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Trade in Intermediate Products and EU Manufacturing Supply Chains

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Based on this background of the importance of the multi-country nature of products, the report provides a detailed analysis of the structure of the international production process and trade in intermediates with respect to EU countries at various levels. Using information gathered from detailed trade statistics, the report analyses the relative importance of trade in intermediate products in overall trade, the respective changes over time and the important differences among the EU-27 countries. Here the importance of considering both exports and imports of trade in intermediates is emphasized. The study investigates the geographic structure of sourcing and provision of intermediates, pointing out important regional shifts, specialization patterns, the significance of two-way trade in intermediates, extensive and intensive margins by use categories and other characteristics such as quality aspects. The report then continues providing information on the using side of imported intermediates and its role in inter-industry linkages. This is further exemplified at a very detailed level – at the level of a single product, the Nokia N95 – analysing the complexity of international production processes for a high-tech product. Finally, the study provides insights into the effects of the crisis on trade in intermediates – whether being a cause or consequence of the trade collapse – and potential implications for future developments.

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1 Introduction

Where is your mobile coming from? This simple question is not easy to answer as the mobile has probably been assembled using components from different countries (including the domestic) and by using services also from the domestic and foreign economies. This multi-country nature of products is not only a feature of more complex high-tech products (such as mobile phones, cars, etc.); in almost all cases a product is not made up entirely of components or inputs from the country where it is finally assembled or sold but at least some of the components and services (e.g. transport services) included to bring the product to the customer are purchased abroad. This is the case for direct inputs, in the way that firms purchase intermediate inputs for production domestically and abroad, but even more so in an indirect way. A component from a particular country may already include other inputs from other countries which are thus used indirectly when using the component for production purposes. At the national level, a pendant to this view may be consideration of inter-industry linkages as emphasized in input-output analysis. The other way round, companies may ship high-tech components to other countries where assembly of the final product takes place. This complex nature of supply chains has been documented in a number of case studies for various products such as T-shirts (Rivoli, 2004), Barbie dolls (Tempest, 1996), computers (Kraemer and Dedrick, 2002), the iPod (Linden, Kraemer and Dedrick, 2007; Varian, 2007) and Boeing (Grossman and Rossi-Hansberg, 2009).

This complex and internationally integrated pattern of production can probably best be seen when considering particular products or the supply chains of single firms, where emphasis is put on firm strategies, conditions specific to the country where the firm operates and the nature of the product. And indeed, there exist detailed studies with respect to one product: prominent examples of products considered are the Barbie doll, the iPod, Dell computers, and Boeing, as already mentioned above. In the European context the changes in the international structure of production are discussed in detail in Faust et al. (2004). This book also provides a number of case studies at the level of industries (the automobile industry, the electronics industry, and the apparel industry). In the present study we provide an even more detailed case study for a European high-tech product (the Nokia N-95) as most case studies so far and those mentioned above refer mostly to US American products.[1]

[1] This case study might answer the very first question raised above.

This complex nature of international linkages at a more aggregate level (e.g. industries or countries) is reflected in trade patterns. Detailed product level trade data allow differentiating products regarding their use as intermediate inputs, capital goods or consumer goods or even more detailed categories (though such a distinction may not be clear in a number of cases[2]). At these more aggregate levels this study provides a detailed analysis of the trading patterns of intermediates for the purpose of production processes as compared to other product categories at various levels of aggregation and by using various methods commonly applied in empirical analysis of trade patterns. An important trend – commonly argued – is the increasing adjustment and adaptation of production structures to more international sourcing structures and cross-border production networks. Accordingly, it is commonly argued that intermediate goods trade as a share of total trade is increasing because of international outsourcing. Firms distribute their production activities and develop their supply chains over different locations according to comparative advantages in a broader sense (e.g. also taking the legal situation in potential target countries of outsourcing into account). We carefully analyse such trends in trade structures of intermediates versus other product types for the EU-27 countries over about the last decade. This will be based on descriptive analysis and common methods in the trade literature with an emphasis on trade in intermediates.

A few considerations have to be made already at this stage: First, one should not expect a common trend across countries which differ with respect to their initial specialization patterns, endowment structures and technological capabilities and their role of both users and producers of intermediates. The extent to which countries import and export intermediates for production purposes varies even at the level of detailed industries, given firm strategies and specialization patterns within these detailed categories, and thus the general patterns and trend at more aggregate levels become blurred. Even the literature speaks of a 'myriad of interesting possibilities' (Grossman and Rossi-Hansberg, 2008) which may emerge even within countries when considering individual industries. Thus we shall emphasize the cross-country and cross-industry differences which emerge from the data.

Second, the common view of an increase in trade in intermediates may also be challenged as this is not necessarily in line with the data. Chen et al. (2005), for example, argue that intermediate goods trade for a number of OECD countries (including the US) has not been increasing, though vertical specialization (i.e. intermediates that are imported and used to make other goods which are exported at later stages) does. A similar observation is made in a recent study on OECD countries, arguing that the share of intermediates trade is roughly constant since 1995 (Mirodout et al., 2009) though these findings may depend on the definition and measurement of trade in intermediates.

[2] To stick to the example of a mobile phone: This can be used for personal purposes (chatting with friends) or in the production processes (negotiating with clients).

Third, another common knowledge aspect seems to be that one expects to find a set of typically outsourcing countries (e.g. large and advanced economies) and a typical set of target countries of outsourcing (e.g. smaller, less developed economies with particular endowment structures). Again, this common knowledge may be challenged by the data. Considering trade in intermediates, in most cases countries are both exporters and importers (i.e. the share of two-way trade is quite high) even at detailed industry levels. Furthermore, we shall see that smaller emerging economies (in the European context the Eastern European transition countries) are highly specialized in trade in intermediates as compared to other economies. Here these specialization patterns can again be found both in imports and exports. This latter point raises the more general question whether trade in intermediates may help countries to integrate into the world economy and in which way this shapes patterns of specialization in both production and trade.

Fourth, having said this, there may however be important shifts taking place in the geographic structure. We shall see that over the last decade some important shifts have occurred with respect to the geography of imports and exports: Within the EU countries, there has been an important shift towards the Eastern European countries which became quite important for at least some countries of the EU-15 (such as Germany and Austria). Within the EU-15, there has been a second shift in the way that some countries lost market shares (such as France and the UK) whereas other countries gained market shares (in particular Germany) though to a varying extent across industries and product categories. Yet another shift can be observed towards larger emerging economies (in this study we consider the BRIC countries) which may be regarded as the 'globalization' of production. However, the study will also show that these shifts are not necessarily taking place only for intermediates trade but similarly for the other product categories.

Of course there is a valid concern that the current economic crisis – which was accompanied by a collapse in trade flows that was larger than the drop in GDP growth rates – may have changed these patterns, and a discussion is raised on the longer-term implications of this. The crisis that unfolded in 2008 and 2009 resulted in an unprecedented collapse in trade flows which hit the countries to a differing degree though there was an astonishing synchronization in time observed (see Araújo, 2009; Araújo and Martin, 2009). In this study we shall investigate whether the trade collapse was more pronounced in intermediate goods trade (as compared to other categories such as final goods trade) and to what extent this collapse differed across countries and industries. Specifically, we shall look at the effect of the crisis on the geographic patterns of trade and intermediate goods trade in particular. Here we are interested in whether the intermediates trade has been more affected with respect to intra-EU or extra-EU trade. The longer-term effects, however, are fairly unclear and there is no consensus so far. Furthermore, in the medium run other factors may be more important (rather than the 'pure' crisis effects) which include Asian trade integration strategies, exchange rate movements, etc.

Relying on trade statistics does, however, not provide a complete picture of the manufacturing supply chains and particularly does not reveal cross-industry differences with respect to sourcing structures. The reason for this is that imports of intermediate products cannot be accounted to the using industries using trade statistics. As an example, though one knows the imports of a particular intermediate product (such as basic metals or transport services), trade data cannot show in which industries and to what extent these are used for the production process. In this study we therefore also use input-output tables (splitting up into domestic and foreign sourcing of intermediates) to reveal supply chains of manufacturing industries and inter-industry linkages. The study particularly shows that inter-industry linkages indeed increased over time, however, this was partly taking place simultaneously with a growing share of intermediate inputs sourced from abroad. Thus the domestic multiplier was growing less than the total multiplier. Here we shall again find striking cross-industry and cross-country differences. The drawback of using input-output tables is that the country of origin of the imported product is not reported.[3]

Nevertheless, at a more detailed level, the actual supply chains and strategies of firms regarding their national and international sourcing strategies can only be revealed using detailed case studies, as already mentioned at the beginning of this introduction. In the case study we perform detailed grass-roots detective work in order to determine how globalization plays out in one particular case, namely, the Nokia N95 mobile phone in 2007. Our best estimate is that Europe captured 55% of the value added generated over the lifetime of this particular phone model. The final assembly of the N95 was mostly done in Europe; the main markets for it were in Europe. The N95 was also assembled in Beijing for, e.g., the US market: even in this case Europe captured 51% of the value, despite the fact that the phone was 'Made in China'.

The study contains detailed information on these issues in the following way. In Section 2 we discuss some conceptual issues and some recent literature with respect to the overall aim of the study. Section 3 provides detailed evidence on the structures and dynamics of trade in intermediates compared to other product categories (such as capital goods and consumer goods). Particularly, we present evidence using descriptive analysis (Section 3.1), measuring revealed comparative advantages and the extent of two-way trade (Section 3.2), discuss to what extent trade patterns differ and evolved with respect to the volumes or numbers of goods traded (Section 3.3), analyse changes in market shares and price changes which may reflect quality changes (Section 3.4) and, finally, show to which extent countries are diversified or specialized in their export structures. In Section 4 we look in detail at the inter-industry linkages, considering manufacturing inputs in services and service inputs in manufacturing (Section 4.1), show to what extent these intermediates are purchased abroad (Section 4.2) and discuss the direct and indirect effects using multi-

[3] An ongoing project in the EU Framework 7 programme tries to combine input-output tables with trade statistics to get an overall picture of sourcing structures at the industry level (see www.wiod.org).

plier analysis differentiating between domestic and imported products (Section 4.3). This section also includes the case study on the Nokia N95 mobile phone, revealing the complexity of a supply chain for a single product. In Section 5 we discuss the effects of the economic crises on the trade patterns with respect to intermediates in particular. Section 6 summarizes the findings and points towards policy-relevant topics.

2 Conceptual issues and related literature

The literature on outsourcing and trade in intermediates is quite voluminous and heterogeneous with respect to definitions applied, measures used and coverage of countries and years considered. Consequently it is almost impossible to provide an exhaustive overview of the studies. The difficulties start with terminology, as for the same or similar phenomena different terms are used (e.g. outsourcing, offshoring, fragmentation, supply chains), different datasets are used for the analysis (e.g. trade data, input-output data, firm-level data). In the theoretical literature, patterns and effects of the outsourcing phenomenon depend greatly on whether one considers single industries or also tries to capture general equilibrium mechanisms and whether outsourcing (offshoring) takes place within the boundaries of a firm or beyond. Furthermore, differences arise due to assumptions on whether firms outsource production of inputs and whether the 'bundling together' takes place at home or abroad or whether this is left unspecified. These assumptions however matter when it comes to a discussion on the patterns of trade flows regarding intermediates versus final products. Finally, one should also keep in mind that in the literature outsourcing is mostly seen from the viewpoint of developed economies in terms of imports of intermediate inputs. However, in many cases these countries are also important exporters of intermediates, and less advanced economies also show large shares of trade of intermediates in both ways.

In this section we therefore provide a brief overview of the most important literature and topics covered though without the claim of being exhaustive. We review important contributions at the country and industry level together with empirical studies and the discussion on trade in value added. We then proceed to overview some literature at the firm level including the concept of trade in tasks and the role of multinationals.

Outsourcing at the country/industry level

The patterns and effects of outsourcing and fragmentation at the industry or country level are even more complex to analyse in particular in the case of differences in outsourcing patterns across industries and heterogeneous firm strategies. The patterns and effects of outsourcing at the more aggregate levels have however been widely covered both in the theoretical literature and empirical literature. A first line of research is based on traditional trade theory and follows closely the Heckscher-Ohlin model (e.g. Arndt, 1997, 1999; Arndt

and Kierzkowski, 2001; Deardorff, 2001). In traditional trade theory with two factors (S for skills and L for labour) and two goods (X as the labour-intensive and Y as the skill-intensive) trade and specialization patterns are determined by differences of relative endowments in the two countries. The difference in relative endowments leads to a comparative advantage of the skill-abundant country in the skill-intensive good. Similarly, in the Ricardian-type models differences in relative productivity levels determine the structure of comparative advantages. It can then be asked what happens if the production of one or both goods can be fragmented into two parts which can be subcontracted (to other firms in foreign countries). These subcontracted activities can either be products or services. In general these fragments require different factor intensities than the composite good. Thus it could be that the more skill-intensive fragment of the labour-intensive good X is more skill-intensive than good Y or as the more labour-intensive fragment own good Y. Such an approach thus requires to distinguish several cases as e.g. in Arndt (1997) with structures and effects of outsourcing being dependent on the exact specifications with a 'myriad of interesting possibilities' (Grossman and Rossi-Hansberg, 2008). We provide two examples: Let us first discuss the case of offshore sourcing of the import sector. This import sector is – following the idea of comparative advantages – the labour-intensive sectors in the skill-abundant country. Arndt (1997) shows that offshore subcontracting by the import-competing industry (where it is assumed that the labour-intensive component is completely outsourced) raises wages of labour relative to skills. In a second stage one can assume that the labour-abundant country outsources the skill-intensive component of good X to the skill-abundant country in the way that each country fully specializes in one segment. Arndt (1997) shows that in this case relative wages are rising in both countries. The effects on general welfare in the two countries are positive and the results are analogous to the Rybczynski effect of technical change or factor accumulation. These results mean that intra-product specialization can be trade enhancing and welfare improving.

Deardorff (2001) discusses the effects of outsourcing in a Heckscher-Ohlin model. If factor price equalization holds it is shown that outsourcing occurs only if it is costless, but this is an uninteresting case. If factor price equalization does not hold initially then even costly fragmentation is able to produce the good at lower costs as different factor prices can be exploited. This can even be the case if the fragmentation technology uses more resources than the original. In this framework the introduction of fragmentation may lead factor price equalization when it did not obtain initially (Deardorff, 2001). But it could also be that the effect on factor prices goes in the other direction, i.e. these are driven further apart. The direction of factor prices depends systematically on how the factor proportions of fragments compare to the average factor intensities within the cones where the fragments are produced.

Arndt and Kierzkowski (2001) are showing in a framework with Ricardian and Heckscher-Ohlin features that in general fragmentation of production can lead to a situation in which a

country is worse off than before fragmentation; this would be the case if a country's terms of trade sufficiently worsen as a consequence of fragmentation. Under the assumption that prices for both fragments fall it could even be that – even if the country was heavily specialized in the former composite product – the country no longer produces either of the two fragments. Jones and Kierzkowski (1990) illustrate this with an Olympic gold winner in a decathlon. If the event were broken up into separate components, the athlete would return without a medal. This means that even if a country is an effective competitor for the composite product potential rivals could exist which are superior in particular fragments. When breaking up the composite production into fragments these rivals may be more effective than the former country. As a finer degree of specialization is possible with fragmentation this allows for a greater scope of Ricardian comparative advantages. Further, if consumption is heavily biased towards this commodity which is fragmented than the consumer may be better off as the lower prices for this commodity more than offset the other welfare effects.

Jones and Kierzkowski (1990) also discuss the role of services starting from two stylized facts: Purely domestic service links are less costly than service links across countries and, second, the production of services is characterized by strong increasing returns to scale. Using these assumptions the most efficient way of the organization of production depends on the output level. At low output levels it is most efficient to organize production in a single block. However, when a certain threshold is reached, a domestically fragmented pattern of production becomes more efficient, and with even higher levels of output international fragmentation becomes the most efficient. This framework then also gives an idea on other causes of the rapid rise in fragmentation. Technical progress in services (e.g. international telephone calls are becoming cheaper, internet and communication technologies, banking transactions and reductions in transport costs) allows (or makes it more efficient) to break up production processes into fragments which can then be internationally outsourced. With respect to income distribution it is shown that the relatively unskilled labour-abundant country induces a fall in the level of real wages of the unskilled workers. In this case, fragmentation for such a country is like technical progress in the capital-intensive sector. On the other hand, the relatively capital-abundant country observes an increase in the relative wage rate due to losses of the labour-intensive fragments. However, under different assumptions it is shown that the results can be opposite. Several other cases are discussed in Jones and Kierzkowski (2001). These results on relative wage rates again suggest that this topic needs a very subtle discussion and popular views are not right in any case.

Other contributions for example rely on the specific factors framework (e.g. Kohler, 2001a and 2001b). In these papers the conclusions are somewhat different from the traditional Heckscher-Ohlin-based contributions and are somewhat similar to the one-sector model's outcome: unskilled labour loses in a country, where the unskilled-labour-intensive fragment is outsourced to a foreign economy. (This is the outcome when associating skilled labour with the sector-specific factor and unskilled labour with the mobile factor.)

Surveys of the various approaches for potential determinants of outsourcing are provided in Egger and Egger (2005), Baldwin and Robert-Nicoud (2007), Grossman and Rossi-Hansberg (2008). Factors considered are comparative advantages, economies of scale, imperfect competition at the level of intermediates, economic geography, costs of coordination of international production networks, Heckscher-Ohlin factor proportions, etc.

Empirical studies on outsourcing

There exist already many studies and overviews on the patterns of outsourcing (see e.g. Feenstra, 1998; Yeats, 2001; Kleinert, 2003; Stehrer, 2006) and we thus only summarize some facts. All studies on outsourcing – despite relying on different measures of outsourcing – indicate that the amount of international outsourcing has increased substantially over the last few decades. However, these studies also point towards large country differences with respect to levels and the relative importance of outsourcing activities. For example, larger countries tend to have lower outsourcing activities. Similarly, there are quite large differences with respect to sectoral reliance on imported intermediate inputs (e.g. Irwin, 1996; Fontagné et al., 1996; Campa and Goldberg, 1997; Hummels et al., 1998; Hummels et al., 2001; Yeats, 2001) for earlier studies. Chen et al. (2005) argue that trade in intermediate goods as a share of total trade has not increased, but only trade in vertical specialized goods has. Agnese and Ricart (2009) review the indicators used in the literature and point out that offshoring is not exclusively undertaken by large developed countries but is a more widespread phenomenon. When proxying outsourcing by trade in intermediates smaller countries show even more pronounced outsourcing patterns. Other studies partly focusing on East Asian trade include Ng and Yeats, 2003; Kimura 2006 and more recently Athukorala (2010) on production networks and trade patterns in East Asia.

A question of concern is – also related to the theoretical approaches – whether fragmentation of production follows countries' comparative advantages or the importance of other factors. The bulk of these studies rely on type of gravity equations in a broader sense including variables like size, income, trade barriers, similarities and endowments. By doing so these approaches also interpret results as testing various trade theories against each other (e.g. factor-endowment based, new trade theory, geographic and spatial models, etc.). Results are however mixed and even with partly opposing conclusions (see e.g. Görg, 2000; Baldone et al., 2001; Kimura et al., 2007, on East Asia versus Europe) depending on samples under consideration and methodological specifications. Apart from these problems there is a general discussion on the theoretical foundations of the gravity approach (see Stack, 2009, for a recent overview).

Vertical trade

Hummels et al. (2001) define vertical specialization as the use of imported inputs for producing goods that are exported. Using input-output tables for a sample of ten OECD coun-

tries (and four emerging economies (Ireland, Korea, Taiwan and Mexico) they find that vertical specialization accounts for 21% of exports for these countries and grew by 30% from 1970 to 1990. Further, growth in vertical specialization accounts for about 30% in total export growth on average, with however partly large country differences. Finally, on average 73% of growth in vertical specialization stems from a higher intensity within sectors; in most countries machinery and chemicals account for more than three-quarters of growth in the vertical specialization share. These differences in VS shares also account for most of cross-country differences with differences in sector composition playing a minor role.

In a recent paper Daudin, et al. (2009) report a measure of vertical specialization (using concepts of VS1 and VS1*) of 27% in 2004 and argue that value added trade differs from standard trade in sectoral dimensions. Further, value added trade is less regionalized. This is based on GTAP database for 1997, 2001, 2004. In terms of regionalization value added trade seems to be less regionalized compared to standard trade.

Johnson and Noguera (2008) calculate bilateral trade in value added in 87 countries or regions using GTAP database and import data to build a global input-output table. The results reported indicate that the ratio of value added to gross exports varies across countries and sectors. Richer countries are more engaged in cross-border production sharing which mostly stems from the composition of exports. This result however does not hold for the manufacturing sector. On a bilateral basis they show that production sharing distorts bilateral trade patterns with large variations across countries. Mirodout et al. (2009) analyse trade patterns for OECD countries using both trade data and input-output data and point towards the importance of intermediates trade in total trade both for developed but even more so for developing countries. They also find that trade in intermediates compared to other categories has not grown particularly faster. This implies rather constant shares of intermediates in trade.

Outsourcing at the firm level

The rise of international outsourcing and the expansion of goods with multiple nationalities is seen as one of the key elements of the new economy and the globalization patterns in the last two decades. Thus the questions addressed in the literature are focusing on the incentive of a firm to outsource versus the potential costs of (international) outsourcing. Consequently, when analysing outsourcing at the firm level, one may even have to start with the question why firms are vertically integrated at all. Coase (1937) answered this question by arguing that market transactions are not costless and thus some stages of the production process are vertically integrated in ‘firms’. Starting from this point of view might help to understand why firms start to vertically disintegrate. One reason for vertically integrating the production process within one firm is that specificities in production factors exist (e.g. firm-specific human capital, specific equipment, ...). For a discussion of supply chains

and their conceptualizations see MacKechnie (2009) who proposes a discussion in terms of hierarchy, networks and markets.

The 'theory of vertical integration' thus shows that specific investment is a determinant for vertical integration albeit integration itself is not costless (e.g. monitoring, bureaucratic costs, etc.). Fragmentation then occurs if the degree of factor specificities declines e.g. via emerging up- and downstream firms, making usage of other products in the value chain, etc. On the former, the argument is that outsourcing enables specialized production at relatively lower costs and furthermore avoids potential corporate governance costs which might arise in case of vertical integration. On the other hand there are potential downsides to these gains from outsourcing which result from the fact that quality delivered might not be fully verifiable and thus potential suppliers have an incentive to provide lower quality to save costs. On the other hand, these supplies of components might face a 'hold-up' problem as there might be relation-specific sunk costs. A potentially outsourcing firm must thus decide where to outsource depending on these factors. In an international context the contributions by Grossman and Helpman (2002, 2003) and Antràs and Helpman (2004) shed light on determinants of the choice between domestic and foreign outsourcing or foreign direct investment. The determinants for these are market thickness, search costs for outsourcing partners, and characteristics of contracts. This is extended to include productivity differences in a firm's outsourcing decision by Antràs and Helpman (2004). From these contributions it follows that 'thicker markets' reduce search costs and thus outsourcing activities are expected to be higher. Similarly, the availability of search and monitoring technologies (such as ICT possibilities) might accelerate outsourcing activities. Further, one expects outsourcing to more relevant in economic environments which are more interconnected.

Other aspects addressed in the literature focus further on the role of networks and business groups, the effects of imperfect contracting, and cross-country differences in the diversity of talented workers. The first aspect was particularly addressed in the contribution by Rauch (1999, 2001) arguing that production networks are as important as comparative advantages, product variety and quality. These issues are further developed in Rauch and Casella (2002) and Rauch and Trindade (2000). This type of research however mainly focuses on the role of networks assuming the degree of vertical specialization being given. This latter issue is addressed by a number of contributions showing that the degree of vertical integration of a firm depends on the costs of corporate governance, the degree of monopolization in input markets, the verifiability of product quality, but also other variables like openness to trade. These issues are stressed in Feenstra et al. (2001) emphasizing the role of monopolistic competition and price mark-ups in both inputs and final goods markets, McLaren (2000) focusing on market externalities and Grossman and Helpman (2002) showing that the decision on outsourcing depends on the trade-off between lower produc-

tion costs (due to lower corporate governance costs and costs due to a loss in specialization) and market imperfections (like verification of quality).

However these contributions do not necessarily focus on the issue of domestic versus global outsourcing. This international geographic dispersion of productive activities is called differently in various contributions, like outsourcing (Feenstra, 1998), fragmentation (Deardorff, 2001a and 2001b), production sharing (Hummels et al., 2001), vertical specialization (Yeats, 2001), slicing up the value chain (Krugman, 1996), etc. Although these contributions have a slightly different focus they all refer to the issue that expansion of trade in intermediate inputs and the fact that more and more products have multiple nationalities. It is stressed that the internationalized production process includes almost all stages of production to a various extent like manufacturing of the product and assembly, R&D, design, accounting and services (like transport and sales activities).

The essential dimensions of the outsourcing decision is whether to outsource at all and if yes, where to outsource. This issue is particularly addressed in Grossman and Helpman (2003) modelling this as a search and matching process.

In a series of recent contributions Grossman and Rossi-Hansberg (2006, 2008) develop a model of 'trade in tasks' as the appropriate level of analysis. Falling costs of offshoring affect factor prices in a country and has productivity effects benefitting the factor whose tasks are offshored. The effects of an increased trade in tasks are similar to factor-augmenting technical change. In this model, rich countries tend to outsource routine tasks, which are rather homogenous, intensive in labour or low-skill labour (machine building, or capital goods production). We discuss this in more detail now as it becomes important in the case of this report.

Trade-in-Tasks

International trade has increasingly moved from the trade of goods – primarily manufactured in one geographic location – to the compilation of bits of value added – created in many geographies – in the provision of goods and services offered globally, i.e., to trade in tasks (Grossman and Rossi-Hansberg, 2008).[4] This process has been assisted by: increasing ease of communication, transportation and trade; drastically falling costs of collecting, storing, processing, and transferring digitally coded information; as well as major political and societal changes opening up of vast input and output markets globally. With these shifts the link between scale/scope and geographic concentration of goods/services provision has weakened. It has thus become feasible to separate tasks in time and space at a relatively fine level of aggregation.

[4] As Grossman and Rossi-Hansberg (2008) note, the distinction between *tasks and intermediate inputs* is largely semantic.

Baldwin (2006; 2009) identifies two major watersheds or 'unbundlings' in the history of modern international trade: The first unbundling relates to the dawn of the industrial revolution in the early 1800s. With major advances in production techniques, the provision of goods could be geographically separated from their consumption. This enabled labour specialization leading to huge productivity and welfare gains. This unbundling operated at the level of whole factories/industries and prevailed until about the mid-1980s. Since then, deepening specialization has taken place within industries, factories, and offices worldwide. Besides provision and consumption, individual tasks within provision could now be separated. The societal importance of this second unbundling may be likened to the first one spanning the industrial revolution. The second unbundling is the fundamental reason for the raise of trade-in-tasks.

Baldwin (2009, Section 1) states that the key difference between the two unbundlings (or paradigms) is the level of analysis. In the old paradigm openness affected broad (national) sectors and labour skill-groups, which thus constituted the appropriate level of analysis. The much finer resolution of the new paradigm calls for an analysis of each value-adding act in the provision of a specific market offering. In his concluding remarks Baldwin (2009, Section 6.2) calls for '… more detailed information on the unbundled supply chains …'. That is indeed what we provide in this paper in the case of one industrial offering, namely Nokia N95 mobile phone.

One may justly argue that the phenomenon Grossman and Rossi-Hansberg (2008) as well as Baldwin (2006, 2009) discuss is not new, even in the narrow sense. For instance, in the context of the textile industry the discussion on the 'flying Singers [sewing machines]' has lingered for at least two decades. Arguably the difference is more in the resolution, nature, and extent: Previously the scope was broader – the 'lowest common denominator' was an establishment/plant. Previously the discussion was on manual 'hands on' activities rather than all tasks. Previously the discussion was on a few well-defined sectors rather than on the economy at large.

Globalization and technology has provided the necessary preconditions as well as carrots (deepening specialization, labour cost arbitrage) and sticks (less protected local markets, stiffer global competition) for the increasing geographic dispersion of supply chains.5 Multinational companies operating in various geographies are the key actors in the process. Both through arms-length relationships with other companies as well as through within company organizational changes they make the decisions that bring the dispersion about. In this context arms-length relationships particularly refer to outsourcing, which simply means acquiring goods/services from an outside (unaffiliated) company, which may or may

[5] In our terminology a *supply chain* refers to the flows of intermediate goods/services involved in providing a good/service for final consumption.

not operate in the same (national) geography.[6] The other key term, offshoring, refers to sourcing goods/services from another (national) geography either from and unaffiliated foreign company (offshore outsourcing) or from an own (or joint venture) foreign affiliate (offshore in-house sourcing). Thus outsourcing and offshoring are overlapping and interrelated issues, but the two terms are not synonymous.

The still unfolding global financial crisis has changed the picture somewhat. While there are just reasons to believe that there might be a 'trend reversal' (Godart, Görg and Görlich, 2009) – at least temporarily – so far it seems that the long-term effects might rather point to the strengthening of the trend.

Multinational Companies – The Drivers of Change

A related issue to this is the role of multinational companies with respect to flows of intermediates. Transactions costs (Coase, 1937; Williamson, 1975, 1985) are perhaps the most frequently cited theory upon discussing firm boundaries. As for multinational companies' geographic organization, Dunning's (1993) eclectic or OLI paradigm is among the most accepted. There is nevertheless no single theory that would fully capture the trade-in-tasks phenomenon from a company perspective.

While (at least some) companies do have other motives, they are primarily in the business of earning a stream of profits via capitalizing on assets and market opportunities within their reach. Profits are an outcome. The more immediate objective is to satisfy customers' needs and desires – that should be reflected in realized ability/willingness to pay for the offering – as cost efficiently as possible. In order to do so, in principle all companies continuously evaluate all tasks in their supply chains by asking two questions: Should we make or buy? By/from whom (and where)? Besides cost advantages realized via outside suppliers higher efficiency and/or simply input cost arbitrage, outsourcing and/or dispersion may bring about economies scale, enable deeper specialization, assist in shifting own resources towards higher value-added activities, and/or bring about market expansion, all of which could contribute to higher productivity and profitability.

Tasks of the supply chain have economic and functional interdependencies not only in terms of supply/competition but also in terms of demand/consumption. Tasks need to be coordinated, some of them need to locate near the end-users or a certain (geographically-bound) factor of production, and the chosen structure has implications on risks and resilience. Various external providers and internal locations for provision have strengths/weaknesses and opportunities/threats that may or may not be altered over time. Besides business objectives, companies may assume national and/or social responsibilities that have to be factored in. Framework conditions – particularly national culture and

[6] For discussion on the outsourcing and offshoring terminology, see http://stats.oecd.org/glossary/index.htm

legislation – vary in significant ways. Due to strategic motives one may want to be near to or far from (potential future) competitors. From the main contractor's point of view it is often assumed that its proprietary knowledge is not being compromised and its longer-run ability to develop its skills and competences are not at stake. Clustering benefits and other externalities have to be accounted for. All-in-all, the optimization process is very complex and seemingly identical organizations might make very different choices.

To varying extent both outsourcing and geographic dispersion necessitate some degree of standardization, modularization, and even commoditization of the tasks involved (and perhaps the ones before/after). They have to be trivial enough to be contracted on and their outcomes have to be handed over with relative ease. Complex feedback loops or interactions between the successive tasks may call for insourcing and co-location.

While outsourcing and dispersion of in-house activities are – from a company perspective – perhaps best seen as opportunities, due to intensifying competition they may also be necessary conditions for a company's survival and ability to pay high wages and earn good returns.

While direct labour costs have been the focal point in outsourcing/offshoring discussions, for companies the real issue is to bring the right range of resources together in providing goods and services. First, one should rather consider productivity-adjusted wages. When nurturing new-to-the-world ideas and/or upon operating in winner-take-all markets (due to, e.g., applicable intellectual property rights regime), for practical purposes productivity differences may be infinite (later or second-best idea has no value). Second, at any given location one is stuck with the locally offered 'bundle': low labour cost may be associated with, e.g., pay bribes to local officials. Third, labour component is often surprisingly small in modern goods (and even services). Fourth, while price is almost invariably a factor, it is rarely the sole determinant defining the competitive landscape. Fifth, geographic dispersion brings about shipping costs, delays, and logistical hurdles that all add up, particularly when air transport is not an option. Conflictingly modern supply chains are increasingly lean and just-in-time emphasizing high speed and exacting logistics. Furthermore, customers are often directly interacting with the supply chain.

In the course of the last few decades the mindset of managers seems to have changed rather fundamentally – regardless of their nationality or the size of the company the happen to lead: arguably no major business decision gets made without at least considering outsourcing and offshoring as a part of the solution.

ICT Industries as Forerunners of Trade-in-Tasks

Due to the nature of their businesses as well as historical path dependences, not all industries are affected by outsourcing and dispersion to the same extent. Development and dif-

fusion of information and communication technology (ICT) has in part enabled outsourcing and geographic diffusion. Furthermore, ICT industries are themselves among the globally most dispersed major industries, which – especially in the case of computers – has been assisted by exceptional modularity of basic designs. With widespread use of ICT, industries have grown both more complex and more alike, which have brought about both the need and the possibility for outsourcing and dispersion. It should nevertheless be noted that the analysis in this report concerns one of the forerunner industries as far as trade-in-tasks is concerned.

The telecommunications industry is typically seen to consist of: network infrastructure equipment and its operation; end-user access (terminals, handsets, portals); as well as (digital) content, services, and their packaging. Since the early 1990s the telecommunications industry has converged with near-by industries, particularly information technology (computers and their data networks) as well as content provision of various types, particularly radio, TV, as well as recorded audio and video.

Our case study of the Nokia N95 mobile phone touches upon one aspect of the telecommunications industry; the phone's primary function is to provide a physical end-user access point to wireless voice and data networks and their services. As it was introduced at a point in time when industry/technology convergence had moved from hype to reality, it embeds dozens of non-communication functionalities.

Europe dominated the mobile communications industry in the late 1990s. As the industry emphasis moved from infrastructure/hardware/operation to software/services/content and equipment became commoditified – not to mention the aftermath of the new economy boom and related 3G/UMTS auctions in Europe – European actors were unable to keep up with the industry's global developments. In fact it now seems that Europe has lost its dominance and largely disappeared from the world scene – a (wrong) perception we wish to challenge.

3 Patterns of trade in intermediates products

In this part we provide a detailed analysis of the patterns of trade in intermediate products as compared to other product categories of EU-27 countries based on detailed trade statistics (see details below). We are first interested in the overall patterns of trade in intermediates as compared to other product categories and in cross-country differences. The chapter therefore aims to address the following questions: What is the extent of trade in intermediate products in overall trade in both exports and imports? Has the share of intermediate trade changed over time and – if yes – was this driven by within or between sectoral shifts? Are there specific country differences in the way that some countries mostly act as providers and others as users of intermediate inputs? Related to the last question the study

undertakes an effort to analyse revealed specialization patterns with respect to intermediate trade across countries. Further, what is the magnitude of two-way trade if countries act as both suppliers and users of intermediate inputs? For overall trade we find significant changes with respect to the geographic patterns of trade which might or might not be the case for all product categories. Therefore we ask, what are the geographic structures of trade in intermediates and has this changed significantly over time? Which country groups have been gained importance and to which extent changes in quality of products traded? Expansion of trade might occur via an increase in the number of products traded or an increase in the volume of each product traded. We analyse this issue in detail as well using econometric analysis. Expansion of trade also implies either more concentration or diversification in terms of products traded or the number of partner countries. To what extent this concentration or diversification has changed over time and do we find significant differences across countries and/or product groups.

As outlined above the fragmentation of production processes has been considered as an important factor in driving the general growth of trade volumes which is however questioned in some of the recent literature (depending on the definition of outsourcing; see Chen et al. (2005) and Mirodout et al (2008)). There are further important cross-country differences with respect to the patterns and overall dynamics which we will explore in detail. Not all countries succeed in participating in such networks due to differences in endowment structures, technological capabilities, geographic patterns, and so on. Trade patterns of EU-15 countries (i.e. members since at least since 1995) have also undergone significant changes extending their production networks to the new member states (NMS-12) and beyond the EU. In this respect we find intensified intra-EU integration of trade and production networks in particular on the one hand, and increased integration with other parts of the world (notably China and BRIC countries in general) on the other. Of course the extent to which particular countries source from other EU countries and beyond and the extent to which these countries export products used as inputs in production processes might vary to a great extent. In addition, one has to bear in mind that all countries serve a role both as suppliers of intermediate products to other countries and demanders of intermediates from other countries implying a considerable amount of intra-industry trade in intermediate products when looking at broader aggregates.

The process of outsourcing and the integration of production across borders can be considered – as trade in general – across various dimensions. One may consider overall developments with respect to volumes traded, considering differences across reporter countries, groups of partner countries, as well as an industry dimension and – the focus of this study – differentiating by product categories. This is done in Section 3.1 below. Trade in intermediates accounts for about 50% of trade in both imports and exports though there are some country differences which are significant. Generally, the dynamics of trade in intermediates as compared to other product categories has not been much larger implying

a rather constant share or only slightly increasing share over the period 1999-2008. We show however that the increasing share of intermediate trades was mostly caused by between industry shifts rather than an increase of trade in intermediates within industries using Structural Decomposition Analyses (SDA). With respect to geographic patterns we find considering EU-27 imports, that the EU-15 countries lost about 4.5 percentage points whereas the NMS-12 and BRIC countries gained 3.9 and 5 percentage points respectively. The advanced OECD countries lost more than 5 percentage points. A similar pattern is found when considering exports.

As mentioned above the view of particular countries serving solely as providers of intermediate inputs on the one hand and other countries as users of intermediate inputs on the other hand is somewhat blurred empirically. Reasons for this relate to the fact that the patterns of outsourcing vary by industry (whereas in particular industries final assembly might be outsourced to another country due to cost advantages it might be that in other industries it is the production of intermediate products which are sourced from abroad). Apart from the industry dimension there might exist firms within relatively narrowly defined industries relying on intermediate inputs from other countries in order to assemble products or to undertake the production of intermediates to be exported. In this study we therefore look at an overall measure of specialization patterns or revealed comparative advantage by product categories rather than trying to use country characteristics to explain actual trade flows (as done in gravity type models for example). Furthermore, we provide figures to explore the extent of intra-industry trade within product categories emphasizing the role of countries as both importers and exporters of intermediate products (see Section 3.2). The analysis reveals that there is no common pattern of specialization by end use categories as the group of countries showing a positive (negative) specialization index is composed both of advanced and less advanced economies. However, we do find a significant share of two-way trade also for intermediate products which are at similar magnitudes as compared to other product categories though with large country differences.

Changes in trade values can be explained by an increase in trade of particular products (the intensive margin) or by an increase in the variety of products traded (the extensive margin7). Related to this issue is whether the quality of products traded – in particular with respect to traded intermediates – has changed over time and whether there are specific country patterns. This issue is tackled in detail in Section 3.3 where differences across countries and changes over time are highlighted along with a discussion of whether there are distinctive differences across product categories. The intensive margin tends to be more important when considering differences across countries for various product categories with no outstanding patterns for trade in intermediates.

[7] One should be aware that the extensive margin might be defined in various ways, e.g. the number of products exported, increases in destination countries, etc.

The issue of a changing quality of imported and exported intermediates is again considered in Section 3.4. While it is not easy to quantify the importance of changing costs versus changing quality in determining changes in prices a simple analysis considering price/quality changes on the one hand and market share changes on the other hand allows one to shed light on the integration process along these dimensions (again differentiating by groups of partner countries, industries and product classifications). The most striking result is that the NMS-12 gained market shares at higher unit value ratios implying a great deal of quality upgrading. On other hand the BRIC countries show less significant increases in unit value ratios but in some cases even more pronounced market share gains. Some of the EU-15 countries turn out to significantly loose market shares (France and Great Britain). These patterns are more pronounced in higher-tech industries with less strong differences across product categories.

Finally, we study the extent to which countries are specialized in terms of products exported or imported and the number of countries to which countries export to and import from. We consider this issue mainly from the perspective of whether there are differences across product categories and how these patterns have changed over time in Section 3.5. With respect to the latter aspect there seems not to be large changes over the period considered, however.

3.1 The magnitudes and patterns of trade in intermediates

This section therefore provides detailed evidence aiming at answering these questions, starting with a discussion on the volumes of trade by product categories where we distinguish between intermediates, consumer goods, capital goods and 'mixed' products (i.e. products for which it is difficult to classify them into other product categories) and the respective changes over time. Detailed information on the data used and the classifications applied is provided in Appendix A, in particular Tables A.1 and A.2. We start first by considering import patterns before considering export patterns. The main focus is on differences across EU-27 countries, changes over time, and differences across industries.

Patterns of imports in intermediate products

In this section we discuss dimensions of trade in intermediates and other product categories corresponding to the classifications introduced above. Table 3.1.1 shows for 2008 (the latest year available) the share of imported products in total imports for each of the product categories and for each EU country and the EU-27 in.

For the EU-27 the share of imported intermediate inputs is 53.7% and thus accounts for the bulk of imports. Consumer goods are the second largest category with 22.6%, closely followed by capital goods (17.6%). This broader structure of imports is also found in most of the

countries with a few exceptions only. The share of imported intermediate inputs ranges from less than 40% in Greece (38.7%) to a maximum of more than 60% in Slovakia (62.3%). It should be noted that five Central and Eastern European countries (Slovenia, Poland, the Czech Republic, Hungary and Slovakia) show the highest shares of intermediates along with Germany (and Malta). One explanation for this would be that these countries are more specialized in manufacturing production or particular industries therein for which cross-border production networks are important which will be discussed in further detail below.

Intermediate inputs can be sourced from different countries or groups of countries around the globe where we consider six different country groups (see Appendix A). Table 3.1.2 therefore provides information on which groups of countries these intermediates are sourced from.

Table 3.1.1

Share of end-use categories in total imports, 2008

	Intermediates	Consumer goods	Capital goods	Mixed
AT	54.2	22.0	17.8	6.0
BE	55.4	24.8	12.2	7.6
BG	52.4	19.6	21.5	6.5
CY	45.7	29.2	12.9	12.2
CZ	59.5	17.7	19.7	3.1
DE	58.0	19.3	17.8	4.9
DK	48.2	27.4	19.9	4.5
EE	51.9	21.7	15.0	11.4
ES	55.2	23.6	14.3	6.9
FI	51.8	19.2	21.6	7.4
FR	52.6	25.0	16.0	6.4
GB	46.8	28.1	17.3	7.7
GR	38.7	34.5	20.2	6.7
HU	60.8	15.4	19.5	4.3
IE	44.5	25.8	24.4	5.3
IT	54.7	22.9	14.3	8.2
LT	46.7	24.7	20.2	8.4
LU	43.8	15.9	32.0	8.3
LV	46.2	27.3	18.5	8.0
MT	59.4	26.4	9.6	4.6
NL	51.1	20.3	24.7	3.9
PL	57.5	17.4	20.2	4.9
PT	50.7	26.0	16.5	6.8
RO	53.9	18.7	21.4	6.0
SE	55.1	21.7	17.9	5.2
SI	56.6	16.7	16.2	10.5
SK	62.3	17.1	15.8	4.8
EU-27	53.7	22.6	17.6	6.1

Source: EU COMEXT; wiiw calculations

Table 3.1.2

Share of imported intermediate inputs by source country groups, 2008

	EU-15	NMS-12	Adv. OECD	Asia	BRIC	RoW
AT	69.5	14.1	9.3	1.5	2.1	3.4
BE	66.8	3.6	11.1	3.1	9.3	6.1
BG	47.8	16.8	2.7	1.8	8.3	22.6
CY	52.8	7.5	4.0	2.5	8.1	25.1
CZ	66.0	18.9	5.0	2.5	5.8	1.7
DE	57.5	13.9	13.2	3.5	8.0	3.9
DK	69.4	7.9	10.0	2.4	6.9	3.4
EE	52.5	23.9	2.7	1.7	11.3	8.0
ES	62.8	4.3	7.6	3.3	11.2	10.8
FI	60.9	6.8	7.9	2.1	17.4	4.9
FR	68.9	5.1	10.6	2.5	6.7	6.2
GB	54.7	4.7	18.1	6.2	9.0	7.3
GR	57.4	8.7	5.8	3.0	11.1	14.0
HU	57.9	14.5	6.0	7.4	10.7	3.6
IE	67.3	2.2	15.7	8.0	4.6	2.1
IT	53.7	6.8	10.8	3.0	11.8	14.0
LT	45.0	29.0	2.3	2.4	13.1	8.2
LU	89.2	4.5	3.4	1.1	0.8	1.0
LV	33.6	34.5	2.8	1.1	15.5	12.5
MT	69.5	1.2	4.6	18.2	4.3	2.3
NL	53.0	2.2	16.4	7.4	13.0	7.9
PL	70.2	11.3	3.1	2.9	6.8	5.7
PT	77.5	1.6	6.5	2.2	6.4	5.8
RO	57.0	18.2	3.0	2.2	6.8	12.9
SE	66.0	8.3	14.9	2.6	5.9	2.3
SI	62.8	10.5	3.2	2.6	5.1	15.8
SK	46.0	32.3	2.2	10.5	6.4	2.6
EU-27	60.9	8.7	11.1	3.8	8.7	6.7

Source: EU COMEXT; wiiw calculations

Considering first the EU-27 as a whole one finds that the bulk of intermediate products are sourced from EU-15 countries (60.9% for the EU-27 as a whole). However, there are significant country differences as these shares range from 33.6% in Latvia to 77.5% in Portugal. With respect to the other country groups of partners, the advanced OECD countries account for 11.1%, the NMS-12 and BRIC countries account for 8.7% each, and the Asian countries account for only 3.8%. But for these other country groups as partners the variation across EU-27 countries is quite large. Some countries source intermediates from the NMS-12 to a large extent – this group mainly comprises the NMS-12 themselves together with Austria and Germany – while others receive only a very small amount of intermediates from these countries (such as Belgium with 3.2%, Ireland with 2.2% and Portugal with 1.2%). In total, in 2008 almost 70% of intermediates were sourced from within the EU-27.

The other country groups are much less important: with the advanced OECD countries (mainly the US) being the second most important provider accounting for 11.1% of intermediates, followed by the NMS-12 and the BRIC countries with 8.7% each. For these other country groups the geographic sourcing structures across the EU-27 countries are rather diversified however.

This sourcing structure of intermediates is somewhat different from those of the other product categories. This is highlighted for total EU-27 imports in Table 3.1.3. The EU-15 and NMS-12 groups account for about 70% of imports of intermediates, consumer goods and capital goods, and even more so for the mixed category (84.6%). But there are some differences for the other sourcing partners, e.g. the BRIC countries account for 13.5% and 13.0%, respectively, for consumer goods and capital goods but for only 8.7% of intermediates. On the other hand, the advanced OECD countries have relative high shares in intermediates and capital goods (11.1% and 13.7%, respectively).

Table 3.1.3

Import structures by end-use categories and partner countries for EU-27, 2008

	EU-15	NMS-12	Adv. OECD	Asia	BRIC	RoW
Intermediates	60.9	8.7	11.1	3.8	8.7	6.7
Consumer goods	59.0	8.8	7.8	3.7	13.5	7.3
Capital goods	55.1	6.8	13.7	7.7	13.0	3.7
Mixed category	73.9	10.7	8.8	2.2	1.1	3.3

Source: EU COMEXT; wiiw calculations

Thus far we have concentrated on the situation in 2008. In the policy debate however, the major concern has been on the changes with respect to the importance of trade in intermediates and the relative importance of cross-border production networks and from which countries intermediate products are sourced from (the 'outsourcing' of intermediates). Concerning the first question Table 3.1.4 presents an index of (nominal) import values for 2008 (1999=1) and the respective change in the shares (in percentage points) of the four end-use categories between 1999 and 2008, i.e. over the last ten years.

For the EU-27 as a whole the value of intermediate imports increased at the fastest rate (85%), closely followed by consumer goods imports (82%). This resulted in a 2.75% higher share of intermediates in 2008 compared to 1999. Consequently, the shares of capital goods and mixed products have fallen. Some countries experienced much stronger increases in the value of intermediate imports over this period for all product types however. This group of countries mainly consists of the NMS-12 where the index tends to be above 3, implying an increase in imports of over 300%. But – as already mentioned – for these countries the value of imports have also grown in the other product categories. Therefore it might be more informative to analyse the extent to which the structure of imports has

shifted over time as shown in Table 3.1.4. We present this graphically in Figure 3.1.1, with countries ranked from the smallest to largest change.

Table 3.1.4

Change in import values and import shares by end-use categories

	Index 1999=1				Change in import shares (in percentage points)			
	Intermediates	Consumer goods	Capital goods	Mixed category	Intermediates	Consumer goods	Capital goods	Mixed category
AT	1.90	1.67	1.60	1.59	3.81	-1.25	-1.88	-0.68
BE	1.92	2.32	1.70	1.95	-1.64	3.67	-1.93	-0.10
BG	5.04	5.18	5.26	4.31	-0.17	0.45	0.85	-1.13
CY	3.09	2.31	1.99	4.11	5.64	-5.12	-4.67	4.15
CZ	3.55	3.58	3.28	3.14	1.10	0.45	-1.22	-0.33
DE	1.92	1.42	1.59	1.20	6.79	-3.63	-1.12	-2.04
DK	1.77	1.85	1.69	1.71	-0.04	1.12	-0.92	-0.16
EE	3.16	2.97	2.68	7.48	-1.29	-2.03	-3.13	6.45
ES	2.09	2.33	1.47	1.31	3.98	3.92	-4.60	-3.29
FI	1.83	1.91	1.80	2.50	-1.31	0.36	-0.87	1.83
FR	1.59	1.65	0.99	1.59	4.23	2.90	-7.63	0.50
GB	1.27	1.58	1.19	1.17	-1.73	4.59	-1.90	-0.96
GR	1.77	2.14	1.51	1.49	-0.50	5.60	-3.75	-1.35
HU	2.35	2.51	2.75	3.56	-3.37	0.15	1.93	1.29
IE	1.09	1.84	1.16	1.12	-6.12	8.42	-1.76	-0.54
IT	1.67	1.80	1.30	1.30	2.50	2.58	-3.23	-1.85
LT	3.87	3.78	4.45	7.69	-3.10	-2.26	1.46	3.91
LU	1.98	1.46	3.00	1.96	-2.44	-6.77	9.76	-0.55
LV	3.91	3.55	3.34	5.41	1.66	-1.69	-2.40	2.42
MT	1.06	1.48	1.15	1.20	-5.77	5.71	-0.08	0.14
NL	1.98	1.78	1.90	1.33	2.57	-1.19	0.22	-1.61
PL	3.09	3.08	2.89	3.21	0.74	0.16	-1.14	0.24
PT	1.45	1.54	1.25	1.00	1.99	2.55	-1.83	-2.70
RO	4.87	5.65	6.67	35.18	-8.44	0.06	3.32	5.06
SE	1.84	1.87	1.58	1.38	2.27	1.25	-2.07	-1.45
SI	2.69	2.41	2.40	3.09	1.38	-1.49	-1.48	1.58
SK	5.02	4.64	4.41	5.23	2.04	-0.80	-1.59	0.34
EU-27	1.85	1.82	1.55	1.49	2.75	0.74	-2.38	-1.12

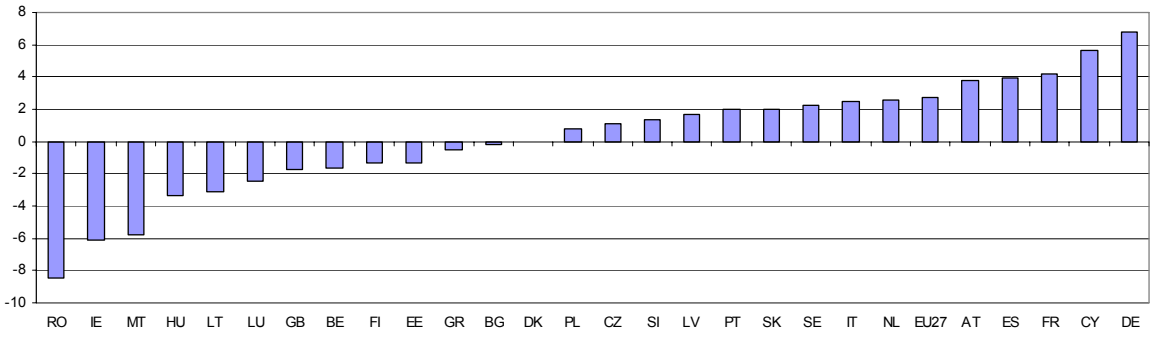
Source: EU COMEXT; wiiw calculations

One should first note that for a number of countries the share of imported intermediate inputs has even decreased. This group comprises countries from the NMS-12 (e.g. Romania, Hungary and Bulgaria) along with countries from the EU-15 such as Great Britain and Finland. There is also a group of countries however that have shown strong increases in the share of intermediate goods imports, these include Germany, Spain, Austria, Italy and Sweden to name a few from the EU-15, but also Slovakia, Slovenia, the Czech Republic

and Poland. Thus, although there has been a general tendency toward a higher share of imported intermediate goods, almost have of the countries in the EU-27 experienced a decline in the share of imported intermediates and the extent in these changes differ markedly across countries. One maybe should note here that these general tendencies are not a fact of the economic crisis which hit the world economy in 2008. A similar pattern (though at slightly different magnitudes) is found when considering changes between 1999 and 2007.

Figure 3.1.1

Change in the share of imported intermediate inputs in total imports, 1999-2008



Source: EU COMEXT; wiiw calculations

This leads us to consider whether the geographic patterns of sourcing of intermediate inputs have changed over time. Table 3.1.5 provides evidence for the period 1999-2008 again for all EU-27 countries individually and the EU-27 in total. Considering the aggregate EU, one notices that the EU-15 and the advanced OECD countries have seen large declines in market shares of total EU-27 imports (by -4.6 and -5.3 percentage points respectively). The NMS-12 and BRIC countries have gained market shares (by 3.9 and 4.9 percentage points respectively). Considering the EU-27 one thus finds a significant shift from EU-27 imports sourced from EU-15 countries towards imports from the NMS-12. Overall, the EU suffers a loss in total market shares, though the loss is rather small (-0.7 percentage points). Once again, there is a great deal of country differentiation with respect to changes in geographic patterns. A common feature is that the NMS-12 and BRIC countries have gained in all countries whereas the advanced OECD countries have lost market shares, however this has occurred to a varying degree. In only a few cases have the EU-15 gained in importance, namely for Great Britain, Ireland, Luxembourg and Malta.

It still has to be considered whether these shifts are similar for all product categories analysed or whether there is a specific pattern observed for intermediate products. Table 3.1.6 provides evidence for the EU-27 total considering the four product categories defined.

Table 3.1.5

Change in import shares of intermediates by sourcing region, 1999-2008

	EU-15	NMS-12	Adv. OECD	Asia	BRIC	RoW
AT	-3.3	2.5	-2.2	0.2	1.1	1.7
BE	-5.1	1.2	-3.2	0.1	5.1	2.0
BG	-15.8	7.5	-3.1	0.1	0.9	10.5
CY	-12.5	5.3	-5.0	-2.7	2.7	12.2
CZ	-5.2	4.6	-1.9	0.5	2.9	-0.9
DE	-1.7	3.5	-5.1	-1.2	4.0	0.5
DK	-7.3	4.6	-2.8	-0.3	4.7	1.1
EE	-17.1	17.1	-6.0	0.3	0.6	5.1
ES	-14.6	2.7	-1.2	0.6	7.5	5.1
FI	-7.0	2.8	-9.2	-0.2	10.1	3.5
FR	-3.0	3.2	-5.1	-0.6	3.7	1.8
GB	1.1	2.9	-7.4	-2.4	5.1	0.7
GR	-14.9	4.4	-0.9	0.0	6.4	5.1
HU	-12.5	7.9	-3.3	1.9	5.2	0.8
IE	8.0	1.6	-10.6	-2.9	3.3	0.5
IT	-11.0	2.7	-3.0	0.3	7.4	3.6
LT	-12.9	13.7	-4.7	0.1	2.9	0.8
LU	1.1	3.2	-4.4	-0.5	0.1	0.4
LV	-21.6	14.8	-1.8	0.4	3.1	5.2
MT	5.9	0.9	-8.7	1.5	3.3	-2.9
NL	-4.8	0.0	-5.0	-1.6	8.3	3.1
PL	-1.5	2.7	-3.8	-3.1	2.5	3.1
PT	-4.8	0.6	-1.3	0.3	4.1	1.1
RO	-12.9	9.0	-1.8	-2.7	2.7	5.7
SE	-5.1	5.2	-4.5	0.2	3.2	1.1
SI	-8.5	0.5	-3.3	1.3	2.2	7.8
SK	-17.8	9.7	-4.1	8.8	3.5	-0.2
EU-27	-4.6	3.9	-5.3	-0.8	4.9	1.9

Source: EU COMEXT; wiiw calculations

Table 3.1.6

Change in import shares by end-use category and sourcing region for EU-27, 1999-2008

	EU-15	NMS-12	Adv. OECD	Asia	BRIC	RoW
Intermediates	-4.57	3.87	-5.32	-0.81	4.94	1.89
Consumer goods	-3.06	3.18	-1.93	-2.49	5.21	-0.90
Capital goods	-5.31	4.22	-9.52	-0.23	9.64	1.20
Mixed category	-5.87	5.98	-2.16	-0.46	0.67	1.84

Source: EU COMEXT; wiiw calculations

The EU-15 countries have lost market shares in all categories, but these have been more pronounced in capital goods and the mixed category of goods (including passenger motor cars and motor spirits). Similarly, the advanced OECD countries lost market share to a large extent in capital goods (-9.52%) and intermediates (-5.32%). The BRIC countries have gained mostly in capital goods (9.64%), with the gain being similar in magnitude to the decline in OECD countries. The gains in market shares of the BRICs in consumer goods (5.21%) and intermediates (4.94%) are similar in size. Finally, the second biggest winners in terms of increasing market shares are the NMS-12, which have seen gains ranging from 5.98% in the products not classified to 3.18% in consumer goods. Thus, in this period a marked shift occurred within Europe from the EU-15 to the NMS-12 as suppliers of intermediate products; these countries however started from a relatively low basis. It is interesting to note that these gains and losses were of a similar magnitude. Simultaneously, there occurred a significant reorientation towards the BRIC countries at the expense of the advanced OECD countries. Thus one observes a reorientation of sourcing structures within the EU on the one hand but also in extra-EU import patterns.

Table 3.1.7

Shares of intermediate imports by industry for EU-27, 2008

		Intermediates	Consumer goods	Capital goods	Mixed category
15	Food and beverages	22.5	77.5	0.0	0.0
16	Tobacco	0.9	99.1	0.0	0.0
17	Textiles	50.8	49.1	0.0	0.1
18	Wearing apparel	0.8	99.2	0.0	0.0
19	Leather	12.3	87.7	0.0	0.0
20	Wood products	95.2	4.8	0.0	0.0
21	Pulp and paper	83.4	16.6	0.0	0.0
22	Publishing	26.7	73.3	0.0	0.0
23	Coke	92.5	0.0	0.8	6.7
24	Chemicals	69.8	30.2	0.0	0.0
25	Rubber and plastics	72.7	27.3	0.0	0.0
26	Other non-metallic	90.0	10.0	0.0	0.0
27	Basic metals	100.0	0.0	0.0	0.0
28	Metal products	80.3	6.5	13.2	0.0
29	Mach. and equipment	43.6	8.8	47.2	0.3
30	Office machinery	17.4	0.1	82.5	0.0
31	Electrical machinery	75.7	2.9	21.4	0.0
32	Radio and television	37.6	20.4	42.0	0.0
33	Instruments	16.1	20.5	63.4	0.0
34	Motor vehicles	37.7	0.2	14.1	48.0
35	Transport equipment	46.4	13.9	39.1	0.5
36	Furniture and n.e.c.	19.0	66.9	13.5	0.5

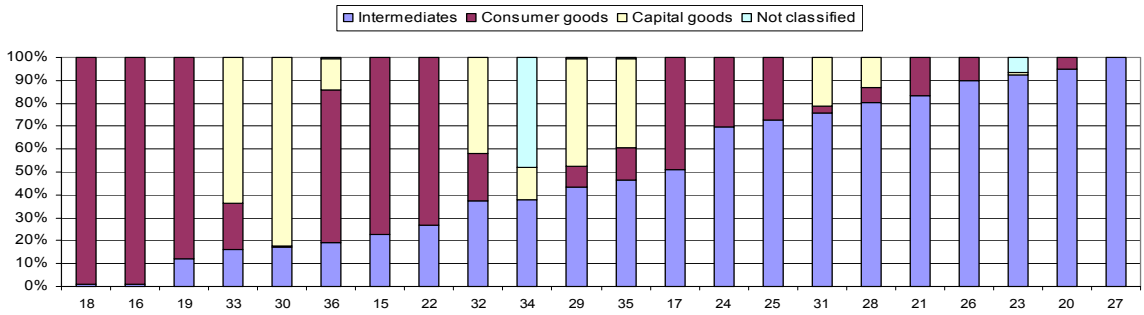
Source: EU COMEXT; wiiw calculations.

Finally let us show the extent to which there are differences when considering these patterns along the industry and product category dimension. Table 3.1.7 presents the shares of imported intermediate inputs in total imports by industry. (An important aspect here is that these industries should not be considered as 'importing industries' rather than imports of products 'typically produced by those industries'. For example, 22.5% of imports corresponding to NACE 15 (Food and beverages) are considered being intermediate products; however, these products might be used in other industries for production purposes, e.g. in the hotels and restaurants sectors. The use of imported intermediates of a particular product across industries will be considered in the second part of the study.)

Imports of intermediates according to 'producing industry' range from almost zero (Tobacco, Wearing apparel) to very high shares up to 100% in Basic metals. These patterns are relatively stable over time and very similar across countries (the correlation coefficient is in all cases above 0.8 and in most cases above 0.9). In Figure 3.1.2 we visualize these patterns. In most cases the major division is between intermediates and consumer goods imports, though there are some industries where capital goods also play a large role (Office machinery, Instruments, Radio and television, Machinery and equipment, Transport equipment). The mixed product category (including motor vehicles and motor spirits) are mostly important in the Motor vehicles and Coke industry as expected.

Figure 3.1.2

Shares of intermediate imports by industry for EU-27, 2008



Source: EU COMEXT; wiiw calculations

With respect to the industry classification across low-, medium-low-, medium-high- and high-tech industries (see Appendix Table A.3) the share of intermediate imports from medium-low-tech industries in total imports in this industry group is 90.5%, for medium-high-tech it is 54.5%. For the other two industry groups the share is much lower, with 31% for low-tech and 24.3% for high-tech industries. These figures are for total EU-27 in 2008.

Patterns of exports in intermediates

As frequently mentioned above, one also has to consider the exports of intermediates as being important part of trade for all countries. As such, we consider the patterns of intermediate exports in comparison to the other categories, i.e. considering the countries as

suppliers of intermediate products. We do this along the same lines as for imports allowing for a comparison of findings between imports and exports. We begin by presenting the share of exported intermediates in total exports for each country in Table 3.1.8. For the EU-27 the shares of the different product categories are very similar to those for imports. We again find that more than half of exports are in intermediates (53.7%), 22.6% are in consumer goods exports and 17.6% in capital goods. With few exceptions the shares are similar in magnitude for the individual countries. Germany, Spain, Lithuania, Slovakia and Slovenia again show larger shares in the mixed products category. The observed large shares of intermediate imports and exports in almost all countries warn that a clear distinction between typical outsourcing and target countries (or outward and inward processing) is not useful and such classifications have to be made with caution. Further, this points towards the existence of large intra-product group trade which will be considered in more detail below.

Table 3.1.8

Shares of end-use categories in total exports, 2008

	Intermediates	Consumer goods	Capital goods	Mixed category
AT	55.7	18.1	21.6	4.6
BE	55.8	25.6	10.6	8.0
BG	61.9	24.6	8.4	5.0
CY	34.8	48.0	11.6	5.7
CZ	55.0	15.2	21.9	7.9
DE	49.0	16.0	23.8	11.1
DK	41.8	35.7	20.9	1.6
EE	58.0	20.9	11.6	9.5
ES	50.2	24.5	11.9	13.4
FI	53.0	7.4	33.9	5.8
FR	49.1	25.6	19.0	6.2
GB	50.7	22.8	17.3	9.3
GR	54.5	35.3	9.6	0.6
HU	46.7	19.5	26.6	7.3
IE	53.0	30.9	16.0	0.1
IT	50.2	26.8	19.4	3.5
LT	52.4	22.2	12.0	13.3
LU	50.6	9.5	37.8	2.1
LV	56.6	26.5	13.6	3.3
MT	68.2	22.2	8.2	1.4
NL	52.1	20.3	24.1	3.5
PL	51.8	28.6	13.0	6.6
PT	53.3	28.4	11.5	6.8
RO	57.8	21.8	12.8	7.5
SE	58.1	15.4	19.9	6.6
SI	51.7	22.8	12.7	12.8
SK	47.7	23.9	11.1	17.4
EU-27	51.2	21.6	19.6	7.6

Source: EU COMEXT; wiiw calculations

Table 3.1.9

Shares of exported intermediate inputs by destination country groups, 2008

	EU-15	NMS-12	Adv. OECD	Asia	BRIC	RoW
AT	55.9	18.3	10.4	2.2	4.6	8.7
BE	72.6	4.2	9.0	2.2	4.1	7.9
BG	44.4	14.6	2.0	3.4	4.2	31.5
CY	72.2	0.7	1.1	2.1	3.8	20.1
CZ	63.7	21.8	4.1	0.8	4.2	5.3
DE	50.3	14.2	14.0	3.9	8.1	9.5
DK	60.8	7.2	17.2	2.7	5.2	6.9
EE	56.3	15.4	7.8	1.0	10.8	8.7
ES	62.0	4.7	7.6	2.1	4.8	18.8
FI	56.4	9.0	9.1	3.1	13.6	8.8
FR	61.6	5.9	10.8	3.8	4.9	13.1
GB	51.9	3.7	19.9	6.4	6.7	11.2
GR	36.8	26.3	8.4	0.8	2.4	25.3
HU	61.9	21.9	3.3	1.1	3.7	8.0
IE	55.8	2.0	28.6	6.1	3.6	3.9
IT	50.0	10.6	11.1	3.5	6.2	18.6
LT	45.0	26.2	5.3	0.8	13.7	9.0
LU	79.8	5.5	6.5	1.3	3.2	3.9
LV	39.8	31.8	6.9	0.8	11.2	9.5
MT	36.5	0.8	17.0	33.9	2.4	9.4
NL	71.4	4.5	9.6	3.2	3.7	7.7
PL	61.9	16.8	4.4	0.7	6.1	10.1
PT	71.1	3.5	5.1	6.6	1.7	12.0
RO	50.6	18.5	3.8	1.1	3.9	22.2
SE	58.8	6.2	17.6	3.2	5.9	8.3
SI	57.2	14.6	2.4	0.6	4.2	21.0
SK	51.4	36.6	1.6	0.5	3.8	6.0
EU-27	58.1	10.1	11.6	3.3	5.9	10.9

Source: EU COMEXT; wiiw calculations

Table 3.1.9 shows the structure of intermediate exports by destination country. Again, the bulk of intermediate exports of the EU-27 countries go to the EU-15 countries. For the EU-27 total the share is 58.1% and thus only slightly lower when compared to imports. The variation across countries ranges from 44.4% for Bulgaria to 79.8% for Luxembourg. About one tenth of EU-27 total exports is destined for the NMS-12 country group (10.1%), the advanced OECD countries (11.6%) and the Rest of World category (10.9%). The share of exports to the BRIC countries is 5.9% whereas Asian countries show a share of only 3.3%. The variation across individual countries is much larger reflecting. Considering trade in intermediates within the EU-27 there are a few EU-15 countries that have relatively large export shares of intermediates to the NMS-12; these countries are Austria (18.3%), Germany (14.2%), Greece (26.3%), and Italy (10.6%). Further, the share of exports of NMS-12 countries to other NMS-12 countries is also very large in most cases. Together with the results on import structures this shows that there is also a lot of intra-regional trade in in-

termediates among the NMS-12 taking place, showing that outsourcing is not only important between advanced and less advanced economies but also within similarly developed countries.

Table 3.1.10 compares these geographic patterns for the EU-27 countries across the four product categories. The share of exports of consumer goods to the EU-15 in total consumer goods exports by the EU-27 has a large share (62.8%) when compared with intermediates (58.1%) and capital goods (48.6%). With respect to the NMS-12, intermediate and capital goods exports to NMS-12 countries have larger shares compared to the other categories. This pattern is reversed for the advanced OECD countries. For the other country groups capital goods exports are more important, in particular for the BRIC countries and the Rest of World category.

Table 3.1.10

Export structure by end-use categories and destination country groups for EU-27, 2008

	EU-15	NMS-12	Adv. OECD	Asia	BRIC	RoW
Intermediates	58.1	10.1	11.6	3.3	5.9	10.9
Consumer goods	62.8	8.4	13.4	2.1	4.3	9.0
Capital goods	48.6	9.2	12.8	3.7	9.9	15.7
Mixed category	57.0	6.9	18.2	1.2	5.3	11.4

Source: EU COMEXT; wiiw calculations

The above discussion has described the actual structure of exports by product categories in 2008. In what follows we consider the changes in these patterns which have occurred over the last ten years in Table 3.1.11.

Similar to the import case, we also find for exports that intermediates trade for the EU-27 total was growing fastest closely followed by exports of consumer goods. Growth rates of exports are higher compared to those for imports though the difference is relatively small in cases of intermediates and consumer goods in particular. The specific patterns of individual countries across product categories are rather mixed. One should however notice that growth rates for the NMS-12 groups are often higher for product groups other than intermediates. Especially for this group of countries one has to notice that these started from a rather low base which partly explains the high growth rates. Within EU-15 countries, typical exporter countries like Germany did only slightly better than the EU-27 average (across product categories); however other larger countries like Great Britain, France, and Italy are below these average rates.

Table 3.1.11

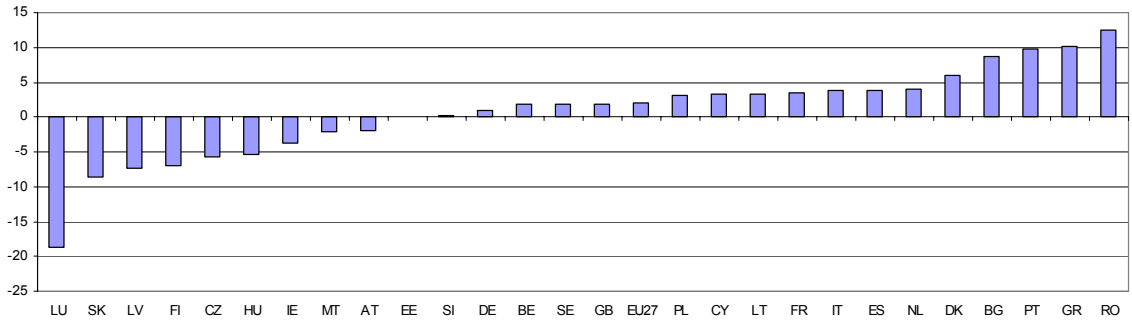
Change in export values and export shares by end-use categories

	Index 1999=1				Change in export shares (in percentage points)			
	Intermediates	Consumer goods	Capital goods	Mixed category	Intermediates	Consumer goods	Capital goods	Mixed category
AT	1.98	2.10	2.34	1.62	-1.99	0.48	2.71	-1.21
BE	2.01	2.26	1.68	1.33	1.77	3.59	-1.69	-3.67
BG	4.92	2.78	5.17	8.69	8.75	-12.87	1.53	2.58
CY	2.49	1.91	2.33	19.82	3.27	-8.68	0.35	5.06
CZ	3.60	3.80	5.91	3.67	-5.77	-0.70	7.14	-0.67
DE	1.96	2.11	1.88	1.65	0.89	1.45	-0.51	-1.83
DK	1.91	1.48	1.45	2.82	5.92	-3.85	-2.74	0.67
EE	3.70	2.57	3.63	119.95	0.10	-9.13	-0.20	9.22
ES	1.97	1.97	1.63	1.39	3.81	1.84	-1.44	-4.21
FI	1.36	1.93	1.68	2.66	-6.91	1.50	2.96	2.45
FR	1.41	1.52	1.00	1.18	3.44	3.38	-6.12	-0.69
GB	1.24	1.36	0.87	1.52	1.84	2.69	-6.52	2.00
GR	2.09	1.27	2.50	0.70	10.07	-12.32	3.06	-0.81
HU	2.65	2.54	4.09	3.65	-5.44	-3.26	7.34	1.36
IE	1.28	2.16	0.94	0.21	-3.68	11.37	-7.35	-0.34
IT	1.76	1.43	1.59	1.75	3.80	-3.68	-0.37	0.24
LT	6.66	3.69	12.36	11.46	3.31	-15.33	5.96	6.06
LU	1.62	1.32	6.77	1.96	-18.67	-6.48	25.42	-0.28
LV	3.54	3.72	10.04	6.09	-7.34	-2.00	8.20	1.14
MT	0.96	0.99	1.06	14.09	-2.11	0.17	0.59	1.34
NL	2.35	1.90	2.09	2.05	4.01	-2.89	-0.91	-0.20
PL	4.88	3.81	4.90	6.40	3.10	-5.80	0.83	1.86
PT	1.78	1.13	1.90	0.89	9.77	-8.12	2.69	-4.34
RO	5.35	2.04	7.18	13.26	12.52	-22.99	5.33	5.14
SE	1.60	1.71	1.30	1.67	1.83	1.44	-3.74	0.47
SI	2.84	2.22	3.51	3.85	0.27	-6.16	2.49	3.41
SK	4.30	6.72	5.65	5.59	-8.59	5.85	1.13	1.61
EU-27	1.87	1.84	1.64	1.69	1.99	0.46	-1.94	-0.51

Source: EU COMEXT; wiiw calculations

Figure 3.1.3

Change in the share of intermediate exports in total exports, 1999-2008



Source: EU COMEXT; wiiw calculations

This is reflected in Figure 3.1.3 showing the changes in the share of intermediate exports relative to total exports. For a number of the NMS-12 (Slovakia, Latvia, the Czech Republic, Hungary) the share of intermediate exports is declining; for other NMS-12 the shares are strongly increasing, notably so for Romania (12.52%) and Bulgaria (8.75%) where shifts are mostly from consumer to intermediate products.

Table 3.1.12

Change in export shares by destination regions, 1999-2008

	EU-15	NMS-12	Adv. OECD	Asia	BRIC	RoW
AT	-8.7	3.8	-1.5	0.2	2.8	3.4
BE	-3.1	1.6	-1.9	-0.3	2.3	1.3
BG	-10.5	8.1	-1.9	2.7	-0.1	1.8
CY	25.1	-0.6	-4.8	0.7	2.9	-23.3
CZ	-7.9	3.8	0.2	0.1	2.6	1.2
DE	-5.7	3.5	-2.8	-0.6	4.5	1.1
DK	-5.0	1.1	0.1	-0.1	3.4	0.5
EE	-15.9	2.9	2.7	-1.0	6.8	4.4
ES	-5.2	2.1	-1.0	-0.7	1.8	3.1
FI	-6.3	1.9	-4.7	-0.1	6.5	2.7
FR	-4.0	2.7	-3.4	0.0	2.3	2.5
GB	-3.6	1.3	-4.2	-0.2	4.2	2.5
GR	-6.6	10.6	0.1	-1.3	0.0	-2.8
HU	-20.5	14.1	-0.9	0.5	2.8	3.9
IE	-1.9	1.0	-1.9	0.1	2.8	0.0
IT	-8.1	3.8	-2.9	-1.0	3.0	5.2
LT	-9.6	5.7	-2.8	0.6	8.5	-2.3
LU	-3.0	2.9	-2.6	0.2	1.6	0.9
LV	-23.7	18.2	-4.5	0.2	6.4	3.3
MT	-2.6	0.4	-12.6	10.3	2.3	2.1
NL	-6.0	1.7	0.7	-0.1	1.9	1.9
PL	-9.7	5.3	-0.7	-0.7	2.9	2.9
PT	-12.2	2.2	-1.9	5.6	0.9	5.4
RO	1.6	7.5	-2.1	-1.4	1.5	-7.1
SE	-3.7	1.6	-2.1	-0.5	2.5	2.2
SI	-11.8	7.5	-1.2	0.1	2.5	2.8
SK	-1.8	-0.2	-1.3	-0.1	2.5	0.8
EU-27	-5.1	3.9	-3.4	-0.6	3.1	2.1

Source: EU COMEXT; wiiw calculations

Next we consider how the geographic pattern with respect to exports of intermediates has changed over the last ten years. Table 3.1.12 presents the relevant figures in percentage changes from 1999 to 2008. Generally, for the EU-27 as a whole export shares to EU-15, advanced OECD and Asian countries declined in all countries with the exception of Cyprus and Romania and increased to NMS-12, BRIC and the Rest of World category. These patterns can also be found for the individual EU-27 countries with few exceptions.

Table 3.1.13

Change in export shares by end-use categories and destination region for EU-27, 1999-2008

	EU-15	NMS-12	Adv. OECD	Asia	BRIC	Row
Intermediates	-5.06	3.90	-3.42	-0.62	3.09	2.11
Consumer goods	-3.86	3.82	-2.86	-0.06	2.46	0.50
Capital goods	-10.95	4.59	-3.95	0.02	6.11	4.17
Mixed category	-14.50	3.98	-1.38	0.49	4.75	6.66

Source: EU COMEXT; wiiw calculations

Considering the EU-27 change in geographic export structure across the product categories (Table 3.1.13) one finds that exports to the EU-15 declined much more for capital goods and the mixed category of products (passenger motor cars, motor spirits). The export shares increased for these product categories to the BRIC countries and the Rest of World. The changes are much more similar across product categories with respect to the NMS-12, the advanced OECD countries and Asia.

Table 3.1.14

Shares of intermediate exports by industry for EU-27, 2008

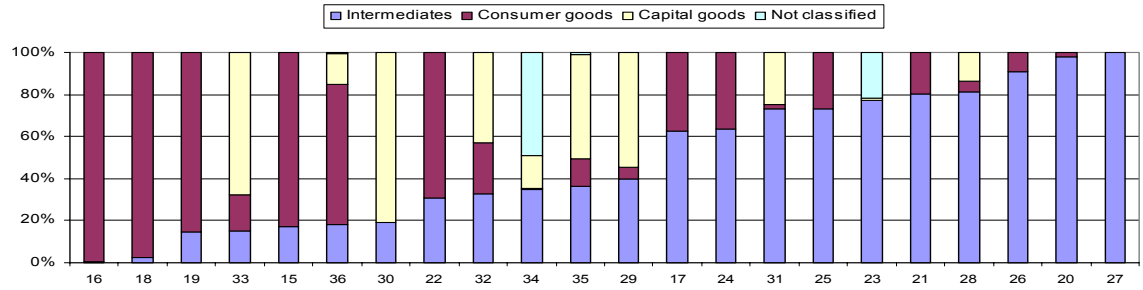
		Intermediates	Consumer goods	Capital goods	Mixed category
15	Food and beverages	17.0	83.0	0.0	0.0
16	Tobacco	0.4	99.6	0.0	0.0
17	Textiles	62.5	37.4	0.0	0.1
18	Wearing apparel	2.3	97.7	0.0	0.0
19	Leather	14.4	85.6	0.0	0.0
20	Wood products	97.9	2.1	0.0	0.0
21	Pulp and paper	80.1	19.9	0.0	0.0
22	Publishing	30.7	69.3	0.0	0.0
23	Coke	77.1	0.0	1.1	21.8
24	Chemicals	63.5	36.5	0.0	0.0
25	Rubber and plastics	73.4	26.6	0.0	0.0
26	Other non-metallic	91.1	8.9	0.0	0.0
27	Basic metals	100.0	0.0	0.0	0.0
28	Metal products	81.5	4.7	13.8	0.0
29	Mach. and equipment	39.7	5.9	54.2	0.2
30	Office machinery	19.0	0.1	80.9	0.0
31	Electrical machinery	73.3	2.1	24.6	0.0
32	Radio and television	32.6	24.4	43.0	0.0
33	Instruments	15.4	17.1	67.5	0.0
34	Motor vehicles	35.1	0.2	15.6	49.2
35	Transport equipment	36.2	13.2	49.9	0.8
36	Furniture and n.e.c.	18.4	66.5	14.6	0.5

Source: EU COMEXT; wiiw calculations.

Finally, we document that the export shares of intermediates by industry have a large range, as they did for imports. The structures are very similar to the ones found for imports and are presented in Table 3.1.14 and Figure 3.1.4 for the EU-27 total. Both the correlation coefficient and the rank correlation are large and significant.

Figure 3.1.4

Shares of intermediate exports, by industry for EU-27, 2008



Source: EU COMEXT; wiiw calculations

Considering industry aggregates, the share of intermediate exports in total exports is highest for medium-low-tech industries (87%), second highest for medium-high-tech industries (50%) and lower for low-tech (32%) and high-tech industries (22%).

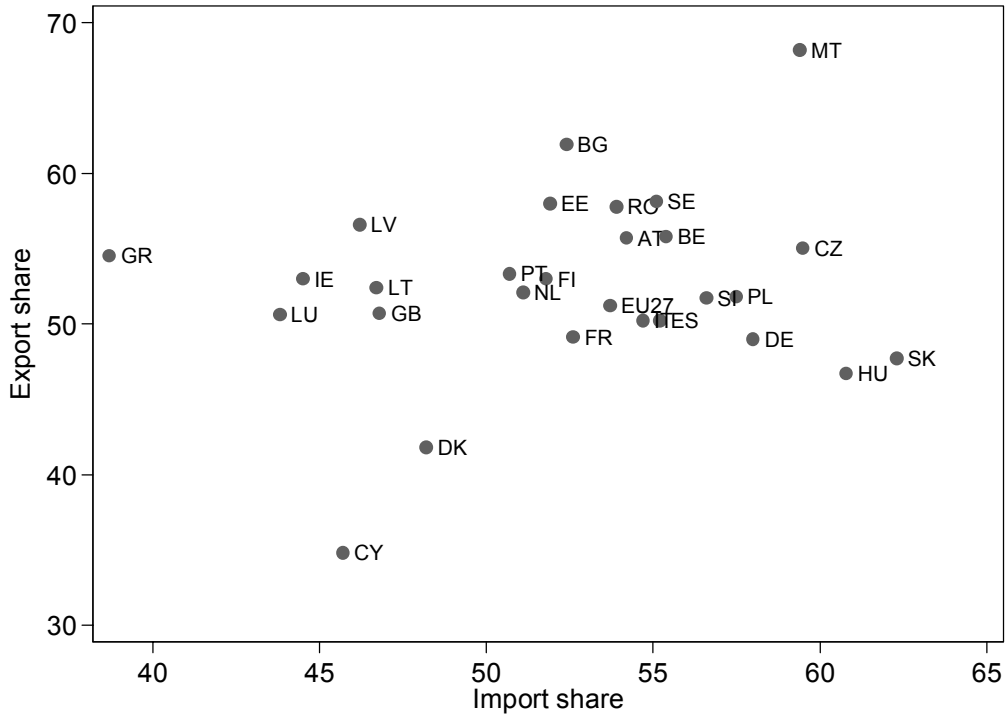
Exploration of cross-country differences

The analysis above shows strong cross-country differences with respect to import and export structures of intermediate products. This is explored in more detail in this section. Figure 3.1.5 presents a scatter plot of export and import shares in intermediates in 2008. Neglecting some outliers (Cyprus, Denmark) one can see that the share of imports varies from about 40% to almost 65%, whereas the range in the share of intermediate exports is smaller, from about 48% to about 65% (excluding Malta). This figure also points towards some kinds of specialization patterns (e.g. export and import shares as compared to EU-27 average) which will be explored in more detail in Section 3.2. There seems to be a negative relationship between export and import shares for a group of countries at least pointing towards some kind of specialization pattern with respect to producers versus users of intermediates (in particular when not considering the outlier countries and further leaving out smaller countries like Latvia, Lithuania, Ireland, Luxembourg together with Great Britain and Greece).

Considering changes over time (Figure 3.1.6) one also finds a diversified pattern, though in the bulk of countries both export and import shares of intermediates increased. For some countries however import shares increased while export shares decreased (Austria, the Czech Republic, Slovakia and Latvia). For other countries export shares decreased while import shares increased (Hungary and Finland, to mention the larger ones). Romania experienced a strong increase in export shares combined with a strong decline of import shares in intermediates.

Figure 3.1.5

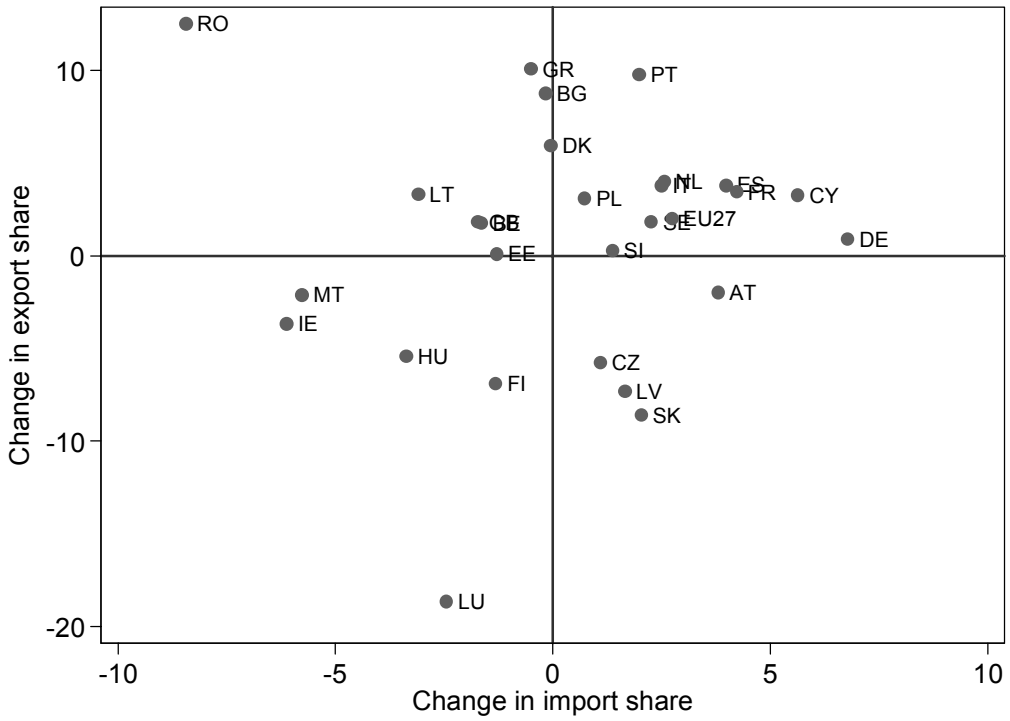
Import and export shares of intermediates, 2008



Source: EU COMEXT; wiiw calculations

Figure 3.1.6

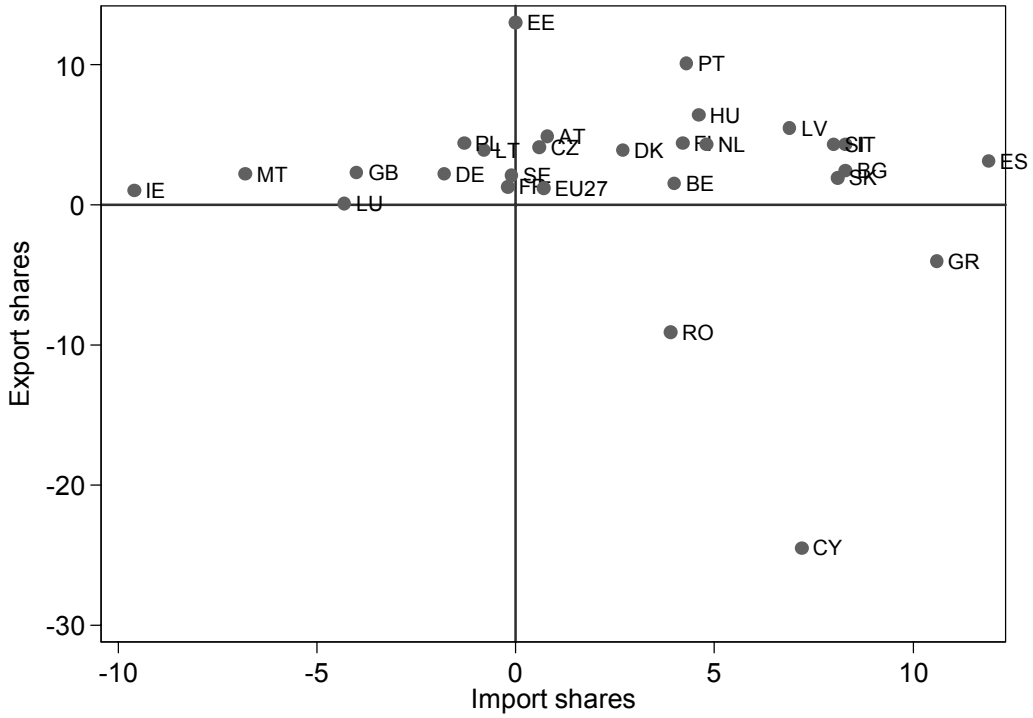
Change in import and export shares in intermediates, 1999-2008



Source: EU COMEXT; wiiw calculations

Figure 3.1.7

Change in trade shares with non EU-27 countries



Source: EU COMEXT; wiiw calculations

We now look further at the geographic patterns of sourcing of intermediate imports versus exports of intermediates and the respective changes over time. Figure 3.1.7 presents the change in the shares of exports and imports of intermediates to non EU-27 areas (i.e. advanced OECD, BRIC, Asia and Rest of World). Import shares from non EU-27 countries have increased for most countries, important exceptions being Great Britain, Ireland and Germany. Disregarding Romania, Greece and Cyprus one also sees that countries have shifted their export structures to non EU-27 countries as most countries are located above the horizontal axes.

Rising importance of trade in intermediates or structural shifts?

Above we pointed towards the fact that the structure of trade within industries (i.e. by product categories) is rather stable over time and highly correlated across countries. This could imply however that the increase in trade of intermediates is mostly driven by a shift towards sectors with higher shares of intermediates trade rather than a general increase in trade in intermediates within sectors. We test this possibility by applying a structural decomposition analysis for both exports and imports. Table 3.1.15 presents the results for imports and Table 3.1.16 for exports.

Box 1

Structural Decomposition Analysis

The structural decomposition analysis starts with the equation.

$$T_{ij} = T * sh_i * sh_{ij}$$

Trade (exports or imports) in sector i of product category j, T_{ij}, can be written as the overall trade volume (exports or imports) T, multiplied by the share of sector i, i.e. $sh_i = T_i / T$, multiplied by the share of product category j in sector i, $sh_{ij} = T_{ij} / T_i$. To track changes over time we apply a decomposition (or shift-share analysis), i.e.

$$\Delta T_{ij} = \Delta T * sh_i * sh_{ij} + T * \Delta sh_i * sh_{ij} + T * sh_i * \Delta sh_{ij} + Mixed\ terms$$

Each term in this decomposition includes a term depicting the change of a variable (i.e., the change in trade volume, change in industry share or change in the structure of trade within sectors). It is not clear a-priori however whether one should use the constant terms for the initial or last year. To circumvent this problem the structural decomposition analysis suggests to use all combinations of these and then to build the average over all combinations. The first term would therefore be decomposed as

$$DT = \frac{1}{6} \sum_{\Theta} \Delta T * sh_i^{\tau_1} * sh_{ij}^{\tau_2}$$

where $\Theta = \{(0,0),(0,1),(1,0),(1,1),(0,0),(1,1)\}$, i.e. a set of six n-tuples (τ_1, τ_2). Analogous expressions are used for the other two terms. This procedure has the additional advantage that the mixed terms cancel out. We did this exercise for both imports and exports.

The first three columns show the results for intermediate imports. For the EU-27 91% of the increase of trade in intermediates is accounted for by the general increase in imports. The shift towards sectors with generally more intermediates traded accounts for 13.6%. The component explaining whether there was a shift in imports of more intermediates in each industry is however negative (-4.5%). This result is surprising as it says that the general trend towards higher shares of intermediates trade is due only to structural shifts and not to a higher share of traded intermediates in the industries in general. This, however, is not the case for all countries: Lithuania, Poland, Slovakia and the Czech Republic from the group of the NMS-12 and Spain, France and Germany from the group of the EU-15 show a positive change of higher imported intermediates. For the other product categories we find that structural change has a negative effect for trade in consumer and capital goods (i.e. import structures shift to sectors with lower consumer and capital goods shares in production) but a positive effect on imported consumer and capital goods within sectors. Similar patterns can be found in most countries. For the other goods not classified there is a negative structural change effect but also a negative within-industry shift.

Table 3.1.15

Results of decomposition analysis for imports, 1999-2008

	Intermediates			Consumer goods			Capital goods			Not classified		
	DT	Dsi	Dsij	DT	Dsi	Dsij	DT	Dsi	Dsij	DT	Dsi	Dsij
AT	88.2	13.6	-1.8	111.4	-13.8	2.4	122.2	-26.8	4.6	124.4	-21.4	-2.9
BE	104.8	16.4	-21.2	79.7	-9.4	29.7	129.3	-42.6	13.4	102.9	-23.5	20.6
BG	100.0	6.4	-6.5	98.9	-13.0	14.1	97.2	-2.6	5.4	113.3	-4.0	-9.3
CY	87.6	19.0	-6.6	122.1	-34.3	12.2	151.7	-41.8	-10.0	66.1	26.7	7.2
CZ	98.5	-0.1	1.6	98.2	-9.2	10.9	104.8	7.7	-12.5	110.2	7.3	-17.5
DE	80.2	15.2	4.6	150.5	-43.5	-6.9	114.3	-21.2	6.9	299.4	-37.0	-162.4
DK	99.7	10.4	-10.0	93.6	-7.5	13.9	109.1	-15.7	6.6	107.3	2.4	-9.7
EE	101.7	3.3	-5.0	111.2	-17.2	6.0	122.2	-22.4	0.2	56.4	34.4	9.2
ES	89.5	9.5	1.0	78.0	9.2	12.7	176.2	-38.9	-37.3	253.4	-134.9	-18.5
FI	103.3	13.2	-16.5	97.8	-16.5	18.7	108.5	-25.6	17.2	68.4	20.2	11.4
FR	82.1	13.4	4.5	75.9	-0.1	24.2	-3965.8	2153.4	1912.4	82.7	30.9	-13.7
GB	114.1	29.9	-44.0	61.2	11.7	27.1	163.0	-142.6	79.6	173.2	-23.4	-49.8
GR	102.1	16.4	-18.5	76.4	7.0	16.6	143.2	-41.9	-1.3	148.0	-54.7	6.7
HU	106.6	2.8	-9.4	99.2	-11.5	12.3	89.3	-0.9	11.7	70.6	6.2	23.2
IE	247.2	51.3	-198.5	35.5	34.5	29.9	152.4	-195.9	143.5	186.2	84.5	-170.7
IT	90.5	13.5	-4.1	79.6	1.2	19.2	180.3	-67.0	-13.3	179.3	-46.4	-32.9
LT	105.1	-5.2	0.1	108.8	-8.6	-0.2	94.1	5.7	0.2	66.6	33.5	-0.1
LU	108.7	-2.5	-6.3	201.5	-105.1	3.6	64.8	22.9	12.2	112.7	22.6	-35.3
LV	96.4	5.5	-2.0	106.0	-11.7	5.7	111.9	-8.2	-3.7	77.1	22.2	0.7
MT	257.6	-22.4	-135.3	39.3	26.7	34.0	120.7	-145.5	124.8	82.5	32.8	-15.3
NL	91.6	18.2	-9.9	110.4	-10.2	-0.2	99.7	-25.1	25.4	229.3	-80.0	-49.3
PL	98.6	1.3	0.1	99.7	-6.3	6.6	105.1	-1.2	-3.9	97.1	12.2	-9.3
PT	89.0	23.5	-12.5	76.4	4.3	19.3	147.5	-54.1	6.6	-17314.7	17283.1	131.6
RO	111.9	-3.6	-8.3	101.4	-15.6	14.3	88.4	9.2	2.4	45.1	39.8	15.1
SE	92.1	9.3	-1.4	91.4	-10.0	18.6	125.5	-27.3	1.8	180.9	33.3	-114.2
SI	97.1	3.5	-0.6	111.6	-15.4	3.8	108.8	-9.3	0.4	85.7	15.6	-1.2
SK	96.9	2.8	0.3	103.7	-14.4	10.7	110.2	-1.7	-8.5	95.7	19.1	-14.8
EU-27	91.0	13.6	-4.5	94.5	-8.4	13.9	130.5	-36.0	5.5	143.9	-12.7	-31.3

Source: EU COMEXT; wiiw calculations

Table 3.1.16 presents the figures for exports. For intermediates exports we find a similar pattern with mostly negative within-industry shifts and a positive effect of a between industry shift. Again however, some countries show positive within-industry effects, namely Bulgaria, France, Italy, Denmark, Cyprus, Portugal and Malta. Some other countries (Latvia, Lithuania, Slovenia, Romania and Poland) show rather small negative numbers. The patterns for the other product categories are similar to imports though the magnitudes are of course different.

Table 3.1.16

Results of decomposition analysis for exports, 1999-2008

	Intermediates			Consumer goods			Capital goods			Not classified		
	DT	Dsi	Dsij	DT	Dsi	Dsij	DT	Dsi	Dsij	DT	Dsi	Dsij
AT	105.2	1.4	-6.6	96.4	-2.0	5.6	83.8	1.4	14.8	152.0	-20.6	-31.4
BE	95.3	14.9	-10.2	80.4	-8.3	27.8	130.6	-25.8	-4.8	240.5	-95.2	-45.2
BG	89.2	10.7	0.1	149.9	-50.5	0.6	86.7	22.6	-9.3	63.5	25.4	11.1
CY	87.7	-3.5	15.8	125.2	-25.8	0.6	110.6	80.6	-91.2	28.4	23.8	47.9
CZ	110.2	-5.8	-4.3	102.7	-16.9	14.2	73.8	21.9	4.3	107.4	3.9	-11.3
DE	97.1	5.0	-2.1	87.1	-0.2	13.1	103.5	-7.2	3.7	131.8	-8.6	-23.1
DK	75.8	20.8	3.4	127.5	-32.9	5.5	134.0	-14.0	-20.0	47.9	54.5	-2.4
EE	101.2	11.4	-12.6	150.0	-60.9	10.9	98.3	-1.4	3.1	28.6	32.2	39.2
ES	88.4	13.8	-2.2	88.2	1.1	10.7	124.1	-30.4	6.3	185.8	-58.0	-27.8
FI	139.5	-16.0	-23.5	66.6	-23.5	56.9	83.0	2.7	14.3	45.1	74.9	-20.0
FR	79.0	20.5	0.5	65.9	16.6	17.5	-6047.9	5196.0	951.9	162.5	16.7	-79.2
GB	82.6	53.2	-35.8	58.8	5.8	35.3	-128.3	269.0	-40.7	42.4	47.2	10.4
GR	72.2	29.6	-1.8	231.2	-133.7	2.5	57.9	24.4	17.8	-169.1	-15.5	284.6
HU	112.8	6.4	-19.2	117.9	-22.1	4.2	75.4	4.9	19.7	82.8	-4.4	21.6
IE	126.0	49.9	-75.9	40.1	23.4	36.5	-513.5	878.0	-264.5	-22.9	43.4	79.5
IT	85.8	11.3	2.8	136.8	-34.3	-2.5	104.5	-3.5	-1.0	84.8	38.3	-23.1
LT	95.2	5.7	-0.9	155.9	-55.0	-0.8	67.5	16.5	15.9	72.6	37.7	-10.4
LU	171.6	-52.7	-18.9	306.0	-194.3	-11.7	41.7	43.9	14.4	122.4	47.0	-69.4
LV	112.2	-11.0	-1.1	105.4	-8.9	3.5	59.9	42.8	-2.7	62.4	33.7	3.9
MT	31.8	14.6	53.6	204.9	-482.9	378.0	-22.6	-149.0	271.7	-0.8	35.1	65.7
NL	90.1	16.8	-6.9	121.8	-28.1	6.3	106.4	-22.3	15.9	104.1	26.4	-30.4
PL	95.4	4.7	-0.1	116.2	-24.4	8.2	95.2	13.3	-8.5	81.1	33.5	-14.6
PT	64.8	17.6	17.6	307.1	-151.9	-55.2	58.3	21.2	20.4	-322.8	27.3	395.6
RO	84.3	16.2	-0.5	226.1	-117.1	-9.1	70.4	28.1	1.5	51.5	34.7	13.7
SE	92.4	14.3	-6.8	83.3	5.0	11.7	166.5	-86.9	20.4	85.8	22.6	-8.4
SI	99.7	1.1	-0.9	133.2	-26.2	-7.0	80.5	5.3	14.2	76.1	25.8	-1.9
SK	116.8	-7.9	-8.9	77.6	2.7	19.7	93.0	10.7	-3.6	93.4	9.6	-3.0
EU-27	93.3	12.0	-5.2	96.8	-13.0	16.2	120.1	-23.5	3.5	112.4	7.4	-19.8

Source: EU COMEXT; wiiw calculations.

These results are in line with those reported in Chen et al. (2005) for a number of OECD countries and Mirodout et al. (2009) arguing that the share of imported intermediates is roughly constant.

3.2 Revealed comparative advantages and two-way trade in intermediates

From the overview above two issues arise which are important to consider in more detail. The first concerns the question of whether one can conclude something on specialization patterns with respect to trade in intermediate products, i.e. are some countries tending to specialize in intermediates versus final consumer goods for example and has this changed over time? Using RCA measures thus gives insight into the revealed patterns of comparative advantages rather than trying to explain patterns by country characteristics (as e.g. in gravity models). The second aspect is the fact that there seems to be a considerable

amount of two-way trade in intermediates, i.e. a country is importing and exporting intermediates simultaneously which conflict with some common knowledge of countries being typically outsourcing and target countries. For both of these issues it may be important to consider not only product categories but also to do this at the more detailed industry level given the results above. In this section we thus provide information on these two issues by using standard measures of revealed comparative advantage and intra-industry trade, focusing on trade in intermediates and other product categories as an additional dimension. This leads then also the case study in the next chapter which shows in much more detail where production takes place in the manufacturing of a particular product.

Box 2

Revealed comparative advantages

Let us start with providing information on specialization patterns with respect to trade in intermediates and other product categories This should give an answer to the question of which countries tend to specialize in the production of intermediates (for use in other countries) and which countries are primarily using intermediate inputs purchased abroad. In the literature various measures of revealed comparative advantages (RCA) have been proposed, early examples being Balassa (1965) and Liesner (1958). Vollrath (1991) and Greenaway and Milner (1993) provide good discussions of the measures used in the literature. In this study we will use four different measures, adapting them to the case considering both an industry and a product category dimension. The first index refers to own country trade performance only and is defined as

$$RCA1 = \frac{X_{ij}^{c} - M_{ij}^{c}}{X_{ij}^{c} + M_{ij}^{c}}$$

where X and M denotes exports and imports respectively, i is an index for industry and j an index for the product category under consideration. In some cases when we do not consider the industry dimension the index i can be skipped; if we choose not to consider the product category dimension the index j can be skipped. This index expresses the net exports of products in a particular category as a share of the total trade volume in this category. The index ranges from -1 (revealed comparative disadvantage with $X_{ij} = 0$) to +1 (revealed comparative advantage with $M_{ij} = 0$). The second index we use is the classical Balassa index comparing the exports of a country to a set of comparison countries. This index is defined as

$$RCA2 = \frac{X_{ij}^{c} / \sum_{k} X_{ij}^{k}}{\sum_{n} X_{in}^{c} / \sum_{k,n} X_{in}^{k}}$$

As written here this index would reveal comparative advantages of particular product categories within industries. Again one might consider only the industry dimension or the product category dimension. The third index, also includes information on imports and is also derived from Balassa (1965), and can be written as

$$RCA3 = \frac{X_{ij}^{c} / M_{ij}^{c}}{\sum_{n} X_{in}^{c} / \sum_{n} M_{in}^{c}}$$

Finally, Vollrath (1991) proposes – amongst others – a measure called revealed competitiveness which is defined as

$$RCA4 = \ln \frac{X_{ij}^{c} / \sum_{k} X_{ij}^{k}}{\sum_{n} X_{in}^{c} / \sum_{k,n} X_{in}^{k}} - \ln \frac{M_{ij}^{c} / \sum_{k} M_{ij}^{k}}{\sum_{n} M_{in}^{c} / \sum_{k,n} M_{in}^{k}}$$

The first term denotes the relative export advantage (and is analogous to the Balassa index $RCA2$ above) and the second term denotes the relative import advantage. In all cases one accounts for double counting by excluding the respective country in the aggregates over countries and the particular product categories in the product aggregates.8 In all cases the EU-27 total was the reference group chosen.

3.2.1 Revealed comparative advantage in intermediates trade

Results by product categories

Let us first present the results for the calculations using the product categories only (i.e. without an industry dimension) in Table 3.2.1. With respect to intermediates it is interesting to note that the set of countries having a comparative disadvantage (i.e. relying relatively more on imported intermediates) is rather heterogeneous including advanced economies like Germany, Denmark, Italy and France on the one and Eastern European countries (Slovakia, Hungary, Poland, Slovenia and the Czech Republic) on the other hand. This should however not be interpreted as a comparative disadvantage (advantage) with respect to factor endowments or productivities but rather reflect the structure of national industries. Many of those countries having a revealed comparative disadvantage in intermediates show a strong comparative advantage in the mixed category (where automobiles features quite important) – like the Eastern European countries where assembly of cars takes place -, in consumer goods (notably Spain and Slovakia) and capital goods (in particular the Czech Republic, Hungary and Germany). These countries might be seen as relatively strong importers of intermediates for the production of final goods (for consumption, capital goods and automobiles).

In Figure 3.2.1 we plot the RCA measure for intermediates in 1999 and 2008. The interpretation of the graph is as follows: Points to the right (left) of the vertical axis at 0 indicate a comparative advantage (disadvantage) in intermediates production in 1999. Similarly, points above (below) the horizontal axis at 0 indicate a comparative advantage (disadvantage) in intermediates production in 2008. Points below the 45 degree line indicate a loss in comparative advantage in intermediates production and points above a gain. Finally, points which would lie on the 45 degree line would imply no change in comparative advantages. According to the graph a number of countries which in 1999 were already specialized in intermediates gained further, notably Greece, Malta and Ireland. Bulgaria and Great Britain

8 This however would not change the results qualitatively.

Table 3.2.1

RCA measures by product categories, 2008

	Intermediates				Consumer goods			
	RCA1	RCA2	RCA3	RCA4	RCA1	RCA2	RCA3	RCA4
AT	0.019	2.469	1.063	0.062	-0.093	1.015	0.781	-0.253
BE	0.047	2.491	1.017	0.018	0.059	1.616	1.044	0.047
BG	-0.079	3.181	1.475	0.389	-0.047	1.514	1.342	0.295
CY	-0.853	1.041	0.632	-0.459	-0.708	4.266	2.238	0.805
CZ	0.017	2.398	0.832	-0.186	-0.020	0.821	0.833	-0.187
DE	0.087	1.855	0.698	-0.402	0.077	0.813	0.797	-0.287
DK	-0.117	1.402	0.773	-0.260	0.084	2.594	1.466	0.389
EE	-0.071	2.704	1.280	0.247	-0.146	1.220	0.950	-0.051
ES	-0.192	1.970	0.818	-0.207	-0.127	1.512	1.051	0.050
FI	0.121	2.203	1.048	0.048	-0.352	0.365	0.335	-1.104
FR	-0.069	1.879	0.872	-0.145	-0.024	1.624	1.030	0.031
GB	-0.105	2.006	1.166	0.162	-0.244	1.373	0.755	-0.310
GR	-0.392	2.344	1.900	0.646	-0.519	2.528	1.035	0.029
HU	-0.096	1.707	0.563	-0.579	0.153	1.117	1.330	0.288
IE	0.328	2.207	1.407	0.344	0.330	2.090	1.283	0.257
IT	0.052	1.970	0.837	-0.186	0.172	1.743	1.235	0.233
LT	0.079	2.156	1.257	0.229	-0.031	1.324	0.873	-0.136
LU	-0.021	2.003	1.317	0.276	-0.338	0.483	0.554	-0.591
LV	-0.135	2.546	1.518	0.418	-0.247	1.668	0.960	-0.042
MT	-0.182	4.193	1.468	0.384	-0.328	1.319	0.794	-0.230
NL	0.094	2.131	1.043	0.044	0.083	1.170	0.997	-0.004
PL	-0.086	2.102	0.794	-0.234	0.212	1.872	1.906	0.662
PT	-0.152	2.233	1.110	0.105	-0.133	1.841	1.128	0.121
RO	-0.172	2.683	1.171	0.158	-0.130	1.292	1.216	0.197
SE	0.103	2.721	1.129	0.124	-0.094	0.835	0.657	-0.430
SI	-0.068	2.090	0.820	-0.199	0.133	1.365	1.475	0.391
SK	-0.095	1.779	0.550	-0.601	0.204	1.455	1.523	0.425

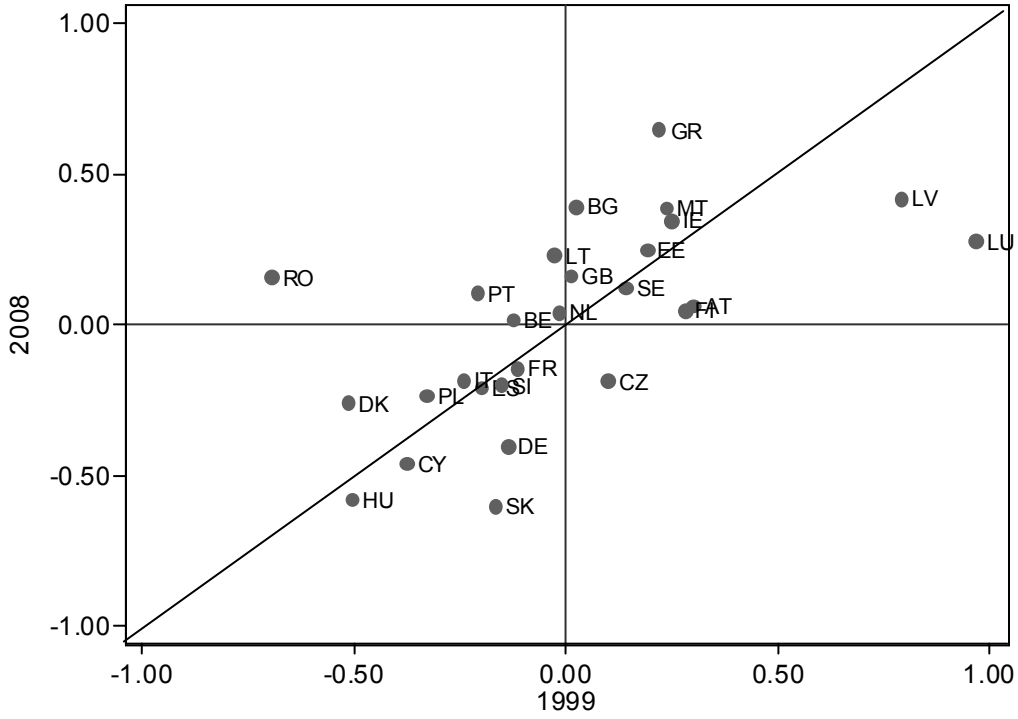
	Capital goods				Not classified			
	RCA1	RCA2	RCA3	RCA4	RCA1	RCA2	RCA3	RCA4
AT	0.102	1.410	1.273	0.247	-0.125	0.623	0.759	-0.282
BE	-0.025	0.583	0.857	-0.164	0.065	1.141	1.048	0.051
BG	-0.558	0.467	0.336	-1.094	-0.283	0.694	0.761	-0.274
CY	-0.829	0.667	0.887	-0.120	-0.907	0.794	0.434	-0.836
CZ	0.109	1.434	1.142	0.136	0.484	1.126	2.702	1.010
DE	0.306	1.717	1.443	0.460	0.521	1.940	2.416	1.121
DK	-0.022	1.350	1.064	0.063	-0.509	0.210	0.347	-1.064
EE	-0.250	0.667	0.744	-0.296	-0.213	1.380	0.818	-0.202
ES	-0.235	0.675	0.808	-0.215	0.186	2.105	2.099	0.785
FI	0.324	2.648	1.860	0.632	-0.012	0.799	0.769	-0.266
FR	0.052	1.197	1.235	0.230	-0.048	0.857	0.972	-0.030
GB	-0.145	1.054	0.997	0.000	-0.055	1.364	1.217	0.212
GR	-0.742	0.543	0.422	-0.865	-0.949	0.074	0.079	-2.536
HU	0.189	1.861	1.496	0.409	0.293	1.027	1.755	0.569
IE	0.044	0.969	0.592	-0.532	-0.962	0.008	0.011	-4.528
IT	0.243	1.228	1.447	0.393	-0.318	0.449	0.408	-0.961
LT	-0.233	0.696	0.541	-0.615	0.244	2.016	1.664	0.512
LU	-0.010	3.115	1.292	0.257	-0.654	0.281	0.236	-1.448
LV	-0.372	0.805	0.695	-0.365	-0.591	0.450	0.394	-0.933
MT	-0.322	0.453	0.838	-0.176	-0.684	0.192	0.301	-1.199
NL	0.072	1.656	0.967	-0.033	0.036	0.454	0.903	-0.115
PL	-0.249	0.756	0.591	-0.538	0.111	0.920	1.362	0.317
PT	-0.342	0.661	0.660	-0.417	-0.179	0.953	0.994	-0.006
RO	-0.433	0.748	0.541	-0.618	-0.096	1.067	1.270	0.242
SE	0.129	1.270	1.138	0.132	0.189	0.920	1.274	0.246
SI	-0.142	0.744	0.755	-0.283	0.075	1.937	1.249	0.224
SK	-0.138	0.631	0.664	-0.413	0.594	2.805	4.180	1.452

Source: EU COMEXT; wiiw calculations

also gained though from an initially low comparative advantage. Portugal and Romania started with an initial comparative disadvantage but also gained and moved into the area of a comparative advantage in 2008. A couple of countries also lost comparative advantage in intermediates production, these countries being Austria, Finland and the Czech Republic (which initially started with a comparative advantage) and Denmark, Slovakia and, to a lesser extent, Hungary.

Figure 3.2.1

Revealed competitiveness measure for intermediate products, 1999 and 2008



Results by industry and product categories

Given the findings above it might also be interesting to analyse the patterns of comparative advantage according to product categories within separate industries. For example, it may be interesting to examine whether in the car industry a country is specialized in the production of intermediates (in which case it should have a comparative advantage in intermediate production) or of the final products (in which case it should have a comparative disadvantage in intermediates but an advantage in consumer goods for example). Table 3.2.2 provides the results for RCA4 at the NACE 2-digit level for intermediates. It is however difficult to draw general and firm conclusions from this large set of results. Therefore we reduced the number of observations by grouping industries into the four groups according to technological intensity as described above shown in Table 3.2.2.

Table 3.2.2

RCA4 measures by industry and for intermediate products, 2008

	15	16	17	18	19	20	21	22	23	24	25
AT	-0.91	-8.64	0.77	1.23	1.32	1.73	1.05	1.19	-1.06	-0.33	0.21
BE	-0.41	-0.48	-0.20	1.41	-0.55	0.21	-0.20	0.68	-1.78	0.18	0.04
BG	-0.27	0.16	-1.72	-2.23	-2.74	0.02	1.50	-0.82	-1.12	0.57	-0.30
CY	-0.56		0.53	3.00	0.57	-1.31	-0.17	-0.26		-0.81	1.04
CZ	0.10	-3.51	0.40	0.19	-0.73	0.78	-0.33	0.24	0.75	-0.01	0.27
DE	-0.23	-2.73	1.13	2.05	0.71	1.43	-0.84	0.12	-1.62	-0.79	0.11
DK	-1.14	-3.01	-0.27	0.84	0.32	-0.01	0.05	-0.07	-0.87	-0.14	-0.47
EE	-0.44		-1.68	1.64	-0.81	0.80	1.33	0.39	-0.83	1.47	-0.40
ES	-0.70	2.80	0.80	2.35	0.11	0.90	-0.27	-0.06	-3.34	-0.27	0.19
FI	-0.24		1.21	2.28	0.94	3.68	1.00	0.42	-2.21	0.56	0.73
FR	-0.38	-1.60	1.19	1.58	0.07	0.73	-0.09	0.15	-1.62	-0.86	0.11
GB	-0.25	-2.19	1.31	3.57	1.82	-0.27	-0.39	-1.11	-0.95	-0.47	0.01
GR	-0.65	0.74	1.21	-1.10	1.11	0.88	0.39	-0.04	1.79	-0.38	0.22
HU	-0.95		-0.64	-0.50	-1.60	2.09	-1.62	-0.28		-0.36	0.35
IE	-0.31	2.36	1.34	5.05	2.18	1.93	0.52	-2.07	2.38	0.11	-0.50
IT	-1.20	8.03	0.47	0.13	0.14	-0.50	-1.10	1.35	-4.00	-0.73	-0.11
LT	-0.12		-0.57	-0.28	0.49	-0.14	0.62	-1.34	-3.99	1.50	0.43
LU	0.00		2.39	0.78	-2.04	1.82	3.34	0.93	3.95	-1.09	0.67
LV	0.12		-0.03	-1.36	1.62	1.59	1.35	-0.05	0.26	0.11	-0.26
MT	0.32		2.67	0.05		1.22	-0.12	3.20	-0.45	-1.83	-0.80
NL	-0.32	-1.77	0.21	1.37	0.30	-0.43	-0.77	0.07	-1.15	0.37	0.10
PL	-1.40	-2.83	-1.30	-0.23	-0.57	0.12	-1.50	0.29	0.41	-0.29	-0.34
PT	-0.78	-2.41	-1.16	0.67	-2.75	1.66	1.46	0.20	-3.27	0.59	0.30
RO	0.36	-3.69	-1.86	-2.48	-3.00	-0.45	0.20	-0.16	-3.09	1.24	0.54
SE	-0.20	-5.10	0.80	0.93	2.22	1.91	0.95	-0.31	-0.46	-0.78	-0.52
SI	0.23		-0.19	0.37	-0.49	0.08	0.11	0.39	0.97	-1.18	0.11
SK	0.46		-0.79	-0.55	-1.18	0.93	-0.58	0.53	-0.47	0.82	0.12

	26	27	28	29	30	31	32	33	34	35	36
AT	0.22	-0.18	0.02	-0.39	0.20	-0.49	0.65	-0.05	0.35	0.56	-0.10
BE	0.41		0.12	-0.05	0.65	-0.21	0.12	-0.20	-0.56	0.92	0.08
BG	-1.50		-0.41	0.94	1.27	0.70	0.40	-0.19	2.36	-0.72	-0.25
CY	-0.43		0.31	0.02	0.51	-0.38	3.44	-1.39	-0.11	0.96	0.53
CZ	-0.78		-0.33	0.06	-1.06	-0.18	-1.25	-0.24	-0.40	0.29	0.63
DE	0.32		0.02	-0.61	0.17	-0.18	0.38	0.03	-0.97	-0.66	-0.31
DK	0.37		0.47	0.01	0.51	-1.06	0.43	-0.38	1.17	-0.19	-0.52
EE	1.54	-2.22	0.70	0.79	2.14	-0.64	0.20	0.38	0.74	-0.55	-0.67
ES	0.93	-0.09	0.10	0.10	1.03	0.18	-1.38	-0.06	-0.80	0.48	-0.29
FI	0.98		0.02	-0.31	-0.34	-1.28	-1.99	-0.45	-0.17	-1.93	-0.63
FR	-0.81		-0.09	0.07	0.67	0.21	1.10	0.30	0.46	-2.23	0.23
GB	0.30		0.34	-0.11	0.28	-0.61	1.07	0.12	-0.23	0.01	0.32
GR	1.76		1.03	0.03	1.17	0.75	0.18	0.18	1.31	1.33	-0.08
HU	0.23		0.12	-0.05	-1.81	0.20	-2.22	-0.39	-0.01	0.81	0.93
IE	-0.86		0.52	0.31	-0.62	0.99	0.01	-0.90	1.74	1.89	0.99
IT	1.19		0.02	-0.36	1.69	0.12	0.68	0.48	1.35	-0.19	-1.33
LT	0.27		0.45	0.28	-0.11	-0.01	0.17	-0.17	0.12	-1.49	-1.02
LU	2.38		0.99	0.25	-0.67	0.01	0.66	-0.33	0.96	0.87	0.64
LV	1.04		0.44	-0.01	0.35	0.02	-0.23	0.42	0.64	0.73	0.02
MT	1.85		1.79	0.42	-0.70	-1.25	2.42	-2.06	-0.98	1.36	-0.07
NL	-0.33	0.27	0.14	-0.23	0.22	0.22	-0.04	-0.68	-0.17	0.11	0.07
PL	-0.60		-0.43	0.22	-0.16	0.24	-1.00	0.06	0.18	-0.07	-0.26
PT	-0.51		0.08	-0.05	-0.59	-0.33	2.72	1.07	0.41	0.06	1.19
RO	-1.60		0.24	0.96	0.38	0.47	0.05	0.49	1.75	-1.95	0.26
SE	0.22		-0.06	-0.09	0.79	-0.10	-0.42	-0.52	-0.34	0.93	-0.50
SI	-0.80	-0.73	0.38	0.27	0.05	-0.25	0.94	-0.52	-0.55	1.03	0.01
SK	-0.70		-0.33	0.57	-0.79	-0.67	-3.35	0.12	-1.51	-1.73	-0.80

Source: EU COMEXT; wiiw calculations

Table 3.2.3

RCA4 measures by industry group and product categories, 2008

	Intermediates				Consumption			
	Low	Medium-Low	Medium-High	High	Low	Medium-Low	Medium-High	High
AT	0.67	-0.01	-0.16	0.38	-0.68	-0.15	-0.11	-0.53
BE	-0.18	-0.26	0.06	0.14	0.20	-0.08	-0.02	0.11
BG	-1.05	-0.58	1.05	0.33	1.07	-0.70	0.07	0.09
CY	-0.54	1.72	-0.11	0.84	0.26	-0.70	1.28	0.92
CZ	0.32	-0.12	-0.19	-0.96	-0.36	0.04	-0.68	0.94
DE	0.22	-0.39	-0.80	-0.05	-0.23	0.22	0.04	-0.66
DK	-0.82	-0.31	0.06	-0.02	0.78	0.26	-0.08	0.34
EE	0.45	-0.17	0.48	1.07	-0.43	-0.13	-1.22	-0.45
ES	-0.01	-0.61	-0.36	-0.70	0.01	-0.06	-0.08	1.41
FI	2.19	-0.68	-0.35	-0.96	-2.14	-0.87	-0.78	-1.48
FR	-0.01	-0.45	-0.34	0.57	0.06	0.05	0.34	-0.30
GB	0.06	-0.14	-0.19	0.45	-0.08	-0.59	0.35	-0.26
GR	-0.22	1.02	0.38	0.65	0.27	-0.99	0.45	-0.72
HU	-0.58	0.27	-0.03	-1.90	0.60	-0.05	0.06	1.34
IE	-0.30	0.14	0.96	-0.79	0.34	0.52	0.58	1.01
IT	-0.42	-1.06	-0.19	0.63	0.34	0.37	0.19	0.09
LT	-0.33	-1.11	0.67	-0.14	0.27	-1.42	-0.63	-0.02
LU	1.31	1.18	0.28	0.08	-1.20	-0.21	0.32	-0.72
LV	0.98	0.88	0.25	0.12	-0.89	-0.23	-0.17	0.44
MT	1.10	-1.39	-0.95	2.23	-1.06	2.27	1.37	-3.03
NL	-0.24	-0.61	0.18	-0.05	0.26	-0.42	-0.23	-0.06
PL	-0.86	-0.40	-0.02	-0.43	0.83	0.56	0.02	2.23
PT	-0.06	-0.82	0.10	2.32	0.06	0.44	-0.62	-1.83
RO	-1.03	-0.62	0.89	0.27	1.08	-0.77	-1.02	-1.52
SE	1.55	-0.24	-0.33	0.18	-1.52	-0.09	0.16	-0.55
SI	0.33	0.20	-0.31	0.10	-0.38	0.51	0.92	0.11
SK	-0.05	-0.14	-0.69	-2.51	0.04	-0.46	-0.71	2.85

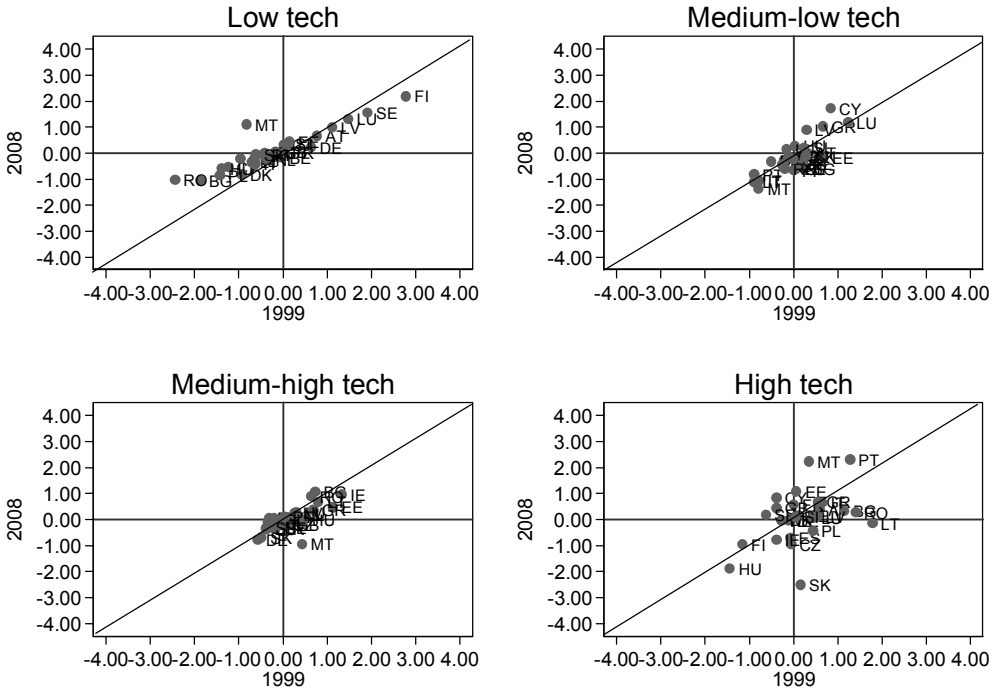
	Capital				Not classified			
	Low	Medium-Low	Medium-High	High	Low	Medium-Low	Medium-High	High
AT	0.29	0.54	0.41	-0.11	0.18	-0.27	-0.36	
BE	-0.54	0.11	-0.05	-0.16	0.33	1.30	-0.04	
BG	-0.54	-0.39	-0.67	-0.28	-1.45	1.65	-3.02	
CY	-0.06	-0.64	-0.64	-1.64	5.98		-1.05	
CZ	0.37	0.76	-0.02	0.35	1.63	-1.06	1.11	
DE	0.46	0.77	0.57	0.25	-1.67	0.99	0.92	
DK	-0.06	-0.17	0.34	-0.21	-0.21	0.71	-1.77	
EE	-0.34	0.00	0.01	-0.96	0.53	0.24	-0.34	
ES	-0.01	0.52	0.05	-0.43	0.68	2.41	0.61	
FI	-1.04	-0.52	1.04	1.18	1.45	2.90	-0.68	
FR	-0.78	-0.34	0.51	-0.24	1.53	2.67	-0.45	
GB	0.26	-0.40	0.20	-0.18	2.74	1.11	-0.22	
GR	-1.01	-1.05	-0.27	-0.05	-2.11	-0.85	-2.92	
HU	-0.50	0.00	-0.58	1.07	-0.41		0.77	
IE	-0.80	0.15	-2.21	0.07	-3.16	-2.82	-5.15	
IT	0.87	0.93	0.92	-0.54	-0.60	4.18	-1.64	
LT	0.71	-1.50	-0.29	0.13	-2.02	5.48	-0.41	
LU	-1.46	-1.25	0.08	0.24	0.01	-8.10	-0.83	
LV	-0.56	0.01	0.01	-0.41	-4.30	-2.06	-0.35	
MT	-2.53	-0.57	-0.01	-1.85	4.72	-2.20	-0.35	
NL	-0.41	-0.30	0.31	0.06	0.47	1.57	-1.38	
PL	0.03	0.31	-0.26	-1.13	1.57	-0.64	0.47	
PT	-0.13	0.37	0.15	-1.77	-0.68	2.63	0.08	
RO	-1.21	-1.08	-0.50	0.14	1.29	3.69	-0.48	
SE	0.12	0.45	0.25	0.08	-0.38	0.44	0.21	
SI	0.74	0.34	-0.54	-0.13	-2.67	-2.25	0.24	
SK	0.00	0.21	-0.42	-0.58	2.70	0.98	1.71	

Source: EU COMEXT; wiiw calculations

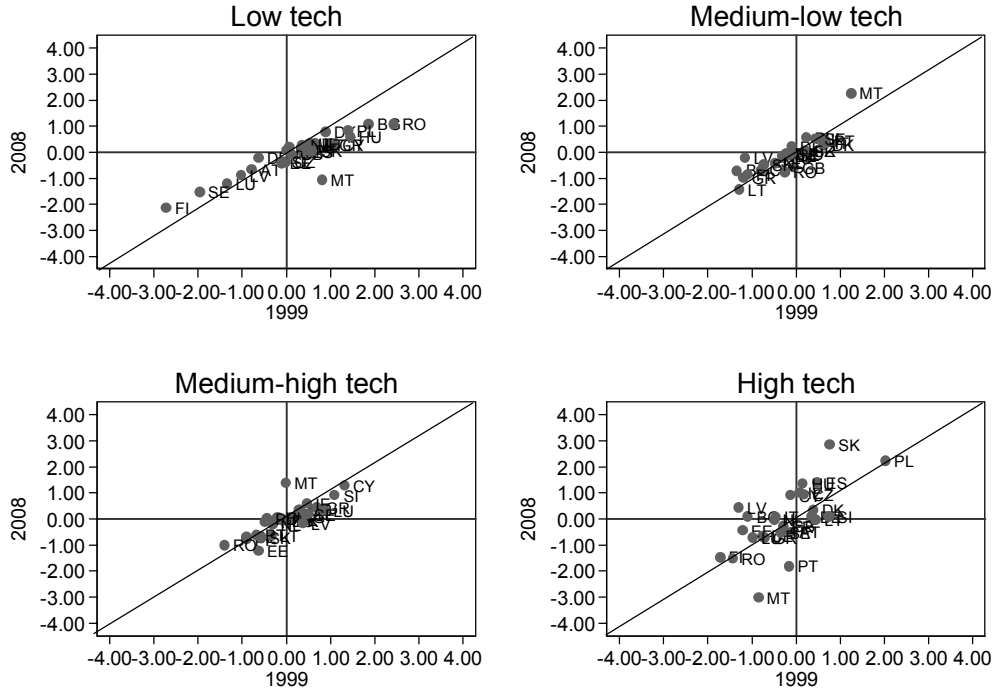
Figure 3.2.2

Revealed competitiveness measure by selected product categories, 1999 and 2008

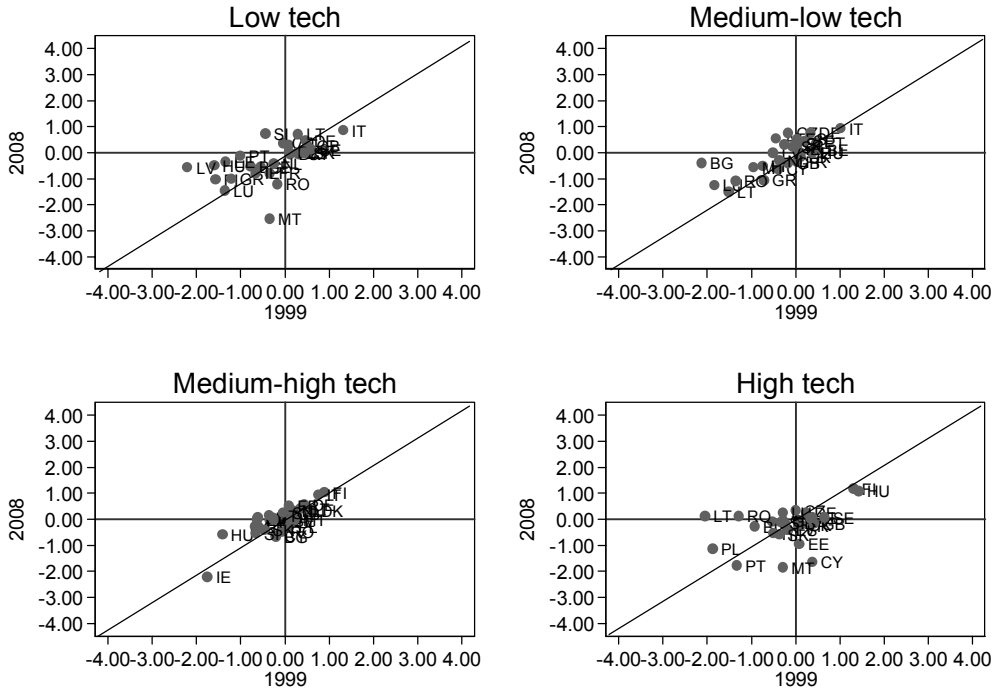
Intermediates



Consumer goods



Capital goods



Source: EU COMEXT; wiiw calculations

For intermediate products we graph the levels of RCA4 for intermediate products in the four industry categories. There are some differences across industries. In the low-tech industries the cloud moved clockwise indicating that those countries having had comparative advantages in 1999 gradually lost them in relative terms whereas those countries having had a comparative disadvantage gained in relative terms. However the overall structure of revealed advantages remains rather stable. There are less significant moves to be observed in the medium-low- and medium-high-tech industries. It is however interesting to note that the range of the RCA measures is smaller compared to the low-tech products.

3.2.2 Two-way trade in intermediate products

The analysis above on revealed comparative advantages might hide the fact that though countries having a revealed comparative advantage or disadvantage in terms of product categories there is still a lot of two-way trade observed across countries, i.e. countries being both exporters and importers of intermediates and the other product categories. In this section we take a closer look at this and provide some summary statistics for this phenomenon.

Box 3

Measurement of two-way trade

To measure two way trade the common method is the Grubel-Lloyd index (see Grubel and Lloyd, 1975). In this study we however use a generalized version of this index which is advantageous in some respects (see the discussion in Greenaway et al., 1994). These more general versions are calculated as

$$GLI^{cr}_{(j,k),t} = \frac{2(\min\{X^{cr}_{(j,k),t}, M^{cr}_{(j,k),t}\})}{\sum_{(j,k)} X^{cr}_{(j,k),t} + \sum_{(j,k)} M^{cr}_{(j,k),t}}$$

$$CGLI^{cr}_{(j,k),t} = \frac{2(\min\{X^{cr}_{(j,k),t}, M^{cr}_{(j,k),t}\})}{\sum_{(j,k)} X^{cr}_{(j,k),t} + \sum_{(j,k)} M^{cr}_{(j,k),t} - abs\left(\sum_{(j,k)} X^{cr}_{(j,k),t} - \sum_{(j,k)} M^{cr}_{(j,k),t}\right)}$$

In this study we report the second index, CGLI, for product categories and country groups based on the CN 8-digit level.[9] One should however be aware that how to deal with missing values remains an open issue and can affect the results obtained. A further issue concerns the treating of missing and zero values. Whenever an export (import) value is reported but no corresponding import (export) value we set this to zero though we cannot be sure whether the value is missing (and consequently should be positive or zero). The alternative to skip those observations would result in higher two-way trade indices but the same conclusions would hold.

Two-way trade by product categories

Table 3.2.4 shows the results for the importance of two-way trade differentiating between the four product categories. The products which are not classified according to end-use categories tend to report the largest values of the index though there are some country differences. These figures may not be reliable due to the relatively low number of products included in this category. For the other categories the index tends to be higher for consumer and capital goods compared to intermediate products. Taking country averages the index in 2008 is 0.35 for intermediates, 0.40 for consumer goods and 0.39 for capital goods. The average for those products not classified is 0.57.

However there is no clear pattern across countries as can be seen from Figure 3.2.3. Further, countries having a high value of the index in one category also tend to have higher values for other product categories. This may be due to country-specific factors such as country size and income per capita being the most important determinants of intra-industry trade. However, these correlations are weaker in 2008 compared to 1999. Whereas in 1999 the correlation across all products was between 0.65 and 0.7, it declined in 2008 to somewhat lower levels.

[9] The other index would yield in qualitatively similar results.

Table 3.2.4

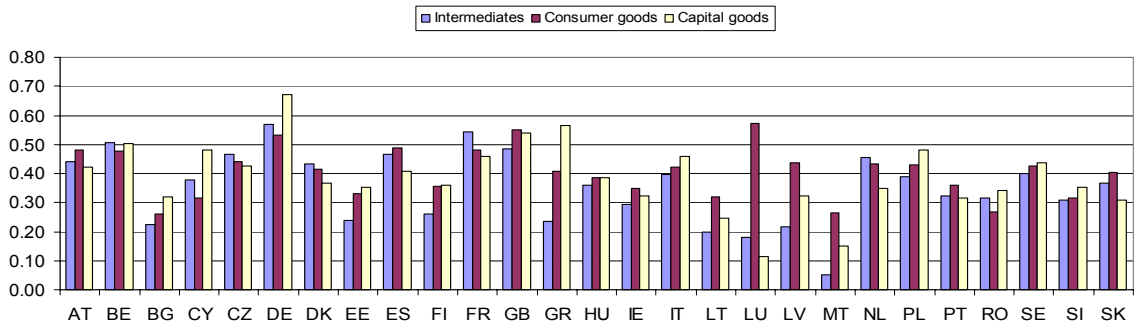
Two-way trade by product categories (CGLI), 1999 and 2008

	Intermediates		Consumer goods		Capital goods		Mixed	
	1999	2008	1999	2008	1999	2008	1999	2008
AT	0.41	0.44	0.51	0.48	0.46	0.42	0.38	0.63
BE	0.50	0.51	0.54	0.48	0.53	0.50	0.90	0.74
BG	0.13	0.22	0.25	0.26	0.20	0.32	0.06	0.11
CY	0.31	0.38	0.32	0.32	0.41	0.48	0.25	0.85
CZ	0.40	0.47	0.35	0.44	0.45	0.43	0.63	0.65
DE	0.57	0.57	0.52	0.53	0.63	0.67	0.77	0.86
DK	0.47	0.43	0.39	0.42	0.37	0.37	0.68	0.57
EE	0.25	0.24	0.23	0.33	0.29	0.35	0.48	0.27
ES	0.50	0.47	0.39	0.49	0.47	0.41	0.81	0.76
FI	0.27	0.26	0.42	0.35	0.36	0.36	0.47	0.14
FR	0.56	0.54	0.46	0.48	0.67	0.46	0.88	0.59
GB	0.51	0.48	0.48	0.55	0.53	0.54	0.70	0.53
GR	0.23	0.24	0.24	0.41	0.46	0.57	0.28	0.57
HU	0.35	0.36	0.28	0.39	0.19	0.38	0.51	0.67
IE	0.41	0.29	0.35	0.35	0.29	0.32	0.75	0.92
IT	0.39	0.40	0.40	0.42	0.47	0.46	0.87	0.47
LT	0.17	0.20	0.14	0.32	0.33	0.25	0.06	0.05
LU	0.28	0.18	0.50	0.57	0.39	0.11	0.74	0.75
LV	0.10	0.22	0.24	0.44	0.34	0.32	0.35	0.80
MT	0.09	0.05	0.09	0.26	0.26	0.15	0.60	0.83
NL	0.43	0.46	0.38	0.43	0.45	0.35	0.77	0.37
PL	0.37	0.39	0.23	0.43	0.35	0.48	0.46	0.64
PT	0.33	0.32	0.25	0.36	0.42	0.32	0.54	0.42
RO	0.15	0.32	0.16	0.27	0.22	0.34	0.12	0.27
SE	0.44	0.40	0.39	0.43	0.39	0.44	0.60	0.62
SI	0.28	0.31	0.37	0.32	0.32	0.35	0.35	0.38
SK	0.24	0.37	0.26	0.40	0.27	0.31	0.33	0.94

Source: EU COMEXT; wiiw calculations

Figure 3.2.3

Two-way trade by product categories, 2008



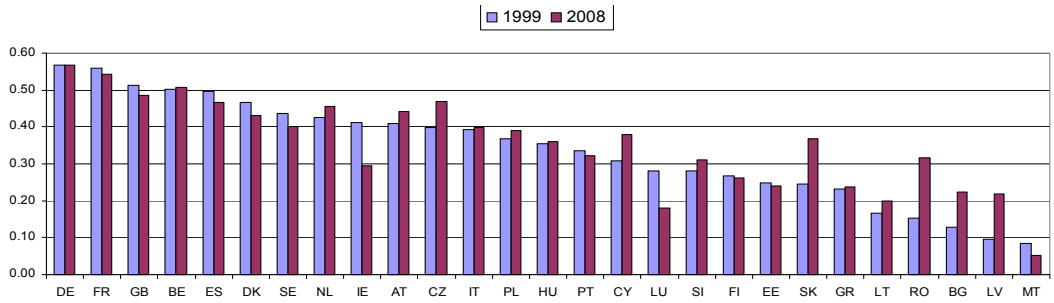
Note: Figures based on CGLI measure.

Source: EU COMEXT; wiiw calculations

A more striking fact is the large variation across countries. This is shown graphically in Figure 3.2.4 for intermediate goods trade.

Figure 3.2.4

Two-way trade in intermediates, 1999 and 2008



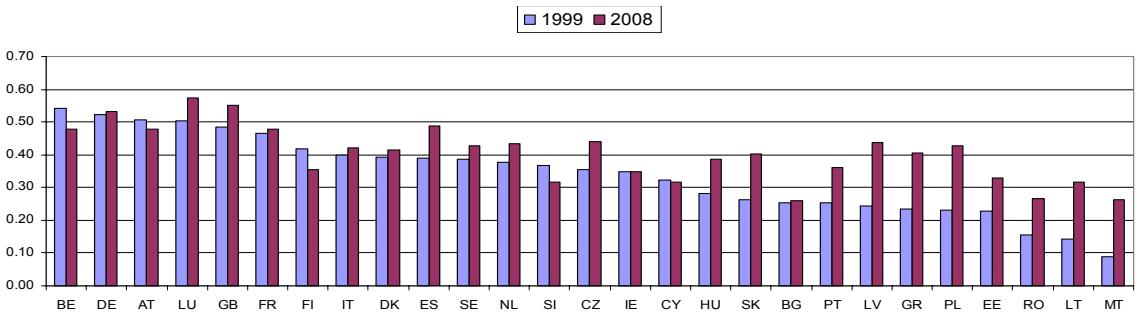
Note: Figures based on CGLI measure.

Source: EU COMEXT; wiiw calculations

The share of two-way trade in intermediates ranges from more than 50% in Germany and France to less than 10% in Malta. As expected, larger and more developed countries in terms of per capita income tend to have a higher index. Interestingly, the index was decreasing for a number of countries between 1999 and 2008; these countries being France, Great Britain, Spain, Denmark, Sweden, Ireland, Portugal, Luxembourg and Estonia. But there are also a number of countries that show an increase, in particular those countries having started with a lower index in 1999. Particularly strong increases are found for Latvia, Bulgaria, Romania, Slovakia and, to a lesser extent, for the Czech Republic.

Figure 3.2.5

Two-way trade in consumer goods, 1999 and 2008



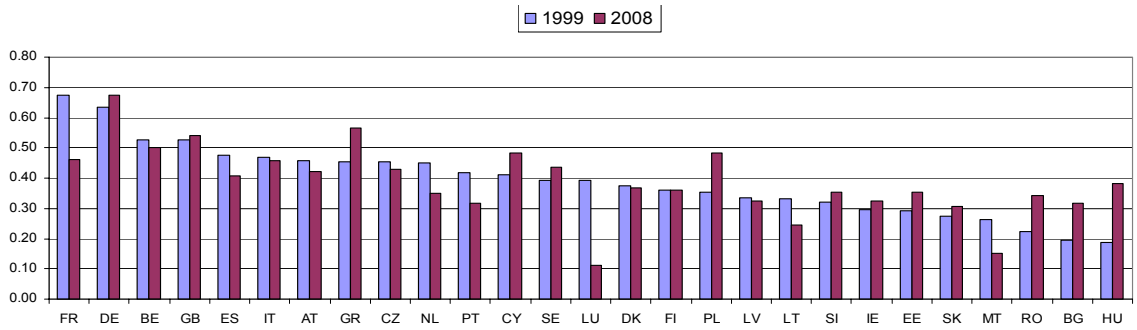
Note: Figures based on CGLI measure.

Source: EU COMEXT; wiiw calculations

These findings can be contrasted with the developments of two-way trade in consumer goods which are graphically presented in Figure 3.2.5. In this case the index was increasing more strongly for those countries having started with lower values such as the Baltic States, Romania, Bulgaria, Poland, Greece, Hungary, the Czech Republic and Slovakia. For capital goods a similar tendency can be observed though it is less pronounced (see Figure 3.2.6).

Figure 3.2.6

Two-way trade in capital goods, 1999 and 2008



Note: Figures based on CGLI measure.

Source: EU COMEXT; wiiw calculations

Table 3.2.5

Two-way trade of intermediates by region, 1999 and 2008

	EU-15		NMS-12		Advanced OECD		Asian countries		BRIC countries		RoW	
	1999	2008	1999	2008	1999	2008	1999	2008	1999	2008	1999	2008
AT	0.48	0.53	0.42	0.54	0.35	0.30	0.20	0.32	0.21	0.29	0.37	0.44
BE	0.59	0.62	0.20	0.32	0.39	0.39	0.32	0.31	0.18	0.31	0.38	0.30
BG	0.13	0.26	0.19	0.25	0.09	0.16	0.03	0.19	0.05	0.27	0.28	0.20
CY	0.34	0.48	0.12	0.08	0.10	0.35	0.17	0.03	0.18	0.07	0.32	0.13
CZ	0.45	0.52	0.38	0.52	0.26	0.30	0.07	0.25	0.10	0.21	0.27	0.38
DE	0.64	0.62	0.48	0.56	0.54	0.56	0.29	0.42	0.26	0.33	0.42	0.46
DK	0.58	0.55	0.23	0.39	0.38	0.36	0.18	0.23	0.14	0.24	0.14	0.17
EE	0.28	0.26	0.33	0.40	0.13	0.20	0.04	0.05	0.13	0.15	0.07	0.12
ES	0.65	0.61	0.26	0.38	0.28	0.29	0.14	0.18	0.17	0.34	0.23	0.18
FI	0.29	0.29	0.46	0.33	0.22	0.22	0.20	0.22	0.17	0.19	0.12	0.13
FR	0.67	0.68	0.45	0.44	0.57	0.51	0.30	0.34	0.18	0.31	0.36	0.31
GB	0.60	0.57	0.23	0.37	0.53	0.53	0.31	0.30	0.30	0.35	0.25	0.28
GR	0.33	0.30	0.19	0.22	0.11	0.09	0.08	0.16	0.09	0.25	0.22	0.27
HU	0.38	0.39	0.27	0.45	0.25	0.37	0.38	0.37	0.16	0.24	0.15	0.31
IE	0.38	0.27	0.21	0.45	0.50	0.41	0.44	0.33	0.23	0.14	0.30	0.17
IT	0.49	0.48	0.34	0.52	0.35	0.38	0.27	0.25	0.20	0.39	0.17	0.22
LT	0.14	0.13	0.26	0.31	0.10	0.26	0.04	0.03	0.26	0.19	0.13	0.18
LU	0.30	0.21	0.11	0.10	0.14	0.21	0.20	0.02	0.04	0.10	0.39	0.09
LV	0.06	0.16	0.34	0.37	0.04	0.21	0.02	0.05	0.12	0.15	0.09	0.14
MT	0.11	0.11	0.02	0.05	0.04	0.05	0.01	0.01	0.10	0.04	0.48	0.09
NL	0.61	0.67	0.27	0.50	0.54	0.41	0.21	0.34	0.26	0.36	0.19	0.18
PL	0.41	0.46	0.34	0.44	0.30	0.29	0.08	0.27	0.16	0.28	0.24	0.24
PT	0.37	0.41	0.11	0.26	0.16	0.18	0.14	0.04	0.19	0.18	0.11	0.15
RO	0.23	0.39	0.10	0.31	0.10	0.14	0.05	0.14	0.02	0.14	0.16	0.26
SE	0.45	0.44	0.39	0.29	0.48	0.40	0.26	0.21	0.20	0.26	0.30	0.31
SI	0.34	0.38	0.17	0.28	0.15	0.13	0.13	0.09	0.05	0.14	0.25	0.28
SK	0.30	0.38	0.31	0.42	0.12	0.24	0.03	0.34	0.08	0.12	0.22	0.24

Source: EU COMEXT; wiiw calculations

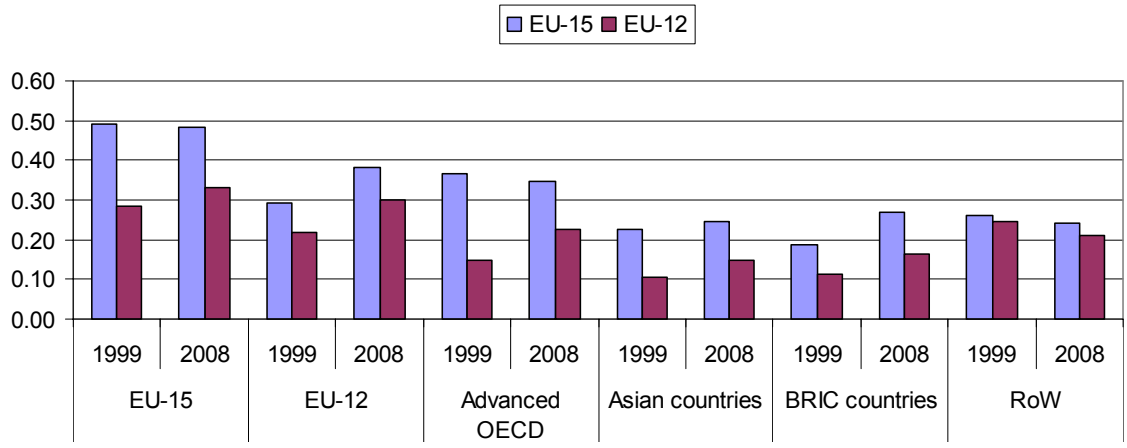
Two-way trade for intermediates by region

Let us now look at two-way trade in intermediates and the other product categories by world regions as defined above. One would expect the share of two-way trade being higher amongst EU countries (and amongst EU-15 countries) in particular due to geographic proximity and similarities with respect to technologies, factor endowments, etc. Table 3.2.5 presents the results for intermediate goods trade and the respective regions in 1999 and 2008.

For an easier discussion we however present the results graphically by calculating arithmetic means across two country groups, EU-15 and NMS-12. Figure 3.2.7 thus shows the averages of the CGLI index of EU-15 and NMS-12 with the other country groups (and of course themselves).

Figure 3.2.7

Averages of CGLI for intermediate products, 1999 and 2008



Source: EU COMEXT; wiiw calculations

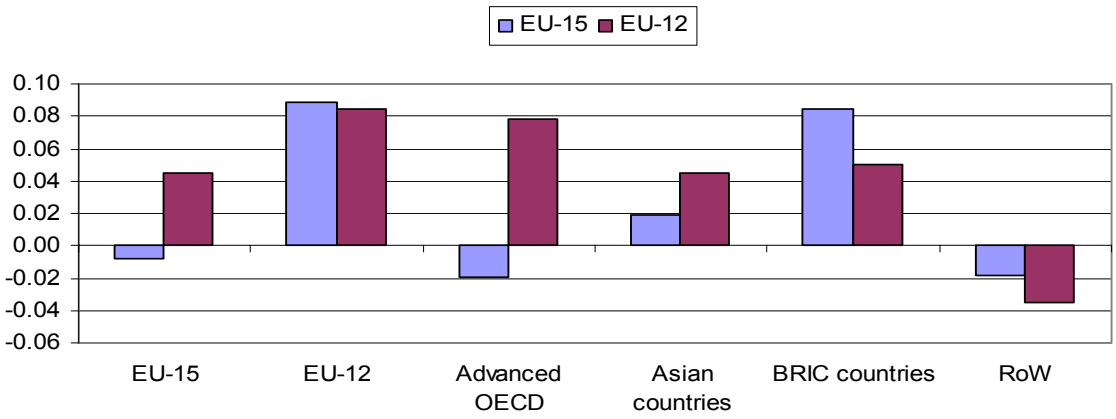
The share of intra-industry trade of EU-15 countries amongst themselves was about 0.5 in both 1999 and 2008. The share of intra-industry trade of the EU-15 with the NMS-12 was about 0.3 in 1999 and increased to almost 0.4 in 2008. This final figure is slightly above the index for EU-15 trade with advanced OECD countries, which showed a decline between 1999 and 2008. For the other three regional groups the index lies between 0.2 and 0.25, with a significantly increasing index found for trade with the BRIC countries. The NMS-12 countries tend to have a lower index on average with respect to all country groupings with levels of around 0.3 for trade with the EU-15 and NMS-12 themselves (at least in 2008), and smaller values with respect to the other country groupings.

As the dynamics seems to be important we present the point changes of these figures in Figure 3.2.8. From this figure one can see the strong increase in two-way for EU-15 countries with the NMS-12 (by about 8 percentage points) and with the BRIC countries, though the starting level was lower for the BRIC countries. With respect to the other country groupings

the changes are much smaller and slightly negative for the EU-15, advanced OECD and the Rest of World category and slightly positive with respect to Asian countries. Concerning the NMS-12, one finds again a strong increase in two-way trade with EU-15 countries (4%) and amongst themselves (8%), but also a very strong increase with the advanced OECD countries (even stronger than with the EU-15) and with Asian countries and BRIC countries; in this latter case the increase was less significant compared to that with the EU-15.

Figure 3.2.8

Changes in averages of CGLI for intermediates, 1999 to 2008

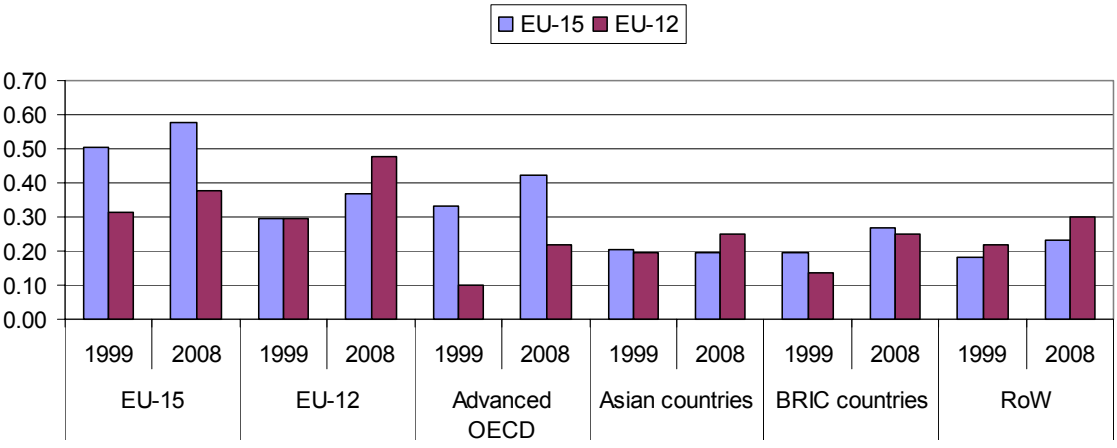


Source: EU COMEXT; wiiw calculations

Next graphs 3.2.9 to 3.2.12 present these averages and the respective changes for consumer and capital goods. In terms of levels there are similar patterns though magnitudes might differ somewhat. More interesting are the dynamic patterns which in this case do rise with respect to all country groups (with one slight exception) and especially so for the NMS-12. Particularly strong increases can be found for the NMS-12 for capital goods, with large changes amongst themselves but also with Asian, BRIC and the other countries (Rest of the World).

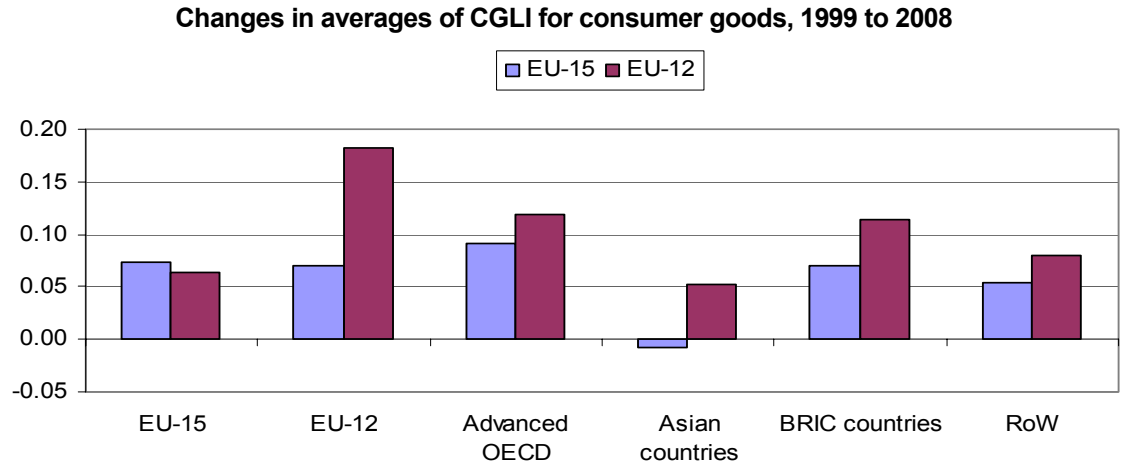
Figure 3.2.9

Averages of CGLI for consumer goods, 1999 and 2008



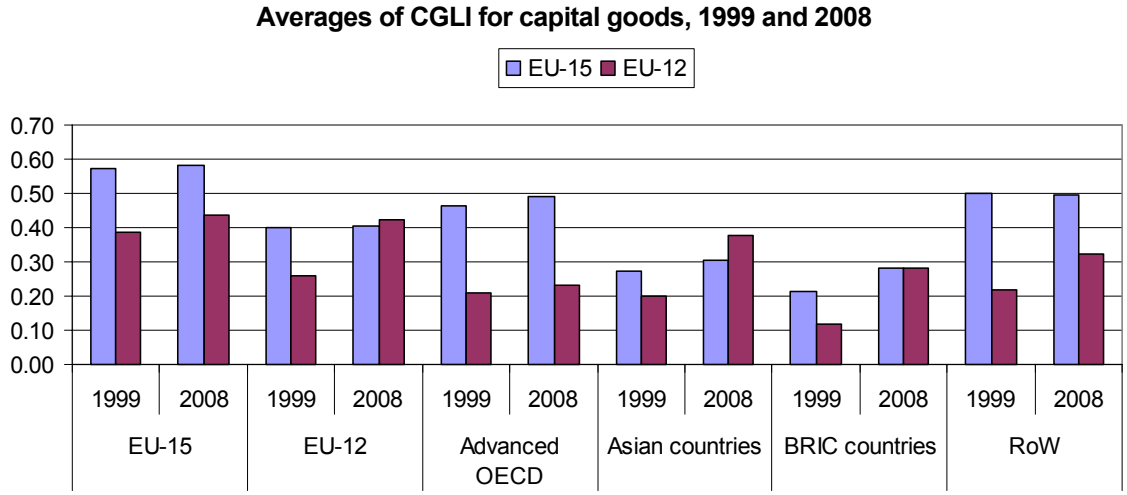
Source: EU COMEXT; wiiw calculations

Figure 3.2.10



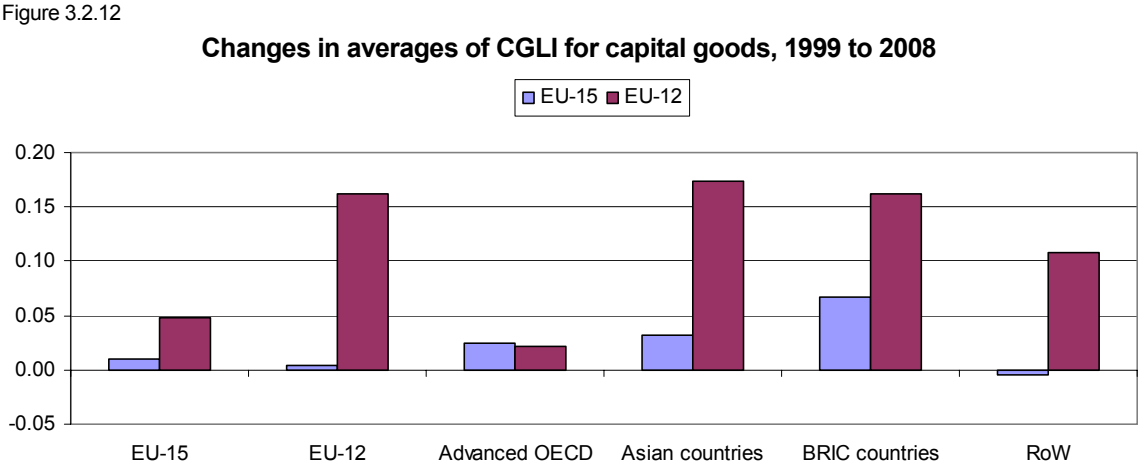
Source: EU COMEXT; wiiw calculations

Figure 3.2.11



Source: EU COMEXT; wiiw calculations

Figure 3.2.12



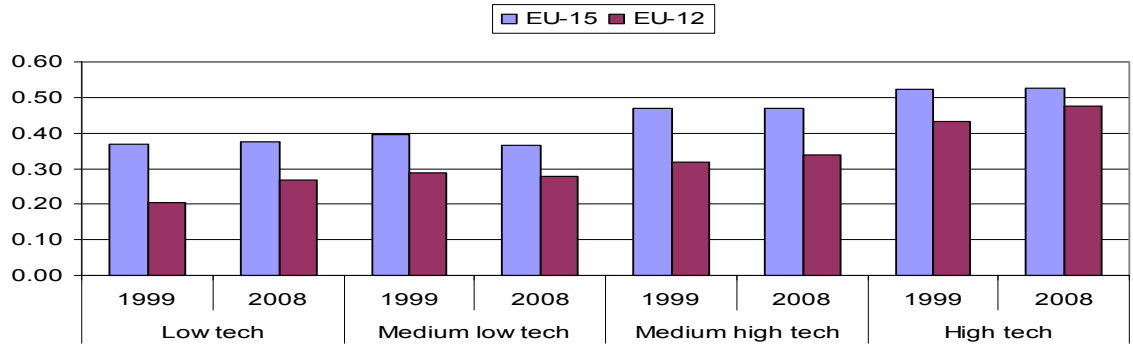
Source: EU COMEXT; wiiw calculations

Two-way trade for intermediates by industry groups

In a similar way one might look at two-way trade by different industries and product categories. We again present arithmetic averages over the two country groups (EU-15 and NMS-12) but differentiating by the four industry groups. Results are presented in Figures 3.2.13 to 3.2.18. For intermediates two-way trade is highest in high-tech industries and lowest in the low-tech industries. This holds for both country groups. In terms of changes we find stronger increases for the NMS-12 mostly in the low- and high-tech industries with little changes for the EU-15 countries. In the medium-low-tech industries there was even a decline in the extent of two-way trade.

Figure 3.2.13

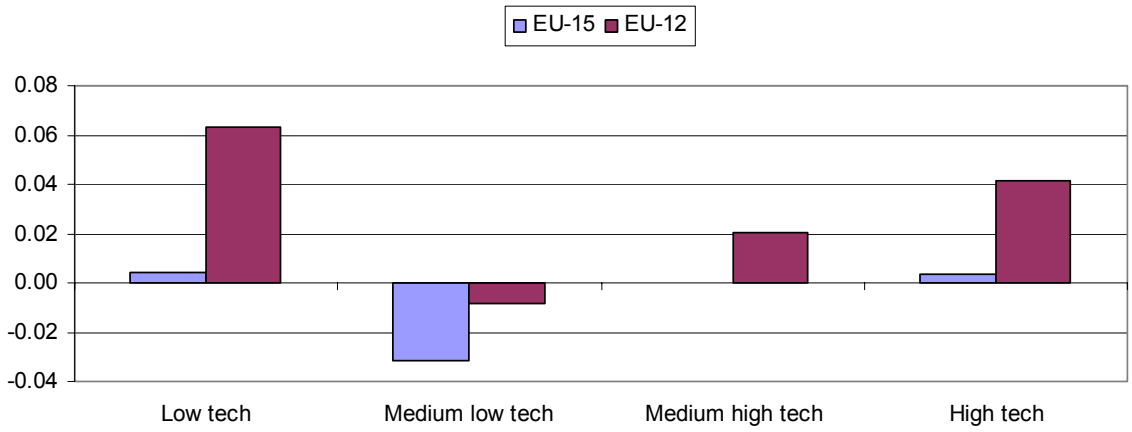
Averages of CGLI for intermediate products by industry groups, 1999 and 2008



Source: EU COMEXT; wiiw calculations

Figure 3.2.14

Changes in averages of CGLI for intermediate products, 1999 to 2008

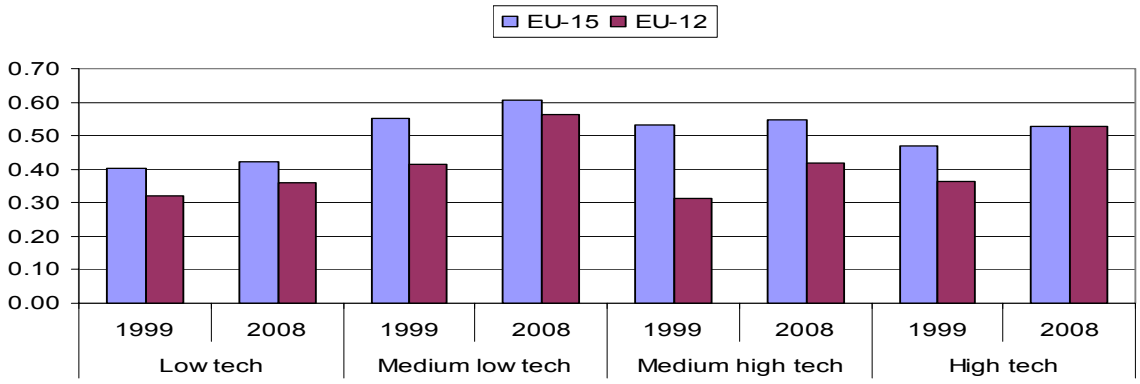


Source: EU COMEXT; wiiw calculations

Next figures present these indices for consumer and capital goods. For the former, the share of intra-industry trade is higher in the medium-low-tech industries with strong increases found in medium-low- and medium-high-tech industries. Again, these increases are particularly strong for the NMS-12 countries.

Figure 3.2.15

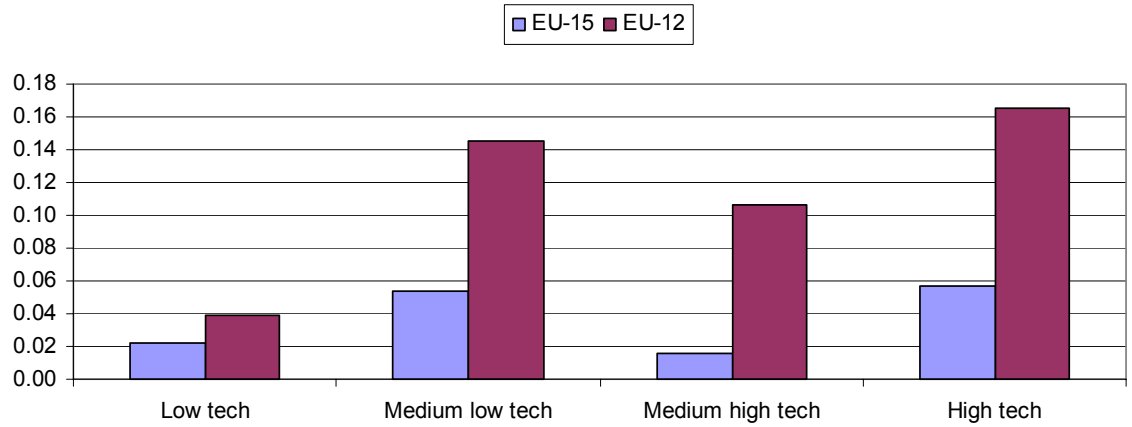
Averages of CGLI for consumer goods by industry groups, 1999 and 2008



Source: EU COMEXT; wiiw calculations

Figure 3.2.16

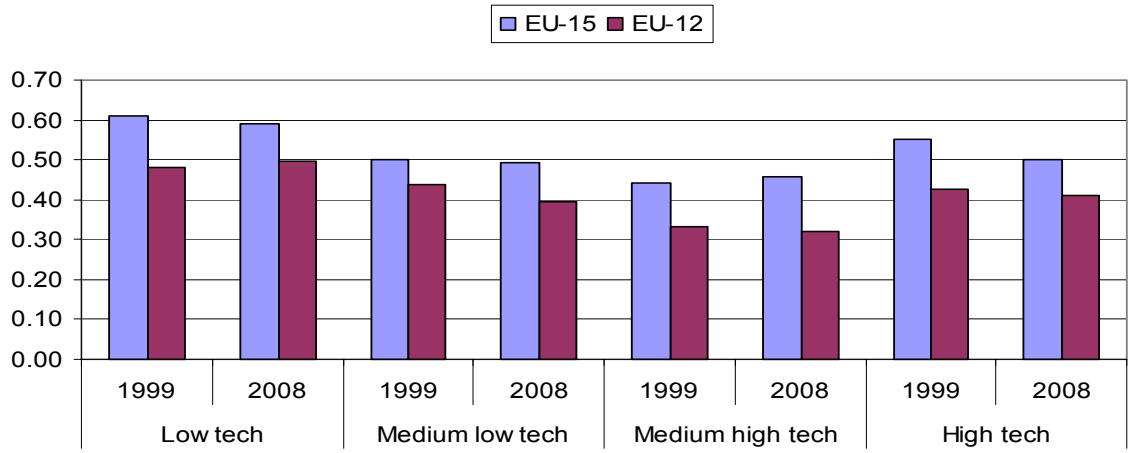
Changes in averages of CGLI for consumer goods, 1999 to 2008



Source: EU COMEXT; wiiw calculations

Figure 3.2.17

Averages of CGLI for capital goods by industry groups, 1999 and 2008

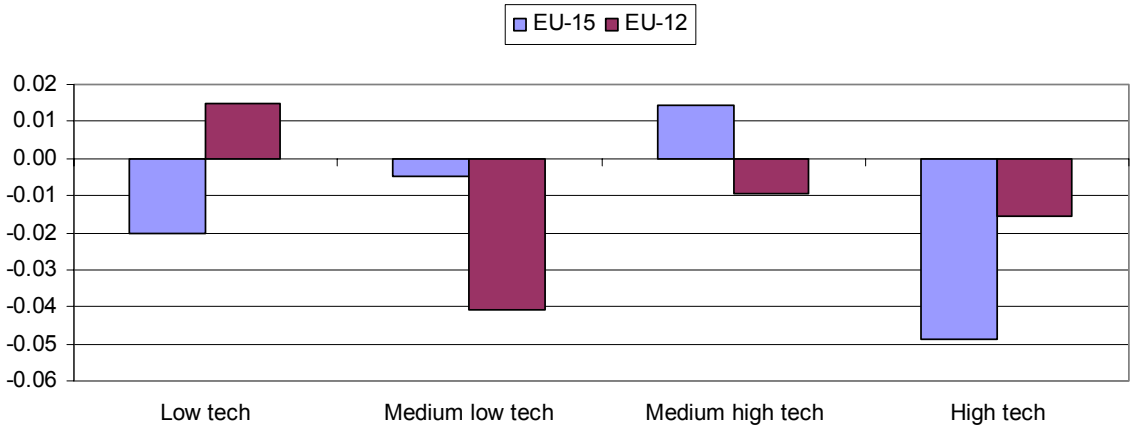


Source: EU COMEXT; wiiw calculations

A different pattern emerges for capital goods. In this case the highest index of two-way trade is observed in the low-tech industries closely followed by the high-tech industries. However, we find more often negative changes, especially so in the case of the EU-15 for low- and high-tech industries and for the NMS-12 for medium-low-tech industries but also – though less strong – for medium-high- and high-tech industries.

Figure 3.2.18

Changes in averages of CGLI for capital goods, 1999 to 2008



Source: EU COMEXT; wiiw calculations

3.3 Trade in varieties and the margins of trade

The change in trade volumes can either occur through changes in the volumes of each good traded or changes in the number of products traded. The former way of trade expansion is labelled the 'intensive' margin, the latter the 'extensive' margin which is defined exactly below. Hummels and Klenow (2005) report that on average the extensive margin accounts for about 60% of the greater exports of larger economies, the remaining part (40%) is consequently accounted for the intensive margin. Furthermore, the intensive margin can be decomposed into a price and a quantity effect. In this study we follow the methodology of Hummels and Klenow (2005) – which is itself based on a contribution by Feenstra (1994) – but in addition differentiate according to end-use categories and further present results for the years 1999 and 2007 to show changes over time, which might be important for specific countries.

Hummels and Klenow (2005) in their analysis examine why it is that larger countries export more. In particular, they consider whether larger countries trade more due to trading larger quantities of each good (the intensive margin), a wider set of goods (the extensive margin) or higher quality goods. To do this they construct measures of each of these aspects of trade using disaggregated trade on about 5000 products for 126 exporting countries to 59 importing countries. While it is not possible to directly observe quality in their data, they make inferences on the importance of quality by considering whether larger countries trade large quan-

tities at high prices. The results they obtain indicate that the majority (around 60%) of the higher exports of larger economies are due to the extensive margin, that is, from exporting a wider variety of products. They find that the intensive margin is driven by higher quantities, rather than higher prices, a result consistent with larger countries exporting higher quality goods. Richer countries tend to export at similar prices which allows them to export higher quantities (see Hummels and Klenow, 2005, for discussion)[10] One of the aims of their work was to relate their results to existing trade models to examine which, if any, could explain the patterns of trade they found. They conclude that models with firm product differentiation (for example, Krugman, 1979) predict a large role for the extensive margin, but that they tend to over-estimate the response of the extensive margin to exporter size. In addition, these theories would predict that exporters would export to all markets if it exports a particular product, which is at odds with the data where countries export to a strict subset of markets, with larger exporters tending to export to more markets. They further argue that models with product differentiation can match the results on the price of exports, while models with a fixed cost of exporting (e.g. Romer, 1994) to a particular market can potentially explain the fact that larger countries tend to export a given product to more countries.

The result that the greater exports of larger countries are due to expansion along the extensive margin has been questioned by other research. Brenton and Newfarmer (2007) find that most export growth for 99 developing countries over the period 1995-2004 came through intensifying growth of existing products to existing markets. Along the extensive margin, they find that growth was mainly driven by diversification into new markets rather than through the introduction of new products. Evennett and Venables (2002) find that a third of the growth of exports of developing countries between 1970 and 1997 can be attributed to the expansion of the extensive margin. Helpman, Melitz, and Rubinstein (2006) find that the majority of the growth of trade between 1970 and 1997 is attributable to the intensive margin rather than the extensive margin.[11]

Box 4

Trade margins

The measures used in this study are based on Feenstra (1994) and Hummels and Klenow (2005). The main additional variables of interest that we introduce here are the intensive and extensive margins. Hummels and Klenow (2005) employ the methodology of Feenstra (1994) in order to decompose exports in to the relevant margins. They define the Extensive Margin (EM) as

$$EM_{jm} = \frac{\sum_{i \in I_{jm}} p_{kmi} x_{kmi}}{\sum_{i \in I} p_{kmi} x_{kmi}}$$

10 Schott (2004) finds evidence consistent with this last result.

11 Felbermayr and Kohler (2006) find that the extensive margin (though defined differently) played a larger role in the growth of world trade between 1950 and 1970 and again in the mid-1990s, while the intensive margin was more important in the intervening years.

where I_{jm} is the set of observable categories in which the exporting country j has positive exports to m, p_{kmi} is the price of a unit of good i exported from reference country k to country m (measured as the unit value, that is value divided by quantity), and x_{kmi} is the quantity of good i exported from reference country k to country m. Reference country k has positive exports to m in

all I categories. In our analysis, the reference 'country' k is chosen to be the EU-27 countries (that is, we consider for reference the sum of all EU-27 countries exports). EM_{jm} can thus be thought

of as a weighted count of j's categories relative to k's (i.e. EU-27) categories. If all categories are of equal importance then the extensive margin would simply be the fraction of categories in which j exports to m. More generally however, the categories are weighted by their importance in k's exports to m. Hummels and Klenow (2005) discuss the advantages and disadvantages of this formulation, noting that by evaluating a category's importance without reference to j's exports itself prevents a category from appearing important just because j and no other country exports a lot in that category. On the other hand, they point out that a country can appear to have a large export margin if it exports a small amount in categories in which k exports a lot.

The intensive margin (IM) compares nominal shipments for country j and k in a common set of goods. It is given by

$$IM_{jm} = \frac{\sum_{i \in I_{jm}} p_{jmi} x_{jmi}}{\sum_{i \in I_{jm}} p_{kmi} x_{kmi}}$$

IM_{jm} equals j's nominal exports relative to k's nominal exports in those categories in which j exports to m. A useful result for the econometric analysis that follows is that the product of the intensive and extensive margin equals the export share of country j in total EU-27 exports,

$$\frac{\sum_{i=1}^{I} p_{jmi} x_{jmi}}{\sum_{i=1}^{I} p_{kmi} x_{kmi}} = IM_{jm} EM_{jm}$$

Hummels and Klenow (2005) go on to discuss the decomposition of the intensive margin into a price and quantity index. To do this they use the result of Feenstra (1994) who derives an exact price index for the intensive margin of country m's imports from j relative to k as;

$$P_{jm} = \prod_{i \in I_{jm}} \left(\frac{p_{jmi}}{p_{kmi}} \right)^{w_{jmi}}$$

where w_{jmi} is the logarithmic mean of s_{jmi} and s_{kmi}, which are the shares of category i in country j's exports to m, and country k's exports to m respectively,

$$s_{jmi} = \frac{p_{jmi} x_{jmi}}{\sum_{i \in I_{jm}} p_{jmi} x_{jmi}} \qquad \text{and} \qquad s_{kmi} = \frac{p_{kmi} x_{kmi}}{\sum_{k \in I_{jm}} p_{kmi} x_{kmi}}$$

and

$$w_{jmi} = \frac{\frac{s_{jmi} - s_{kmi}}{\ln s_{jmi} - \ln s_{kmi}}}{\sum_{i \in I_{jm}} \frac{s_{jmi} - s_{kmi}}{\ln s_{jmi} - \ln s_{kmi}}}$$

Hummels and Klenow (2005) use these results to decompose the intensive margin into a price and an implicit quantity index

$$IM_{jm} = P_{jm} X_{jm}$$

To obtain an aggregate measure of each of the above variables for each exporter j Hummels and Klenow (2005) take the geometric averages of each of the variables for country j across the M_{-j} markets

$$IM_j = \prod_{m \in M_{-j}} (IM_{jm})^{\alpha_{jm}} \qquad EM_j = \prod_{m \in M_{-j}} (EM_{jm})^{\alpha_{jm}}$$

and

$$P_j = \prod_{m \in M_{-j}} (P_{jm})^{\alpha_{jm}} \qquad \text{and} \qquad X_j = \prod_{m \in M_{-j}} (X_{jm})^{\alpha_{jm}}$$

where the weight α_{jm} is the logarithmic mean of the shares of m in the overall exports of j and W_{-j-m} respectively. As mentioned above, in addition to constructing the above margins for exports, we repeat the above steps replacing exports with imports. In addition we calculate these measures for different categories of goods as indicated in Table A.3.2 above (primary, intermediate, consumer, capital and processed goods). In this case we apply a slightly more detailed categorization of products. In the analysis that follows we will rely on the aggregate measures (EM_j and IM_j).

These measures are then regressed on relative GDP or country size in log terms both for the intensive and the extensive margins. As the OLS is a linear operator this allows to calculate the relative importance of these margins in the following way: The percentages are calculated as the respective coefficient for the intensive and the extensive margin relative to the sum of these (expressed in %).

Descriptive results – import margins

Let us provide a short description of the most important results focusing on cross-country differences and changes in the margins. Table 3.3.1 reports the import margins for all countries in 1999 and 2007 and in Figure 3.3.1 we present the differences between 1999 and 2007 in arithmetic averages by groups of countries.

The reported means in Table 3.3.1 are arithmetic averages over country groups as well. First, the extensive margins are generally lower for NMS-12 compared to EU-15 countries. As we shall see later, this might reflect both differences in country size and productivity. Further, it is interesting to note that the extensive margin was slightly decreasing in most countries (with a few exceptions) over this period, i.e. countries tended to import fewer products compared to EU-27, or put it differently, other countries in the EU-27 start to import different products or from other markets which implies a decrease of the extensive margin

for other countries.[12] Second, for the intensive margin the difference between NMS-12 compared to the EU-15 countries is larger. The margin tended to increase slightly between 1999 and 2007 for most countries, with particularly large increases found for the NMS-12 (increasing from 0.009 to 0.015 on average). Thus integration of these countries was mostly along the intensive margin, i.e. importing more of the same products in value terms. Third, as noted above the intensive margin can be split into a price and an implicit quantity component. Doing this one finds that import prices are generally lower for the NMS-12 (1.089 in 1999 and 1.015 in 2007) when compared with the EU-15 average (1.171 and 1.205, respectively); changes in the price index on average are positive for the EU-15 but negative for the group of the NMS-12. Thus, EU-15 countries tended to import goods at relatively higher prices while for NMS-12 countries the prices of imports have tended to fall. Finally, the quantity index is almost stable for EU-15 but increases for NMS-12.

Table 3.3.1

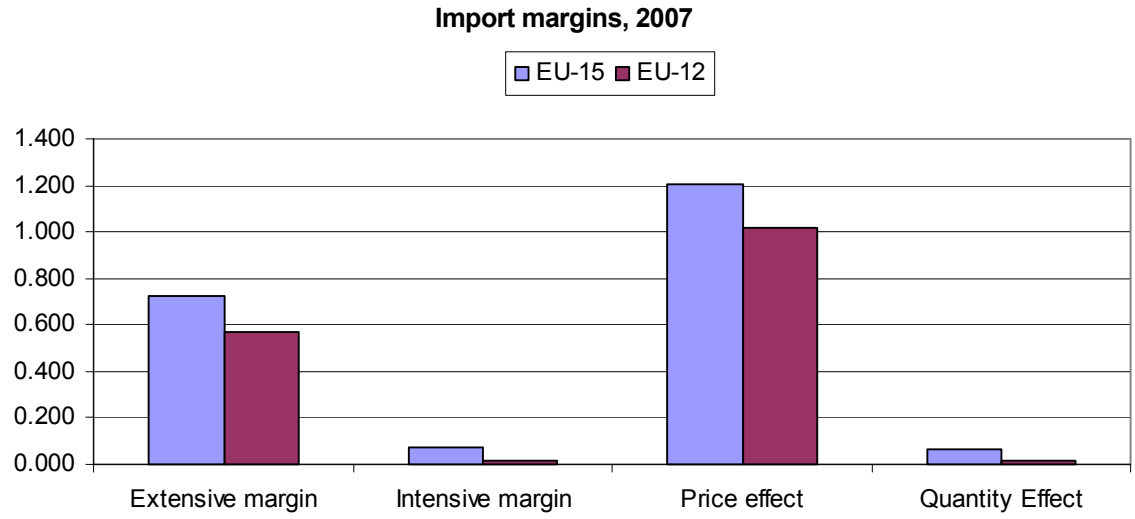
Import margins, 1999 and 2007

	Extensive margin		Intensive margin		Price index		Quantity index	
	1999	2007	1999	2007	1999	2007	1999	2007
AT	0.849	0.797	0.041	0.040	1.249	1.022	0.033	0.039
BE	0.872	0.689	0.094	0.110	1.091	1.490	0.086	0.074
BG	0.548	0.571	0.004	0.009	0.915	0.888	0.004	0.010
CY	0.306	0.361	0.003	0.004	1.149	1.125	0.003	0.003
CZ	0.846	0.577	0.017	0.030	0.996	1.125	0.017	0.027
DE	0.964	0.932	0.243	0.234	1.111	1.023	0.218	0.229
DK	0.755	0.666	0.028	0.029	1.236	1.209	0.022	0.024
EE	0.577	0.547	0.003	0.005	1.052	0.956	0.003	0.006
ES	0.881	0.798	0.077	0.086	1.105	1.768	0.070	0.049
FI	0.744	0.700	0.019	0.023	1.221	1.079	0.016	0.021
FR	0.963	0.819	0.153	0.141	1.074	1.903	0.142	0.074
GB	0.935	0.874	0.164	0.137	1.082	0.953	0.152	0.144
GR	0.735	0.696	0.020	0.022	1.133	1.035	0.018	0.022
HU	0.767	0.670	0.017	0.023	1.098	0.980	0.015	0.023
IE	0.630	0.588	0.028	0.024	1.235	1.104	0.022	0.022
IT	0.937	0.726	0.120	0.113	1.135	1.132	0.106	0.100
LT	0.591	0.580	0.004	0.009	1.092	0.946	0.004	0.009
LU	0.532	0.419	0.009	0.013	1.476	1.203	0.006	0.011
LV	0.507	0.346	0.003	0.006	1.150	1.258	0.003	0.005
MT	0.138	0.378	0.003	0.002	1.510	1.031	0.002	0.002
NL	0.871	0.698	0.100	0.105	1.060	1.084	0.094	0.097
PL	0.847	0.791	0.027	0.041	0.997	0.923	0.027	0.045
PT	0.736	0.675	0.026	0.021	1.137	0.965	0.022	0.022
RO	0.674	0.731	0.007	0.019	0.961	0.887	0.008	0.021
SE	0.812	0.775	0.038	0.039	1.227	1.099	0.031	0.036
SI	0.728	0.619	0.007	0.011	1.108	0.984	0.006	0.011
SK	0.711	0.638	0.008	0.017	1.035	1.082	0.008	0.016
Mean – EU-15	0.814	0.723	0.077	0.076	1.171	1.205	0.069	0.064
Mean – NMS-12	0.603	0.567	0.009	0.015	1.089	1.015	0.008	0.015

Source: EU COMEXT; wiiw calculations

[12] This point can clearly be seen when looking at the equation for the extensive margin: If one country starts to import a new variety the extensive margins for the other countries tend to decline. This would explain the decline of the extensive margins over time.

Figure 3.3.1



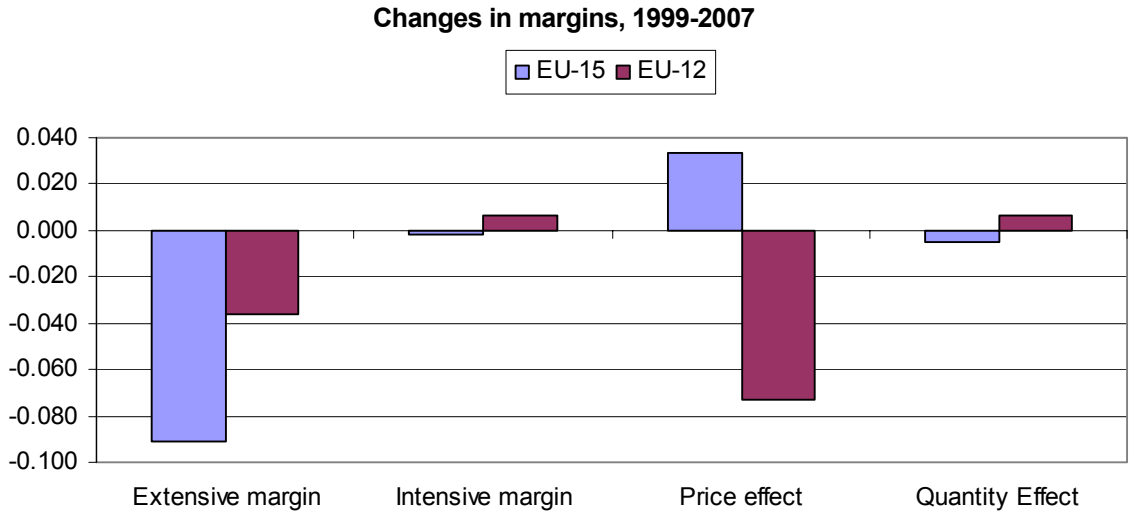
Note: Graph shows arithmetic averages over country groups

Source: EU COMEXT; wiiw calculations

Table 3.3.2 presents these margins differentiating by product categories. In this table we again report the arithmetic averages over the respective country groups. Detailed results at the country level can be found in Appendix Tables A.3.3.1 to A.3.3.3. The extensive margins tend to be lower in intermediates compared to consumer and capital goods whereas the intensive margins tend to higher. This means that countries tend to import more varieties of intermediates compared to the other categories. The price index tends to be slightly higher for intermediates and capital goods with little variation in the quantity index which might be interpreted in that quality of imports is higher. Considering changes over time one finds that the extensive margins were decreasing for intermediates and capital goods, but increasing for consumer goods. There are few changes over time in the intensive margins however. Changes in the intensive margins are further mostly dominated by price changes rather than quantity changes; these changes in the price index are slightly negative for intermediate products, slightly positive for consumer goods and strongly positive for capital goods.

More interesting are the respective changes over time where one can find an increase in the extensive margin of consumer goods in NMS-12 whereas all other changes are negative. Changes in the intensive margin are relatively small however, and are mostly positive for the NMS-12 and mostly negative for EU-15 countries. For the former group of countries these changes are larger in intermediates and capital goods. The changes in the intensive import margins are negative for all product categories for the NMS-12 (again being largest for intermediates and capital goods) but have been positive in the EU-15 in consumer and particularly in capital goods.

Figure 3.3.2



Note: Graph shows changes in arithmetic averages over country groups

Source: EU COMEXT; wiiw calculations

Considering differences across country groups one can observe that these more or less follow the findings for total trade above, i.e. the extensive and intensive margins by product categories tend to smaller for NMS-12 compared to EU-15, the price index is smaller for the former group as well. One striking aspect is that the price index for intermediates is similar for intermediates comparing EU-15 and NMS-12 whereas for consumer goods and in particular capital goods is much lower (only half of the EU-15 index)..

Table 3.3.2

Import margins in 2007 and differences 1999-2007

	Margins in 2007				**Changes in margins, 1999-2007**			
	Extensive margin	Intensive margin	Price index	Quantity index	Extensive margin	Intensive margin	Price index	Quantity index
		Total trade				Total trade		
EU-15	0.723	0.076	1.205	0.064	-0.091	-0.002	0.033	-0.005
NMS-12	0.567	0.015	1.015	0.015	-0.036	0.006	-0.073	0.007
		Intermediate products				Intermediate products		
EU-15	0.682	0.079	1.173	0.070	-0.081	0.000	-0.009	-0.001
NMS-12	0.486	0.017	1.154	0.016	-0.071	0.007	-0.056	0.007
		Consumer goods				Consumer goods		
EU-15	0.811	0.071	1.239	0.060	-0.028	-0.003	0.033	-0.007
NMS-12	0.697	0.010	0.985	0.010	0.067	0.003	-0.021	0.004
		Capital goods				Capital goods		
EU-15	0.763	0.073	1.521	0.062	-0.165	-0.004	0.324	-0.006
NMS-12	0.668	0.015	0.870	0.018	-0.009	0.006	-0.084	0.008

Note: Table reports arithmetic averages over country groups.

Source: EU COMEXT; wiiw calculations

Descriptive results – export margins

We now consider the respective export margins. Table 3.3.3 reports these for all countries and again shows the arithmetic averages over the two country groups. Figures 3.3.3.and 3.3.4 visualize the differences across country groups and the changes over time.

With respect to the extensive export margins one first has to note that these tend to be generally lower compared to the extensive import margins meaning that countries tend export more varieties. Second, the difference between EU-15 and NMS-12 tends to be more pronounced. Conversely, the intensive export margins tend to be larger than the intensive import margins with again large differences across country groups. Decomposing the intensive import margins reveals that the NMS-12 tend to export at relatively lower prices which might be consistent with lower quality.

Table 3.3.3

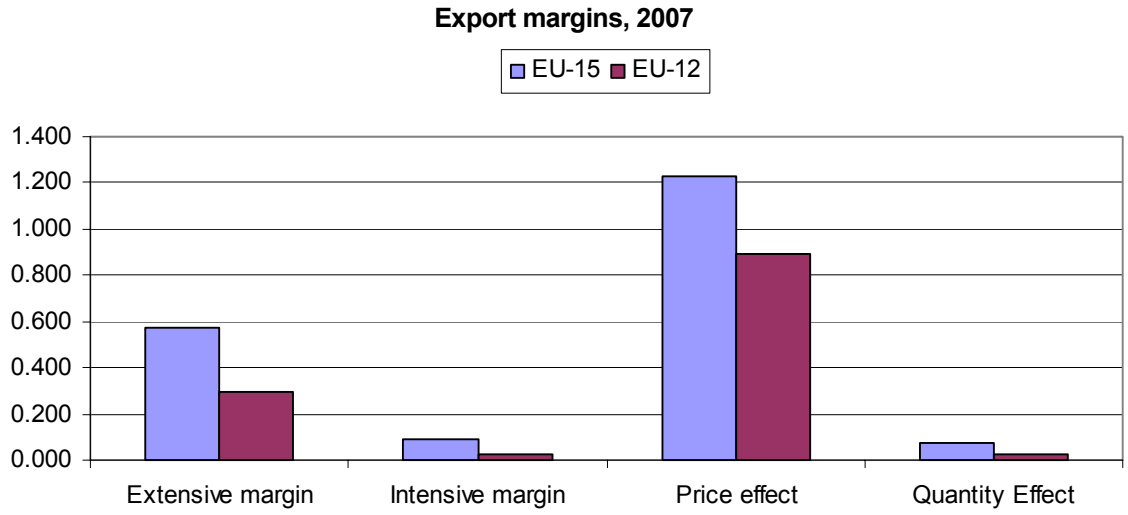
Export margins, 1999 and 2007

	Extensive margin		Intensive margin		Price index		Quantity index	
	1999	2007	1999	2007	1999	2007	1999	2007
AT	0.651	0.682	0.046	0.047	1.238	1.081	0.037	0.044
BE	0.792	0.660	0.107	0.119	1.162	1.911	0.092	0.062
BG	0.169	0.262	0.010	0.014	0.609	0.724	0.017	0.020
CY	0.050	0.064	0.003	0.003	0.753	0.952	0.004	0.004
CZ	0.541	0.436	0.026	0.037	0.753	0.988	0.035	0.038
DE	0.941	0.927	0.305	0.311	1.164	0.993	0.262	0.313
DK	0.547	0.530	0.040	0.035	1.359	1.302	0.029	0.027
EE	0.135	0.195	0.008	0.011	0.905	0.904	0.009	0.012
ES	0.707	0.605	0.074	0.070	1.015	1.420	0.073	0.050
FI	0.438	0.447	0.032	0.035	1.383	1.176	0.023	0.030
FR	0.900	0.706	0.161	0.135	1.129	1.361	0.142	0.099
GB	0.860	0.828	0.145	0.112	1.210	1.086	0.119	0.103
GR	0.290	0.279	0.019	0.017	1.001	0.902	0.019	0.019
HU	0.421	0.435	0.027	0.033	0.939	0.859	0.029	0.038
IE	0.334	0.314	0.079	0.073	1.481	1.733	0.053	0.042
IT	0.881	0.688	0.148	0.130	1.024	1.006	0.145	0.129
LT	0.164	0.250	0.007	0.015	0.732	0.834	0.010	0.018
LU	0.273	0.243	0.014	0.018	1.324	1.267	0.011	0.014
LV	0.102	0.132	0.009	0.009	0.774	1.028	0.011	0.009
MT	0.024	0.076	0.005	0.009	1.309	1.271	0.004	0.007
NL	0.773	0.639	0.108	0.116	1.122	1.163	0.096	0.100
PL	0.529	0.633	0.027	0.045	0.794	0.790	0.034	0.057
PT	0.373	0.366	0.028	0.023	0.957	0.797	0.030	0.029
RO	0.240	0.313	0.018	0.027	0.615	0.755	0.030	0.036
SE	0.604	0.640	0.062	0.052	1.390	1.200	0.045	0.043
SI	0.332	0.398	0.013	0.016	0.869	0.806	0.015	0.020
SK	0.332	0.362	0.015	0.031	0.805	0.825	0.019	0.038
Mean – EU-15	0.624	0.570	0.091	0.086	1.197	1.227	0.078	0.074
Mean – NMS-12	0.253	0.296	0.014	0.021	0.821	0.895	0.018	0.025

Source: EU COMEXT; wiiw calculations

Regarding changes in the margins there is again a striking difference between the EU-15 and the NMS-12. The extensive export margin was increasing for the NMS-12 but decreasing for the EU-15; a similar but less strong change also holds for the intensive margins. The change in the price index was positive for both country groups however, though more pronounced for the NMS-12.

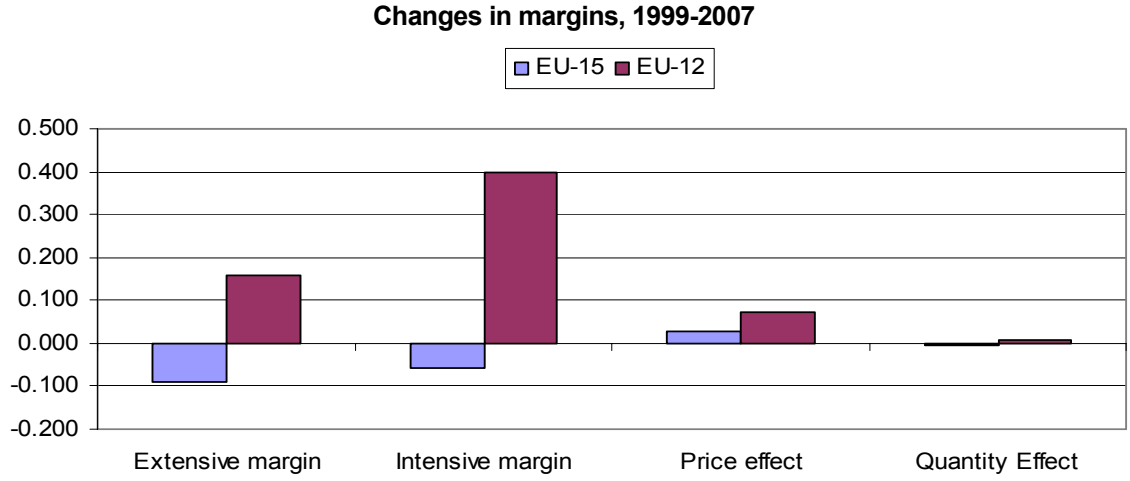
Figure 3.3.3



Note: Graph shows arithmetic averages over country groups

Source: EU COMEXT; wiiw calculations.

Figure 3.3.4



Note: Graph shows changes in arithmetic averages over country groups.

Source: EU COMEXT; wiiw calculations.

Table 3.3.4 presents the arithmetic averages over country groups for different product categories. The extensive margin tends to be larger for consumer goods (0.517) compared to intermediates (0.443) and capital goods (0.391). There is less differentiation however in the intensive margins. In all categories the margins are on average larger for EU-15 coun-

tries. Export prices are higher in the EU-15 with the differences being larger in consumer and intermediate goods. With respect to changes one finds an increase in the extensive margin for NMS-12 but negative values for EU-15 in all categories. Similar, but less pronounced results are found for the intensive margins. The change in the price index is positive for intermediates for both country groups (but more pronounced for NMS-12). In the other two product categories the price index changes are negative for EU-15 but positive for NMS-12.

Table 3.3.4

Import margins in 2007 and differences 1999-2007

	Margins in 2007				Changes in margins, 1999-2007			
	Extensive margin	Intensive margin	Price index	Quantity index	Extensive margin	Intensive margin	Price index	Quantity index
	Total trade				Total trade			
EU-15	0.570	0.086	1.227	0.074	-0.054	-0.005	0.029	-0.005
NMS-12	0.296	0.021	0.895	0.025	0.043	0.007	0.073	0.007
	Intermediate products				Intermediate products			
EU-15	0.569	0.089	1.290	0.075	-0.026	-0.004	0.071	-0.003
NMS-12	0.285	0.024	1.055	0.024	0.029	0.009	0.186	0.006
	Consumer goods				Consumer goods			
EU-15	0.642	0.078	1.220	0.067	-0.007	-0.008	-0.035	-0.006
NMS-12	0.360	0.017	0.874	0.021	0.077	0.001	0.103	0.001
	Capital goods				Capital goods			
EU-15	0.513	0.086	1.100	0.084	-0.068	-0.005	-0.084	-0.007
NMS-12	0.238	0.021	0.783	0.028	0.069	0.007	0.093	0.007

Source: EU COMEXT; wiiw calculations

Summary of econometric results

The cross-country differences in these margins might be explained by country characteristics. In this section we therefore adopt the methodology of Hummels and Klenow (2005) to examine the importance of the intensive and extensive margins for EU-27 trade econometrically also differentiating end-use categories. The latter are split up in even more detail to be able to highlight some differences; the differentiation follows Frensch and Wittich (2008) as outlined in Table A.2. Following Hummels and Klenow (2005) we regress our measure of trade; the intensive and the extensive margin, as well as the price and quantity index, constructed using the methodology above, on either a measure of GDP, representing country size, or a measure of GDP per worker and the size of the workforce. The estimating equations are therefore

$$TRADE_{jt} = \alpha_0 + \beta_1 GDP_{jt} + \varepsilon_{jt}$$

$$TRADE_{jt} = \alpha_0 + \beta_1 GDPPW_{jt} + LAB_{jt} + \varepsilon_{jt}$$

where $TRADE$ is one of the following variables: (i) the ratio of total exports (or imports) in j relative to EU-27; (ii) the extensive margin; (iii) the intensive margin; (iv) the price index, or (v) the quantity index. The variables GDP, $GDPPW$ and LAB are measured in logs relative to the log of the corresponding EU-27 value. A coefficient larger than zero thus indicates that larger countries tend to trade relatively more. With respect to margins, adopting this approach has the advantage, as discussed by Hummels and Klenow (2005), that given that OLS is a linear operator the regressions additively decompose the margins along which larger economies trade more. That is, we can identify the share of the greater trade of larger countries that is due to the intensive and extensive margins. The percentages are calculated as the respective coefficient for the intensive and the extensive margin relative to the sum of these (expressed in %).

Let us start by summarizing the results for the export margins. The detailed econometric results for all regressions now reported are found in the appendix (Tables B.7 to B.14). The results in the top panel of Table B.7 indicate that larger countries export more to the typical market.[13] The size of the coefficient for overall exports is somewhat higher than that found by Hummels and Klenow (here we obtain a coefficient of 1.13, whereas Hummels and Klenow find a coefficient of 1.0). The results for the different BEC categories show some variation being largest for capital (1.342) and processed (1.241) goods and smallest for primary (1.028) and consumer (1.087) goods. The bottom two panels quantify how much of this increase occurs along the intensive and extensive margin. For total exports we find that 59% of the effect of higher GDP on exports occurs along the intensive margin, with 41% occurring along the extensive margin. These figures are different to those found by Hummels and Klenow (2005) who obtain a figure of 62% for the extensive margin and 38% for the intensive margin. They are more in line with other results however, such those obtained by Brenton and Newfarmer (2007).[14] We again find differences for the different BEC categories. In some cases the intensive margin plays a more prominent role, with the intensive margin accounting for 71% of the increase for processed goods, and 61% and 59% for consumer and intermediate goods respectively. These initial results indicate that the volume of trade in existing goods, rather than the variety of goods traded, is the relatively more important source of higher export volumes in the EU-27 and this is more pronounced for consumer and processed goods and intermediates.

Table B.8 replaces the level of GDP with the levels of GDP per worker and the labour force which distinguishes between richer and larger countries. The coefficients on income per capita for capital goods and processed goods tend to be higher, i.e. richer countries tend to export relatively more in these categories. With respect to the margins the results indicate

[13] None of the results reported here include either time or country fixed effects. The results when including such fixed effects are qualitatively similar however and are available upon request.

[14] We experimented by estimating the regressions for old Europe (i.e. the EU-15 members prior to 2000) and new Europe (i.e. the 12 new members). The results were found to differ very little for the two different sub-samples and so the results are not reported here. The results are available upon request however.

that for total exports the intensive margin plays a more important role for richer countries (64%) than for economies with more workers (58%). The results for the BEC categories are largely similar with the intensive margin being more important for richer countries than those with more workers for all categories except primary goods. Once again the intensive margin is most prominent for the processed category.

Table B.9 reports the results from the decomposition of the intensive export margin into its price and quantity components. The results suggest that countries with twice the GDP export 65% more quantities at 2% higher prices. Qualitatively, these results are similar to Hummels and Klenow (2005) who also find that larger countries export more at slightly higher quantities and thus that larger countries tend to export higher quantities. Quantitatively, however the results are somewhat different with Hummels and Klenow (2005) who find that larger countries export only 37% higher quantities at 9% higher prices. For the BEC categories we find that for processed categories, countries with twice the GDP export 89% more quantities at slightly lower prices (-0.3%). The figures on quantity are lowest for primary goods at 53%, with the price effect being 0.9%, while the price effect is found to be largest for consumer goods at 6%. When decomposing GDP (Table B.10), we find that countries with twice the GDP per worker export 67% more goods at 33% higher prices. The quantity effect is largest for processed (107%) and capital (98%) goods, and lowest for primary (41%) and consumer (45%) goods. Countries with twice the labour force are found to export (total exports) 64% higher quantities at slightly lower prices. The effect on quantities is largest again for processed (87%) goods and smallest for primary (55%) goods.

We now consider import rather than export margins. The results in Table B.11 indicate that larger countries import more. In particular, an increase in relative GDP of 1% increases imports by 1% for total manufacturing imports. The results are similar for the different BEC categories, with the effects varying between 0.95% (primary) and 1.14% (capital goods). The higher imports of larger countries are again dominated by the intensive margin, with 82% of the greater imports of larger countries due to the intensive margin. This figure varies for the different BEC categories, ranging from 66% for primary to 88% for processed goods. These figures tend to be even higher than those for the export margins.

Table B.12 reports the results when splitting GDP into its components. The results indicate that richer countries and countries with a larger workforce import more, and that the majority of this higher trade occurs along the intensive margin (95% in richer countries and 80% in countries with a larger workforce). These figures again vary across the BEC codes. For richer countries the intensive margin accounts for 102% and 99% of the larger imports for capital and processed goods respectively, and a minimum value of 76% for primary goods. In countries with a larger workforce the percentage of the larger imports accounted for by the intensive margin range from 64% and 68% for primary and capital goods to 86% for processed goods.

Tables B.13 and B.14 report the effects of country size on prices and quantities. The results indicate that larger countries import higher quantities at slightly lower prices. While the size of the coefficient varies for quantities, being smallest for primary goods and largest for processed goods, the coefficients are always positive. For prices however, the coefficient does vary across BEC categories. For intermediate, primary and processed goods the coefficient is found to be negative, but is positive for capital and consumer goods. As such, while larger countries can in general import goods at lower prices, for capital and consumer goods the reverse is true. When decomposing GDP (Table B.14) we find that richer countries tend to import higher quantities at higher prices. This is also true for the BEC categories, with the coefficient being largest for processed and consumer goods for quantities, and consumer and capital goods for prices. Countries with a larger workforce however are able to import higher quantities at lower prices, with prices being between 2.5% and 5.1% lower (the exception being capital goods for which no significant coefficient on price is found).

3.4 Quality of traded intermediates

In this section we identify reasons behind the geographic shifts of sourcing patterns (see description in Section 3.1 above) and destination of exports of EU-27 countries and relate these shifts to changes in import (export) prices which may reflect changes in product quality. We do so first by relating changes in the market shares of the imports of the six country groups under consideration (EU-15, NMS-12, AOECD, Asia, BRIC, RoW) in total EU-27 imports to changes in the relative price of the products which can provide information on whether these changes are driven by price or quality competition. On the export side we similarly calculate unit value ratios and market shares: in this case however we are only able to relate shares of exports of the respective EU-27 countries in EU-27 total exports to the six country groups as the COMEXT dataset does not provide information on total world exports to these groups. The respective export prices are set in relation to the EU-27 exports prices to the particular regions. We again do these exercises by differentiating between end-use categories and broad industry aggregates. Firstly we shortly summarize the method applied.

Box 5

Calculations of unit value ratios

For this purpose let us denote the value of exports to the EU-27 of commodity i by country c in year t by v_{it}^{c} and the quantity (measured in tons) by q_{it}^{c}, the export unit value is defined as

$$u_{it}^{c} = \frac{v_{it}^{c}}{q_{it}^{c}}$$

The unit values of country c's exports to the EU are then compared to the unit values of total EU imports (from the world, including intra-EU trade) by calculating the logs of the unit value ratios

$$r_{it}^{c} = \ln \frac{u_{it}^{c}}{u_{it}^{EU-27}}$$

Here, $u_{it}^{EU-27} = \sum_c v_{it}^c \Big/ \sum_c q_{it}^c$ denotes the unit value of total EU imports for a particular commodity i in year t. Taking the logarithm ensures a symmetric aggregation across products for ratios larger and smaller than 1 (see below). In logs, the ratio is thus larger (smaller) than zero if the export unit value of country c is larger (smaller) than the unit value of total EU imports. We shall not present information at the very detailed (8-digit) product level but aggregate the unit value ratios to the level of product categories and industry groups. This is done by constructing a weighted sum of the unit value ratios r_{it}^{c} across the products belonging to a particular industry group j and product group k. The weight used for a particular commodity i in such an aggregation is the share of its export value in the industry's or product group's exports of country c. Denoting the set of commodities i belonging to an aggregate j,k by $i \in I(j,k)$ the weights are calculated as

$$w_{it}^{c} = \frac{v_{it}^{c}}{\sum_{k \in I(j,k)} v_{(j,k)t}^{c}}$$

The unit value ratio for a particular aggregate j,k is then

$$r_{(j,k),t}^{c} = \sum_{i \in I(j,k)} w_{it}^{c} r_{it}^{c}$$

This measure can be interpreted analogously to the unit value ratios for a particular commodity as mentioned above. Since we perform this exercise for groups of partner countries (i.e. countries exporting to the EU-27), index c has to be interpreted as a group of partner countries (e.g. Asian countries, BRIC countries, etc.).

The market shares of a particular country (group) c in EU-27 markets (or individual countries or country groups) is defined as

$$m_{(j,k),t}^{c} = \frac{v_{(j,k),t}^{c}}{v_{(j,k),t}^{EU-27}}$$

i.e. the export values from country c of product category (j,k) relative to total import values of EU-27.

For exports of the EU-27 we perform a similar exercise. However, one has to keep in mind that using the EU COMEXT database does not allow to use total exports to the world (from all countries) as a unit for comparison as this dataset provides information on exports and imports of EU-27 countries only, thus excluding trade flows between non EU members. Consequently, we have to define the unit value ratios for exports as

$$r_{it}^{c} = \ln \frac{u_{it}^{c}}{u_{it}^{EU-27}}$$

where u_{it}^{c} denotes the unit value of exports for country c being a member of the EU-27 and u_{it}^{EU-27} denotes the unit value of total EU-27 exports to the world. Export shares are defined as the share of country c's exports to the world in total EU-27 exports in the respective product and industry categories.

Below we summarize the findings in graphical form using the following scheme. If both market shares of a particular country group and the unit value ratios are changing positively we speak of a 'successful quality competition' (quadrant I). In the case that market shares are increasing, but unit values are falling we speak of 'successful price competition' (quadrant II). If both market shares and unit value ratios are declining we define it as 'unsuccessful price competition' (quadrant III). Finally, the situation of increasing unit value ratios but decreasing market shares is described by 'pricing oneself out of the market' (quadrant IV).

Figure 3.4.1

Schematic presentation of changes in market shares and relative prices

Imports by product categories

Let us first consider the import side. Table 3.4.1 reports the unit value ratios and market shares in 1999 and 2008 and the respective changes.

Considering first the unit value ratios in 1999 the striking fact is that these are negative for the NMS-12 and BRIC countries for all product categories. For Asian countries these are negative for consumer goods and those products not classified. For the NMS-12 the unit value ratios are relatively smaller for intermediate products and capital goods; for the Asian countries the unit value ratio is particularly low for those products not classified but positive for intermediates and capital goods. For the BRIC countries the unit value ratio is highest for the intermediates, but much lower for consumer goods and capital goods in particular. The advanced OECD countries show particularly high unit value ratios in all product categories with the exception of the products not classified.

Interpreting these differentials one might argue that the NMS-12 started off in 1999 with a comparatively low quality of products whereas Asian countries managed to sell (intermedi-

ates??) at quality levels even above EU-15. But this has changed quite a bit over time as can be seen from Figure 3.4.2 showing the unit value ratios in 1999 and 2008.

Table 3.4.1

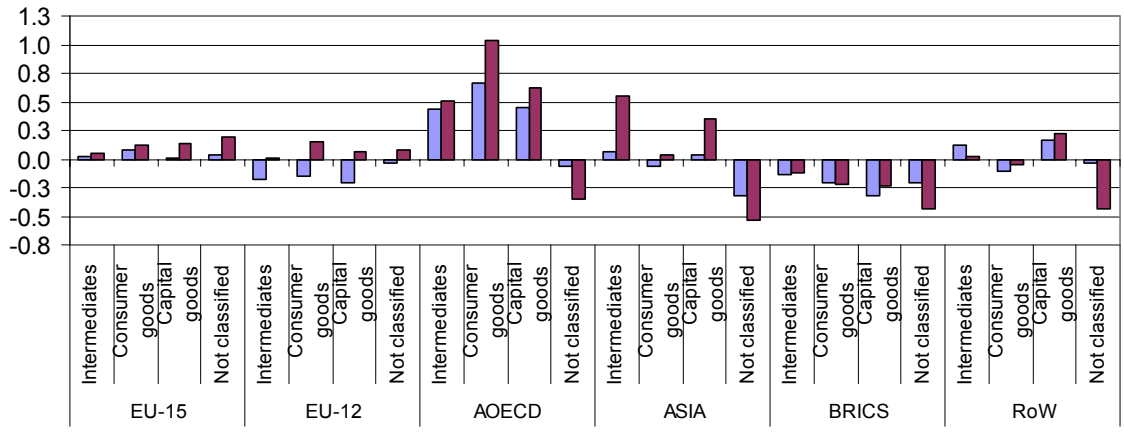
Unit value ratios and market shares, 1999 and 2008

		1999		2008		Change in	
Partner	Product category	unit value ratio	market share	unit value ratio	market share	unit value ratio	market share
EU-15	Intermediates	0.022	65.5	0.043	60.9	0.021	-4.6
	Consumer goods	0.082	62.0	0.122	59.0	0.040	-3.1
	Capital goods	0.011	60.4	0.141	55.1	0.130	-5.3
	Not classified	0.036	79.8	0.192	73.9	0.156	-5.9
NMS-12	Intermediates	-0.183	4.9	0.005	8.7	0.188	3.9
	Consumer goods	-0.145	5.6	0.143	8.8	0.288	3.2
	Capital goods	-0.211	2.6	0.061	6.8	0.272	4.2
	Not classified	-0.035	4.8	0.080	10.7	0.115	6.0
AOECD	Intermediates	0.432	16.4	0.507	11.1	0.075	-5.3
	Consumer goods	0.668	9.7	1.039	7.8	0.370	-1.9
	Capital goods	0.449	23.2	0.627	13.7	0.178	-9.5
	Not classified	-0.062	11.0	-0.354	8.8	-0.292	-2.2
ASIA	Intermediates	0.059	4.6	0.546	3.8	0.488	-0.8
	Consumer goods	-0.063	6.2	0.040	3.7	0.104	-2.5
	Capital goods	0.036	7.9	0.355	7.7	0.319	-0.2
	Not classified	-0.318	2.6	-0.541	2.2	-0.223	-0.5
BRICS	Intermediates	-0.134	3.7	-0.115	8.7	0.020	4.9
	Consumer goods	-0.213	8.3	-0.218	13.5	-0.005	5.2
	Capital goods	-0.324	3.3	-0.239	13.0	0.086	9.6
	Not classified	-0.204	0.4	-0.431	1.1	-0.226	0.7
RoW	Intermediates	0.118	4.9	0.021	6.7	-0.097	1.9
	Consumer goods	-0.112	8.2	-0.045	7.3	0.068	-0.9
	Capital goods	0.160	2.5	0.227	3.7	0.067	1.2
	Not classified	-0.033	1.5	-0.440	3.3	-0.406	1.8

Source: EU COMEXT; wiiw calculations

Figure 3.4.2

Unit value ratios by product categories, 1999 and 2008

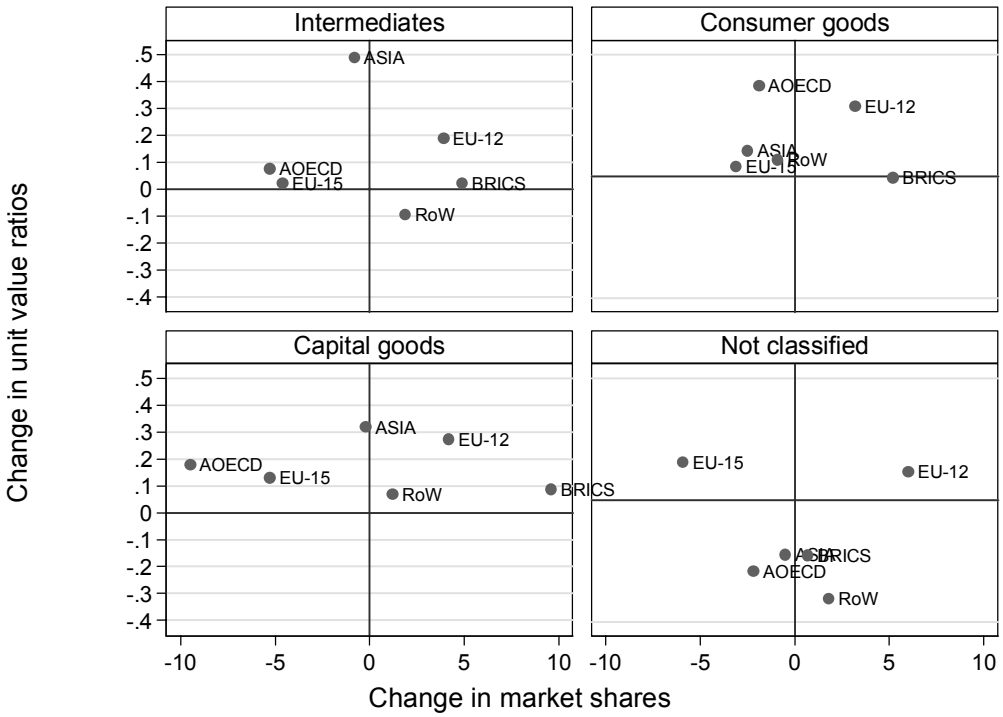


Source: EU COMEXT; wiiw calculations

The NMS-12 countries managed to close the gap in unit value ratios for all products. Comparing across product categories this was particularly the case for consumer goods and capital goods but less so for intermediate products. This is in stark contrast to the developments regarding the BRIC countries where the unit value ratios tended to remain more or less constant (only slightly increasing for capital goods), with strong declines found for products not classified. The Asian countries experienced strong increases in unit value ratios for intermediates and capital goods; the advanced OECD countries for all product categories with the exception of those not classified. Finally, for the EU-15 countries one also observes an increase in all categories, being largest for capital goods and those products not classified.

Figure 3.4.3

Change in market shares and unit value ratios, 1999-2008



Source: EU COMEXT; wiiw calculations

One has to bear in mind however that these changes in unit value ratios might reflect not only quality differentiation but also cost movements, the two of which are hard to disentangle. To investigate this in more detail we consider the scheme as indicated in Figure 3.4.1, which requires us to consider changes in market shares also. From Table 3.4.1 one can see that market shares declined for the EU-15 countries, Asian and advanced OECD countries, and increased for the NMS-12 and the BRIC group. There is however some differentiation across product categories: Whereas the advanced OECD countries lost market shares mostly in capital goods (-9.5 percentage points) and intermediates (-5.3 percentage points) the BRIC countries gained market shares in capital goods (9.6 percent-

age points) and also – but to a lesser extent – in intermediates (4.9 percentage points) and consumer goods (5.2 percentage points). For the EU-15 and NMS-12 these changes are less differentiated across product categories.

Figure 3.4.3 now presents the relationship between changes in market shares and changes in unit value ratios which can be interpreted according to the scheme in Figure 3.4.1.

The figure reveals different movements by country groups and product categories. Starting with intermediates the Asian countries have been successful in selling at higher unit value ratios with very little losses in terms of market shares. The advanced OECD and EU-15 countries lost market shares with only small observed changes in unit value ratios (though slightly increasing), whereas the BRIC countries managed to gain market shares without significant changes in unit value ratios. This would indicate that there was a substitution process going with intermediates from advanced economies being replaced by those from the BRIC countries. One should note in this respect that unit value ratio differences for intermediates are relatively low (compared to other product categories) for intermediates (see Figure 3.4.2). Only the NMS-12 countries developed accordingly to what was named 'successful quality competition', i.e. rising unit value ratios and gaining market shares simultaneously. For consumer goods the situation is somewhat similar though a little less pronounced. In particular, in this case the advanced OECD countries show relatively large increases in unit value ratios with relatively minor losses in market shares, while Asian countries lost market shares and only small increases unit value ratios. Again BRIC countries and the NMS-12 managed to increase their market shares, the former group at constant unit value ratios and the latter group at higher unit value ratios. The largest changes in market shares occurred with respect to capital goods. The advanced OECD and EU-15 countries lost to the BRIC and NMS-12 countries. The Asian countries managed to keep their market shares at higher unit value ratios. For those products not classified (including important categories such as motor cars) the most important changes in market shares can be observed between the EU-15 and NMS-12 countries with the first group losing market shares (-6 percentage points) at higher unit value ratios and the second group gaining market shares (6 percentage points) at higher unit value ratios. The other country groups show fewer significant changes in market shares but at lower unit value ratios indicating that the BRIC countries have been successful in competing in price levels whereas the advanced OECD and Asian countries have been unsuccessful in this respect.

Imports by product categories and industry groups

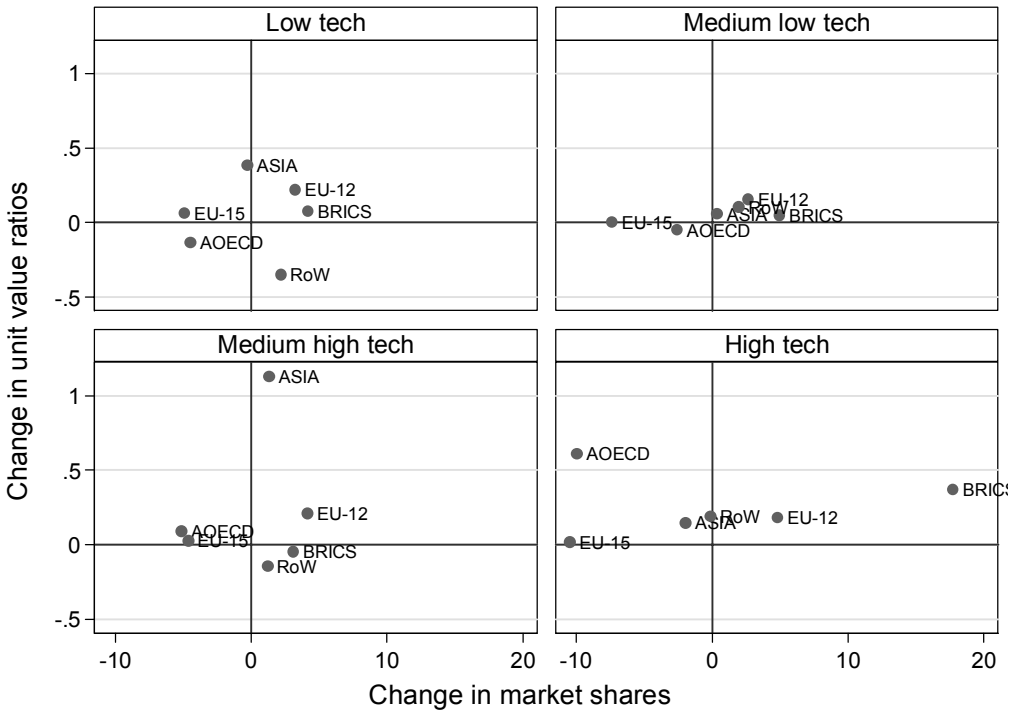
A similar exercise can be undertaken when considering trade in product categories for the four different industry groups introduced above (low-tech, medium-low-tech, medium-high-tech, and high-tech). This may yield additional insights with respect to differences across industry and country groups. We start by considering changes in unit value ratios and mar-

ket shares of intermediate products in the four industry groups. These are presented in Figure 3.4.4.

The EU-15 countries lost market share at almost unchanged unit value ratios in all industry groups, with losses being largest in medium-low- and high-tech industries. NMS-12 countries gained market shares at higher unit value ratios in all industry groups without much differentiation across industry groups. The BRIC countries also show increases in all industry groups with only minor changes in unit value ratios. The exception however is the high-tech industry group where the BRIC countries gained almost 20 percentage points in market shares at – compared to changes of unit value ratios in other industry groups – higher prices. The advanced OECD countries lost market shares in all industry groups but particularly so in the high-tech industries where also unit value ratios increased relatively strongly for this country group. Finally, the Asian countries more or less defended their market shares in all product categories. A striking aspect is the large increase in unit value ratios in medium-high-tech industries pointing towards higher quality.

Figure 3.4.4

Change in market shares and unit value ratios for intermediates by industry groups, 1999-2008



Source: EU COMEXT; wiiw calculations

It is interesting to compare these changes with those for consumer goods which are presented in Figure 3.4.4. The most interesting aspect is that the NMS-12 countries strongly gained in market shares in the high-tech industries at moderately higher unit value ratios

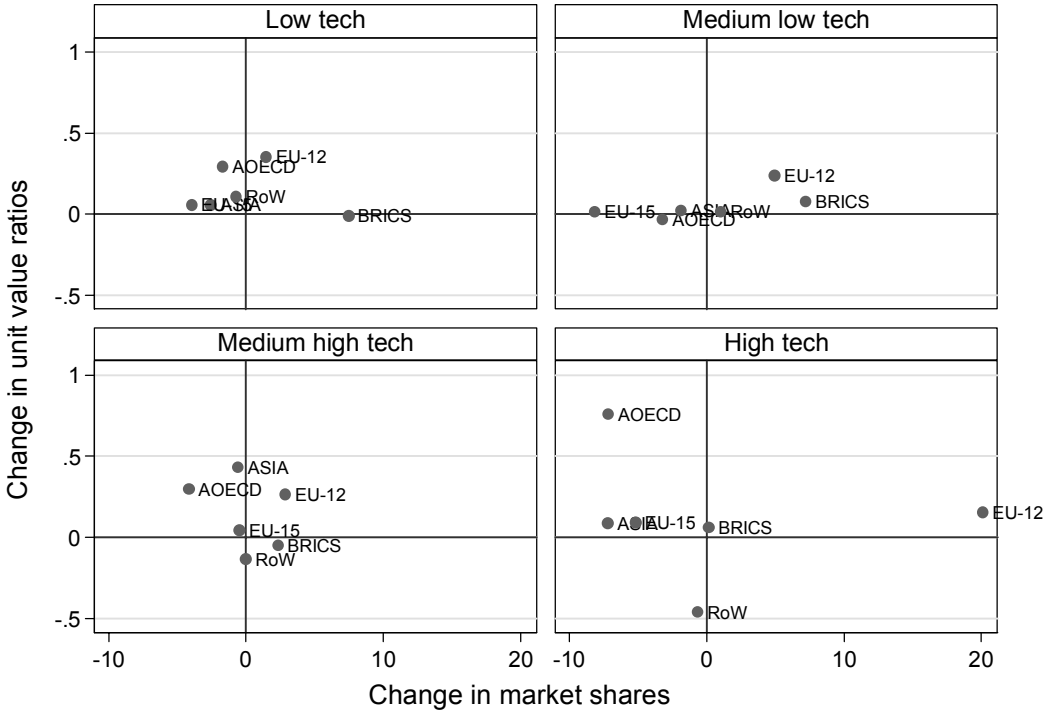
while for the BRIC countries no change in market shares can be observed. The other patterns are comparable to those found for intermediate products though changes in unit value ratios seems to be less pronounced (e.g. for Asian countries in medium-high-tech industries).

Figures 3.4.5 and 3.4.6 present these changes for capital goods and those products which are not classified according to end-use categories.

Without going into detail the most striking aspects are that for capital goods the BRIC countries gained mostly in low- and high-tech industries where losses for EU-15 countries were relatively high. It is also interesting to note that BRIC countries show a decrease in unit value ratios in low-tech but an increase in unit value ratios in high-tech industries, pointing towards successful price competition in the low-tech industries, but successful quality competition in the high-tech sectors. For the remaining product categories the situation is somewhat different as the NMS-12 gained most in market shares, in particular in medium-low- and medium-high-tech industries. Again, the EU-15 are the most important losers in terms of market shares in these two industry groups, though they gained a little in low-tech industries with falling unit value ratios however.

Figure 3.4.5

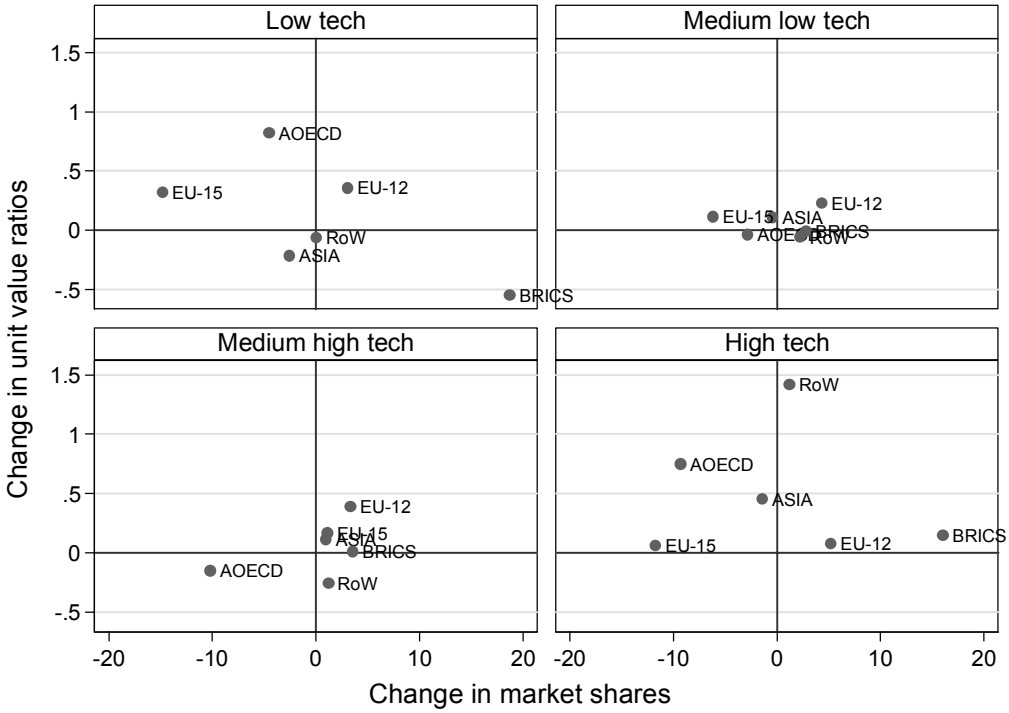
Change in market shares and unit value ratios for consumer goods by industry groups, 1999-2008



Source: EU COMEXT; wiiw calculations

Figure 3.4.6

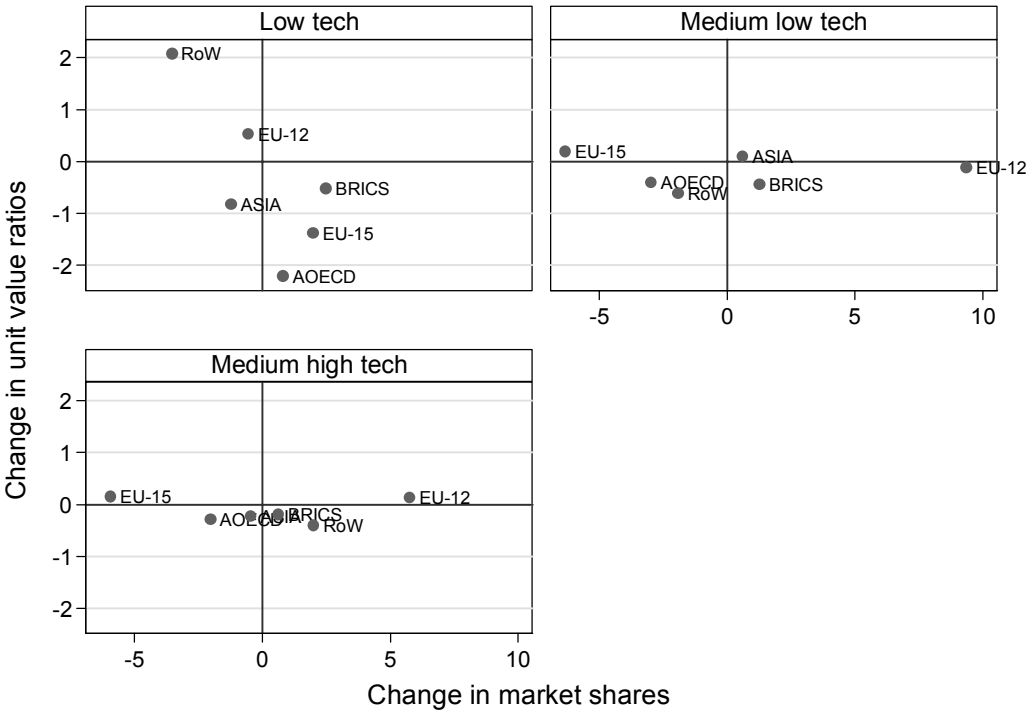
Change in market shares and unit value ratios for capital goods by industry groups, 1999-2008



Source: EU COMEXT; wiiw calculations

Figure 3.4.7

Change in market shares and unit value ratios for goods not classified by industry groups, 1999-2008



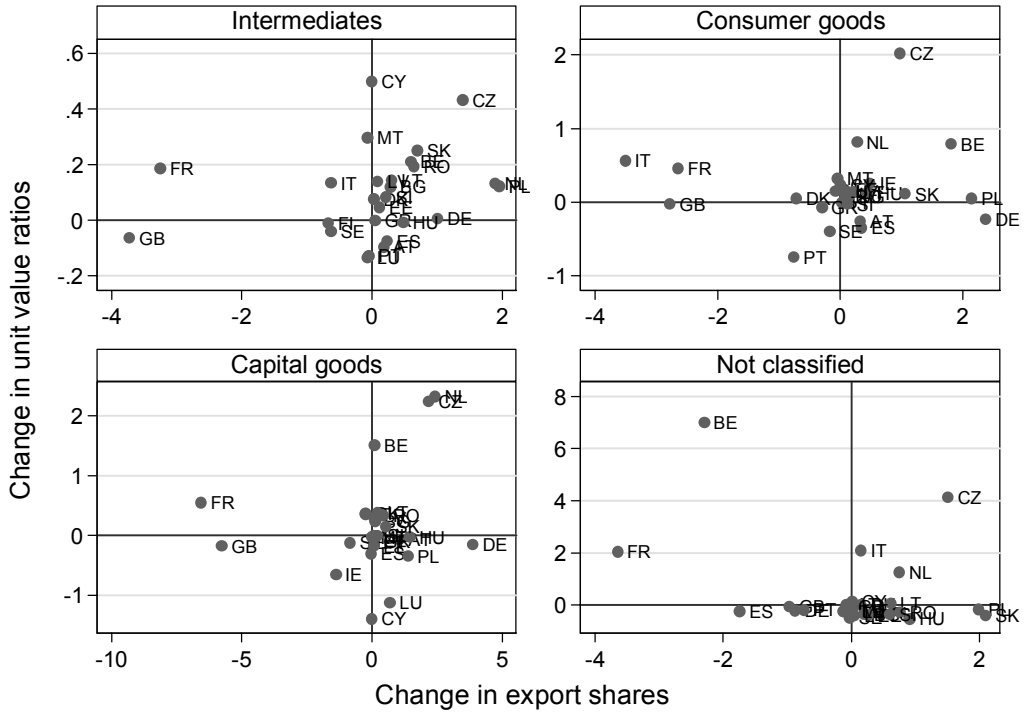
Source: EU COMEXT; wiiw calculations

Exports

As already noted above, trade in intermediates does not only imply importing intermediate products for use in the domestic production process but also exporting intermediates which for some countries makes up an important part of trade. Countries are not only users but also producers of intermediates.

Figure 3.4.8

Change in export shares and unit value ratios by product category, 1999-2008



Source: EU COMEXT; wiiw calculations

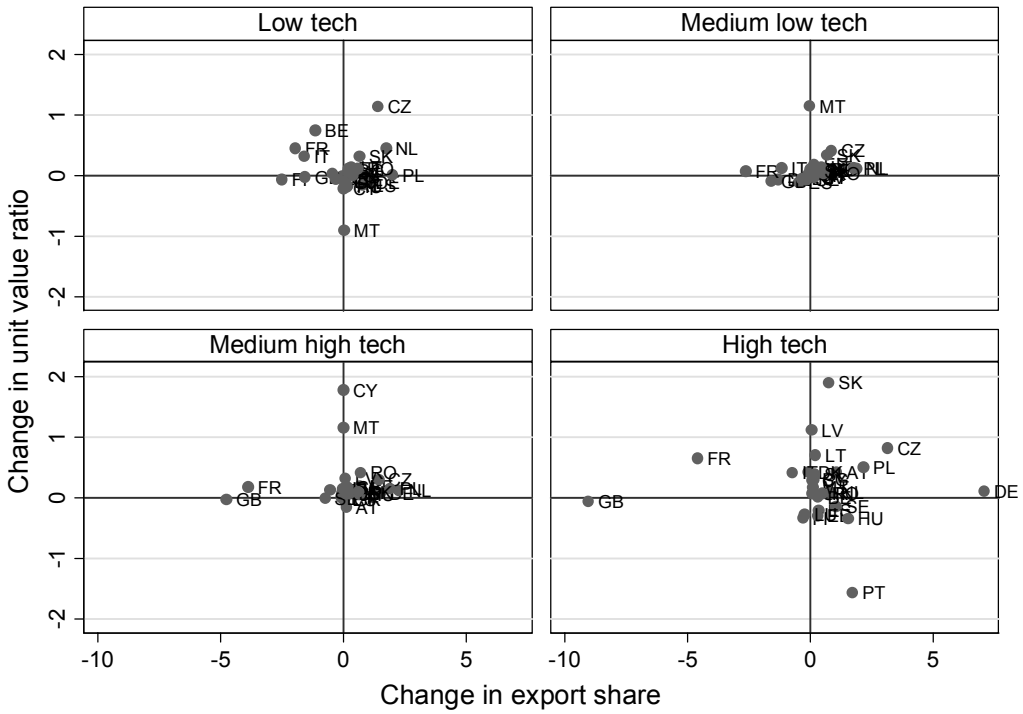
Figure 3.4.7 presents the results following the method outlined above for exports. We immediately split the products into the end-use categories considered. From this figure it is apparent that France and Great Britain faced a loss in export shares in almost all product categories, Italy in consumer goods and Belgium in products not classified. One should notice that the change in market shares for these countries can be rather large in particular groups (4 to 5 percentage points) whereas the gains in market shares for the other countries are lower and more spread across countries (the exception being Germany for capital goods). The loss in market shares in France, Italy and Belgium occurred alongside higher prices. Second, there are a number of countries gaining export shares at higher prices (thus performing a successful quality upgrading in the sense of Figure 3.4.1). In particular, a number of NMS-12 countries gained shares at higher unit value ratios in intermediates suggesting that these countries successfully upgraded their exports for intermediate products. This is less so for consumer goods (with the exception of Czech Republic) and capital goods.

An analogous exercise can now be performed at the level of industry or industry groups. In Figure 3.4.8 we show this for trade in intermediate products.

The most striking feature in this graph is that most dynamics in terms of market shares are observed in the medium-high- and high-tech industries. In particular, Great Britain and France are losing export shares in these two industry groups whereas Germany is gaining in the high-tech group. Some Eastern European countries (Slovakia, the Czech Republic, Poland) experience both increases in unit value ratios and market shares. In fact in these two groups most countries are gaining at the expense of France and Great Britain.

Figure 3.4.9

Change in export shares and unit value ratios for intermediates by industry groups, 1999-2008



Source: EU COMEXT; wiiw calculations

3.5 Diversification and concentration of trading patterns

Another aspects concerns the diversification of exports and imports both in terms of products and countries of origin (in case of imports) and destination (in case of exports) respectively. This topic was already addressed in a certain sense in section 3.3 above when we discussed the developments in the intensive and extensive margins. In this section we however refer more to the issue whether countries are more diversified with respect to the product ranges trade and the number and relative importance of partner countries. For example, a larger diversification makes countries less vulnerable to country-specific or

industry-specific demand shocks and thus reduces the vulnerabilities of countries as exporters. On the importer side a higher diversification would imply a lower dependency on specific suppliers which might make it easier to exploit cost advantages. One generally might expect that smaller countries and less developed countries tend to be more specialized. Regarding product categories one might expect that trade in intermediates is less diversified as supplier-client relations are more important.

From the discussion above one should expect an increase in trade diversification along both dimensions. In the recent past we have witnessed a movement towards trade liberalization, developments in information and communication technologies allowing one to collect information on export markets and import possibilities more easily, a general trend towards lower transport costs, and so on. For the EU-27 countries in particular a further factor has been the increasing intra-EU trade integration from which countries might have benefitted by diversifying their spatial export and import structures. These factors would lead to more diversification with respect to countries to be exported to or imported from. With respect to the product space countries expand their extensive margins due to learning processes, the engagement of more firms in international trade and possibly a structural shift towards more trade oriented industries.

Box 6

Measuring concentration and diversification

A convenient tool to look at the general trends in diversification is to employ inequality measures as recently done in the literature (see Wacziarg and Welch, 2008, De Benedictis and Tamberi, 2004; De Benedictis et al., 2008; UNIDO, 2009). In this study we rely on the Gini index. Other measures such as the Theil index, the Herfindahl index, and so on have also been considered, but did not yield qualitatively different results. The Gini index is a measure in the range of 0 and 1. A value of zero would indicate equality, i.e. no specialization or high diversification, a value of 1 complete inequality or high specialization and little diversification. The Gini coefficient is calculated – separately for each country – as

$$G = (csh_n - csh_{n-1})(2n-1)/N$$

.

Here, G denotes the Gini index for each country, csh_n denotes the cumulative share of product n (where products are ranked by value from lowest to the highest), and N denotes the total number of products traded (exported or imported) in the EU-27. This latter allows for a comparison across countries. An analogous expression is used for diversification across partner countries where n would denote the partner country and N the total number of trading partners of the EU-27. From the formula above one can see that if a country would be specialized in one product only the Gini coefficient would be one, while if exports or imports are spread equally across all products the coefficient would be zero. An analogous interpretation holds for the specialization (or diversification) with respect to destination or supplier countries. Later we shall look at both dimensions, i.e. on the Gini in products and countries which allows to see if some countries are specialized more in product space, country space, or both.

Diversification and specialization in total trade

We first present the results for total exports and imports along both dimensions (products and partner countries) in Table 3.5.1 and 3.5.2 respectively for all EU-27 countries and the years 1999 and 2008. These tables also include the respective number of products or trading partners.

A few interesting aspects emerge from these calculations: First, the degree of specialization is rather high for all countries for both imports and exports with a Gini coefficient above 0.8 in all cases. Second, comparing exports and imports one finds that export concentration is higher than import concentration though differences are quite small in some cases (e.g. Italy). The average difference between export and import concentration is 6.7 (in 1999) and 5.4 (in 2008) Gini points (i.e. percentage points), thus slightly decreasing. Third, concentration tended to increase for imports (with a few exceptions such as Bulgaria, France, and Romania) but tended to be stable for exports.

Table 3.5.1

Gini coefficient of trade specialization and diversification in product space, 1999 and 2008

	Imports				Exports			
	1999		2008		1999		2008	
	Number	Gini	Number	Gini	Number	Gini	Number	Gini
AT	9131	0.819	8543	0.826	8239	0.877	7894	0.875
BE	9327	0.831	8701	0.855	8875	0.870	8361	0.879
BG	7682	0.834	7933	0.831	6138	0.920	6290	0.921
CY	7103	0.840	6823	0.884	2757	0.915	2002	0.933
CZ	8960	0.820	8491	0.844	7994	0.873	7830	0.890
DE	9312	0.824	8536	0.831	8830	0.841	8087	0.840
DK	8592	0.809	8339	0.828	7600	0.883	7745	0.889
EE	7906	0.832	7488	0.855	5385	0.922	5733	0.915
ES	9177	0.833	8640	0.839	8693	0.869	8351	0.859
FI	8563	0.840	8037	0.855	7423	0.941	6503	0.938
FR	9498	0.820	8870	0.819	9123	0.860	8496	0.858
GB	9273	0.833	8730	0.834	9085	0.861	8609	0.872
GR	8695	0.847	8190	0.850	6422	0.918	6638	0.915
HU	6865	0.830	6567	0.861	4818	0.902	4608	0.911
IE	8633	0.877	8129	0.869	6026	0.957	5705	0.967
IT	9336	0.824	8740	0.827	9067	0.835	8473	0.831
LT	7628	0.827	7642	0.843	5530	0.928	6526	0.921
LU	8226	0.893	7997	0.921	5363	0.956	5832	0.967
LV	7466	0.839	7667	0.853	4526	0.941	5924	0.897
MT	6737	0.903	6347	0.900	2322	0.978	1963	0.972
NL	9078	0.849	8590	0.862	8553	0.879	8380	0.887
PL	8862	0.819	8497	0.830	8133	0.893	7824	0.891
PT	8683	0.832	8355	0.836	6803	0.923	7026	0.908
RO	8253	0.837	8274	0.830	5998	0.928	6236	0.920
SE	8914	0.834	8369	0.836	8326	0.913	7828	0.902
SI	8250	0.831	8100	0.853	6546	0.908	7118	0.906
SK	8126	0.830	8022	0.865	6176	0.921	6256	0.932
EU-27	9666	0.791	9004	0.801	9664	0.798	8995	0.808

Source: EU COMEXT; wiiw calculations

With respect to partner countries one can find somewhat more variation in the concentration measures. These tend to be lower for smaller and/or less developed countries (in terms of GDP per capita). Nonetheless the Gini tends to be above 0.85. Comparing the coefficients over time one finds a decline in a number of cases (meaning more diversification) or only slight increases. This holds for imports but even more so for exports. Thus there seems to be a tendency for countries to differentiate their import and export structures in terms of trading partners. Comparing import and export concentration it seems that in general the former are more concentrated than the latter (though there are a few exceptions).

Table 3.5.2

Gini coefficient of trade specialization and diversification in partner country space, 1999 and 2008

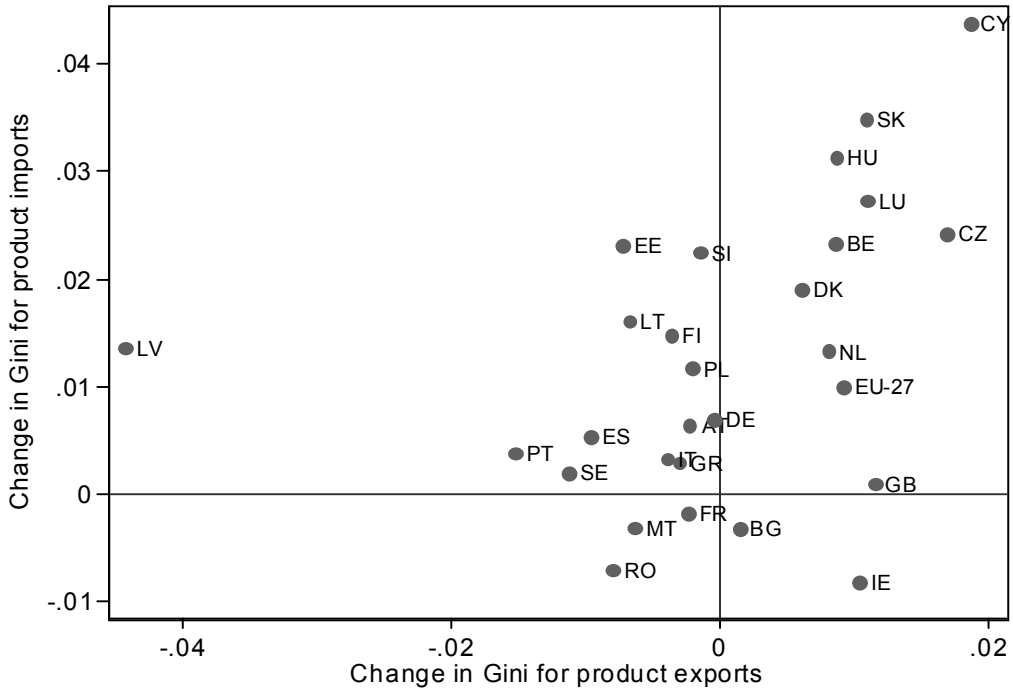
	Imports				Exports			
	1999		2008		1999		2008	
	Number	Gini	Number	Gini	Number	Gini	Number	Gini
AT	183	0.944	204	0.944	211	0.921	217	0.897
BE	194	0.924	222	0.926	220	0.929	230	0.919
BG	173	0.895	161	0.882	170	0.879	193	0.868
CY	161	0.881	153	0.881	154	0.824	161	0.843
CZ	192	0.931	182	0.929	193	0.927	206	0.920
DE	215	0.903	219	0.905	221	0.894	234	0.884
DK	177	0.914	212	0.918	215	0.907	224	0.902
EE	162	0.914	141	0.898	135	0.918	165	0.909
ES	201	0.919	203	0.898	213	0.894	225	0.887
FI	162	0.913	184	0.912	210	0.894	213	0.878
FR	213	0.919	223	0.920	220	0.883	230	0.874
GB	216	0.904	222	0.903	221	0.896	233	0.885
GR	190	0.912	180	0.884	205	0.880	198	0.869
HU	189	0.922	182	0.915	182	0.932	198	0.899
IE	182	0.945	198	0.945	210	0.934	206	0.931
IT	211	0.905	216	0.892	220	0.882	224	0.855
LT	140	0.865	149	0.885	122	0.875	169	0.894
LU	126	0.947	137	0.951	180	0.938	185	0.928
LV	106	0.852	134	0.881	129	0.897	183	0.912
MT	121	0.904	138	0.904	133	0.930	152	0.891
NL	204	0.906	223	0.906	221	0.923	233	0.908
PL	210	0.923	199	0.919	200	0.914	212	0.905
PT	182	0.934	181	0.926	202	0.939	209	0.923
RO	174	0.912	163	0.896	171	0.897	189	0.884
SE	201	0.925	216	0.921	214	0.899	221	0.885
SI	193	0.928	147	0.888	162	0.916	184	0.900
SK	170	0.934	170	0.929	164	0.929	191	0.916
EU-27	223	0.904	235	0.902	224	0.884	235	0.873

Source: EU COMEXT; wiiw calculations

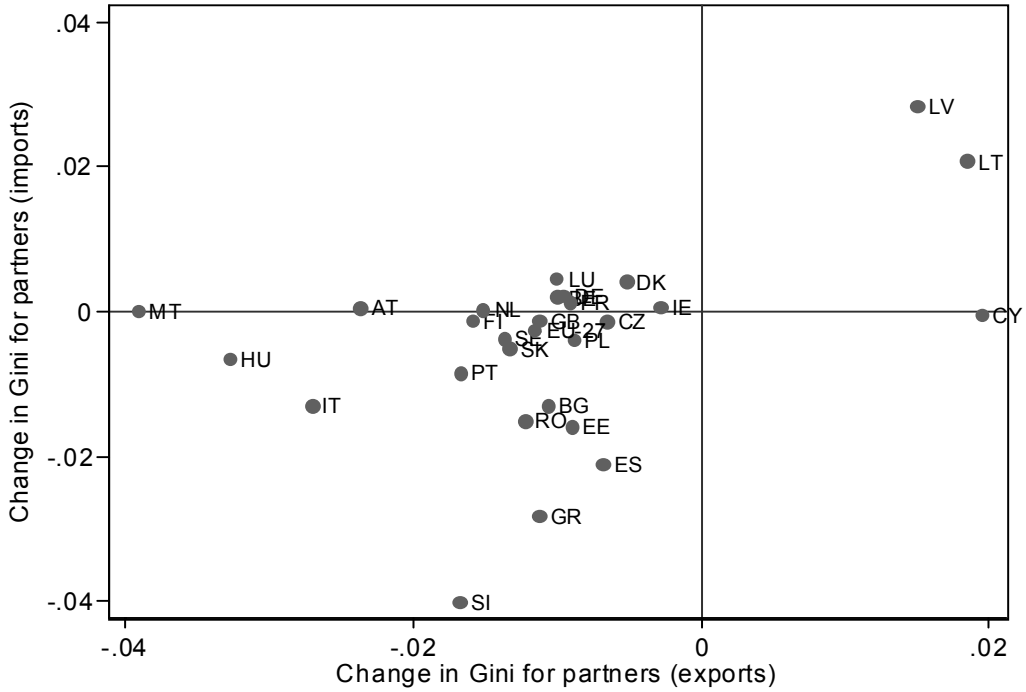
Figure 3.5.1

Change in concentration and diversification patterns in total trade, 1999-2008

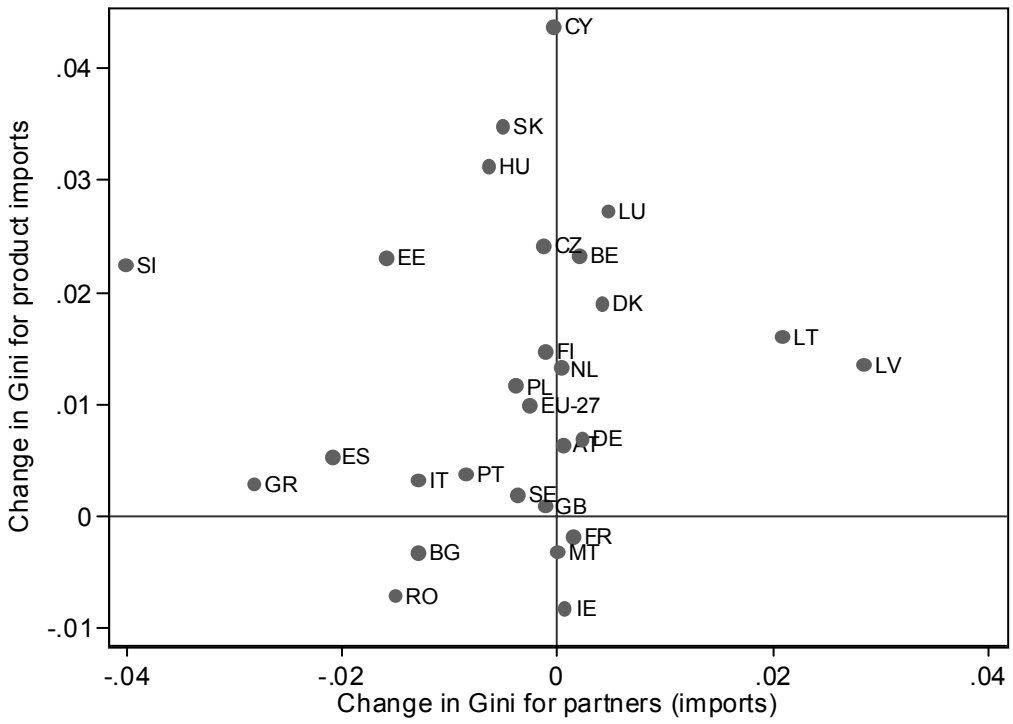
Panel a)



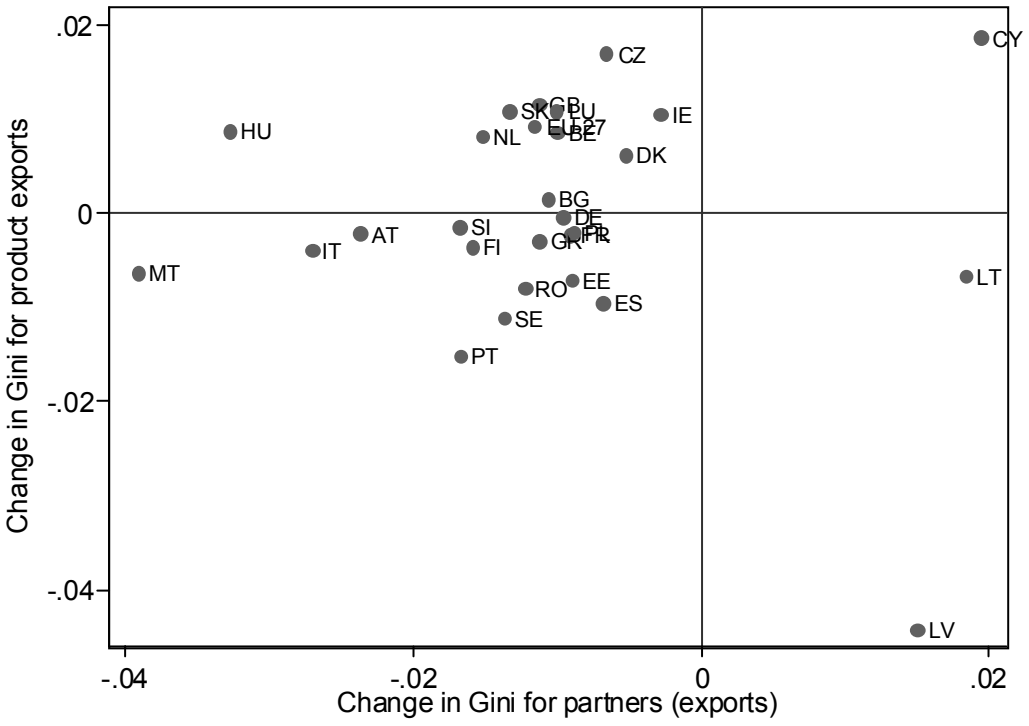
Panel b)



Panel c)



Panel d)



Source: EU COMEXT; wiiw calculations

This information is graphically summarized in Figure 3.5.1. Panel a shows that there is a number of countries which tended to become more specialized with respect to products (both for exports and imports). These countries are Slovakia, Hungary, the Czech Republic, Luxembourg, Belgium, Denmark, the Netherlands, and the EU-27 as a total. The second large group comprises countries which have specialized in terms of imported products but de-specialized in terms of exported products. The largest shifts are found for Estonia, Lithuania, Spain, Sweden, Portugal and Latvia. A few countries have de-specialized in terms of imported products but only to a small extent.

Panel b presents a similar graph with respect to the export markets or sourcing countries. Here one can see that – apart from some small countries such as Latvia, Lithuania and Cyprus – all have de-specialized in their export markets and most also with respect to the sourcing countries. The largest changes in both directions are found for Hungary, Italy, Portugal, Bulgaria, Romania, Estonia, Spain, Greece and Slovenia.

It is also interesting to look at these patterns relating imports by products and sourcing countries on the one hand and exports by products and destination countries on the other. This is shown in Panels c and d respectively. Without going into detail the important result is that for imports we can see an increasing concentration in the product space, but smaller changes or even de-specialization with respect to sourcing countries. This can be compared to the changes with respect to exports: In this case all countries de-specialized with respect to partner countries (except Cyprus, Lithuania, and Latvia) though there is not a common pattern concerning concentration or specialization in terms of products.

Diversification and specialization in intermediates trade

We now consider whether these patterns and the respective changes are distinct for the subset of intermediate products. In Tables 3.5.3 and 3.5.4 we report the corresponding figures for imports and exports in both the product and country space respectively. With respect to concentration in the product space we find similar magnitudes compared to total trade though the number of products is of course smaller. However, there is much less significant change over time for imports as we found for total trade. For exports we again find relatively small changes over time. Similar to total trade we find higher concentration in exports compared to imports.

Table 3.5.4 reports the concentration measures for exports for the subset of intermediate products. The number of supplying countries tends to be smaller than for total imports as shown in Table 3.5.2. As for total trade the number of destination countries for exports is again larger, but still smaller than for total trade, though the difference between the figure for total trade is lower. Thus there seems to be a pattern that intermediate inputs are sourced from a smaller set of countries. One distinct pattern also seems to be that there

were more significant changes over time in particular with respect to import concentration which can seen from the graphs below.

Table 3.5.3

Gini coefficient of trade specialization and diversification in partner country space for intermediate products, 1999 and 2008

	Imports				Exports			
	1999		2008		1999		2008	
	Number	Gini	Number	Gini	Number	Gini	Number	Gini
AT	5116	0.813	4769	0.827	4559	0.879	4306	0.875
BE	5230	0.825	4873	0.844	4947	0.849	4640	0.864
BG	4368	0.804	4421	0.822	3180	0.927	3288	0.933
CY	3838	0.843	3536	0.909	1089	0.916	760	0.942
CZ	5092	0.808	4758	0.840	4575	0.867	4343	0.878
DE	5211	0.812	4804	0.827	4866	0.804	4435	0.815
DK	4798	0.803	4642	0.831	4057	0.880	4157	0.904
EE	4307	0.842	4072	0.865	2724	0.934	2885	0.926
ES	5163	0.817	4812	0.840	4801	0.847	4604	0.840
FI	4848	0.841	4497	0.856	4085	0.938	3463	0.932
FR	5324	0.797	4971	0.813	4987	0.826	4629	0.838
GB	5234	0.827	4904	0.829	5077	0.842	4833	0.858
GR	4843	0.828	4534	0.837	3296	0.919	3461	0.924
HU	4027	0.832	3642	0.858	2528	0.902	2340	0.892
IE	4822	0.876	4500	0.868	3096	0.963	2872	0.970
IT	5248	0.798	4903	0.808	5010	0.823	4682	0.826
LT	4257	0.818	4182	0.839	3030	0.936	3379	0.933
LU	4358	0.900	4236	0.916	2449	0.954	2773	0.957
LV	4059	0.833	4128	0.869	2343	0.956	2911	0.917
MT	3575	0.937	3230	0.933	1042	0.988	770	0.978
NL	5053	0.833	4837	0.852	4694	0.864	4658	0.882
PL	5098	0.806	4779	0.820	4462	0.889	4306	0.889
PT	4858	0.817	4639	0.831	3561	0.920	3668	0.914
RO	4676	0.826	4640	0.818	3256	0.925	3422	0.920
SE	5052	0.836	4691	0.844	4666	0.901	4376	0.899
SI	4757	0.822	4511	0.851	3693	0.901	4008	0.898
SK	4655	0.824	4430	0.869	3418	0.916	3382	0.912
EU-27	5415	0.772	5031	0.789	5415	0.776	5025	0.792

Source: EU COMEXT; wiiw calculations

As for total trade we find that countries tend to become more specialized in imported products whereas for exported products the pattern is mixed. A number of the NMS-12 group however seem to de-specialize in exports as might be expected (Panel a). In Panel b one finds that more countries de-specialize in terms of export partners, though one should note that the scale is smaller as might be expected for intermediates good trade. With respect to import partners there is also general tendency to de-specialize; somewhat more significantly for some countries such as Slovenia, Estonia and Spain. There are only a few countries which tend to increase specialization (Austria, Luxembourg, Denmark and Latvia). Finally, similarly to total trade this results in a general tendency towards increasing spe-

cialization in imported products and to a lower concentration in terms of export partners (Panels c and d).

Table 3.5.4

Gini coefficient of trade specialization and diversification in partner country space for intermediate products, 1999 and 2008

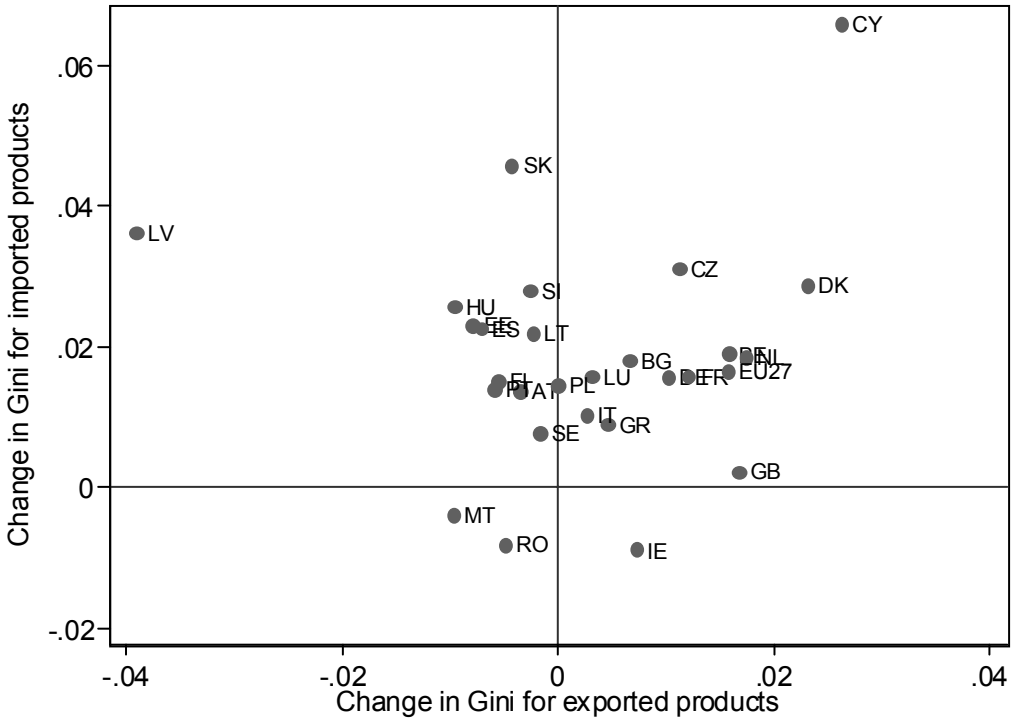
	Imports				Exports			
	1999		2008		1999		2008	
	Number	Gini	Number	Gini	Number	Gini	Number	Gini
AT	164	0.940	190	0.943	205	0.927	210	0.904
BE	180	0.919	210	0.917	213	0.922	226	0.918
BG	151	0.880	140	0.866	154	0.878	187	0.879
CY	116	0.831	116	0.840	100	0.844	117	0.887
CZ	163	0.930	153	0.923	186	0.934	201	0.928
DE	209	0.906	206	0.905	220	0.890	234	0.889
DK	151	0.915	200	0.925	210	0.907	217	0.902
EE	133	0.916	107	0.872	131	0.907	144	0.895
ES	185	0.918	189	0.889	206	0.889	219	0.884
FI	139	0.904	163	0.902	202	0.895	210	0.889
FR	201	0.923	214	0.916	218	0.898	226	0.889
GB	203	0.899	210	0.895	220	0.898	228	0.888
GR	175	0.898	163	0.858	198	0.863	186	0.869
HU	175	0.924	155	0.905	175	0.942	181	0.919
IE	161	0.940	168	0.932	201	0.933	201	0.931
IT	199	0.894	207	0.878	215	0.879	220	0.860
LT	112	0.848	117	0.860	114	0.861	162	0.893
LU	94	0.934	118	0.944	173	0.934	176	0.924
LV	87	0.844	107	0.866	115	0.896	168	0.895
MT	92	0.902	108	0.894	100	0.928	136	0.905
NL	193	0.907	214	0.901	221	0.925	229	0.915
PL	199	0.926	177	0.914	196	0.916	204	0.908
PT	168	0.926	160	0.909	199	0.937	201	0.923
RO	145	0.903	145	0.877	164	0.860	173	0.880
SE	178	0.926	196	0.920	206	0.899	218	0.888
SI	165	0.919	125	0.863	156	0.919	175	0.903
SK	145	0.930	142	0.918	156	0.923	175	0.929
EU-27	223	0.907	233	0.898	224	0.887	235	0.879

Source: EU COMEXT; wiiw calculations

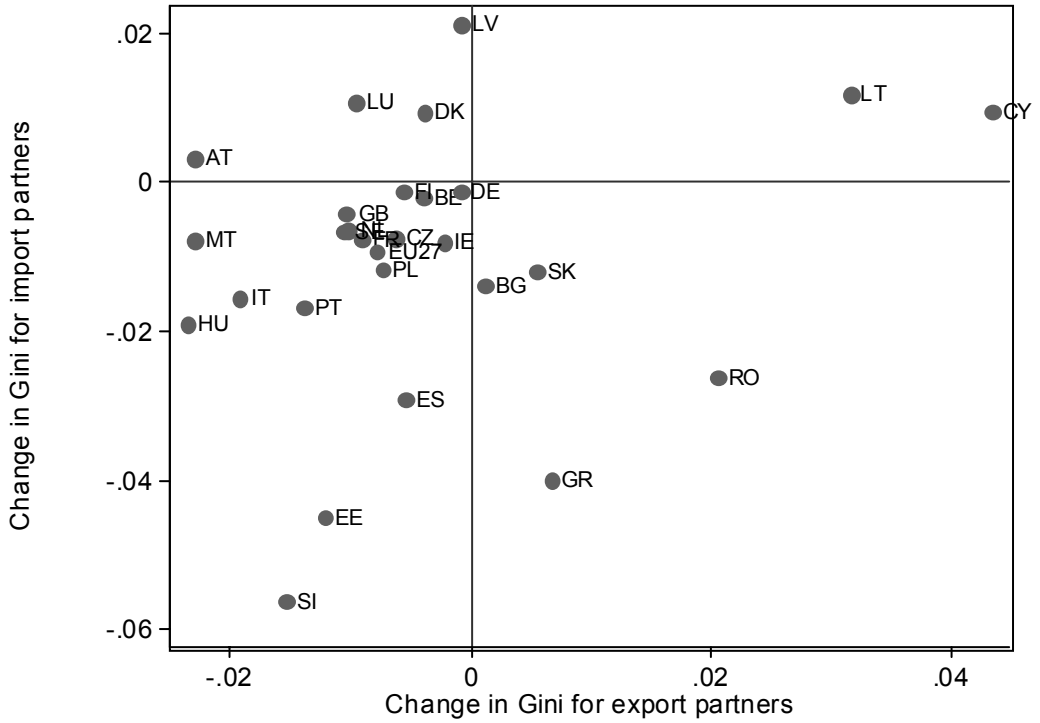
Figure 3.5.2

Change in concentration and diversification patterns in intermediates trade, 1999-2008

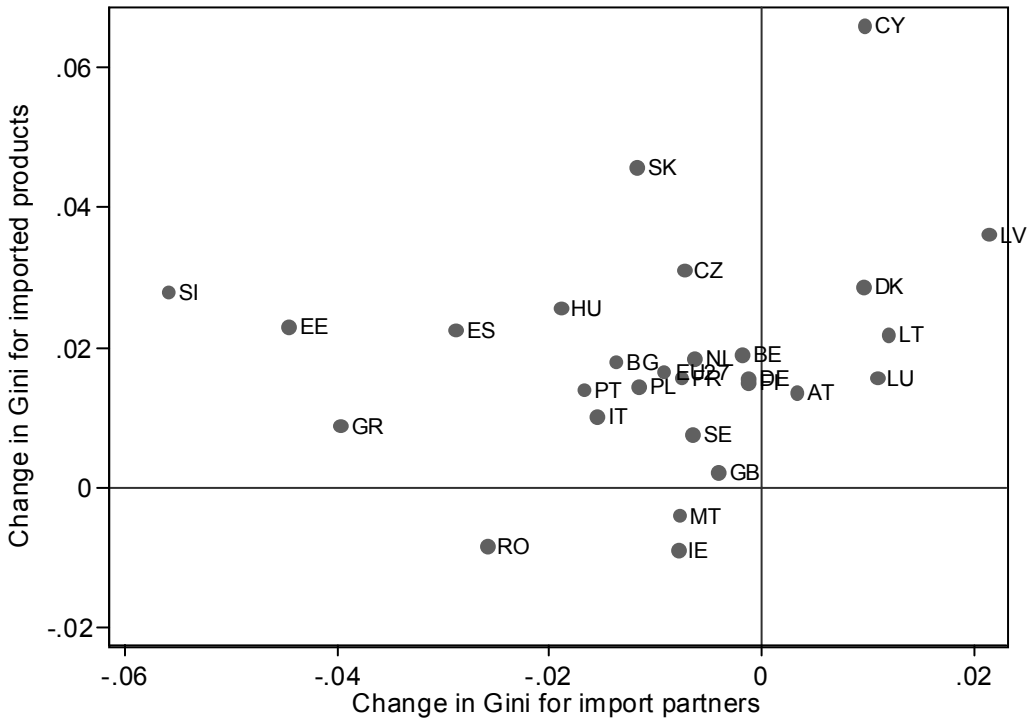
Panel a)



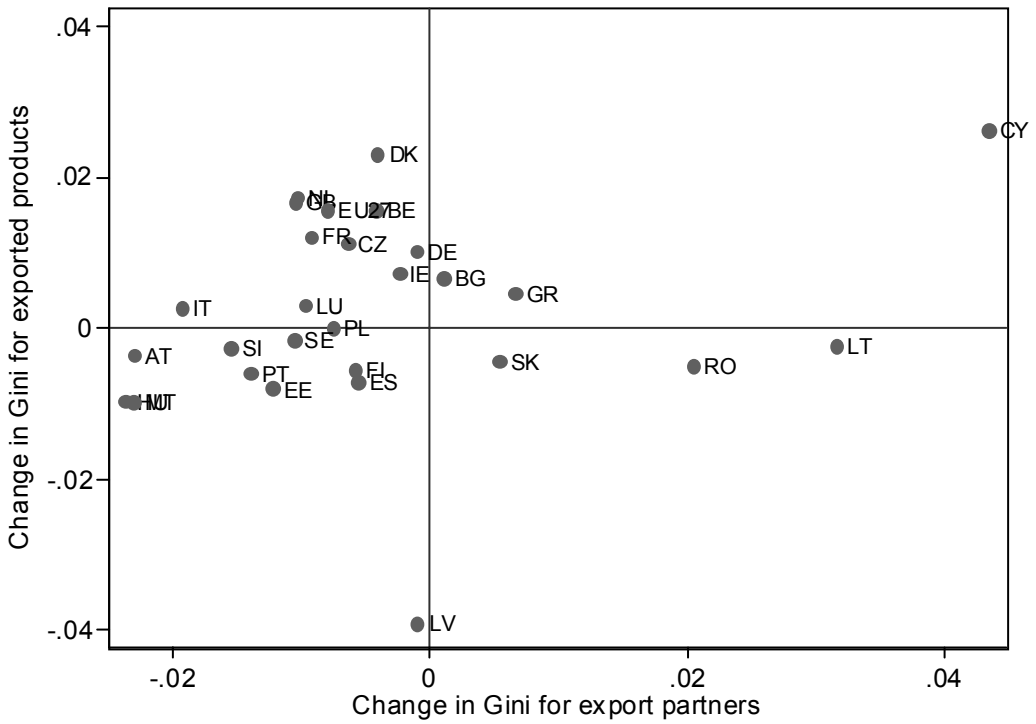
Panel b)



Panel c)



Panel d)



Source: EU COMEXT; wiiw calculations

3.6 Summary

In this chapter we looked at the patterns of trade in intermediates and its changes over time using detailed trade data. Let us summarize the most important findings: We first focused on the overall share of intermediates trade which is the most important part with about 50% on average with significant cross-country differences however. This share was only slightly increasing over the period 1999-2008 with between industry shifts being the more important explanation for the rising share. There have however been significant changes with respect to the geography of trade in intermediates with NMS-12 and BRIC countries gaining shares in EU-27 imports and exports. The chapter further pointed out that there is no particular pattern across countries with respect to specialization patterns by end-use categories which therefore is more driven by industry structure. However, there is a significant share of intra-industry trade up to 60% observed which is similar across end-use categories. The NMS-12 countries and the BRIC countries have gained market shares – as already mentioned above – and additionally seemed to have upgraded overall quality of their products exported to EU-27 markets which is even more significant for NMS-12 countries. With respect to other trade statistics trade in intermediates does not behave too differently from other product categories though there are some detailed differences as outlined above.

4 Manufacturing supply chains and services

So far the analysis was based on detailed trade data providing information on which products (or product groups) are traded with which countries. In particular with respect to imports we looked at the structure of imported products which are typically produced by a given industry. However, when considering intermediate inputs this does not say anything about the using industry of this particular product (e.g. a semi-conductor or light pulps might be used in different industries as intermediates). The main question related to this is then to which extent is the output of manufacturing used in services and vice versa? And, to which extent the inputs in a particular industry are sourced domestically and from abroad? Such information is available from input-output (or supply and use) tables. Additionally, these tables in some cases provide information whether these intermediate inputs are sourced domestically are from abroad. However, there is no information on the country of origin of these products. Additionally, using input-output tables also provides some further information on the interlinkages between industries including services. For the latter also information on imports is available. The chapter continues providing a case study which exemplifies the inter-industry linkages – both domestic and internationally – in an even more detailed way.

The aim of this chapter is therefore to analyse these interlinkages between manufacturing and services in a descriptive manner. The analysis will be based on the EU KLEMS data which distinguish intermediates input by energy, material and services. These data are

based on the respective use tables for each country and allows including 19 countries in the analysis. For this we focus mainly on the inputs of services in manufacturing and on material inputs in services. One should note here that this analysis is based on nominal values. In the following section we then study the share of imported intermediates by industry group in more detail. This analysis will be based on total and domestic input-output tables provided by Eurostat (at purchaser's prices; current values). In the final section of this part, we then use input-output methods (see Miller and Blair, 2009, for an extensive treatment) to study the direct and indirect interlinkages of industries together with the effect of potentially increasing import of intermediates. In particular we provide calculations of output multipliers and their changes over time for both the total and the domestic tables. For a detailed outline of the compilation of European supply and use and symmetric input output tables see Eurostat (2008). The main result is that the share of service inputs in manufacturing industries is about 10% and 25% on average with large country differences. Further, there seems to be no common trend across countries over time. The share of material inputs in services is higher with about 30% with country differences being less pronounced. The share of imported intermediates depends very much on the sector considered but is typically higher for manufacturing industries as compared to services. Though, overall inter-industry linkages have been increasing over the time period considered as measured by total output multipliers, the domestic multipliers – i.e. not considering imported intermediates – have been rather constant, pointing towards the increasing importance of imported intermediates.

4.1 Interlinkages between manufacturing and services

In this section, interlinkages between manufacturing and services are investigated from the manufacturing's point of view. On the one hand, manufacturing uses service inputs, i.e. it acts as a client of the service sector and hence creates a pull factor (i.e. demand for service inputs as intermediates). On the other hand, manufacturing sells its products to the services sector, i.e. it supplies products and hence acts as a pull factor (see European Commission, 2009, p.79).

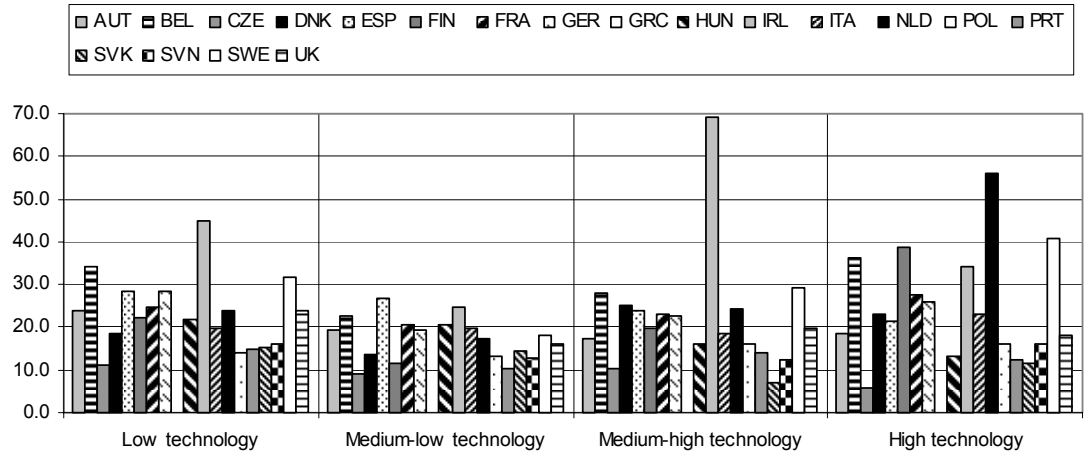
The pull effect is measured by the share of service inputs in manufacturing industries which are classified by technology categories. Service inputs include both market and non-market services and represent the direct services component embodied in manufacturing here (for the direct and indirect effects measured by a multiplier see later on). The push effect is captured by the share of material inputs in services, detailed by service categories. For details on classification of material and service inputs see Timmer et al. (2008).

Looking at the pull effect of manufacturing first, Figure 4.1.1 displays the share of service inputs in four manufacturing industry groups. Overall, high-tech industries take up the largest share of service inputs in 2005 (the average over countries is 24.4%), hence creating the largest pull effect, followed by low-tech industries (23%) and medium-high-tech indus-

tries (22%). Medium-low-tech industries require slightly less service inputs (17% on average). Interestingly, these figures hide large differences across countries: in general, the new EU member states and Portugal show smaller service shares across all manufacturing industries (with the only exception of Hungary, which has a relatively higher service input share in medium-low-tech industries). It is the Czech Republic which exhibits the relatively lowest service input shares among manufacturing industries. Ireland, Sweden and Belgium show the largest service input shares. Ranges between the smallest and largest shares are large and most pronounced for the medium-high-tech industries (7% service inputs in Slovakia and 70% in Ireland).

Figure 4.1.1

Share of service inputs in total inputs (current prices), 2005



Source: EU KLEMS database, wiiw calculations.

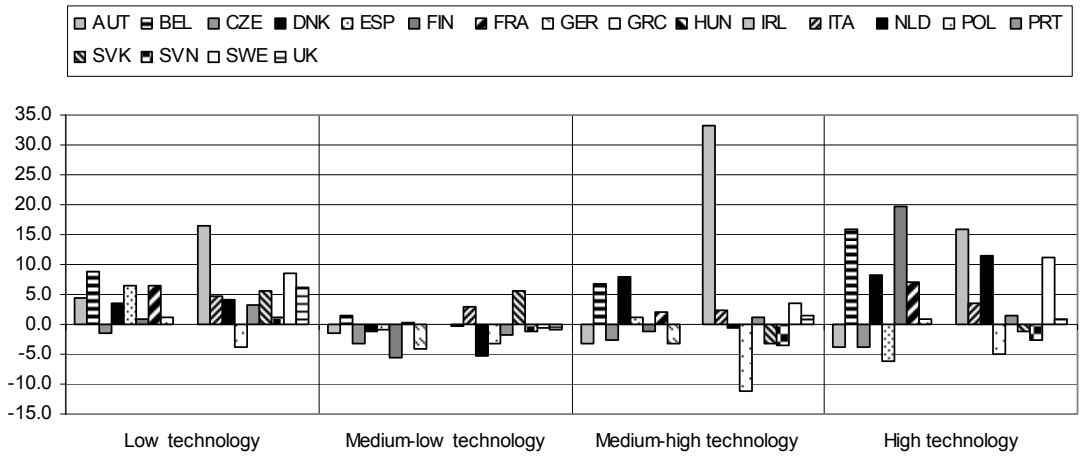
When looking at changes in the share size between 1995 and 2005 (see Figure 4.1.2), service input shares increased in low-tech industries in almost all countries which might be interpreted as (domestic or foreign) outsourcing to upgrade production. In high-tech industries as well as in medium-high-tech industries, many countries saw service input shares increase, although at lower rates in the latter category. Only in medium-low-tech industries did service input shares decrease in most countries. Differences among countries are again marked. Particularly, the new EU member states display – surprisingly – decreasing service input shares in all four technology categories (Slovakia is a slight exception, in that low-tech service input shares and especially medium-low-tech service input shares increased). This is particularly surprising given the generally lower shares of services in total manufacturing inputs in those countries.

Looking at the push effect of manufacturing now, Figure 4.1.3 displays the share of material inputs in four service categories. Overall, material inputs account for an average of 33% in Trade & hotels (GH) and in Community Services (LP), creating the largest push effects in these services industries. The share is smaller in Business Services (JK, 22%) and also

in Transport services (I, 16%). Generally, country differences are less pronounced with larger differences being found in Business Services (JK). Interestingly, the new EU member states are among those countries with relatively large input shares especially in Business Services (JK) and Community Services (LP).

Figure 4.1.2

Share of service inputs in total inputs (current prices), p.p. change 1995-2005

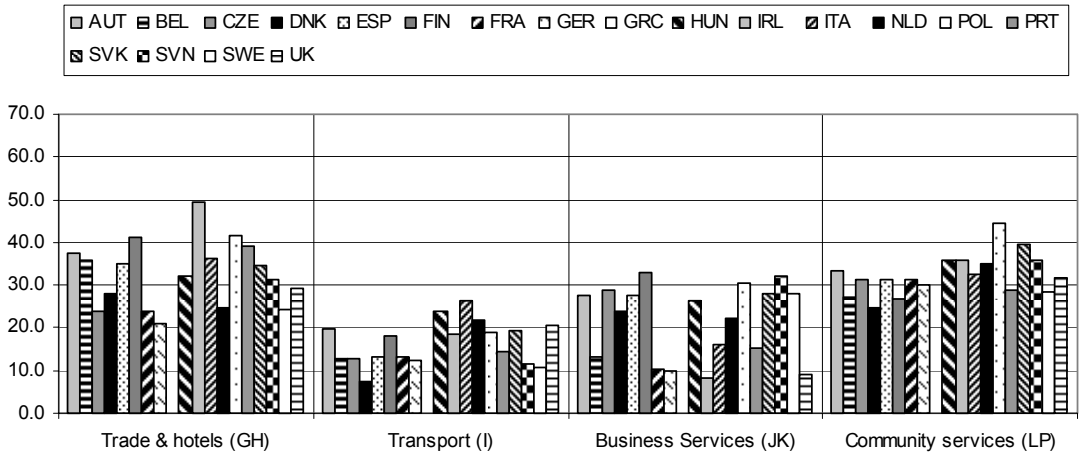


Source: EU KLEMS database, wiiw calculations.

Material input shares declined between 1995 and 2005 in all service categories and among all countries (see Figure 4.1.4). Variations are less marked; Poland is the only country where material input shares increased in three service industries.

Figure 4.1.3

Share of material inputs in total inputs (current prices), 2005

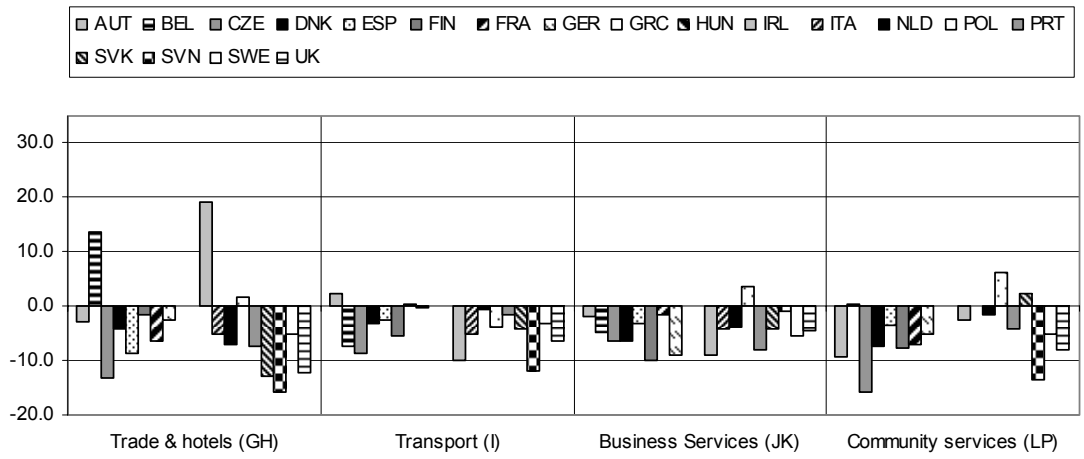


Source: EU KLEMS database, wiiw calculations.

Overall it thus seems that the push factor of manufacturing on services is slightly larger (on average) than the direct pull factor. However, while the former declined over the last ten years, the pull effect increased largely.

Figure 4.1.4

Share of material inputs in total inputs (current prices), p.p. change 1995-2005

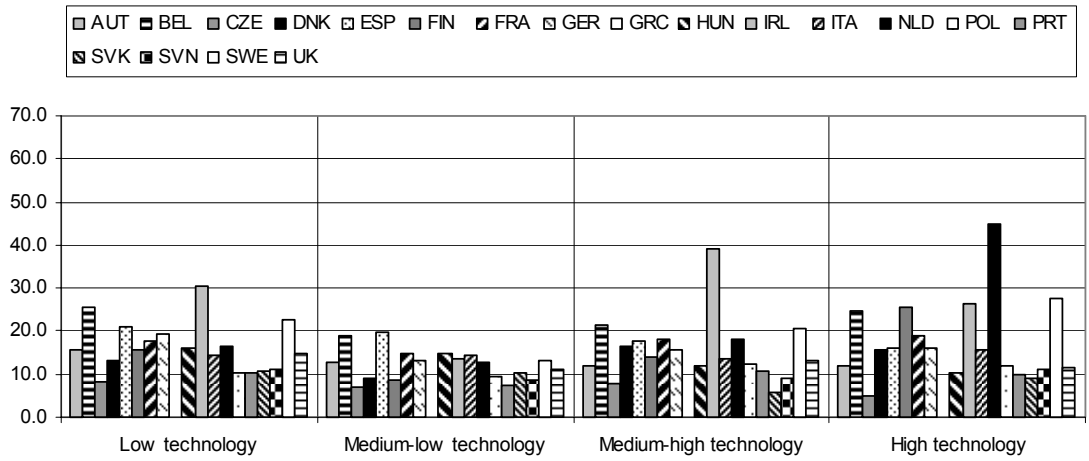


Source: EU KLEMS database, wiiw calculations.

Using a second measure, i.e. the share of service inputs in gross output, yields the same picture as above only at a lower level (compare Figure 4.1.5 to Figure 4.1.1). Again, high-tech industries take up the largest share of service inputs in 2005 (on EU average 17%), followed by the low-tech (16%) and medium-high-tech industries (15%). Medium-low-tech industries require on average about 12% of services inputs. (The difference is due to value added, which is relatively large for high-tech industries and lowest for the medium-low-tech industries.) Country differences are shrinking, although country rankings remain the same: Once again, the new member states and Portugal exhibit the smallest service shares, while Ireland, Sweden and Belgium show the largest shares. It is now the high-tech industries for which the range between the smallest and the largest share becomes most pronounced, with 5% in the Czech Republic and 45% in the Netherlands.

Figure 4.1.5

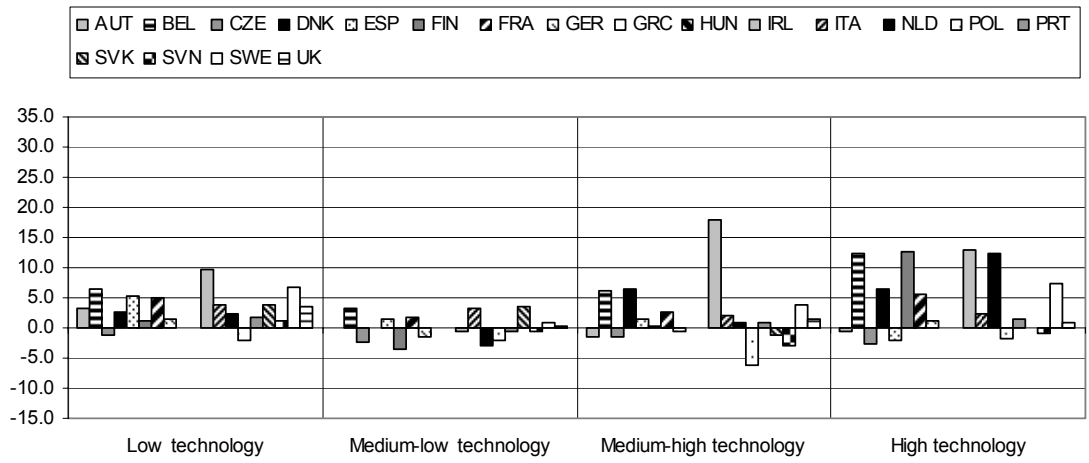
Share of service inputs in gross output (current prices), 2005



Source: EU KLEMS database, wiiw calculations.

Figure 4.1.6

Share of service inputs in gross output (current prices), p.p. change 1995-2005

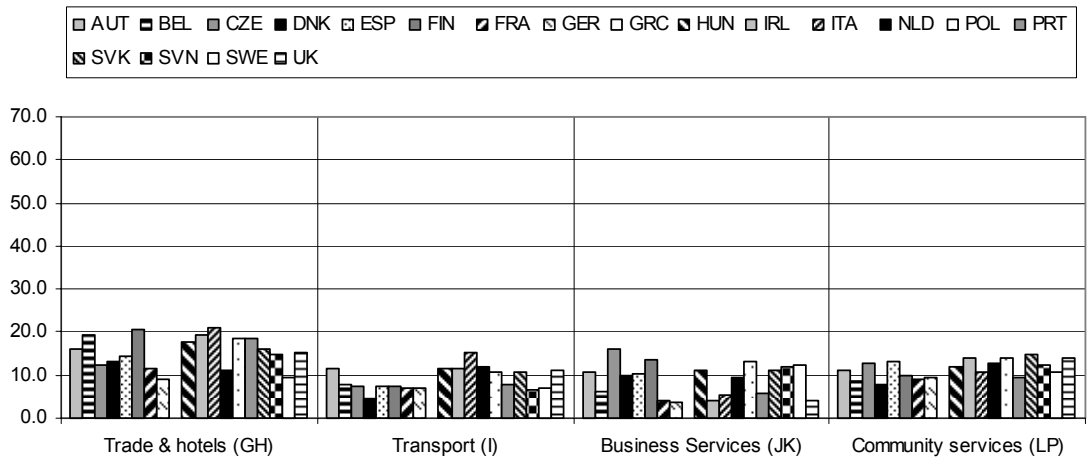


Source: EU KLEMS database, wiiw calculations.

Also changes in the share size between 1995 and 2005 resemble those above (compare Figure 4.1.6 to Figure 4.1.2). Service shares increased for almost all countries in the low-tech industries. Also in the high-tech industries and the medium-high-tech industries most countries experienced a rising services share. Only in the medium-low-tech industries is the picture mixed. (In the medium-low- and the medium-high-tech industries some countries saw a share increase compared to a share decline in the first measure. This would imply a fall in value added.) Again, the services share fell mostly in the new member states.

Figure 4.1.7

Share of material inputs in gross output (current prices), 2005



Source: EU KLEMS database, wiiw calculations.

Using the second measure, the share of material inputs in gross output, gives a quite equalized picture on a lower level (compare Figure 4.1.7 to Figure 4.1.5): Overall, material

inputs account for an average of 15% of gross output in Trade & hotels (GH), for 12% in Community Services (LP) and for about 9% in Transport services (I) and also Business Services (JK). Again, country differences are less pronounced. Once again, the new EU member states are among those countries with relatively large input shares especially in Business Services (JK, Czech Republic with 16%) and Community Services (LP, Slovakia with 15%).

Figure 4.1.8

Share of material inputs in gross output (current prices), p.p. change 1995-2005

Source: EU KLEMS database, wiiw calculations.

Between 1995 and 2005 material input shares declined in all service categories and in almost all countries (but in less than in the previous measure, compare Figure 4.1.8 to Figure 4.1.6). Variations are less marked; again Poland is the only country where material input shares increased in three service industries

4.2 Imports of intermediate inputs by industry

Having analysed the structures and changes in (direct) inter-industry linkages we investigate here the structure and respective changes in imported versus domestically sourced intermediates. Specifically, patterns of imported intermediate inputs by using industry will be analysed focusing on cross-industry and cross country differences. This analysis is again based on Eurostat symmetric input-output tables (product by product) which are computed for the total economy, the domestic economy and for imports. As a consequence, the role of imports in the economy can be investigated in more detail and we will look at the share of intermediate imports in total intermediate inputs. Data are only available for the benchmark years 1995, 2000 and 2005.

Looking first at the shares of imported intermediates in total intermediates in four manufacturing industries (see Figure 4.2.1), data show that imported intermediates are most

important in high-tech industries, where they account on average for 55% of total inputs in 2005. Imports still compose 50% of all intermediates in medium-high-tech industries and 48% in medium-low-tech industries. Low-tech industries require substantially less imports, amounting to some 30% of intermediates on average. Interestingly, mainly the new EU member states Estonia, Slovakia, Hungary and Slovenia, but also Ireland and to some part also Austria show the largest import shares in substantially all technology categories. This may be due to the fact of being small open economies (Romania does not hold large shares) on the one hand, but also due to the increased need of imported intermediates for the new member states on the other, not supplying the necessary inputs domestically. In high-tech industries the differences among countries are most pronounced: imported intermediates amount to 94% in Estonia, 89% in Hungary, 85% in Ireland and 76% in Slovakia on the upper range, and 29% in France and 33% in Germany on the lower range.

Figure 4.2.1

Share of imported intermediates in total intermediate inputs (current prices)

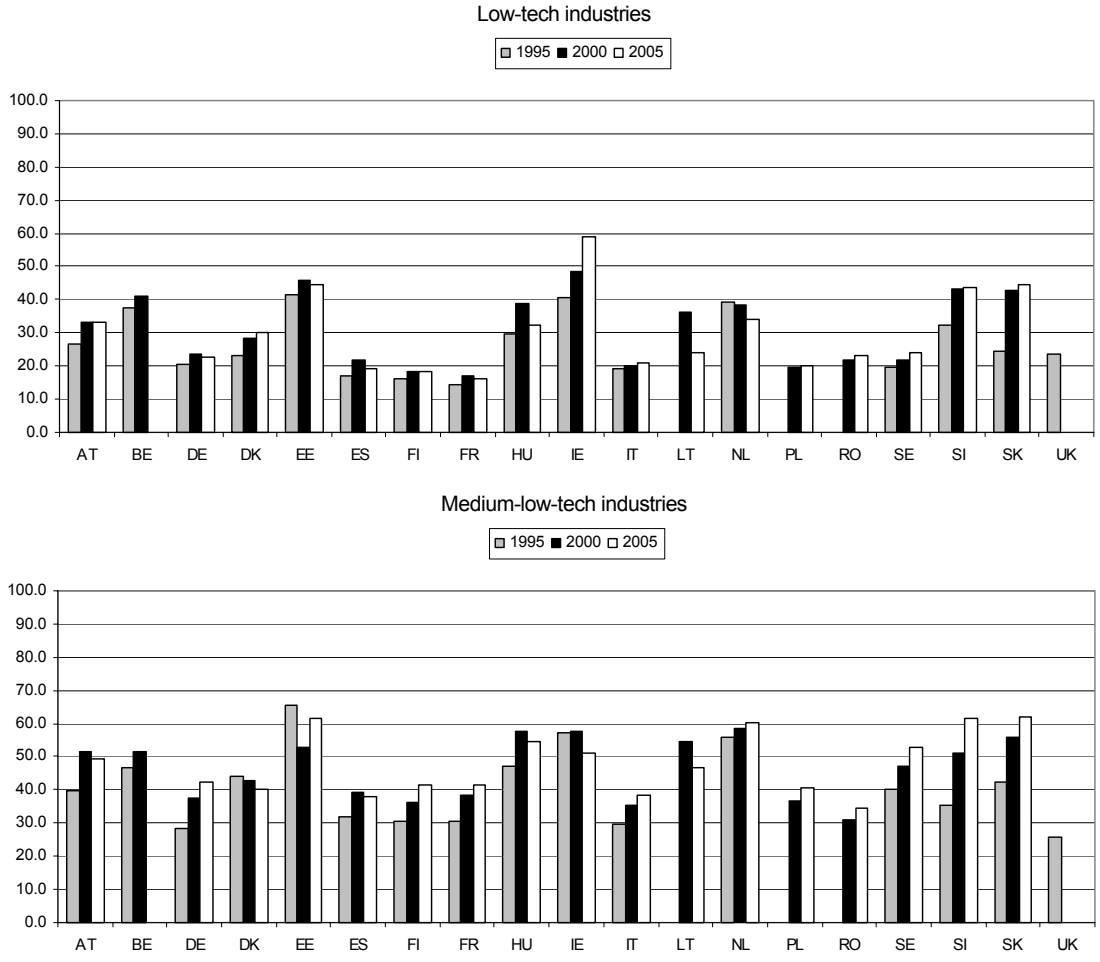
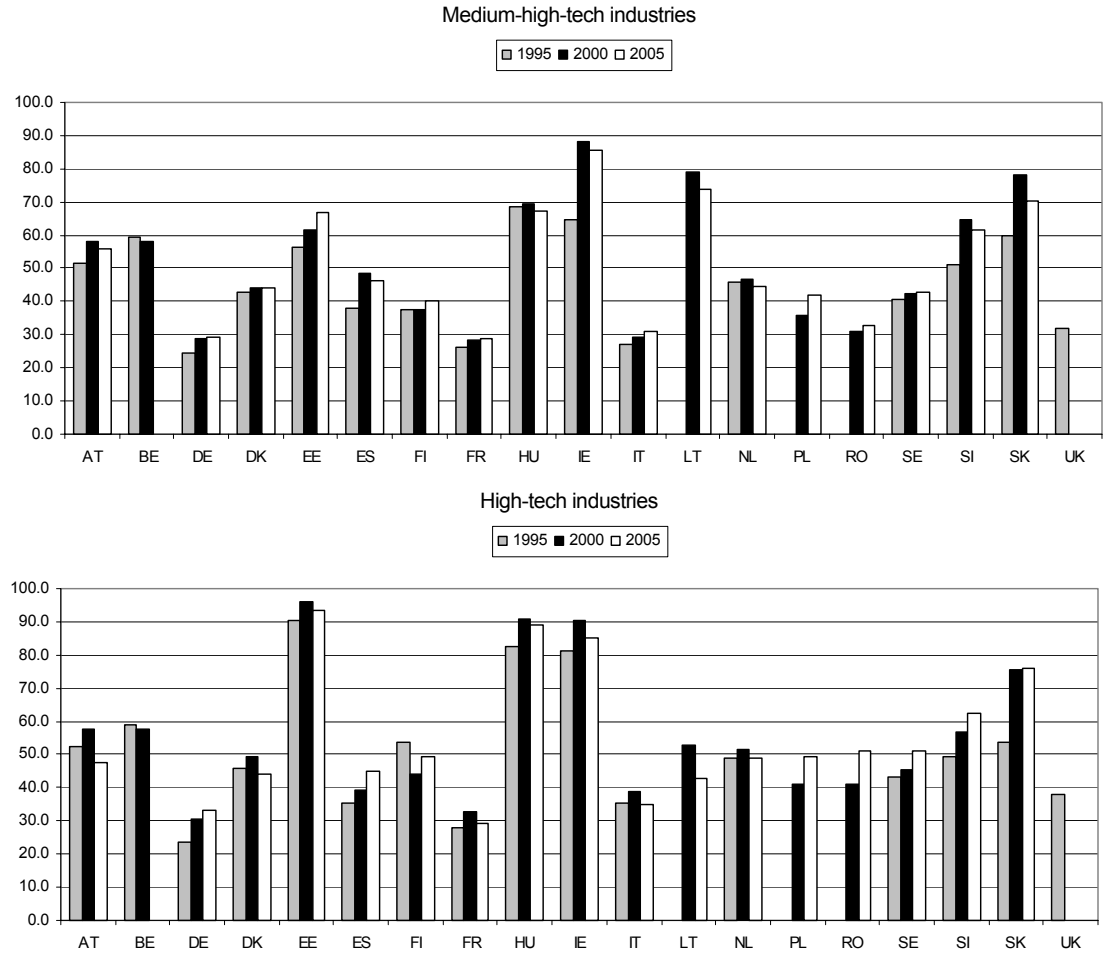


Figure 4.2.1 continued

Figure 4.2.1 (continued)



Source: EUROSTAT Input-Output Tables, wiiw calculations.

Between 1995 and 2005 import shares increased among all manufacturing industries and almost all countries (with only very few exceptions), with the largest increase taking place on average in the medium-low-tech industries. Among the countries, the most pronounced import share increase for all four technology categories can be found in Slovenia and Slovakia. However, not only new member states experienced rising import shares but also old member states: above average increases took place also in Austria, Ireland, Germany, Sweden or Spain.

Looking now at the share of imported intermediates in total intermediates in four service categories (see Figure 4.2.2), gives a different picture: As foreign trade plays a smaller role in service industries than in manufacturing industries, import shares are much smaller. They range at around 16, 17% on average for Trade & hotels (GH), Business Services (JK) and Community Services (LP) in 2005 and are only somewhat larger for Transport services (I, 26%). In addition, country differences are small, with Italy displaying the lowest import shares and Ireland the largest.

Figure 4.2.2

Share of imported intermediates in total intermediate inputs (current prices)

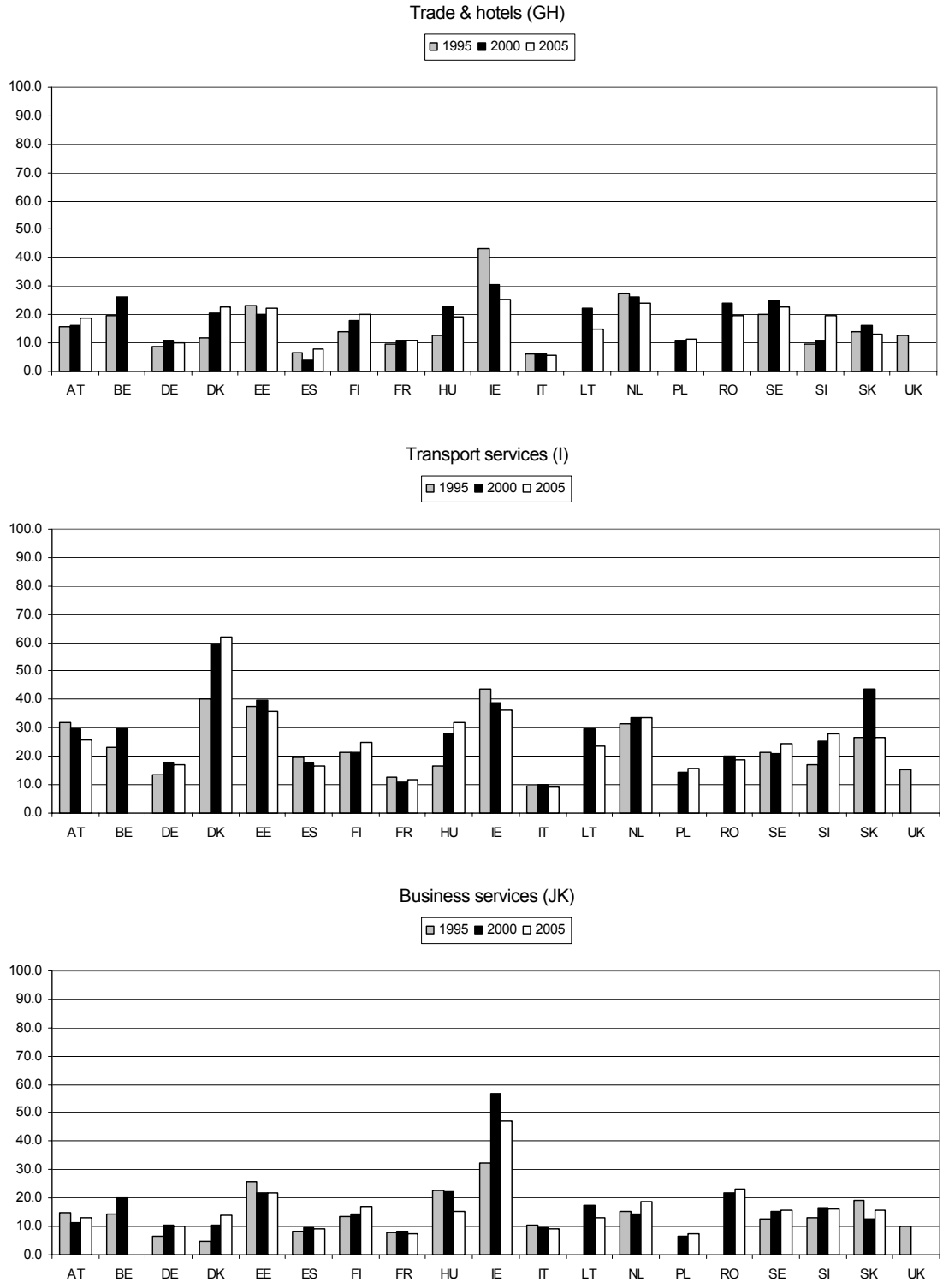
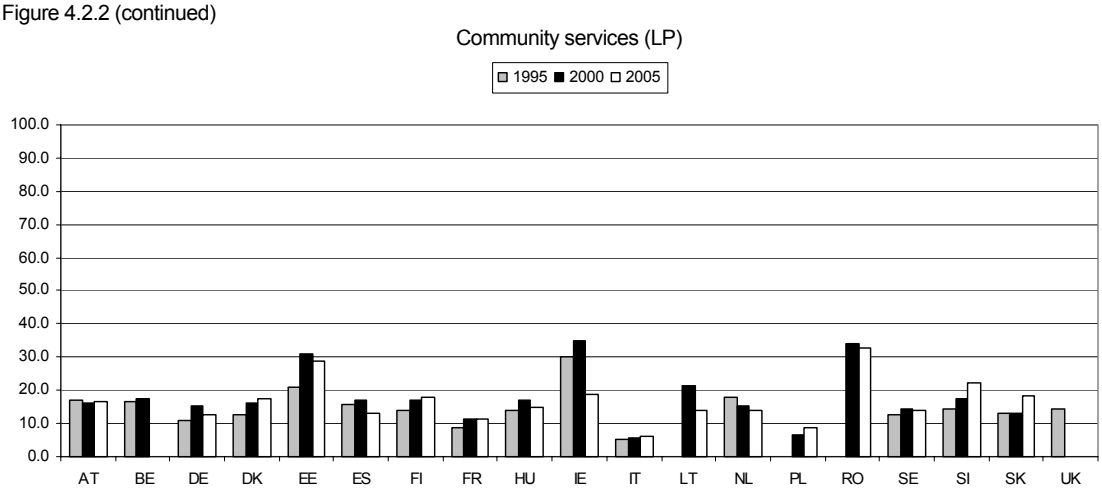


Figure 4.2.2 continued

Figure 4.2.2 (continued)



Source: EUROSTAT Input-Output Tables, wiiw calculations.

Between 1995 and 2005 import shares increased in most cases, although there is a lot of variation across countries and no common picture can be found. Import share in Business Services (JK) decreased for three new member states (Hungary, Estonia and Slovakia).

4.3 Sectoral interlinkages and trade in intermediates – a multiplier analysis

These considerations lead us now to an analysis taking into account both direct and indirect effects as the previous sections considered only the first aspect. We thus continue to study inter-industry linkages between sectors using input-output techniques, in particular by calculating output multipliers. This multiplier approach also takes indirect effects into account. The analysis is undertaken for a limited set of countries (Austria, Germany, Spain, Hungary, Slovakia) and for the years 1995, 2000 and 2005 for which symmetric tables are available (for Hungary and Slovakia symmetric tables are only available for 2000 and 2005). We therefore can study not only cross-country differences but also whether there have been significant changes of inter-industry linkages over time. In addition, in the analysis we differentiate between domestic and imported intermediates. Specifically, we calculate output multipliers for the totals (i.e. domestic plus import tables) and the domestic tables. The former provides information on changes in inter-industry linkages over time; the latter then provides information on whether the effects of changes in linkages are diminished by imports of intermediates instead of domestic production. For example, even if a sector might demand more inputs from other sectors (which would increase the total multiplier) these additional imports might be imported (thus leaving the domestic multiplier unchanged).

More formally, we calculate the Leontief inverse matrix from the total symmetric input-output table A and from the domestic table A^d, L and L^d. The output multiplier for a given sector k is the sum over the k^{th} column of the Leontief inverse matrix. When calcu-

lating the output multiplier for all sectors one thus has to pre-multiply the Leontief inverse with a row vector of ones of appropriate dimension. In matrix notation, $m = \iota' L$ or $m^d = \iota' L^d$ where ι' denotes a vector of ones.

In a recent study European Commission (2009) reports the average of multipliers over 22 countries at the product level and highlight important differences when considering the total and the domestic multipliers (or the leakage effects). This is done by showing that the sectors with the highest total multipliers (motor vehicles, trailers and semi-trailers, basic metals, food products and beverages, office machinery and computers, chemicals and chemical products) and domestic multipliers (food products and beverages, construction work, wood and products of wood and cork except furniture, articles of straw and plaiting materials, recovered secondary raw materials, supporting and auxiliary transport services and travel agency services) does not coincide.

Detailed results are presented in Appendix Tables C.1 – C.5. Here we only summarize the most important facts by presenting arithmetic means over products. Table 4.3.1 presents the arithmetic means over all products.

Table 4.3.1

Average over output multipliers

	1995		2005		Difference	
	Domestic	Total	Domestic	Total	Domestic	Total
Austria	1.62	2.14	1.58	2.25	-0.03	0.12
Germany	1.68	2.06	1.65	2.17	-0.03	0.11
Spain	1.71	2.15	1.77	2.48	0.06	0.34
Hungary*	1.56	2.68	1.55	2.51	-0.01	-0.17
Slovak Republic*	1.72	2.70	1.55	2.48	-0.16	-0.22

* 2000 and 2005 considered

Source: Eurostat input-output tables; wiiw calculations.

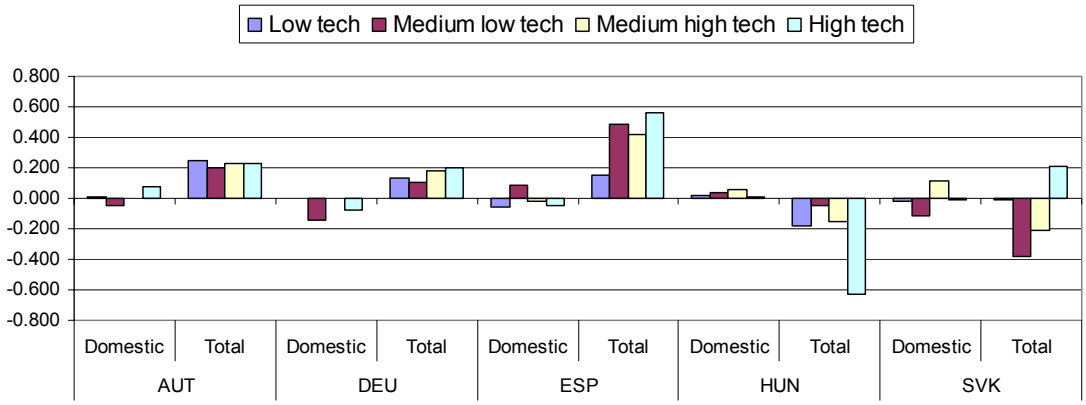
The domestic multipliers are between 20% and 40% lower compared to the total multipliers. In Germany and Spain the differences are lower, whereas highest in the two Eastern European countries. This difference was growing over the periods considered in Austria, Germany, and Spain, but not so in Hungary and Slovakia.

The total multiplier was increasing in Austria, Germany and Spain but falling in Hungary and Slovakia. The domestic multiplier was declining in all countries with the exception of Spain (but to a much lesser extent compared to the total multiplier). In Hungary and Slovakia the decline in the domestic multiplier was less strong than those in the total multiplier.

Going a little bit more into detail we show the changes in the averages over the output multipliers by industry categories in Figures 4.3.1 and 4.3.2. Figure 4.3.1 focuses on the four manufacturing categories, whereas Figure 4.3.2 on the service industries.

Figure 4.3.1

Changes in output multipliers in manufacturing industries,



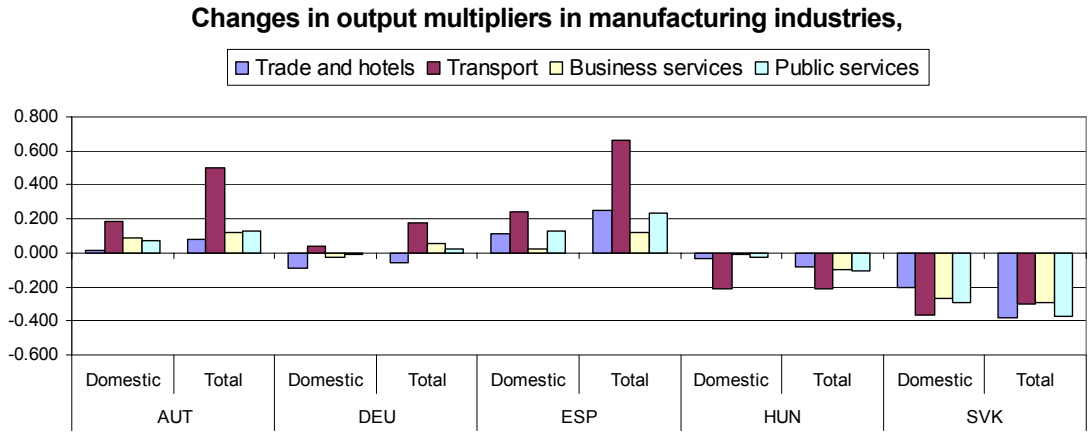
Note: For Hungary and the Slovak Republic the period considered is 2000-2005.

In Austria, Germany and Spain the multipliers for all manufacturing industry groups have been increasing with however little variation across these groupings. An exception is Spain where the total multipliers have been increasing relatively little in the low-tech industry group. The picture is completely different in Hungary and Slovakia where the total multipliers have been decreasing (with some extensions). A strong decrease is found in particular in the high-tech industry in Hungary. Comparing these figures to the domestic multipliers one first observes that for Austria, Germany and Spain the changes are much smaller and in many cases even negative. This means that though the inter-industry linkages of manufacturing sectors have increased in general the domestic linkages have been rather constant or even slightly falling due to international outsourcing. The situation is somewhat different in the two other countries considered, Hungary and Slovakia, where the domestic multipliers have been even slightly increasing. Only in Slovakia the domestic multipliers decreased in the medium-high-tech industries.

A similar exercise can be undertaken for service industries as mentioned above. Figure 4.3.2 presents these changes in total and domestic multipliers.

Again, total multipliers have been increasing in the three Western European countries, in particular in the transport industry in Austria and Spain. In most cases the domestic multipliers have increased much less and in Germany even decreased. However, compared to the manufacturing industries these differences are much smaller in many cases. In Hungary and Slovakia the total multipliers have decreased to some extent with relatively little differences across industry groups. In all cases also the domestic multipliers decreased though to a lower extent compared to the total multipliers.

Figure 4.3.2



Note: For Hungary and the Slovak Republic the period considered is 2000-2005.

4.4 Case study: Nokia N95 Mobile Phone[15]

In the analysis above we have quite large differences across countries and industries to which extent the intermediates are sourced domestically or from abroad. Together with the results from the trade data analysis (Section 3) and the literature review this confirms that there is a multitude of patterns of outsourcing which cannot be analysed from aggregate data. Therefore case studies are necessary. We thus provide a detailed case study on the Nokia N95 Mobile Phone on how a supply chain might look at and where the value added is created.

In terms of methodology and approach this part is similar to Linden *et al.* (2009), who study the supply chain of Apple's iPod digital music play in 2005. Besides obvious differences of industry, product, and point in time, our analysis is more detailed on several accounts. Furthermore, our analysis is on value added (rather than gross margin) basis. Our most important contribution concerns the geographic breakdown of value added. We go beyond headquarter locations as far as geography is concerned, as well as we allow for the generation of each component's value added in multiple locations/functions. This part builds on earlier work done at ETLA (Ali-Yrkkö 2010), which we extend in three major ways: we also consider vendors-of-vendors, go more into details in integrated circuits and other inputs, as well as refine the geographic distribution sufficiently to be able to accurately capture Europe's value added. To our knowledge this is the first contribution looking at global supply chains on value added basis with such detail.

[15] This part is based on an accompanying case study for this project: J. Ali-Yrkkö, P. Rouvinen, T. Seppälä, and P. Ylä-Anttila (2010), 'Who captures value in global supply chains? Europe remains important in mobile telephony', Paper prepared as background material for the Competitiveness Report 2010 of the European Commission, ETLA internal draft.

Introduction

Upon its announcement in 26 September 2006, N95 may be considered Nokia's flagship product. It was globally one of the first 'all-in-one multimedia computers' with size and weight of a standard phone. N95 supported the latest high-speed mobile telephony protocols; it also had WiFi for long-range and Bluetooth for short-range data communications. It integrated GPS navigation, MP3 player, FM radio, and two video/still cameras as well as supported multiple email, messaging, and internet protocols. With its cameras, color display, and multiple speakers, audio, video, and images could be easily recorded and played. Preinstalled software included a calculator, calendar, dictionary etc. and, as with any computer, more could be installed. The phone was actively marketed as an access point to Internet services of Yahoo!, Amazon, and Flickr. The afore-mentioned convergence would have been complete, if only the phone supported viewing of over-the-air television broadcastings. This omission was not, however, due to Nokia but rather related to the (still) lacking standards and unresolved intellectual property rights issues in this particular domain.

While there were some initial difficulties with the phone's two-way sliding design, both technically and commercially N95 was a success: some twenty million – presumably highly profitable – copies were sold worldwide. Several 'face lift' versions were introduced and aspects of its basic design are being employed in models currently in production. In terms of basic functionality, later models launched in 2007-2008 have added relatively little to what N95 had to offer, even though all features continue to be refined.

Data

Our analysis is based on five sources. *First*, in August 2008 we physically broke down a fully-functioning N95 phone and examined each of its approximately 600 individual components with two engineering experts. *Second*, we accessed public (particularly Internet searches) and private (direct contacts to various companies and individuals across the supply chain) information to get an idea of direct (coding/manufacturing) and indirect (development/design) value added of each component. *Third*, we purchased a standard 'teardown' report of the component composition of Nokia N95 (Portelligent, 2007), which also included estimates of factory prices and vendors. *Fourth* – armed with the knowledge gathered in the previous steps – we collected further qualitative and quantitative information (as well as confirmed what we had gathered so far) via interviews of 16 industry experts working currently or previously in various roles in the mobile handsets' supply chain. *Fifth*, we examined financial reports and press releases of the companies involved as well as those of their direct competitors. We particularly exploited the differences in reporting in various geographies as well as officially required further information such as 20-F reports in the US.

The structure of the mobile handsets' supply chain

A *supply chain* refers to the global flows of intermediate goods/services – both those provided in-house and purchased from outside (unaffiliated) companies – involved in providing a good/service for final consumption. In each step, the vendor employs inputs, conducts its own value adding activities, and transfers its output to the other participants in the supply chain. *The sum of all value-adding activities equals the final retail price* (before any applicable taxes).

Figure 4.4.1

Manufacturing supply chain

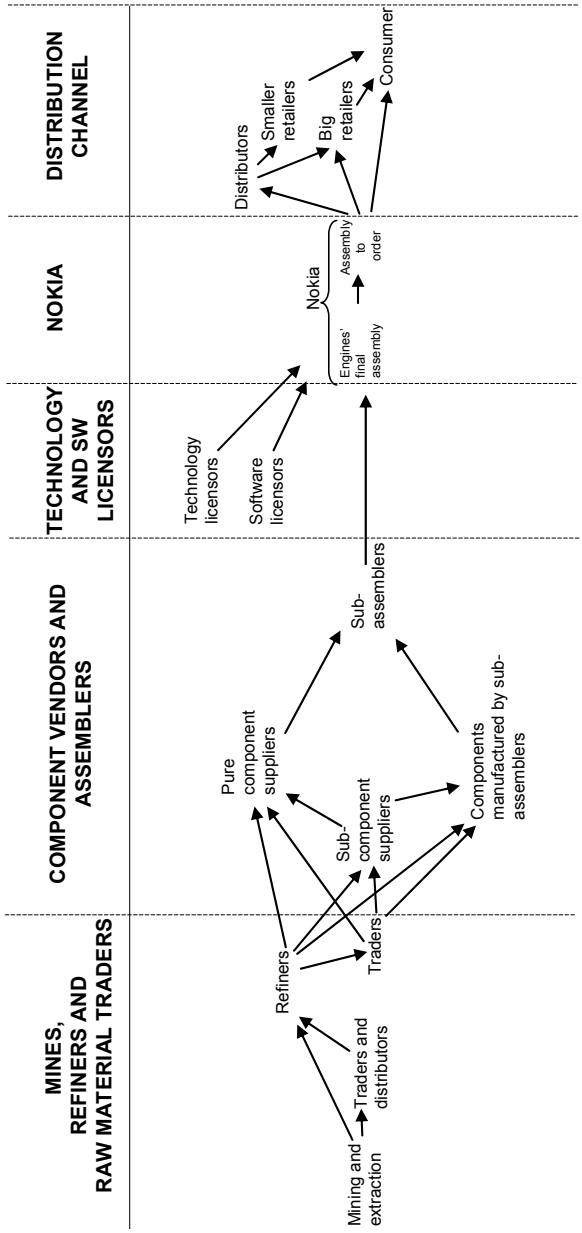


Figure 4.4.1 represents a stylized supply chain of N95. In the case of tangible components, there are typically 4–8 layers between Nokia and the extraction of metals and minerals for the earth's crust (Nokia, 2009). All components embed intangible assets in some form and confirm to one or more industry standards. In the case of intangible components – licensed and purchased embedded and standalone software – the flows cannot be readily mapped in a similar manner, but typically there are fewer layers.

In Figure 4.4.1 the actors in supply chain of N95 are categorized into five groups: mines and refiners, component vendors and sub-assemblers, software and technology providers and licensors, the actual phone assembly by Nokia (or by an original equipment manufacturer, OEM), as well as wholesale and retail distribution by telecommunication network operators and/or by general traders. Unlike some of its competitors, Nokia maintained significant in-house manufacturing and assembly capacity and thus relied less on OEMs. In the case of N95 all final assembly was done by Nokia itself, i.e., it did not use providers of electronic manufacturing/assembly services (EMSs) or outsource this task otherwise.

In the course of the 2000s, Nokia re-organized its supply chain several times – it went from having hundreds of predominantly Finnish first-tier suppliers in the later 1990s (see Ali-Yrkkö, 2001) to interacting with a few primarily Asian vertically integrated EMSs (see Seppälä 2010, forthcoming) as well as hundreds of global technology partners in relatively narrow and specific domains. This change also meant that in addition to manufacturing operations of the Finnish electronics subcontractors, also the majority of their product development tasks were transferred to China. N95 was introduced at a time when the current system was more-or-less already in place.

Roughly speaking, the flow in Figure 4.4.1 is as follows: The (still raw but now purified) outputs of miners/refiners are turned to sheets of metal and other elementary processed goods that are traded to parts and components vendors. They in turn deliver to sub-assemblers (which may in turn deliver to other sub-assemblers) feeding the final assembler. Some of the intangibles – to the extent they are not embedded to and bundled with physical components – are licensed in a 'pooled' form as parts of industry standards. Purchased standalone software is acquired as necessary. Much of the intangibles are provided in-house or by vendors compensated by billable hour, which have to be considered separately. Depending on the market, in the case of phones Nokia's direct customers are typically distributors (e.g., Brightpoint Inc.) – who in turn supply wholesalers and retailers – or operators (e.g., Vodafone). In both cases cooperation and support of the operators is often vitally important.

The final assembly may be divided into two parts: The first bit involves all aspects of the phone that do not vary by each customer's order – within the industry the physical outcome of this phase is commonly called an *engine* (hardware and software performing core functions of a phone but lacking aspects that vary from customer to customer). The second bit

adds varying elements, which may range from – besides determining, e.g., the choice of languages – adding a retailer's sticker to an extra button for a direct access to the services offered by the operator – in the industry this stage is commonly called *assembly-to-order* (the engine obtains its final software and external appearance per the customer's requests). Nokia considered this two-stage assembly process as one of its key differentiators within the industry – its customer promise is to deliver a desired variation from initial order to final delivery with 48 hours. N95 was delivered in some 170 variations of the physical handset and in some 250 variations of the sales packaging (including the box / outer packaging, printed manuals, CD-ROMs, as well as chargers and other included accessories).

Who captures value? By types of actors

Let us first consider the direct components, parts, sub-assemblies, software, and licences of N95 – the *bill-of-materials* in the industry jargon. We first consider the actual sales prices (the gross value). Later we consider the first-tier suppliers on value-added basis.

As shown in Table 4.4.1, the direct bill-of-materials (BOM) amounts to about EUR 200. One should note, however, that Nokia is a major holder of intellectual property rights (IPRs) in the GSM/WCDMA cellular communication standards and it does not pay licensing fees to itself. Furthermore, cross-licensing is quite common within the industry, in which case fees paid do not reflect the full value of the IPR employed. For a company without own employable/tradable IPRs, licensing fees could – in our view – more than double from those presented in Table 4.4.1. Licensing fees aside, the most costly components were processors and other integrated circuits as well as the large colour display.

Table 4.4.1

The bill of materials of Nokia N95 (in 2007)

Description	**Eur**	**%**
Processors	34.3	17.3%
Display	21.6	10.9%
5MP camera module	16.5	8.3%
Memories	14.5	7.3%
Battery pack	3.0	1.5%
VGA camera	1.2	0.6%
Other integrated circuits (excl. processors and memories)	31.5	15.9%
Mechanics	18.7	9.4%
All other hardware inputs	21.1	10.6%
BOM (excluding supporting material, licence fees and manufacturing)	**162.4**	**81.8%**
Supporting material	15.5	7.8%
BOM (excluding licence fees and manufacturing)	**177.9**	**89.6%**
GSM/WCDMA licence fees	13.5	6.8%
Symbian OS	3.0	1.5%
Other licence fees	4.2	2.1%
BOM (excluding manufacturing)	**198.6**	**100.0%**

Data source: ETLA database.

The main integrated circuits of N95 were provided by Nokia's long-time ally *Texas Instruments* (US). The display and the most expensive memory chips came from *Samsung* (South Korea). On the semiconductor-side main European companies were *NXP Semiconductor* (Netherlands), *STMicroelectronics* (Switzerland) and *Cambridge Silicon Radio* (UK).

As shown in Table 4.4.2, the licensing fee for the Symbian operating system was about EUR 3. According to Nokia, it paid less than 3% aggregate licence fees on its WCDMA handset sales (press release, 12 April 2007; see also the above discussion on Nokia's IPR position in this domain). On the basis of our interviews we use 2.9% of Nokia's EUR 467 sales price of N95, which amounts to EUR 13.5. Besides Nokia, *Qualcomm* (US), *Motorola* (US), and *Ericsson* (Sweden) are among the major WCDMA IPR holders. Besides the operating system and telecommunication air interface, Nokia paid fees for, e.g., the inclusion of *Adobe Acrobat Reader*, *RealPlayer* and *Zip Manager*. We estimate that in total they were 0.9% of Nokia's sales price, i.e., EUR 4.2. All in all, the total cost of separately licensed intangibles was thus EUR 21.

The about EUR 200 in the bill-of-materials is what Nokia purchased from upstream vendors as inputs for the final assembly of N95. It is the total value added of all the first-tier vendors and their suppliers (second- and subsequent tier vendors). Below we proceed with the analysis of value added by Nokia and the distribution channel.

For each company in the supply chain of N95, we derive the ratio of value added to net sales (what we call the value added margin) at the firm level. For the most part we then equate this with the component-level value added margin.

For the distributors, wholesalers, and retailers, the value added margin and the sales margin are effectively identical. Retailers' sales margins on a high-end mobile phone are somewhat lower than generally in electronics, 10–12% of the final sale price, leading to an estimated value added of EUR 60.1 by the retailer. The distributors'/wholesalers' margins are 3.3–4.5% suggesting an estimated value added of EUR 19.1.

Subtracting all downstream costs from the price Nokia sells the phone to the distribution channel yields its own value added, which amounts to EUR 269. It is allocated to direct and indirect in-house labour costs – e.g., in manufacturing/assembly, R&D, marketing, sales, sourcing, and management – depreciation of tangible and intangible assets, investments, and operating profit.

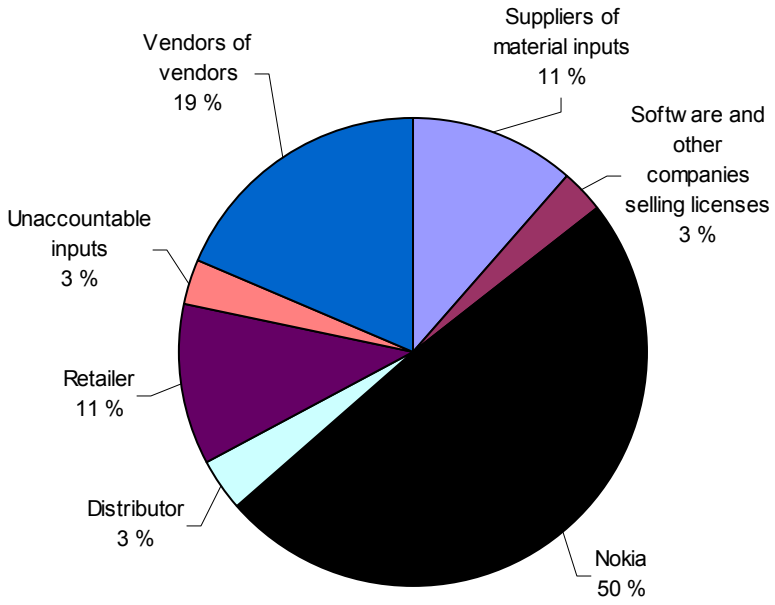
Careful studies of industry sources as well as our interviews suggest that *the final assembly/manufacturing cost of N95 is EUR 11.5, i.e., 2% of the pre-tax final sales price.* Thus, even if final assembly is the essential part of the supply chain and it is what meets of eyes

of laymen (not least because of the 'Made in …' labelling found in manufactured goods), the value added it commands is surprisingly low.

Figure 4.4.2 shows a value-added breakdown of N95's pre-tax retail price of EUR 547: Nokia captures 50% of the value, first-tier hardware vendors 11%, first-tier (external, non-cross-licensed) intangible vendors 3%, second- and higher-tier vendors (vendors-of-vendors) in both categories 19%, distribution/wholesale 3.5%, and retail 11%. Thus, Nokia generates most of the value added, which should not – as discussed above – be equated to pure profits.

Figure 4.4.2

Value added breakdown by the participants of the N95's supply chain



Source: ETLA database.

Who captures value? By geography

Figure 4.4.2 gives a global breakdown of value added by actors' major categories. Since GDP (Gross Domestic Product) can be measured as the sum of the values added by all organizations in a particular country, national interest is on *where* the value capturing takes place. This is somewhat difficult, as companies are reluctant to reveal the geography of their operations even at the firm level let alone at the level of a specific offering. With some detective work we can nevertheless make estimates that are fairly accurate at least as far as broader regions are concerned.

The value capture of in-house *indirect inputs* – such as the role of general management and corporate brand/image – as well as re-usable *tangible and intangible assets* – such as design/technical aspects copied from previous and/or contributing to future models – are particularly tricky to allocate in general and particularly across geographies. Furthermore,

we do not observe all aspects of supply chains of all actors involved. Thus, we consider five alternatives in making the geographic breakdown (Table 4.4.3):

a) Our baseline method allocates the value added to the headquarter location of each participant in the supply chain. This tends to *over-estimate* the role of the developed countries and regions.

b) Our second method (see equation (4) in Appendix) assigns the value capture *just* on the basis of the locations of production factors (physical capital, labor and knowledge capital or R&D). This does, for instance, implicitly assume that the general management or corporate brand has no specific role in the value capture, which tends to *under-estimate* the role of the developed countries and regions.

c) The third alternative is an intermediate case between (a) and (b): it is assumed that, in the case of each participant, 10% of the value capture takes place at the headquarter location and 90% is attributed according to the actual location(s) of participant's production factors.

d) Individuals and organizations in various locations have different productivities. Thus, their ability to capture value may vary. Column (d) is a replication of Column (b) but with an attempt to correct for this fact using multifactor productivity differences between regions (see equation (6) in Appendix).

e) Our preferred estimation method combines our approaches (c) and (d). Thus, in the case of each participant, 10% of the value capture takes place at the headquarter location and 90% is attributed in a same way as in column (d).

In some sense Columns (a) and (b) constitute the lower and upper bounds for Europe. Columns (c) and (d) refine aspects of the issue. Column (e) provides our preferred estimate of the geography of the value capture.

It should be noted that the first five rows in Table 4.3 (Finland … Other countries) do *not* fully reflect the value captured by each location, simply because the next four rows (Other countries … The country of final assembly) have not been allocated accordingly. While we have a sense of the geography of vendors-of-vendors and we can make educated guesses on the small amount of inputs we cannot allocate to specific vendors (Unaccounted inputs), the level of detail in our data is not comparable to what we know of Nokia and its first-tier suppliers. With these caveats, we take our 'rock-bottom' estimate (e) from Table 4.4.2 and split the value added of unaccounted inputs and vendors of vendors to geographies with the assumptions discussed below.[16]

[16] *Unaccounted inputs*: The majority of these are low cost inputs such as resistors, capacitors and screws manufactured and designed in Asia. We assume that 80% of the total value added of these inputs is created in Asia, 10% in EU-27 and 10% in the U.S.

Other countries: Based on our firm-level data, roughly 1/3 of this value is created in the new member states of EU. Thus, we attribute this amount to EU-27 and leave the rest 2/3 to other countries (i.e. countries outside EU-27, Asia and North-America.

Table 4.4.2

Value added breakdown by regions

	(a) Based on headquarters	(b) Based on locations of production factors	(c) 10% to headquarters country and 90% based on locations of production factors	(d) Based on locations of production factors, productivity corrected	(e) 10% to headquarters country and 90% based on locations of production factors, productivity corrected
Finland	47.2 %	34.0 %	35.3 %	37.9 %	38.8 %
Other EU-15	3.1 %	9.3 %	8.7 %	7.7 %	7.2 %
North America	6.6 %	9.1 %	8.9 %	9.1 %	8.9 %
Asia	4.7 %	8.3 %	8.0 %	6.6 %	6.4 %
Other countries	0.0 %	0.8 %	0.7 %	0.3 %	0.3 %
Unaccounted inputs	3.1 %	3.1 %	3.1 %	3.1 %	3.1 %
Vendors of vendors	18.7 %	18.7 %	18.7 %	18.7 %	18.7 %
The country of final sales	14.5 %	14.5 %	14.5 %	14.5 %	14.5 %
The country of final assembly (Finland or China)*	2.1 %	2.1 %	2.1 %	2.1 %	2.1 %
	100 %	100 %	100 %	100 %	100 %

Note: Based on our interviews, Nokia assembled N95 devices only in Finland and China.

Data source: ETLA database.

The geographic allocations of the country of final sales and final assembly depend on case. For instance in the case of a N95 assembled in Salo (Finland) for the German market an extra 2.1% would go to Finland and an extra 14.5% to Germany (Other EU-15); in the case of an assembly in Beijing (China) for the US market the outcome would be different. We considered all potential combinations and calculated the average of these results. This average is presented in Figure 4.4.3.[17]

Thus, our best estimate that, on average, overall 55% of the value added of Nokia N95 mobile phone is captured in EU-27. This is remarkably large share for a truly global product. Even in the case of final assembly in China and final sales in the U.S, EU-27 captured

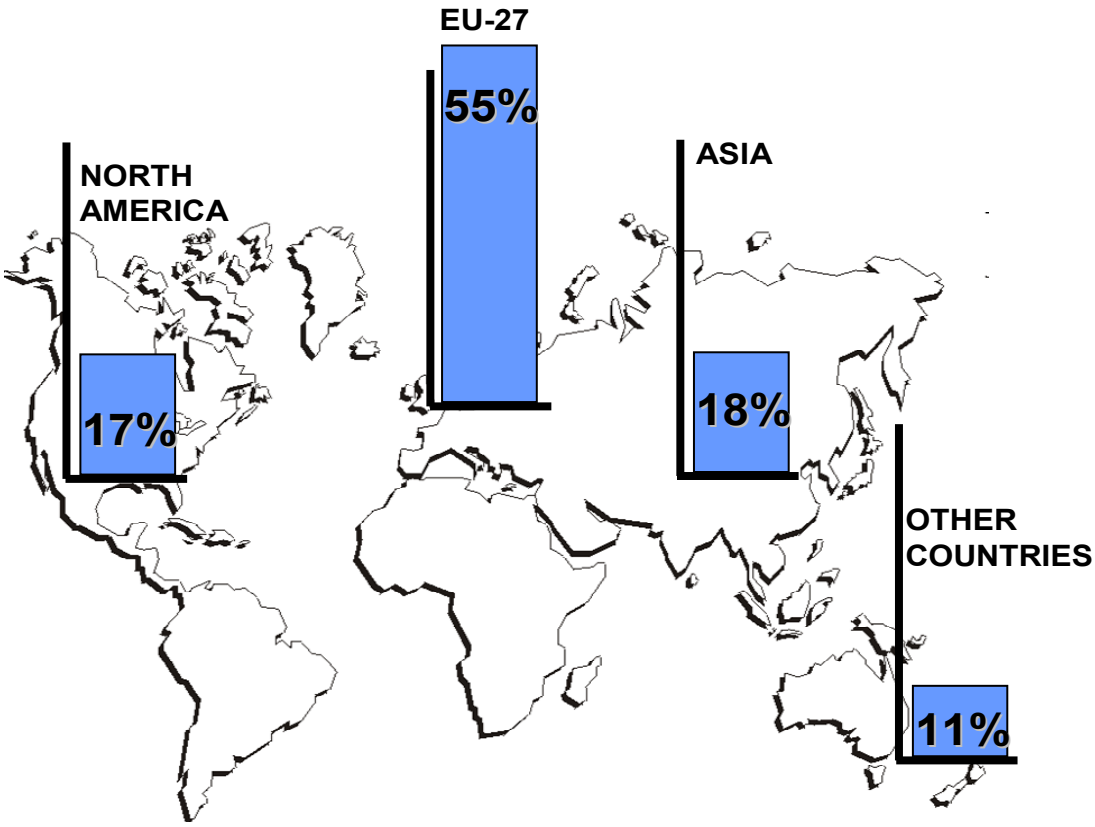
Vendors of vendors: We consider separately the vendors of material suppliers and immaterial suppliers. Dividing value added created by material suppliers' vendors to different regions is a difficult task as the following examples show. On the one hand, the majority of components that, for instance, charger includes are designed and manufactured in Asia. On the other hand, for instance, semiconductors include silicon wafers, lead frames, mold compounds, ceramic packages and chemicals that can be purchased from all continents. Due to this complexity, we divide the value added created by vendors of material suppliers equally to all regions (EU-27, North America, Asia and other countries). In terms of value added created by immaterial suppliers' vendors, we proceed as follows. First, we know that the great majority of first tier immaterial suppliers are mainly the U.S, European or Japanese companies and we assume that also their vendors operate in these areas. Hence, we assume that 90% of value added created by vendors of immaterial suppliers has been created in these three regions and we divide this 90% equally to EU-27, North America and Asia. The rest of 10% is attributed to other countries.

[17] In 2007, the basic principle of Nokia was that smartphones for the European market were manufactured in Europe and correspondingly smartphones for the Asian market were manufactured in Asia. And to our knowledge, smartphones for the U.S market are mainly manufactured in Asia. Thus using these three as our guidelines, potential combinations are: (assembled in EU and sold in EU; assembled in EU and sold in other countries; assembled in Asia and sold in Asia; assembled in Asia and sold in North America; assembled in Asia and sold in other countries).

51% of the value added – despite of the fact that the phone was 'Made in China'. While final assembly is obviously the main step in the physical incarnation of the product, this stage only commands 2% of the overall value added. On the other hand the distribution channel and particularly its very final retail loop captures a large share of the value added – many times more than the final assembly. And if we take into account the value added tax or sales tax, the value added received by the country of final sales is even bigger.

Figure 4.4.3

Value added breakdown by regions, taking into account the value added created in the country of final sales and the country of final sales



Source: ETLA database.

To test to what extent our results depend on our assumptions related to the value added created by material suppliers' vendors, we recalculate the geographic breakdown of value added by changing these assumptions. One could argue that Asia's role in these upstream activities is bigger than we assumed in our basic calculations. Moreover, Australia, Russia and Africa are important raw material providers, and in this sense our basic assumptions potentially under-estimate the role of these regions. For these two reasons, we raise the share of Asia to 50% and Other countries (including, e.g., Australia, Russia and Africa) to 30% of the entire value added created by vendors of vendors, and respectively lower the share of EU-27 to 10% and that of North America to 10%. Then we re-calculate all potential combinations related to the final assembly location and the country of final sales. The

results of this re-calculation show that our basic results hold. On average, overall 52% of the total value added is captured in EU-27, 14% in North America, 22% in Asia and 12% in the rest of the world.

How is it possible that EU-27 captures so much of the value from a seemingly minor role? Simply because Europe was dominant in the branding, development, design, and management of the N95 and related processes.

Uncovering geographic connections often requires some detective work. For instance, in the case of N95's main processor and *Texas Instruments* (US): The hardware design was made in Dallas (US) and in Nice (France). Much of the software design and its integration to hardware were of Indian origin. Besides Dallas (US), the processor was also manufactured in Japan.

Global flows are often quite complex, raising some concerns how well gross-value based trade statistics reflect underlying economic activity – for example:

> 'National Semiconductor manufactures wafers at three fabrication plants, or "fabs": South Portland (Maine), Arlington (Texas), and Greenock (Scotland). Wafers are then shipped to the company's assembly and packaging houses at Melaka (Malaysia) and Suzhou (China) where they are subjected to final testing and from where they are shipped directly to the production lines of customers worldwide. … For a particular project we could have a marketing engineer in Germany and design engineer in Korea, a layout engineer from Santa Clara, a production engineer based in Longmont (Colorado), and test engineers in Melaka and Santa Clara.'

Table 4.4.3 summarizes some locations of the key tasks in the case of N95.

Table 4.4.3

Location of Nokia's in-house tasks related to the N95

Task group	Tasks	Location 1	Location 2	Location 3
Management	General management	Finland	UK	
	Product and product line management tasks	Finland	UK	
Hardware design	Mechanics design tasks	Finland	UK	
	Electromechanics design tasks: Camera, Display etc.	Finland	Vendors (primarily in South-Korea and Japan)	
	Integrated circuit board design tasks	Finland	Vendors (primarily in South-Korea, China and Japan)	
	The design tasks of Nokia-specific integrated circuits	Finland	Vendors (the U.S., France)	
Software design	The N95 product-specific software development, in-house	Finland	Germany	
	The N95 product-specific software development, sub-contracting	UK		
	The N95 product-specific technology and software, licensed	US	Japan	Germany
Manufacturing	Prototypes' final assembly	Finland		
	Mass manufacturing	Finland	China	
Other tasks	Sourcing	Finland	Asia	the U.S.
	Sales and marketing	All market regions		

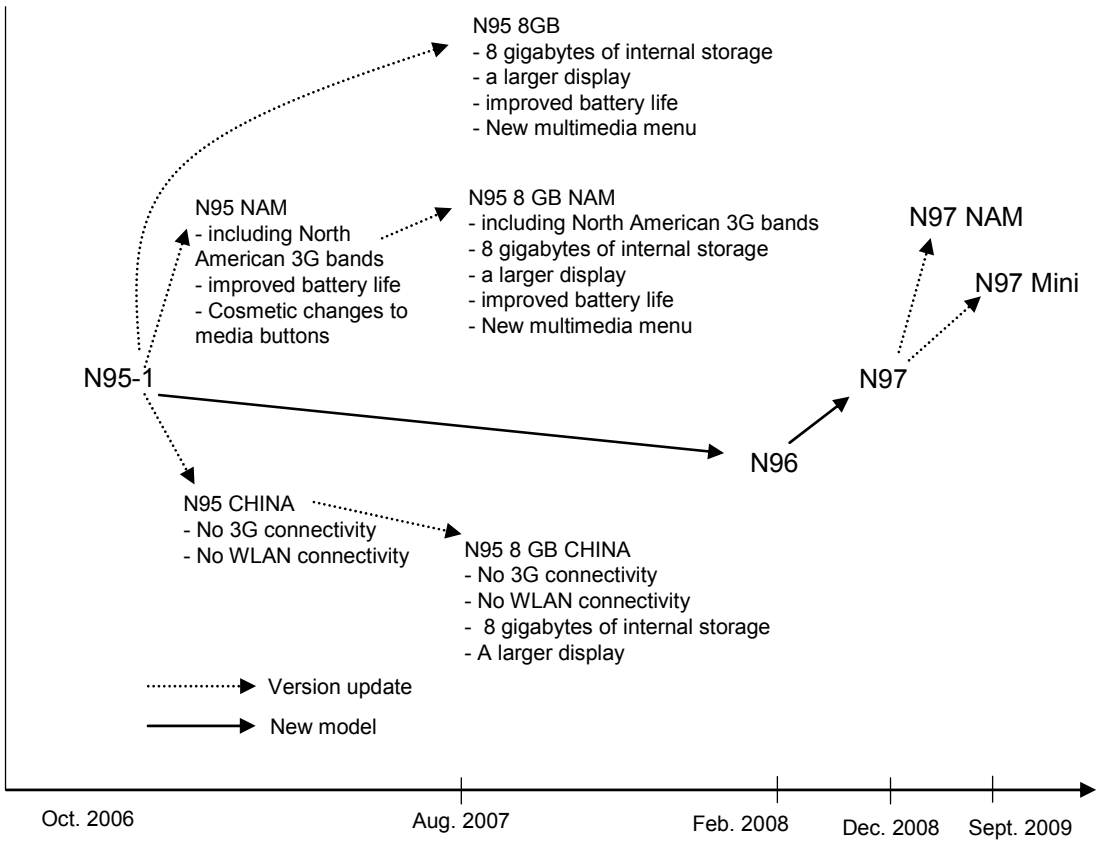
Data source: ETLA database.

Evolutionary path

N95 was obviously only one model sold in 2007 and was ultimately replaced by newer offerings. Figure 4.4.4 illustrates the subsequent evolutionary path. With the subsequent models the role of EU-27 in the final assembly has weakened but in our understanding its share of the overall value added is not too different from what we have gauged in the case of N95.

Figure 4.4.4

Product family and life cycle of the N95



Source: ETLA database.

Is ICT and smart phone a unique case?

The ICT sector and the N95 handset are undeniably only specific cases while looking at the whole industrial landscape. They represent, however, quite well the electronics industry as a whole and lead the way in global industrial transformation. Many industries are following suit. On the other hand, there are industries where the unbundling of production has been a rule for decades, but locational outcomes differ from those observed in electronics.

The most notable example is automobile industry where outsourcing and separating different stages of production have proceeded quite far. Advanced information and communica-

tion technologies have facilitated outsourcing offshore, but much of the production has remained regional rather become global. The simple reason is transportation costs. ICT helps coordinate the activities of international supply chains, but intercontinental shipping of some auto parts is costly compared to electronics component.

Hence, there are regional clusters or hubs specializing in auto parts within a reasonable distance from the final assembly. Nevertheless, the same logic applies: manufacturing that originally was done by the same company in the same factory is today dispersed into a network of hundreds of suppliers and subcontractors in order to achieve advantages through scale and specialization.

There has been some discussion how the current economic crisis might affect the global supply chains. Would some of the off-shored production be in-shored back to its original location? There are arguments for and against. The need to seek more cost advantaged locations has probably increased for some producers only, the crisis revealed the vulnerability and unpredictability of production chains for others. The net effect is likely to be relatively small. There is no return to the old production model.

On the contrary, unbundling and trade tasks will expand in services production as a consequence of digitalization. More and more services are becoming tradable once transformed digital. Firms – both in manufacturing and services – will increase their offshore outsourcing of services to a much greater extent than has ever happened in manufacturing.

In addition to manufacturing tasks, other tasks such as product development tasks have also been transferred to low cost countries. And it seems that this trend continues as the following example concerning one German-based component supplier of the N95 shows.

> *'Alongside production, more and more administrative and research and development activities too are now also being transferred to low-labor-cost countries. … The proportion of technical experts in countries with low labor costs is shifting accordingly. Since 2004, the share of EPCOS' R&D staff who work in these countries has since risen from about 30 percent to more than 40 percent.' (Epcos Annual Report 2008, p. 66)*

Technical appendix

To estimate the geographic breakdown of the N95's value, we proceed as follows. The total value of product *Y* is composed of the value added of all parts of the N95's value chain or

$$Y = \sum_{c=1}^{N} Y_c \ , \qquad (1)$$

where

Y = total value of the N95

Y_c = value added of value chain's part *c.*

The value added of each part (Y_c) can be created globally. We assume that this total value added of each part is created in an area covering the home country (Finland), other Europe, North-America and Asia, thus

$$Y_c = Y_{c,D} + Y_{c,E} + Y_{c,N} + Y_{c,A} + Y_{c,O} \quad (2)$$

where

D = domestic (Finland)
E = Europe (other EU-15)
N = North-America
A = Asia
0 = others

Our data includes the value add of each part (Y_c) but we do not have information how this value added is created in different areas. To estimate the value added of part *c* created in each region ($Y_{c,D}, Y_{c,E}, Y_{c,N}, Y_{c,A}, Y_{c,O}$), we have to proceed as follows.

We assume that the value added of part *c* captured in each region is created through factors of production. As usually in the economic literature, we consider three factors of production: physical capital stock (C), the size of labour force (*L*) and knowledge capital stock (K). We assume the impact of each production factor is the same as their elasticities of output. The previous empirical literature including a number of studies has estimated a Cobb-Douglas style of production function:

$$Q = AC^{\alpha} L^{\beta} K^{\gamma} \quad (3)$$

where

A = multiplicative technology parameter

The equation (3) is typically estimated in logarithm form thus the parameters α, β and γ are the elasticities of output (Q) with respect to physical capital stock, labour and knowledge, respectively. In the majority of empirical studies, the estimated production function has included only two factors of production: physical capital and labour. Usually, the results of empirical studies show that the physical capital elasticity is about 0.4 and labour elasticity about 0.6.

In studies, where knowledge capital is approximated by using R&D stock, the estimated knowledge capital elasticity varies typically between 0.05 and 0.25 (e.g. Hall, 1993; Mair-

esse and Hall, 1994; Harhoff, 1998; Capron and Cincera, 1998). Based on these studies, in our calculations we assume that this elasticity is 0.15. However, most studies have not taken into account the double counting related to R&D. R&D investment also consists of investment in physical capital and labour and these components are included in the regular production factors (see e.g. Schankerman, 1981; Hall and Mairesse, 1996). Based on earlier literature, we know that roughly 50% of R&D expenditure are labour costs (Hall, 2009; NSF, 1995). By taking this fact into account, we modify the capital elasticity (0.6) and labour elasticity (0.4) as follows.

$$\hat{\alpha} = \alpha - 0.5\gamma$$
$$\hat{\beta} = \beta - 0.5\gamma$$

Thus, our double counting corrected elasticities for capital, labour and R&D are 0.325, 0.525 and 0.15, respectively. We use these elasticities as the multipliers of production factors.

We continue by calculating what share of each production factor is located in each region R and then multiply each share by the elasticity of output. Then we sum these values by region and obtain each region's share of value added (related to part c). Finally, we multiply this share by the value added of part c (Y_c). The value added of part c created in region R, is calculated as follows:

$$Y_{c,R} = \left(\frac{C_R}{C}\hat{\alpha} + \frac{L_R}{L}\hat{\beta} + \frac{K_R}{K}\gamma \right) Y_c \qquad (4)$$

where

C_R is firms' physical capital stock in region R,

C is the sum of firms' physical capital in all regions,

L_R is firms' employment in region R,

L is the sum of firms' employment in all regions,

K_R is firms' knowledge capital in region R,

K is the sum of firms' knowledge capital in all regions,

Thus, for instance, the domestically created value added is calculated as follows:

$$Y_{c,D} = \left(\frac{C_D}{C}\hat{\alpha} + \frac{L_D}{L}\hat{\beta} + \frac{K_D}{K}\gamma \right) Y_c \qquad (5)$$

Equations (4) and (5) implicitly assume that the total productivity is equal in each region. To take into account the regional productivity differences, we calculate the productivity corrected value added of part c created in region R as follows:

$$\hat{Y}_{c,R} = \frac{MFP_R\left(\frac{C_R}{C}\hat{\alpha} + \frac{L_R}{L}\hat{\beta} + \frac{K_R}{K}\gamma\right)}{\sum MFP_R\left(\frac{C_R}{C}\hat{\alpha} + \frac{L_R}{L}\hat{\beta} + \frac{K_R}{K}\gamma\right)} Y_c \qquad R \in (D,E,N,A,O) \tag{6}$$

,where

MFP_R is multi-factor productivity in region R.

Thus, for instance the domestically created value added is calculated as follows:

$$\hat{Y}_{c,D} = \frac{MFP_D\left(\frac{C_D}{C}\hat{\alpha} + \frac{L_D}{L}\hat{\beta} + \frac{K_D}{K}\gamma\right)}{\sum MFP_R\left(\frac{C_R}{C}\hat{\alpha} + \frac{L_R}{L}\hat{\beta} + \frac{K_R}{K}\gamma\right)} Y_c \qquad R \in (D,E,N,A,O) \tag{7}$$

Operationalization of production factors

If component-level factors and factor shares are unavailable, we use firm-level information on the location of different factors. Firm-level data is based on the annual reports and websites of each vendor. We have operationalized variables as follows:

C = Non-current assets or long-lived assets depending on which one has been reported in 2007.

L = Number of employees (in 2007).

K = R&D expenditure. We are unable to calculate R&D stock for each region thus we have used R&D expenditure in 2007.

In some cases, the reported regional breakdown of some factor is imperfect. In those cases, we have read carefully the entire annual report and also searched necessary information from the Internet in order to approximate roughly the regional breakdown. For instance, National Semiconductor (US company) reports the regional breakdown of long-lived assets (annual report, p. 104) and employees (annual report, p. 12), but does not report an exact geographic breakdown of its R&D expenditure. However, on p. 21 the company reports that their principal research facilities are located in Santa Clara (California), and that they also operate small design facilities in 13 different locations in the US and 11 different locations outside the United States. Out of those 11 overseas R&D units, roughly half are located in Asia and half in the EU-15 area. Based on these facts, we estimate that approximately 70% of R&D is done in the US and we divide the rest of 30% fifty-fifty for Europe (15%) and Asia (15%).

Operationalization of multi-factor productivity (MFP)

We have used value added based *MFP* figures of the Electrical and optical equipment and Post and Telecommunicationss industries reported by Inklaar & Timmer (2008). This data is downloadable at www.ggdc.net/databases/levels.htm. Based on this database, the regional MFP's used in our estimations are as follows:

MFP_D = 1.24 (Finland)

MFP_E = 0.81 (the average of EU-15 countries excluding Finland)

MFP_N = 1 (United States)

MFP_A = 0.52 (the average of Japan, China, South-Korea and Taiwan). The MFPs of China, South-Korea and Taiwan are based on Motohashi (2008) using Japan as a reference country (Japan=1.00).

MFP_O = 0.37 (the average of Australia, Czech Republic, Hungary, Slovenia)

5 Analysis of the trade collapse in the EU-27

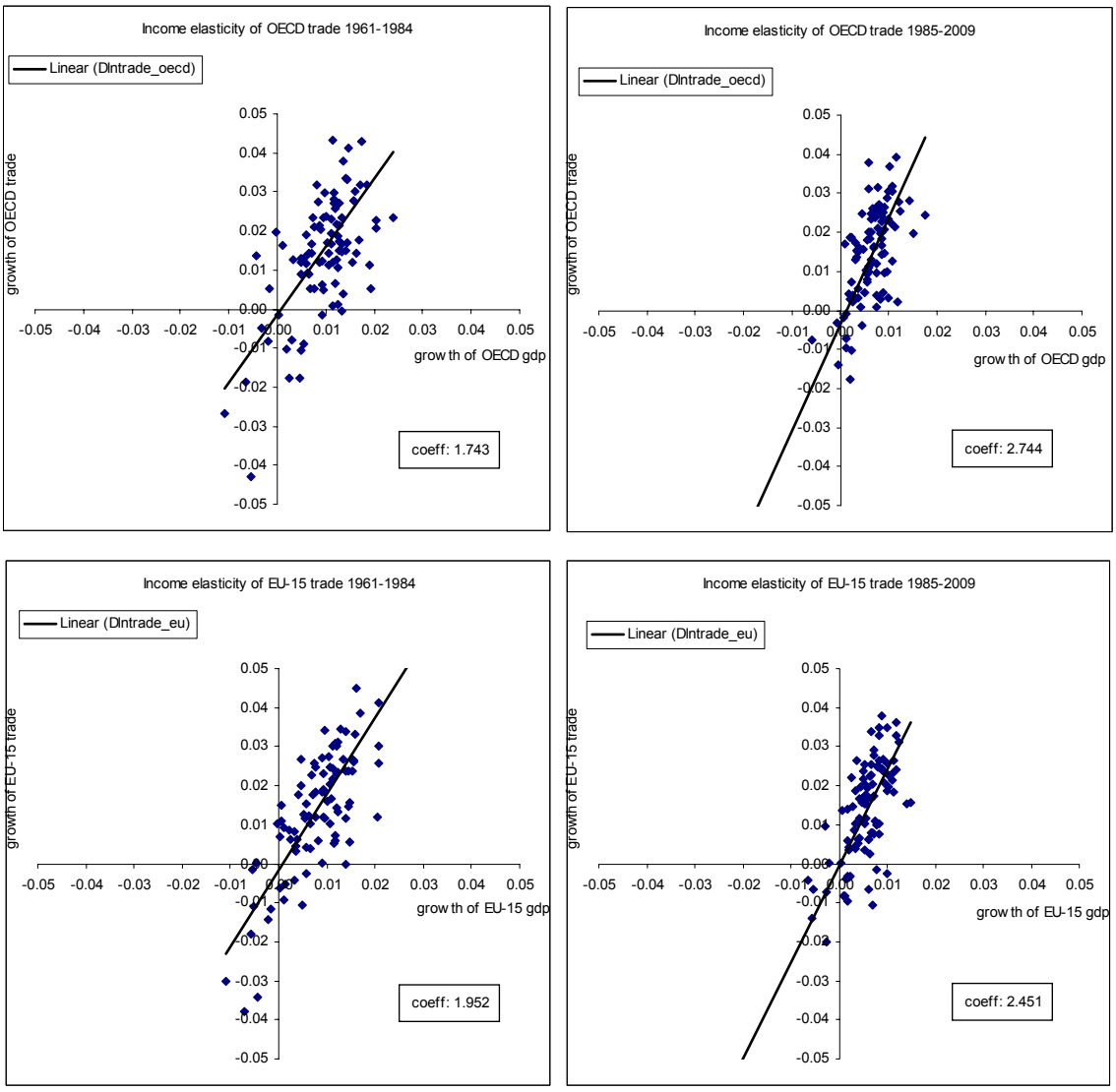
Introduction

The trade collapse following the financial market turbulences of September 2008 and reaching its peaks in the winter months of 2008/2009 was in many respects unprecedented. The trade slump was steeper than even in the Great Depression (Eichengreen and O'Rourke, 2009). Moreover, the trade decline happened on a global scale with an extraordinarily high degree of synchronization (Araújo and Martins, 2009; Araújo, 2009). Various explanations offered to explain the trade collapse of 2008-2009 have been suggested such as an increase in trade costs due to the credit crunch (Escaith and Gonguet, 2009) or protectionist tendencies by major trading partners (Evenett, 2009). From all the potential explanations on offer, the idea that the intensity of the trade decline may be connected to a change in the structure of trade, in particular the increased share of trade in intermediates including intra-industry trade in goods of different stages of the production process, attracted special attention. Related to but partly opposing to these arguments the role of a composition effect has been considered, i.e. the trade slump was reinforced by the fact that important industries (partly intensive in intermediates or components trade) for world trade, such as the automobile industry, were particularly hard hit by the negative global demand shock triggered off by the crisis of the real economy. We shall analyse these issues using COMEXT monthly trade data available at the same detailed level as in section 3. However, in this part we group the products by more refined categories of end-uses than in the previous sections in order to draw the attention of the impact of the crisis on trade in parts and components which is the goods category most closely associated with the notion of international intra-industry vertical supply chains in the actual debate.

Before focussing on the developments of the trade of the EU-27 during the crisis period and the trade in parts and components (P&C) in particular, we take a brief look the income elasticity of trade, that is, the responsiveness of trade to changes in the growth of GDP. Figure 5.1 (upper panels) indicates that the income elasticity of trade increased significantly since the outset of globalization (around 1985) for the group of OECD countries. While this elasticity was 1.74 during the period 1961-1984 so that global trade changed by 1.74% for every 1% change in world GDP, it was 2.74% for the period 1985-2009. The same development is also observable for the EU-15 (Figure 5.1, lower panels). For the EU-15 the income elasticity of trade increased from 1.95 to 2.45 over the same period.

Figure 5.1

Income elasticity of OECD trade and EU-15 trade – 1961-1984 vs 1985-2009



Source: OECD, wiiw estimations.

This significant increase in the income elasticity of trade is well documented in the literature (e.g. Cheung and Guichard, 2009; Freund, 2009) and is closely linked to the analysis of the trade collapse and the role of intermediates trade. The reason is that the higher elasticity of trade with respect to income is, at least partly, driven by increased vertical specialization of countries. That is, countries are not necessarily specialized in the production of goods but in certain stages of production of that good as documented in the literature. The vertical specialization implies that countries produce and export a large amount of intermediate products (and parts and components in particular) which are then further processed or assembled in other parts of the world. Hence, before a country exports a final good, a series of related trade flows (imports of primary, semi-finished goods and parts and components) will have taken place already. If, as was the case during the crisis, demand declines in many parts of the world, not only are the trade flows of finished goods negatively impacted but also the related trade flows in semi-finished goods and parts and components. Because trade statistics register all trade flows in their full amount – contrary to the concept of GDP that is based on the concept of value added – a drop in GDP will have a more than proportional impact on trade with the trade in intermediates acting as a kind of multiplier. The notion that the income elasticity of trade has increased considerably over the past decades is fully in line with the hypothesis that changes in the structure of global trade due to a higher degree of vertical specialization form an important part of the explanation for the severity of the trade collapse.

Trade of the EU-27 during the crisis

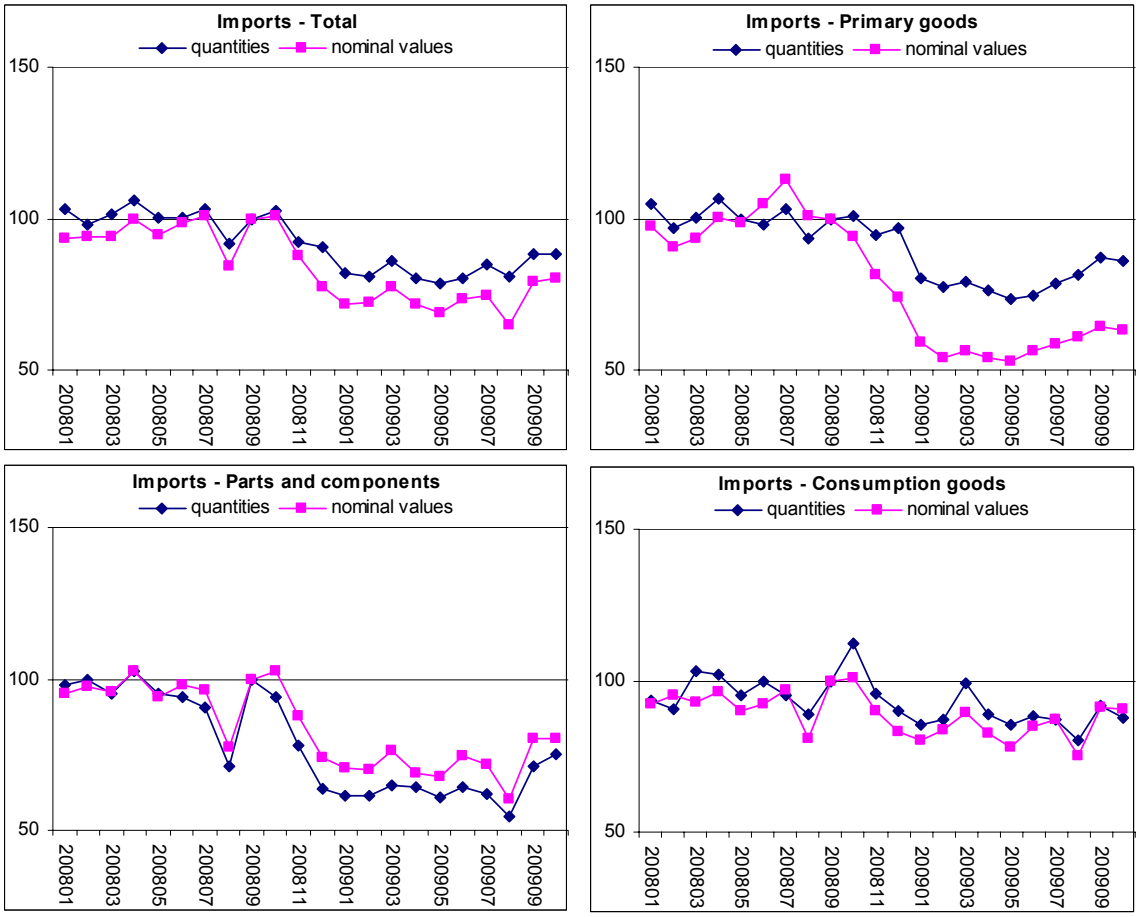
Our analysis of the trade collapse builds on detailed (CN8 digit level) monthly trade data for the EU-27 from the COMEXT database. As in the previous sections we will strongly focus on developments of exports and imports by end-use category. However, given the various and partially rivalling explanations for the global trade slump, including the composition effect of trade, in this chapter we opt for a more refined categorization of end-uses. In particular, we follow the approach in Gaulier et al. (2007) and separate the broad category of intermediates of the OECD classification in *(i)* primary goods, *(ii)* semi-finished goods and *(iii)* parts and components. In line with OECD we continue to treat the two groups of final goods, capital goods and consumption goods separately. Another important difference in this classification is that product groups for passenger cars (BEC category 51) are subsumed under the consumption goods (instead of the catch-all group of category 'not classified' or 'mixed'). This finer split-up of intermediates is motivated by the fact that – though all intermediate goods enter the production process – the crisis reaction was very different for various categories of intermediates. Location and sourcing decisions for primary goods are probably quite different from those for parts and components which also include a high share of inter-company trade of multinationals. The analysis of trade in parts and components which, in contrast to primary and semi-finished goods, include a high share of tech-

nologically sophisticated goods may in general be a more appropriate proxy for vertical specialization *within* particular industries[18].

The degree of disaggregation of our data and the fact that not only values but also quantities (in tons) are reported allows us not only to track developments based on nominal trade data but also developments in trade volumes and, using implied unit values, trade in real values. Figure 5.2 demonstrates that there is actually a big difference in the nominal trade slump and the real trade decline measured in the actual volumes trade.

Figure 5.2

Import volumes vs. nominal values of the EU-27 by end-use category, (September 2008 = 100)



Source: COMEXT, wiiw calculations.

A glance at total EU-27 imports shows that both volumes and nominal values declined very sharply between October 2008 and January 2009, with imported values declining even more strongly because of decreasing import prices. The development of prices, however,

[18] The trade statistics as used here in fact only allow us to reveal intra-industry vertical specialization because products are always allocated to the industry that typically produces this product and not to the industry where it is used for production purposes.

was not uniform across the different types of goods. In particular, the price declines were most pronounced in imported primary goods, where import values dropped below 60% of their September 2008 level while imported volumes declined to approximately 80%. In contrast, price declines were much more modest in imported consumption goods, where the difference in the decline of imported values (15 percentage points) and volumes (10 percentage points) amounted to only 5 percentage points, again comparing January 2009 with September 2008 which serves as the general point of reference for this analysis. Interestingly, the situation is very different for imported parts and components (P&C). In this category of goods, volumes declined stronger than values indicating even rising import prices in this category of goods. The situation is very similar for EU-27 exports for all goods categories. We use this comparison of values and volumes to demonstrate that there can be considerable differences in the development of these two series. Whenever possible, we rely on the volumes indicator or a derived series of real values as the interest is with respect to trade flows and the location of production[19]. In all comparisons of trade over time, we fully exploit information based on trade volumes. For comparisons across different categories of goods, however, we will occasionally also have to fall back on our series of nominal value.

The impact of the crisis on trade flows across end-use categories

Relying on trade volumes we analyse the development of total EU-27 export and imports by the end-use categories introduced above, i.e. primary goods, semi-finished goods, parts and components (P&C), capital goods and consumption goods (including passenger cars). There is also a category of not classified goods which mainly consists of motor spirits and confidential values in the COMEXT database.

Looking first at the development of aggregate exports during the crisis, Figure 5.3 reveals that export volumes declined sharply between October 2008 and January 2009 where the index of aggregate exports reached its trough at a level of 77% compared to the September 2008 volume, i.e. a decline of 23% in real values. The start and the intensity of the trade collapse were similar on the import side but the decline was somewhat more extended lasting until April 2009 where the volume index reached its low at 80%. Hence, during the peak of the crisis the export decline (24%) was stronger than on the import side (20%) in real terms. Differences are also observable for the initial recovery phase which is discernible on the export side, starting in February/March 2009 and – neglecting the seasonal drop in August – lasts until October 2009, the end of our observation period. In contrast, for imports no real recovery can be detected before September 2009 so that one year after the outbreak of the crisis (September 2008) the index level of exports was 4 percentage points above the import level despite the initially stronger drop of export volumes.

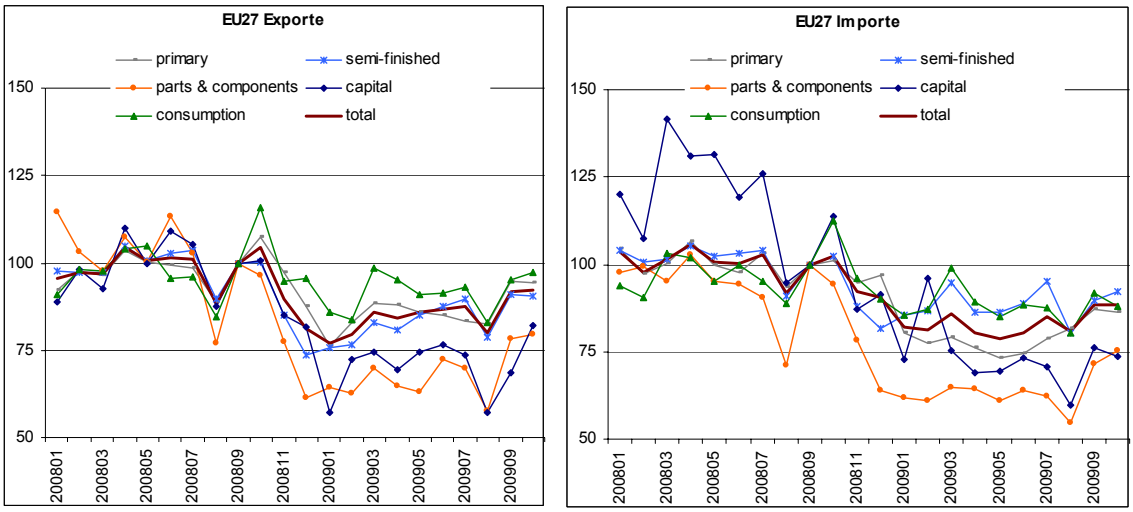
[19] Trade values are more telling if one would be predominantly interested in the impact of the crisis on the balance of payments for example.

These differences in the recovery of trade volumes largely reflect differences in the overall recovery from the crisis which appears to be more sluggish in the EU-27 than in other regions, in particular Asia and China.

Against this background, the most outstanding point that emerges from Figure 5.3 is that parts and components registered the most pronounced drop in trade volumes both on the export and on the import side, followed by capital goods. For example, imported parts and components stood at about 62% of its September 2008 volume level and remained at a very low level until September 2009 when it started to pick up again. Both on the export and on the import side the EU-27 trade in parts and components remains depressed at around 75% of its September 2008 level at the end of our observation period.

Figure 5.3

Development of EU-27 exports and imports by end-use categories during the crisis, (trade volumes, September 2008 = 100)



Source: COMEXT, wiiw calculations.

How can this relatively stronger decline in trade of parts and components be explained? At least two explanations are on offer here. First, the crisis might have reversed the tendency of ever deeper vertical integration and fragmentation of the production process. This reversal may have caused a split-up of established international vertical supply chains which also include a considerable amount of intra-company trade. Raising protectionism and export financing costs during the crisis resulting in higher trade costs lend support to this hypothesis because higher trade costs make, everything else equal, off-shoring and other forms of international vertical specialization less profitable (Escaith and Gonguet, 2009). A related argument is that the crisis made firms to notice that they may have overdone vertical specialization and that the complexity of international supply chains is hard to manage, in particular but not only in times of crisis. In fact, in the managerial literature the argument is made that the advantages of outsourcing may have been overestimated due to the fact

that increased costs associated with the higher complexity involved in long vertically differentiated supply chains are 'hidden' in overhead costs (e.g. Mariotti and Conway, 2007). This must be even more the case when the supply chains are international as the vulnerabilities and complexities are also larger. In this sense, the crisis could have increased the awareness towards the 'costs of complexity' thereby reversing the trend of outsourcing and international outsourcing and offshoring of activities in particular which are reorganized to be kept inside the boundary of the firm. This hypothesis stresses supply side factors impacting trade flows negatively.

Second, an alternative, but not necessarily contradicting hypothesis, is that the more than proportional decline in parts and components (or intermediates more generally as semi-finished goods were also among the worst hit categories at the beginning of the crisis) can be explained by a sectoral composition effect (e.g. Araújo and Martins, 2009; Bricogne et al, 2009). According to this hypothesis parts and components were hit harder because vertical specialization plays a bigger role in industries that were most strongly affected by the negative demand shocks such as machinery or the car industry. This explanation stresses the demand side as the main source for the trade collapse. To make matters even more complicated: the supply side driven hypothesis is also reconcilable with a sectoral bias if trade costs differ according to external credit dependencies of different sectors (Iacovone and Zavacka, 2009; Bricongne et al., 2009).

Behrens et al. (2010) even argue that there is no composition effect in the trade collapse based on a detailed analysis of Belgian firm level data. They find that the trade decline is due almost entirely to the intensive margin of trade, that is, exporters reducing the volume of their exports as opposed to the extensive margin, that is, changes in the number of exporters. The finding that the trade decline is predominantly due to the intensive margin suggests that existing international supplier relations have not been broken up. It therefore lends support to a purely demand driven explanation for the trade collapse. In absence of a composition effect, the extremely large drop in trade flows compared to declines in GDP is then attributable to the multiplicative effect of trade in intermediates as explained before.

We can use our detailed trade data to track the development of the share of parts and components in total trade. In this exercise we will treat parts and components as a proxy for the intensity of international supply linkages and therefore the depth of vertical specialization. For the purpose of crisis analysis we consider this narrower but also more specific category of parts and components more appropriate than a broader measure of intermediates trade because, if any, it is this kind of supply linkages that are more likely being shattered by the crisis (e.g. carmakers might reconsider their production locations during the crisis to source domestically). In particular we will compare the share of trade in parts and components before and after the crisis. If international supply linkages were really broken as a consequence of the crisis, the share of this category in total trade should have de-

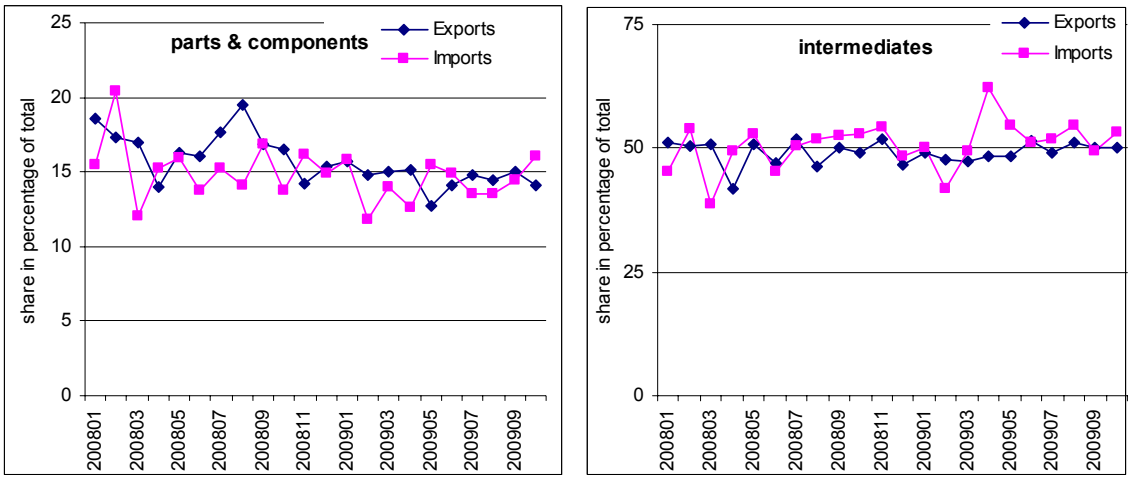
clined both at the total manufacturing level20 (NACE 15-26) and in individual industries. The alternative explanation stresses the composition effect and we are therefore interested in the relative decline of real values across industries. Note that this hypothesis also implies a lower share of trade in parts and components at the level of total manufacturing but, importantly, not at the level of individual industries. In other words, if parts and components trade declined at the level of manufacturing but not at the level of individual industries, the composition effect should play an important role. The decline in manufacturing wide share of parts and components trade is then attributable to the stronger trade decline in industries with higher shares of parts and components trade. The causality according to the demand driven hypothesis is assumed to run from industries to shares in parts and components. With the trade data at hands we can only track the correlation between those two but – unfortunately – are unable to identify the causality.

The development of trade in parts and components on the level of manufacturing

For the comparisons of trade developments during the crisis and across groups of products we use as far as possible real trade values as mentioned above. Real trade values are derived from nominal trade values and an implicit price index constructed from the data on values and quantities at the detailed 8-digit level. We first use trade volumes to calculate implicit unit values. On the basis of these unit values a price index is derived which enables us to transform nominal trade values in real values. This means that we express real trade values at constant prices of September 2008.

Figure 5.4

Share of parts and components (left) and intermediates (right) trade in total EU-27 manufacturing trade – real values



Source: COMEXT, wiiw calculations.

[20] In the manufacturing level a decline in the share of parts and components is to be expected given that it was the category of goods hit strongest by the crisis.

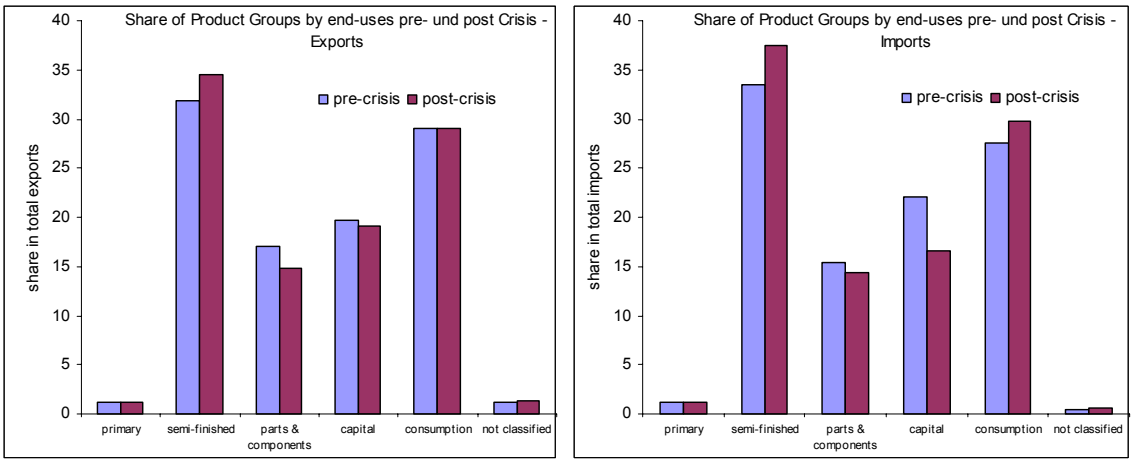
Figure 5.4 (left panel) plots the shares of part and components in total trade (real values) over time for both EU-27 manufacturing exports and imports. The development is characterized by considerable monthly fluctuations which is often the case with high frequency trade data. More importantly, there is a slight decline discernible in the share of parts and components trade although this decline is not dramatic.

Figure 5.4 also shows the development of a broader measure of intermediates trade which including parts and components and semi-finished goods (right panel). As pointed out above, we do not think that semi-finished goods are a good indicator for the break-up of intra-industry vertical supply chains which might be mostly hit by the crisis. However the development is shown for comparative reasons. The share of the intermediate goods is rather constant, with even a slight increase of its share on the import side which is due to an increase in the share of semi-finished products.

Since the monthly fluctuations blur the development in the shares of the different product categories we also compute the pre-crisis and post-crisis averages of these shares (January 2008 to September 2008 and October 2008 to October 2009, respectively). These calculations confirm the decrease in the share of trade in parts and components: 2.25 percentage points on the export side (from 17.02% to 14.77%) and 1.07 percentage points on the import side (from 15.46% to 14.39%) (Figure 5.5).

Figure 5.5

Changes in the share of exports and imports by end-use category in EU-27 manufacturing trade: pre-crisis (Jan 2008 – Sept 2008) versus post-crisis averages (Oct 2008 – Oct 2009) – real values



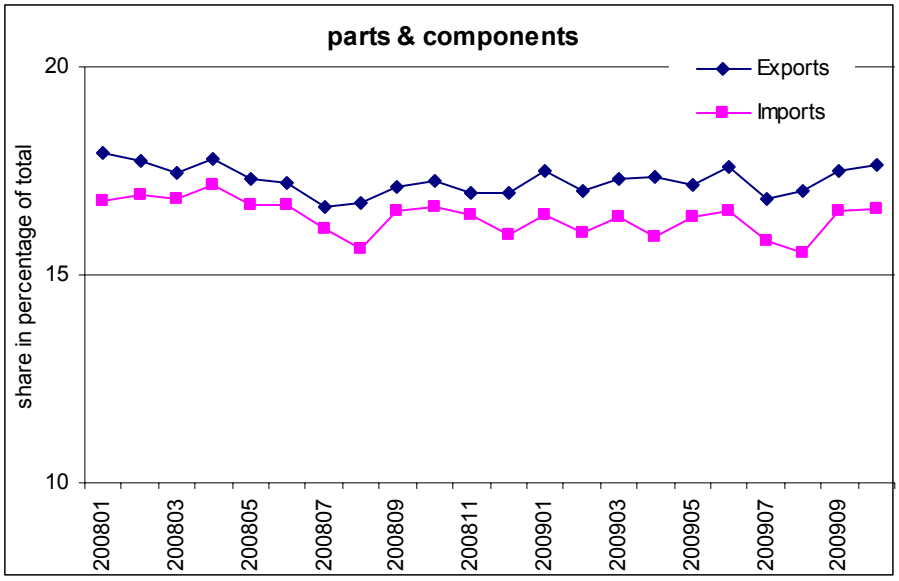
Source: COMEXT, wiiw calculations.

The decline in the share of parts and components contrasts with the increase in the share of trade in semi-finished products mentioned above, both on the export and on the import side. On the import side there is also a marked decline in the share of capital goods which is compensated by increases in the share of imported consumption goods.

For the sake of completeness and because this is a major aspect in the discussion on the reasons behind the trade collapse we also show the corresponding developments in nominal value terms. In accordance with the fact shown above, that the prices of products in the end-use category parts and components, on average, has increased, the share of parts and components trade has remained rather constant over the crisis period, with only the usual monthly fluctuations discernible (Figure 5.6).

Figure 5.6

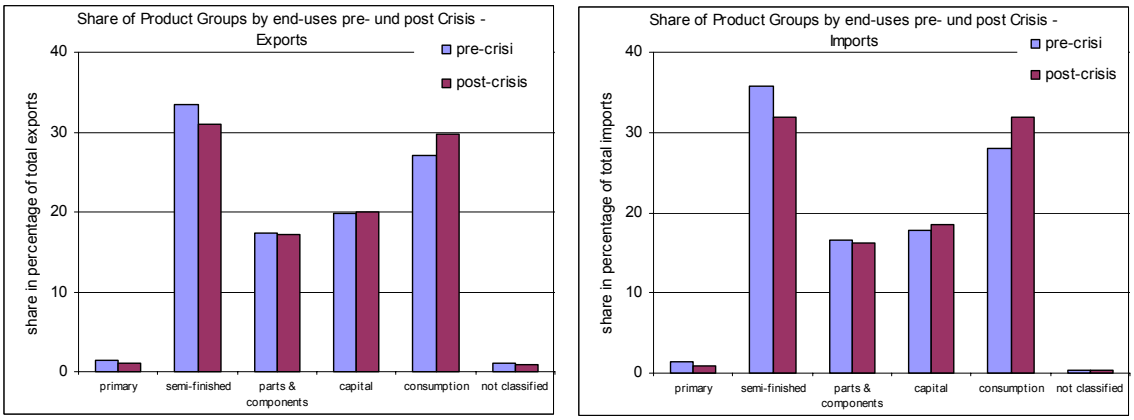
Share of parts and components (left) and intermediates (right) trade in total EU-27 manufacturing trade – nominal values



Source: COMEXT, wiiw calculations.

Figure 5.7

Changes in the share of exports and imports by end-use category in EU-27 manufacturing trade (nominal values): pre-crisis (Jan 2008 – Sept 2008) versus post-crisis averages (Oct 2008 – Oct 2009) – nominal values



Source: COMEXT, wiiw calculations.

Comparing the pre-crisis average with the post-crisis average of the share of parts and components in total nominal trade there is no decline on the export side and de facto no decline on the import side (-0.35 percentage points) either (Figure 5.7).

For our purpose, the most important fact to note is that there has been a decline in the share of parts and components trade in real value terms but that this decline is modest. Hence, this result does not lend too much support to the thesis that the crisis led to a break-up of international supply links. We will further investigate this issue by looking at the share of parts and components trade in individual industries.

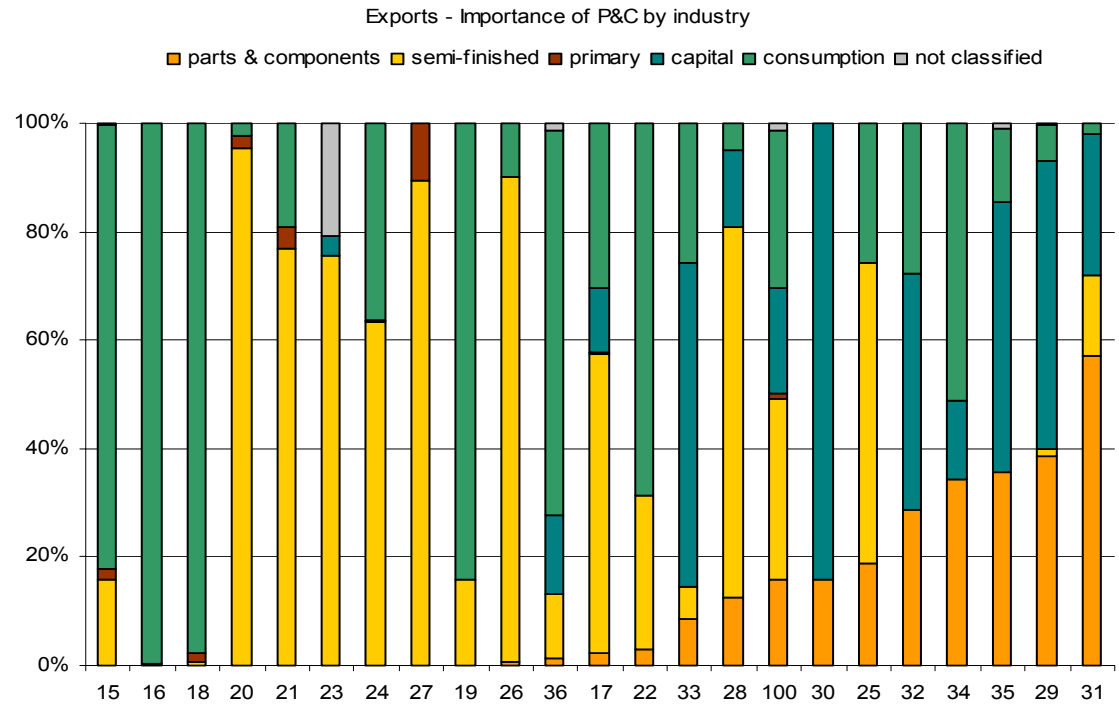
The share of parts and components across industries

The next step is to identify the industries with the most advanced (intra-industry) stage of vertical specialization. Figure 5.8 shows that vertical specialization, as measured by parts and components trade, plays a role in roughly half the manufacturing industries. These are mainly industries with medium and high technology intensity. The highest degree of vertical specialization is found in the electrical machinery industry (NACE 31) with 57% of exported goods constituting trade in parts and components, followed by the machinery and equipment industry (NACE 29) with a share of 39% in parts and components trade. In the transport equipment (NACE 35) and automotive industry (NACE 34) parts and components account for 36% and 34% of industry exports respectively. Note that industries which produce semi-finished goods as main outputs such as the basic metals (NACE 27) or the wood industry (NACE 20) (which is a results of the way NACE industry are defined) would in this case not been characterized by vertical specialization. The trade in parts and components in the metal industry then shows up in the metal products industry (NACE 28), together with a high share of semi-finished products. While the definition of NACE industries certainly influences these results we are nevertheless confident with the parts and components trade share as a measure for vertical specialization as the latter naturally plays a more important role in the production of more complex goods.

The industry ranking by the share of parts and components imports looks very similar albeit some differences exist (Figure 5.9). While the electrical machinery industry (NACE 31) is also the industry with the highest share of parts and components in imports (55%), it is followed by transportation equipment (45%). The machinery and equipment industry come third and the radio and television industry (NACE 32) fourth. The automotive industry, which comes next, has a share of 36% of parts and components trade. So, despite some differences in the precise ranking, the importance of parts and components is very similar on both the export and import side with the five industries mentioned being those with the highest degree of vertical specialization.

Figure 5.8

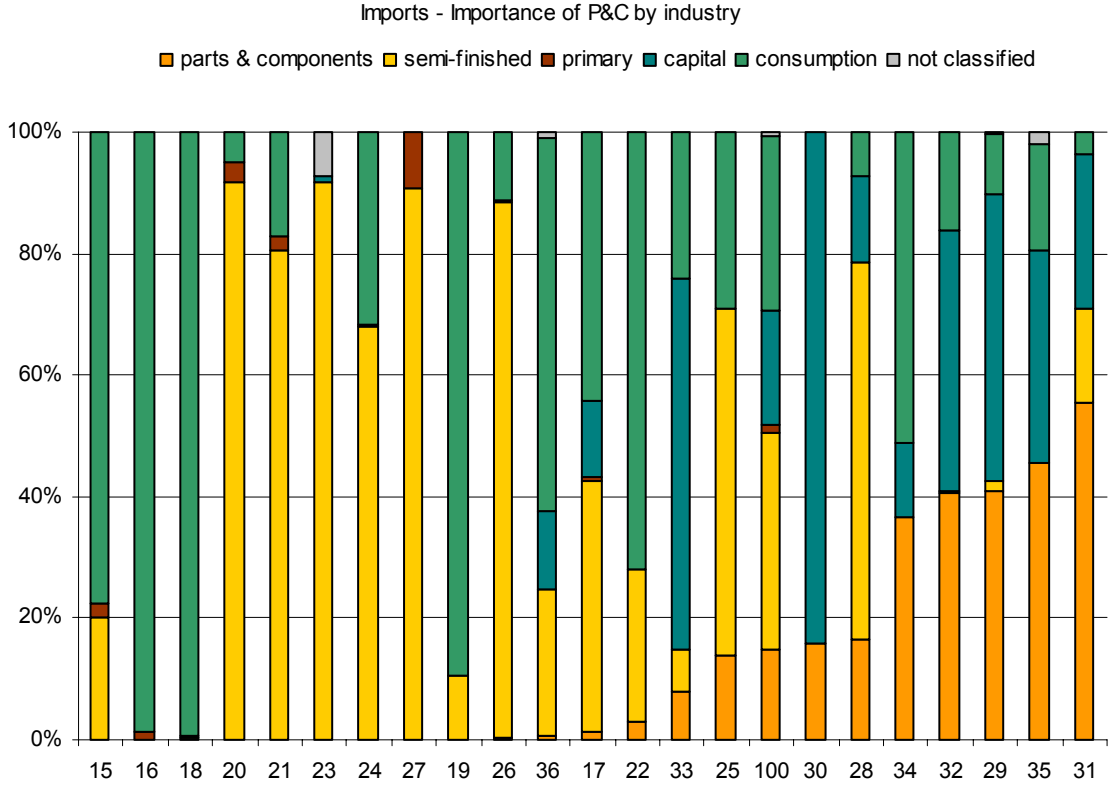
Share of parts and components trade in EU-27 exports (average Sep 2008 to Oct 2009)



Source: COMEXT, wiiw calculations.

Figure 5.9

Share of P&C trade in EU-27 imports (average Sep 2008 – Oct 2009)



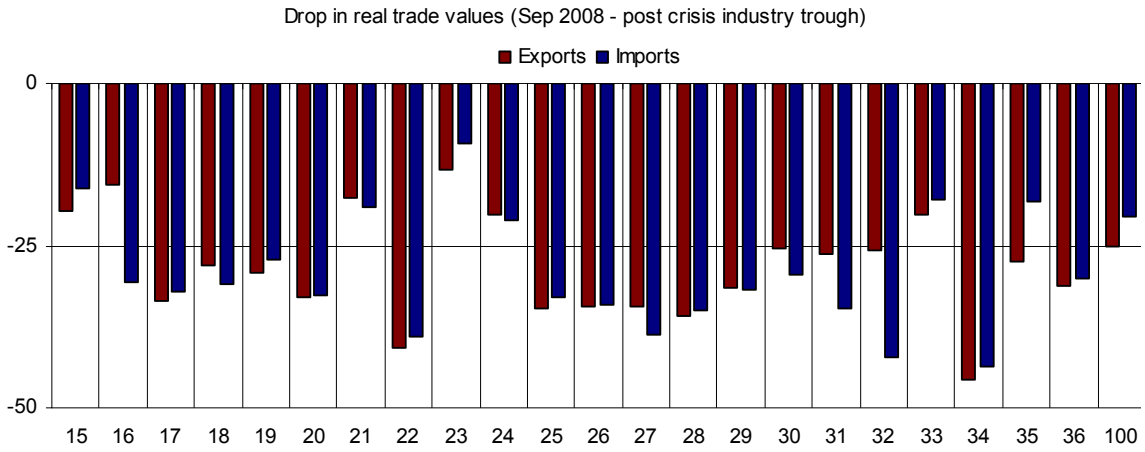
Source: COMEXT, wiiw calculations.

The decline in total trade across industries

The composition effect would only be a plausible explanation for the strong decline in total trade in comparison with GDP if there are large differences in the decline of export and imports across industries and the industries that are more than proportionately hit by the negative demand shock have a large trade share in total trade. Similarly, and more specifically on the role of intermediates for the trade collapse, the composition effect can only explain the more than proportionate drop in parts and components (on the manufacturing level) if the industries which have a high share of parts and components trade account for more than a proportionate drops in total trade. Figure 5.10, showing the drop of real EU-27 trade values in percentages from September 2008 to the lowest post-crisis level, indicates that there is indeed a large degree of variations in the growth performance of individual sectors. If we compare the industries with the most pronounced declines of real trade values, we find that for both export and imports, the automotive industry (NACE 34) experienced the biggest drop amounting to about 45% of its September 2008 level. As was shown above, the automotive industry is also among the industries with the highest share in parts and components trade. Apart from the devastating developments taking place in the automotive industry, the other industries singled out with high shares in parts and components trade did not performed as bad, albeit the machinery and equipment industry (NACE29) experienced a drop in real trade values clearly above the average, as did the imports attributed to the electrical machinery industry (NACE 31) and the radio and television industry (NACE 32). The same, however, is true for a series of other industries with hardly any trade in parts and components such as publishing and printing (NACE 22), rubber and plastics (NACE 25), mineral products (NACE 26) and basic metals industry (NACE 27). Moreover, the transport equipment industry registered a below average decline, at last on the import side.

Figure 5.10

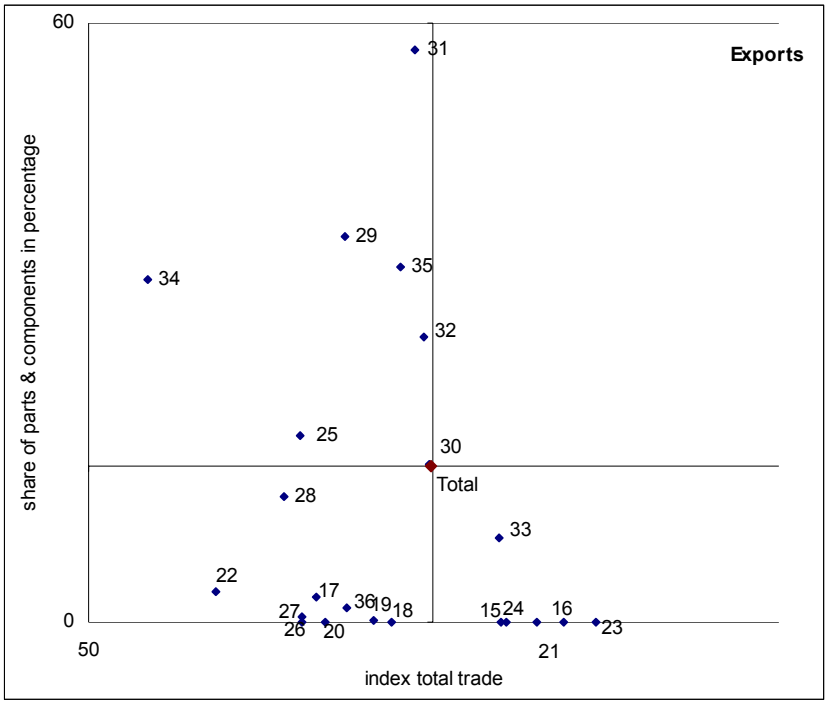
Decline in real export and import values – Sep 2008 to post-crisis industry low



Source: COMEXT, wiiw calculations. August 2009 values neglected due to seasonal fluctuations.

Figure 5.11

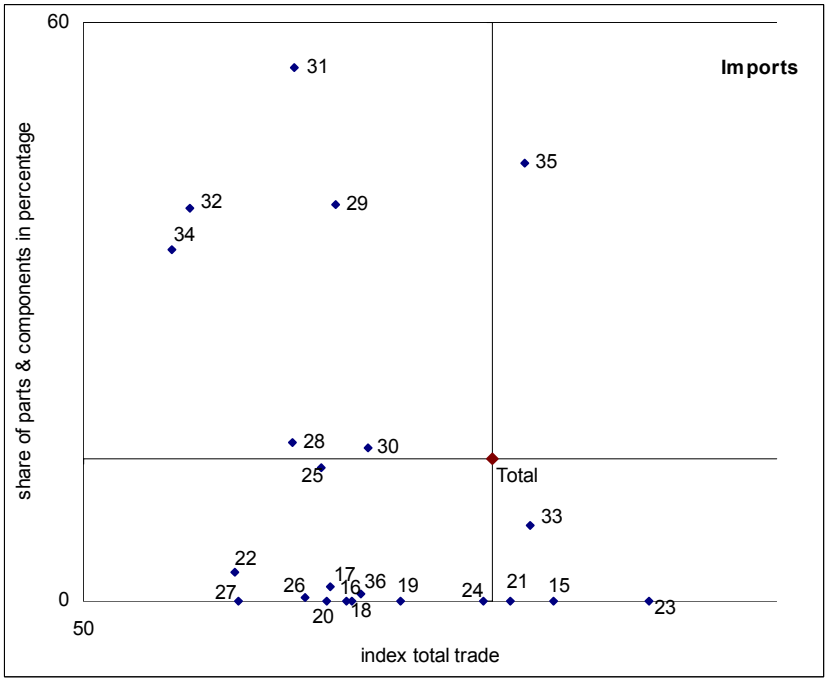
Index of real export values against share of parts and components trade of individual industries. Decline from Sep 2008 to post-crisis industry low



Source: COMEXT, wiiw calculations. August 2009 values neglected due to seasonal fluctuations.

Figure 5.12

Index real import values against share of parts and components trade of individual industries. Decline from Sep 2008 to post-crisis industry low



Source: COMEXT, wiiw calculations. August 2009 values neglected due to seasonal fluctuations.

Figures 5.11 and 5.12 show that there seems to exist some (negative) correlation between the single industry's exports and imports drop respectively during the crisis and the share of parts and components trade of industries. However, the correlation is rather weak. Most industries with a high share in parts and components trade appear in the left upper quadrant in these figures implying that they also experienced a higher drop than the overall manufacturing sector. However, there is also a series of industries with no or hardly any trade in parts and components (left lower quadrant). The correlation seems to be somewhat stronger for EU-27 imports than for exports, but also in this case industries such as basic metals (NACE 27) and publishing and printing (NACE 22) are among the industries with the largest decline in imports (albeit having no or very low shares of parts and components trade).

Since the data does not contain information on the causality in this (weak) correlation, the argument can also be put on its head, so that the argument is that the automotive industry and the machinery and equipment industry registered a large drop in trade values *because* of the high degree of vertical specialization and the corresponding high share in exports and imports of parts and components (e.g. Araújo and Martins, 2009). This argumentation builds on the multiplicative negative effect on trade if a lot of trade is in the form of intermediates trade. This line of argumentation does *not* necessarily predict that P&C and semi-finished goods are the goods categories that declined most during the crisis but stresses the fact that a given drop in demand has a greater impact in industries with a high share in intermediates trade because 'lost' trade flows of final goods are most likely to be accompanied by preceding trade flows in intermediates.

In some respect this is a puzzling result as both the composition effect and the hypothesis that the crisis shattered many established international vertical supply chains would suggest a much stronger and clearer picture. It is, however, reconcilable with the earlier finding that parts and components trade, albeit being the hardest hit goods category, the loss in the share of this category of goods was rather moderate (2.25 percentage points on the export side and 1.07 p.p. on the import side).

The development of trade in parts and components on the level of individual industries

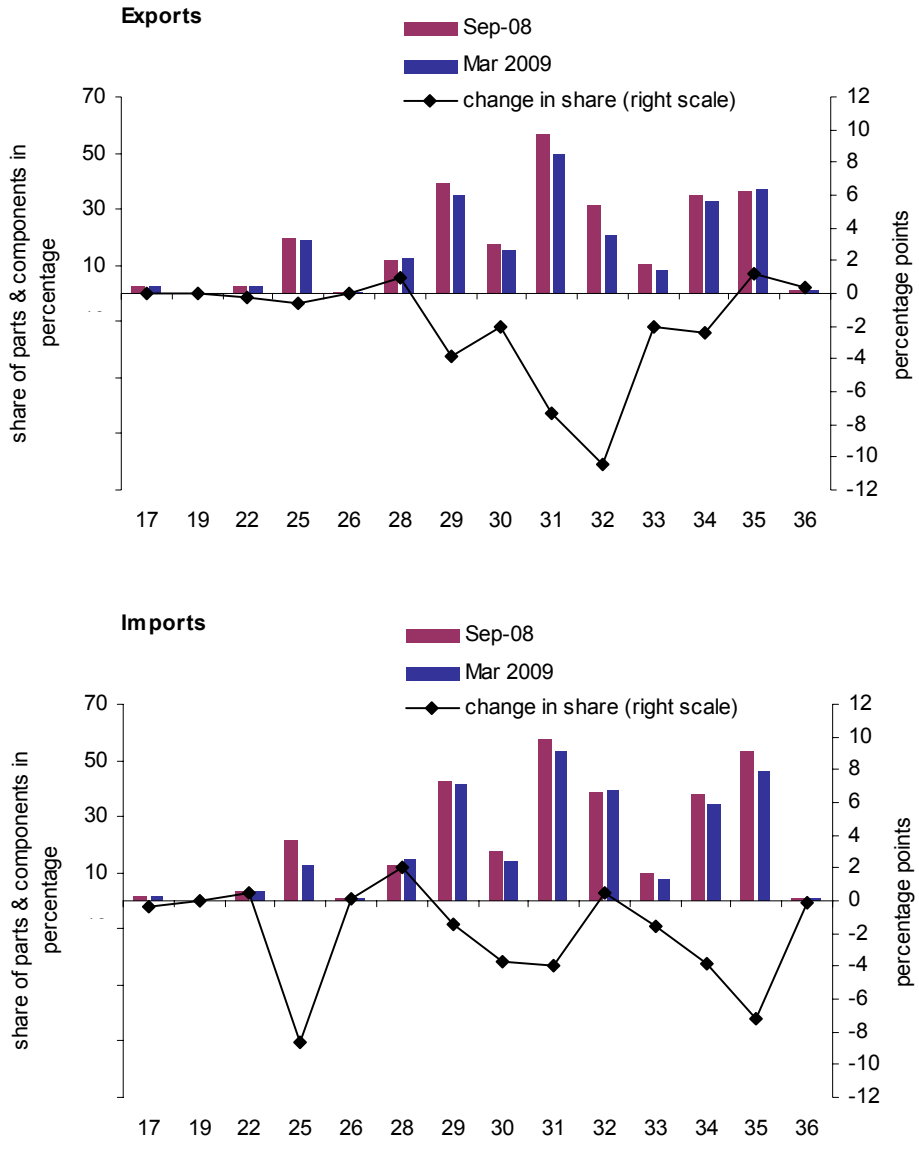
Finally, we look at the change in the share of parts and components exports and imports on the level of individual industries. As can be seen in Figure 5.13, which shows all manufacturing industries where P&C trade plays some role, the share of parts and components in EU-27 exports declined considerably due to the crisis in basically all industries where this type of trade is important. Remarkable is the decline in the highly vertically specialized electrical machinery industry (NACE 31) where the share of P&C exports dropped by more than 7 percentage points, and the decline in the radio, television, communication industry (NACE 32) which amounted to more than 10 p.p.. The share of parts and components in EU-27 exports also declined by 2 p.p. or more in the machinery and equipment industry

(NACE 29), the office machinery industry (NACE 30) and the automotive industry (NACE 34).

On the import side, strong declines in the share of parts and components trade was registered in the rubber and plastics industry (NACE 25) and the transport equipment industry (NACE 35). A reduction in the relative importance of parts and components is also found for the other industries with a high share of P&C in total imports including the machinery and equipment industry (NACE 29), the electrical machinery industry (NACE 31), the radio, television, communication industry (NACE 32) and the automotive industry (NACE 34).

Figure 5.13

Changes in the share of parts and components in EU-27 manufacturing export and imports; September 2008 and March 2009



Source: COMEXT, wiiw calculations.

Overall Figure 5.13 suggests considerably declines in single industries with a high share of P&C trade. Therefore, the manufacturing wide decline in the share of parts and components trade is apparently not entirely explained by the composition effect but also the result of a decline in the relative importance of trade in parts and components, our indicator for the degree of vertical specialization. Hence, while the result may be also influenced by other factors that contributed to the trade collapse, notably the inventory cycle, the development of P&C between September 2008 and March 2009 is compatible with the hypothesis that the crisis caused a disruption of established international supply chains.

Summary of findings and conclusion

This section analysed the impact of the crisis on EU-27 trade flows with a strong focus on the role and development of trade in parts and components, our proxy of for vertical specialization of industries. While a series of rivalling explanations for the trade collapse in the winter months 2008/2009 has been offered, the results of our analysis suggests that these explanations must not be seen as mutually exclusive. More likely, the trade collapse between September 2008 and February 2009 is the result of an interaction of demand side and supply side factors.

We first reconfirmed the stylized fact that the changes in the structure of trade, i.e. the larger share of trade in intermediates, caused the income elasticity of trade to increase. This fact helps to explain why the drop in real values was so much higher than the drop in outputs. However, trade data for the EU-.27 also shows that trade in intermediates not only acts as a multiplier in the trade statistics but that the category of parts and components was also the one most badly affected by the crisis, standing at 62% of its September 2008 volume in January 2009. As a result, the relative importance of parts and components in EU-27 trade declined, with the post-crisis share of parts and components in EU exports and EU imports declining by 2.25% and 1% respectively. This decline appears to be rather small but when individual industries are considered, the changes become more pronounced for some industries with a high share of parts and components trade, reaching 6 percentage points for the share of P&C in EU-27 exports in the electrical machinery industry. This result supports the claim that the manufacturing wide share decrease in the share of parts and components trade is not entirely attributable to a composition effect, i.e. that the relatively higher drop in parts and components trade is the result of larger drops in real trade values of industries with a lot of parts and components trade. Rather, parts and components as a goods category also declined relative to other categories at the level of individual industries. This would be in line with the hypothesis that the crisis destroyed existing international vertical supply chains, maybe because crisis-related increases in trade costs made some firms in some industries ‘onshore’ some of the previously outsourced production processes due to higher trade and transaction costs which could be seen as supply side shock causing a drop in trade flows during the crisis. The demand driven decline is visible from the fact that there is a wide variation in the decline of total trade across indus-

tries with some (automotive) but not all (electrical machinery) industries with a high share of parts and components trade being highly affected by the crisis. Moreover, some of the industries where vertical integration plays no role were also hard hit by the crisis (publishing, minerals). This may suggest that the sector-specific demand shocks may have played a large role. Consequently, the fact that many of the industries with a high share in parts and components trade also registered large drops in total trade flows may mainly be due to industry-specific negative shocks but in several cases aggravated by the multiplicative effect of the trade in parts and components and a reversal of the outsourcing trend and ever deeper international vertical integration.

If the drop in the share of parts and components trade actually reflects the destruction of vertical supply chains, this will cause the recovery of trade flows to be slower than would otherwise be the case once foreign demand sets in again.

6 Summary

The study provides a detailed analysis of the structure of the international production process with respect to EU countries at various levels of analysis. We started using information gathered from detailed trade statistics to analyse the relative importance of trade in intermediate products in overall trade, the respective changes over time and the important differences between EU-27 countries. Here we emphasized the importance of considering both exports and imports of trade in intermediates, the geographic structure of sourcing and provision of intermediates, pointing out important regional shifts, specialization patterns and the importance of two-way trade in intermediates amongst other things. The study then continued providing information on the using side of imported intermediates and its role in inter-industry linkages. This was studied at a very detailed level – at the level of a single product, the Nokia N95 – exemplifying the complexity of international production processes for a high-tech product. Finally, we studied the effects of the crisis on trade in intermediates – whether being a cause or a consequence of the trade collapse – and potential implications for future developments. Let us now provide a summary of the most important findings of these issues.

Patterns of trade in intermediates

Here we summarize the most important findings of the study focusing on policy-relevant areas which might emerge based on the findings. Using a broad definition of trade in intermediates that captures the idea of a supply chain (including parts and components, semi-finished and primary products), the share of intermediate imports in total EU-27 trade is higher than 50%. This, however, conceals large country variations, with shares ranging from less than 40% (Greece) to more than 60% (Hungary, Slovakia). Similar numbers are found when considering exports: again slightly more than 50% of total EU-27 exports is

accounted for by intermediate goods exports, with significant differences found across countries. With respect to trading partners, the bulk of EU-27 trade occurs mostly between EU-27 countries (almost 70% for both exports and imports of intermediates). These figures differ somewhat across product categories, being higher for imports of the 'mixed' product category including passenger cars and motor spirits (about 85%) and lower for exports of capital goods (about 60%). About 9% to 10% of trade in intermediates occurs between EU-15 and EU-12 countries. The remaining part of EU-27 trade is split between advanced OECD countries (about 11%) and BRIC countries (about 9% in the case of imports and 6% in the case of exports). Asian countries play a relatively minor role. In some cases there are important differences across product categories, with imports from BRIC countries of consumer and capital goods for example accounting for more than 13% of total imports (compared to 9% for intermediates).

One of the most commonly mentioned aspects of the process of increasing globalization of production is that the share of intermediates has increased over time and thus gained importance. As mentioned above, the extent to which this is true may depend on the exact definitions applied and the level of analysis adopted (e.g. industry level) as well as the time span considered. At the aggregate level, an important aspect to be considered is whether the level of outsourcing (e.g. as a share of total trade) has increased over time and, if so, whether this has been driven by changes in industrial specialization structures (e.g. towards industries which are traditionally more intensive in outsourcing) or a general increase across all industries. The current study shows that the shares of imported intermediates are rather stable for each industry and that there is a high correlation of these shares across countries (again at the level of industries). This would suggest that specialization patterns may play an important role in explaining cross-country differences and changes over time. Concerning the time aspect, we considered whether there was a general trend towards increasing shares of trade in intermediates using a decomposition methodology. One striking aspect that results from this exercise is that the slightly larger increase in trade in intermediates as compared to other product categories is mostly due to a shift in the import or export structures across industries (i.e. a shift towards industries with more trade in intermediates, the between-component) rather than a generally higher share of intermediates trade in each industry (within-component) – which is even negative. This is in line with the fact that the shares of intermediates in total trade (by industry) are relatively constant over time and very similar across countries.

Of greater importance and interest, however, are the shifts that have occurred over the last decade with respect to the geographic structure of trade in general and intermediates in particular. Considering first EU-27 imports, a common trend is that the EU-15 countries, the advanced OECD countries and the Asian countries have lost market shares in all product categories whereas the EU-12 and the BRIC countries have gained market shares. These shifts have been slightly less pronounced for trade in intermediates (espe-

cially when compared to capital goods). A similar pattern is found for EU-27 exports, with rising export shares (in total EU-27 exports) observed for EU-12 and BRIC countries. In this sense, trade in intermediates is thus not too distinct from trade in other product categories though the shifts seem to be slightly less pronounced in intermediates trade. A more striking aspect is that these shifts can be observed across all industry categories (in the study industries are grouped into low-, medium-low-, medium-high-, and high-tech industries). In particular, import shares from BRIC countries increased relatively strongly in high-tech intermediates at the expense of EU-15 and advanced OECD countries, whereas EU-12 countries gained mostly in high-tech consumer goods (shifts are similar for other industry categories but less pronounced). On top of that, there have also been important shifts within EU-15 export structures. For all product categories, Great Britain and France (along with Italy and Belgium to an extent) lost shares in total EU-27 exports whereas most of the EU-12 countries and Germany gained shares. This pattern is again particularly pronounced for intermediates in high-tech industries.

Summarizing, there are three trends observed with respect to geographic patterns: a shift towards increased extra-EU-27 trade, a general shift of trade within the EU-27 towards the EU-12 countries, and a pronounced shift in export shares within the EU-15, with Great Britain and France losing shares and Germany gaining shares. Though there are some differences across product categories, these are more or less following common trends in trade patterns, with shifts tending to be a little less pronounced for trade in intermediates. Changes of shares in industries classified as high-tech seem to be more pronounced. For all product categories these shifts seem mostly to be driven by factors related to comparative and absolute advantage (wage changes, exchange rates, productivity dynamics and changes in specialization patterns). In a broader sense, this leads to the question of whether Europe as a whole loses in terms of creation of value added and whether there are significant shifts within the EU, though this study does not tackle this issue in detail at a broader level (see however the case study).

One then may be tempted to ask whether there is a specific group of countries that tend to be relatively specialized in the supply of intermediate products (due to various country characteristics, specificities of firm behaviour, network effects) and a group that consists primary of users of intermediates for production purposes which according to the literature is not clear a-priori. Given the fact that countries are both exporters and importers of intermediates, one would however not expect complete specialization – it is rather a question of degree. In the present study various relative specialization measures (RCA measures) are employed to pin down these patterns. The results point towards the fact that the countries relying relatively more on imported intermediates are rather heterogeneous, e.g. including Germany, Italy and France but also a number of Eastern European countries – which might come as a surprise as this latter group of countries is often seen as important target countries for outsourcing. Countries in this group serve as important assemblers of particu-

lar products (especially cars) however, pointing again to the importance of industry structures. Although there are some changes over time, the general pattern of revealed specialization remains quite constant. Again, industrial specialization seems to play an important role. In addition, changes in revealed specialization patterns are more significant in higher-tech products and sectors.

Related to these revealed specialization patterns – which take both imports and exports into account – is the extent of simultaneous imports and exports of the same products within the product categories, i.e. two-way trade. As mentioned above, at the industry and country level one observes both exports and imports of intermediates as firms (not necessarily the same ones but within particular industries) both use intermediates for production processes and serve as providers of such products for other firms, a fact that would suggest a large share of two-way trade. The share of two-way trade in intermediates – calculated by using a 'corrected' Grubel-Lloyd index (CGLI) – ranges from about 55% (Germany) to less than 10% (Malta) and tends to be higher for larger and more developed countries. There have been significant increases in these shares for a number of countries including Romania, Bulgaria, Latvia and Slovakia over the period considered. The data tend to suggest that there is a positive correlation between these indicators for intermediates and other product categories. Changes in the shares of two-way trade are particularly pronounced in consumer goods for a number of smaller and comparatively less developed countries for which these shares are rising. When differentiating by country groups, one finds, firstly, that these shares are highest for intra-EU trade and, secondly, that increases with respect to almost all geographic areas considered (with a few exceptions) are observed, with the strongest increases found for EU-12 countries. Increases tend to be slightly larger for product categories other than intermediates. Differentiating by industry categories, two-way trade is more important in high-tech industries for intermediate products (more than 50%), for consumer goods in medium-low-tech industries (also about 50%) and for capital goods in low-tech industries.

Further, we calculated the extensive and intensive margins of trade (as defined in Hummels and Klenow, 2004) by product categories. The volume of trade (both exports and imports) is considered to be a function of a larger number of products (differentiated by country) traded (the extensive margin) or a larger volume of each product (the intensive margin). Two facts emerge from this exercise: Firstly, though there are some differences with respect to product categories, these are not striking. Secondly, and more importantly, there seems to be a difference between EU-15 and EU-12 countries with both the extensive and intensive margins (for both exports and imports) being larger in EU-15 compared to EU-12 countries; the price effect is also larger in the EU-15, which suggests that this group of countries imports or exports higher-quality goods. While the price effect of imports is declining in the EU-12, the export price effect is increasing more strongly than in the EU-15, pointing towards quality improvement.

A related topic is the degree of trade diversification or specialization in terms of the products that are traded or the markets that are served (or from which products are sourced). To examine this, we calculated concentration/diversity measures by product categories (the study presents the Gini measure). Considering such indicators we initially find that overall concentration in terms of products is rather high for both exports and imports; the latter tends to be slightly lower but shows a rising trend over time. With respect to partner countries, we find more variation in the concentration measures being lower for smaller and/or less developed countries. Concentration has tended to decline over the period considered, which is in line with increased internationalization with respect to trading partners. Thus, for imports we find an increasing concentration in the product space but smaller increases and even de-specialization with respect to sourcing countries. In the case of exports, countries tended to de-specialize with respect to partner countries but there is no common trend with respect to products. These patterns are only slightly differentiated across product categories. Consequently, relatively similar patterns are found for trade in intermediates though diversification with respect to countries tends to be smaller.

Overall, the analysis suggests that the pattern of trade in intermediates and its change over time tend not to be too different from other product categories despite its more complex role as an input into the production process. As such, there seems to be no requirement for specific or distinct policies with respect to different product categories. The findings are suggestive of the importance of the international supply of products used in production processes, which have to be taken into account in any bilateral policy measures. A further important finding is that the industry dimension (i.e. specialization patterns) shapes general patterns and volumes of trade in intermediates for individual countries. In some cases our results indicate that trade in intermediates may serve as an important vehicle for successful trade integration into world markets (or EU markets) and may allow countries to overcome adverse initial specialization patterns (e.g. in low-tech sectors) thus allowing for dynamic shifts in comparative advantage structures through learning effects. If this happens in developing countries, this might be seen as a threat to existing developed countries, since by definition these countries are losing comparative advantage in higher-tech industries or products. As we have seen, countries such as China but also others show particularly dynamic patterns in higher-tech industries or products, not only with respect to consumer goods but also intermediate products.

The analysis also points to important geographic shifts which can be observed: trade (also in intermediates) shifted from intra-EU to extra-EU trade (notably with BRIC countries and China in particular). Within the EU there has been an oberved shift towards integration of the New Member States. However, some countries perform also quite well with respect to exports (e.g. Germany) whereas other countries lose shares (e.g. UK and France) to a considerable extent. There is already a discussion underway examining whether these different strategies at the country level (which also relate to macroeconomic policies) are

compatible in the medium to longer run. The basic questions to be addressed are how should the EU as a whole act towards the integration of large emerging and technologically upgrading countries that are becoming important in high-tech sectors and the extent to which country-specific differences are sustainable (e.g. export promoting strategies versus strategies relying on internal demand) in an integrated Europe. Further, the emerging markets have to be seen no longer only as providers of (cheap) intermediate products but also as demanders for such products in internationally integrated production networks raising the question of which production stages (or tasks) Europe and the individual countries can or should specialize in.

Inter-industry linkages

An alternative way of considering the patterns and extent of imported intermediates is to rely on input-output and use tables differentiating not only between domestically and internationally sourced intermediates but also considering the using industries of imported intermediates in more detail (which is not possible from the trade data alone). In the second part of the study we therefore analyse inter-industry linkages of manufacturing and service industries also with respect to imported intermediates. We begin by considering the shares of material and inputs in four industry categories (low-, medium-low-, medium-high- and high-tech industries) and four service industries (trade and hotels, transport, business services, and community services) based on EU KLEMS data. High-tech industries make up the largest share of service inputs with about 25%, followed by low-tech industries. These figures hide large country differences, with shares being particularly low for new member states. Over time the service input shares increased in low-tech industries and to a lesser extent in high- and medium-high-tech industries whereas in medium-low-tech industries shares decreased in almost all countries. Looking at material input shares in service industries, these account for about 33% in trade and hotels and community services, for 22% in business services and only 16% in transport services. Further these tended to decline over the period 1995 and 2005. Country differences are less marked in this case. Considering the shares in gross output (instead of total intermediates) yields a similar picture.

The availability of domestic and import symmetric input-output tables allows one to consider also the share of imported intermediate inputs in total intermediate inputs by using industry (where again we show results for the four manufacturing and the four service industries). With respect to the former we find that imported intermediates are more important in high-tech industries with an average share of about 55%. These are however also important in medium-high-tech industries (50%) and medium-low-tech industries (48%) but less so in low-tech industries with about 30%. Again there are quite substantial country differences with respect to some EU-12 countries (Estonia, Slovakia, Hungary and Slovenia) with Ireland and Austria also showing larger shares (which thus might point to larger shares for small economies more generally). These country differences seem to be more pronounced in high-tech industries. With few exceptions these shares have been rising

over the period 1995 to 2005. Regarding the four service industries we find that imports generally play a much less important role ranging from around 16% in trade and hotels to about 26% in transport services. Differences across countries are smaller compared to manufacturing industries.

These results point towards an increase in inter-industry linkages over about the last decade, though this is not uniform across industries and with some large country differences emerging. However, this increased integration would mean weaker effects in terms of multipliers for the domestic economy as the share of imported intermediates was also growing. Calculations of multipliers allow one to take account not only of indirect effects but also of import effect by comparing domestic versus total multipliers. Generally, for the countries studied we find an increase in the output multipliers for the total economy in the case of EU-15 economies but a decrease (though from a higher level) for EU-12 economies, thus pointing to stronger inter-industry linkages for the former set of countries. When looking at domestic multipliers, we find for the former group more or less constant multipliers, implying that increased imports of intermediates are the trigger for increased linkages in terms of multiplier effects.

Summary, conclusions and policy implications from case study

The case study points out that the standard level of trade analysis – sector, industry, product group or labour skill groups – is too broad for a detailed analysis and conceals much of the ongoing processes at the firm level. The analysis shows that global trade and globalization of economic activities has to be considered at a much more detailed level of aggregation – at the level of 'tasks'. Stages of production that used to be performed by the same company in the same geographic location are now fragmented around the world. The various stages are either owned and controlled by one manufacturer or owned and controlled by independent suppliers. This forms the system of global supply chains – increasingly not only of goods, but also of services, the tradability of which has exploded due to digitalization.

Unbundling production processes leads to growing trade in intermediate goods and services and opens new ways of organizing final-good production more efficiently. It is the firm-specific competitive advantages – or differences at the firm rather than the country level – that drive this trade.[21] Firms are seeking scale economies and productivity gains by unbundling their production and other tasks. Nations compete for their role in these globally dispersed supply chains to derive as much wealth as possible.

[21] Of course this rests on the assumption of a heterogeneous population of firms within industries which is only recently addressed in the theoretical literature.

The questions that then arise are, Who captures the value in these supply chains? Can we identify the value created at different stages of production? How is the value added of a product produced in highly fragmented networks being distributed geographically? In this study we have used detailed information on the unbundled supply chains to address these questions. We have performed grass-roots detective work in one particular case, namely the Nokia 95 mobile phone. It turned out that, on average, Europe captured 55% of the total value added. The N95 was assembled both in Europe and China. In the case when the device was assembled and sold in Europe, the share of Europe rose to 68%. Even in the case where it was assembled in Beijing and sold in the US market, Europe captured as much as 51% of the value, despite the fact that the phone was 'Made in China'. The final assembly – although important – represents only a fraction of the overall value added of a high-tech product such as a mobile phone. The value capture is largely detached from the physical flows of goods within the supply chain. The major part of the value is attributed to design, R&D, brand, marketing and distribution, and the management of these functions.

The estimates based on trade statistics and national accounts tend to give a somewhat biased and inadequate picture of how value added spreads geographically. The only way to shed light on this issue, given the availability of statistical data, is to conduct case studies. The black box needs to be opened in order to understand the very nature and consequences of production unbundling. National accounts take great care in distilling what value added gets created within national borders whereas imports and exports are based on the gross-value concept. National accounting has little concern for inputs coming from foreign locations or where the output might end up. Our case study data show that if we take services flows into account and use value-added based information we come up with strikingly different conclusions on global trade flows than by using gross values of flows of goods.

This seems to suggest – as our first policy conclusion – that concerted efforts should be taken to develop value-added based trade statistics. The current system was developed for the 'old paradigm' of globalization where trade and specialization in the international economy was based on comparative advantages of sectors. In order to dig deeper into the consequences of global trade in tasks, value-added based data on trade flows are needed.

There are several other policy implications from our analysis. Baldwin (2009) points out that off-shoring and unbundling increases unpredictability. The winners and losers from globalization are hard to predict. It is not easy to identify winning and losing tasks in the same way as governments felt they could indentify sectors some decades ago. Second, we know very little of what might keep different tasks in particular locations. Tasks move from one place to another much faster than firms or whole industries. That is Baldwin's second policy-related point – suddenness. A job that was absolutely safe some years ago, e.g., in Europe, may be off-shored today quite easily to China or India or other emerging

economies. The reason is not just costs, but complex interactions within factories and offices (Baldwin, 2009).

Taking a longer-term view, unbundling can be compared to technological change – higher value of final goods is produced from the same amount of primary inputs. Hence, it leads to higher global output and well-being. It is not a zero sum game; economic growth in one part of the world benefits others. The issue and concern is positioning in the supply chain – or more broadly in the value-added network – according to comparative advantages that today are mostly created, not inherited.

Crisis effects and beyond

The current economic crisis which was triggered by the financial sector resulted in substantial declines in overall GDP growth rates and was accompanied by an even stronger decline in trade volumes in most countries. Some contributions in the literature pointed towards the specific role of trade in intermediates and parts and components in particular in explaining this trade collapse. We therefore analysed the impact of the crisis on EU-27 trade flows with a strong focus on the role and development of trade in parts and components, our proxy for the vertical specialization of industries which seems to be more appropriate when discussing the crisis effects. While a series of rivalling explanations for the trade collapse in the winter months 2008/2009 has been offered, the results of our analysis suggests that these explanations must not be seen as mutually exclusive. More likely, the trade collapse between September 2008 and February 2009 is the result of an interaction of demand- and supply-side factors.

We first reconfirm the stylized fact that – in the longer run – the changes in the structure of trade, i.e. the larger share of trade in intermediates, caused the income elasticity of trade to increase. This fact helps to explain why the drop in real values was much higher than the drop in outputs. However, trade data for the EU-27 also show that trade in intermediates not only acts as a multiplier in the trade statistics but that the category of parts and components was also the one most severely affected by the crisis, with imports standing at 62% of its September 2008 volume in January 2009. As a result, the relative importance of parts and components in EU-27 trade declined, with the post-crisis share of parts and components in EU exports and imports declining by 2.25% and 1% respectively. This decline appears to be rather small but when individual industries are considered, the changes become more pronounced for some industries with a high share of parts and components trade, reaching e.g. 7 percentage points for the share of parts and components in EU-27 exports in the electrical machinery industry. This result supports the claim that the manufacturing-wide decrease in the share of parts and components trade is not entirely attributable to a composition effect, which would imply that the relatively higher decline in parts and components trade is the result of stronger declines in real trade values of industries with a lot of parts and components trade. Rather, parts and components as a goods cate-

gory also declined relative to other categories at the level of individual industries. This is in line with the hypothesis that the crisis disrupted some of the existing international vertical supply chains, maybe because crisis-related increases in trade costs made some firms in some industries 'onshore' some of the previously outsourced production processes due to higher trade and transaction costs which could be seen as supply-side shock causing a drop in trade flows during the crisis. The demand-driven decline is visible from the fact that there is wide variation in the decline of total trade across industries with some (motor vehicles) but not all (electrical machinery) industries with a high share of parts and components trade being highly affected by the crisis. Moreover, some of the industries where vertical integration plays no role were also hit hard by the crisis (publishing, minerals). This may suggest that the sector-specific demand shocks may have played a large role. Consequently, the fact that many of the industries with a high share in parts and components trade also registered large declines in total trade flows may be due largely to industry-specific negative shocks in several cases aggravated by the multiplicative effect of the trade in parts and components and a reversal of the outsourcing trend and ever deeper international vertical integration. If the decline in the share of parts and components trade actually reflects the disruption of vertical supply chains, this will cause the recovery of trade flows to be slower than would otherwise be the case once demand sets in again depending on how easily these could be set up again.

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Appendix A – Data and classifications

The analysis is firstly based on the EU COMEXT trade database which provides data at the detailed CN 8-digit level. Data are available for the EU-15 countries as reporter countries over the period 1995-2008 and for the countries entering the EU in 2004 and after over the period 1999-2008. For a better comparability over time we however restrict the analysis to the period 1999-2008, thus capturing the last 10 years before the actual economic crisis which hit the world economy by the end of 2008. (Below we look at the effects of the crisis in detail using monthly trade statistics.) The EU COMEXT gives us information on export and imports at the detailed product level with all other countries in the world, i.e. there are about 230 partner countries.

The CN 8-digit nomenclature includes about 11500 product codes on average per year for which data on both values and quantities (in kilograms) of imports and exports are available. The information on the quantities traded is later on used to calculate unit values or unit value ratios. One important aspect is that the CN 8-digit classification is slightly changed every year thus that on average about 500 product codes per year are replaced, though the overall number of products in the nomenclature is roughly constant. Whenever these changes in classification pose some problems we circumvent this by aggregating the data to the CN 6-digit level which corresponds to the HS 6-digit classification for which the revisions are less problematic. For the detailed product-level data correspondences exist to NACE industries (at the 2 and 3-digit level) and to end-use categories known as 'Broad Economic Categories' (BEC) classification as provided by UN. Table A.1 shows the list of BEC categories. At the 1-digit level there are seven categories classified which are broken down in primary goods and processed goods in case of the first three 1-digit product categories, Parts and accessories as a subgroup of capital goods and transport equipment goods; in this latter category also passenger motor cars are included. At the 3-digit level part of these groupings are further classified whether the products are mainly used by industry or for household consumption. This more detailed classification of products allows one to aggregate up to somewhat higher aggregates to consider trade in intermediates, in final consumer goods, and capital goods separately. There are however various ways how this aggregation is exactly done and various suggestions are made in the literature. In this study we follow the definitions as suggested by OECD which is shown in Table A.2 (see Miroudot et al., 2009, for example)[22].

As might be clear from Tables A.1 and A.2 this classification is not a one-to-one correspondence as many products might be used by households for final consumption as well as by industries as inputs in the production process. The most important example for this might be passenger cars which are therefore not classified. Together with motor spirits (BEC 321) this category is however reported separately.

[22] Examples for slightly different classifications are Gaulier et al. (2007) or Frensch and Wittich (2009).

Table A.1

BEC classification

1-digit	Description	2-digit	Description	3-digit	Description
1	Food and beverages	11	Primary	111	Mainly for industry
				112	Mainly for household consumption
		12	Processed	121	Mainly for industry
				122	Mainly for household consumption
2	Industrial supplies n.e.s.	21	Primary		
		22	Processed		
3	Fuels and lubricants	31	Primary		
		32	Processed	321	Motor spirit
				322	Other
4	Capital goods (except transport equipment)				
	and parts and accessories thereof	41	Capital goods		
		42	Parts and accessories		
5	Transport equipment and parts and accessories thereof	51	Passenger motor cars		
		52	Other	521	Industrial
				522	Non-Industrial
		53	Parts and accessories		
6	Consumer goods n.e.s	61	Durable		
		62	Semi-durable		
		63	Non-durable		
7	Goods n.e.s				

Table A.2

Aggregation to end-use categories used in study

BEC code	OECD	Frensch and Wittich (2008)
111	Intermediate	Primary
112	Consumption	Consumer goods
121	Intermediate	Processed
122	Consumption	Consumer goods
21	Intermediate	Primary
22	Intermediate	Processed
31	Intermediate	Not classified
321	Not classified	Not classified
322	Intermediate	Not classified
41	Capital goods	Capital goods
42	Intermediate	Intermediates
51	Not classified	Not classified
521	Capital goods	Capital goods
522	Consumption	Consumer goods
53	Intermediate	Intermediates
61	Consumption	Consumer goods
62	Consumption	Consumer goods
63	Consumption	Consumer goods
7	Not classified	Not classified

Note that this is a rather broad definition of trade in intermediate products as it also includes primary products (111, 21, 31) as intermediates. (An example would be milk produced in country A and exported to country B for the production of cheese.)[23] We stick to this broad definition in most parts of the study; however, whenever it is advantageous we might use a more narrow definition by separating single BEC codes or groups of these.

At some stages we will also report results at the industry level. For this purpose we use the NACE revision 1 2-digit classification as reported in Table A.3. To circumvent too many detailed statistics we also aggregate them to broader groups comprising low-tech, medium-low-tech, medium-high-tech and high-tech industry aggregates as indicated in Table A.3.

Table A.3

Industry classification

Code	Description	Group
15	Manufacture of food products and beverages	Low
16	Manufacture of tobacco products	Low
17	Manufacture of textiles	Low
18	Manufacture of wearing apparel; dressing and dyeing of fur	Low
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	Low
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Low
21	Manufacture of pulp, paper and paper products	Low
22	Publishing, printing and reproduction of recorded media	Low
23	Manufacture of coke, refined petroleum products and nuclear fuel	Medium low
24	Manufacture of chemicals and chemical products	Medium high
25	Manufacture of rubber and plastic products	Medium low
26	Manufacture of other non-metallic mineral products	Medium low
27	Manufacture of basic metals	Medium low
28	Manufacture of fabricated metal products, except machinery and equipment	Medium low
29	Manufacture of machinery and equipment n.e.c.	Medium high
30	Manufacture of office machinery and computers	High
31	Manufacture of electrical machinery and apparatus n.e.c.	Medium high
32	Manufacture of radio, television and communication equipment and apparatus	High
33	Manufacture of medical, precision and optical instruments, watches and clocks	High
34	Manufacture of motor vehicles, trailers and semi-trailers	Medium high
35	Manufacture of other transport equipment	Medium high
36	Manufacture of furniture; manufacturing n.e.c.	Low

[23] There are many definitions of supply chains. All of them share this broad view as expressed in the following statement: 'Entire network of entities, directly or indirectly interlinked and interdependent in serving the same consumer or customer. It comprises of vendors that supply raw material, producers who convert the material into products, warehouses that store, distribution centers that deliver to the retailers, and retailers who bring the product to the ultimate user.' (http://www.businessdictionary.com/definition/supply-chain.html)

An additional aspect concerns the detailed list of partner countries. As it is not possible to show the relevant figures for all partner countries we have to build country groups. The country groups considered are listed in Table A.4

Table A.4

Country groupings

PARG	Description
EU-15	EU15
EU-12	Central and Eastern European countries
AOECD	Advanced OECD
ASIA	Asia
BRICS	BRICs
RoW	Rest of World

Thus we consider six different country groups: EU-15 includes all countries being members of the EU since 1995, EU-12 includes all countries having joined the EU in 2004 or later (thus this group includes all Central and Eastern European countries together with Cyprus and Malta). EU-15 and NMS-12 together are denoted as EU-27. Further we consider a set of advanced OECD countries not included in EU-15 or EU-12 (Australia, Canada, Switzerland, Iceland, Japan, Norway, New Zealand, US), a group of Asian countries including Hong Kong, Indonesia, South Korea, Macau, Malaysia, Philippines, Singapore, Thailand, Taiwan and Vietnam, the BRIC countries (Brazil, Russia, India, and China) and finally a rest of world category (RoW). One should note however, that we provide detailed information for each of the EU-27 countries as reporter countries and only aggregated the partner countries accordingly.

Appendix B - Tables to Section 3.3

Table B.1

Import margins – intermediate products, 1999 and 2007

	Extensive margin		Intensive margin		Price effect		Quantity effect	
	1999	2007	1999	2007	1999	2007	1999	2007
AT	0.780	0.712	0.042	0.043	1.245	1.134	0.033	0.038
BE	0.841	0.730	0.105	0.115	1.055	1.097	0.100	0.105
BG	0.483	0.450	0.005	0.012	1.087	1.108	0.004	0.010
CY	0.361	0.286	0.003	0.004	1.164	1.003	0.002	0.004
CZ	0.800	0.626	0.020	0.035	1.029	1.140	0.019	0.031
DE	0.921	0.894	0.243	0.249	1.116	1.094	0.218	0.228
DK	0.698	0.564	0.027	0.029	1.303	1.374	0.021	0.021
EE	0.488	0.439	0.003	0.006	1.191	1.113	0.003	0.005
ES	0.840	0.804	0.079	0.090	1.068	1.169	0.074	0.077
FI	0.675	0.605	0.023	0.028	1.306	1.232	0.018	0.023
FR	0.922	0.822	0.151	0.140	1.091	1.195	0.138	0.117
GB	0.888	0.822	0.155	0.125	1.097	1.076	0.141	0.116
GR	0.666	0.599	0.017	0.022	1.088	1.047	0.016	0.021
HU	0.708	0.607	0.022	0.027	1.195	1.140	0.018	0.024
IE	0.587	0.490	0.031	0.023	1.203	1.272	0.026	0.018
IT	0.898	0.810	0.125	0.124	1.160	1.130	0.108	0.110
LT	0.518	0.479	0.005	0.010	1.202	1.135	0.004	0.009
LU	0.447	0.323	0.010	0.013	1.510	1.351	0.007	0.009
LV	0.432	0.316	0.003	0.007	1.366	1.234	0.002	0.006
MT	0.174	0.250	0.003	0.003	1.741	1.420	0.002	0.002
NL	0.812	0.756	0.111	0.113	1.075	1.066	0.103	0.106
PL	0.801	0.714	0.032	0.048	1.091	1.059	0.029	0.046
PT	0.704	0.603	0.026	0.024	1.162	1.120	0.023	0.021
RO	0.619	0.631	0.009	0.021	1.116	1.093	0.008	0.020
SE	0.757	0.694	0.041	0.042	1.252	1.239	0.033	0.034
SI	0.645	0.489	0.008	0.013	1.200	1.183	0.006	0.011
SK	0.650	0.543	0.011	0.023	1.131	1.214	0.009	0.019
Mean – EU-15	0.762	0.682	0.079	0.079	1.182	1.173	0.071	0.070
Mean – NMS-12	0.557	0.486	0.010	0.017	1.209	1.154	0.009	0.016

Source: EU COMEXT; wiiw calculations

Table B.2

Import margins – consumer goods, 1999 and 2007

	Extensive margin		Intensive margin		Price effect		Quantity effect	
	1999	2007	1999	2007	1999	2007	1999	2007
AT	0.887	0.878	0.040	0.037	1.359	1.053	0.030	0.035
BE	0.861	0.764	0.079	0.114	1.177	1.570	0.067	0.073
BG	0.576	0.719	0.003	0.006	0.712	0.773	0.004	0.007
CY	0.360	0.611	0.003	0.003	1.124	1.223	0.003	0.003
CZ	0.843	0.668	0.013	0.019	1.009	1.038	0.013	0.019
DE	0.979	0.959	0.243	0.192	1.103	1.006	0.220	0.191
DK	0.777	0.782	0.031	0.030	1.276	1.364	0.025	0.022
EE	0.665	0.669	0.003	0.004	1.022	0.989	0.003	0.004
ES	0.888	0.859	0.065	0.081	1.280	1.810	0.051	0.045
FI	0.778	0.793	0.015	0.015	1.241	1.130	0.012	0.013
FR	0.973	0.856	0.163	0.145	1.048	1.707	0.156	0.085
GB	0.960	0.949	0.175	0.162	1.025	0.927	0.171	0.175
GR	0.816	0.854	0.023	0.025	1.125	0.992	0.020	0.025
HU	0.769	0.709	0.010	0.013	1.026	0.942	0.010	0.014
IE	0.654	0.708	0.022	0.023	1.324	1.215	0.017	0.019
IT	0.945	0.775	0.104	0.101	1.148	1.173	0.091	0.086
LT	0.648	0.696	0.004	0.006	1.116	1.018	0.003	0.006
LU	0.612	0.614	0.009	0.007	1.481	1.434	0.006	0.005
LV	0.578	0.524	0.003	0.005	1.064	1.236	0.003	0.004
MT	0.152	0.609	0.004	0.002	1.186	0.949	0.003	0.002
NL	0.904	0.776	0.092	0.082	1.070	1.084	0.086	0.076
PL	0.823	0.858	0.020	0.027	0.937	0.873	0.021	0.031
PT	0.700	0.743	0.025	0.021	1.193	1.015	0.021	0.020
RO	0.666	0.812	0.006	0.013	0.818	0.824	0.007	0.015
SE	0.858	0.862	0.035	0.034	1.242	1.106	0.028	0.031
SI	0.759	0.776	0.005	0.006	1.101	0.946	0.005	0.007
SK	0.720	0.713	0.005	0.011	0.957	1.014	0.006	0.011
Mean – EU-15	0.839	0.811	0.075	0.071	1.206	1.239	0.067	0.060
Mean – NMS-12	0.630	0.697	0.007	0.010	1.006	0.985	0.007	0.010

Source: EU COMEXT; wiiw calculations

Table B.3

Import margins – capital goods, 1999 and 2007

	Extensive margin		Intensive margin		Price effect		Quantity effect	
	1999	2007	1999	2007	1999	2007	1999	2007
AT	0.985	0.941	0.044	0.042	1.251	0.952	0.035	0.044
BE	0.972	0.510	0.078	0.077	1.104	1.263	0.070	0.061
BG	0.675	0.788	0.004	0.009	0.811	0.703	0.005	0.013
CY	0.043	0.369	0.004	0.002	1.106	0.763	0.004	0.003
CZ	0.996	0.488	0.021	0.031	0.981	1.206	0.021	0.026
DE	1.126	1.051	0.232	0.245	1.126	0.933	0.206	0.263
DK	0.854	0.821	0.031	0.029	1.187	0.974	0.026	0.029
EE	0.654	0.646	0.003	0.005	0.881	0.843	0.004	0.006
ES	1.001	0.684	0.078	0.076	1.092	4.430	0.071	0.017
FI	0.875	0.866	0.021	0.021	1.214	0.961	0.018	0.022
FR	1.107	0.722	0.153	0.143	1.115	4.964	0.137	0.029
GB	1.063	0.935	0.162	0.129	1.119	0.857	0.144	0.151
GR	0.855	0.790	0.028	0.023	1.308	1.336	0.021	0.017
HU	0.949	0.823	0.019	0.026	0.994	0.914	0.019	0.028
IE	0.703	0.696	0.034	0.033	1.307	1.003	0.026	0.032
IT	1.070	0.540	0.118	0.087	1.107	1.082	0.107	0.080
LT	0.655	0.734	0.004	0.009	0.934	0.746	0.004	0.012
LU	0.525	0.572	0.009	0.020	1.591	1.150	0.006	0.017
LV	0.562	0.285	0.004	0.005	0.939	1.211	0.005	0.004
MT	0.004	0.409	0.001	0.001	1.326	0.802	0.000	0.002
NL	0.999	0.616	0.100	0.117	1.077	1.152	0.093	0.102
PL	1.020	0.942	0.032	0.046	0.877	0.780	0.037	0.059
PT	0.855	0.777	0.028	0.017	1.050	0.774	0.026	0.022
RO	0.835	0.929	0.008	0.022	0.741	0.660	0.010	0.034
SE	0.931	0.930	0.036	0.040	1.302	0.978	0.027	0.041
SI	0.878	0.824	0.008	0.009	0.933	0.803	0.008	0.012
SK	0.844	0.773	0.008	0.018	0.924	1.010	0.008	0.018
Mean – EU-15	0.928	0.763	0.077	0.073	1.197	1.521	0.068	0.062
Mean – NMS-12	0.676	0.668	0.010	0.015	0.954	0.870	0.010	0.018

Source: EU COMEXT; wiiw calculations

Table B.4

Export margins – intermediate products, 1999 and 2007

	Extensive margin		Intensive margin		Price effect		Quantity effect	
	1999	2007	1999	2007	1999	2007	1999	2007
AT	0.607	0.628	0.052	0.053	1.370	1.223	0.038	0.043
BE	0.793	0.749	0.113	0.128	1.162	1.252	0.097	0.103
BG	0.164	0.248	0.011	0.018	0.729	0.853	0.015	0.022
CY	0.054	0.034	0.002	0.004	0.740	1.032	0.003	0.004
CZ	0.580	0.523	0.030	0.043	0.734	1.009	0.041	0.043
DE	0.891	0.879	0.306	0.301	1.197	1.087	0.255	0.277
DK	0.521	0.503	0.034	0.034	1.434	1.435	0.023	0.024
EE	0.129	0.182	0.010	0.012	0.973	0.993	0.010	0.012
ES	0.674	0.635	0.069	0.065	0.945	1.089	0.073	0.060
FI	0.416	0.410	0.038	0.046	1.263	1.185	0.030	0.039
FR	0.861	0.768	0.166	0.129	1.173	1.195	0.142	0.108
GB	0.835	0.810	0.152	0.120	1.290	1.213	0.118	0.099
GR	0.234	0.224	0.020	0.022	1.002	0.963	0.020	0.023
HU	0.441	0.408	0.031	0.038	0.915	1.034	0.034	0.037
IE	0.305	0.269	0.082	0.084	1.551	2.860	0.053	0.030
IT	0.822	0.759	0.134	0.121	1.016	1.015	0.131	0.120
LT	0.146	0.200	0.008	0.018	0.802	0.910	0.010	0.020
LU	0.250	0.211	0.022	0.022	1.403	1.525	0.016	0.015
LV	0.094	0.123	0.012	0.012	0.863	1.103	0.014	0.010
MT	0.034	0.048	0.004	0.019	1.598	1.898	0.002	0.010
NL	0.755	0.749	0.117	0.127	1.142	1.115	0.103	0.114
PL	0.524	0.599	0.027	0.050	0.796	0.916	0.034	0.055
PT	0.343	0.326	0.028	0.028	0.982	0.925	0.029	0.030
RO	0.226	0.330	0.017	0.028	0.673	0.947	0.025	0.030
SE	0.619	0.619	0.070	0.060	1.348	1.261	0.052	0.047
SI	0.344	0.368	0.013	0.017	0.863	0.956	0.015	0.018
SK	0.337	0.357	0.016	0.031	0.736	1.003	0.021	0.031
Mean – EU-15	0.595	0.569	0.094	0.089	1.219	1.290	0.079	0.075
Mean – NMS-12	0.256	0.285	0.015	0.024	0.869	1.055	0.019	0.024

Source: EU COMEXT; wiiw calculations

Table B.5

Export margins – consumer goods, 1999 and 2007

	Extensive margin		Intensive margin		Price effect		Quantity effect	
	1999	2007	1999	2007	1999	2007	1999	2007
AT	0.659	0.736	0.037	0.036	1.190	1.075	0.031	0.034
BE	0.774	0.691	0.098	0.139	1.326	1.912	0.074	0.073
BG	0.255	0.407	0.011	0.011	0.517	0.567	0.020	0.019
CY	0.078	0.179	0.004	0.003	0.765	0.858	0.005	0.004
CZ	0.477	0.469	0.018	0.020	0.799	1.015	0.023	0.020
DE	0.941	0.942	0.197	0.211	1.130	0.950	0.174	0.222
DK	0.571	0.606	0.061	0.044	1.370	1.369	0.044	0.033
EE	0.185	0.223	0.008	0.009	0.786	0.844	0.011	0.011
ES	0.746	0.693	0.075	0.078	1.260	1.136	0.060	0.068
FI	0.411	0.438	0.013	0.011	1.805	1.631	0.007	0.007
FR	0.946	0.791	0.180	0.152	1.128	1.270	0.160	0.119
GB	0.872	0.870	0.139	0.106	1.184	1.091	0.117	0.098
GR	0.456	0.499	0.024	0.017	0.981	0.891	0.024	0.019
HU	0.464	0.465	0.025	0.022	1.020	1.019	0.024	0.021
IE	0.416	0.472	0.094	0.069	1.468	1.226	0.064	0.056
IT	0.903	0.747	0.181	0.138	1.083	1.020	0.167	0.135
LT	0.225	0.358	0.010	0.013	0.679	0.837	0.014	0.016
LU	0.277	0.312	0.009	0.006	1.157	1.281	0.008	0.004
LV	0.158	0.219	0.007	0.007	0.717	1.003	0.009	0.007
MT	0.032	0.138	0.009	0.004	0.878	1.215	0.011	0.004
NL	0.789	0.697	0.117	0.108	1.112	1.251	0.105	0.086
PL	0.585	0.737	0.034	0.047	0.767	0.770	0.044	0.061
PT	0.401	0.494	0.029	0.018	0.995	0.839	0.029	0.022
RO	0.303	0.353	0.027	0.028	0.594	0.581	0.045	0.048
SE	0.573	0.648	0.042	0.038	1.645	1.364	0.025	0.028
SI	0.364	0.469	0.015	0.014	0.934	0.941	0.016	0.014
SK	0.269	0.300	0.015	0.021	0.788	0.832	0.019	0.026
Mean – EU-15	0.649	0.642	0.086	0.078	1.256	1.220	0.073	0.067
Mean – NMS-12	0.283	0.360	0.015	0.017	0.770	0.874	0.020	0.021

Source: EU COMEXT; wiiw calculations.

Table B.6

Export margins – capital goods, 1999 and 2007

	Extensive margin		Intensive margin		Price effect		Quantity effect	
	1999	2007	1999	2007	1999	2007	1999	2007
AT	0.630	0.700	0.046	0.047	1.215	0.979	0.050	0.059
BE	0.711	0.433	0.107	0.119	1.056	1.824	0.085	0.034
BG	0.102	0.180	0.010	0.014	0.523	0.557	0.020	0.019
CY	0.006	0.041	0.003	0.003	0.933	1.699	0.008	0.002
CZ	0.432	0.319	0.026	0.037	0.737	0.887	0.043	0.048
DE	1.070	1.038	0.305	0.311	1.160	0.955	0.317	0.398
DK	0.453	0.524	0.040	0.035	1.187	1.067	0.046	0.033
EE	0.085	0.180	0.008	0.011	0.800	0.769	0.006	0.010
ES	0.622	0.425	0.074	0.070	0.972	1.270	0.075	0.046
FI	0.391	0.510	0.032	0.035	1.521	1.086	0.050	0.039
FR	0.900	0.607	0.161	0.135	1.132	1.519	0.115	0.093
GB	0.857	0.788	0.145	0.112	1.162	0.994	0.128	0.097
GR	0.138	0.172	0.019	0.017	1.237	0.828	0.009	0.012
HU	0.278	0.363	0.027	0.033	0.684	0.634	0.026	0.067
IE	0.276	0.308	0.079	0.073	1.409	1.026	0.058	0.070
IT	0.982	0.582	0.148	0.130	0.921	0.903	0.210	0.185
LT	0.097	0.253	0.007	0.015	0.581	0.643	0.011	0.016
LU	0.156	0.242	0.014	0.018	1.529	1.061	0.010	0.032
LV	0.060	0.101	0.009	0.009	0.568	0.855	0.008	0.010
MT	0.000	0.044	0.005	0.009		0.651	0.026	0.008
NL	0.713	0.458	0.108	0.116	1.132	1.257	0.102	0.074
PL	0.427	0.569	0.027	0.045	0.801	0.690	0.033	0.052
PT	0.230	0.279	0.028	0.023	0.826	0.611	0.037	0.031
RO	0.139	0.237	0.018	0.027	0.527	0.616	0.032	0.038
SE	0.579	0.625	0.062	0.052	1.295	1.113	0.063	0.050
SI	0.190	0.300	0.013	0.016	0.767	0.634	0.020	0.023
SK	0.216	0.271	0.015	0.031	0.668	0.757	0.023	0.042
Mean – EU-15	0.581	0.513	0.091	0.086	1.184	1.100	0.090	0.084
Mean – NMS-12	0.169	0.238	0.014	0.021	0.690	0.783	0.021	0.028

Source: EU COMEXT; wiiw calculations.

Table B.7

Extensive and intensive export margins

	(Total) Exports	(Capital) Exports	(Consumer) Exports	(Intermediate) Exports	(Primary) Exports	(Processed) Exports
Y	1.133***	1.342***	1.087***	1.120***	1.028***	1.241***
	(0.0349)	(0.0613)	(0.0251)	(0.0415)	(0.0374)	(0.0531)
R-squared	0.847	0.749	0.880	0.796	0.818	0.741
F-Test	1056	478.9	1880	728.5	754.3	546.7
	Intensive Margin	**Intensive Margin**	**Intensive Margin**	**Intensive Margin**	**Intensive Margin**	**Intensive Margin**
Y	0.670***	0.662***	0.667***	0.660***	0.542***	0.884***
	(0.0200)	(0.0346)	(0.0212)	(0.0297)	(0.0206)	(0.0472)
	59%	49%	61%	59%	53%	71%
R-squared	0.830	0.686	0.807	0.740	0.748	0.690
F-Test	1117	365.0	994.8	495.3	691.9	350.8
	Extensive Margin	**Extensive Margin**	**Extensive Margin**	**Extensive Margin**	**Extensive Margin**	**Extensive Margin**
Y	0.463***	0.680***	0.420***	0.460***	0.486***	0.358***
	(0.0262)	(0.0658)	(0.0320)	(0.0212)	(0.0261)	(0.0183)
	(41%)	51%	39%	41%	47%	29%
R-squared	0.744	0.570	0.702	0.760	0.704	0.723
F-Test	311.7	106.9	172.3	472.5	347.1	383.2
Observations	216	216	216	216	216	216

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table B.8

Extensive and intensive export margins

	(Total) Exports	(Capital) Exports	(Consumer) Exports	(Intermediate) Exports	(Primary) Exports	(Processed) Exports
Y/L	1.622***	2.199***	1.381***	1.656***	1.039***	1.912***
	(0.0582)	(0.0983)	(0.0571)	(0.0689)	(0.0840)	(0.0983)
L	1.078***	1.245***	1.054***	1.060***	1.027***	1.166***
	(0.0408)	(0.0725)	(0.0296)	(0.0479)	(0.0386)	(0.0569)
R-squared	0.865	0.784	0.888	0.817	0.817	0.766
F-Test	758.5	511.9	970.2	543.9	372.2	348.8
	Intensive Margin	**Intensive Margin**	**Intensive Margin**	**Intensive Margin**	**Intensive Margin**	**Intensive Margin**
Y/L	1.040***	1.419***	0.891***	1.105***	0.525***	1.526***
	(0.0420)	(0.0561)	(0.0566)	(0.0509)	(0.0694)	(0.0771)
	64%	65%	65%	67%	51%	80%
L	0.628***	0.577***	0.643***	0.610***	0.544***	0.811***
	(0.0222)	(0.0333)	(0.0242)	(0.0330)	(0.0222)	(0.0494)
	58%	46%	61%	58%	53%	70%
R-squared	0.859	0.792	0.818	0.779	0.749	0.733
F-Test	712.6	547.5	660.5	383.0	351.9	287.8
	Extensive Margin	**Extensive Margin**	**Extensive Margin**	**Extensive Margin**	**Extensive Margin**	**Extensive Margin**
Y/L	0.582***	0.780***	0.490***	0.551***	0.515***	0.386***
	(0.0388)	(0.0818)	(0.0347)	(0.0365)	(0.0575)	(0.0319)
	36%	35%	35%	33%	49%	20%
L	0.450***	0.668***	0.411***	0.450***	0.482***	0.355***
	(0.0305)	(0.0764)	(0.0370)	(0.0239)	(0.0298)	(0.0204)
	42%	54%	39%	42%	47%	30%
R-squared	0.749	0.570	0.703	0.763	0.703	0.723
F-Test	274.5	124.3	221.4	302.0	204.0	234.4
Observations	216	216	216	216	216	216

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table B.9

Price and quantity components of the intensive export margin

	(Total) Prices	(Capital) Prices	(Consumer) Prices	(Intermediate) Prices	(Primary) Prices	(Processed) Prices
Y	0.0231**	0.0237	0.0639***	0.00115	0.00851	-0.00298
	(0.0101)	(0.0224)	(0.00852)	(0.0122)	(0.00699)	(0.0149)
R-squared	0.013	0.011	0.122	0.000	0.011	0.000
F-Test	5.180	1.115	56.25	0.00892	1.484	0.0399
	Quantities	**Quantities**	**Quantities**	**Quantities**	**Quantities**	**Quantities**
Y	0.646***	0.638***	0.603***	0.659***	0.533***	0.887***
	(0.0176)	(0.0249)	(0.0204)	(0.0270)	(0.0227)	(0.0421)
R-squared	0.876	0.750	0.770	0.806	0.727	0.741
F-Test	1349	656.5	877.1	595.2	550.6	443.7
Observations	216	216	216	216	216	216

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table B.10

Price and quantity components of the intensive export margin

	(Total) Prices	(Capital) Prices	(Consumer) Prices	(Intermediate) Prices	(Primary) Prices	(Processed) Prices
Y/L	0.332***	0.442***	0.441***	0.367***	0.113***	0.453***
	(0.0271)	(0.0251)	(0.0218)	(0.0267)	(0.0178)	(0.0261)
L	-0.0118	-0.0232	0.0214***	-0.0401***	-0.00332	-0.0544***
	(0.00986)	(0.0225)	(0.00794)	(0.0118)	(0.00756)	(0.0133)
R-squared	0.285	0.417	0.624	0.451	0.200	0.566
F-Test	79.66	166.0	243.7	96.38	20.55	153.5
	Quantities	**Quantities**	**Quantities**	**Quantities**	**Quantities**	**Quantities**
Y/L	0.672***	0.977***	0.450***	0.738***	0.412***	1.073***
	(0.0361)	(0.0608)	(0.0510)	(0.0506)	(0.0675)	(0.0779)
L	0.643***	0.600***	0.621***	0.650***	0.548***	0.865***
	(0.0189)	(0.0267)	(0.0230)	(0.0297)	(0.0230)	(0.0449)
R-squared	0.876	0.776	0.777	0.808	0.732	0.745
F-Test	691.0	435.9	465.8	332.5	304.5	243.6
Observations	216	216	216	216	216	216

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table B.11

Extensive and intensive import margins

	(Total) Imports	(Capital) Imports	(Consumer) Imports	(Intermediate) Imports	(Primary) Imports	(Processed) Imports
Y	0.991***	1.141***	0.984***	0.989***	0.949***	1.039***
	(0.0176)	(0.0766)	(0.0153)	(0.0180)	(0.0214)	(0.0272)
R-squared	0.927	0.755	0.909	0.916	0.854	0.856
F-Test	3183***	221.9***	4148***	3010***	1975***	1455***
	Intensive Margin	Intensive Margin	Intensive Margin	Intensive Margin	Intensive Margin	Intensive Margin
Y	0.815***	0.821***	0.842***	0.828***	0.629***	0.916***
	(0.0129)	(0.0210)	(0.0177)	(0.0156)	(0.0151)	(0.0271)
	82%	72%	86%	84%	66%	88%
R-squared	0.912	0.889	0.877	0.902	0.802	0.833
F-Test	3994***	1523***	2251***	2798***	1726***	1141***
	Extensive Margin	Extensive Margin	Extensive Margin	Extensive Margin	Extensive Margin	Extensive Margin
Y	0.176***	0.319***	0.143***	0.161***	0.320***	0.122***
	(0.0159)	(0.0628)	(0.0181)	(0.0108)	(0.0129)	(0.0121)
	18%	28%	14%	16%	34%	12%
R-squared	0.633	0.282	0.489	0.719	0.815	0.560
F-Test	122.8***	25.84***	62.23***	220.5***	615.3***	102.0***
Observations	216	216	216	216	216	216

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table B.12

Extensive and intensive import margins

	(Total) Imports	(Capital) Imports	(Consumer) Imports	(Intermediate) Imports	(Primary) Imports	(Processed) Imports
Y/L	1.451***	1.351***	1.642***	1.375***	1.497***	1.564***
	(0.0392)	(0.104)	(0.0475)	(0.0439)	(0.0667)	(0.0717)
L	0.939***	1.116***	0.910***	0.945***	0.888***	0.980***
	(0.0201)	(0.0900)	(0.0167)	(0.0196)	(0.0216)	(0.0292)
R-squared	0.950	0.757	0.956	0.932	0.887	0.882
F-Test	1681***	246.8***	2035***	1470***	1099***	740.8***
	Intensive Margin	**Intensive Margin**	**Intensive Margin**	**Intensive Margin**	**Intensive Margin**	**Intensive Margin**
Y/L	1.372***	1.382***	1.564***	1.307***	1.134***	1.554***
	(0.0321)	(0.0479)	(0.0460)	(0.0369)	(0.0463)	(0.0670)
	95%	102%	95%	95%	76%	99%
L	0.752***	0.758***	0.761***	0.774***	0.572***	0.845***
	(0.00911)	(0.0245)	(0.0144)	(0.0145)	(0.0120)	(0.0275)
	80%	68%	84%	82%	64%	86%
R-squared	0.961	0.937	0.953	0.937	0.862	0.880
F-Test	3976***	1168***	2480***	1806***	1297***	729.4***
	Extensive Margin	**Extensive Margin**	**Extensive Margin**	**Extensive Margin**	**Extensive Margin**	**Extensive Margin**
Y/L	0.0797***	-0.0318	0.0776***	0.0677***	0.363***	0.0100
	(0.0170)	(0.0672)	(0.0177)	(0.0126)	(0.0307)	(0.0127)
	5%	-2%	5%	5%	24%	1%
L	0.187***	0.358***	0.150***	0.172***	0.316***	0.135***
	(0.0173)	(0.0698)	(0.0202)	(0.0114)	(0.0147)	(0.0127)
	20%	32%	16%	18%	36%	14%
R-squared	0.655	0.322	0.499	0.747	0.818	0.616
F-Test	88.58***	14.46***	51.64***	140.7***	352.9***	59.92***
Observations	216	216	216	216	216	216

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table B.13

Price and quantity components of the intensive import margin

	(Total) Prices	(Capital) Prices	(Consumer) Prices	(Intermediate) Prices	(Primary) Prices	(Processed) Prices
Y	-0.0106**	0.0323***	0.000185	-0.0308***	-0.0388***	-0.0371***
	(0.00528)	(0.0114)	(0.00640)	(0.00459)	(0.00432)	(0.00689)
R-squared	0.024	0.044	0.000	0.213	0.316	0.131
F-Test	4.065***	7.967***	0.000832	44.96***	80.90***	29.03***
	Quantities	**Quantities**	**Quantities**	**Quantities**	**Quantities**	**Quantities**
Y	0.825***	0.789***	0.841***	0.858***	0.668***	0.954***
	(0.0120)	(0.0241)	(0.0164)	(0.0135)	(0.0159)	(0.0249)
R-squared	0.925	0.866	0.916	0.915	0.799	0.855
F-Test	4733***	1074***	2627***	4052***	1760***	1471***
Observations	216	216	216	216	216	216

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table B.14

Price and quantity components of the intensive import margin

	(Total) Prices	(Capital) Prices	(Consumer) Prices	(Intermediate) Prices	(Primary) Prices	(Processed) Prices
Y/L	0.116***	0.206***	0.238***	0.0502***	-0.000190	0.0880***
	(0.00820)	(0.0194)	(0.0139)	(0.00890)	(0.0128)	(0.0160)
L	-0.0250***	0.0126	-0.0266***	-0.0399***	-0.0432***	-0.0513***
	(0.00456)	(0.0112)	(0.00499)	(0.00460)	(0.00447)	(0.00712)
R-squared	0.432	0.193	0.588	0.388	0.352	0.307
F-Test	156.9***	61.57***	213.5***	48.42***	46.96***	36.73***
	Quantities	**Quantities**	**Quantities**	**Quantities**	**Quantities**	**Quantities**
Y/L	1.255***	1.177***	1.326***	1.257***	1.134***	1.466***
	(0.0342)	(0.0559)	(0.0430)	(0.0411)	(0.0539)	(0.0751)
L	0.777***	0.746***	0.787***	0.814***	0.615***	0.896***
	(0.0103)	(0.0278)	(0.0158)	(0.0131)	(0.0141)	(0.0264)
R-squared	0.954	0.891	0.951	0.938	0.845	0.884
F-Test	3187***	711.1***	2086***	2258***	1096***	832.6***
Observations	216	216	216	216	216	216

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Appendix C – Tables to Section 4.3

Table C.1

Output multipliers, Austria

	1995		2005		Difference	
CPA	Domestic	Total	Domestic	Total	Domestic	Total
P01-P05	1.380	1.597	1.822	2.273	0.44	0.68
P10-P14	1.616	1.970	1.590	1.965	-0.03	-0.01
P15	2.010	2.416	1.890	2.561	-0.12	0.15
P16	1.600	2.193	1.674	2.774	0.07	0.58
P17	1.478	2.392	1.489	2.497	0.01	0.11
P18	1.399	2.307	1.381	2.423	-0.02	0.12
P19	1.441	2.563	1.574	2.706	0.13	0.14
P20	1.880	2.336	1.916	2.693	0.04	0.36
P21	1.726	2.456	1.706	2.642	-0.02	0.19
P22	1.591	2.252	1.566	2.374	-0.03	0.12
P23	1.349	2.499	1.216	2.878	-0.13	0.38
P24	1.602	2.484	1.424	2.520	-0.18	0.04
P25	1.424	2.331	1.490	2.463	0.07	0.13
P26	1.726	2.177	1.646	2.251	-0.08	0.07
P27	1.645	2.615	1.545	2.797	-0.10	0.18
P28	1.608	2.220	1.610	2.445	0.00	0.22
P29	1.516	2.351	1.526	2.488	0.01	0.14
P30	1.656	2.385	1.759	2.781	0.10	0.40
P31	1.429	2.174	1.560	2.631	0.13	0.46
P32	1.429	2.421	1.437	2.454	0.01	0.03
P33	1.415	1.986	1.481	2.024	0.07	0.04
P34	1.377	2.806	1.426	3.233	0.05	0.43
P35	1.551	2.462	1.664	2.795	0.11	0.33
P36	1.610	2.279	1.631	2.434	0.02	0.16
P37	1.582	2.142	1.562	2.750	-0.02	0.61
P40	1.745	2.121	2.073	3.019	0.33	0.90
P41	1.487	1.729	1.476	1.774	-0.01	0.05
P45	1.553	2.000	1.599	2.157	0.05	0.16
P50	1.370	1.878	1.542	2.115	0.17	0.24
P51	1.564	1.815	1.506	1.884	-0.06	0.07
P52	1.487	1.670	1.543	1.750	0.06	0.08
P55	1.643	1.871	1.525	1.792	-0.12	-0.08
P60	1.346	1.534	1.687	2.129	0.34	0.60
P61	1.698	2.122	1.585	2.452	-0.11	0.33
P62	1.762	2.356	1.715	2.893	-0.05	0.54
P63	1.586	2.297	1.746	2.406	0.16	0.11
P64	1.096	1.207	1.669	2.153	0.57	0.95
P65	6.133	7.348	1.539	1.756	-4.59	-5.59
P66	1.501	1.722	1.594	1.892	0.09	0.17
P67	1.890	2.166	1.933	2.103	0.04	-0.06
P70	1.468	1.587	1.482	1.626	0.01	0.04
P71	1.349	1.466	1.385	1.523	0.04	0.06
P72	1.684	1.872	1.679	1.969	0.00	0.10
P73	1.284	1.444	1.632	1.899	0.35	0.46
P74	1.424	1.713	1.627	1.963	0.20	0.25
P75	1.410	1.595	1.380	1.553	-0.03	-0.04
P80	1.146	1.202	1.193	1.296	0.05	0.09
P85	1.313	1.579	1.385	1.685	0.07	0.11
P90	1.592	1.718	1.747	1.951	0.15	0.23
P91	1.532	1.735	1.548	1.830	0.02	0.10
P92	1.479	1.677	1.533	1.817	0.05	0.14
P93	1.328	1.484	1.402	1.605	0.07	0.12

Source: Eurostat input-output tables; wiiw calculations

Table C.2

Output multipliers, Germany

	1995		2005		Difference	
CPA	Domestic	Total	Domestic	Total	Domestic	Total
P01-P05	1.707	1.974	1.791	2.241	0.08	0.27
P10-P14	1.834	2.083	1.837	2.424	0.00	0.34
P15	2.076	2.503	2.061	2.619	-0.02	0.12
P16	1.945	2.403	1.775	2.337	-0.17	-0.07
P17	1.761	2.415	1.652	2.469	-0.11	0.05
P18	1.639	2.582	1.629	2.719	-0.01	0.14
P19	1.719	2.513	1.677	2.643	-0.04	0.13
P20	1.970	2.308	2.042	2.555	0.07	0.25
P21	1.797	2.538	1.743	2.540	-0.05	0.00
P22	1.770	2.044	1.793	2.111	0.02	0.07
P23	1.730	3.351	1.247	3.266	-0.48	-0.08
P24	1.787	2.334	1.687	2.538	-0.10	0.20
P25	1.730	2.290	1.678	2.422	-0.05	0.13
P26	1.835	2.098	1.855	2.308	0.02	0.21
P27	1.799	2.629	1.681	2.817	-0.12	0.19
P28	1.822	2.263	1.735	2.336	-0.09	0.07
P29	1.821	2.268	1.764	2.372	-0.06	0.10
P30	1.605	2.434	1.665	2.948	0.06	0.51
P31	1.848	2.229	1.818	2.451	-0.03	0.22
P32	1.736	2.512	1.528	2.545	-0.21	0.03
P33	1.680	2.002	1.569	2.033	-0.11	0.03
P34	1.917	2.554	2.013	2.967	0.10	0.41
P35	1.655	2.577	1.709	2.592	0.05	0.02
P36	1.765	2.248	1.697	2.395	-0.07	0.15
P37	1.875	2.184	2.251	2.668	0.38	0.48
P40	1.693	1.886	1.651	2.175	-0.04	0.29
P41	1.408	1.503	1.285	1.409	-0.12	-0.09
P45	1.809	2.054	1.792	2.160	-0.02	0.11
P50	1.690	1.887	1.419	1.619	-0.27	-0.27
P51	1.454	1.562	1.610	1.780	0.16	0.22
P52	1.586	1.677	1.601	1.758	0.02	0.08
P55	1.912	2.193	1.638	1.935	-0.27	-0.26
P60	1.717	1.850	1.803	2.096	0.09	0.25
P61	1.468	2.558	1.481	2.358	0.01	-0.20
P62	1.680	2.423	1.783	2.937	0.10	0.51
P63	2.427	2.552	1.952	2.215	-0.48	-0.34
P64	1.216	1.318	1.687	1.990	0.47	0.67
P65	6.907	7.563	1.574	1.761	-5.33	-5.80
P66	2.086	2.231	2.184	2.408	0.10	0.18
P67	1.638	1.884	1.545	2.082	-0.09	0.20
P70	1.363	1.405	1.302	1.379	-0.06	-0.03
P71	1.446	1.466	1.278	1.301	-0.17	-0.17
P72	1.391	1.483	1.375	1.524	-0.02	0.04
P73	1.724	1.885	1.681	1.921	-0.04	0.04
P74	1.426	1.507	1.474	1.591	0.05	0.08
P75	1.344	1.452	1.392	1.562	0.05	0.11
P80	1.233	1.292	1.280	1.352	0.05	0.06
P85	1.418	1.534	1.357	1.522	-0.06	-0.01
P90	1.720	1.910	1.679	1.902	-0.04	-0.01
P91	1.368	1.423	1.386	1.481	0.02	0.06
P92	1.461	1.592	1.529	1.719	0.07	0.13
P93	1.339	1.391	1.258	1.321	-0.08	-0.07

Source: Eurostat input-output tables; wiiw calculations

Table C.3

Output multipliers, Spain

	1995		2005		Difference	
CPA	Domestic	Total	Domestic	Total	Domestic	Total
P01-P05	1.792	2.052	1.731	2.101	-0.06	0.05
P10-P14	1.632	1.847	1.872	2.491	0.24	0.64
P15	2.337	2.790	2.355	3.028	0.02	0.24
P16	1.974	2.749	1.696	2.382	-0.28	-0.37
P17	1.714	2.563	1.844	2.911	0.13	0.35
P18	1.983	2.582	2.013	2.816	0.03	0.23
P19	2.436	3.149	2.021	2.903	-0.41	-0.25
P20	1.915	2.463	1.880	2.824	-0.03	0.36
P21	1.685	2.496	1.814	2.838	0.13	0.34
P22	2.076	2.612	1.842	2.418	-0.23	-0.19
P23	1.325	2.466	1.283	3.237	-0.04	0.77
P24	1.794	2.553	1.581	2.925	-0.21	0.37
P25	1.604	2.516	1.788	2.898	0.18	0.38
P26	1.903	2.184	2.040	2.643	0.14	0.46
P27	1.993	2.628	2.149	3.099	0.16	0.47
P28	1.900	2.481	1.882	2.849	-0.02	0.37
P29	1.848	2.447	1.837	2.721	-0.01	0.27
P30	1.648	2.738	1.593	2.987	-0.05	0.25
P31	1.836	2.496	1.893	3.201	0.06	0.70
P32	1.723	2.623	1.554	3.471	-0.17	0.85
P33	1.626	2.359	1.614	2.792	-0.01	0.43
P34	1.745	3.050	1.756	3.556	0.01	0.51
P35	1.658	2.462	1.795	2.993	0.14	0.53
P36	1.933	2.477	1.888	2.693	-0.04	0.22
P37	2.487	3.067	2.643	3.618	0.16	0.55
P40	1.519	1.836	1.732	2.670	0.21	0.83
P41	1.640	1.832	1.916	2.463	0.28	0.63
P45	2.023	2.325	2.351	2.755	0.33	0.43
P50	1.604	1.912	1.928	2.568	0.32	0.66
P51	1.531	1.655	1.606	1.895	0.07	0.24
P52	1.449	1.535	1.549	1.682	0.10	0.15
P55	1.823	2.046	1.760	2.008	-0.06	-0.04
P60	1.452	1.636	1.822	2.296	0.37	0.66
P61	1.676	2.114	1.673	2.743	0.00	0.63
P62	1.594	2.128	1.588	2.726	-0.01	0.60
P63	1.672	1.954	1.939	2.511	0.27	0.56
P64	1.204	1.323	1.779	2.205	0.57	0.88
P65	6.723	7.274	1.303	1.426	-5.42	-5.85
P66	2.107	2.265	1.834	2.084	-0.27	-0.18
P67	1.758	1.893	1.683	1.911	-0.07	0.02
P70	1.330	1.382	1.449	1.537	0.12	0.15
P71	1.642	1.799	1.731	2.052	0.09	0.25
P72	1.407	1.624	1.511	1.767	0.10	0.14
P73	1.491	1.653	1.546	1.921	0.06	0.27
P74	1.584	1.763	1.665	1.939	0.08	0.18
P75	1.351	1.468	1.422	1.619	0.07	0.15
P80	1.194	1.248	1.208	1.288	0.01	0.04
P85	1.330	1.565	1.431	1.748	0.10	0.18
P90	2.022	2.183	2.004	2.273	-0.02	0.09
P91	1.352	1.419	1.793	2.104	0.44	0.68
P92	1.480	1.664	1.621	1.921	0.14	0.26
P93	1.266	1.343	1.350	1.480	0.08	0.14

Source: Eurostat input-output tables; wiiw calculations

Table C.4

Output multipliers, Hungary

	2000		2005		Difference	
CPA	Domestic	Total	Domestic	Total	Domestic	Total
P01-P05	1.985	2.763	1.806	2.435	-0.18	-0.33
P10-P14	1.873	2.713	1.848	2.408	-0.03	-0.31
P15	2.220	3.259	2.152	3.030	-0.07	-0.23
P16	1.574	2.720	1.726	2.576	0.15	-0.14
P17	1.343	3.336	1.328	3.051	-0.01	-0.29
P18	1.217	3.364	1.281	3.144	0.06	-0.22
P19	1.230	3.411	1.363	3.190	0.13	-0.22
P20	1.660	2.917	1.745	2.896	0.09	-0.02
P21	1.462	3.368	1.486	3.150	0.02	-0.22
P22	1.919	2.981	1.818	2.745	-0.10	-0.24
P23	1.205	2.819	1.328	2.889	0.12	0.07
P24	1.540	2.780	1.596	2.775	0.06	-0.01
P25	1.501	3.117	1.331	2.969	-0.17	-0.15
P26	1.687	2.563	1.771	2.718	0.08	0.16
P27	1.543	3.497	1.712	3.278	0.17	-0.22
P28	1.674	3.065	1.648	2.973	-0.03	-0.09
P29	1.520	3.152	1.485	3.017	-0.03	-0.13
P30	1.021	4.767	1.089	4.013	0.07	-0.75
P31	1.284	3.962	1.199	3.010	-0.09	-0.95
P32	1.066	4.612	1.083	4.208	0.02	-0.40
P33	1.403	2.923	1.426	2.503	0.02	-0.42
P34	1.199	3.800	1.193	3.588	-0.01	-0.21
P35	1.444	2.946	1.666	2.676	0.22	-0.27
P36	1.509	2.876	1.646	2.840	0.14	-0.04
P37	2.013	2.832	1.797	2.677	-0.22	-0.15
P40	1.317	2.590	1.587	2.705	0.27	0.11
P41	1.725	2.265	1.678	2.075	-0.05	-0.19
P45	1.648	2.507	1.730	2.584	0.08	0.08
P50	1.653	2.373	1.638	2.385	-0.02	0.01
P51	1.773	2.480	1.698	2.309	-0.08	-0.17
P52	1.652	2.113	1.629	2.000	-0.02	-0.11
P55	1.949	2.493	1.943	2.442	-0.01	-0.05
P60	1.516	2.154	1.452	2.135	-0.06	-0.02
P61	1.970	2.774	1.421	2.331	-0.55	-0.44
P62	1.911	3.039	1.507	2.854	-0.40	-0.19
P63	1.607	2.127	1.523	2.001	-0.08	-0.13
P64	1.432	1.999	1.463	1.719	0.03	-0.28
P65	3.202	4.356	1.571	1.763	-1.63	-2.59
P66	1.760	2.263	1.769	2.129	0.01	-0.13
P67	1.688	1.892	1.651	1.796	-0.04	-0.10
P70	1.327	1.606	1.424	1.693	0.10	0.09
P71	1.311	1.752	1.246	1.480	-0.06	-0.27
P72	1.512	2.104	1.513	1.970	0.00	-0.13
P73	1.482	2.044	1.493	1.986	0.01	-0.06
P74	1.608	2.032	1.588	1.962	-0.02	-0.07
P75	1.309	1.575	1.268	1.467	-0.04	-0.11
P80	1.312	1.510	1.285	1.445	-0.03	-0.06
P85	1.427	1.864	1.408	1.799	-0.02	-0.07
P90	1.637	2.198	1.650	2.156	0.01	-0.04
P91	1.851	2.222	1.747	2.010	-0.10	-0.21
P92	1.807	2.326	1.793	2.212	-0.01	-0.11
P93	1.477	1.890	1.480	1.771	0.00	-0.12

Source: Eurostat input-output tables; wiiw calculations

Table C.5

Output multipliers, Slovakia

	2000		2005		Difference	
CPA	Domestic	Total	Domestic	Total	Domestic	Total
P01-P05	2.025	2.564	1.808	2.307	-0.22	-0.26
P10-P14	1.811	2.435	1.593	2.061	-0.22	-0.37
P15	1.950	3.003	1.826	2.892	-0.12	-0.11
P16	1.443	2.659	1.703	2.353	0.26	-0.31
P17	1.484	2.474	1.334	2.617	-0.15	0.14
P18	1.285	2.271	1.350	2.398	0.06	0.13
P19	1.251	2.409	1.358	3.014	0.11	0.60
P20	2.002	2.706	1.687	2.581	-0.32	-0.12
P21	1.586	2.996	1.766	3.118	0.18	0.12
P22	1.677	2.738	1.668	2.679	-0.01	-0.06
P23	1.135	3.210	1.169	2.755	0.03	-0.45
P24	1.429	2.955	1.509	2.945	0.08	-0.01
P25	1.350	3.112	1.461	3.144	0.11	0.03
P26	1.758	2.834	1.845	2.662	0.09	-0.17
P27	1.991	3.483	1.460	2.646	-0.53	-0.84
P28	1.661	2.927	1.406	2.437	-0.25	-0.49
P29	1.464	3.315	1.454	2.882	-0.01	-0.43
P30	1.215	4.144	1.289	3.956	0.07	-0.19
P31	1.287	3.119	1.292	3.191	0.00	0.07
P32	1.248	3.205	1.232	4.009	-0.02	0.80
P33	1.593	2.466	1.482	2.603	-0.11	0.14
P34	1.119	4.070	1.223	3.995	0.10	-0.07
P35	1.441	3.395	1.733	3.085	0.29	-0.31
P36	1.424	3.298	1.490	2.937	0.07	-0.36
P37	1.958	2.351	1.660	2.251	-0.30	-0.10
P40	2.606	3.235	1.982	2.791	-0.62	-0.44
P41	2.010	2.443	1.766	2.113	-0.24	-0.33
P45	1.983	2.689	1.925	2.678	-0.06	-0.01
P50	1.708	2.465	1.729	2.475	0.02	0.01
P51	1.775	2.471	1.628	2.050	-0.15	-0.42
P52	1.721	2.214	1.533	1.895	-0.19	-0.32
P55	2.160	2.774	1.645	1.984	-0.52	-0.79
P60	1.511	2.682	1.578	2.256	0.07	-0.43
P61	2.294	3.002	1.646	2.171	-0.65	-0.83
P62	2.471	3.569	1.408	3.690	-1.06	0.12
P63	2.056	3.106	1.873	2.790	-0.18	-0.32
P64	1.536	1.928	1.517	1.866	-0.02	-0.06
P65	1.774	2.074	1.389	1.621	-0.39	-0.45
P66	1.625	1.806	1.451	1.869	-0.17	0.06
P67	2.655	3.061	1.395	1.759	-1.26	-1.30
P70	1.408	1.503	1.457	1.675	0.05	0.17
P71	1.776	2.259	1.717	2.046	-0.06	-0.21
P72	1.586	2.250	1.501	2.114	-0.08	-0.14
P73	1.845	2.487	1.488	2.041	-0.36	-0.45
P74	1.762	2.373	1.672	2.108	-0.09	-0.26
P75	1.586	1.874	1.426	1.692	-0.16	-0.18
P80	1.254	1.390	1.252	1.423	0.00	0.03
P85	1.455	1.949	1.377	1.944	-0.08	-0.01
P90	1.969	2.421	1.645	1.956	-0.32	-0.47
P91	2.780	3.360	1.676	2.006	-1.10	-1.35
P92	1.925	2.474	1.790	2.168	-0.14	-0.31
P93	1.443	1.678	1.351	1.511	-0.09	-0.17

Source: Eurostat input-output tables; wiiw calculations

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