„Global Value Chains:
Implications for the Austrian economy"

Veronika Kulmer, Michael Kernitzkyi, Judith Köberl, Andreas Niederl

─────────────── **Abstract** ───────────────

This study focuses on the implications of rising global value chains (GVCs) on international trade and analysis the impacts on small open economies. Small open economies rely heavily on international trade and are highly integrated in global production networks but have so far been hardly considered in the literature. On the example of Austria, an industrialized small open economy in central Europe, we addressed the role of small open economies in a globalized economy. Based on the WIOD database we apply network analysis and use GVC as well as competiveness indicators to measure the associated risks as well as benefits. Findings imply for Austria a sharp turn in the focus of trade policy away from the traditional gross trade perspective. Austria's competitiveness has been strengthened considerably via the participation in GVCs since resource and endowment constraints have been overcoming easier and foreign inputs are used in the production processes efficiently enabling vast economies of scale. Results also reveal that the promotion of service oriented activities which are a main source of the domestic value added content in manufacturing exports is of key importance for Austria's competitiveness on the global market. In particular we found a mutual integration of EU enlargement countries of 2004 and Austria: Austria's intermediate exports are mainly characterized by high knowledge- and service-intensive manufacturing goods, while the EU enlargement countries of 2004 specialize in low-skilled employment and less knowledge intensive services.

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Executive Summary

In the last decade the internationalization of supply chains has considerably increased. The production process of industries and companies is more and more divided up into numerous stages and allocated among several countries. In today's world international trade and competition increasingly take place at task rather than industry level resulting in a high degree of interdependencies in the global trade and production network. The analysis of global value chains (GVC) on a macroeconomic level typically draws on multiregional input-output tables. In the last couple of years, several attempts were made to provide such databases. This analysis uses the World Input Output Database (WIOD), which comprises 35 sectors of production and 41 regions and covers a time span from 1995 to 2011. Global input output databases enable to trace the production of goods from primary inputs over intermediate stages to final demand and across country borders. By using input-output decomposition techniques the identification of the domestic and foreign value added content in the production process of goods and services is now possible.

The high level of global interconnectedness poses a variety of challenges, benefits and risks on countries participating in GVCs. However the impacts differ regarding size, development, industry mix and level of participation of countries. This paper focuses on the implications of rising GVCs on international trade and analysis the impacts especially on small open economies. Small open economies rely heavily on international trade and are highly integrated in global production networks but have so far been hardly considered in the literature. On the example of Austria, an industrialized small open economy in central Europe, we addressed the role of small open economies in a globalized economy and the associated risks as well as benefits.

Regarding Austria's position in the global trade network and its main trading partners the consideration of value added in trade confirms the findings derived by traditional gross trade statistics: Austria is highly integrated in the European trade network and is heavily involved in trade with its neighboring countries in particular Italy and Germany. But for policy analysis on a finer level of resolution (e.g. economic sectors) and regarding competitiveness as well as embodied risks value added in trade gives new insights.

At aggregated level, our findings show that Austria lies rather downstream in the global value chain where the share of foreign value added embodied in gross exports will be much higher than the indirectly exported value added. From a policy perspective, Austria faces due to its rather downstream location characterized by a relatively high amount of imported contend of gross exports a higher vulnerability on trade tariffs than large economies. Tariffs may still reach quite a high level by the time the finished good reaches final demand which then dampens demand and affects production and investment. Austria holds intense trade relations in gross as well as in value added terms within the European Union, which lowers Austria's vulnerability because of absence of tariffs in trade. Nonetheless these issues underline the importance of a rethinking of traditional trade policies and to consider the complex nature of global value chains in policy design as well as trade analysis.

At sectoral level we find that metal, transport equipment, machinery and electrics are in gross terms Austria's main export activities. However, most of these industries show a high share of foreign value added (on average 37 %) and hence the production of exports depends to the extent of one third on imported intermediate inputs. Regarding the production process of manufacturing exports, Austria shows a high degree of value added from services. More precisely, on average over 30 % of value added in exports of manufactured goods represents services. Thereby, a large extent regards business services and activities and a smaller amount relates to transport and telecommunication as well as distribution

services. While the vast share of the imported value added in Austria's manufacturing exports relates to fabrication and assembling, the knowledge intensive activities (e.g. R&D, branding and marketing) are located domestically. Additionally most of Austria's export sectors hold in value added terms a comparative advantage. Therefore promoting domestic service sectors strengthens the international competitiveness of Austria's exports on a whole, also in manufacturing industries.

Currently, the EU enlargement countries of 2004 are an important market for Austria's goods and services and the demand for further intermediate inputs from Austria in their production process is expected to grow. We find a mutual integration of both regions which strengthens their respective competitiveness and specialisation patterns: Austria's intermediate exports are mainly characterized by high knowledge- and service-intensive manufacturing goods, while the EU enlargement countries of 2004 specialize in low-skilled employment and less knowledge intensive services. Following Godart and Görg (2011) the successful and effective integration of these countries via the EU enlargement in GVCs led to rising incomes, fostered GDP growth and hence boosted consumption of private households. This increase in the consumption level of private households is also reflected in our analysis where eastern European countries became important target markets of Austria's value added. In particular the final demand of Austria's value added in the EU enlargement countries of 2004 increased on average annually by a rate of 3.5 % (in the period 2004 to 2011). In contrary the amount of value added consumed in Austria that has been imported more than doubled in the last two decades. Currently nearly 20% of the value added consumed in Austria's final demand is imported. These growing dependencies make policies that target domestic demand less effective since there are no direct links to job creation and GDP, there are maybe positive spillovers to other countries.

Underlining the importance of value added in trade and identifying the benefits and risks associated with GVCs on the example of a small open economy, new rules in global trade policy are required. It is absolutely clear that the optimal governance solution for global supply chains would be on a global scale. However, since GVCs are of a complex nature where countries hold different positions and strategies, a global trade agreement in the near future is extremely hard to achieve and hence rather impossible. But there is still much room at country- or regional level for promoting and stimulating interconnected policies. The main findings of this study imply for Austria, as a small open economy, a sharp turn in the focus of trade policy away from the traditional gross trade perspective. Austria's competitiveness has been strengthened considerably via the participation in GVCs since resource and endowment constraints have been overcoming easily and foreign inputs are used in the production processes efficiently enabling vast economies of scale. Due to this dependency on foreign inputs Austria's trade policy should focus on the reduction of various trade facilitation bottlenecks such as the lowering of administrative hurdles at the border (e.g. border processing days) and an enhancement of the quality of transport and logistics which would significantly reduce trade costs and hence improve cost-effectiveness. Moreover our findings suggest that the promotion of service oriented activities which are a main source of the domestic value added content in manufacturing exports is of key importance for Austria's competitiveness on the global market. In particular in Austria the business services embodied in manufacturing exports mainly comprise the tasks computer and related activities, research and development as well as other business activities like engineering activities. Additionally it is necessary to foster investments in sticky factors of production such as know-how and research activities, which are essential ingredients to a long-run competitive advantage.

Building on the findings of this study, one future research approach might be the analysis of the macroeconomic and distributional impacts of different trade agreements (e.g. between the EU and USA) or policy schemes on Austria and its main trading partners. In order to gain more comprehensive

insights in policy analysis on the basis of global value chains (considering price induced long-term feedback effects between demand and supply) a methodological switch from classical input-output techniques mainly applied in this study to a multiregional general equilibrium model (CGE) is most suitable (e.g. see Koopman et al. 2013, Bednar-Friedl et al. 2012).

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1 Introducing global value chains

In the last decade we observed a substantial internationalization of supply chains. More precisely, the production process of industries and companies is divided up into numerous stages and allocated among several countries. The reasons for this dramatic change in global trade patterns are manifold: multilateral trade agreements which led to lower trade tariffs and investment barriers, falling transport costs, technological change in information and communication systems as well as internationalization of R&D activities (Baldwin and Frederic 2014, Hummels and Schaur 2013, Yi 2003). All these factors boosted the rise of global value chains (GVC). In order to fully capture risks and benefits of this development, traditional statistic measures do not gauge the full complexity of the nature and provide only gross flows of imports and exports. However, this view is problematic. Trade in intermediate goods is now more than two thirds of total trade and hence, gross flows include a high degree of double counting (Johnson and Noguera 2012).

The identification of the "real" value in trade is therefore of key importance to policy makers and provides new insights on the nature of economic globalization. In particular, analysing GVCs gives valuable and additional information on countries' trade patterns, specialisation behaviour, vulnerability to macro-economic shocks and competitiveness. In the literature the debate on value added in trade and their policy relevance in terms of countries' strategies and perspectives is not a new phenomenon. A variety of empirical studies, which comprise product based analysis (e.g. Tempest 1996 on the Barbie; Kraemer and Dedrick 2002 and Fields 2006 on Dell computers; Linden et al. 2011 and Varian 2007 on the iPod; Grossman and Rossi-Hansberg 2009 on the Boeing), the identification of industry clusters and manufacturing cores (Humphrey and Schmitz 2002, Gibbon 2001, Bowen et al. 2006) as well as an assessment of countries performance and position in international trade (e.g. Coe et al. 2004, Coe et al. 2008, OECD 2013a, Gereffi et al. 2005) underline the long-lasting interest in this issue.

In general global value chains describe the full range of activities required to bring a product or service from conception via the intermediate phases of production to delivery to consumers and final disposal after use (Kaplinsky and Morris 2000). Empirical evidence to the emergency of GVC is provided by Gereffi and Korzeniewicz (1994), Kapulinsky (1998) as well as Dedrick et al. (2010). The rise of GVC started in the early nineties'. More precisely, in the last decades, according to the OECD (2011a) many industrialized economies have experienced a fall in the ratio of value added to production as well as a growing use of intermediates and increased outsourcing of activities (OECD 2011a). The growth in gross exports relative to output, observed in most OECD countries, also underlines this result and indicates an intensification of GVCs (Saito et al. 2013).

In terms of internationalization of supply chains special consideration should be given to small open economies (SOE), which rely heavily on international trade and are highly integrated in global production networks. As indicated by economic theory (Baldwin et al. 1999) size of the economy and openness substantially influence countries' degree of integration in the global production network and hence its' value added in trade. Within the literature a variety of studies pays attention to the emerging economies (e.g India, Indonesia, Brazil) and their role on the global market. Moreover, most of these studies focus on Asia (e.g. Hiratsuka 2010, Gereffi and Sturgeon 2013). However there is hardly any empirical evidence on economic performance, vulnerability to external shocks, position in the global network and degree of specialisation of small open economies. Therefore this study aims to close the gap in the literature by analysing the effects of the rise of GVCs on a small open economy. On the example of Austria a typical European SOE – with special geographical significance between western and eastern Europe –we address the following issues: (i) how is Austria integrating in the international trade network

and what are the implications on competitiveness?; (ii) how did the rising internationalization change the trade pattern of Austria and what role do neighbouring countries and historic important trade partners still play?; (iii) how did the EU-enlargement shape and influence Austria's trade relations? and (iv) is the rising importance of emerging countries (e.g. China, Brazil) beneficial for Austria and its' international competitiveness?

Methodologically this study draws on recent developments and advances in the field of GVC analysis. However the measurement of GVCs and value added in trade poses some challenges. First and foremost availability and reliability of data is a key issue. GVC analyses draw on input-output tables, which measure the relationships between the producers of goods and services (including imports) in an economy and the users of the same goods and services (including exports). However, global input – output tables are hardly available. In the last couple of years, several attempts were made to provide global input –output data: Trade in Value Added Initiative (TiVA)[1] of the OECD and WTO, the Global Trade Analysis Project (GTAP)[2] at Purdue University, the External Trade Organization (IDE-Jetro)[3] project at Institute for Development Economies Japan and WTO as well as the World Input Output Database (WIOD)[4] project. The emergence of these different classes of global input output data enables a measurement of GVC. Second, methodologically, within the literature there is no agreed measurement or indicator to analyse GVCs. Depending on the applied global input-output dataset regarding level of sectoral and regional resolution, the used indicators are various: degree of vertical specialisation, foreign and domestic valued added in exports, participation rate, distance to final demand, value added exports, revealed comparative advantage and many more. These two issues underline the complexity of GVC research as well as the importance of further studies and deeper research. Moreover, since the rise of GVC started in the nineties' and global databases are only available for a short period of time; this research field is relatively new.

For the purpose of this research the World Input Output Database (WIOD), which comprises 35 sectors of production and 41 regions (for a sectoral and regional description see Table A.1 and Table A.2 in the Appendix) is most suitable. In contrast to other global input-output datasets, WIOD provides a time series of tables (1995-2011) and additional accounts (e.g. socio-economic data, energy data) as well as includes a *regional x sectoral* specification of intermediate demand.

[1] http://www.oecd.org/sti/ind/measuringtradeinvalue-addedanoecd-wtojointinitiative.htm

[2] https://www.gtap.agecon.purdue.edu

[3] http://www.ide.go.jp

[4] http://www.wiod.org

2 Trends and Challenges in international trade

Past developments such as trade liberalizations in terms of lower trade tariffs and investment barriers, falling transport costs, technological advances in information and communication systems as well as internationalization of R&D activities shaped international trade relations considerably and led to the internalization of supply chains. Within the literature implications of the internalization of supply chains are well observed for certain products (e.g. Kraemer and Dedrick 2002 and Fields 2006 on Dell computers; Linden et al. 2007 and Varian 2007 on the iPod) but there is hardly research on aggregate level concerning countries' role, participation and position in international trade. Therefore in this section we illustrate how the perspective of global value chains changes the global trade network and focus thereby on countries' economic characteristics, openness to trade (small open economy versus large economies), relative position and importance in the network. Furthermore this section provides an overview of impacts and drivers of global value chains that mainly shaped the recent developments in international trade.

2.1 The global trade network: what do we learn from value added in trade?

Within the economic literature, network analysis is widely used and a standard tool to study and illustrate international trade relations (e.g. League of Nations 1942, Saul 1945, Feenstra and Taylor 2008). From an economic point of view analyzing international trade flows and production clusters via networks gives emphasize on the relationships between countries, the structure and systematic features such as diversity in trade, the emergence of new countries and industries as well as economic push and pull factors in trade. In this section we use network analysis to emphasize the changes in the global trade network regarding structure and density of the network as well as countries position and importance in the network.

From a policy perspective the consideration of global value chains in the international trade network is of key importance because trade in intermediate inputs accounts for as much as two thirds of international trade (Johnson and Noguera 2012, Ambador and Cabral 2009). Thus, gross trade flows which are based on traditional trade indicators tend to overstate the implicit value or factor content in trade, since they consider the gross value of goods at each border crossing, rather than the net value added between border crossings (Johnson and Noguera 2012). In order to provide a detailed picture of the different faces of global trade and to emphasize the importance to consider the "real" value in trade we illustrate the global trade network from three perspectives: First, we start with the trade network of gross trade flows, based on traditional trade statistics. Second, we consider intermediate trade and focus on the global network of value added in trade (in particular the imported and domestic content of value added in gross trade flows). Third, the focus is on the destination of value added and therefore we illustrate the global trade network of value added exports to countries' final demand.

The graphical illustration and analysis of the global trade network from these three perspectives shows the complexity of the nature of rising global value chains and allows first insights at country level regarding competiveness, participation and trade policy. In order to enhance comparability the methodological approach and the used database are identical in the three analyses. Regarding data we use the global input-output database WIOD, which depicts trade in intermediates and final consumption of 41 regions. This database is most suitable to address the issue of value added in trade and to highlight its policy relevance compared to traditional trade statistics. However, for a complete picture of global trade the regional resolution of WIOD with its focus on Europe (27 countries) and North-America is limited. Other databases like UN comtrade have a wider scope regarding covered countries and are

better suited to give more insights especially to Asian, African and South American economies (in WIOD treated "as rest of the world"), but they only enable analyses on the basis of gross flows and therefore provide no information on value added in trade and global value chains. Thus the applied network analysis depends on the available data and gives an overview and graphical illustration on different perspectives of global trade and its implications on countries.

2.1.1 Gross exports

Starting the analysis with the traditional trade perspective, Figure 1 illustrates the global network of gross export flows, which is based on several assumptions. Each country is represented by a node in the network, labeled with the respective iso-3 country code (see Table A.1 in the Appendix). The colors represent different geographical and economic features: Red for Austria, as the case-study region, green for the G8 countries, gold for Austria's' neighboring countries (except Germany and Italy as G8 members) and grey for all other countries. The links represent export flows in absolute terms between the nodes, where the thickness of the link indicates the intensity of the trade relation (the thicker the higher is the value of gross exports). Additionally, the arrow indicates the direction of the trade relation.

The position of the country in the network depends on its degree of interlinkage to other countries in the global trade network (the higher the number of significant relations the more centric is its' position in the network). Methodologically we measure centrality of a country by means of the outdegree prestige indicator (Wasserman and Faust 1999), which counts all significant outgoing flows of every node and gives an indication of how prestigious a node tends to be. In particular, a prestigious node is characterized as one who is the object of extensive ties and is defined by the number of direct linkages to other nodes. The prestige indicator considers the number of linkages but does not weight for the value in trade carried by each flow. An alternative measure for centrality would be the proximity prestige indicator which additionally takes the indirect relations into account. However, indirect relations are captured by the methodology of global value chains itself. Moreover, the comparison between both measures shows that the results are nearly identical.

Following the approach of Benedicits and Tajoli (2011) we drop all network relations smaller than 200 million USD. That limit corresponds to the 25th percentile of all gross export relations. Therefore the smallest 25 % of all total gross trade flows were dropped as insignificant trade flows in the global trade network. Such cut-off is arbitrary yet necessary to calculate network indices based on relevant interlinkages and to facilitate the graphical rendition.

Based on the outdegree prestige indicator we find that Germany is the center of the global network of gross export flows and hence shows the highest level of interconnectivity. Additionally, Italy, Great Britain, France, United States, Russia and China are also highly connected nodes and thus important reference markets in terms of gross exports for a large number of countries. As illustrated in Figure 1, we also find that the geographical scale by means of the physical distance along with free trade agreements is a key factor in the world trade network of gross exports: trade tends to be regionalized and high among neighboring countries (e.g. United States with Canada and Mexico, among the EU-15 as well as Japan with countries of South-East Asia like Korea and Taiwan). These findings correspond to the well-known and empirically tested classical gravity model of trade which was first introduced by Tinbergen (1962) and explains trade flows as a function of economic size and distance between two units. Thereby the gravity model of bilateral trade, in its most basic form, states that trade between two countries is proportional to the product of the GDP of both countries and inversely related to the distance between them.

Less connected economies like the Baltic States (Latvia, Lithuania and Estonia) hold a peripheral position – because of the small size of those economies – and are hence on the edges of Figure 1. However, they maintain knot ties between each other and their nearest neighbors like Russia and Finland. Austria's position in the global trade network is of mid-centrality to high centrality especially compared to other small open economies like Sweden and Denmark which generate a clearly higher value added per year than Austria. Apart from Germany Austria also holds intensive trade relations with its other neighboring countries Italy, Czech Republic and Hungary.
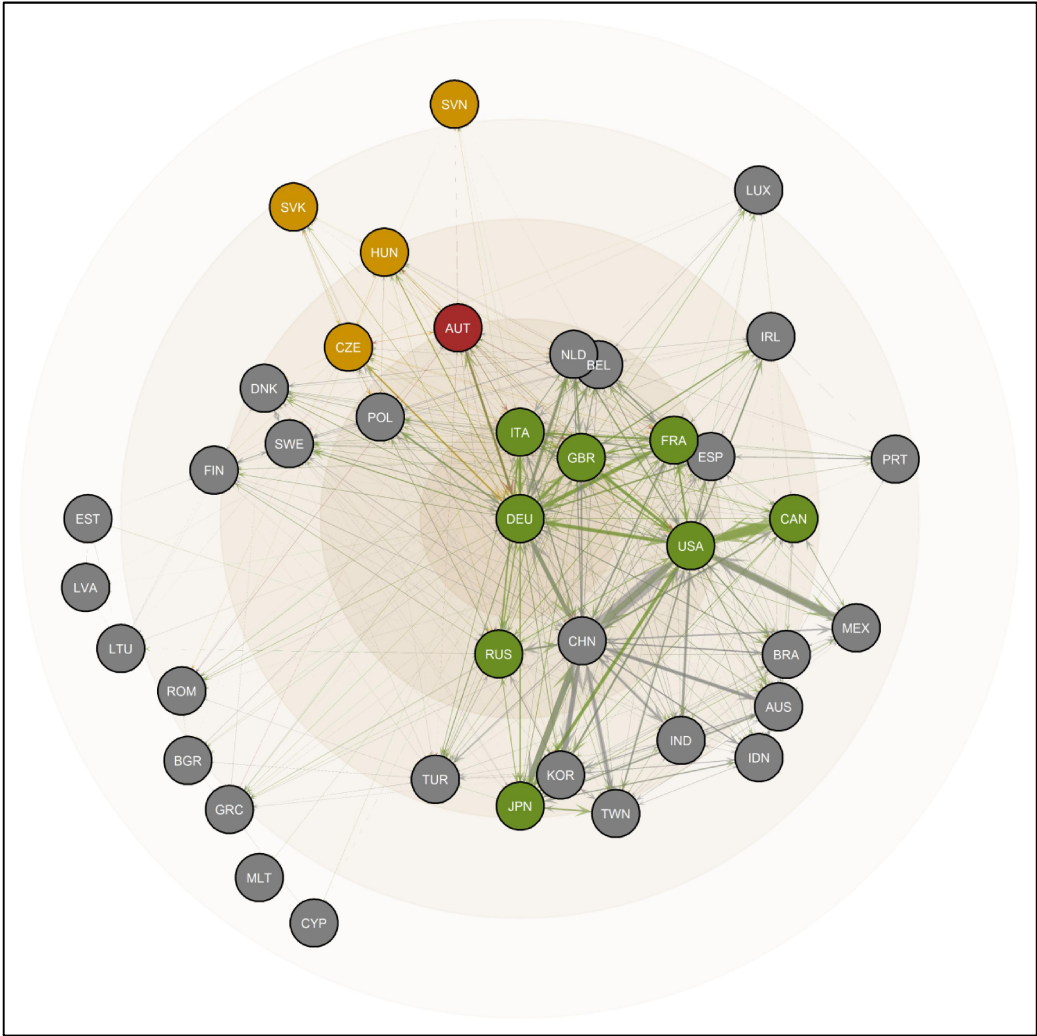

Figure 1: Global trade network based on the outdegree prestige indicator in 2011: gross export flows – all industries (Graph: own illustration, data: WIOD 2013)

Following standard indicators of network analysis results report that the global trade network of gross exports is characterized by a middle density, a high degree of homogeneity and a small level of hierarchy. In particular, the density value of 0.64 indicates that by randomly taking two countries in the global trade network of gross exports (Figure 1) the probability of a significant trade link among them is about 64 %. This density value suggests that many countries in the applied network are connected to each other and hold trade relations at a significant level. This result underlines that in 2011 most countries are highly open to and dependent on international trade. Furthermore regarding homogeneity we find a small degree of variation regarding countries prestige scores. In particular, 75 % of the countries in the global trade network of gross exports experience trade relations with at least 50 % of the regions, while a quarter have trade relations with more than 80% of all regions. This rather high degree of homogeneity among the countries in the network is supported by two group centrality measures: (i) the

degree centrality, which is based on the number of links of each node and (ii) the closeness centrality, which takes into account the geodesic length of the links (Wasserman and Faust 1999). Both measures indicate with a value of 0.36[5] for the degree centrality and a value 0.24 for closeness centrality a rather equal and complete network, where the trade relations regarding length and number of linkages are distributed equally between the countries (Everett & Borgatti 2005). Thus, there is hardly any evidence of a hierarchical structure in the network of gross trade.

2.1.2   Domestic and foreign value added in gross exports

Subsequent to the analysis of the global network of gross exports, which describes only a partial aspect of global trade by missing indirect flows, we focus on the value added content in gross trade. As above mentioned gross trade flows tend to overstate the implicit value or factor content in trade and account for the gross value of goods at each border crossing, rather than the net value added between border crossings (Johnson and Noguera 2012). In order to illustrate the global network of value added in trade we derive the "real" value embodied in trade by following the methodological approach of Koopman et al. (2014). They provide a comprehensive framework of decomposing gross exports into its respective domestic and foreign value-added components. In particular, all value-added in a country's gross exports is distributed to its original sources, either produced domestically or imported from countries abroad. In order to capture the real value in trade, we focus on the foreign content of value added in countries' gross exports, which gives, based on WIOD, information on the value of imported intermediates to produce countries' exports.

Figure 2 illustrates the global trade network of foreign value added in trade and thus depicts the full scale of intermediate trade and internalization of supply chains at country level. Each link represents the flow of value added from country s to country r in order to produce exports of country r[6]. In other words, the amount of intermediate input in terms of value added of country s that is used in the production of gross exports of country r. Analogous to Figure 1, the thickness of the link indicates the intensity of the trade relation (the thicker the higher is the content of foreign value added), the arrow indicates the direction of the trade relation. The position of countries in the network is again based on the outdegree prestige indicator as measurement for centrality.

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[5] Both group centrality measures are standardized and range between 0 and 1 (see Wasserman and Faust 1999). At the minimum value of 0, closeness centrality implies that the geodesic lengths of all links are equal (circle graph) and degree centrality states that there is no range or variability between the nodes (full degree of homogeneity).

[6] Again, in order to improve the intelligibility of the network map, only the main network connections are retained. We thus drop all network relations smaller than 60 million USD (that limit corresponds to the 25th percentile of all foreign value added in trade relations).
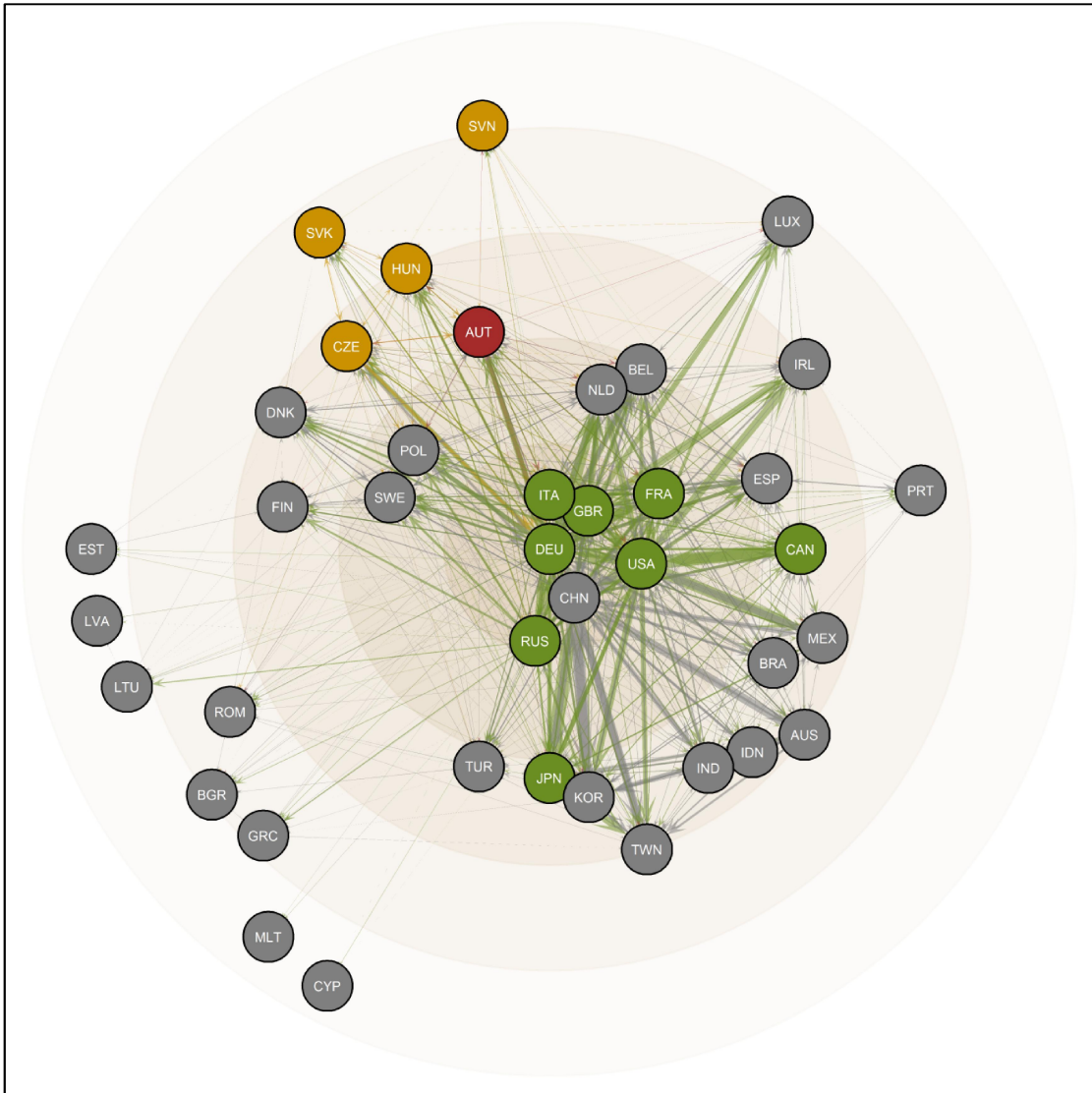
Figure 2: Global trade network based on the outdegree prestige indicator in 2011: value added in trade – all industries (Graph: own illustration, data: WIOD 2013)

As in the case of gross exports, Germany is with the highest level of interconnectivity in the center of the network and hence the most active country in terms of value added in trade as well. By comparing countries' position in the value added in trade network (Figure 2) with the network of gross trade (Figure 1) we find that by considering value added in trade the global trade network shows a rising network density. In particular the G8 countries, apart from Japan and Canada, along with China are much closer together. This shift in the centrality and interconnectivity of countries in the global network by focusing on value added in trade underlines the importance of the consideration of intermediate trade regarding competiveness and vulnerability to external shocks. For instance, China is even a more important player in the global trade network in terms of value added in trade than in gross exports. On the one hand, China is the typical example of an economy of assembly and manufacturing, which is characterized by a high degree of fragmentation, incorporating substantial amounts of value added from other countries. Thus production of Chinas exports dependents strongly on foreign inputs. On the other hand, concerning the high degree of fragmentation, China also exports value added in terms of intermediate inputs to numerous countries like United States and Japan. In contrary, Canada is in absolute terms an important provider of resources and intermediate inputs, but it hardly relies on foreign value added to produce its exports and hence the respective level of interconnectivity is much lower in value added terms. These structural differences in the value added composition in the gross exports of China and

Canada indicated by their position in the global trade network emphasize the role of global value chains: the global trade network comprises so called "headquarter" economies like the United States, Canada and Great Britain, whose exports contain a relatively small amount of imported intermediates and "factory" economies (e.g. China and Taiwan), whose exports contain a large share of imported intermediates (Baldwin 2013a). Furthermore the value added in trade network depicted in Figure 2 underlines the relevance of the geographic scale as well. For instance, exports of Canada and Mexico rely heavily on inputs of the United States. Germany is an important supplier of intermediate inputs and resources in Europe, especially for Austria, Czech Republic, Great Britain and Hungary. Of course trade agreements such as NAFTA in North America or within the EU are an important factor along with geographical scale. We also find that, Russia holds extensive ties with Eastern European countries like Greece, Romania and Poland.

Figure 2 assigns Austria a rather central position in the network of value added in trade. Austria is along with the Spain and Canada in the ranking of the prestige scores and holds trade relations at a considerable level with 85 % of all countries. As expected, Austria is mainly involved in trade with its neighboring countries in particular Italy and Germany but also Hungary, Czech Republic and Slovakia. For a detailed overview on Austria's trade relations in terms of value added inflows and outflows see Figure 31 in the Appendix.

Austria's strong integration in the European network of value added in trade is clearly visible in Figure 3 which illustrates the flows of value added on Europe's geographical scale. Furthermore in order to account for the size of the economies, countries depicted in Figure 3 are colored according to their value of gross exports. Germany is with more than 2,000 Bn. USD (WIOD) the so called world champion of exports but, as already pointed out in Figure 2 Germany depends on a considerable amount of foreign intermediate inputs as well. At the European scale these intermediate inputs are mainly provided by Italy, France, Great Britain, Belgium and Austria. While Germany depends on value added imports from central European countries it indirectly exports a vast share of value added to Eastern-Europe. In addition to Germany, eastern European countries such as Bulgaria, Romania and Poland depend in their production of exports also on Russia and Austria. The latter has used its geographical position as former boarder country of the EU-15 to intensive the respective trade relations and for outsourcing of certain stages in the production process to Eastern-Europe. Russia supplies a vast share of intermediate inputs to other countries (mainly former Soviet Union countries) but hardly depends on inputs from foreign countries in its production of exports. The reason is that Russia exports mainly resources and prime energy (for further details on Russia's trade pattern see Section 3.4).

Figure 3: European network of value added in trade in 2011 – all industries (Graph: own illustration, data: WIOD 2013)

Overall our findings reveal that the global network of value added in trade shows with a value of 0.72 a considerable higher density than the network of gross exports (0.65), which means by randomly taking two countries in the global trade network of value added in trade the probability of a significant trade link among them is about 72 %. This high degree of global interlinkage by considering intermediate trade is supported by the range of the countries' prestige scores: 75 % of the country's trade with at least 60% of all countries in the dataset, while a quarter has trade relations with more than 80%. The degree centrality index which is based on the number of links of each node in value added trade has a value of 0.29 compared to 0.36 in gross export terms. The closeness centrality index which takes into account the geodesic length of the links between all nodes amounts to 0.21 in contrast to 0.24 in terms of gross exports. Thus both measure support the finding of a higher density in the network of value added in trade.

Comparing the value added in trade network of 2011 (Figure 2) with the one of 1995 (see Figure 32 in the Appendix) we find that: First, the number and intensity of trade relations grew considerably. This increasing number of linkages between 1995 and 2011 goes along with a rising density of the global trade network. In 1995 the probability of a trade link among a random pair of countries was about 57 %, whereas in 2011 the network shows a probability of 72 %. Regarding policy relevance this increase in density implies that on average each country has a larger number of trade partners and that the entire system is more intensely connected. Thus, changes in the network such as regulatory reforms, supply

constraints and demand shocks have nowadays a much stronger impact and affect numerous countries. Second, new players' emerged on the global market such as China and Korea, while others, in particular Russia but also the United States, lost centrality. The increasing involvement of the new economies is of key importance for the rising density and interconnectivity of the global trade network. For instance considering inward flows, China, Brazil and some eastern European countries (Poland, Czech Republic and Hungary) more than doubled their trade relations. In 2011 75 % of the countries are involved in trade relations with at least 60% of all countries, while in 1995 this share only amounts to 30% of all countries. In terms of competitiveness (e.g. specialization behavior of countries) our findings imply that in 2011 trade is not anymore concentrated among certain large economies and that most countries, independent of size and economic structure participate in international trade.

2.1.3 Value added exports

Subsequent to the analysis of value added embodied in trade and the importance of intermediate trade in the global trade network this section focuses on final consumption and target markets. As already laid out in the previous sections identifying the "real" value in trade and accounting for intermediate trade brings new insights into the global trade network and the implications of global value chains. However, the rising fragmentation of production processes and the high degree of interdependencies between countries hampers the identification of the final destination of value added and target markets. Depending on industry mix and size of a country the share of value added that is exported to final demand abroad differs considerable (Koopman et al. 2014, OECD 2013a). Therefore, we illustrate the global trade network of value added exports to final demand.

Figure 4 illustrates the global trade network of value added exports where each link represents export flows of value added generated in one country to final demand in a partner country taking into account all indirect flows[7]. In particular, each flow contains the amount of value added that is produced in source country i and absorbed in final demand in destination country j (Koopman et al. 2014). The thickness of the link indicates the intensity of the trade relation (the thicker the higher is the value of value added exports), while the arrow shows the direction of the respective relation. In order to ensure comparability with the global network of value added in trade, the position of each country in the global network of value added exports is once more determined by the outdegree prestige indicator.

The global trade network of value added exports depicted in Figure 4 reveals that Germany is again the most central point in the network and hence the highest connected one. However, Italy, Great Britain, China, the Unites States, France and Russia follow quite closely in the ranking. For instance, while Germany imports and exports a significant amount of value added with more than 92 % of all countries in the dataset, the United States and China hold trade relations with 90% of the countries. The global trade network of value added exports employs a density index of 0.62, implying that two thirds of the country's trade with all other countries in the network (whereas in the global network of value added in trade this share amounts to 72 %). The degree centrality index has a value of 0.36 and is identical to the degree centrality in gross export terms. The closeness centrality index amounts to 0.11 in contrast to 0.24 in terms of gross exports. Both measures indicate a lower network density than in value added in trade terms.

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[7] Following the methodological approach in the previous sections, we only retain the main network connections in order to improve the intelligibility of the network map. We thus drop all network relations smaller than smaller than 100 million USD (that limit corresponds to the 25th percentile of all value added export relations).
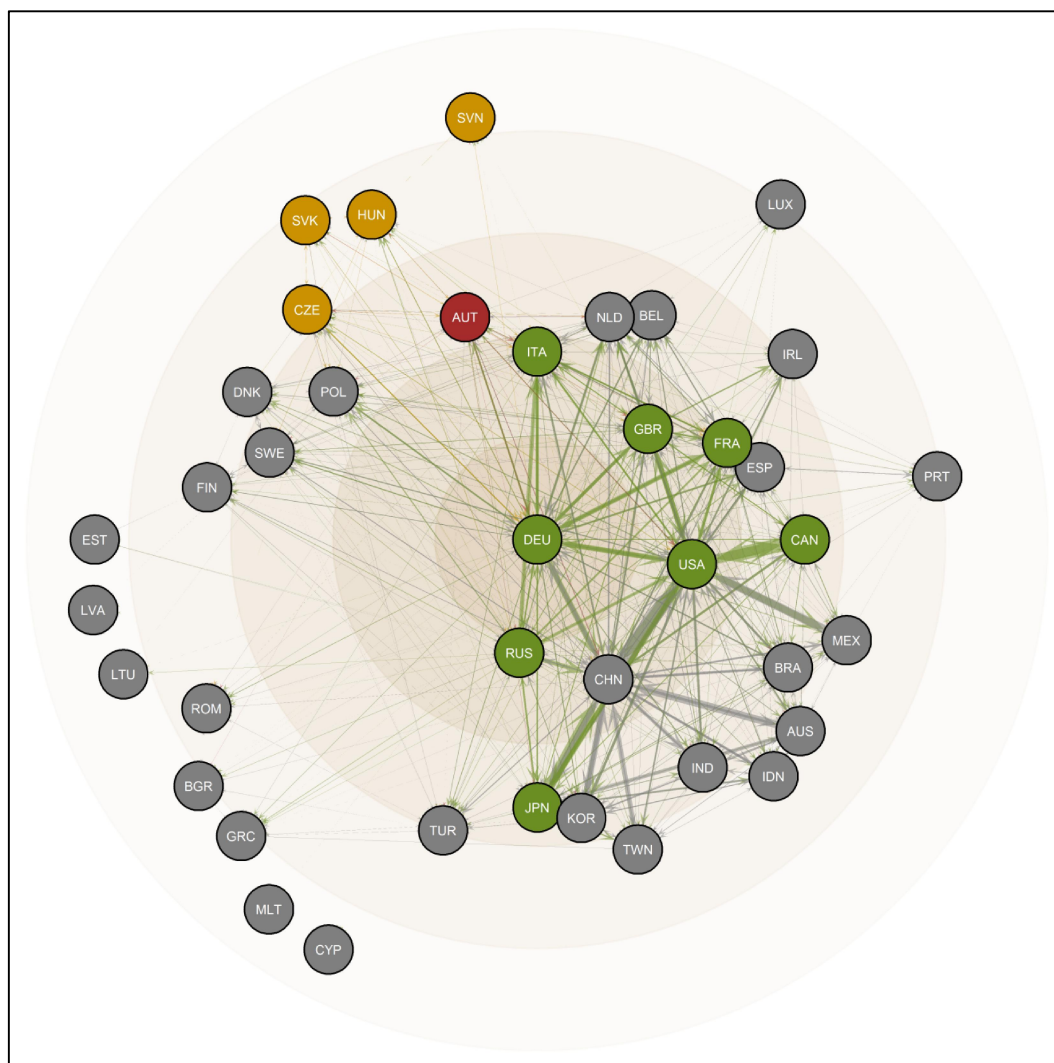
Figure 4 Global trade network based on the outdegree prestige indicator in 2011: value added exports– all industries (Graph: own illustration, data: WIOD 2013)

2.2 Impacts and drivers of GVCs: An Overview

While Section 2.1 analysis the different perspectives of the global trade network – gross trade vs. value added trade – this section provides an overview on impacts (e.g. competitiveness, vulnerability) and drivers of global value chains. Thereby we draw on indicators widely used in the GVC literature such as participation rate, length of GVC, distance to final demand, foreign value added in trade and indirectly exported value added (Stacey and Gerreffi 2011, OECD 2013b, Koopman et al. 2014). In order to account for the differences in economic structure, size and development these indicators are illustrated on the example of the main world regions: NAFTA (aggregate of USA, Canada and Mexico), EU-15 states, RoE (rest of European countries: all non EU-15 states), BRIC countries (Brazil, Russia, India, China), ASIA (aggregate of all Asian countries in WIOD, except China and India) as well as the rest of the world (RoW).

Generally, as elaborated in many trade statistics and empirical studies gross exports are growing in all world regions over time. As illustrated in Panel 1 (a), while gross exports of the EU-15, BRIC and RoW show a sharp rise between 2000 and 2008, NAFTA and ASIA experience growth on a constant and steady rate. However data also reveals that the content of foreign value added in gross exports is also rising. More precisely the import content of exports or in other words the share of value-added by the export of a given product that originates abroad increases significantly in all regions. Panel 1 (c) shows the foreign

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value added share in gross exports and reveals strong regional differences. For instance NAFTA's share of foreign value added in gross exports is rather constant around 15 %, while RoE has by far the highest share of foreign value added, which is also constantly rising. ASIA, EU-15 and BRIC countries show a rising share of foreign value added as well. In addition to the rising gross exports and their growing content of foreign value added, Panel 1 (b) provides further evidence for increasing fragmentation and rising global value chains. It depicts the length of global value chains which is measured by the index of the number of production stages following Fally (2011). Basically the index takes the value of 1 if there is a single production stage in the final industry and its value increases when inputs from other industries are used, with a weighted average of the length of the production involved in these sectors (Fally 2011). Since we use a global input output database we are able to further distinguish the international and domestic part of the value chain. As indicated the average length of value chains is increasing in all regions between 1995 and 2011. Furthermore findings reveal that the domestic length has remained nearly unchanged and that hence all the increase is met by the international part of the value chain. At regional level trend and level of the number of production stages are quite homogenous, only NAFTA experiences a much lower level. At industry level, however, we find a higher variation where the economic sectors *communication equipment*, *metals*, electrics, machinery and *transport equipment* show the highest fragmentation rates. Service oriented sectors such as *education* and *health* which have a high labor-intensity show a relatively low fragmentation rate with a value around 1.5. These differences at the sectoral level clearly impact the small deviations among countries (e.g. industry mix by region).
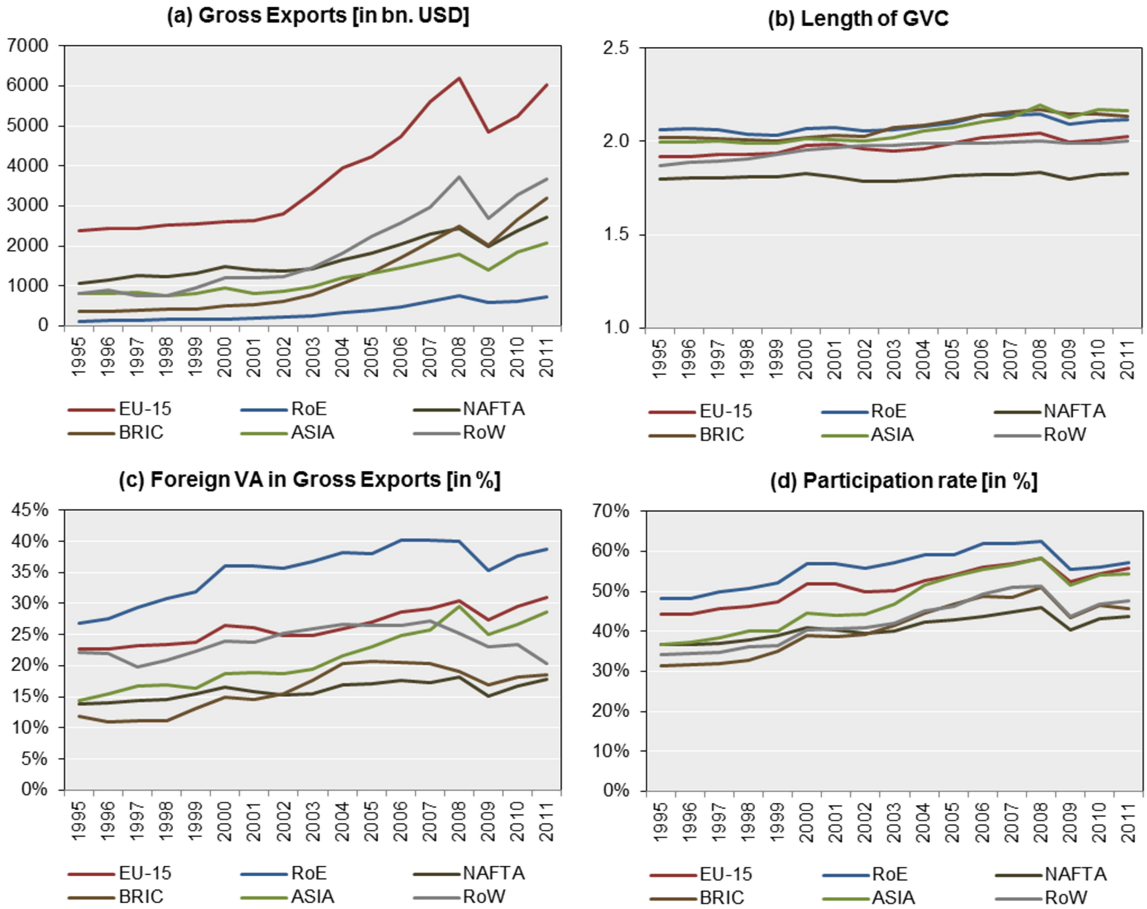
Panel 1: GVC impacts and drivers over time

One aspect that has not been considered so far by analyzing Panel 1 (a - d) concerns the economic crisis and the unprecedented slowdown in global trade in 2009, which is said to be the nadir of the recent financial crisis. In 2009 we observe a collapse in trade expressed by a fall across the globe in gross exports, a sharp decline in the foreign content of value added and hence a fall in the length of GVCs. It is evident that the internationalization is the reason for the increase in global trade and that in the crisis companies have switched back to domestic suppliers in the context of the lack of availability of trade finance and risks associated with international suppliers (OECD 2013). However in 2010, when the global economy recovered, the increasing trend of internationalization and fragmentation in value chains continued and in 2011 most countries realized their pre-crises level of trade.
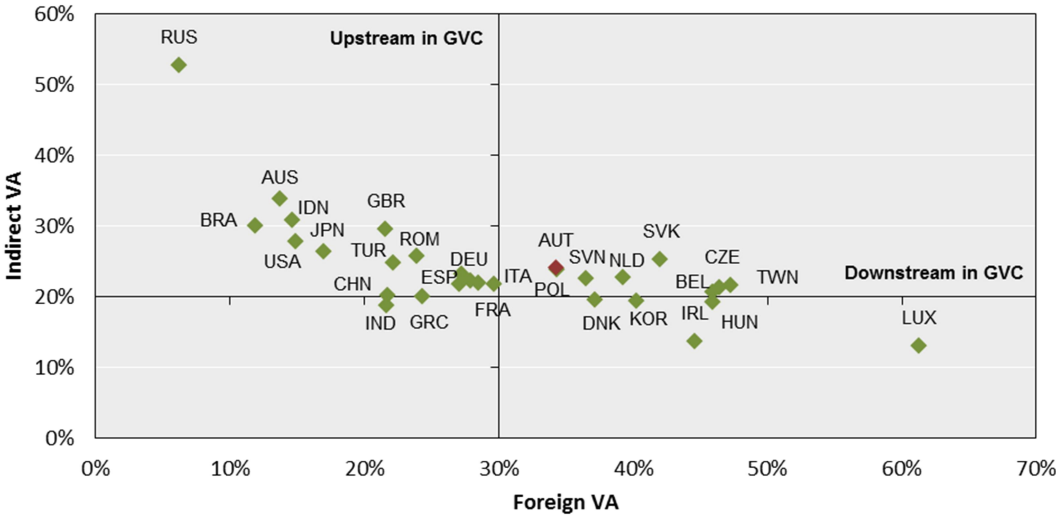

Figure 5: Foreign and indirect value added by country in 2011

In a next step, subsequent to the analysis of depth and length of GVCs we raise the question of where countries are located along the value chain. Depending on their specialization behavior, countries are either located upstream or downstream. Basically along a value chain, countries located rather upstream provide raw materials and resources at the beginning of the production process, while countries downstream do the assembly of processed products or specialize in customer services. Methodologically the participation index by Koopman et al. (2014) gives insights of the location along the value chain and measures the participation of economies in GVCs in both directions: as users of foreign inputs and as suppliers of intermediate goods and services used in other economies' exports. Panel 1 (d) shows that the participation index is rising continuously in all regions over time.

At country level our findings reveal a high degree of heterogeneity. It is empirically evident that the degree of participation depends on the size of the economy and that small economies (such as Austria, Luxemburg, Belgium) participate much stronger on the world market than larger economies. The reason is simple and often stated in the literature: large economies like USA and Germany are able to produce a vast share of their production inputs domestically and most large economies hardly face factor, knowledge or resource constraints. Luxemburg, Belgium and Slovakia show the highest rates, while Canada, USA and China show the lowest values. China and India are of special interest, since as mainly manufacturing countries, they have a high share of foreign value added in their exports but their value added in other countries exports' is comparably low. These differences in location along the value chain are depicted in Figure 5 which shows the decomposition of the participation rate in its value added contents: foreign value-added and domestic value-added used in third countries' exports (so called indirect value added) – both as a share of each country's gross exports. Countries that lie upstream in the global value chain participate by producing inputs for others, either by providing raw materials (e.g.

Russia and Australia), or by providing manufactured intermediates (e.g. Japan). For such a country, its indirect value added exports - domestic value-added used in third countries' exports - will be higher than its content of foreign value added. Contrary, if a country lies downstream in the global value chain, it will use a large portion of other countries intermediates to produce final goods for exports, and its share of foreign value added will be much higher than its indirectly exported value added (Koopman et al. 2014). Examples of countries more downstream the value chain are Taiwan, Luxemburg and Hungary.

3 A case study: Austria's role in global value chains

Our previous findings reveal striking differences in countries position in the global trade network and degree of participation depending on the perspective of trade: value added versus gross trade. The value added in trade perspective, which accounts for intermediate trade and the net value embodied in trade, shows that small open economies are well integrated in the global trade network, depend highly on international trade and are major contributor of intermediate inputs. Furthermore, a countries competitiveness and vulnerability to trade corresponds to the foreign content of value added in its' gross exports and its location along the value chain, either upstream or downstream. In order to enhance the importance of GVC and the "real" value added embodied in trade for small open economies (SOE) we apply a case study analysis. On the example of Austria, an industrialized small open economy in central Europe with a special historic and geographic position, which has been influenced by historic developments such as the EU-enlargement, climate change agreements (e.g. EU-20-20-20 targets) and the recent financial crisis we address these issues. In particular we raise the following questions: (i) facing rising GVCs, how is Austria integrating in the international trade network and what are the implications on competitiveness?; (ii) how did the rising internationalization change the trade pattern of Austria and what role do neighboring countries and historic important trade partners still play?; (iii) how did the EU-enlargement shape and influence Austria's trade relations? and (iv) is the rising importance of emerging countries (e.g. China, Brazil) beneficial for Austria and its' international competitiveness?

3.1 Austria's integration in the international trade network

3.1.1 Austria's Value added in trade: How much imports are used to produce exports?

In line with the global trend, Austria's gross exports are rising over time. In the period under consideration, 1995 to 2011, gross exports grew annually by about 7 %. The highest growth rates were observed between 2000 and 2008 (with an annual rate of 12 %). The growth of gross exports hit rock-bottom in 2009 due to the global financial crisis. In 2011, the Austrian economy has recovered from the setback and gross exports nearly reach the level of 2008. However, although gross exports experience a sharp rise over time, the share of domestic value added is falling. With other words, the share of foreign value added in gross exports increased from 24 % in 1995 to 34 % in 2011 implying that currently one third of the value added in gross exports is imported from abroad and that the dependency on foreign countries is rising. Further results show that in absolute terms foreign value added in gross exports annually grew by 7.8 %, whereas the domestic value added only experienced an increase of annually 4.4 %. However, this rising importance of the import content in Austria's exports does not hamper Austria's competiveness it may be beneficial. Austria, as a small open economy, faces resource and endowment constraints and hence GVCs and the associated imported inputs enable obtaining economies of scale within specific segments or tasks in a cost-effective and competitive way (which would not be possible otherwise by solely using domestically produced inputs).

In the context of rising foreign value added in exports the question of country of origin arises. More precisely, which countries and regions are the main provider of inputs in production of Austria's exports and hence contribute a large share to the content of foreign value added? As illustrated in Figure 7, the majority of the imported inputs are provided by the EU-15, in particular Germany (9 %) and Italy (2 %) as well as the large economies China (2 %) and USA (2 %). Furthermore, results show that while the share of the EU-15 is relatively constant over time (around 15 %), the influences of Rest of Europe (RoE), mainly south-east European countries, and BRIC states are rising continuously. Thus, for Austria to produce its

exports inputs from south-east Europe, in particular Hungary, Poland and Slovenia, as well as BRIC states gain in importance. Sections 3.3 and 3.4 analyse and describe Austria's trade relation with these regions in greater detail.
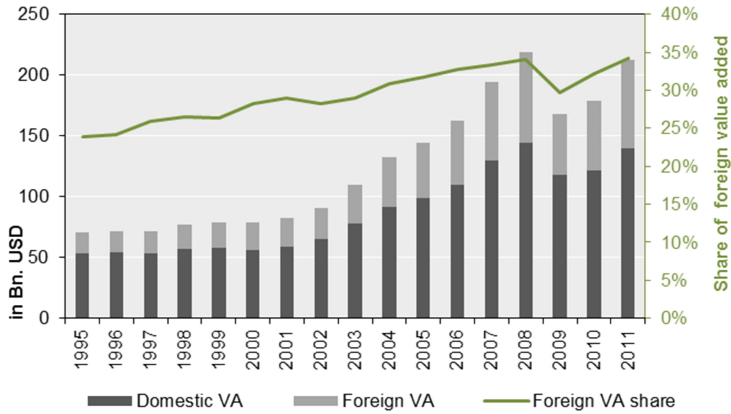

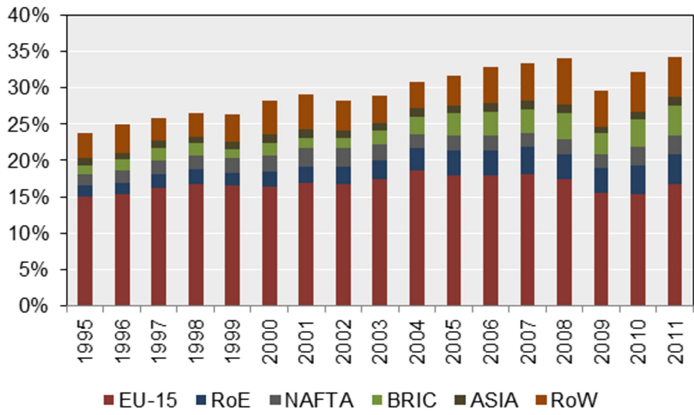*Figure 6: Austria's gross exports and its' value added content*

Figure 7: Foreign value added in Austria's' gross exports by region of origin

Subsequent to analyzing the countries which supply crucial inputs for Austria's production of exports we focus on industry level. More precisely, we report which sectors depend mainly in their production process on imported inputs and which are rather independent from abroad. Regarding implications on competitiveness and economic development a sectoral assessment of exports and their value added content is crucial. In a globalized economy competitiveness depends on various factors: (i) imports and exports in the sense that offshoring and outsourcing of activities has the potential to reinforce competitiveness, (ii) manufacturing of goods is the core activity in GVC's and countries with strong manufacturing industries are more likely to be highly competitive, (iii) however, in addition to manufacturing activities, marketing and customization services are of equal importance to enhance a countries competitiveness on the world market and (iv) production factors that are "sticky' and hence not likely to move across border, mainly knowledge based factors, are of key importance to foster competiveness (OECD 2013a, Baldwin and Venables 2010, Bernard et al. 2007).
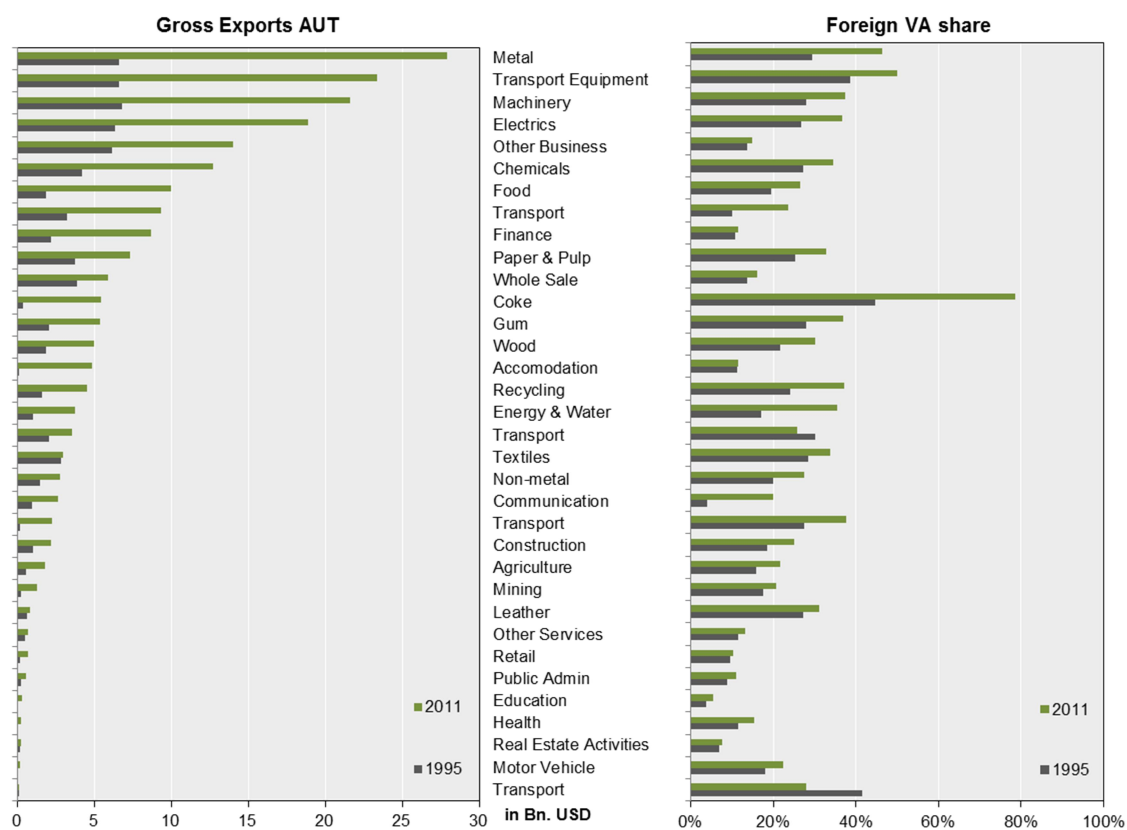
Figure 8: Austria's gross exports by sector (left) and the respective foreign value added share for 1995 and 2011 (right)

The economic sectors *metal*, *transport equipment*, *machinery*, *electrics* and *other business activities* are, in absolute terms, Austria's Top-5 export activities. Except of business activities, Austria's gross exports mainly comprise manufacturing industries. However, as indicated in Figure 8, on the example of Austria's manufacturing industries the difference between value added and gross exports becomes clearer. Most of these industries show a high share of foreign value added (on average 37 %) and hence the production of exports depends to the extent of one third on imported intermediate inputs. As identified in Figure 7, Austria mainly imports these inputs from Germany, Italy and the south-east European countries Hungary, Czech Republic and Poland. Regarding the production process of manufacturing exports, Austria shows a high degree of value added from services. More precisely, on average over 30 % of value added in exports of manufactured goods represents services. Thereby, a large extent regards business services and activities and a smaller amount relates to transport and telecommunication as well as distribution services. While the vast share of the imported value added in Austria's manufacturing exports relates to fabrication and assembling, the knowledge intensive activities (e.g. R&D, branding and marketing) are located domestically. These findings are in line with other studies (e.g. OECD 2013a, Stöllinger et al. 2012) and highlight the importance of so called "sticky" production factors for a countries' competiveness in GVCs. Figure 8 also shows that Austria's domestic value added is relatively high in services sectors such as *health*, *education*, *retail* and *public administration*. However, these economic sectors are generally demanded and consumed locally and hence their overall export share is relatively low.

However, the phenomenon of a rising foreign content in countries' gross exports is a global one. Therefore, also Austria provides inputs in the production of other countries exports. In other words, Austria's firms also indirectly engage in trade by selling intermediates to purchasers that produce goods for export. In this case, there is no direct trade relation in terms of exports from the intermediate goods supplier, as reported by traditional trade statistics, but we find exports of value added. Figure 9 shows

Austria's indirectly exported value added in the production of other countries exports, which is rising considerably over time (annually by a rate of 7 %). It is also obvious that between 2004 and 2008 indirect value added grew sharply. This suggests that the EU enlargement in 2004 not only boosted exports growth in most enlargement countries, they also depend more on imports from abroad (for details regarding the impacts of the EU-enlargement on Austria's trade relations see section 3.3). In 2011, 24 % of Austria's exports are re-exported and hence again part of other countries exports. Furthermore regarding trading partners, as illustrated in Figure 9, south-east Europe (part of RoE) has become an important market for Austria's indirect value added. At regional level, the EU-15 is not only the main provider of inputs in production of Austria's exports, they also indirectly export a vast share of Austria's value added. Again, the main trading partners among the EU-15 are Germany, Italy and France.
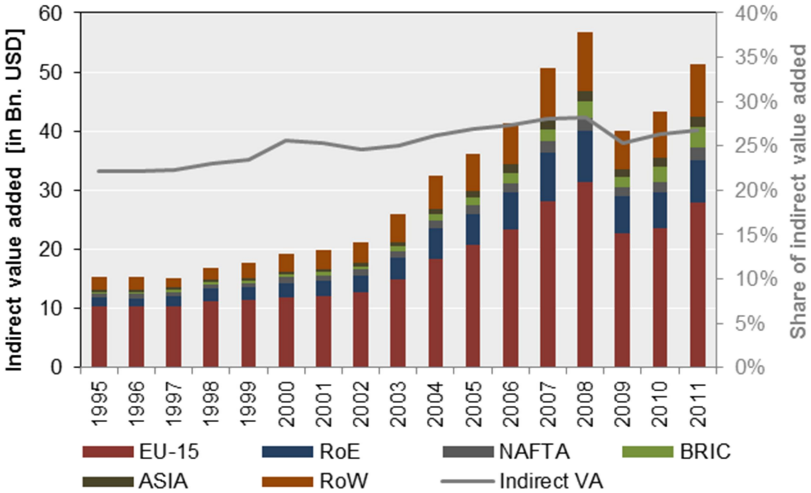

Figure 9: Austria's indirectly exported value added by region

Considering both channels of value added in trade, the direct link regarding domestic value added in gross exports as well as value added exports that are indirectly embodied in other countries exports, allows an assessment of a Austria's degree of participation on the global market. Furthermore Austria's position in GVCs whether it is more specialized in upstream activities (e.g. in the production of components and inputs) or in downstream activities like the final assembly of products affects Austria's competiveness and trade policy design. We find that the use of foreign intermediates in Austria's gross exports is more important than the use of Austrian intermediates in other countries exports and hence Austria lies rather downstream in the global value chain (see also Figure 5). From a police perspective, countries rather downstream in GVCs normally face tariffs on their imported inputs and again on the full value of their exports (including those same imported inputs). It is empirically evident that tariffs may still reach quite a high level by the time the finished good reaches final demand which then dampens demand and affects production and investment at all stages of the value chain. However, since Austria holds trade relations in gross as well as value added terms mainly with European countries, in particular EU-28, trade tariffs play a role but have no crucial impact. Still, small open economies which are not able to produce all their intermediate inputs and resources domestically have a much higher vulnerability to trade tariffs and barriers than large economies and thus a higher risk of losing competiveness as well as of migration of companies, know-how and qualified workers.

3.1.2 Where does Austria's value added end up?

Besides the import content of exports, another crucial question in the context of global value chains arises: where does value added generated in Austria end up? More precisely, where is the final demand of Austria's goods and services located? According to WIOD (Timmer 2012) Austria's value added in 2011 sums up to about 400 Bn. USD[8] and with about 76 %, a vast share of it is consumed domestically (see Figure 33 in the Appendix). Germany (4 %), Italy (2 %), France (2 %), USA (2 %) and China (2 %) are at country level important markets regarding final consumption of Austria's goods and services. These findings underline that Austria is well integrated in the European trade network (see also Section 2.1) and that also in terms of final demand and target markets of Austria's value added, Europe is of key importance (over 50% of Austria's value added exports are located within Europe).

By taking a closer look on Europe we find that the demand of goods and services from Austria is rising in central and east Europe over time. Figure 10 illustrates changes in the allocation of Austria's value added by country in Europe and indicates that while the final demand thereof is falling in Great Britain, Denmark, Slovenia and Greece it is rising sharply in Sweden, Czech Republic and several states in south-eastern Europe. Results thus suggest a shift from central to east Europe in the importance of target markets of Austria's value added within Europe. Moreover, in the period under consideration data shows a considerable increase in Austria's value added exports: in 1995 16 % of Austria's value added entered final consumption abroad, while in 2011 the share was about 23 %. Moreover along with gross exports, also value added exports experience a substantial rise in 2003. As aforementioned, in 2009 and 2010 the global economic crises hit rock bottom and exports were falling considerably.

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[8] This amount is in line with national trade statistics and Eurostat data.
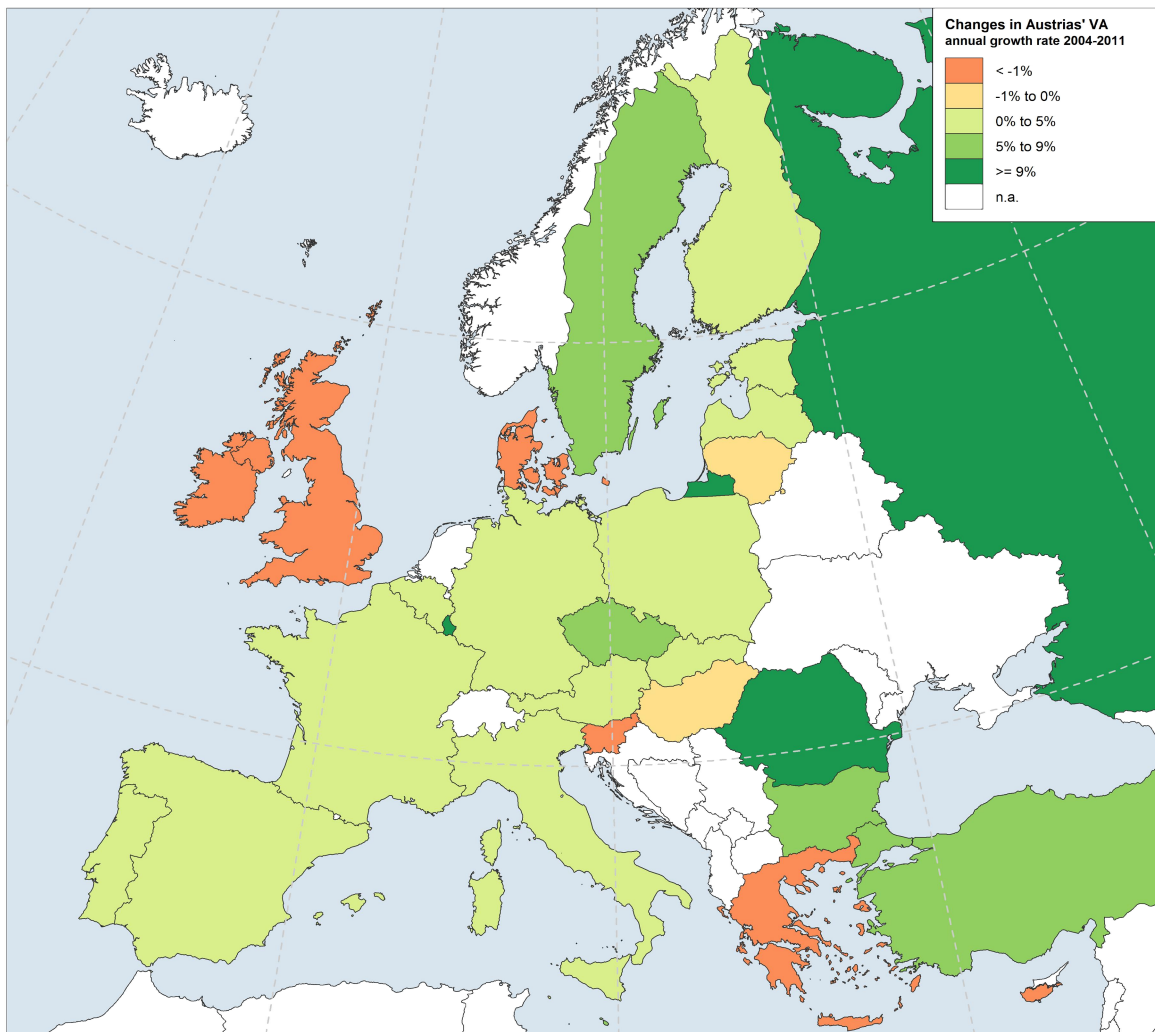
Figure 10: Changes in final consumption of Austria's value added by country (annual growth rate between 1995 and 2011)

Value added in final demand is a measure that shows how industries are connected to consumers at home and abroad, even if there is no apparent direct trade relationship. For instance, at sectoral level, for Austria we find that value added is the highest in *other business related services*, *real estate activities*, *whole sale* and *construction*. With over 60 %, a vast majority of the generated value added is consumed at home. Regarding consumption abroad, *leather*, *transport equipment*, *machinery* and *electrics* are the leading industries and show, as depicted in Figure 11, an export ration of over 80 %. At industry level results further report a sharp increase in value added exports to final demand of *metal*, *machinery*, *wood* and *construction*. More precisely, between 1995 and 2011, exports of some of these industries tripled (e.g. machinery, wood) or even quadrupled (e.g. construction).
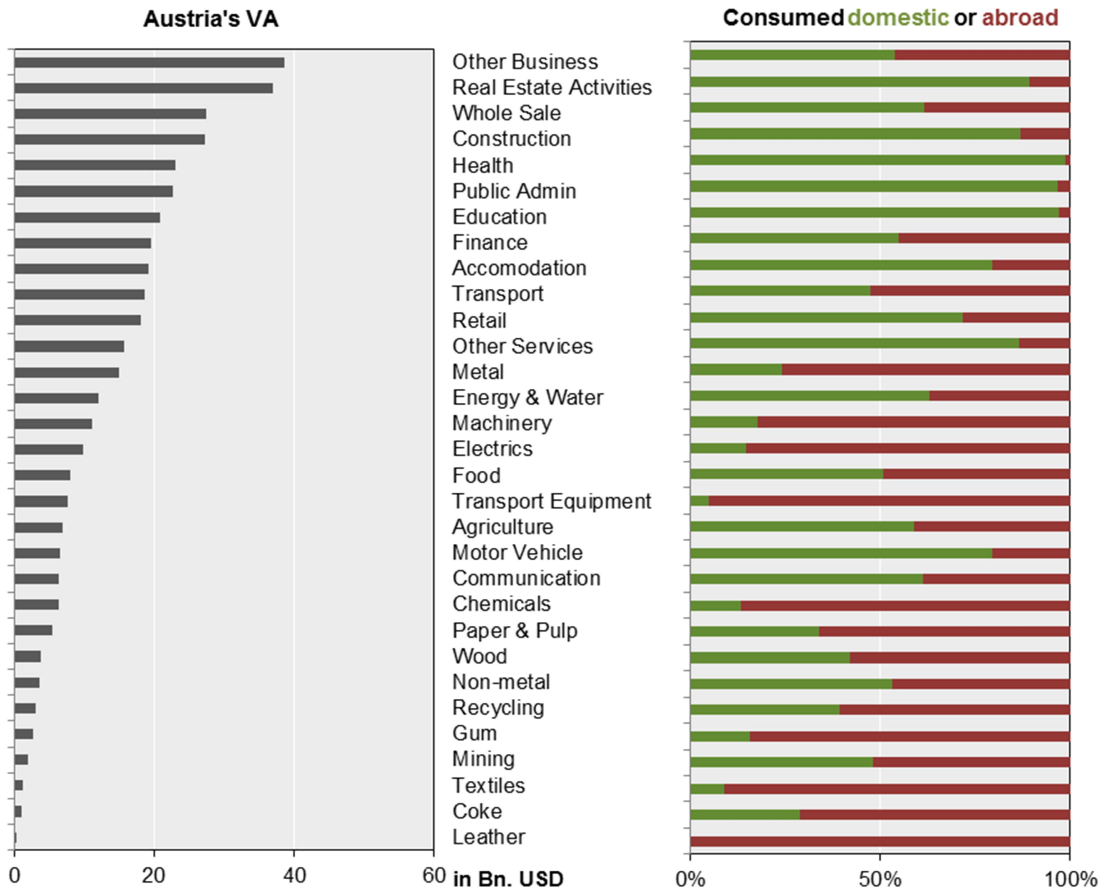
Figure 11: Austria's value added by sector in 2011 (left) and its respective share of consumption, domestically and abroad (right)

3.1.3 Austria's final demand: domestic and foreign value added

Austria's final demand comprises numerous goods and services from abroad and hence imports foreign value added. Currently nearly 20% of the value added consumed in Austria originates abroad. At a regional scale, European and BRIC countries provide the majority of imports in Austria's final demand. Within Europe, as illustrated in Figure 12, we observe a shift in import markets at country level: the value added imports in final demand from south-eastern Europe are rising continuously, while the importance of the EU-15 is falling. But still, at country level Germany, Italy, France and Great Britain are the main trading partners.
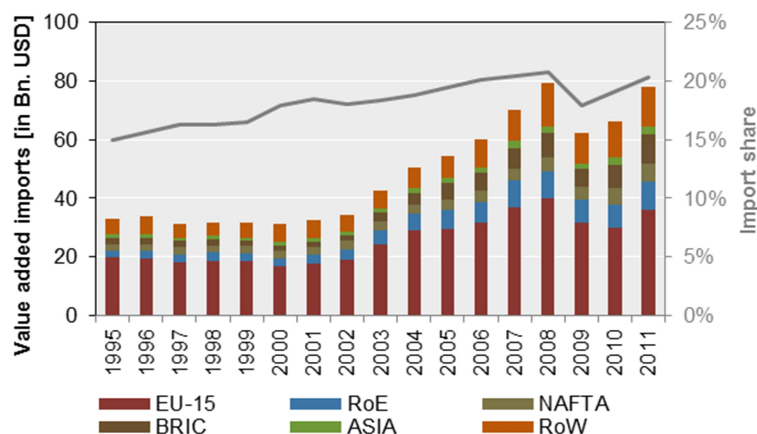

Figure 12: VA imports in Austria's final demand by region of origin (2011)

Generally Austria's dependency on other countries exports is rising continuously over time. While in 1995 not even a tenth of the value added consumed in Austria has been imported, this share more than doubled within the last couple of years. Even in the economic downturn (2009-2010) the import content has been above 15 %. These growing interdependencies pose a challenge to Austria's policy makers to directly influence economic growth, job creation and GDP. The reasons are twofold: On the one hand, it is likely that policies which aim to promote domestic activities have effects beyond national borders in terms of spillover to other countries. On the other hand, policies that target domestic demand may be less effective because of the large foreign value added content in final demand (OECD 2013a, Gereffi et al. 2005). In order to account for these growing regional independencies in a countries' final demand and to meet the challenges in policy designs and evaluation a detailed analysis of households' demand pattern is of key importance.

At aggregate level a countries' household demand is mainly driven by the respective industry composition, demand pattern and relative product prices. Therefore we focus our analysis at sectoral level and assess which goods and services in Austria's final demand are heavily dependent on foreign countries and which are mainly connected to domestic firms and suppliers? In line with other industrialized small open economies, foreign value added in Austria's final demand is the largest among basic goods and materials (e.g. coke, wood, metal and mining). As illustrated in Figure 13, their content of foreign value added is about 80 %. Since Austria is a small open economy with limited resources production of basic goods and materials (as reported in Section 3.1.1) depends heavily on imported primary goods such as minerals and chemicals. According to findings of the OECD (2013), the complement of foreign products in domestic final demand is by far more elaborated in manufacturing goods than in services, which are less likely to be sliced up and affected by outsourcing. This is in line with our results and explains why Austria's final demand of communication services, finance and health hardly depends on other countries (the share of foreign value added is below 10 %). Moreover, education and health relay vastly on personal, face-to-face contact between supplier and consumer.
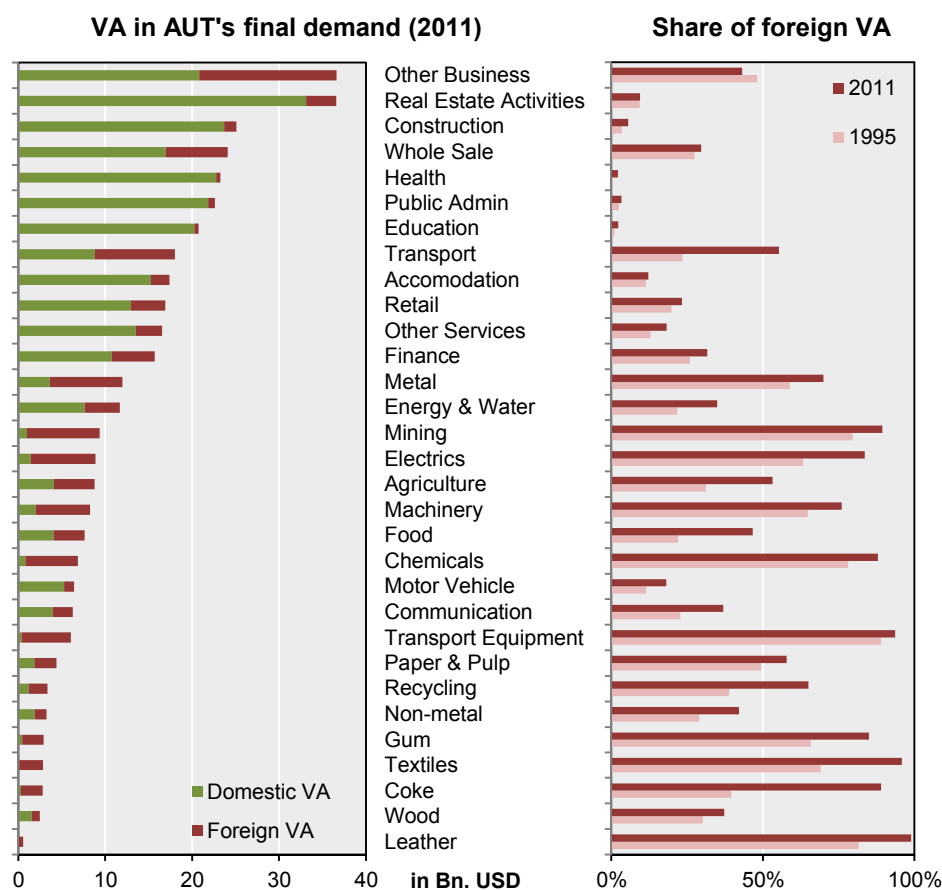
VA in AUT's final demand (2011)

Share of foreign VA

| Other Business |
| Real Estate Activities |
| Construction |
| Whole Sale |
| Health |
| Public Admin |
| Education |
| Transport |
| Accomodation |
| Retail |
| Other Services |
| Finance |
| Metal |
| Energy & Water |
| Mining |
| Electrics |
| Agriculture |
| Machinery |
| Food |
| Chemicals |
| Motor Vehicle |
| Communication |
| Transport Equipment |
| Paper & Pulp |
| Recycling |
| Non-metal |
| Gum |
| Textiles |
| Coke |
| Wood |
| Leather |

Domestic VA
Foreign VA

■ 2011
■ 1995

in Bn. USD

Figure 13: Final demand in Austria's value added by sector (left) and the respective share of foreign value added for 1995 and 2011 (right)

3.1.4   Austria's sectorial specialization in the context of global value chains

Regarding competiveness and the implications of GVCs we focus on the sectorial specializations of an economy. The perspective of value added exports offers new insights regarding the specialization patterns and behavior. In contrast to the traditional approach based on gross trade data the analysis of sectorial specialization in value added terms gives a more realistic view of the underlying comparative advantages of an economy. Following Balassa (1965) and Legler et al. (2006) we calculate the measure of Revealed Comparative Advantage (RCA) respectively the Relative Export Advantage (RXA) on the basis of the previously determined value added exports. Within the economic literature RXA is a widely used indicator of concentration and gives the ratio of the percentage share of a sector in national exports over the percentage share of this sector in total global exports. For instance, when RXA equals 1 the percentage share of this sector is equal to the overall global share. When RXA is above 1 a country tends to be specialized in that sector whereas when RXA is below 1 the country tends to have no specialization in that sector. This specialization correlates to the comparative advantage formulated by David Ricardo (1817). Due to the non-symmetry (0 to 1 for comparative disadvantage and 1 to infinity for comparative advantage) the RXA has to be standardized in order to compare both directions. We follow the standardization approach of Laursen (1998). The standardized and symmetric RXA[9] takes values between -100 (complete comparative disadvantage) and +100 (complete comparative advantage).

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[9] The standardized and symmetric RXA is calculated as follows: RSXA = 100*(RXA-1)/(RXA+1).

Figure 14 presents the standardized RXA in value added terms on the left side in contrast to RXA in terms of gross exports on the right side for Austria for the year 2011. The upper panel a (b) reports the RXA values in terms of value added exports (gross exports) on the x-axis compared to the share in exported value added (share in gross exports) on the y-axis. The lower panels (c, d) report changes in the RXA values and in the export shares respectively for value added and gross data between 1995 and 2011.

Panel a and b indicate that the export shares of economic sectors differ significantly between value added and gross trade flows. For instance, the economic sector m*etal* has with a gross-export share of around 13 % by far the highest value, while the value added export share is with around 8 % only half as high. This result underlines the findings in Section 3.1.1 that the production of *metal* depends heavily on intermediate inputs and has hence a high share of foreign value added embodied in its exports. In contrast domestic service sectors like *renting and other business activities* (7 % from to 13 %) and *sales* (3 % from to 12 %) gain substantially in importance by focusing on the "real" value added that is exported. The same argument holds for *transport equipment* and *machinery*. Summarizing we find striking evidence that the ranking of the top 10 exporting sectors change substantially when indirect exports are taken into account.

Although the export shares differ substantially, the measure of comparative advantages doesn't change to that extent. In terms of exported value added, the top five sectors in which Austria has a comparative advantage are *construction* (RXA: 55), *wood and wooden products* (49), *hotels and restaurants* (46), *machinery* (26) and *paper and pulp* (21). In terms of gross exports these sectors are also found in the top-10 and rank as follows: *construction* ranks 3rd (RXA: 57), *wood and wooden products* 2nd (61), *hotels and restaurants* 4th (51), *machinery* 8th (22) and *paper and pulp* 6th (34). The top five sectors measured in gross exports are *energy & water* (63), *wood & cork* (61), *construction* (57), *hotels & restaurants* (51) and *post & telecommunications* (34).

Panel c and d in Figure 14 show the changes in export shares and RXA between 1995 and 2011. Sectors located in the 1st quadrant (upper right) improved their international competitiveness as well as the export share in the period under consideration. Measured in exported value added the sectors *food & tabaco*, *transport equipment*, *machinery* and *metal* improved their international competitiveness considerably. Sectors located in the 3rd quadrant (lower left) have fallen back in the context of specialization and exports. In terms of value added exports these developments concern the economic sectors *textiles and leather*, *post & telecommunication*, *rubber & plastics* and t*ransport*. Sectors located in the 2nd quadrant (upper left) improved their value added export share but lost in specialization, particularly *mining & quarrying*. Sectors located in the 4th quadrant (lower right) lost in value added export share but gained in specialization.
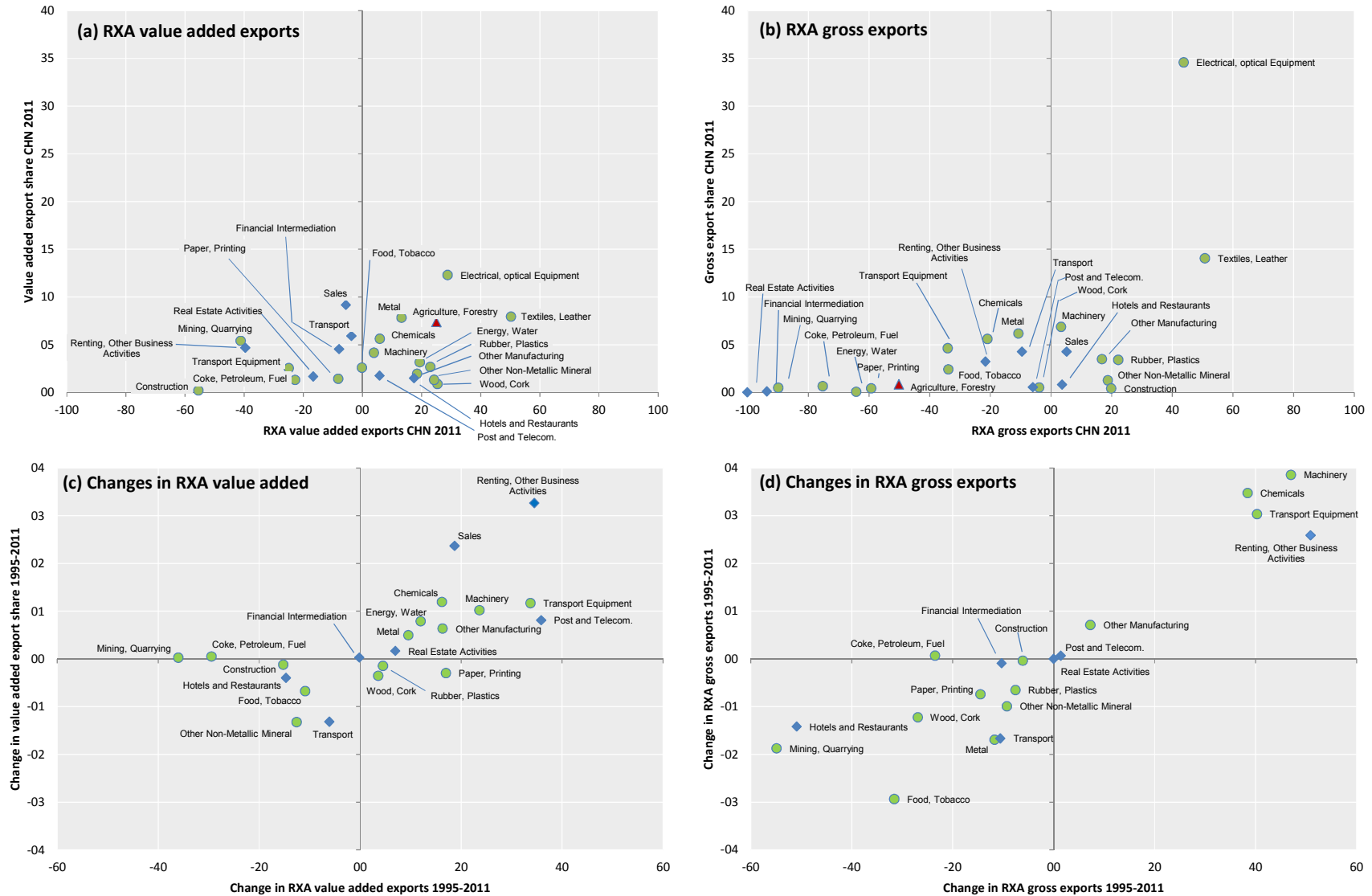
Figure 14: Austria's revealed export advantage (RXA) for 2011 in value added terms (Panel a, c) an gross export terms (Panel b, d)

In the case of Austria the difference between the two measures – gross vs. net of value added - regarding specialization in exports does not differ substantially. As Figure 15 shows, just a few sectors change their position from a comparative disadvantage in terms of gross exports to a comparative advantage in terms of value added exports (4th sector in Figure 15). The sectors which are located along or close to the diagonal gain the same or nearly the same value regarding direction and magnitude in both RXA measures. Sectors, located a bit aside of the diagonal show modest difference in both RXA measures. The highest and most evident difference in direction is shown by the sector *real estate activities* (comprising real estate activities with own property, letting of own property, real estate activities on a fee or contract basis) where RXA in value added terms reports a slight comparative advantage in 2011 while RXA in terms of gross exports reports a clear comparative disadvantage. This difference is due to fact that the output of the sector *real estate activities* is mainly demanded domestically and not a direct traded good (with a gross export share of 0.1 % it hardly appears in gross trade statistics). However, *real estate activities* are a valuable input factor for domestic production and hence the value added of the sector *real estate activities* is indirectly exported by other domestic sectors. The slight comparative advantage means that Austria exports relatively more value added from *real estate activities* as in world total. We also find in terms of the magnitude of the RXA measure strong evidence that the perspective of gross exports distorts the real picture of trade and competiveness. For instance the sector *energy & water* gains a considerable higher RXA in gross exports (63) than in value added exports (19) indicating that a vast share of imported intermediates (foremost prime energy and resources) is used in the production process. The real value added embodied in trade and hence the comparative advantage is much lower.
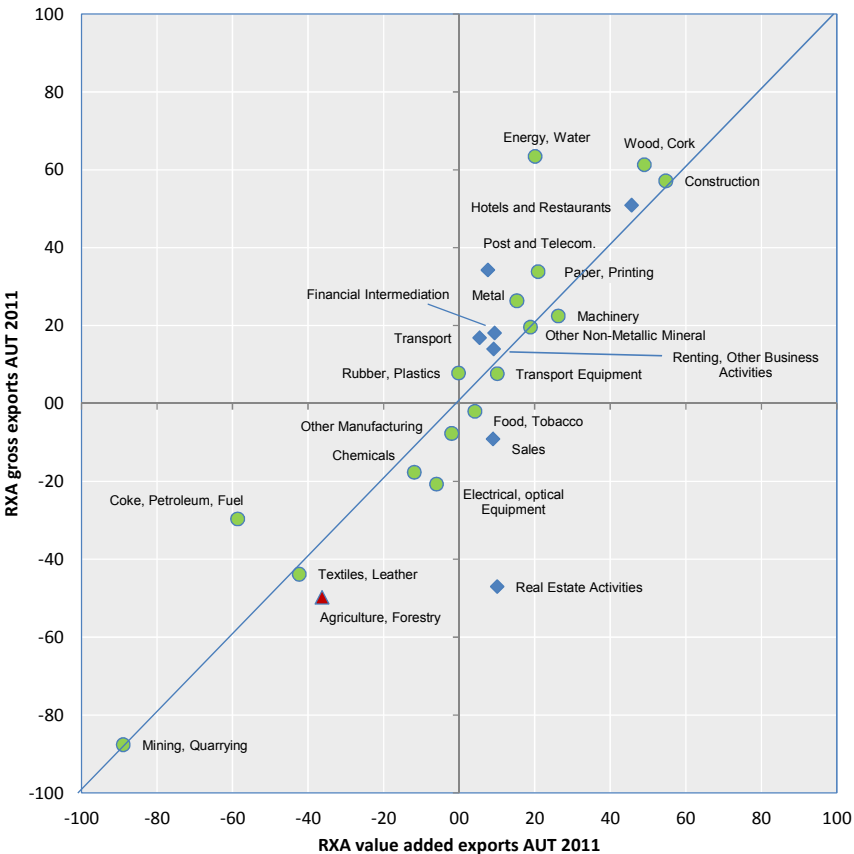

Figure 15: RXA in value added terms versus RXA in gross export terms for Austria

The strength of RXA in value added terms is to capture indirect exports and to give a more accurate picture of a countries specialization pattern. Particularly for countries of assembly and manufacturing like China where gross exports differ widely from exported value added this perspective is of key importance. However, in terms of Austria we find that the sectors *metal, machinery, electrical & optical equipment* as well as *transport equipment* are also in value added terms the main exporting sectors by having a high export share and holding a comparative advantage (with the exception of *electrical and optical equipment* where the specialization is nearly zero). Due to their domestic, sectoral linkages in the production process these sectors are also so-called gatekeepers by offering internationally demanded products and indirectly exporting domestic value added of other economic sectors. Thus these major export sectors of Austria are the first stage in international competitiveness although they depend on other domestic sectors, like *renting & other business activities* and *sales*. In particular the service content such as b*usiness activities* (e.g. computer & related activities, research & development as well as other business activities) in manufacturing exports is of main importance for international competitiveness. The reason is that these services embodied in manufacturing goods involve a high amount of domestic value added and also employ so-called 'sticky' production factors which are not likely to move across border (e.g. know how). Therefore promoting such domestic service sectors strengthens the international competitiveness of Austria's exports on a whole, also in manufacturing industries. In this analysis however we have to abstract from a deeper level of resolution and an isolated consideration of b*usiness related activities* due to the high level of sectoral aggregation in the WIOD database (e.g. the sector aggregate of *renting & other business activities*).

3.2 Austria's relationship with Germany: Historic trends and challenges

As illustrated in Figure 2, Germany is the center of the European trade network and as a so called "World Champion in Exports" Germany provides a vast share of intermediate inputs to foreign production as well as final goods to foreign demand. For Austria and its position in global value chains, is Germany of special importance. On the one hand Germany is a key provider of intermediate inputs in Austria's production but on the other hand Austria indirectly exports a vast share of its value added via Germany. Germany is an important market for Austria's final goods as well and at country level it imports the highest amount of Austria's value added.

Historically, Austria shows strong links with Germany, its largest neighbor. Parameters such as geographical proximity, a common language, cultural similarities and turbulent historical ties favor this strong connection (Schneider and Fenz 2006). Germany is the largest country in the Euro-area and compared to other large European economies the share of domestic value added in gross exports is somewhat smaller. In 2011, the domestic value added content was about 73 %, which is below the OECD average of 77 %. Figure 16 underlines that also Germany follows the global trend of increasing vertical specialization and that the content of foreign value added in its exports is rising considerably over time (from 17 % in 1995 to 27 % in 2011). However, Germany is within Europe the main provider of manufacturing goods and thus a supplier of important intermediate inputs. This is reflected by the indirectly exported value added of Germany (see Figure 16). In particular, around 23 % of Germanys gross exports are again part of other countries exports. Besides, this share of indirect value added in Germany is rather constant over time suggesting that a significant share of exports are processed elsewhere (e.g. eastern Europe, China) and then sent as finished goods to developed, industrialized countries such as the United States, France and the Netherlands. Among OECD countries this portion of value added that is embodied in other countries exports is considerably lower in other western EU countries like France and Italy as well as Canada, but slightly higher in the United States and Japan.
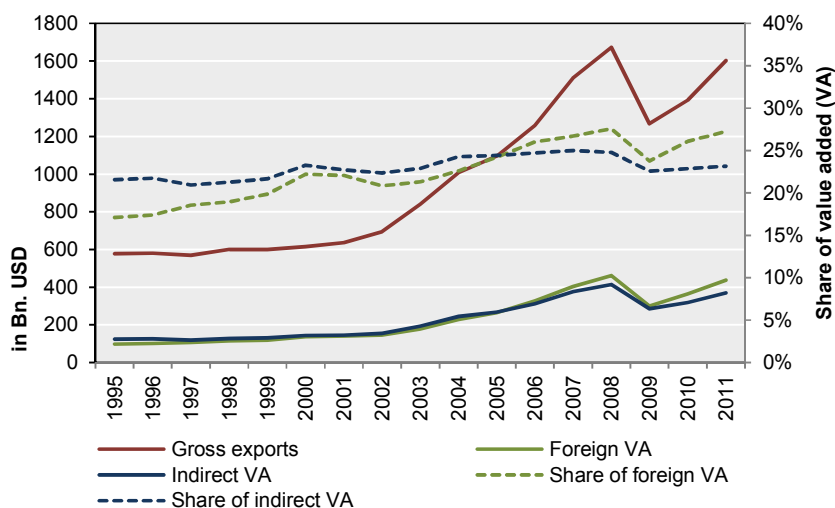
Figure 16: Germany's value added in trade

In general the German economy is characterized by a high share of manufacturing industry and currently manufacturing accounts for about 22 percent of its' GDP. This share is much higher than in other industrialized economies such as UK, Canada, US, but also considerably higher than in the newly industrializing BRIC countries (except China). Historically, Germany has established itself as European manufacturing center and according to Godart and Görg (2011) its export has become a pillar of its economic post-war success. Thus, at no surprise, the sectoral decomposition of exports in Figure 17 shows that Germany is relatively specialized in manufacturing industries such as *transport equipment*, *machinery*, *electric equipment* and *metal*. However, by considering global value chains we also find that the production process of these sectors is highly dependent on foreign intermediate and primary inputs. More precisely the leading manufacturing industries in exports embody a significant share of over 34 % of foreign value added. Figure 17 also shows a considerable heterogeneity in the importance of imported intermediates across sectors. In addition to the leading manufacturing industries also *textiles*, *wood & wooden products* as well as *mining* show high levels of outsourcing, suggesting that global value chains are particularly important for those sectors, while *communication, finance & business activities* and *other service sectors* do not rely heavily on imported intermediates (see also Godart and Görg 2011; OECD 2013a; Koopmann et al. 2014).
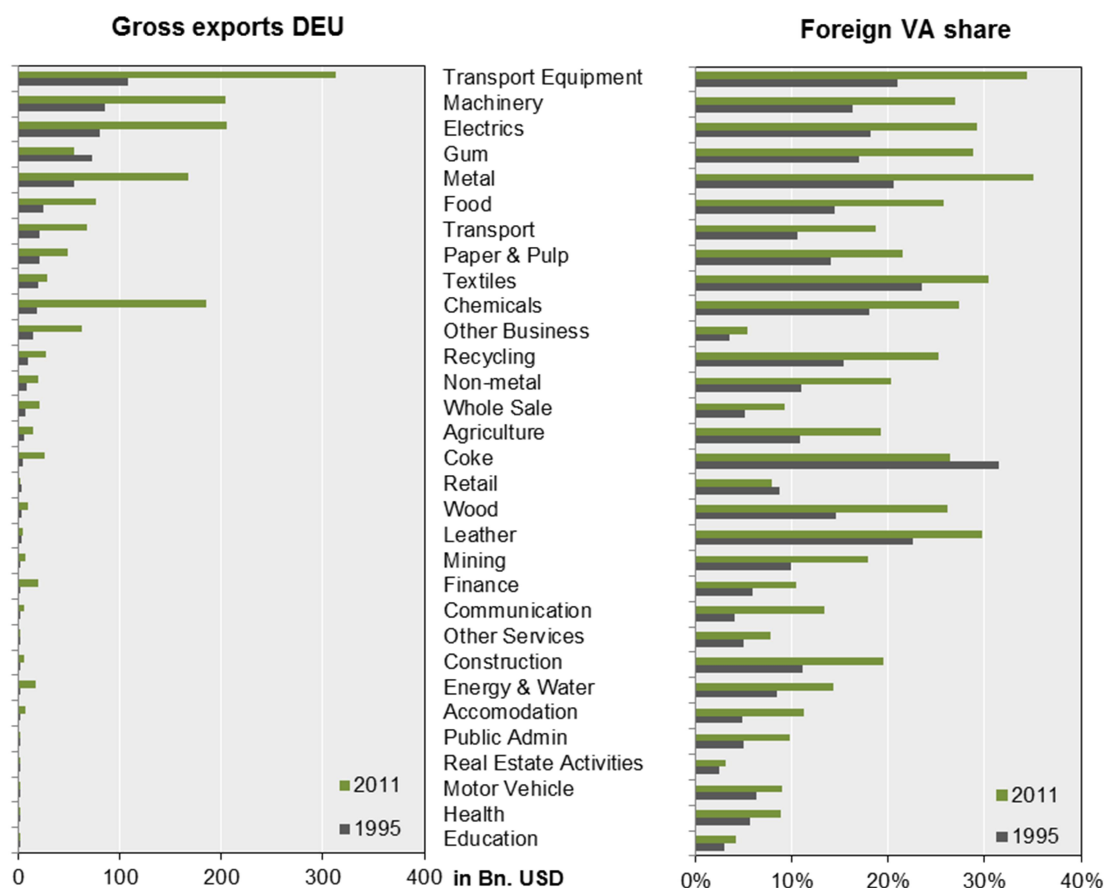
Figure 17: Sectoral decomposition of Germany's exports (left) and the respective foreign value added share (right)

Since foreign value added in Germany's exports is rising over time we are interested in the significance of Austria. More precisely, given the strong link between both countries, did the rising integration of Germany on the world market benefit Austria and moreover in terms of Austria's competitiveness what role does the EU enlargement play? First, we start by analyzing Austria's current value added content in Germany's exports. Overall, the share of Austrian value added is about 1 %, but is very heterogeneous among economic sectors (ranging from 0.2 % to 4.2 %). As illustrated in Figure 18, in absolute terms Austria's value added is mainly embodied in exports of *transport equipment*, *metal*, *machinery* and *electrics*. In particular, in 2011 Austria's value added content in the major export industries of Germany *transport equipment*, *machinery* and *metal*, was about 9 billion USD. Taking into account that Austria's indirectly exported value added in 2011 amounts to around 51 Bn. USD, Germany and its' export industries are of key importance for Austria.
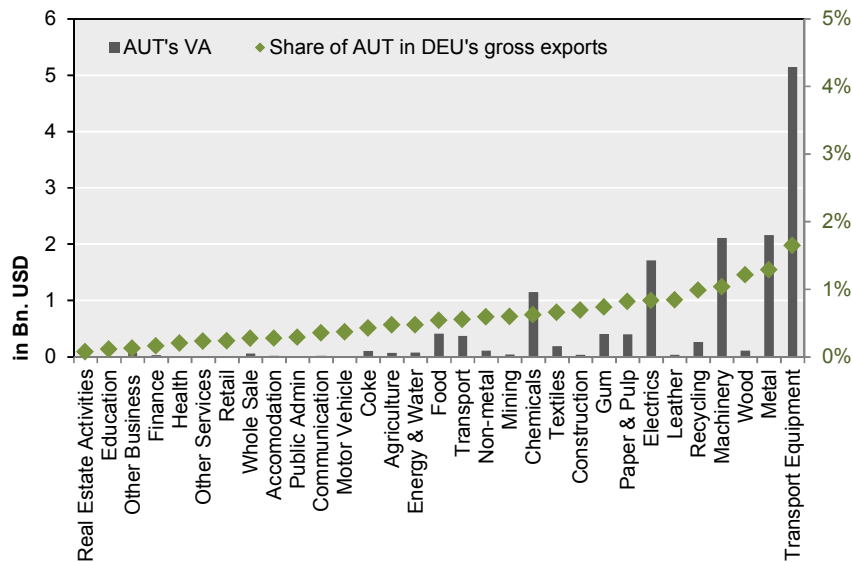
Figure 18: Sectoral decomposition of Austria's value added in Germany's gross exports

Furthermore, a time series assessment reveals that in absolute terms Austria's value added embodied in Germany's exports is increasing over time. Thereby, the economic sectors *transport equipment* and *metal* show by far the highest growth rates. There is further evidence that German companies successfully integrated Eastern Europe and the emerging markets into their supply chain and were thereby able to strengthen their competitiveness (Gräf et al. 2013). These developments, mainly the rising competiveness of Eastern Europe countries, also affect the trade relation between Austria and Germany. For deeper insights Figure 19 shows the value added content of Austria and the EU enlargement countries 2004[10] (EU-NMS-2004) in Germany's exports for the respective top-15 economic sectors and different points in time. Although in 1995 the size in terms of GDP of the EU-NMS-2004 was already larger than the one of Austria, their value added content in Germany's exports was quite similar. With rising economic development and EU-wide harmonization of tariffs, their content of value added embodied in Germany's exports grew considerably and doubled between 1995 and 2011 (from 1 % in 1995 to 2.4 % in 2011).

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[10] The accessions in 2004 concerned the following countries: Cyprus (CYP), Czech Republic (CZE), Estonia (EST), Hungary (HUN), Latvia (LAT), Lithuania (LTU), Malta (MLT), Poland (POL), Slovakia (SVK) and Slovenia (SVN).
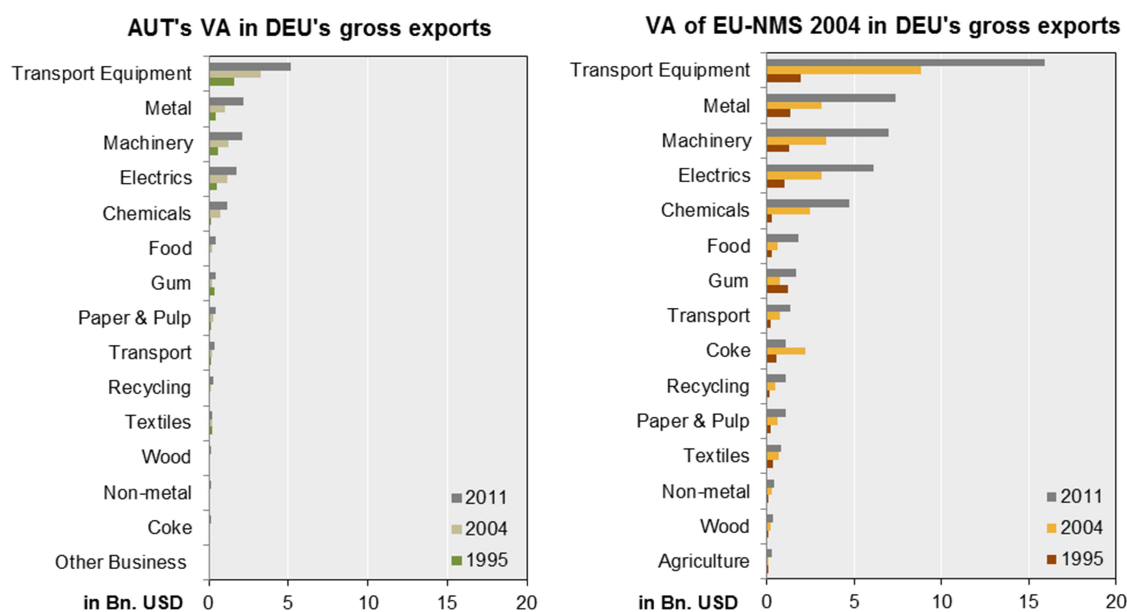
Figure 19: Value added content of Austria (left) and the EU-NMS-2004 (right) in Germany's exports for the Top-15 economic sectors and point in time

In order to emphasize the significance of the EU enlargement for the relationship between Germany and Austria we compare annual growth rates of the value added of Austria and the EU-NMS-2004 embodied in Germany's exports before and after the EU enlargement in 2004 (see Figure 19). For the period before, 1995-2003, we find that the value added content of both regions grew considerably, however the EU-NMS-2004 show slightly higher rates. For the period after, 2004-2011, results show that in absolute terms Germany's demand of Austria's value added to produce its' exports is rising, but in relative terms the respective share is falling in some sectors. The right panel in Figure 19 shows that the value added of EU-NMS-2004 in Germany's exports is rising in nearly all sectors (the annual growth rates in the period 2004-2011 are around 3 %, which is below the level of the period 1995-2003 with 5 %). Moreover the growth rate of the EU-NMS-2004 is well above the rate of Austria. These findings suggest that the EU enlargement favored the integration of eastern European countries in the supply chain of German products and export goods. At country level, we find evidence that Poland benefits significantly, which seems to be a source country of intermediate goods for German firms. According to Godart and Görg (2011) a relatively large share of German affiliates is located in Poland; mainly in low-tech manufacturing industries (see also Amador et al. 2013). Results report that in terms of foreign value added in Germany's exports, there is a vast demand in sectors with low-skilled employment and less knowledge intensive services. Thus, the outsourcing of certain steps in Germany's supply chain and production process to eastern European countries hardly affected Austria's role as important provider of goods and services. In contrast to the EU-NMS-2004 countries, Austria's intermediate exports to Germany are mainly characterized by high knowledge- and service-intensive manufacturing goods. Moreover these respective industries and economic sectors, which are of key importance for Austria's competiveness, were able to sustain its growth potential (in the period after the EU-enlargement they still experience an annual growth rate between 1.5 % and 3 %).
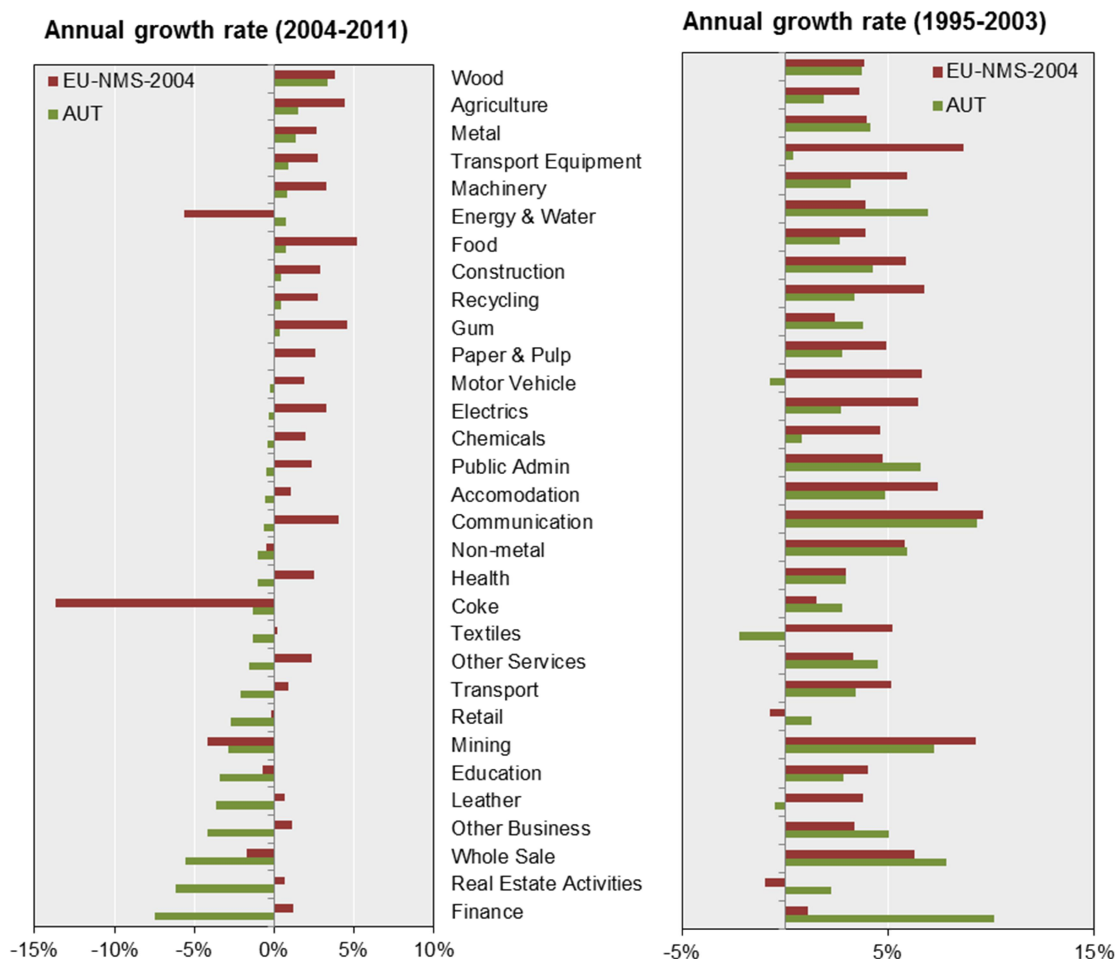
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Figure 20: Annual growth rate for the period 1995-2003 (left) and 2004 – 2011 (right) of foreign value added in Germany's exports by sector

3.3 The role of the EU-enlargement in Austria 's trade relations

Subsequent to section 3.3, where we found evidence that the EU enlargement did not hamper the trade relation between Austria and Germany, this section analysis the direct and indirect impacts of the EU enlargement on Austria. More precisely, we raise the question if in general the accession of the new member states in 2004 benefited or hampered Austria's competitiveness.

First we analyze the value added content of EU-NMS-2004 in Austria's exports. As already laid out in Section 3.1.1, Austria's gross exports embody a share of 34 % of foreign value added, with a vast share located in Europe. In order to produce its' exports, Austria demands a variety of intermediate inputs from eastern Europe and currently the share of the EU enlargement countries of 2004 amounts to 4 % (see Figure 21). Thereby, at country level, Austria's production mainly depends on Czech Republic, Poland, Hungary and Slovakia. By taking a closer look, data reveals, as illustrated in Figure 21 (right panel), that the value added of the EU-NMS-2004 in Austria's exports grew considerable in the period under consideration. From 2000 onwards to 2008, Austria's demand in intermediate and primary inputs from the EU-NMS-2004 grew significantly and in 2004 with accession to the EU we particularly observe a sharp push. In 2010, when the global economy starts to recover from the financial crises, the rise in value added of EU-NMS-2004 embodied in Austria's gross exports continued.
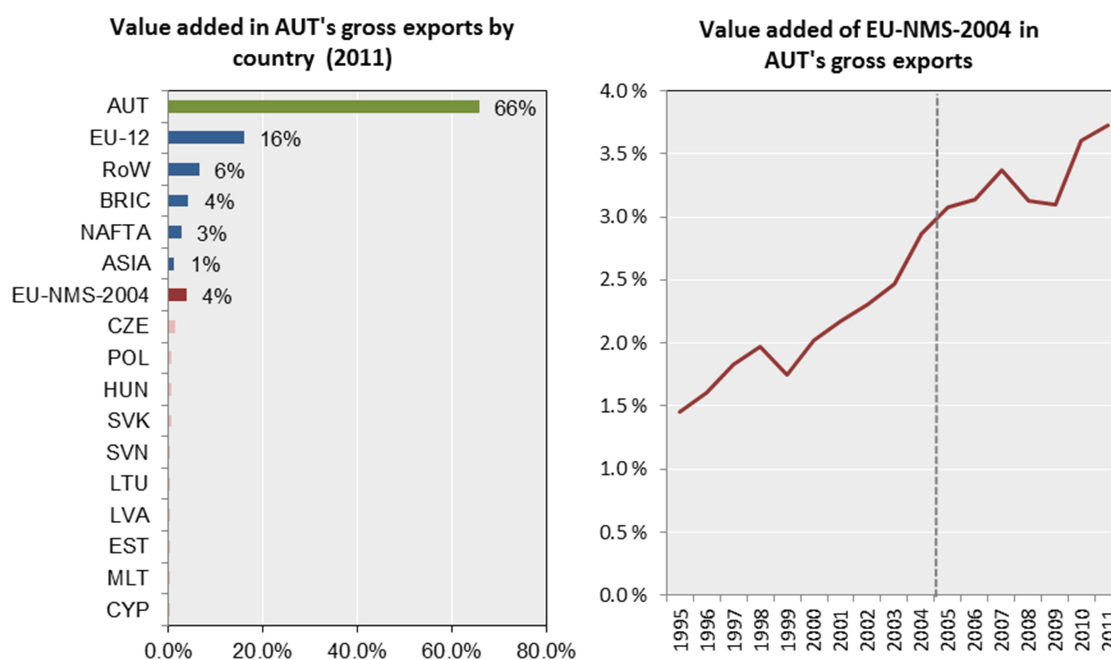
Figure 21: Value added content of Austria's exports by region (left) and the share of value added of EU-NMS-2004 for the period 1995-2011 (right)

In order to emphasize the relevance of the EU-NMS-2004 as provider of inputs in Austria's production we focus on sectoral interdependencies. As illustrated in Figure 22, the value added of the EU-NMS 2004 is the highest in exports of the economic sectors *coke*, *energy & water*, *wood* and *metal*. This result is at no surprise considering the economic conditions and the specialization of certain eastern European countries like Poland and Hungary on manufacturing industries. However, comparing the years 2004 and 2011 we find that the dependency of Austria's coke exports from the supply of the EU-NMS-2004 grew enormously (from around 4 % in 2004 to over 25 % in 2011). In general, Austria's coke industry has always demanded a vast share of inputs from abroad and at regional level Russia and other non-European countries along with Germany were the main source. With the accession of the east European countries to the EU in 2004 we observe a drastic shift in the demand structure of the coke industry in Austria away from Russia and other non-European regions towards the new member states. In particular, in this case Poland and the Czech Republic benefited mostly from the accession to the EU and the respective market liberalizations. Both countries rely on large coal reserves, with a significant share being exported and used in other countries production processes as primary inputs.
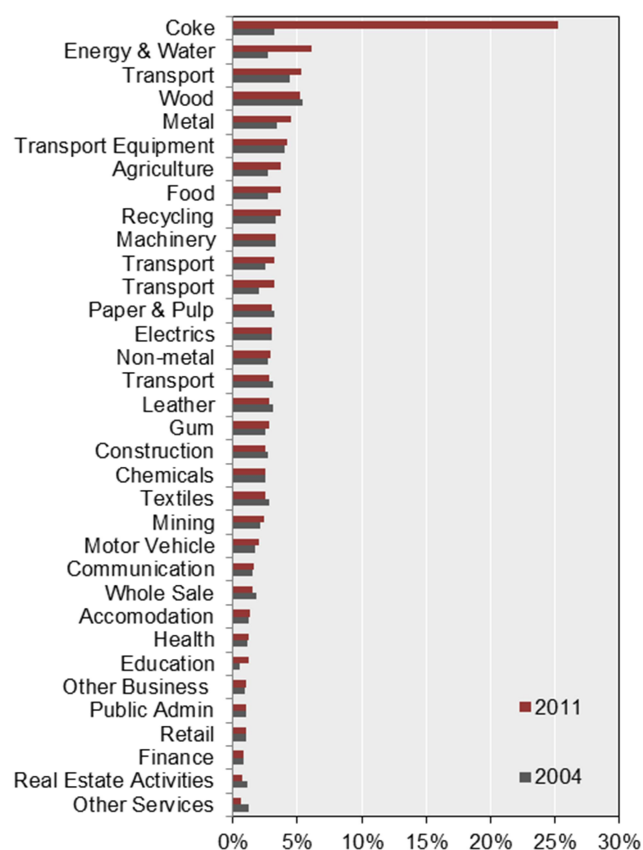
Figure 22: Share of value added of EU-NMS-2004 in Austria's exports by sector (for the years 2004 and 2011).

Next, we analyse Austria's indirectly exported value added to the EU-NMS-2004. Currently more than 5 % of Austria's exports are re-exported via EU-NMS-2004; at country level first and foremost Czech Republic, Hungary and Poland. Between 1995 and 2008, the amount of value added of Austria that is embodied in the exports of EU-NMS-2004 was rising constantly (from 1.2 % in 1995 to almost 3 % in 2008). In contrast to the value added content of EU-NMS-2004 in Austria's exports (Figure 21) the accession to the EU in 2004 had no additional growth impact on Austria's indirectly exported value added. However, we find that in 2011, the period after the global economic crisis, the demand of Austria's intermediate inputs in the production of the EU-NMS-2004 shows a sharp increase (see Figure 23, right panel). Currently, the EU-NMS-2004 are an important market for Austria's goods and services and the demand for further intermediate inputs from Austria in their production process is expected to grow. Overall, our findings, illustrated in Figure 21 and Figure 23, reveal a mutual integration of both regions which strengthens their respective competitiveness and specialisation patterns.
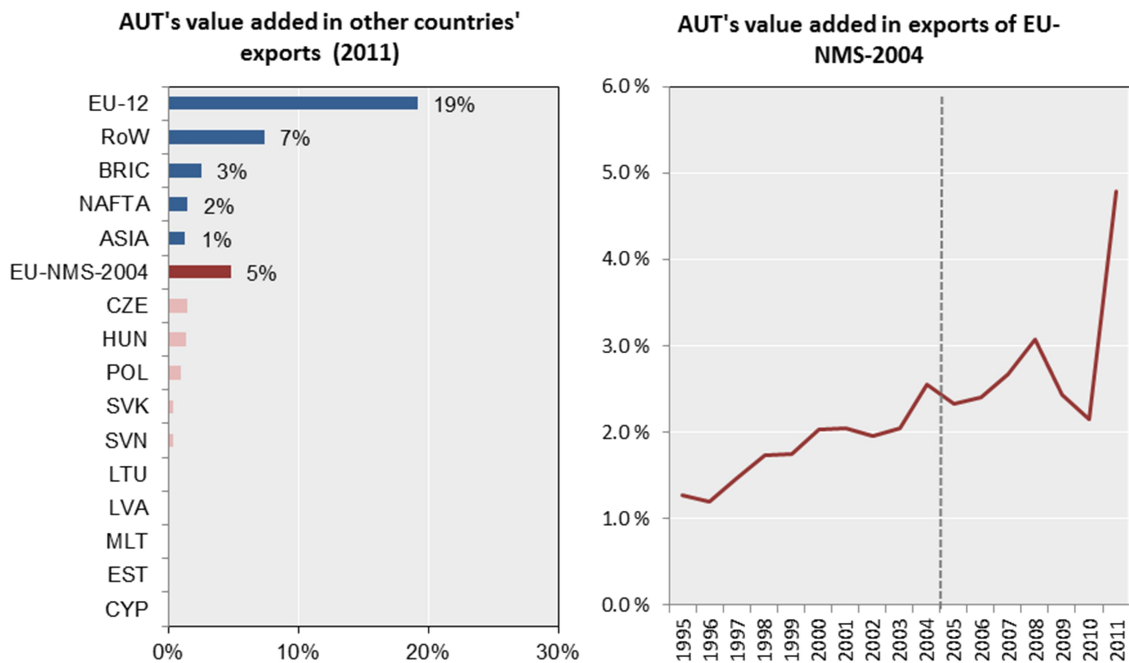
Figure 23: AUT's indirectly exported value added by country (left) and the respective share that is exported to the EU-NMS-2004 in the period 1995-2011 (right)

3.4 Rising influence of BRIC countries and their impacts on Austria

The rise of global value chains and hence, the increasing international fragmentation benefited in terms of competiveness and economic development most countries (for an overview see OECD 2013a). However their impacts differ significantly: Generally advanced large economies tend to be more upstream in the supply chain (small share of foreign value added in their exports and relatively large contributions to value added in other countries' exports). By contrast, as illustrated in Section 2, emerging economies tend to be more downstream in the supply chain, with relatively large shares of imported content in their exports (Koopman et al 2014).

Historically, emerging economies accelerate the globalization process and play a key role in the rising internationalization of production processes. In the nineties, large firms sourced part of their supply chain out to new markets, like Russian Federation, China, Brazil and India (the so called BRIC states). The reasons were twofold (Gereffi and Sturgeon 2013): (i) these countries represented rapidly growing consumer markets and (ii) production costs were extremely low (e.g. a vast pool of low-wage workers, increasingly capable manufacturing and trade infrastructures as well as abundant raw materials). This outsourcing of distinct production stages from industrialized countries like the United States and Great Britain had a huge impact on the position of these countries in GVC: they are mainly known as "Worlds manufacturer/assembler" (e.g. China) or in the case of India as "Worlds back office" which indicates there rather downstream position in global supply chains. However, during the economic crises (2008-2010) emerging economies were the main engine of growth and according to Fung (2011) their position in GVCs is going to change considerably in the near future (Gereffi and Sturgeon 2013). As our analysis shows, in terms of final demand emerging economies gain in importance and we observe a shift in end markets towards them. Therefore this section provides an overview of the rising influence of the BRIC countries in the last decades and their impacts on international trade patterns and trade relations. In particular we put deeper emphasize on the role of Austria regarding benefits and risks in the course of rising emerging markets.

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3.4.1 Historical development and current role in GVCs

In the period under consideration, from 1995 to 2011, Figure 24 shows that gross exports of BRIC countries are rising constantly and considerably over time, except for the period of the economic crisis (2008-2010). In particular, Chinas gross exports grew annually by a rate of 16 % and in 2011 China was the worlds' leading export nation (with 11 % of global gross exports). Furthermore, Figure 24 illustrates that India and Brazil show a similar development of gross exports in terms of direction and magnitude. However, since these countries are characterized as economies of assembly and manufacturing, in the debate of GVCs we are interested in their value added content. In absolute terms, data shows that domestic value added in exports rises considerably in all BRIC countries: In China domestic value added between 1995 and 2011 is multiplied by factor of 11, in India by a factor of 7, Russia by a factor of 6 and Brazil by a factor of 5. In relative terms, more precisely the share of foreign and domestic value added, the results are somewhat different. Currently, nearly a quarter of Chinas and India's value added in gross exports is imported from abroad. The foreign value added share for Brazil and Russia is considerably smaller, 13 % and 7 % respectively.
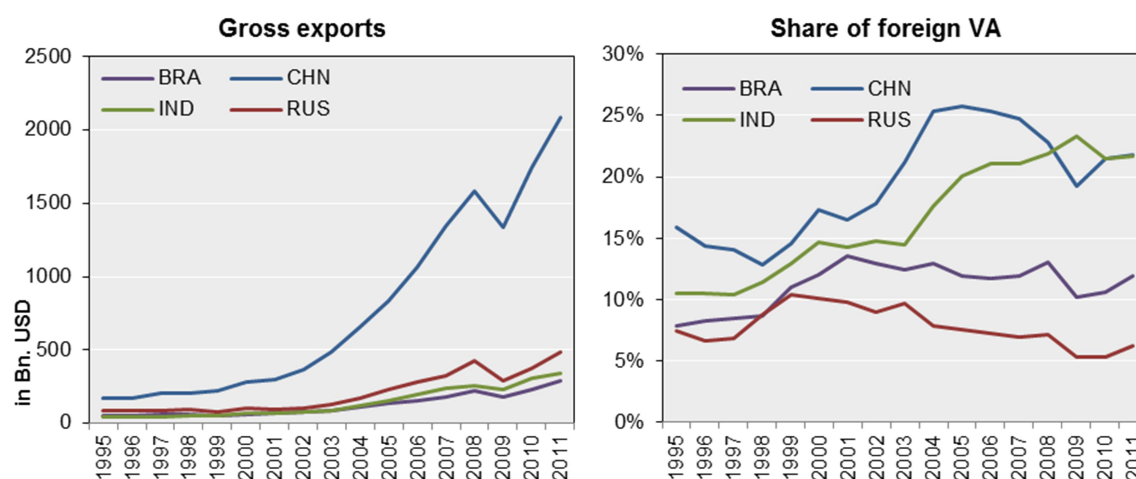

Figure 24: Gross exports of BRIC countries (left) and their respective share of foreign value added (right)

In comparison with most industrialized countries, these shares are far below average (EU-15 shows a foreign value added share of 31 %). However, in comparison with other large economies such as the United States with 15 % and Japan with 17 %, China and India show a much higher content of foreign value added in their exports. Globally, Russia's content of foreign value added is by far the smallest. Considering development over time, as illustrated in Figure 24 we find that while the foreign content of value added is falling constantly in Russia, it is rising in India as well as China. Brazils' foreign value added content fluctuates significantly: due to the trade liberalizations in the early nineties it is rising between 1995 and 2001, in the period 2002 to 2009 the share of foreign value added is falling and in 2010, when the world economy has recovered from the economic crises, it is rising again. These differences in the level of foreign value added in exports among the BRIC countries is due to numerous factors and economic characteristics (Gereffi and Sturgeon 2013, Koopman et al. 2014): degree of openness to trade and foreign investment, pool of primary factors and resources, infrastructure, level of technological knowledge as well as the geopolitical relationships to the world's most powerful countries as well as their direct neighbors.

In order to gain deeper insights in the current position of BRIC countries in GVCs and their special economic characteristics we analyze value added in trade at sectoral and country level. Value added in trade at sectoral level gives an indication of the role emerging countries play in GVCs in terms of

competitiveness, trade exposure and vulnerability. As reported in Figure 25 and Figure 26, Brazil and Russia are heavily involved in exports of primary inputs in production and resources. Thus, in Brazil the economic sectors *food*, *mining* and *agriculture* are the main export industries and their respective share of foreign value added with around 10 % is relatively small. In Brazil the production of exports in the economic sectors *electrics*, *transport equipment* and *coke & refinement* is most depended on imported intermediates: in order to produce one unit of exports, 0.2 units of imported intermediate inputs are used. Regarding exports, Russia mainly depends on the mining industry, followed by transport and whole sale. The declining importance of intermediate inputs imported from abroad to produce Russia's exports, as reported in Figure 24, traces back to the specialization in the mining industry. Thus, Russia is relatively independent from other countries and the falling relevance of foreign value added also affects other countries and regions, which are upstream suppliers of intermediates like Europe and NAFTA countries.
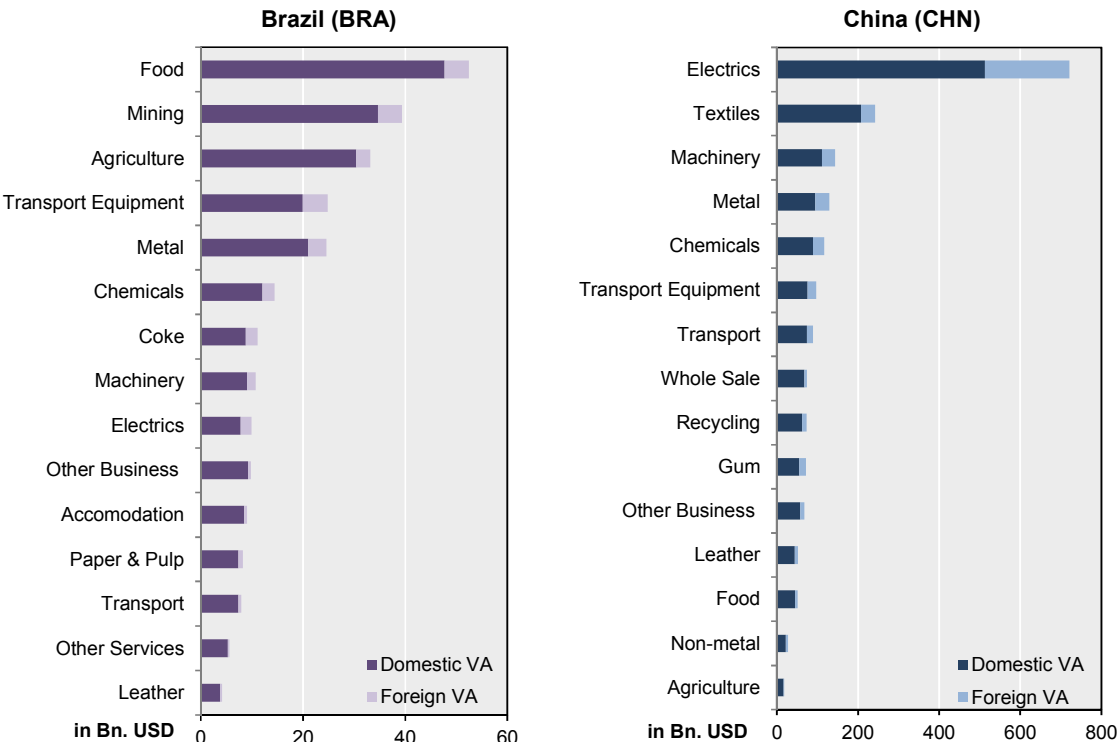

Figure 25: Domestic and foreign value added in the Top-15 exporting sectors in 2011: Brazil (left) and China (right)

India's content of foreign value added, which has been rising significantly over time, traces back to its export profile: two third of its exports are manufacturing based and one third is service oriented. In India the economic sector *recycling and other manufacturing* is by far the main export industry. However, more than a half of the intermediate inputs are imported from abroad. India's value added in trade shows two characteristics: First, with the considerably share of foreign value added in recycling and other manufacturing India underlines that emerging economies are more specialized in pure production and assembly activities, while industrialized countries specialize in activities like R&D, design, innovation, logistics and marketing. Second, with the relatively high share of service-oriented exports, which mainly contain domestic value added, India shows its importance as a global provider of office and telecommunication support. By contrast, China is with a manufacturing share of over 90 % of its' export goods, heavily involved in manufacturing GVCs. Thereby, electronics which are solely manufactured in China (distribution, marketing, design and other stages in the production process are abroad) show by far the highest content of imported intermediates. Moreover, electronics are the main export industry of China which explains the overall dependency of foreign inputs in production.
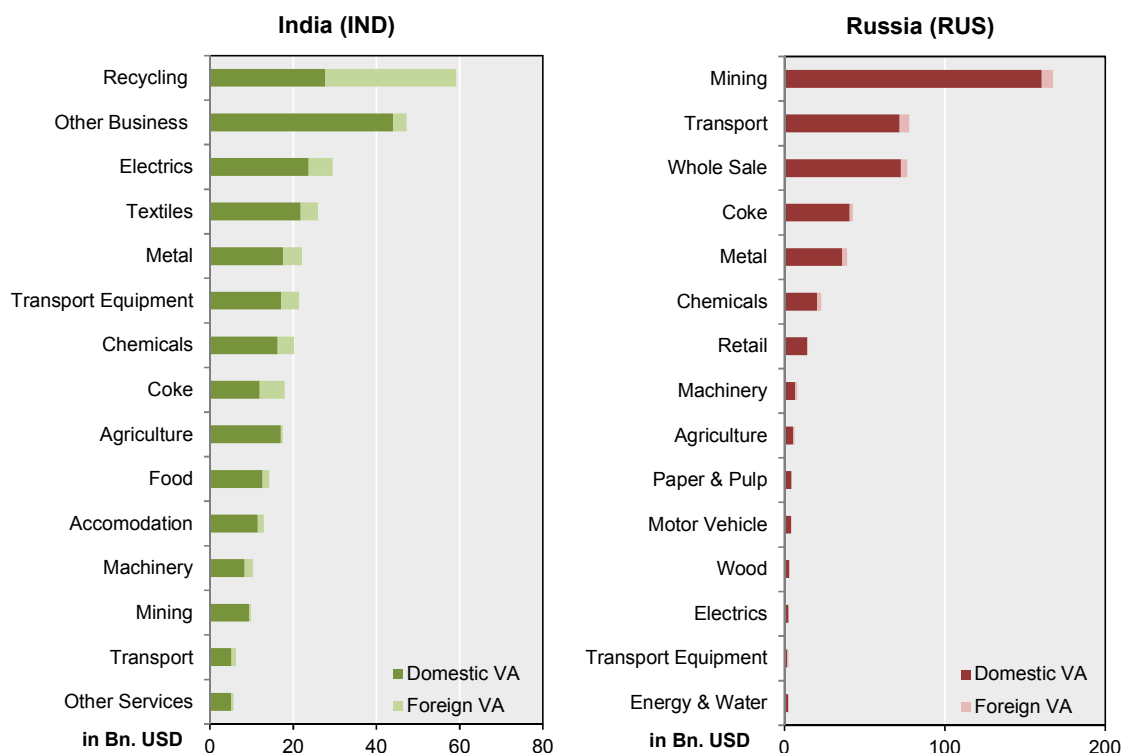
Figure 26: Domestic and foreign value added in the Top-15 exporting sector in 2011: India (left) and Russia (right)

Regarding global value chains, BRIC countries not only depend on foreign imports to produce their exports they also provide distinct intermediate goods and services for other countries. Therefore the BRIC countries indirectly participate in other countries exports. As illustrated in Figure 27, indirect value added of all BRIC countries is rising continuously, in particular Chinas indirectly exported value added shows with annually 18 % an extremely high growth rate. At country level further findings report that most indirect value added exports of China and India are on behalf of USA, Germany and Korea. At sectoral level we find that Russia's high amount of indirectly exported value added traces back to its vast share of mining goods which are embodied in other countries exports. Our results also underline changes on the global market in terms of role and position of BRIC countries: in the last decade the BRIC countries moved upstream in some global value chains and hence, exported a vast share of intermediate goods and services that are used by third countries exports. Moreover we identified the United States as a key final market for the value added of BRIC countries, since most of its indirectly exported value added (via the channel of third countries exports) ends up in the final consumption of the United States.
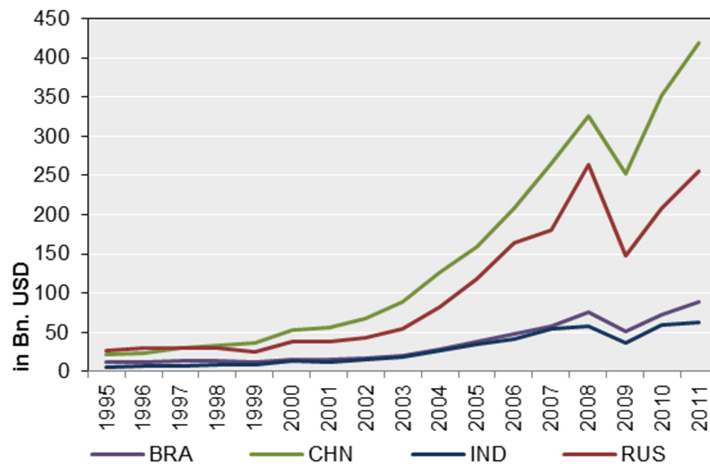
Figure 27: Indirect value added of BRIC countries

However, regarding value added in final demand, as illustrated in Figure 28, 89 % of BRICs value added is consumed domestically. In contrast to other larger economies this share is relatively high and moreover shows only a slight decrease in the period under consideration (from 92 % in 1995 to 89 % in 2011). At country level the US, Germany, Korea and Great Britain are the main final markets. Between the years 1995 and 2011 the share of the United States in final consumption of BRICs value added doubled.
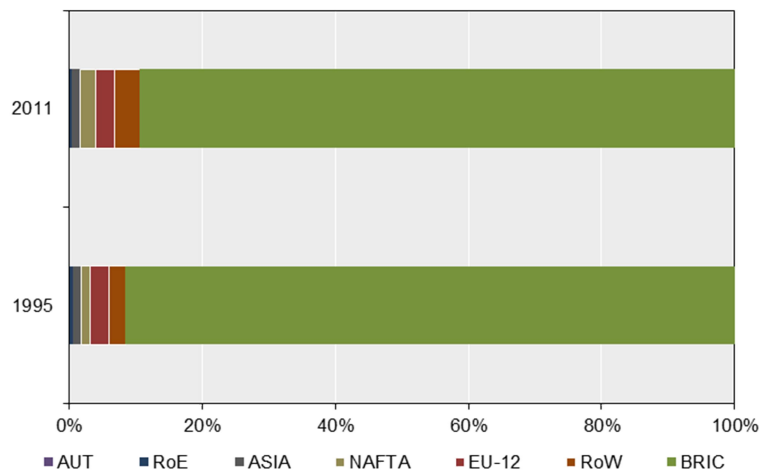

Figure 28: Allocation of final consumption of BRIC's value added

3.4.2 Impacts on Austria

Subsequent to the detailed description of the rise of the role of BRIC countries in GVC we now turn to the impacts on Austria. As already illustrated in Section 3.1, BRIC countries became an important trading partner for Austria, in terms of value added in trade as well as in final demand. In this section we focus on the impact of the rising influence of BRIC countries in GVC on Austria's competitiveness and their role in Austria's trade network. Starting with value added in trade we find that the participation of China in Austria's exports is rising sharply. Between the years 2000 and 2011, the amount of Chinas value added that was indirectly exported by Austria grew annually, on average by 22 %. In 2011, over 5 % of the foreign value added content in Austria's exports refers to China. Figure 29 illustrates that Austria also indirectly exports a vast amount of value added from Russia. In order to produce its exports, Austria depends on raw materials and mining goods from Russia. Thus, the exports of the industries *coke & refinement*, *metal & metal products* as well as *transport equipment* rely on Russia's resources. In contrast, BRIC countries also require intermediate inputs and services from Austria to produce their exports. At

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country level, thereby China is of key importance. From 2000 to 2011, the amount of Austria's value added used in Chinas exports grew by a factor of 5 (with an annual average growth rate of 23 %). At industry level Austria is mainly involved in Chinas exports of *electrics* and *machinery*.
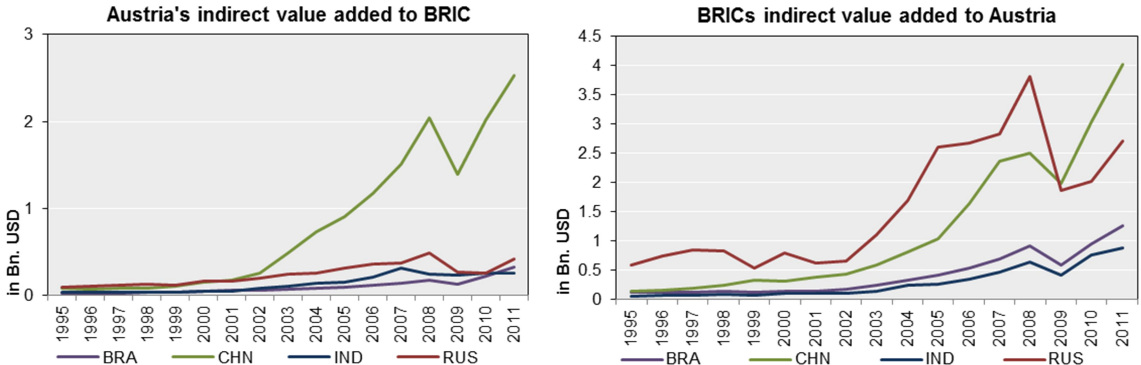

Figure 29: Value added in trade: BRICs indirectly exported VA to Austria (left) and Austria's value added content in BRICs exports (right)

As already laid out in Section 3.1.3 (see Figure 13) the foreign value added content in Austria's final demand is rising over time. In 2011, 3 % of the value added in Austria's final consumption refers to BRIC. However, the influence differs substantially at country level: while the value added content of India and Brazil in Austria's final consumption is negligible, China and Russia are of importance. As illustrated in Figure 30, in the period from 1995 to 2007, among BRIC countries, Russia provided by far the largest amount of goods and services and hence value added to Austria's final consumption. Thereby Russia's value added is mainly demanded in the consumption of raw materials and mining products. However in 2007 Russia lost significantly in importance, while Chinas value added in the final consumption of Austria started to grow considerably. On the one hand we find that in addition to Russia, also China is of key importance in the Austrian final consumption of raw material and mining goods. Furthermore, as analyzed in Section 3.3, due to the EU-Enlargement the demand from Poland and Czech Republic is also rising and our results suggest a shift in favor of China and eastern Europe. On the other hand, as reported in Figure 30, in the last decade Austria's importance as final market for Chinas value added rises continuously (between 2005 and 2011 demand of Chinas value added grew by a factor of 4). Currently, in the final consumption of *metal & metal products*, *electric equipment* and *whole sale*, Austria depends heavily on China. This result also suggests a shift in trade pattern between Austria and China, since in 1995 (prior to Chinas WTO membership) China mainly provided value added only in the final consumption of *agricultural products* and *textiles*.
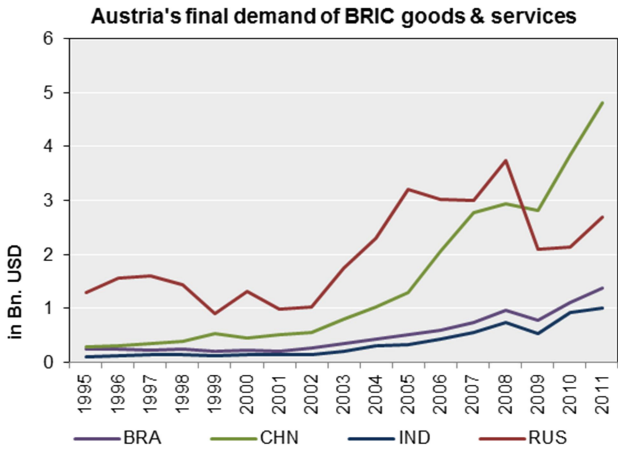

Figure 30: Austria's final demand of BRICs value added

4 Conclusions and policy implications

In the past decades global value chains (GVCs) considerably shaped and challenged international trade relations. In today's world global trade is mainly characterized by offshoring of activities and a fragmentation of production processes. International trade and competition increasingly take place at task rather than industry level resulting in a high degree of interdependencies in the global trade network (OECD 2013a). This high level of global interconnectedness poses a variety of risks for countries participating in GVCs and enhances their vulnerability to external shocks. For instance, the recent incidents in Japan (tsunami and nuclear disaster) not only affected the economy itself severely but due to the nature of GVCs other countries experienced strong negative impacts as well (particularly visible in other Asian countries but also in North America). Japan is a key supplier of technological products in the electronics and automotive industry and has hence a strategic position in the respective supply chains (Cattaneo et al. 2013, OECD 2013b).

❖ **Rethinking of traditional and historically effective trade policies**

In the face of GVCs trade flows are rather driven by companies and businesses than government strategies. Our findings show that on world average more than one-third of the imported intermediate goods are destined for the export-market, in smaller economies this share is much larger. This implies that government policies targeting the border crossing of goods, e.g. raising import tariffs to protect domestic production, are less suitable to address the real issue of strengthening the position of domestic production in GVCs and hence less effective. Therefore a rethinking of traditional and historically effective trade policies is indispensable. Traditional tariff policies and preferential trade agreements will not only protect some domestic firms and suppliers but also harm other domestic firms and suppliers substantially in gaining a beneficial position in the global value chain due to the limitation of import possibilities.

Strategies and policy incentives at national level depend on size, development, industry mix and level of participation GVCs which force different challenges and risks of vulnerability on countries. For instance, developing economies are often excluded from GVCs since they lack in infrastructure, political stability as well as production and technical capacities and are hence not efficiently connected to the global market (Cattaneo et al. 2013, Gereffi and Sturgeon. 2013). Emerging economies like China will likely face rising labor and energy costs which challenge their position as a so-called "world assembler" in GVCs.

❖ **Foster the ability to efficiently import goods and hence overcome resource constraints**

Furthermore, in line with the economic literature (Baldwin and Okubo 2006, Baldwin and Venables 2013, Fujita et al., 1999) results of this study show that in the context of GVCs the size of an economy matters. Small open economies (from here on SOE) highly participate in GVCs and hence play a key role in the global trade network. The reason is that the perspective of GVCs and the real value embodied in trade shifts the focus in terms of competitiveness and policy relevance from exports to imports, particularly to the imported and domestic content in exports. Following Koopman et al. (2014) **a country's competitiveness depends as much on its capacity to efficiently import inputs as on its capacity to export**. Small open economies may take full advantage of GVCs, but there are also high risks involved. One the one hand small open economies have a much higher vulnerability to trade tariffs and barriers than large economies and thus a higher risk of losing competiveness as well as of migration of companies, know-how and qualified workers since they are not able to produce all their intermediate inputs and resources domestically. On the other hand due to this dependency on international supply

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chains small open economies are able to overcome resource and endowment constraints and hence GVCs enable them to obtain vast economies of scale within specific segments or tasks (regardless of the size of the respective domestic market). Thus, at policy level programs and initiatives aiming to promote international cooperation within supply chains and hence facilitate imports are key contributors to efficient production and a high level of synergies as well as economies of scale.

❖ **Austria lies rather downstream in the global value chain and is therefore relatively vulnerable on its import side**

Austria is a typical example of an industrialized small open economy. Regarding Austria's position in the global trade network and its main trading partners there are no striking differences between gross trade flows and value added in trade: Austria is highly integrated in the European trade network and is highly involved in trade with its neighboring countries in particular Germany and Italy. However regarding target oriented policy design (e.g. good or industry-level) and to strengthen Austria's competiveness on the global market considering **the "real" value added in trade which is of key interest but yet a missing aspect**. At aggregated level, our findings show that Austria lies rather downstream in the global value chain where **the share of foreign value added embodied in Austria's gross exports is much higher than the indirectly exported value added (exports which pass other countries until they reach its final destination)**. From a policy perspective, Austria faces due its rather downstream location along with its high degree of participation a higher vulnerability on trade tariffs on imports due to a high amount of imported contend of gross exports than large economies. Tariffs accumulate and may still reach quite a high level by the time the finished good reaches final demand which dampens demand and affects production and investment. Austria holds intense trade relations in gross as well as value added terms within the European Union, which clearly lowers Austria's vulnerability because of absence of tariffs in trade. Nonetheless these issues underline the importance of a rethinking of traditional trade policies and to consider the complex nature of global value chains in policy design as well as trade analysis.

❖ **Austria's main exporting goods embody a high amount of domestic services but also a relatively large share of foreign value added**

At sectoral level we find that metal, transport equipment, machinery and electrics are in gross terms Austria's main export activities. However, most of these industries show a high share of foreign value added (on average 37 %) and hence the production of exports depends to the extent of one third on imported intermediate inputs. Regarding the production process of manufacturing exports, Austria shows a high degree of value added from services. More precisely**, on average over 30 % of value added in exports of manufactured goods represents services**. Thereby, a large extent regards business services and activities and a smaller amount relates to transport and telecommunication as well as distribution services. While the vast share of the imported value added in Austria's manufacturing exports relates to fabrication and assembling, **the knowledge intensive activities (e.g. R&D, branding and marketing) are located domestically**. Additionally most of Austria's export sectors (except electrics) hold in value added terms a comparative advantage. Therefore promoting domestic service sectors strengthens the international competitiveness of Austria's exports on a whole, also in manufacturing industries. Especially services which are intensively related to Austrian Exports – like business services, transport and telecommunication – are of vital relevance. Therefore the actual discussed investment offensive in broadband internet could contribute substantially to the intensification of international cooperation.

❖ **EU enlargement countries are new production partners within the European Union as well as a new and growing market for Austrian Exports**

Currently, the EU enlargement countries of 2004 are an important market for Austria's goods and services and the demand for further intermediate inputs from Austria in their production process is expected to grow. We find a mutual integration of both regions which strengthens their respective competitiveness and specialisation patterns: **Austria's intermediate exports are mainly characterized by high knowledge- and service-intensive manufacturing goods, while the EU enlargement countries of 2004 specialize in low-skilled employment and less knowledge intensive services**. Following Godart and Görg (2011) the successful and effective integration of these countries via the EU enlargement in GVCs led to rising incomes, fostered GDP growth and hence boosted consumption of private households. This increase in the consumption level of private households is also reflected in our analysis where **eastern European countries became important target markets of Austria's value added**. In particular the final demand of Austria's value added in the EU enlargement countries of 2004 increased on average annually by a rate of 3.5 % (in the period 2004 to 2011). In order to benefit of new production and cooperation possibilities which arose from the EU enlargement Austria has to specialize in knowledge intensive sectors to hold a comparative advantage and to avoid a predominantly price driven competition in production. According to Gnan and Kronberger Austria's export industry compensates high labor and production costs with specializations in high production and service quality. At policy level Austria's joint program of export promotion of the Ministry of Economy and the Chamber of Commerce is seen by the Competitiveness Report of the European Commission (EC 2013), as a successful stimulator of the export industry. However, since Austria's exports are rather technology intensive it is of key importance to invest in the so called knowledge triangle of education-research-innovation. This enables Austria to keep its rather beneficial position within the supply chain and to enhance technology intensive exports which are characterized by a high value-added.

❖ **Further research on spillover possibilities of national policies due to Austria's international linkages**

In contrary the amount of value added consumed in Austria that has been imported more than doubled in the last two decades. **Currently nearly 20% of the value added consumed in Austria's final demand is imported**. These growing dependencies make policies that target domestic demand less effective since the link to job creation and GDP declines, there are maybe positive spillovers to other countries. For a more detailed picture on Austria's international linkages and spillover of national policies a macroeconomic analysis by means of a multiregional general equilibrium model (CGE) has to be applied (e.g. see Koopman et al. 2013, Bednar-Friedl et al. 2012). Building on the findings of this study, one future research approach might be the analysis of the macroeconomic and distributional impacts of a trade agreement (e.g. between the EU and USA) or different trade policy schemes on Austria and its main trading partners. More precisely, **in order to gain more comprehensive insights in policy analysis on the basis of global value chains** (considering price induced long-term feedback effects between demand and supply) a **methodological switch from classical input-output techniques mainly applied in this study to a multiregional general equilibrium model (CGE) is most suitable**.

❖ **The optimal governance solution for global supply chains would be on a global scale**

Underlining the importance of value added in trade and identifying the benefits and risks associated with GVCs on the example a small open economy, new rules in global trade policy are required. It is absolutely clear that the optimal governance solution for global supply chains would be on a global scale. However, since GVCs are of a complex nature where countries hold different positions and strategies, a multilateral, global trade agreement in the near future is extremely hard to achieve and hence rather impossible. **But there is still much room at country- or regional level for promoting and stimulating**

interconnected policies. The main findings of this study imply for Austria, as a small open economy, a sharp shift in the focus of trade policy from the traditional gross trade perspective to the following:

    ✓ *Reduction of the various trade facilitation bottlenecks*

Reduction of the various trade facilitation bottlenecks since tariffs are for Austria as a member of the EU which holds trade relations mainly with other member states not a crucial issue. These bottlenecks mainly comprise regulatory requirements for importing and exporting and have an adverse impact on the internalization of production. For instance a lowering of administrative hurdles at the border (inefficiency in logistics, customs – e.g. border processing days - and other agencies at the border) and an enhancement of the quality of transport and logistics significantly reduce trade costs and hence improve cost-effectiveness.

    ✓ *Comprehensive government strategies for more efficient business related service activities*

The promotion of service oriented activities which are a main source of the domestic value added content in manufacturing exports is of key importance for Austria's competitiveness on the global market. Thus, **more efficient service sectors enhance the competitiveness of manufacturing firms and allow them to better participate in global production networks**. Our results show that in case of Austria the business related services comprising the tasks computer and related activities, research and development as well as other business activities like data management are mainly embodied in Austria's manufacturing exports. Furthermore the business related service sector is a main exporter of value added in Austria (with a share of 12 % of total value added exports of Austria). Generally on policy level regulatory simplicity and efficiency are important determinants of services competitiveness and the ability of a country to capture services "tasks" in the value chain. Government strategies for more efficient business related service activities are manifold and following the National Board of Trade (2010) comprise for instance **the removal of unnecessarily burdensome administrative measures, development and implementation of international standards and recognition of foreign licensing procedures**.

    ✓ *Strong protections of intellectual property rights are necessary and sufficient conditions in order to reduce international exposure of a firm's knowledge and capital*

Foster investments in sticky factors of production such as know-how and research activities, which are essential ingredients to a long-run competitive advantage. In this context from a policy perspective strong protections of intellectual property rights (IPRs) as well as of investment rights are necessary and sufficient conditions in order to reduce international exposure of a firm's knowledge and capital. At policy level, **Austria's government strategies should focus on measures enhancing awareness of firms and businesses towards IPR, strengthening the role and influence of the EU-patent as well as enforcing IPRs via informal institutions**. The latter is of key importance for service businesses which have adopted a wide range of alternative IP management and protection practices to enhance innovation. This is particularly suitable for Austria, where business services are a main source of the domestic value added content in manufacturing exports (see above).

    ✓ *Enhance FDI with South- and East European countries who share Austria's GVCs*

Promote trade relations in terms of reducing the aforementioned trade facilitation bottlenecks and **enhance FDI with countries that share Austria's GVCs**. In particular at country level this mainly

regards eastern European countries such as Romania, the Czech Republic and Poland. Austria will be able to improve its competitiveness and strengthen its position as high technology base while the eastern European countries will benefit from a higher integration in GVCs by an increase in the level of income and an economic as well as social upgrading.

5 Literature

Amador, J., Cappariello, R. and Stehrer, R. (2013) *'Global Value Chains: A View from the Euro Area'*, paper presented at the CompNet Conference, Washington DC, 16-17 April.

Amador, J.; Cabral, S. (2009) 'Vertical Specialization Across the World: A Relative Measure', *The North American Journal of Economics and Finance*, Volume 20, Issue 3, December: 267–280.

Balassa, B. (1965). 'Trade Liberalization and 'Revealed' Comparative Advantage', *The Manchester School of Economic and Social Studies*, Vol. 32, pp. 99-123.

Baldwin, R. (2013a), *Global supply chains: why they emerged, why they matter, and where they are going* In 'Global value chains in a changing world' ed. by Deborah K. Elms and Patrick Low, Fung Global Institute (FGI), Nanyang Technological University (NTU), and World Trade Organization (WTO), 2013.

Baldwin, R., and Venables, A. (2010), '*Spiders and Snakes: Offshoring and Agglomeration in the Global Economy*', NBER Working Paper Series, No. 16611, Cambridge, Massachusetts.

Baldwin, R., Frédéric, R.N. (2014) 'Trade-in-goods and trade-in-tasks: An integrating framework', *Journal of International Economics*, Elsevier, vol. 92(1), pages 51-62.

Baldwin, R., Toshihiro, O. (2006). 'Heterogeneous firms, agglomeration and economic geography: spatial selection and sorting,' *Journal of Economic Geography*, Oxford University Press, vol. 6(3), pages 323-34.

Baldwin, R., Venables, A.J. (2013b), 'Spiders and snakes: Offshoring and agglomeration in the global economy,' *Journal of International Economics*, Elsevier, vol. 90(2), pages 245-254.

Baldwin, Richard & Cohen, Daniel & Sapir, Andre & Venables, Anthony (ed.), 1999. "Market Integration, Regionalism and the Global Economy," Cambridge Books, Cambridge University Press, number 9780521645898, Autumn.

Bednar-Friedl, B., Kulmer, V., Schinko, T. (2012) 'The effectiveness of anti-leakage policies in the European Union: results for Austria', *Empirica*. DOI 10.1007/s10663-012-9186-7.

Bernard, A., B.J. Jensens, S.J. Redding and P. Schott (2007), 'Firms in International Trade', *Journal of Economic Perspectives*, Vol. 21(3), 105-130.

Bowen, J., Leinbach, T.R. (2006), 'Competitive advantage in global production networks: air freight services and the electronics industry in Southeast Asia', *Economic Geography*, Vol.82(2), pp.147-66.

Cattaneo, O., Gereffi, G., Miroudot, S., Taglioni, D., Joining, (2013), '*Upgrading and Being Competitive in Global Value Chains: A Strategic Framework*', World Bank Policy Research Working Paper No. 6406. Available at SSRN: http://ssrn.com/abstract=2248476.

Coe, N., Dicken, P., Hess, M. (2008) 'Introduction: global production networks—debates and challenges,' *Journal of Economic Geography*, Oxford University Press, vol. 8(3), pages 267-269.

Coe, N.M., Hess, M., Yeung, H.W-C., Dicken, P., Henderson, J. (2004) 'Globalizing regional development: a global production networks perspective', *Transactions of the Institute of British Geographers*, 29(4), pp. 468-484.

De Backer, K., N. Yamano (2007), *The measurement of globalisation using international input-output tables*, STI Working Paper 2007/8.

Dedrick, J., Kraemer, K.L., Linden, G. (2010), 'Who profits from innovation in global value chains?: a study of the iPod and notebook PCs', *Industrial and Corporate Change*, Volume 19, Issue 1, Pp. 81-116.

European Commission (2013): *European Competitiveness Report 2013*, Towards knowledge driven reindustrialization, Luxembourg: Publications Office of the European Union.

Everett, M. G., Borgatti, S. P. (2005). Extending centrality. In P. J. Carrington, J. Scott & S. Wasserman (Eds.), *Models and methods in social network analysis* (pp. 57-76). New York: Cambridge University Press.

Fally, T. (2011), *On the Fragmentation of Production in the US*, University of Colorado-Boulder, July.

Feenstra, R. , A. Taylor, (2008), *International Economics*, New York: Worth.

Fenz, G., Schneider, M. (2006), '*Austria's Economy Will Continue to Grow Dynamically in 2007*,' Monetary Policy & the Economy, Österreichische Nationalbank (Austrian Central Bank), issue 4, pages 6-25.

Fields, G. (2006), 'Innovation, time, and territory: space and the business organization of Dell Computer', *Economic Geography*, Vol.82(2), pp.119-46.

Fujita, M., P. Krugman and A.J. Venables, 1999, *The Spatial Economy*, MIT Press.

Gereffi, G. and Korzeniewicz, G. (Ed) (1994) *Commodity Chains and Global Capitalism,* Praeger: London.

Gereffi, G., Humphrey, J. and Sturgeon, T. (2005) The governance of global value chains, *Review of International Political Economy* , 12, pp. 78-104.

Gerreffi G., Sturgeon, T. (2013) *Global value chains and industrial policy: the role of emerging economies* In 'Global value chains in a changing world' ed. by Deborah K. Elms and Patrick Low, Fung Global Institute (FGI), Nanyang Technological University (NTU), and World Trade Organization (WTO), 2013.

Gibbon P. (2001) *At the cutting edge: UK clothing retailers and global sourcing*, CDR Working Paper No. 01.4, Centre for Development Research, Copenhagen.

Gnan E., Kronberger R. (2014) *Standort Österreich: Bestandsaufnahme und Zukunft aus Praktikersicht*, in: Gnan E., Kronberger R. (2014): *Schwerpunkt Außenwirtschaft 2013/2014, Internationale Wettbewerbsfähigkeit Österreich*, Vienna: Facultas Verlags- und Buchhandels AG.

Godard, O., Gorg, H. (2011) *The Role of Global Value Chains for German Manufacturing*, Available at SSRN: http://ssrn.com/abstract=2179948 or http://dx.doi.org/10.2139/ssrn.2179948

Gräf, B., Möbert, J., Peters, H., Schneider, S. (2013), 'F*ocus Germany. The worst is (probably) over*', Policy Brief der Deutschen Bank.

Grossman, G. and E. Helpman (2005), 'Outsourcing in a Global Economy', *Review of Economic Studies*, Vol. 72, No. 1, pp. 135-159.

Grossman, G. M., Rossi-Hansberg, E. (2008), 'Trading tasks: A simple theory of offshoring', *American Economic Review*, 98(5), pp. 1 978 –1 997.

Hiratsuka, D. (2010), 'Characteristics and determinants of East Asia's trade patterns', in Hiratsuka, D. and Uchida, Y. (Eds) (2010), Input Trade and Production Networks in East Asia , IDE-JETRO and Edward Elgar Publishing.

Hummels D., Schaur, G. (2013), 'Time as a Trade Barrier,' *American Economic Review*, American Economic Association, vol. 103(7), pages 2935-59, December.

Humphrey, H., Schmitz, H. (2002). 'How does insertion in global value chains affect upgrading in industrial clusters?,' *Regional Studies*, Taylor & Francis Journals, vol. 36(9).

Johnson, R.C. and G. Noguera (2012). Accounting for intermediates: Production sharing and trade in value-added, *Journal of International Economics* 86(2), 224-236.

Kaplinsky, R. (1998) *'Globalisation, Industrialisation and Sustainable Growth: The Pursuit of the Nth Rent'*, IDS Discussion Paper 365, Institute of Development Studies, Sussex University.

Kaplinsky, R. and Morris, M. (2000) '*A Handbook for Value Chain Research*', preparedfor the IDRC.

Koopman, R.; Tsigas, M.; Wang, Z. (2013). '*Potential Rebalancing of U.S.-Asia Trade: Dynamic General Equilibrium Linkages and the Implications of Global Value Chains'*, USITC Unpublished Manuscript (Washington, DC, United States International Trade Commission).

Koopman, Robert, Zhi Wang, and Shang-Jin Wei. (2014). 'Tracing Value-Added and Double Counting in Gross Exports.' *American Economic Review*, 104(2): 459-94.

Kraemer, K. and Dedrick, J. (2002), 'D*ell computer: Organisation of a global production network'*, unpublished manuscript, Personal Computing Industry Centre, UC Irvine, Irvine, CA.

Laursen, K. (1998*). Revealed Comparative Advantage and the Alternatives as Measures of International Specialisation*, DRUID Working Paper No. 98-30.

League of Nations (1942), *The World Trade Network* (Princeton, NJ: Princeton University Press).

Legler, H., Krawczyk, O., Leidmann, M., Rammer, C., Löhlein, H., Frietsch, R. (2006). Zur technologischen Leistungsfähigkeit der deutschen Umweltschutzwirtschaft im internationalen Vergleich. *Studien zum deutschen Innovationssystem* Nr. 20-2007.

Linden, G., K.L. Kraemer, and J. Dedrick. (2011), *Innovation and Job Creation in a Global Economy: The Case of Apple's iPo*d, US Trade Commission. Proceedings of the Joint Symposiumof U.S. -China Advanced Technology Trade and Industrial Development. Journal of International Commerce and Economics. May, Pp. 223-240.

Luca De Benedictis & Lucia Tajoli, (2011). 'The World Trade Network,' *The World Economy*, Wiley Blackwell, vol. 34(8), pages 1417-1454, 08.

Marcel P. Timmer (ed) (2012), '*The World Input-Output Database (WIOD): Contents, Sources and Methods*' WIOD Working Paper Number 1.

Meng, B., Qu, C. (2008), Application of the input-output decomposition technique to China's regional economies, *Journal of Applied Regional Science* 13: 27-46.

National Board of Trade (2010), At your service – The Importance of Services for Manufacturing Companies and Possible Trade Policy Implications, *Kommerskollegium 2010*:2.

OECD (2013a), *Interconnected Economies: Benefiting from Global Value Chains* – Book, Paris, 2013.

OECD (2013b), *OECD Science, Technology and Industry Scoreboard 2013*, Innovation for Growth, Paris, 2013, doi: 10.1787/sti_scoreboard-2013-en.

Ricardo, D. (1817). *On the Principles of Political Economy and Taxation*. London: John Murray.

Saito, M., Ruta, M., Turunen, J. (2013) '*Trade Interconnectedness: The World with Global Value Chains*' IMF Policy Paper, August 2013.

Saul, S. B. (1954), 'Britain and World Trade, 1870–1914', *Economic History Review*, 7,1, 49–66.

Stacey, F., Gereffi, G (2011), *Global Value Chain Analysis: A Primer*, Center on Globalization, Governance & Competitiveness (CGGC), Duke University, North Carolina.

Stöllinger, R., Stehrer, R., Pöschl, J. (2012). 'Austrian exporters: unique or alike? New insights and missing puzzle pieces,' *Empirica*, Springer, vol. 39(3), pages 375-405, August.

Tempest, R., (1996), '*Barbie and the world economy'*, Los Angeles Times , 22 September 1996.

Tinbergen, J. (1962) '*An Analysis of World Trade Flows*,' in Shaping the World Economy, edited by Jan Tinbergen. New York, NY: Twentieth Century Fund.

Varian, H. R. (2007), '*An iPod has global value: Ask the (many) countries that make it*', The New York Times, 28 June 2007.

Wasserman, S. and Faust, K. (1999) '*Social Network Analysis: Methods and Applications'*, New York and Cambridge, ENG: Cambridge University Press, Third Edition.

Yi, K-M. (2003),'Can Vertical Specialisation Explain the Growth of World Trade?', *Journal of Political Economy*, Vol. 111, pp. 52-102.

6 Appendix

6.1 World Input Output Database (WIOD)

Table A.1: Description of sectors in WIOD

Code	Description
AtB	Agriculture, Hunting, Forestry and Fishing
C	Mining and Quarrying
15t16	Food, Beverages and Tobacco
17t18	Textiles and Textile Products
19	Leather, Leather and Footwear
20	Wood and Products of Wood and Cork
21t22	Pulp, Paper, Paper , Printing and Publishing
23	Coke, Refined Petroleum and Nuclear Fuel
24	Chemicals and Chemical Products
25	Rubber and Plastics
26	Other Non-Metallic Mineral
27t28	Basic Metals and Fabricated Metal
29	Machinery, Nec
30t33	Electrical and Optical Equipment
34t35	Transport Equipment
36t37	Manufacturing, Nec; Recycling
E	Electricity, Gas and Water Supply
F	Construction
50	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel
51	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles
52	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods
H	Hotels and Restaurants
60	Inland Transport
61	Water Transport
62	Air Transport
63	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies
64	Post and Telecommunications
J	Financial Intermediation
70	Real Estate Activities
71t74	Renting of M&Eq and Other Business Activities
L	Public Admin and Defence; Compulsory Social Security
M	Education
N	Health and Social Work
O	Other Community, Social and Personal Services
P	Private Households with Employed Persons

Table A.2: Regional classification in WIOD

| ISO-3-code	Country
AUS	Australia
AUT	Austria
BEL	Belgium
BGR	Bulgaria
BRA	Brazil
CAN	Canada
CHN	China
CYP	Cyprus
CZE	Czech Republic
DEU	Germany
DNK	Denmark
ESP	Spain
EST	Estonia
FIN	Finland
FRA	France
GBR	United Kingdom
GRC	Greece
HUN	Hungary
IDN	Indonesia
IND	India
IRL	Ireland
ITA	Italy
JPN	Japan
KOR	Korea, Republic of
LTU	Lithuania
LUX	Luxembourg
LVA	Latvia
MEX	Mexico
MLT	Malta
NLD	Netherlands
POL	Poland
PRT	Portugal
ROM	Romania
RUS	Russian Federation
SVK	Slovakia
SVN	Slovenia
SWE	Sweden
TUR	Turkey
TWN	Taiwan
USA	United States
RoW	Rest oft he World

6.2 The global trade network
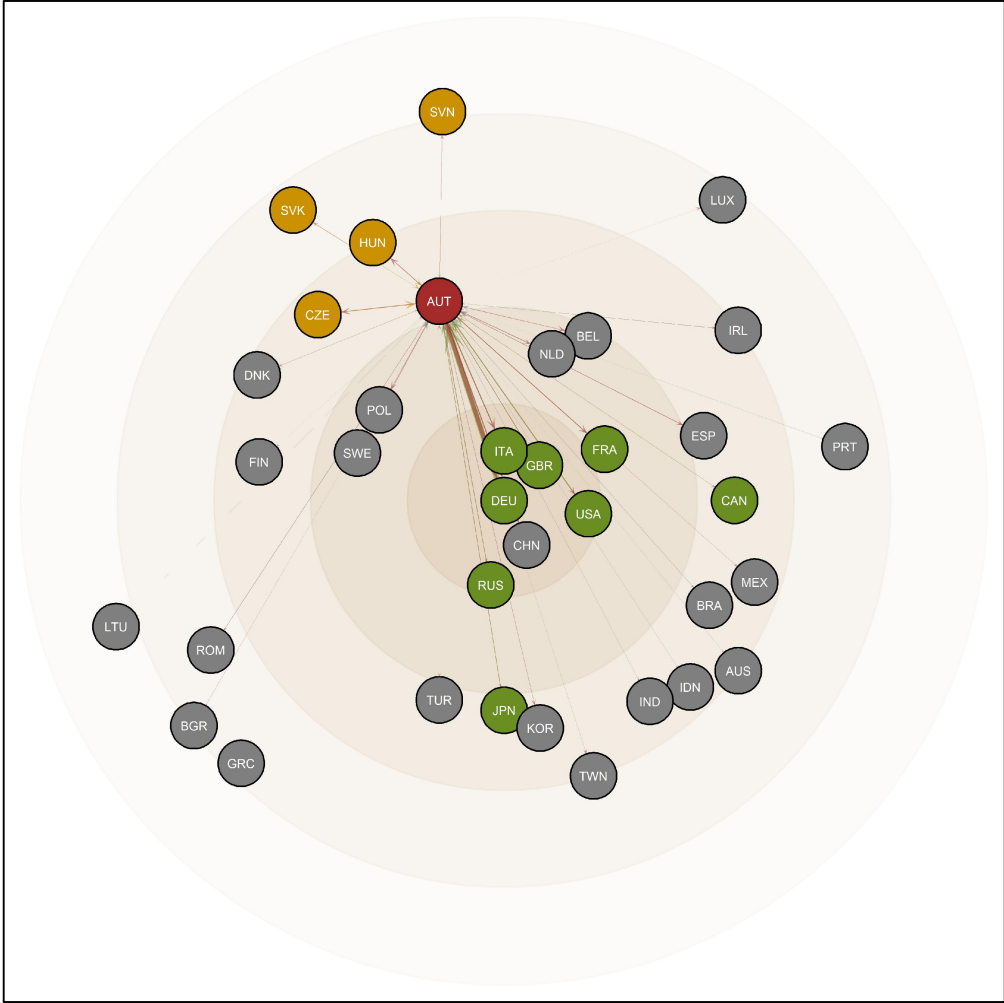
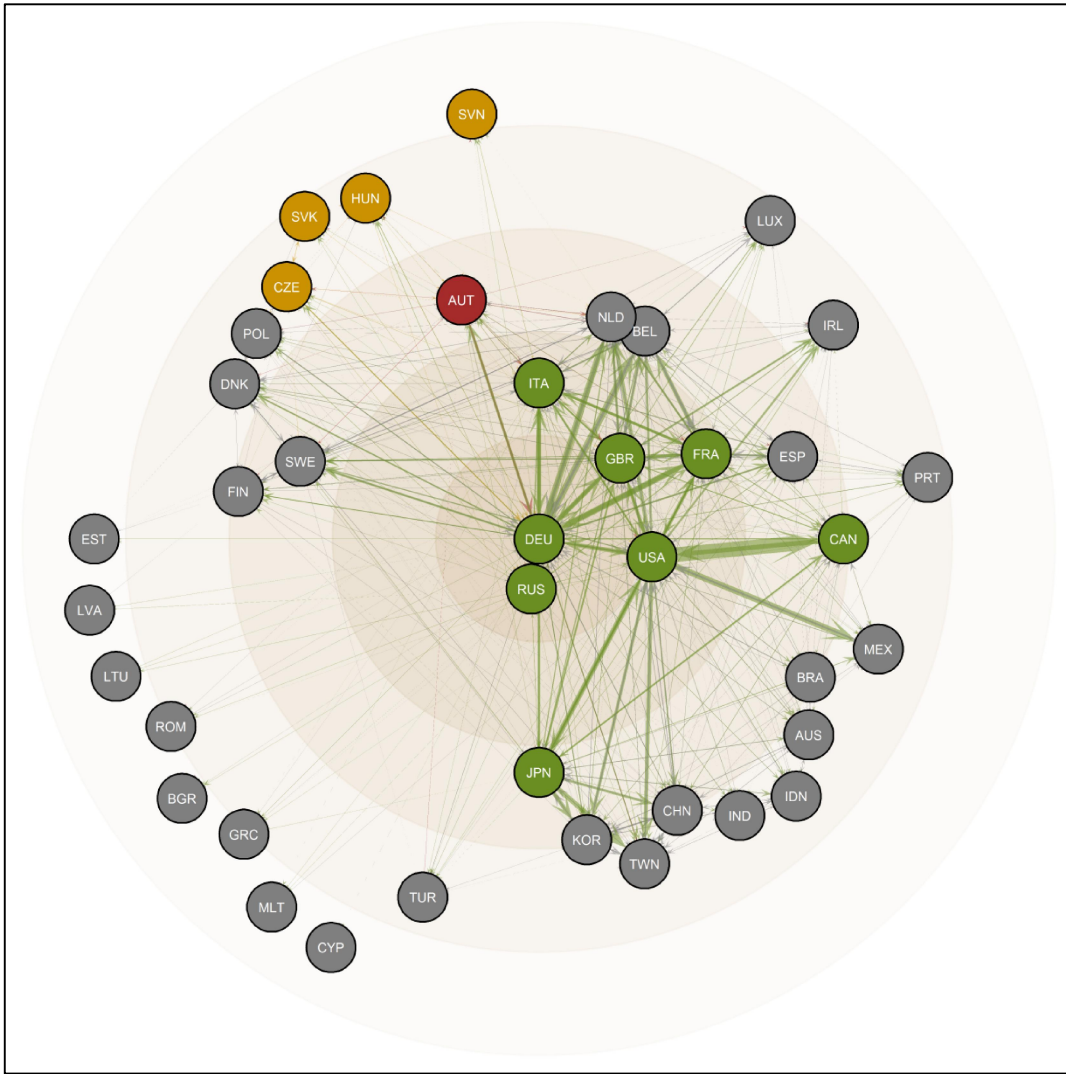*Figure 31: Global trade network in 2011: Austria's value added in trade*

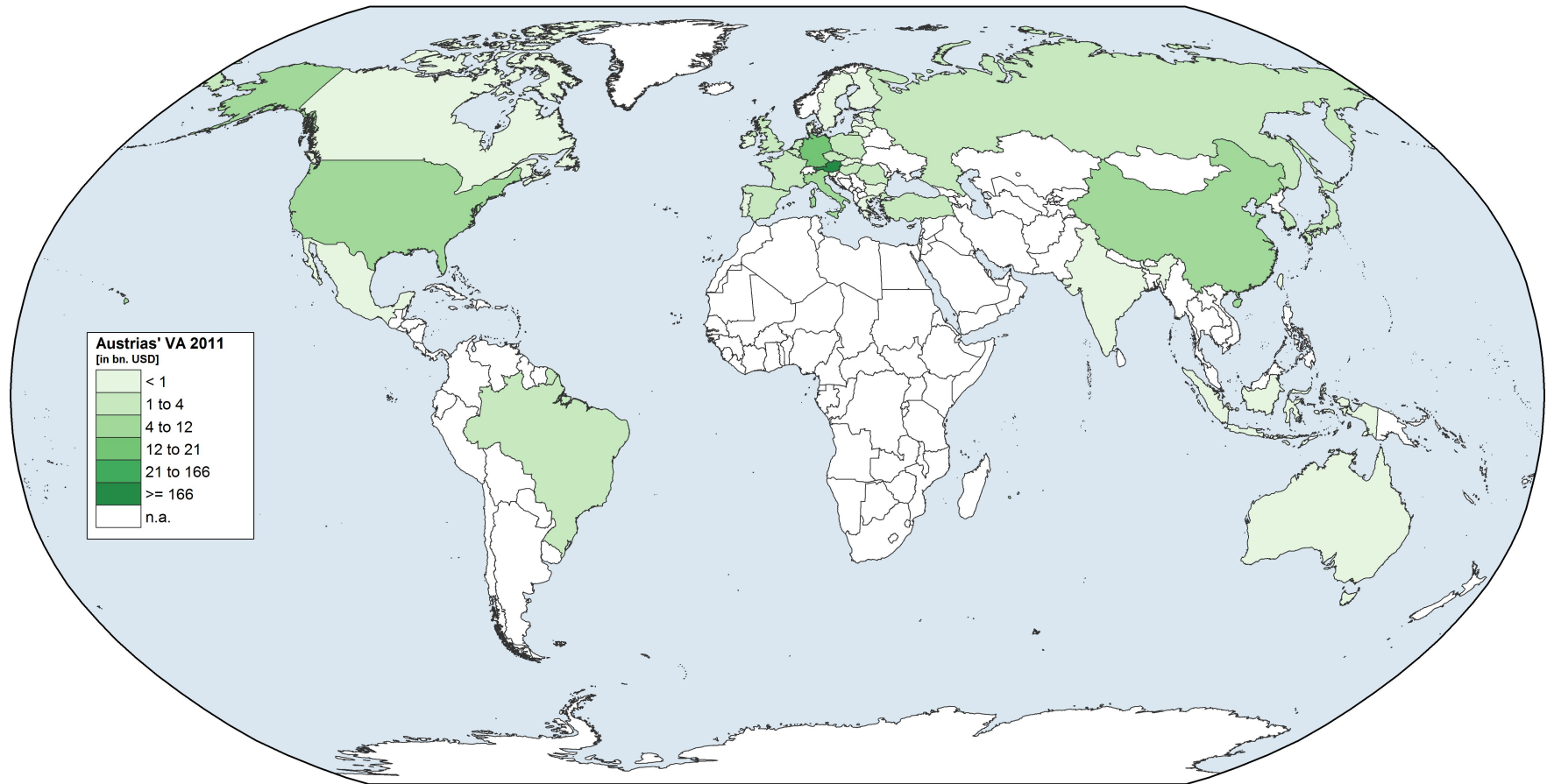*Figure 32: Global trade network in 1995: value added in trade – all industries (Graph: own illustration, data: WIOD 2013)*

Figure 33: Final consumption of Austria's value added (2011)

Austrias' VA 2011
[in bn. USD]

< 1
1 to 4
4 to 12
12 to 21
21 to 166
>= 166
n.a.