158	-0.007	-0.161	-0.007
Capital goods	0.509***	-0.015**	0.511***	-0.015**	0.516***	-0.012*	0.506***	-0.013*	0.515***	-0.013*	0.500***	-0.013**
	-0.178	-0.007	-0.172	-0.007	-0.173	-0.007	-0.173	-0.007	-0.176	-0.007	-0.18	-0.006
US	2.831***	0.447***	2.396***	0.269***	3.033***	0.328***	2.845***	0.330***	1.869***	0.283***	2.122***	0.268***
	-0.28	-0.034	-0.313	-0.049	-0.696	-0.104	-0.675	-0.104	-0.676	-0.101	-0.579	-0.102
GDP				0.043***		0.046***		0.046***		0.040***		0.032***
				-0.011		-0.011		-0.011		-0.012		-0.011
Distance					-0.447*	-0.046**	-0.361	-0.021	-0.541**	-0.021	-0.744**	-0.034
					-0.263	-0.018	-0.266	-0.021	-0.232	-0.019	-0.29	-0.021
Common language						0.005		-0.045		-0.044		-0.006
						-0.048		-0.056		-0.053		-0.046
Common border						-0.081		-0.03		-0.021		-0.02
						-0.053		-0.062		-0.057		-0.054
Rule of law							-0.026	0.048*	0.519	0.055**	-0.86	-0.016
							-0.63	-0.026	-0.747	-0.025	-0.821	-0.033
Corporate tax rate									4.155***	0.101*	2.970***	0.064
									-0.884	-0.06	-0.798	-0.055
R&D intensity											2.317***	0.110***
											-0.877	-0.038
Capital intensity											-2.300*	0.007
											-1.397	-0.066
rho		1.373***		1.268***		1.245***		1.242***		1.308***		1.366***
		-0.063		-0.057		-0.071		-0.07		-0.063		-0.06
Insigma		1.399***		1.357***		1.347***		1.345***		1.368***		1.388***

Notes: Marginal effects obtained with a Heckman two step estimator. The explanatory variables are lagged by one year with respect to the dependent variables. The following variables are in logarithms: productivity, size, GDP, distance, rule of law, corporate tax rate, R&D intensity, capital intensity. The rest of the variables are dummy variables. All intensity regressions include year-specific, industry-specific and region-specific effects. Standard errors are clustered at firm level. \*\*\*, \*\*, \* denote statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.

These results are broadly in line with existing evidence from other advanced economies discussed in Section 3.4.1 (Bernard et al., 2010 – for the US; Defever and Toubal, 2010, and Corcos et al., 2013 for France; Kohler and Smolka, 2011 for Spain). In contrast to existing evidence, in the case of Ireland the engagement in intra-firm exports is linked to less capital-abundant countries while at the intensive margin, capital abundance in the destination countries does not matter. However, similarly to the US, the shares of intra-firm imports are higher in the case of imports from capital-abundant countries.

Two findings at the intensive margin of Ireland's intra-firm trade stand out: the intensity of intra-trade firm is negatively linked to firm productivity and positively linked to trading partners with higher corporate tax rates. Both findings might reflect the use of transfer pricing by multinationals operating globally as a business strategy to boost profits. Existing literature (Antras and Helpman, 2004; Corcos et al., 2013) generally finds that the productivity cut off level is higher for engagement in intra-firm trade in comparison to arm's length trade. Thus, one would expect a positive relationship between productivity and the extent of intra-firm trade. Consistent with this literature, the results reported here show a positive relationship between productivity and engagement in intra-firm trade (albeit not statistically significant in the case of intra-firm exports). However, at the intensive margin, the share of intra-firm trade in total trade appears to be negatively linked to productivity. This result is consistent with the theoretical prediction of the model by Antras and Helpman (2008) of an increased extent of intra-firm trade following a fall in the productivity cut off. A potential explanation for this result in the case of Ireland is the role of transfer pricing which results in an over-proportionally increase in intra-firm trade relative to the firm productivity cutoff.

The high intensity of Ireland's intra-firm trade with countries with higher corporate tax rates is consistent with evidence for the US provided by Egger and Seidel (2013) showing that corporate tax rate differentials boost intra-firm trade due to transfer pricing. A competitive tax rate has been part of Ireland's strategy to attract foreign direct investment over the past five decades. Multinational firms make a sizeable positive contribution to Ireland's competitiveness.<sup>35</sup> Currently at 12.5% Ireland's corporate tax rate is one of the lowest among EU countries. This competitive corporate tax rate combined with a skilled English-speaking labour force has boosted Ireland's attractiveness as a location for multinational firms, particularly from the US, the UK and other large advanced economies which tend to have higher corporate tax rates.

### 3.4.5. Summary of case study

This section analyses highly disaggregated trade data from Ireland by product and country of destination/origin over the period 1994-2015. Firstly, the analysis identifies patterns and trends of intra-firm exports and imports of manufactured goods. Secondly, it uncovers the importance of the extensive and intensive margins of intra-firm trade. Thirdly, firm, industry and country characteristics that explain the engagement of firms in intra-firm trade and the intensity of intra-firm trade are identified. A number of key policy relevant messages emerge from this empirical analysis.

*The scale of intra-firm trade in Ireland is consistent with evidence from other developed economies discussed in Section 3.4.1. Intra-firm trade in Ireland accounts for 30% of exports and 25% of imports.*

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<sup>35</sup> Siedschlag and Zhang (2015) provide evidence on the contribution of multinational firms to Ireland's innovation and productivity performance.

Over the period, the scale of intra-firm exports increased while it declined for intra-firm imports. During the financial crisis, intra-firm exports were resilient, while intra-firm imports declined sharply and then rebounded in 2009.

*The US dominates Ireland's intra-firm trade, accounting for 70% of the total number of intra-firm flows and 72% of the total number of intra-firm import flows.* This dominance is explained by the large number of US multinationals located in Ireland. Germany and the United Kingdom are the next most important trading partners, followed by Japan, France, Switzerland and the Netherlands.

*Ireland's intra-firm trade is important, and in particular, in industries producing intermediate goods, capital goods, as well as consumer non-durable goods.* Over the period, the share of intra-firm exports of capital goods increased while the share of intra-firm imports of capital goods declined. The scale of intra-firm trade with intermediate goods increased over the period with the exception of a sharp decline in 2010. *The top 10 products traded intra-firm are predominantly chemicals and pharmaceuticals, medical devices and electronics, reflecting the specialisation of multinational enterprises located in Ireland.*

*On average, intra-firm traders are larger than foreign-owned traders. However, on average, foreign-owned traders are slightly more productive than intra-firm traders.* The average intra-firm exports per firm increased over the period with the exceptions of declines in 2001, 2003, 2005, and 2009. The average share of intra-firm exports per firm ranges from 35% to 39%. The average intra-firm imports per firm increased over the period with the exceptions of declines in 1996, 2001-2004, and 2006-2009. The average share of intra-firm imports per firm over the analysed period ranges between 41% and 56%.

*The variation of intra-firm trade across firms is explained, to a large extent, by the intensive margin (the average intra-trade per product per firm), while the extensive margin (the number of products traded intra-firm) plays a less important role.* In the case of intra-firm exports, the intensive margin accounts for 87% of the variation of intra-firm exports while the extensive margin accounts for 13%. In the case of intra-firm imports, the intensive margin also dominates, although to a lesser extent at 71%, while the extensive margin accounts for 29% of the variation of intra-firm imports across firms.

*Firms engaged in intra-firm trade are likely to be larger and more likely to trade with the US and with other larger economies.* Trade costs reduce the propensity of firms to engage in intra-firm trade. Intra-firm exports are more likely for exports of intermediate goods. The empirical results also suggest, in line with international evidence, that intra-firm trade is more likely with countries having strong contract enforcement laws and higher R&D intensity.

*The intensity of intra-firm exports is negatively linked to firm productivity and positively linked to exports of capital goods.* Trade costs reduce the intensity of intra-firm trade. The intensity of intra-firm trade is higher in less productive firms. Over and above other factors affecting intra-firm trade, the intensity of intra-firm trade is higher with countries with higher corporate tax rates. These latter two results might be linked to the use of transfer pricing by multinationals operating globally as a business strategy to boost profits.

## 4. Summary

Whether the global financial crisis of 2008 marked a change in the development of global trade growth – at least after the immediate recovery period – is still vividly debated. This study contributes to the still ongoing discussion and provides evidence for trade patterns and dynamics within Europe. In particular, it sheds light on changing patterns of trade – particularly of intra-EU trade – before and after the crisis. Before the crisis, EU integration led to an increase in bilateral trade relative to GDP in general and was accompanied by a specific specialisation pattern within Europe. It seems that with the crisis, these trends have changed significantly in Europe, possibly marking an end to an export-driven growth model which had been prevalent, at least for some countries, before the onset of the crisis.

The study provides evidence on specialisation dynamics of (intra-EU) exports across EU Member States, determines whether there is a trend towards more concentration and clustering of export activities and whether bilateral trade flows intensified. It is argued that the crisis marked a structural break in these trends. In addition to this, shifts in the role of multinational companies, patterns of FDI and patterns of outsourcing, offshoring and reshoring have impacted and will continue to have an impact on intra-firm trade, which might play a more prominent role in world trade without necessarily being reflected in the data. Hence, shedding more light on the role of intra-firm trade is therefore another objective of this study. As information on intra-firm trade is limited, the study sheds light on this phenomenon based on various data sources and a case study based on Irish firm data.

Summarising trends in global trade, until the onset of the crisis global trade in goods had developed rather dynamically. However, as a result of the crisis, global trade went into a pronounced but short-lived collapse, quickly recovering until 2011. From 2011 onwards, global trade in goods has been rather low, partly driven by the low dynamics of intra-EU trade and relatively weak dynamics of EU-28 imports from the rest of the world. This also led to a decline in the share of intra-EU-28 trade in global trade flows to about 20% in 2011 from almost 30% a decade ago. Trade with other EU countries is however still the most important component by far, accounting for about 60% of trade across EU Member States, with marked differences in the importance of intra-EU trade across countries.

EU integration also triggered a specialisation dynamics across Europe manifesting in an agglomeration of industrial activities in a subset of countries which therefore also gained shares in intra-EU trade. This is similarly the case for services with agglomeration tendencies in another area of Europe. These specialisation dynamics slowed down after the crisis.

Another aspect of the dynamics of EU integration, overall export activities, have become slightly less concentrated as relatively small countries – the EU-CEE in particular – have gained shares in intra-EU trade flows. Since these countries also experienced a relatively strong increase in the ratio of (manufacturing) exports to GDP (whereas for other countries this remained stable or even declined) there has been an increase in relative concentration of intra-EU exports – i.e. export activities becoming relatively more concentrated than overall economic activity measured by GDP – together with a

clustering of these activities in the European core, which is the result of the export-driven growth model in this period. No such developments are observed after the crisis.

EU integration has further led to a strong increase in overall bilateral trade intensities, as measured by bilateral trade flows relative to GDP. However, bilateral trade relations intensified significantly for a subset of countries only, amongst them the EU-CEE economies and also Austria, Germany, Belgium and the Netherlands. For the remaining EU countries, bilateral trade intensities have either increased less significantly or even remained more or less constant over the whole period. Again, since no further increases in bilateral trade intensities are observable after the crisis, this might again indicate a structural break in the trend.

These general trends are however not uniform across industries. Notable exceptions are wearing apparel, wood products and other transport equipment which all experienced an increase in intra-EU export concentration. In contrast, concentration in some other industries (e.g. chemicals) did not change over the period considered. Clustering of exporting activities increased for most industries over the period 2000-2008, but remained stable or even declined afterwards. Notable exceptions are the computer, electronic and optical products industry and other transport equipment where clustering only declined from 2011 onwards. The overall increase in bilateral gross trade intensities has been driven by a few, though important, industries, namely food products, coke and refined petroleum, chemicals and chemical products, basic metals, machinery and motor vehicles, trailers and semi-trailers. The crisis seems to have put an end to this trend though.

With respect to end-use categories, a generally decreasing concentration in all product types can be observed, indicating that exporting activities are more spread across countries. Specialisation by end-use categories is relatively similar across countries with no clear trend over time with the exception of the first years of the period in which the EU-CEE de-specialised strongly. Compared to GDP, the most concentrated exports by end-use categories are trade in passenger motor cars, other transport equipment and transport equipment – parts and components though there is a slight tendency towards lower concentration (though mostly driven by differentiated GDP growth). The most regionally clustered exporting activities are food and beverages, industrial supply, fuels and goods n.e.s. Generally there is a weak tendency towards lower clustering over time. Bilateral gross trade intensities are particularly high in industrial supplies n.e.s. and in transport equipment and consumer goods. In these categories bilateral trade intensities increased before the crisis with no clear trends afterwards. In the category food, bilateral intensities continuously increased.

Splitting trade into quality segments using detailed trade data demonstrates that the overall shift in the geographical patterns of intra-EU trade has happened almost exclusively in the medium-quality segment of traded products and to a (much) smaller degree in the low-quality segments. In contrast, the shares in the high-quality segments are almost unchanged (with two exceptions). This is indicative of a 'climbing up' phenomenon of less advanced countries which have gained in medium-quality segments at the expense of (some of) the advanced countries. Further detailed investigation at the product level suggests that the distribution of exports by products is highly skewed with between 50 (for relatively smaller countries) to 100 (for larger countries), accounting for about 50% of exports.

Another important part of EU integration is trade in services. In summary, compared to goods trade, services trade had developed slightly more dynamically before the crisis and experienced a less severe

trade slump as a result of the crisis. However, after the crisis, global services flows are even more anaemic than global flows in goods. Thus the notion of a 'global trade slowdown' applies as well – or even more so – to services trade. Similar to goods trade, intra-EU flows and EU trade with the rest of the world has been underperforming compared to global developments.

These results suggest that export activities have become slightly less concentrated, although some countries have strongly specialised in services export activities. Nonetheless, a clustering of services trade activities over time is observable. Furthermore, before the crisis, Europe experienced a strong increase in bilateral trade intensities which, however, stopped after the crisis, thus marking a structural break in these trends.

Again there are marked differences across services categories. Concentration strongly increased in insurance services, financial services and computer and information services until about 2006; after the crisis these patterns reversed. The overall tendency towards lower concentration is driven by the trends in the large categories (transport, travel and other business services) which are characterised by a decline in concentration. However, concentration in business services increased again after the crisis. Bilateral trade intensities increased particularly strongly in transport services and other business services. For the latter this trend also continued after the crisis, whereas in transportation services this trend flattened after the crisis. In travel services, bilateral trade intensities increased in the first few years of the period considered but have stabilised since then.

Summarising this part of the study, EU integration has fostered an intensification of bilateral exporting relationships in both goods and services. This has also led to specific specialisation patterns across Europe, implying a concentration and clustering of exporting activities in a subset of countries. It seems to be the case that these integration dynamics have come to a standstill in the aftermath of the global crisis. The generally debated 'global trade slowdown' is also observed in Europe or – more precisely – sluggish dynamics in Europe is part of the explanation for the global slowdown.

It is further documented that trade-to-GDP elasticities for EU-28 exports have become significantly smaller when considering the exporters' GDP. In contrast, trade-to-GDP elasticities have not changed or became even larger with respect to the importer's GDP. On top of that, when distinguishing between intra- and extra-EU-28 exports results suggest that these own-GDP elasticities declined more for intra-EU trade relations. Furthermore, whereas the elasticities to the partner countries' GDP increased for extra-EU-28 exports, they declined for intra-EU-28 exports which indicates that the slowdown of exports has not only resulted from a slowdown in GDP growth, but also from the lower elasticity between GDP and export growth, particularly for intra-EU-28 trade. These patterns seem to be even more pronounced for services trade compared to goods trade. These results seem to point towards a breakdown of the 'intra-EU-28 export-driven growth model' which has dominated the dynamics before the crisis (e.g. because of increased integration of economies and production within the European Union), whereas the 'extra-EU-28 export-driven growth model' even gained importance.

Finally, a decomposition analysis shows that the geographical dimension (of export destinations) played a larger role in explaining the loss in world market shares the EU experienced over the period considered. Changes in the sectoral structures in general counteracted these trends. For the crisis period this again points towards the sluggish trade performance within the EU in line with the results of the gravity regressions above.

The second part of the study was devoted to the role and magnitudes of intra-firm trade and potential determinants thereof. For this purpose, various databases were used to investigate this important aspect. First, the analysis of FIGE firm-level data demonstrates that only a very small share of firms run at least part of their production activities in another country, which generally points to a low degree of production internationalisation among European firms. However, those firms that do internationalise their production activities predominantly internationalise through direct investments instead of contracts and arms' length agreements. Furthermore, average returns from production activities through direct investments are (i) rather moderate and (ii) predominantly coming from production activities in Europe (particularly for Hungarian and Austrian firms). In addition, intra-firm trade is generally of substantial size, with imports of intermediates and final products of most importance. Finally, internationalised production activities of European firms predominantly serve in the production of finished products and semi-finished products or components while other activities such as R&D, engineering and design services or other business services abroad are of little importance.

Second, the analysis of FATS data highlights that intra-firm trade is of fundamental importance, accounting for 59% of EU exports to the US in 2012 and for 42% on the import side. Thus, taken together, intra-firm trade flows were responsible for more than half (52%) of total trade between the EU and the US in 2012. Results also suggest that intra-firm trade has been more resilient to the trade crisis despite the more difficult global environment for foreign direct investment and export activities. The Member States which are the major EU FDI investors and hence also those with the most prominent MNEs activities, notably Germany and the UK, are also characterised by a higher share of intra-firm trade, amounting to 62% of country-level goods trade in both cases.

Finally, a detailed firm-data-based case study on Ireland suggests that the scale of intra-firm trade in Ireland is similar to other developed economies. In particular, intra-firm trade in Ireland accounts for 30% of exports and 25% of imports. Over time, the scale of intra-firm exports increased while it declined for intra-firm imports. During the financial crisis, intra-firm exports were resilient, while intra-firm imports declined sharply but rebounded quickly in 2009. This is the result of US dominance, which accounts for about 70% of total intra-firm trade exports and 72% of total intra-firm import flows, and the result of the large number of US multinationals located in Ireland. Germany and the United Kingdom are the next most important trade partners followed by Japan, France, Switzerland and the Netherlands.

Ireland's intra-firm trade is of particular importance in industries producing intermediate goods, capital goods and consumer non-durable goods. Results indicate that the top 10 products traded intra-firm are predominantly chemicals and pharmaceuticals, medical devices and electronics, reflecting the specialisation of multinational enterprises located in Ireland.

Generally, intra-firm traders are on average larger than foreign-owned traders. Furthermore, intra-firm trading shares are substantial: the average share of intra-firm exports per firm ranges from 35% to 39%. The average intra-firm imports per firm have generally increased over time and the average share of intra-firm imports per firm over the analysed period range between 41% and 56%. The variation of intra-firm trade across firms is explained to a large extent by the intensive margin (the average intra-trade per product per firm), while the extensive margin (the number of products traded intra-firm) plays a less important role.

With respect to determinants of intra-firm trade, firms engaged in intra-firm trade are likely to be larger and more likely to trade with the US and with other larger economies. In contrast, trade costs reduce the propensity of firms to engage in intra-firm trade. Furthermore, intra-firm exports are more likely for exports in intermediate goods, and, in line with international evidence, also more likely with countries with strong contract enforcement laws and higher R&D intensities. The intensity of intra-firm exports is negatively related to firm productivity and trade costs and positively related to exports of capital goods. The intensity of intra-firm trade is higher in less productive firms and for countries with higher corporate tax rates.

Summarising, these results indicate that intra-firm trade is an important phenomenon which needs further attention for a complete understanding of bilateral trade flows and the working of global value chains.



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# Appendix

**Table A.2.8.1 / Trade elasticities for EU-28 intra- and extra-trade by industry**

	$\ln GDP_{it}$	$\ln GDP_{it}$	$D_2 * \ln GDP_{it}$	$D_3 * \ln GDP_{it}$	$D_4 * \ln GDP_{it}$	$D_2 * \ln GDP_{it}$	$D_3 * \ln GDP_{it}$	$D_4 * \ln GDP_{it}$
Food products	0.619***	0.449***	0.004	0.017**	0.007	0.029***	0.041***	0.038***
Beverages	0.565***	0.642***	0.029**	0.046***	0.016	0.028***	0.035***	0.043***
Tobacco products	0.945***	-0.192***	0.007	-0.000	-0.008	0.057***	0.067***	0.060***
Textiles	0.231***	0.487***	0.019	0.009	-0.011	-0.004	0.011*	0.011*
Wearing apparel	0.414***	0.661***	0.057***	0.068***	0.047***	-0.007	-0.005	-0.004
Leather and related products	0.187***	0.692***	0.038***	0.028**	0.011	-0.012	0.005	0.007
Wood products (exc. furniture), etc.	0.154***	0.891***	-0.057***	-0.087***	-0.027**	-0.001	0.023***	0.006
Paper and paper products	0.416***	0.472***	0.014	-0.012	-0.034***	0.009	0.028***	0.015**
Printing and reproduction of recorded media	0.518***	0.242***	-0.044	-0.015	-0.059**	0.029	-0.002	0.006
Coke and refined petroleum products	0.743***	0.669***	0.021	0.044**	0.060***	-0.009	0.036***	0.044***
Chemicals and chemical products	0.476***	0.632***	-0.004	-0.029**	-0.032***	0.008	0.038***	0.035***
Pharmaceutical products	0.822***	0.397***	-0.016	-0.023**	-0.071***	0.031***	0.065***	0.082***
Rubber and plastic products	0.790***	0.510***	0.041***	0.016*	0.006	0.031***	0.052***	0.063***
Other non-metallic mineral products	0.098***	0.802***	-0.020	-0.055***	-0.075***	0.012	0.036***	0.025***
Basic metals	0.460***	0.714***	0.041**	0.007	0.019	0.020**	0.068***	0.059***
Fabricated metal products (exc. M&E)	0.576***	0.703***	-0.001	-0.035***	-0.048***	0.001	0.019***	0.022***
Computer, electronic and optical products	1.029***	0.562***	-0.047***	-0.073***	-0.102***	-0.006	0.014**	0.001
Electrical equipment	0.767***	0.672***	0.004	-0.031***	-0.067***	0.014*	0.027***	0.038***
Machinery and equipment n.e.c.	0.682***	0.759***	-0.032***	-0.044***	-0.083***	0.007	0.015***	0.021***
Motor vehicles, trailers and semi-trailers	0.822***	0.844***	-0.111***	-0.076***	-0.080***	0.006	0.042***	0.046***
Other transport equipment	0.259***	0.749***	0.058**	0.058***	0.073***	0.078***	0.038***	0.057***
Furniture	0.444***	0.720***	0.050***	0.052***	0.025**	0.004	0.064***	0.025***
Other manufacturing	0.725***	0.635***	-0.023**	-0.048***	-0.079***	0.020**	0.043***	0.057***

Note: Only selected coefficients are reported. \*\*\*, \*\*, \* denote statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.

Source: BACI, WDI; own calculations.

**Table A.2.8.2 / Trade elasticities for EU-28 extra-trade by industry**

	$\ln GDP_{it}$	$\ln GDP_{jt}$	$D_2 * \ln GDP_{it}$	$D_3 * \ln GDP_{it}$	$D_4 * \ln GDP_{it}$	$D_2 * \ln GDP_{jt}$	$D_3 * \ln GDP_{jt}$	$D_4 * \ln GDP_{jt}$
Food products	0.396***	0.467***	0.011	0.031***	0.024***	0.018**	0.040***	0.039***
Beverages	0.545***	0.575***	0.067***	0.074***	0.048***	0.026***	0.044***	0.056***
Tobacco products	0.423***	-0.126*	0.010	0.013	0.004	0.033	0.051***	0.055***
Textiles	0.251***	0.494***	0.035**	0.028**	0.018	-0.001	0.012*	0.018***
Wearing apparel	0.613***	0.552***	0.043***	0.055***	0.044***	-0.001	0.007	0.016***
Leather and related products	0.237***	0.649***	0.061***	0.049***	0.030**	-0.015	0.003	0.008
Wood products (exc. furniture), etc.	0.182***	0.782***	-0.076***	-0.111***	-0.048***	-0.009	0.022**	0.018**
Paper and paper products	0.256***	0.488***	0.021	-0.003	-0.016	0.007	0.032***	0.020***
Printing and reproduction of recorded media	0.366***	0.300***	-0.089*	-0.043	-0.094***	0.060**	0.037*	0.042**
Coke and refined petroleum products	0.758***	0.623***	0.029	0.075***	0.102***	0.006	0.051***	0.050***
Chemicals and chemical products	0.369***	0.645***	0.012	-0.016	-0.008	0.009	0.038***	0.033***
Pharmaceutical products	0.523***	0.512***	-0.004	0.019*	-0.024**	0.017*	0.051***	0.067***
Rubber and plastic products	0.751***	0.474***	0.054***	0.036***	0.022**	0.038***	0.061***	0.077***
Other non-metallic mineral products	0.049	0.764***	-0.011	-0.039***	-0.071***	0.013	0.042***	0.031***
Basic metals	0.227***	0.709***	0.036*	0.018	0.035**	0.029**	0.061***	0.052***
Fabricated metal products (exc. M&E)	0.543***	0.665***	0.019	-0.024**	-0.041***	0.005	0.026***	0.031***
Computer, electronic and optical products	1.048***	0.519***	-0.031**	-0.055***	-0.084***	0.004	0.028***	0.024***
Electrical equipment	0.777***	0.637***	0.019	-0.015	-0.050***	0.024**	0.035***	0.050***
Machinery and equipment n.e.c.	0.657***	0.733***	-0.032**	-0.038***	-0.079***	0.013	0.020***	0.026***
Motor vehicles, trailers and semi-trailers	0.736***	0.751***	-0.088***	-0.063***	-0.073***	0.020**	0.058***	0.073***
Other transport equipment	0.290***	0.635***	0.079***	0.063***	0.097***	0.087***	0.063***	0.083***
Furniture	0.458***	0.588***	0.075***	0.076***	0.032**	0.021**	0.086***	0.056***
Other manufacturing	0.710***	0.611***	-0.022*	-0.041***	-0.074***	0.023***	0.047***	0.068***

Note: Only selected coefficients are reported. \*\*\*, \*\*, \* denote statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.

Source: BACI, WDI; own calculations.

**Table A.2.8.3 / Trade elasticities for EU-28 intra-trade by industry**

	$\ln GDP_{it}$	$\ln GDP_{jt}$	$D_2 * \ln GDP_{it}$	$D_3 * \ln GDP_{it}$	$D_4 * \ln GDP_{it}$	$D_2 * \ln GDP_{jt}$	$D_3 * \ln GDP_{jt}$	$D_4 * \ln GDP_{jt}$
Food products	0.996***	0.569***	-0.011	-0.029**	-0.058***	-0.025**	-0.028**	-0.039***
Beverages	0.171**	1.230***	-0.066***	-0.041**	-0.081***	-0.004	-0.008	-0.019
Tobacco products	1.554***	-0.218	0.053	0.018	0.010	0.033	0.072**	0.038
Textiles	0.426***	0.223***	-0.031	-0.047***	-0.091***	0.026*	0.038***	-0.006
Wearing apparel	-0.029	0.932***	0.102***	0.115***	0.070***	0.007	-0.010	-0.037***
Leather and related products	-0.222***	1.134***	-0.022	-0.016	-0.026	0.025	0.016	0.006
Wood products (exc. furniture), etc.	0.186***	1.074***	-0.005	-0.022	0.002	0.050***	0.064***	0.074***
Paper and paper products	0.748***	0.426***	-0.006	-0.038**	-0.081***	0.014	-0.006	-0.012
Printing and reproduction of recorded media	0.698***	0.134	-0.019	-0.004	-0.002	-0.036	-0.104***	-0.112***
Coke and refined petroleum products	0.219*	1.252***	-0.016	-0.030	-0.021	-0.044	-0.047	-0.014
Chemicals and chemical products	0.570***	0.788***	-0.070***	-0.082***	-0.120***	0.011	0.025*	0.009
Pharmaceutical products	1.403***	0.201***	-0.048**	-0.142***	-0.216***	0.012	0.036**	0.064***
Rubber and plastic products	0.935***	0.582***	-0.008	-0.055***	-0.055***	0.034***	0.045***	0.049***
Other non-metallic mineral products	0.057	1.070***	-0.054***	-0.100***	-0.090***	0.025	0.028**	0.027**
Basic metals	0.426***	1.299***	0.027	-0.019	-0.016	0.025	0.079***	0.081***
Fabricated metal products (exc. M&E)	0.612***	0.875***	-0.079***	-0.079***	-0.075***	0.048***	0.044***	0.026**
Computer, electronic and optical products	1.344***	0.246***	-0.092***	-0.123***	-0.147***	-0.026	-0.057***	-0.111***
Electrical equipment	0.838***	0.681***	-0.057***	-0.085***	-0.127***	0.049***	0.030**	0.028**
Machinery and equipment n.e.c.	0.805***	0.814***	-0.040**	-0.075***	-0.100***	0.067***	0.060***	0.060***
Motor vehicles, trailers and semi-trailers	1.135***	1.019***	-0.193***	-0.122***	-0.109***	0.036*	0.049***	0.010
Other transport equipment	0.060	1.140***	-0.002	0.023	0.007	0.079**	0.020	0.008
Furniture	0.188***	1.257***	-0.023	-0.012	-0.001	-0.018	0.025*	-0.025*
Other manufacturing	0.609***	0.811***	-0.026	-0.069***	-0.087***	0.018	0.031***	-0.012

Note: Only selected coefficients are reported. \*\*\*, \*\*, \* denote statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.

Source: BACI, WDI; own calculations.

**Table A.2.8.4 / Trade elasticities for EU-28 intra- and extra-trade by BEC**

	$\ln GDP_{it}$	$\ln GDP_{it}$	$D_2 * \ln GDP_{it}$	$D_3 * \ln GDP_{it}$	$D_4 * \ln GDP_{it}$	$D_2 * \ln GDP_{it}$	$D_3 * \ln GDP_{it}$	$D_4 * \ln GDP_{it}$
Food and beverages - Primary	0.738***	0.511***	0.050***	0.055***	0.023*	-0.008	0.016*	0.008
Food and beverages - Processed	0.559***	0.520***	0.020*	0.021***	0.006	0.032***	0.051***	0.049***
Industrial supply n.e.s. - Primary	0.453***	0.517***	0.014	-0.004	-0.030***	-0.031***	-0.003	-0.019***
Industrial supply n.e.s. - Processed	0.361***	0.680***	-0.001	-0.032***	-0.030***	-0.000	0.032***	0.039***
Fuels and lubricants - Primary	0.477**	0.231*	0.120	-0.000	-0.001	0.004	-0.023	-0.008
Fuels and lubricants - Processed	0.765***	0.645***	0.035	0.016	0.043**	-0.010	0.049***	0.059***
Capital goods (except transport equipment)	0.788***	0.717***	-0.022**	-0.045***	-0.085***	0.014*	0.023***	0.019***
Capital goods - Parts and accessoires	0.784***	0.611***	-0.015	-0.043***	-0.072***	-0.016**	0.001	-0.001
Passenger motor cars	0.746***	0.698***	-0.123***	-0.083***	-0.061***	0.015	0.041***	0.044***
Other transport equipment	0.432***	0.982***	-0.004	-0.013	-0.004	-0.007	0.014	-0.014
Transport equipment - Parts and accessoires	0.706***	0.641***	0.020	-0.003	-0.015	0.033***	0.057***	0.064***
Consumer goods - Durable	0.527***	0.718***	-0.015	-0.045***	-0.082***	0.026***	0.033***	0.052***
Consumer goods - Semi-durable	0.376***	0.830***	-0.007	-0.015**	-0.029***	0.018***	0.008	0.017***
Consumer goods - Non-durable	0.714***	0.484***	-0.003	-0.020***	-0.058***	0.042***	0.062***	0.082***
Goods n.e.s.	0.367***	0.428***	0.011	0.050**	-0.027	0.019	0.053***	0.069***

Note: Only selected coefficients are reported. \*\*\*, \*\*, \* denote statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.

Source: BACI, WDI; own calculations.

**Table A.2.8.5 / Trade elasticities for EU-28 extra-trade by BEC**

	$\ln GDP_{it}$	$\ln GDP_{it}$	$D_2 * \ln GDP_{it}$	$D_3 * \ln GDP_{it}$	$D_4 * \ln GDP_{it}$	$D_2 * \ln GDP_{it}$	$D_3 * \ln GDP_{it}$	$D_4 * \ln GDP_{it}$
Food and beverages - Primary	0.259***	0.550***	0.057**	0.108***	0.096***	-0.020	0.012	0.019**
Food and beverages - Processed	0.379***	0.520***	0.030**	0.037***	0.021**	0.022***	0.051***	0.051***
Industrial supply n.e.s. - Primary	0.435***	0.480***	0.007	0.002	-0.013	-0.020*	0.001	-0.023***
Industrial supply n.e.s. - Processed	0.279***	0.667***	0.006	-0.020**	-0.016*	0.003	0.032***	0.039***
Fuels and lubricants - Primary	0.273	0.002	0.231*	0.079	-0.054	-0.003	-0.007	0.058
Fuels and lubricants - Processed	0.850***	0.580***	0.049*	0.034	0.081***	0.003	0.068***	0.068***
Capital goods (except transport equipment)	0.788***	0.695***	-0.014	-0.033***	-0.072***	0.024***	0.033***	0.031***
Capital goods - Parts and accessoires	0.792***	0.571***	-0.012	-0.039***	-0.068***	-0.009	0.007	0.010*
Passenger motor cars	0.511***	0.651***	-0.094***	-0.059***	-0.048***	0.006	0.039***	0.065***
Other transport equipment	0.345***	0.920***	0.015	0.003	-0.000	0.006	0.026**	-0.000
Transport equipment - Parts and accessoires	0.676***	0.569***	0.024	0.017	-0.002	0.040***	0.067***	0.079***
Consumer goods - Durable	0.519***	0.638***	-0.003	-0.020*	-0.066***	0.035***	0.048***	0.085***
Consumer goods - Semi-durable	0.455***	0.758***	-0.004	-0.008	-0.023***	0.029***	0.018***	0.032***
Consumer goods - Non-durable	0.712***	0.452***	0.019	0.011	-0.020**	0.049***	0.075***	0.102***
Goods n.e.s.	0.442***	0.322***	0.029	0.059*	-0.022	0.020	0.059***	0.088**

Note: Only selected coefficients are reported. \*\*\*, \*\*, \* denote statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.

Source: BACI, WDI; own calculations.

**Table A.2.8.6 / Trade elasticities for EU-28 intra-trade by BEC**

	$\ln GDP_{it}$	$\ln GDP_{jt}$	$D_2 \cdot \ln GDP_{it}$	$D_3 \cdot \ln GDP_{it}$	$D_4 \cdot \ln GDP_{it}$	$D_2 \cdot \ln GDP_{jt}$	$D_3 \cdot \ln GDP_{jt}$	$D_4 \cdot \ln GDP_{jt}$
Food and beverages - Primary	1.206***	0.672***	0.055*	-0.009	-0.084***	-0.016	-0.020	-0.073***
Food and beverages - Processed	0.759***	0.789***	-0.011	-0.039***	-0.058***	-0.011	-0.010	-0.020*
Industrial supply n.e.s. - Primary	0.201***	0.904***	0.010	-0.031	-0.075***	-0.013	0.030*	0.043***
Industrial supply n.e.s. - Processed	0.591***	0.760***	-0.039**	-0.090***	-0.094***	0.015	0.014*	0.017**
Fuels and lubricants - Primary	0.555	0.685*	0.024	-0.070	0.025	0.054	0.021	-0.027
Fuels and lubricants - Processed	0.084	1.291***	-0.014	-0.032	-0.034	-0.043	-0.039	-0.004
Capital goods (except transport equipment)	0.999***	0.549***	-0.052***	-0.089***	-0.132***	0.014	0.004	-0.033***
Capital goods - Parts and accessoires	0.775***	0.701***	-0.031*	-0.060***	-0.081***	0.029*	0.017	-0.029**
Passenger motor cars	1.181***	0.812***	-0.198***	-0.135***	-0.111***	0.130***	0.110***	0.074***
Other transport equipment	0.617***	1.172***	-0.100**	-0.092***	-0.041	0.081**	0.068***	0.023
Transport equipment - Parts and accessoires	0.659***	0.981***	-0.004	-0.076***	-0.068***	0.073***	0.070***	0.072***
Consumer goods - Durable	0.705***	0.759***	-0.043**	-0.117***	-0.131***	0.001	-0.008	-0.054***
Consumer goods - Semi-durable	0.043	1.146***	-0.017	-0.035***	-0.041***	-0.000	-0.022**	-0.032***
Consumer goods - Non-durable	0.776***	0.509***	-0.080***	-0.135***	-0.205***	0.003	0.002	-0.019*
Goods n.e.s.	-0.155	0.978***	-0.017	0.046	-0.035	0.013	0.038	0.032

Note: Only selected coefficients are reported. \*\*\*, \*\*, \* denote statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.

Source: BACI, WDI; own calculations.

**Table A.2.8.7 / Trade elasticities for EU-28 intra- and extra-trade by service trade categories**

	$\ln GDP_{it}$	$\ln GDP_{jt}$	$D_2 \cdot \ln GDP_{it}$	$D_3 \cdot \ln GDP_{it}$	$D_4 \cdot \ln GDP_{it}$	$D_2 \cdot \ln GDP_{jt}$	$D_3 \cdot \ln GDP_{jt}$	$D_4 \cdot \ln GDP_{jt}$
Transportation	0.979***	0.713***	-0.020***	-0.023***	-0.061***	0.023***	0.025***	0.029***
Travel	0.965***	0.567***	-0.025***	-0.037***	-0.069***	0.005	0.003	0.012***
Communications services	0.784***	0.691***	-0.014*	-0.015***	-0.087***	0.038***	0.029***	-0.010**
Construction services	1.013***	0.464***	-0.016**	-0.049***	-0.086***	0.012**	-0.000	0.000
Insurance services	0.921***	0.459***	-0.021***	-0.016***	-0.053***	0.032***	0.022***	0.026***
Financial services	1.073***	0.560***	-0.029***	-0.039***	-0.061***	0.006	0.002	0.012**
Computer and information services	1.481***	0.776***	0.000	-0.015**	-0.046***	0.038***	0.039***	0.051***
Royalties and license fees	0.878***	0.855***	0.000	0.003	-0.023***	0.039***	0.026***	0.031***
Other business services	0.956***	0.829***	-0.021***	-0.033***	-0.074***	0.027***	0.027***	0.023***
Personal, cultural, and recreational services	0.919***	0.538***	-0.038***	-0.045***	-0.082***	0.005	0.001	0.007
Government services, n.i.e.	0.531***	0.427***	-0.013*	-0.035***	-0.079***	0.011**	-0.013***	-0.018***

Note: Only selected coefficients are reported. \*\*\*, \*\*, \* denote statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.

Source: UN, WDI; own calculations.



**Table A.2.8.8 / Trade elasticities for EU-28 extra-trade by service trade categories**

	$\ln GDP_{it}$	$\ln GDP_{it}$	$D_2 \cdot \ln GDP_{it}$	$D_3 \cdot \ln GDP_{it}$	$D_4 \cdot \ln GDP_{it}$	$D_2 \cdot \ln GDP_{it}$	$D_3 \cdot \ln GDP_{it}$	$D_4 \cdot \ln GDP_{it}$
Transportation	0.872***	0.659***	-0.014*	-0.019***	-0.062***	0.020***	0.019***	0.023***
Travel	0.909***	0.491***	-0.021***	-0.033***	-0.073***	0.002	0.001	0.015***
Communications services	0.746***	0.582***	-0.008	-0.011*	-0.069***	0.037***	0.031***	0.010**
Construction services	1.007***	0.395***	-0.027***	-0.049***	-0.088***	0.012*	0.004	0.009*
Insurance services	0.838***	0.445***	-0.018**	-0.017***	-0.065***	0.026***	0.015***	0.019***
Financial services	1.026***	0.539***	-0.030***	-0.035***	-0.067***	0.005	0.000	0.010*
Computer and information services	1.432***	0.775***	-0.003	-0.016***	-0.049***	0.035***	0.033***	0.043***
Royalties and license fees	0.828***	0.834***	-0.006	-0.005	-0.036***	0.035***	0.023***	0.026***
Other business services	0.921***	0.778***	-0.015*	-0.029***	-0.071***	0.031***	0.028***	0.027***
Personal, cultural, and recreational services	0.896***	0.493***	-0.044***	-0.053***	-0.094***	0.009	0.000	0.004
Government services, n.i.e.	0.547***	0.349***	-0.016**	-0.036***	-0.084***	0.019***	-0.002	-0.007

Note: Only selected coefficients are reported. \*\*\*, \*\*, \* denote statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.

Source: UN, WDI; own calculations.

**Table A.2.8.9 / Trade elasticities for EU-28 intra-trade by service trade categories**

	$\ln GDP_{it}$	$\ln GDP_{it}$	$D_2 \cdot \ln GDP_{it}$	$D_3 \cdot \ln GDP_{it}$	$D_4 \cdot \ln GDP_{it}$	$D_2 \cdot \ln GDP_{it}$	$D_3 \cdot \ln GDP_{it}$	$D_4 \cdot \ln GDP_{it}$
Transportation	0.889***	1.513***	-0.098***	-0.083***	-0.095***	-0.020	-0.013	-0.045**
Travel	0.708***	1.382***	-0.086***	-0.089***	-0.077***	-0.016	-0.038***	-0.071***
Communications services	0.552***	1.565***	-0.075***	-0.064***	-0.236***	-0.006	-0.038**	-0.178***
Construction services	0.666***	1.133***	0.034	-0.066***	-0.093***	-0.022	-0.011	-0.076***
Insurance services	0.990***	0.770***	-0.060**	-0.035*	-0.004	-0.068***	-0.036*	-0.106***
Financial services	1.100***	0.824***	-0.034	-0.075***	-0.040	-0.020	-0.018	-0.073***
Computer and information services	1.463***	0.932***	0.008	-0.022	-0.045**	-0.016	-0.028	-0.076***
Royalties and license fees	0.896***	1.130***	0.028	0.037	0.037	0.052**	0.022	-0.037
Other business services	0.913***	1.222***	-0.071***	-0.073***	-0.105***	-0.058***	-0.055***	-0.076***
Personal, cultural, and recreational services	0.643***	1.086***	-0.019	-0.003	-0.032	0.006	0.027	-0.033
Government services, n.i.e.	0.178**	1.103***	-0.008	-0.037**	-0.061***	-0.013	0.007	-0.023

Note: Only selected coefficients are reported. \*\*\*, \*\*, \* denote statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.

Source: UN, WDI; own calculations.

**Appendix – Section 3.4: Definitions of variables and data sources**

<b>Variable</b>	<b>Definition</b>	<b>Data source</b>
Intra-firm export flow	Firm-product level export flow between foreign affiliate and the country where the headquarter is located	Central Statistics of Ireland, transaction level trade statistics
Intra-firm import flow	Firm-product level import flow between foreign affiliate and the country where the headquarter is located	Central Statistics of Ireland, transaction level trade statistics
Intra-firm trader	Firm with intra-firm trade	Central Statistics of Ireland, transaction level trade statistics
Firm productivity	Total turnover per person employed	Central Statistics of Ireland, Census of Industrial Production
Firm size	Total persons employed	Central Statistics of Ireland, Census of Industrial Production
High-tech industry	Binary variable equal to 1 for high-tech industries	Eurostat
Capital goods	Binary variable which is equal to 1 for trade with capital goods; 0 otherwise	UN Trade Statistics
Corporate policy tax rate	Statutory corporate tax rate	KPMG
Real GDP	GDP in 2005 prices	The World Bank, Economy & Growth Indicators
Distance	Distance in km between Dublin and capital cities of countries of destination/origin	CEPII
Common language	Binary variable equal to 1 if home and host countries have a common official primary language, 0 otherwise	CEPII
Common border	Binary variable equal to 1 if home and host countries share a border, 0 otherwise	CEPII
Rule of law	Index that reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	The Worldwide governance indicators, 2015 update <a href="http://www.govindicators.org">www.govindicators.org</a>
R&D expenditure intensity	Public and private R&D expenditure in per cent of GDP	The World Bank, Science & Technology Indicators
Capital intensity	Gross fixed capital formation in per cent of GDP	The World Bank, Economy & Growth Indicators

**Table A.3.4.1 / Summary statistics for exporters: Employment, 1994-2015**

	<i>All exporters</i>					<i>Foreign-owned exporters</i>					<i>Intra-firm exporters</i>				
	Obs.	Mean	St. dev.	Min.	Max.	Obs.	Mean	St. dev.	Min.	Max.	Obs.	Mean	St. dev.	Min.	Max.
1994	895	116.6	400.3	3	10,713	351	152.9	209.3	3	1,732	266	173.6	229.7	4	1,732
1995	997	119.2	379.3	2	10,128	374	168.5	273.3	2	3,272	291	187.8	301.3	2	3,272
1996	1,076	117.6	353.6	1	9,707	395	174.1	264.1	3	2,952	304	194.3	291.4	3	2,952
1997	1,149	122.2	346.0	0	9,165	416	192.9	306.8	4	3,422	340	209.6	331.9	4	3,422
1998	1,217	124.9	341.0	2	8,833	439	198.9	328.8	3	3,260	367	215.6	352.2	3	3,260
1999	1,320	127.7	350.6	0	8,916	467	213.6	372.8	0	4,554	397	226.1	395.7	0	4,554
2000	1,378	129.4	348.4	0	8,832	476	222.7	382.5	3	3,860	395	246.0	410.7	3	3,860
2001	1,408	125.8	348.7	0	8,949	507	208.4	374.7	0	4,306	415	229.9	405.1	0	4,306
2002	1,392	121.1	333.4	0	8,898	509	197.4	338.0	0	3,266	405	219.3	366.9	0	3,266
2003	1,375	119.6	328.5	0	8,564	484	196.7	345.5	2	3,281	384	220.4	376.7	2	3,281
2004	1,353	123.3	345.0	0	8,490	463	209.2	394.4	0	3,966	371	229.2	430.1	0	3,966
2005	1,265	127.6	348.6	3	7,844	453	214.8	411.4	3	4,419	362	239.6	451.9	4	4,419
2006	1,277	125.4	342.7	0	7,706	420	223.8	424.7	3	4,259	325	252.9	473.0	5	4,259
2007	1,233	126.5	340.1	0	7,362	398	232.3	430.0	4	4,515	313	256.7	475.2	4	4,515
2008	1,158	123.2	335.9	1	7,410	372	222.3	412.4	4	4,338	282	251.7	462.6	4	4,338
2009	1,199	113.1	302.8	1	7,254	380	198.5	340.7	4	3,122	288	225.8	380.5	4	3,122
2010	1,213	108.0	286.9	0	6,863	376	193.7	329.2	3	2,890	297	215.4	360.9	3	2,890
2011	1,309	102.9	282.2	0	6,863	379	193.9	340.6	0	2,822	301	218.9	372.6	0	2,822
2012	1,275	104.2	303.4	0	7,992	365	201.5	332.2	0	2,812	284	225.3	365.4	0	2,812
2013	1,293	103.6	302.7	0	7,992	365	201.0	332.4	0	2,812	283	220.0	364.5	0	2,812
2014	1,277	103.0	303.3	0	7,992	354	204.7	336.5	0	2,812	277	229.9	368.9	0	2,812
2015	1,244	104.0	305.9	0	7,992	338	205.7	336.7	0	2,812	263	224.7	370.6	0	2,812

Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

**Table A.3.4.2 / Summary statistics for importers: Employment, 1994-2015**

	<i>All importers</i>					<i>Foreign-owned importers</i>					<i>Intra-firm importers</i>				
	Obs.	Mean	St. dev.	Min.	Max.	Obs.	Mean	St. dev.	Min.	Max.	Obs.	Mean	St. dev.	Min.	Max.
1994	1,320	88.3	333.0	3	10,713	362	149.8	207.1	3	1,732	306	157.7	218.7	3	1,732
1995	1,400	93.4	322.9	3	10,128	383	164.5	270.3	3	3,272	339	173.1	284.0	3	3,272
1996	1,520	91.8	300.6	0	9,707	401	172.0	262.1	3	2,952	347	181.9	277.5	3	2,952
1997	1,630	95.3	294.3	0	9,165	425	189.3	304.6	3	3,422	376	199.2	320.1	3	3,422
1998	1,722	97.8	290.7	3	8,833	452	195.7	325.4	3	3,260	402	203.1	340.2	3	3,260
1999	1,896	98.9	297.4	0	8,916	482	209.5	368.5	0	4,554	429	221.2	384.6	0	4,554
2000	1,973	101.2	297.1	1	8,832	491	219.8	378.0	3	3,860	440	231.6	394.4	3	3,860
2001	2,007	98.5	297.4	0	8,949	537	198.4	366.4	0	4,306	470	212.9	385.8	0	4,306
2002	2,020	94.5	282.6	0	8,898	539	189.0	330.4	0	3,266	454	202.9	351.2	0	3,266
2003	1,998	92.8	277.7	0	8,564	515	189.2	336.8	2	3,281	439	200.6	356.2	2	3,281
2004	1,943	95.5	292.7	0	8,490	485	203.3	386.5	0	3,966	413	215.5	410.7	0	3,966
2005	1,884	97.0	291.6	0	7,844	480	205.9	401.6	4	4,419	404	223.0	431.6	5	4,419
2006	1,986	91.6	280.2	0	7,706	443	216.4	415.1	3	4,259	374	232.9	445.6	4	4,259
2007	2,144	86.1	265.4	0	7,362	423	222.2	419.6	3	4,515	351	243.8	453.4	4	4,515
2008	2,035	81.8	260.7	0	7,410	407	209.2	397.9	3	4,338	336	228.2	430.2	4	4,338
2009	1,943	78.8	243.4	0	7,254	397	193.2	334.9	4	3,122	338	208.7	357.3	4	3,122
2010	1,861	78.3	236.9	0	6,863	393	186.5	323.4	0	2,890	327	196.5	331.3	3	2,890
2011	1,985	73.7	230.2	0	6,863	395	181.5	321.9	0	2,822	337	197.6	343.2	0	2,822
2012	1,816	80.0	259.6	0	7,992	383	192.2	325.7	0	2,812	321	208.7	348.8	0	2,812
2013	1,850	79.0	256.8	0	7,992	378	194.9	327.3	0	2,812	324	209.8	347.6	0	2,812
2014	1,828	80.4	259.1	0	7,992	364	202.5	332.5	0	2,812	307	218.3	355.3	0	2,812
2015	1,771	80.9	260.5	0	7,992	352	201.2	329.5	0	2,812	298	218.0	351.9	0	2,812

Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

**Table A.3.4.3 / Summary statistics for exporters: Productivity, 1994-2015**

	<i>All exporters</i>					<i>Foreign-owned exporters</i>					<i>Intra-firm exporters</i>				
	Obs.	Mean	St. dev.	Min.	Max.	Obs.	Mean	St. dev.	Min.	Max.	Obs.	Mean	St. dev.	Min.	Max.
1994	895	168.1	329.3	0.7	4546.3	266	252.8	536.8	10.9	4546.3	351	237.9	486.0	10.9	4546.3
1995	997	170.0	308.5	0.0	3525.0	291	272.3	502.8	8.0	3525.0	374	249.5	456.8	8.0	3525.0
1996	1,076	174.5	305.2	0.6	3695.2	304	279.0	509.9	4.5	3695.2	395	252.6	457.3	4.5	3695.2
1997	1,148	182.5	351.1	0.6	5404.0	340	282.6	557.2	18.1	5404.0	416	275.6	536.8	16.3	5404.0
1998	1,217	196.1	416.6	0.0	6507.2	367	331.4	705.1	0.0	6507.2	439	309.6	652.6	0.0	6507.2
1999	1,318	209.1	472.0	0.7	6579.5	396	350.8	756.3	2.5	6579.5	466	336.3	732.0	2.5	6579.5
2000	1,377	247.4	677.5	0.0	13100.0	395	407.4	973.9	26.1	11400.0	476	406.6	1074.2	17.0	13100.0
2001	1,391	258.1	719.8	0.0	13329.2	412	468.2	1226.9	23.6	13329.2	503	426.0	1119.4	0.1	13329.2
2002	1,388	258.9	662.8	1.5	11071.3	403	463.6	1130.9	1.7	11071.3	507	419.7	1018.7	1.7	11071.3
2003	1,373	270.9	658.3	1.6	9453.2	384	488.4	1136.0	29.6	9453.2	484	449.9	1039.7	19.4	9453.2
2004	1,352	272.8	675.2	2.7	12292.6	370	485.4	1174.9	22.2	12292.6	462	467.6	1098.3	22.2	12292.6
2005	1,265	310.8	783.5	2.8	12805.9	362	540.6	1227.8	21.9	12805.9	453	532.6	1255.3	21.9	12805.9
2006	1,276	327.8	800.2	2.8	12660.0	325	587.2	1406.5	3.2	12660.0	420	553.1	1316.5	3.2	12660.0
2007	1,231	348.8	805.2	1.0	11308.7	313	642.9	1485.9	3.4	11308.7	398	575.6	1330.5	3.4	11308.7
2008	1,158	372.8	901.7	2.8	13716.2	282	673.1	1476.8	40.2	10710.0	372	634.0	1484.5	40.2	13716.2
2009	1,199	360.6	922.8	0.0	14923.7	288	631.4	1541.2	37.6	14923.7	380	617.4	1495.6	34.8	14923.7
2010	1,211	377.5	1212.7	0.0	31187.3	297	740.8	2279.4	36.1	31187.3	376	695.5	2076.1	36.1	31187.3
2011	1,286	574.8	7477.9	0.2	266666.7	300	1539.0	15431.6	10.2	266666.7	376	1349.9	13795.3	10.2	266666.7
2012	1,160	377.5	931.9	0.0	16285.5	274	700.0	1616.2	23.5	16285.5	352	691.2	1578.6	23.5	16285.5
2013	1,173	368.1	878.7	1.8	16285.5	273	702.2	1617.9	23.5	16285.5	352	665.3	1487.4	23.5	16285.5
2014	1,164	379.8	940.0	13.6	16285.5	270	730.6	1653.9	23.5	16285.5	342	718.8	1618.6	23.5	16285.5
2015	1,139	364.5	820.4	13.6	10623.4	256	703.0	1432.9	23.5	8288.9	330	682.0	1404.4	23.5	10623.4

Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

**Table A.3.4.4 / Summary statistics for importers: Productivity, 1994-2015**

	<i>All importers</i>					<i>Foreign-owned importers</i>					<i>Intra-firm importers</i>				
	Obs.	Mean	St. dev.	Min.	Max.	Obs.	Mean	St. dev.	Min.	Max.	Obs.	Mean	St. dev.	Min.	Max.
1994	1,320	142.3	275.8	0.0	4546.3	306	247.8	512.6	0.0	4546.3	362	235.9	478.9	0.0	4546.3
1995	1,400	152.6	271.5	0.0	3525.0	339	263.7	477.2	8.0	3525.0	383	250.8	451.6	8.0	3525.0
1996	1,519	155.1	269.6	4.0	3695.2	347	264.5	482.2	4.5	3695.2	401	251.9	454.0	4.5	3695.2
1997	1,629	163.0	304.2	3.3	5404.0	376	290.2	560.2	16.3	5404.0	425	275.2	531.3	16.3	5404.0
1998	1,722	173.9	357.7	0.0	6507.2	402	328.4	678.6	0.0	6507.2	452	309.0	644.1	0.0	6507.2
1999	1,894	190.5	530.1	0.0	15240.0	428	389.5	1045.3	2.5	15240.0	481	366.9	990.1	2.5	15240.0
2000	1,973	213.2	577.8	0.0	13100.0	440	432.6	1122.3	30.9	13100.0	491	411.2	1069.7	17.0	13100.0
2001	1,983	223.3	612.4	0.0	13329.2	467	447.0	1157.3	0.0	13329.2	533	420.2	1090.4	0.0	13329.2
2002	2,014	224.3	570.0	0.0	11071.3	450	442.9	1075.8	11.8	11071.3	535	415.0	995.3	11.8	11071.3
2003	1,994	232.9	555.3	2.1	9453.2	439	459.9	1068.7	19.4	9453.2	515	441.5	1011.8	19.4	9453.2
2004	1,941	244.3	593.8	10.0	12292.6	412	494.7	1157.3	22.2	12292.6	484	467.7	1084.0	22.2	12292.6
2005	1,883	287.2	1116.2	3.0	39144.1	404	552.5	1284.0	21.9	12805.9	480	531.1	1234.8	7.8	12805.9
2006	1,983	288.6	987.2	3.2	32637.2	374	574.1	1346.8	3.2	12660.0	443	562.7	1313.5	3.2	12660.0
2007	2,139	298.8	854.9	0.0	25961.5	351	626.9	1434.8	3.4	11308.7	423	575.5	1318.2	3.4	11308.7
2008	2,034	307.9	942.7	1.7	28303.6	336	683.7	1569.5	40.2	13716.2	407	623.7	1439.1	40.2	13716.2
2009	1,937	330.6	1658.1	0.0	58676.0	338	638.2	1530.5	34.8	14923.7	397	693.6	2059.0	34.8	29200.3
2010	1,856	358.9	1781.1	1.7	53222.0	327	642.8	1410.9	27.4	12465.1	392	776.9	2598.4	1.7	32202.8
2011	1,927	345.2	1782.9	0.0	61186.0	334	645.0	1473.9	10.2	14830.2	391	752.5	2341.1	1.7	35475.2
2012	1,605	336.2	1206.8	0.0	37067.9	312	707.7	1589.3	23.5	16285.5	372	750.3	2391.5	23.5	37067.9
2013	1,637	315.8	811.6	1.8	16285.5	316	708.4	1580.9	23.5	16285.5	366	692.1	1570.5	23.5	16285.5
2014	1,620	341.8	1223.9	1.8	37067.9	299	724.2	1618.5	23.5	16285.5	355	809.4	2501.8	23.5	37067.9
2015	1,588	324.0	823.6	1.8	16285.5	292	719.8	1603.1	23.5	16285.5	344	706.2	1591.8	23.5	16285.5

Source: Own calculations based on transaction-level trade data provided by the Central Statistics Office of Ireland.

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