



GED Focus Paper

# Factory Europe

and its Ties in Global Value Chains



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## and its Ties in Global Value Chains

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Expert opinion on behalf of the Bertelsmann Stiftung

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# 1 Introduction

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Global value chains have continued to expand over the last few decades. This has made them a central part of many companies' internationalization strategies and an important facet of globalization. However, catchwords such as offshoring, bazaar economy and relocation of production have also caused this trend to become a focus of globalization critics. Above all in the United States under the new government, but also in France and other parts of Europe, this skepticism is playing an important role.

However, partnerships on the production side offer great opportunities to take advantage of the international division of labor. This applies not only to the inner-European ties in the EU Single Market. Intermediate consumption networks between Germany and the United Kingdom (UK) are also very close and placed at risk due to the Brexit. Something similar applies to the transatlantic ties on the production side. A protectionist backlash against globalization and offshoring would therefore threaten an important source of prosperity in regard to European and global value chains.

## 2 Genesis of global value chains

### 2.1 Term and economic logic

The term value chain refers in the narrow sense to the series of activities in the production of goods, beginning with the planning and design, extending to the numerous steps in the actual production process, and culminating in sales or after-sale service. These steps can be handled at a company location or distributed to various affiliates of the company or to unaffiliated domestic and foreign companies. If a company's own production is contracted out to another company, we speak of outsourcing; if the activities are relocated abroad and purchased from there, the term offshoring is used. Multinationals in particular use foreign locations for the manufacturing of products and have invested in subsidiaries there or engage foreign companies (see Helpman, 1984; Markusen, 2002, for the theory of multinational companies). In this way, global value chains have developed. In the economic literature dominated by the United States, this process has been given many names in addition to the ones already mentioned: "fragmentation, global production sharing, vertical specialization, vertical production networks, trade in tasks, second unbundling."

The location of the individual parts (activities) in the value chain is based on a corporate cost calculation since multinational companies weigh the advantages and disadvantages of outsourcing. Cost advantages result from the outsourcing of an activity to a foreign country that has lower production costs and the scaling advantages in production usually connected with this and associated with concentration on the core competencies of the involved operations. Cost disadvantages result from the higher expenses for the coordination of the value chain, above all in the form of higher transport costs, more management expenses and higher risks, for example in regard to quality and timely delivery.

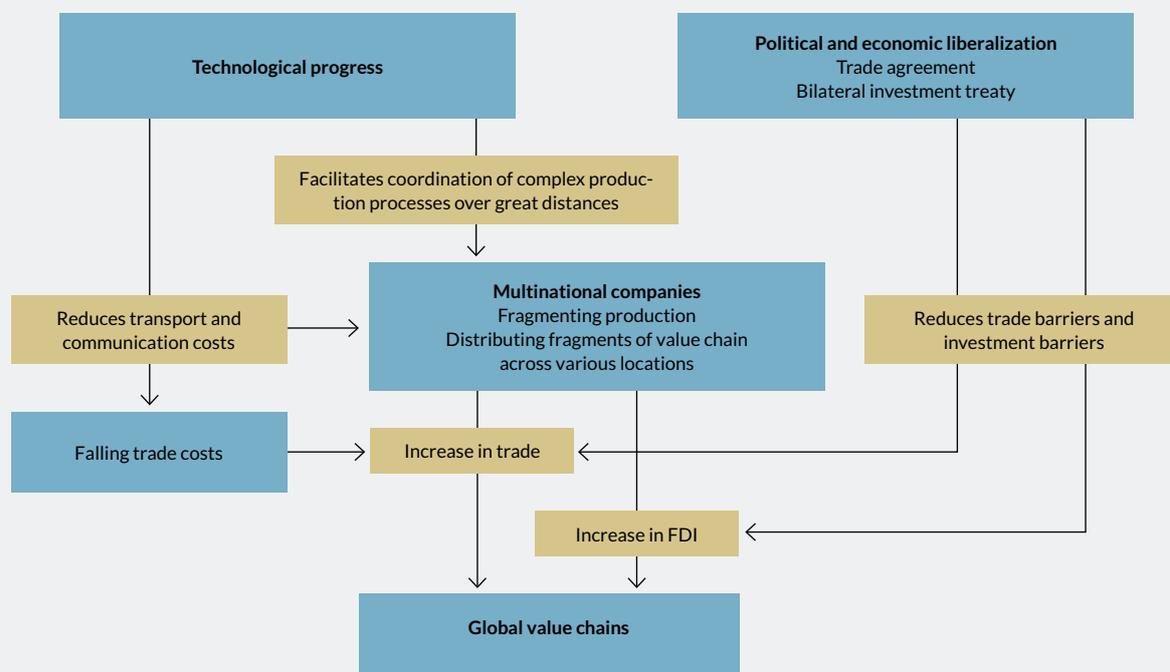
When the economic cost advantages in low wage countries are used, comparative and absolute (cost) advantages from

an economic point of view play an important role. Parts or activities in the value chain that can be standardized and are therefore more likely to be relocated usually have a higher level of less qualified tasks than more challenging activities. Therefore, developing and emerging countries can profit from their relatively rich factor endowment with a relatively low qualified workforce, which results in correspondingly low relative wages for less demanding tasks as compared to more challenging activities. Furthermore, the more limited availability of capital and technology as well as the resulting lower labour productivity also lead to lower wages. If multinational companies outsource activities from industrialized nations to developing and emerging countries and equip the workplaces there with modern machines, know-how and technology, they can generate significant cost advantages (particularly in regard to unit labor costs). This transfer of capital and technology is an important reason for why many emerging countries are quickly catching up economically and why the incomes there are converging with those in industrialized countries (Baldwin, 2016).

### 2.2 Causes

There are two main causes that initially made the development of today's global value chains possible: technical progress and economic liberalization (figure 2-1). First of all, the technologically induced reduction in transport and communication costs over the last few decades contributed to the fact that the average bilateral trade costs between 1995 and 2008 fell by roughly 15 percent (OECD et al., 2014). Even more important, however, is the influence of technical progress on the possibility of controlling global value chains from the parent company (headquarters). Here, the so-called ICT revolution since the middle of the 1980s has played a central role (Baldwin, 2011; Park et al., 2013). The reduction in communication costs is also a very significant development in this regard. Above all, the ICT revolution allowed for new communication possibilities over long dis-

FIGURE 2-1: Causes for the emergence of global value chains



Source: Author's own chart, based on (and along with translation) Amador/Cabral (2014)

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tances: first by phone and fax, and since the 1990s through the internet, email, mobile phones and Skype. Both the network coverage and the data capacity of the transmission paths have become larger and larger. As a result, the coordination costs have fallen so fast that it has become possible to manage complex international production networks centrally. Fort (2016) proves the connection between the usage of modern communication technology and the scope of the fragmentation in production empirically on the corporate level for the period from 2002 to 2007.

The second important factor is the politically determined liberalization of international trade and global investments. Johnson and Noguera (2017) show that the change in (implicitly derived) trading costs has played a dominant role in the increasing importance of global value chains. The reduction in trade barriers was a central driver of this cost reduction: Many developing and emerging countries shifted away from their traditional protectionist and import substitution policies during the 1980s and 1990s in order to accelerate their own economic development by joining global value chains. Often these countries reduced their tariffs unilaterally to a significant extent (Baldwin, 2010). Alongside this, trade barriers were also reduced as part of

multilateral and bilateral trade agreements. The Uruguay Round was implemented from the middle of the 1990s. But in the Doha Development Round, which began in 2001, multilateral liberalization of trade has ground to a halt. For this reason, many countries have been increasingly shifting to bilateral and regional trade agreements. They amounted to over 440 in 2017 according to information provided by the WTO; in 1995 there were only 100 (WTO, 2017).

In addition, also other important rules for a further expansion of global value chains were liberalized. In particular, this includes rules for simpler service trade (including the deployment of employees) and the provisions for protection of intellectual property (Baldwin, 2012b). This gave international trade agreements new depth and quality. Johnson and Noguera (2017) show that the existence and the depth of trade agreements are important explanatory factors for the development of global value chains in the involved countries. Furthermore, foreign direct investments by multinational companies in developing and emerging countries were accompanied by and secured with bilateral investment protection agreements. Their number rose globally from under 500 at the end of the 1980s to far above 2,000 at the end of the last decade (Baldwin, 2012a).

Due to the causes discussed above, global value chains have gradually assumed a different type of character since the middle of the 1980s. Before, international value chains existed already under the English term “global commodity chain” (Gereffi, 1994; Bair, 2005). These were usually not very complex value chains involving the purchase of commodities in developing countries and extending to the sale of final products in advanced economies for example, in the clothing sector.

But the ICT revolution allowed multinational companies to move further and further into the center of the expansion of global value chains (figure 2-1) and develop complex production networks by slicing up production processes and distributing the components across multiple countries. The diverse trade in numerous intermediate products plays a much bigger role today than it did before in the “global commodity chain” (Baldwin, 2012a; de Backer/Miroudot, 2014).

Another point of view also puts multinational companies at the center. Accordingly, Baldwin (2012a; 2012b) describes the emergence of global value chains as a development from a “first to a second unbundling.” According to him, the sharp reduction in transport costs in the 19th century (connected with the invention of the steam engine) led to the first unbundling, in this case of production and consumption in a geographic regard. In the second unbundling, the production steps were separated from each other geographically as explained because the coordination possibilities increased and coordination costs fell.

### 2.3 Indicators and empirical evidence

In order to measure the new form of global value chains, suitable indicators must be identified. This was problematic for a long time because insufficient trade data made their recording difficult. For example, the integration of a country in global value chains tends to be associated with a simultaneous increase in exports and imports, since the imported goods are processed and then re-exported. Specialization and trade performance indicators can provide a false picture in this case if they only rely on exports, as is often the case (Matthes, 2009; Timmer et al., 2013). A simultaneous increase in imports and exports also makes it more difficult to identify the change in the trade specialization of a country (Baldwin, 2012a).

Nonetheless, traditional trade statistics can also provide useful metrics: In the following, some selected indicators

will be presented to highlight the relevance and increase in significance of global value chains today from a global perspective over multiple decades:

- Intermediate goods dominate global trade relative to final products. Their share amounts to roughly two-thirds today (Baldwin/Lopez-Gonzales, 2015).
- The special role of Asia in comparison to other regions with regard to the inclusion in global value chains was illustrated by Baldwin (2011; 2012a) with an indicator for “21st century trade.” The value of the overlapping exports and imports of a country is viewed in relation to global trade in industrial products. This metric rose in Asia from below 0.5 around 1970 to over 4 prior to the end of the previous decade. The greatest increase took place after 1990, when the percentage exceeded 1 for the first time. Latin America and Africa recently continued to be significantly below 0.5, while developed countries in Europe and North America were around 2 on average.
- In comparison of various sectors, there was a very sharp increase in the electronics industry above all.

In the recent past, there data availability has significantly improved. Foreign trade data has been linked to national input-output data that shows the ties between a country’s sectors. The great advantage of this approach is that it allows for a calculation of the actual value added of a country within the global value chains as well as the domestic or foreign value added content of a country’s exports and imports:

- Johnson and Noguera (2017) have calculated the ratio of value added to gross exports in global exports since 1970. A decline in this indicator for the expansion of the value chains means that intermediate products (and the value added already contained in them) cross borders multiple times. The authors calculate that the share of value added in global exports fell from roughly 87 percent to roughly 77 percent between 1970 and 2008. The decline after 1990 was three times as fast as in the two decades before. In Germany the decline in the percentage over the entire time period was roughly one-sixth and thus relatively sharp.
- A more systematic source of data for determining trade based on value added is provided by the World Input-Output Database (WIOD). This data is only available since 1995, however. It was analyzed, for example, by Los et al. (2014) in regard to the worldwide development of global value chains. The authors use a similar, (mirroring) measurement concept as Johnson and Noguera. According to this concept, the foreign value added content in the end products of important trade

actors increased between 1995 and 2011 on average from roughly 17 percent to roughly 26 percent. In Germany, this percentage increased from 18 percent to over 30 percent between 1995 and 2008.

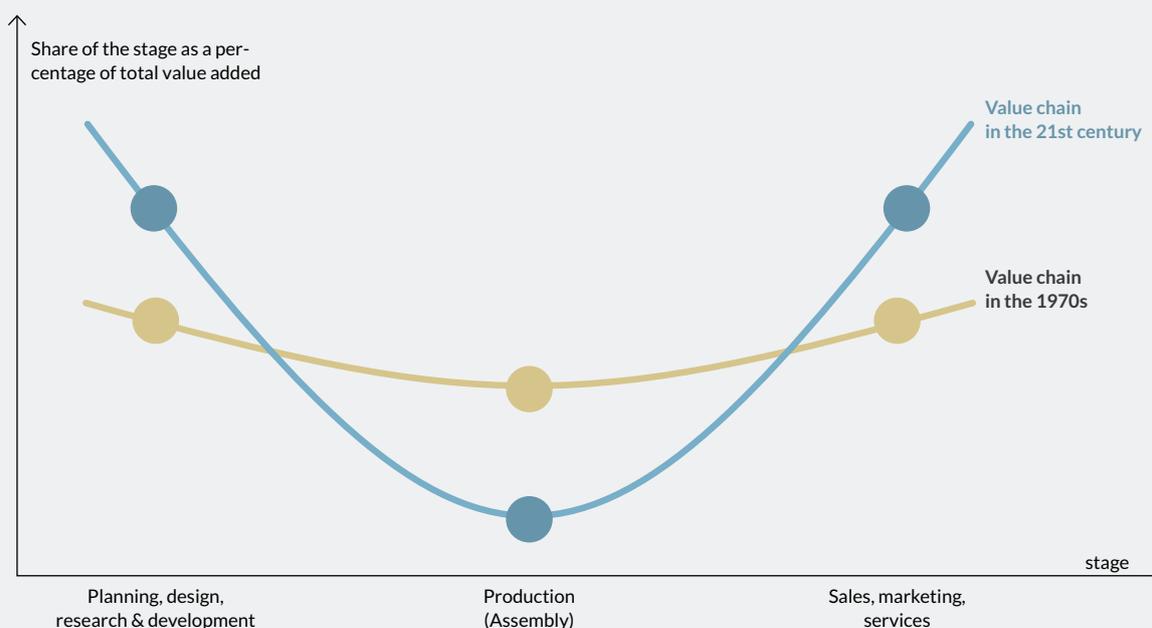
In the literature, there is no agreement at first glance as to whether the described increase in importance for global value chains is primarily due to greater inter-regional ties or whether the ties between regions were the major driver. Baldwin and Lopez-Gonzales (2015) defend the first thesis; Los et al. (2014) the second. The key to resolving this apparent contradiction is that Baldwin and Lopez-Gonzales use standard trade data, while Los et al. use value added flows and thus avoid double counts. Ultimately, the two approaches complement each other and provide the following picture: Inter-regional ties increased sharply, although intermediate goods (and the value added contained in them) cross borders multiple times and are also counted multiple times in the trade data. The value added approach of Los et al. removes the double counts so that the significance of greater regionalization is less prominent here. Therefore, the influence of stronger inter-regional and thus global ties in the value chains dominates. Due to the greater distance (and thus higher transport costs), the relationship between trade and value added in this case is naturally lower than on

the regional level. In sum, the international division of labor increased substantially as a result of the fragmentation of value chains, both regionally and internationally.

Besides the metrics discussed above, there are numerous other indicators for the measurement of global value chains (Foster et al. (2013), Amador/Cabral (2014), de Backer/Miroudot (2014), Baldwin/Lopez-Gonzales (2015), Ming et al. (2015), van der Marel (2015), Santoni/Taglioni (2015), Amador/Cabral (2017)). These include:

- Length of value chains (number of processing steps): This is another informative indicator because the degree of the international division of labor usually increases with the number of processing steps, which can also be proven from the data.
- Illustration of networks: The structure of global and inner-European ties can be seen in the cross-border value added flows. It is possible to show what countries are integrated especially strongly into international value chains and what countries are more on the fringe of production centers. For example, Germany in Europe and Japan in Asia assume a central role.
- Smile Curve (figure 2-2): In a value chain for an individual product, value-intensive activities are usually

FIGURE 2-2: Stylized Smile Curve



Source: Baldwin/Lopez-Gonzales (2015, translated)

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located at the beginning (among others in the planning and research) and at the end (marketing, sales and customer service). In the middle, there is often standardized production (“assembly”). Visually, the resulting stylized Smile Curve (U-shaped line) can be depicted in a diagram where the horizontal axis contains the position of individual processing steps as distance from the end user and the vertical axis depicts the share of this activity as a percentage of the total value of the end product. The interesting aspect here is that the stylized Smile Curve has become steeper for many products over the course of time and in the course of greater offshoring from industrialized countries. Assembly functions at the present time account for a lower share of value added than before because the relocation of assembly functions led to cost savings from the company’s point of view and because there is intense competition between emerging countries for the establishment of these often standardized activities (Baldwin/Lopez-Gonzales, 2015).

Furthermore, it is also possible to measure the intensity of participation in global value chains.

- Participation of individual countries in international value chains: In the two possible perspectives, it can be seen in most countries that their integration has increased:
  - Purchase of intermediate goods from abroad (“backward participation”): The foreign value added content as a percentage of domestic exports shows how strongly a country as the buyer of intermediate goods is connected with the preceding stages of the value chain.
  - Delivery of intermediate goods abroad (“forward participation”): The share of domestic value added that flows into exports of other countries as a percentage of domestic exports shows how well a country succeeds in passing its intermediate products on to the next stages in international value chains. This indicator also indicates the success of a country on the global market.
- Position of a country in the global value chain. This indicator is described as “upstreamness” or “distance to final demand” and shows whether a country is positioned more at the beginning or more toward the end of value chains.
- The combination of participation and positioning makes a graphic locating of the country in an X-Y diagram possible. This shows, generally speaking, that larger countries have relatively lower participation rates and are located closer to the end consumer.

## 2.4 Opportunities

Offshoring and the usage of global value chains significantly increase global prosperity. This is because the greater international division of labor and the usage of comparative advantages increase the efficiency with which global production factors can be used. In global production networks, it is possible to select the most ideal location for the production of each component in the value chain. Furthermore, productivity in the recipient countries, generally speaking, rises due to the better technological resources of multinational companies.

Theoretical models can prove these positive global effects. They also show, however, that not all countries need to profit from offshoring. This is because offshoring usually leads to a change in global market prices for end consumer goods, the components of which are relocated abroad. Consequently, from the perspective of a country, it can occur that the global market prices of its exported goods (for end consumption) will fall relative to the global prices for its imported goods. This deterioration in the terms of trade, when viewed in isolation, leads to a loss of prosperity for the country. This effect can theoretically overcompensate the advantages of offshoring resulting from a better division of labor. Without a change in the terms of trade, the two countries participating in the offshoring (in a two country model) will be in a better or at least not worse position (Pareto improvement). With a change in global market price relationships, this is the case in at least one of the two countries.

However, it is necessary to consider that the traditional trade models under consideration do not reflect all the positive impacts of economic integration (Busch/Matthes, 2016). For example, a higher level of intensity in competition, a greater choice of products (in the case of intermediate goods) and a transfer of technology will improve the prosperity of a country that relies more on offshoring and participation in international value chains. In fact the theoretical and empirical proof for this thesis can be shown in a more in-depth analysis. From a theoretical point of view, it appears sensible to distinguish between two different motives:

- If offshoring takes place primarily due to cost reasons, a noteworthy analogy can be made. This is because the productivity of the offshored production factor increases, which is a similar effect as technical progress has (Jones/Kierzkowski, 1990; Grossman/Rossi-Hansberg, 2008). The offshoring

company saves labor costs, for example, through the relocation of low qualified activities. This results in an increase in the productivity of low qualified work because the same output can be produced at lower labor costs. If the same quantity of low qualified work (now abroad instead of domestic) is needed, the effect of the offshoring is equivalent to factor-augmenting technical progress.

- If participation in global value chains should also facilitate access to more or better intermediate goods, other positive effects occur from a theoretical perspective (Miroudot et al., 2009; Goldberg et al., 2010). Accordingly, larger imports of intermediate goods may lead to a transfer of technology, facilitate access to products with a better price-performance ratios and simplify the manufacturing of end products through greater complementarities due to the larger choice of supplier products. Furthermore, the intensity of competition increases from the perspective of domestic producers of intermediate goods. This also puts pressure on their prices and increases the incentives for companies to produce more efficiently and become more innovative. These effects are important in particular for developing and emerging countries, which profit immensely from integration in international value chains (Baldwin, 2016). These positive impacts may also play an important role for more developed countries. Accordingly, Miroudot et al. (2009) make it clear that the majority of trade in intermediate goods takes place between OECD countries. It appears plausible to assume that not only cost motives play a role in this.

Numerous analyses provide empirical evidence of the positive impact of participation in global value chains. Here it is only possible to provide a short overview of the findings in selected studies:

- On the macroeconomic level, it can be seen that various indicators for integration in global value chains are positively connected to economic growth (IW Köln/IWConsult, 2016).
- In an analysis of eleven sectors for 29 OECD countries, Miroudot et al. (2009) show that more imports of foreign intermediate goods are associated with higher labour productivity (also see OECD, 2012, in this regard). They explain these effects by better access to technology and greater efficiency in the input factor. Formai et al. (2016) come to similar conclusions, also in a multi-country analysis.
- On the basis of international input-output data, Kummritz (2015) shows for many countries that,

generally speaking, the value added of sectors is higher, the more they are integrated into global value chains.

- In sector analyses, a number of authors also show positive productivity effects for individual countries – Amiti and Wei (2009) for the United States (US), Michel and Rycx (2014) for Belgium, and Agnese (2013) for Japan. The results tend to suggest that the offshoring of services is associated with a greater productivity impact than the shifting of material inputs.
- A number of studies examine the subject on the corporate level and show significant improvements in productivity as a result of an increase in the purchase of intermediate goods. Stone and Shepherd (2011) show this for multiple countries. Company-related studies on individual countries have also produced findings in the same direction, for example, on Canada (Baldwin/Yan, 2014), Spain (Kohler/Smolka, 2009), Denmark (Bandick, 2014), Ireland (Görg/Hanley, 2009) and Hungary (Halpern et al., 2015). Bandick differentiates by countries of origin in intermediate consumption and finds a positive correlation to higher productivity only with imports from high income countries.
- Positive productivity effects also have an impact on competitiveness and export performance. The OECD (2013) shows, for example, that inclusion in global value chains is associated with a higher domestic value added content in (higher) domestic exports and thus with a more intensive export specialization.

## 2.5 Risks

The increasing significance of global value chains is discussed critically at times, however. There are fears that developed countries will turn into bazaar economies through the relocation of production and hollow out their economies as a result. A negative impact on the labor market is also feared as a result of offshoring.

The bazaar thesis states that Germany and other industrialized nations will increasingly become only a pass-through for products and intermediate goods manufactured abroad (Sinn, 2005). The domestic country benefits less and less from export success according to this view. As alleged proof, the increase in the share of imports in Germany's exports is cited. The bazaar thesis can be significantly relativized, however. It is true that a larger share of German exports is no longer due to domestic value added. But the fact that domestic value added is combined more with cheap foreign labor through cost-saving offshoring increases the competitiveness of the German economy

(see chapter 2.4). As a result, total German exports have increased substantially. The cake has become larger, so to say, and Germany is clearly profiting from it. Accordingly, the share of domestic value added contained in German exports has increased substantially over time, not fallen, as the lower share of exports seems to suggest. Receiving a smaller share of the cake therefore means in this case that one's own piece has become larger nonetheless because the cake grew substantially larger overall. This positive evidence applies to Germany, but also to the European Union (EU) as a whole (IW Köln/IW Consult, 2016). For this reason, it is wrong to speak of a hollowing-out of the economic structures.

Because offshoring, tends to increase productivity and competitiveness, the concern that there will be substantial losses in employment on the macroeconomic level is also exaggerated (Matthes (2008), OECD (2013), Wright, (2014), Andersson et al. (2016), Hummels et al. (2016) und Ornaghi et al. (2017)). The empirical evidence proves this. A still small number of studies have come to the conclusion that offshoring can even have positive effects on employment overall. However, there are also a few studies that have found negative impacts on employment because in the observed cases the direct effect of layoffs on account of the relocation of production overcompensates for the indirect positive effects of productivity. Overall, however, the studies mostly show only a minor impact on employment in the one direction or the other due to opposing effects.

Even if the net effect is positive from a macroeconomic perspective, offshoring can certainly put pressure on employees with lower qualifications and performing routine activities. This is because, industrialized countries specializing in comparative advantages, tend to relocate low-qualified jobs and routine activities to lower wage countries in order to profit from low labor and production costs there. By contrast, the domestic economy focuses more on higher-qualified and complex activities.

In reality, the empirical evidence shows quite clearly that offshoring leads to a commensurate shift in labor demand and thus tends to increase the wage inequality between higher and lower qualified employees (for a summary, see Harrison et al., 2011; Andersson et al., 2016; Hummels et al., 2016). In addition, some studies have pointed out that there may also be limited declines in income for the latter group (particularly in the case of routine activities) (among others, Hummels et al., 2014). This can be due to declines in wages in continued employment, in a new job or due to temporary unemployment. However, the contribu-

tion of offshoring appears to be significantly less than that of import competition (Ebenstein et al., 2015). The aforesaid empirical findings, tend to apply apply also to Germany (Baumgarten et al., 2013). A few studies focus explicitly on layoffs induced by offshoring and show in part clear losses in income – although there are certain methodological problems here. Furthermore, offshoring appears, to increase job insecurity and labor demand elasticity. The concern that the relocation of (possibly more demanding) service activities will also put pressure on more highly qualified labor has not been confirmed, however, when one looks at the data, even if the body of evidence is still small here (Ornaghi et al., 2017).

This limited amount of empirical evidence makes it clear that offshoring – like globalization in general – leads to a structural change. This change, however, is a prerequisite for economic growth and well-being due to the better usage of production factors, but can also lead to notable individual adjustment challenges. Economic policy must therefore – more than in the past – put a greater focus on the losers of globalization.

Furthermore, the use of global value chains in which very specialized foreign firms are integrated can make companies more vulnerable to shortages. This is because certain supplier products can hardly be substituted in a short period of time. Such shortages can arise not only on account of strikes at neuralgic suppliers, but also on account of natural disasters (for example, tsunami and nuclear disaster in Japan in 2011). Furthermore, countries or intermediate product suppliers can also position themselves strategically in value chains in order to gain market power in this way and put the coordinating companies under pressure.

## 2.6 Impact of protectionism

It makes a big difference whether tariffs and trade barriers are raised in a world in which only end products are imported or whether international trade is also heavily characterized by intermediate goods and international value chains. If countries only raise tariffs on end products manufactured abroad, they also tax only the foreign value added and protect domestic production as a result. In this world of traditional trade models, it can even be optimal for a large country to impose tariffs in a considerable amount (Krugman/Obstfeld, 2004). If this country demands less on the global market due to the tariffs, the prices of its imported goods will fall due to its size and its associated influence

on the global market so that its terms of trade will improve. As a result, domestic consumers suffer less from higher tariff-induced prices while the customs revenue and additional profits from domestic producers continue to have a positive impact. This view of protectionism changes fundamentally when trade in intermediate goods and international value chains are included.

First of all, domestic producers may use a significant amount of foreign intermediate goods in their products. Import duties would limit the competitiveness of these domestic manufacturers (Baldwin, 2010). For example, US punitive tariffs on German products should significantly increase the manufacturing costs of US companies that are dependent on highly specialized German machines or steel products, and cannot switch over to equivalent US products in the near term. In the EU, too, there have been controversial discussions repeatedly regarding anti-dumping policies because, for example, companies competing with solar panels from China have supported punitive tariffs. Other companies that use these products as intermediate goods suffer from this, however.

Second, protectionism would be especially damaging for products where the components and intermediate stages are processed in many countries as part of very labor-divided global production networks. If tariffs are charged each time a product crosses a country's border, the end products would become substantially more expensive. Precisely because such internationalized production processes dominate in information and communication technology, it is not surprising that the WTO succeeded in concluding a plurilateral agreement on the elimination of tariffs for such products (Information Technology Agreement – ITA).

While the ITA is mainly relevant for the region of Asia, international production networks also play a major role in the EU. This applies in particular to the automotive industry and becomes highly relevant in regard to the forthcoming Brexit. If tariffs are also introduced on automotive products in trade between the EU and the UK, there is a threat of established value chains collapsing to the detriment of the UK. According to Clepa, the European Association of Automotive Suppliers, a vehicle today consists of roughly 30,000 parts. A single one of these parts may be composed of over 30 individual components, pass through over 100 production steps in up to 15 countries until completion of the finished product and thus cross country borders multiple times (Clepa, 2017). Even if only a small tariff is imposed in each case, the entire business model is placed at risk.

Third, small EU countries would primarily be affected if the EU imposed tariffs itself as a countermeasure against new US trade barriers and thus cause a trade war to break out. This is because small countries are naturally more dependent on imports (also of intermediate goods). For example, the import content of exports in the United States and Japan is only between 13 and 15 percent, while it is over 50 percent in Ireland and Hungary (Baldwin-Lopez-Gonzalez, 2015).

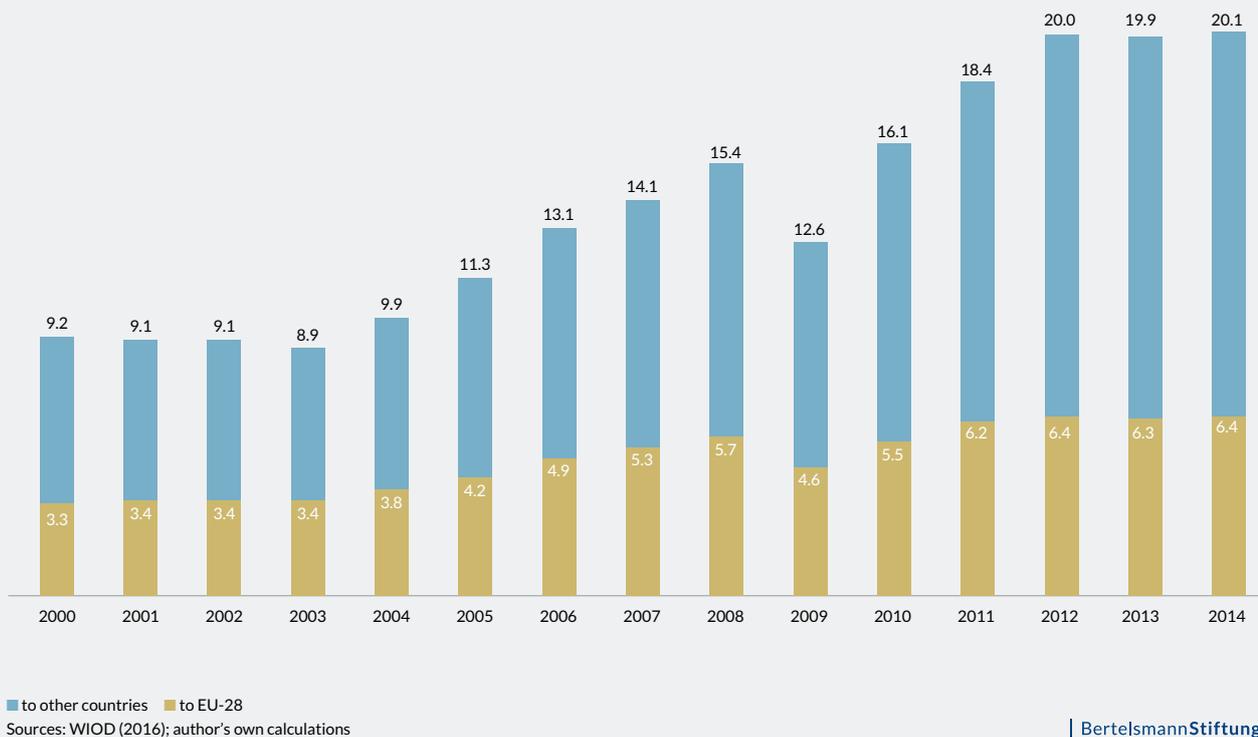
# 3 The role of Factory Europe in the global value added network

Over the last 15 years there has been a clear trend toward more globalization of value chains. Chapter 2.3 identifies various indicators that show the intensification of global value added networks on the basis of empirical data. This indicator is based on multinational input-output tables that have been available for a few years and reflect the ties between individual sectors and countries on the international level. When this study was finalized, the available basis for the data consisted of the Inter-Country Input-Output (ICIO) database of the OECD and the World Input-Output Database (WIOD), which was originally derived from the 7th Framework Program of the EU. The ICIO database contains data on 61 countries for the years 1995 to 2011. The WIOD offers metrics on 42 coun-

tries for the years 2000 to 2014. The greater proximity of the data to the current situation means that the WIOD was used as the underlying data for the following calculations.

Figure 3-1 shows the change in global purchase figures for foreign intermediate goods. They have more than doubled since 2000. To a similar degree, these findings also apply to the countries in the EU-28. The absolute number of foreign intermediate goods rose from € 3.34 billion in 2000 to € 6.4 billion in 2014. This corresponds to growth of roughly 92 percent in the last 15 years. With the exception of the economic crisis in 2009, the purchase of foreign intermediate goods has continually increased in all regions since

FIGURE 3-1: Global purchase of foreign intermediate goods in billion euros



2000. However, since 2012, we have seen a sideways movement in absolute imports of intermediate goods.

The share of foreign intermediate goods as a percentage of all intermediate goods has also increased globally over the last 15 years. This percentage rose from 14.2 percent in 2000 to 15.6 percent in 2014. During the economic crisis in 2009, the percentage of foreign intermediate goods fell to 14.8 percent worldwide. After a recovery in the foreign share of intermediate goods took place through 2011 (16.6 percent), the percentage has fallen slightly over the last few years. One reason for this is China's increasingly large share as a percentage of the global total of purchased intermediate goods. The share of foreign intermediate goods as a percentage of total purchases is not only well below average, but has also continued to fall in recent years. In 2000, 7.8 percent of the purchases of intermediate goods in China came from abroad. After this share rose to 9.5 percent through 2008, it has constantly fallen in the period after the economic crisis. In 2014, the purchase of intermediate goods from abroad was only at 6.4 percent.

To a lesser extent, the slight decline in the percentage of foreign intermediate goods has also been observed in the EU in recent years. Since 2012, the share of foreign intermediate goods as a percentage of all deliveries of intermediate goods fell from 25.4 percent to 25 percent. Before – as in other countries – steady growth in the percentage of foreign intermediate goods was observed. In the base year of 2000, the international share of intermediate goods was at 19.7 percent. Except for the year 2009, there was a continuous rise in the share of foreign intermediate goods as a percentage of all purchases through 2012.

This development allows the conclusion to be drawn that protectionism in the form of general trade barriers would have a significantly more counterproductive impact today than was the case at the turn of the millennium. The stagnation in the foreign share of purchases of intermediate goods could indicate that companies view their value chains

as largely optimized at the present time. However, this question must continue to be researched.

### 3.1 Factory Europe compared to countries abroad

If one compares the intermediate consumption ties of countries in the EU-28 with those of the other two regional networks of North America and Asia in aggregate, it can be seen that the inter-regional density of intermediate goods is similarly intensive in the three hubs. In Europe, 89.6 percent of the purchases of intermediate goods come from the same region; in North America and Asia they are 92.1 percent and 92.6 percent, respectively, and thus roughly 3 percent higher (table 31). The domestic purchases of intermediate goods are included, however.

If we look at cross-border intermediate consumption within the respective regions, the EU-28 is significantly more interwoven. In Europe, trade in intermediate goods between individual countries in the region is substantially more developed. While in Asia only 2.6 percent of the intermediate goods come from the regional abroad, this figure is 14.6 percent of intermediate goods in Europe. Furthermore, the regional ties in intermediate consumption in the EU have developed significantly more dynamically than in the two comparative regions. While the percentage of intermediate goods from the regional abroad in Asia and North America has hardly changed over the last 15 years, it has increased by 3 percentage points in Europe. The EU Single Market undoubtedly plays an important role.

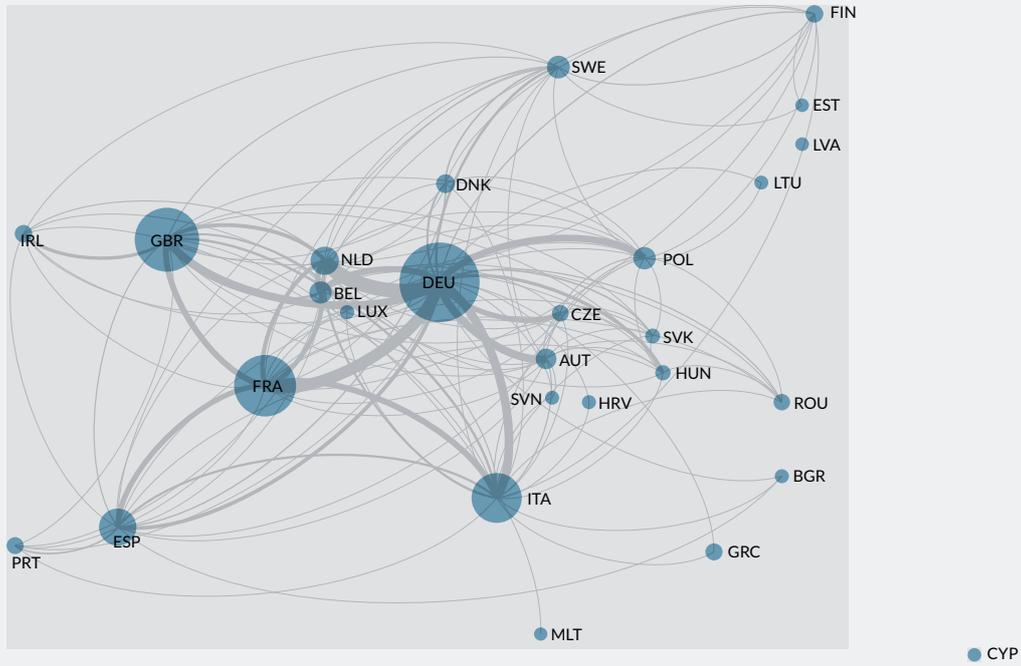
Another reason for the intensification of European ties in intermediate consumption is the stronger integration of central and eastern European (CEE) countries in the European value chains. In 2000 countries in central and eastern Europe accounted for only 13.9 percent of the inter-regional trade in intermediate goods within Europe. In 2014 this

TABLE 3-1: Purchases of intermediate goods by regional network

|                            | 2000        |               |             | 2014        |               |             |
|----------------------------|-------------|---------------|-------------|-------------|---------------|-------------|
|                            | EU-28       | North America | Asia        | EU-28       | North America | Asia        |
| <b>Internal / Regional</b> | <b>91.9</b> | <b>93.9</b>   | <b>93.1</b> | <b>89.6</b> | <b>92.1</b>   | <b>92.6</b> |
| of which: Domestic         | 80.3        | 90.2          | 90.5        | 75.0        | 87.6          | 89.9        |
| of which: Regional abroad  | 11.6        | 3.8           | 2.6         | 14.6        | 4.5           | 2.6         |

North America: Canada, United States, Mexico, Asia: China, India, Indonesia, Japan, Korea, Taiwan  
Sources: WIOD (2016); author's own calculations

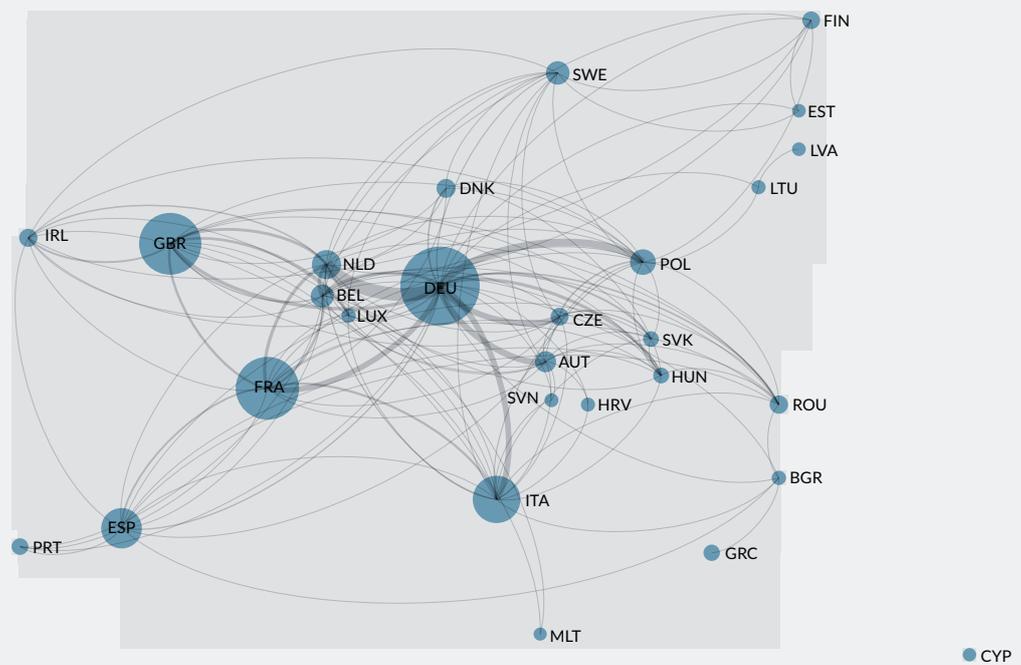
FIGURE 3-2: Intermediate consumption ties in Europe in 2014



Figures in billion euros – Size of nodes on the basis of national value added – Threshold for illustrated ties: €2 billion  
Sources: WIOD (2016); author's own calculations

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FIGURE 3-3: Growth of intermediate consumption ties in Europe from 2000 to 2014



Figures in billion euros – Size of nodes on the basis of national value added – Threshold for illustrated ties: €1 billion  
Sources: WIOD (2016); author's own calculations

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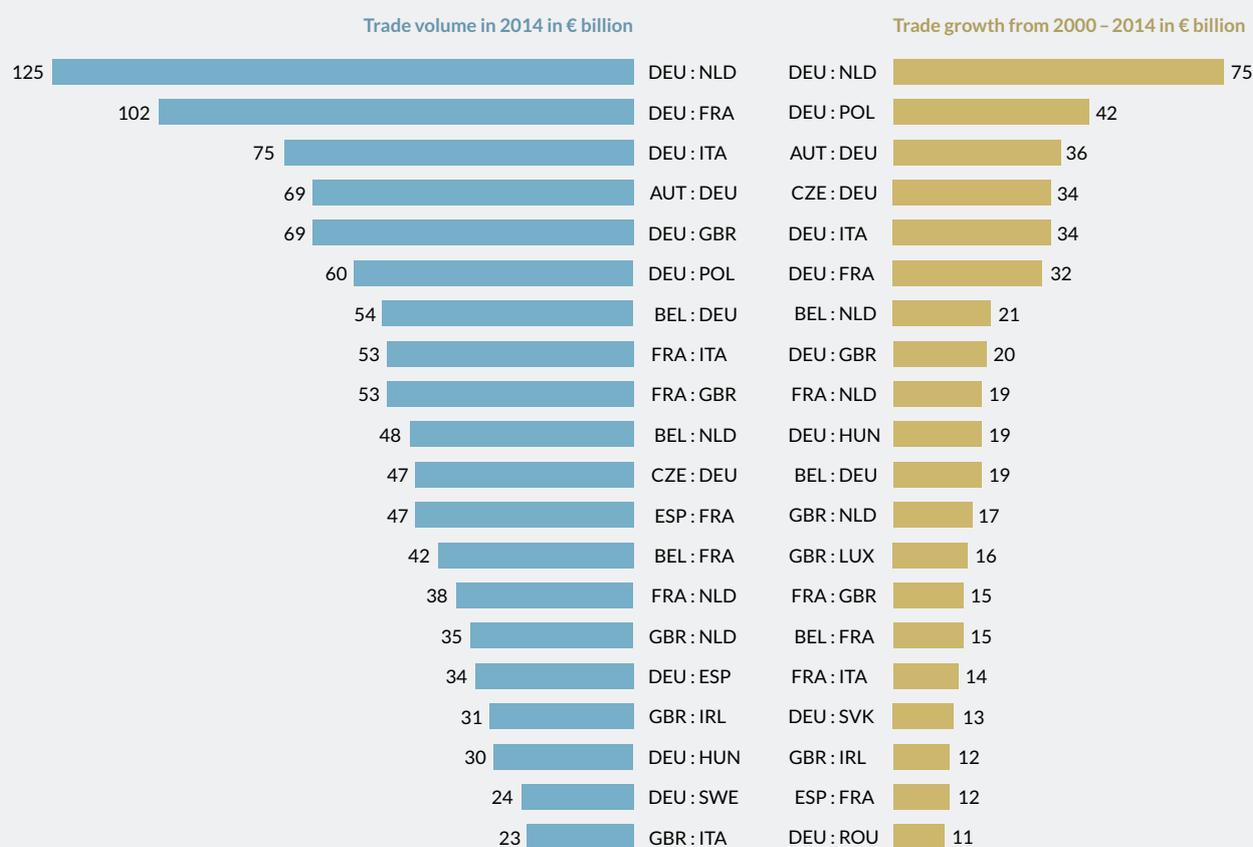
percentage had more than doubled to 28.9 percent. But the largest European economies, Germany, France, the United Kingdom and Italy, have also continued to network dynamically in European value chains over the last 15 years. These four countries are involved in 17 of the 20 bilateral ties in intermediate consumption with the largest growth in absolute terms from 2000 to 2014. Figure 3-2 shows the ties in intermediate consumption for the EU-28 in 2014. As can be seen there, the large national economies stand at the center of the European value added network.

Germany, due to its position at the heart of Europe, assumes a special place in the integration of CEE countries. Since 2000 Germany's trading in intermediate goods with countries in central and eastern Europe has increased by roughly €128 billion. That equates to 14.4 percent of total growth in inter-regional European trade of intermediate goods. In total, the Germany economy participated in 44.2 percent of the growth in inter-regional trade of intermediate goods in

Europe. This shows how intensively the German economy – benefiting from the EU Single Market and the EU expansion to the east – could be networked with European partners.

Figure 3-3 shows in chart form the growth of trade in intermediate goods between the countries of the EU-28. It can be seen that the growth in trading of intermediate goods by countries in central and eastern Europe largely took place with Germany as the main trading partner. As a percentage of the total growth of trade in intermediate goods by all EU countries with countries in central and eastern Europe, Germany accounted for €128 billion or 36.8 percent of the increase in the volume of trade in intermediate goods. In comparison to this, direct trade in intermediate goods between individual CEE countries only increased by roughly €57 billion (16.4 percent of the growth in CEE). The other large European countries also intensified their trade with the countries of central and eastern Europe over the last 15 years. Italy has seen its trade grow by €28.5 bil-

FIGURE 3-4: The 20 largest intermediate consumption ties in 2014



Sources: WIOD (2016); author's own calculations.

lion. France has increased its trade in intermediate goods with CEE countries by € 22.8 billion, while the United Kingdom has raised its deliveries and purchases of intermediate goods from central and eastern Europe by € 15.5 billion.

Figure 3-4 shows the 20 largest ties in intermediate consumption between the countries in the EU-28. In an absolute analysis and from a dynamic point of view, the most intensive ties in intermediate consumption have been between Germany and the Netherlands over the last 15 years. Above all in the chemical, machinery and refinery sectors there have been intensive ties in intermediate consumption between the two countries. There are also tight intermediate consumption networks with other European countries. Germany is directly involved in the seven largest bilateral intermediate consumption relationships in Europe.

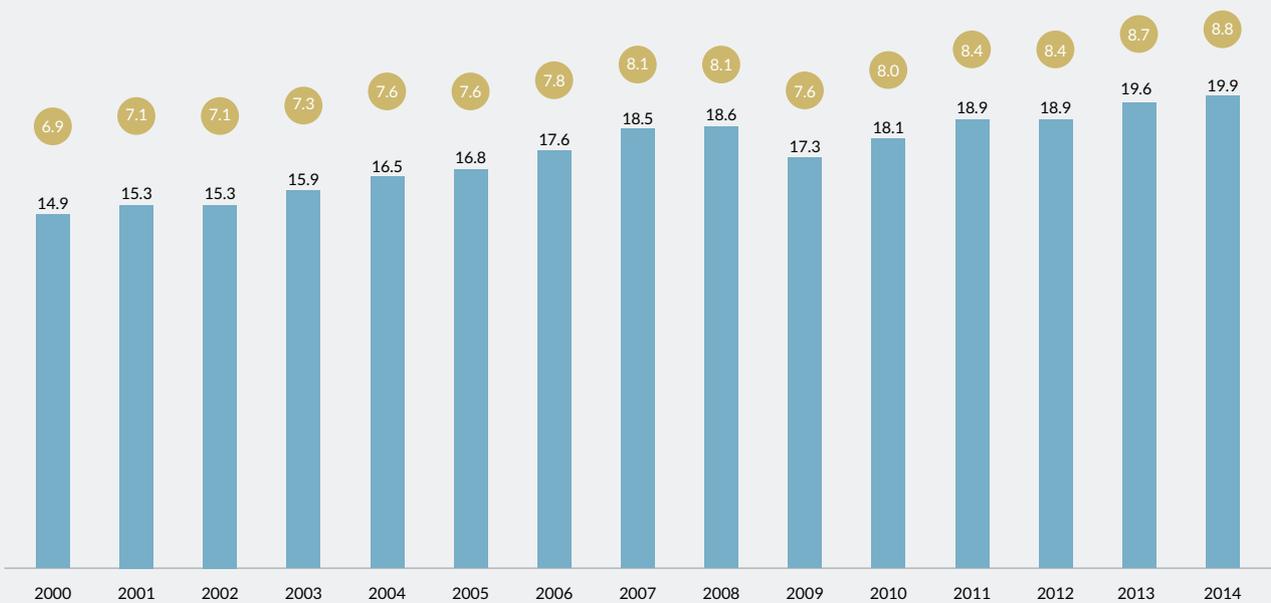
### 3.2 Employment effects of inter-regional intermediate consumption networks

The European value chains have achieved increasing relevance for employment in Europe over the course of time.

In 2014 roughly 227 million people were employed in the countries of the EU-28 according to information provided by Eurostat (2017). That is 5.4 percent more than in 2000. At the same time, the total population in the period under consideration increased by only 4.1 percent. This means that a larger share of the population in Europe is integrated in the labor market. The intensifying of European value added networks made no small contribution to this employment growth. In 2000 roughly 14.9 million jobs in the EU-28 were based on demand for intermediate goods from the EU abroad. In 2014 this figure had increased to 19.9 million people. That represents a significant rise of one-third over the last 15 years and is thus substantially above the average employment growth in the EU.

This metric measures the domestic employees of each of the countries in the EU-28 that are dependent directly as exporters of intermediate goods to the European abroad or work along a value chain that produces a final product in a neighboring European country. Therefore, it measures how many people are employed domestically by the ties with production in other countries of the EU-28. In the process, it is necessary to remember that solely the direct and indirect intermediate consumption ties were considered rather

FIGURE 3-5: Employment effects in inter-regional intermediate consumption network in the EU-28



■ EU-28, figures in millions of employed people ● percentage  
 Indirect employment effects through the purchase of intermediate goods in EU neighboring states  
 Absolute employment numbers for Croatia from 2000 to 2007, estimate  
 Sources: Eurostat (2017); WIOD (2016); author's own calculations

than the jobs that depend directly on the export of end products manufactured in the national domestic country.

Figure 3-4 shows the development of jobs due to European intermediate consumption networks over the course of time. This shows that both the absolute number of employees in European value chains and the share of these employees as a percentage of total people employed in Europe has constantly increased. The percentage of employees in European value chains rose to 8.1 percent of the workforce through 2008. After a brief drop during the economic crisis in 2009 (7.6 percent), the pre-crisis level was clearly passed once again in 2011 with a total of 8.4 percent of the workforce. Since then, inner-European partnerships have intensified even more.

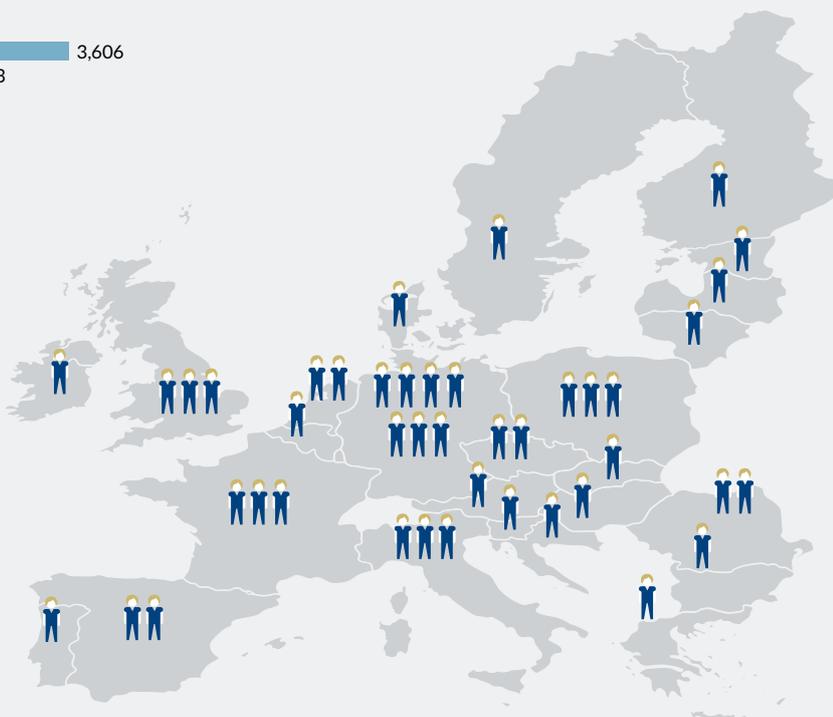
Figure 3-5 shows the regional distribution of employees in these value added networks. The number of people working in German companies that produce intermediate goods for the European abroad is the largest at roughly 3.6 million employees. In Poland, this number is the second highest at roughly 2.1 million employees, although Poland is smaller than France, the United Kingdom and Italy when measured in terms of gross domestic product.

The intermediate consumption ties with other European partners are of different degrees of importance for the national labor market from country to country. While roughly every fifth employed person in the Czech Republic or 19.8 percent of the labor force works directly or indirectly as a supplier of intermediate goods for other European partners, only roughly every twentieth employed person in Greece, or 2.7 percent of the labor force, works as a supplier for European value chains. Not only the geographic location, but also the quality of economic policy conditions play a role in determining whether integration in the European value chains succeeds.

The differences can also be explained by other factors. In regard to inter-regional value added networks, smaller countries, generally speaking, have a larger percentage of the workforce in this area primarily because they are naturally more open to trade. The share of industry that uses international value chains more as service providers also plays an important role for the amount of the employment effects. Therefore, it is not surprising that the observed share of employees is higher above all in small, industry-heavy countries of central and eastern Europe and in the Benelux countries than in the larger western European

FIGURE 3-6: Distribution of employment effects in inter-regional intermediate consumption network in 2014

|                |       |
|----------------|-------|
| Germany        | 3,606 |
| Poland         | 2,093 |
| France         | 1,709 |
| United Kingdom | 1,700 |
| Italy          | 1,543 |
| Netherlands    | 1,404 |
| Czech Republic | 1,011 |
| Romania        | 960   |
| Spain          | 914   |
| Hungary        | 714   |
| Belgium        | 654   |
| Austria        | 504   |
| Bulgaria       | 502   |
| Slovakia       | 381   |
| Sweden         | 367   |
| Portugal       | 325   |
| Ireland        | 221   |
| Denmark        | 201   |
| Finland        | 194   |
| Croatia        | 162   |
| Slovenia       | 157   |
| Lithuania      | 134   |
| Latvia         | 109   |
| Greece         | 108   |
| Estonia        | 86    |
| Luxembourg     | 73    |
| Cyprus         | 33    |
| Malta          | 16    |

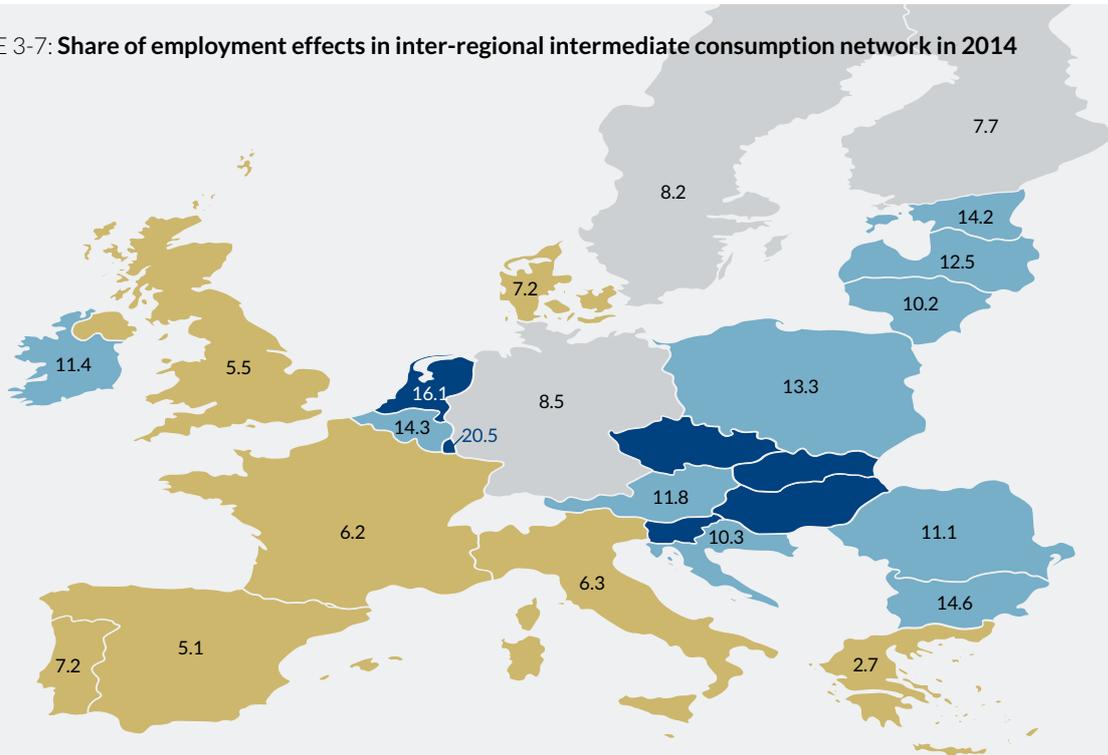


Figures in thousands of employed people

Sources: Eurostat (2017); WIOD (2016); author's own calculations

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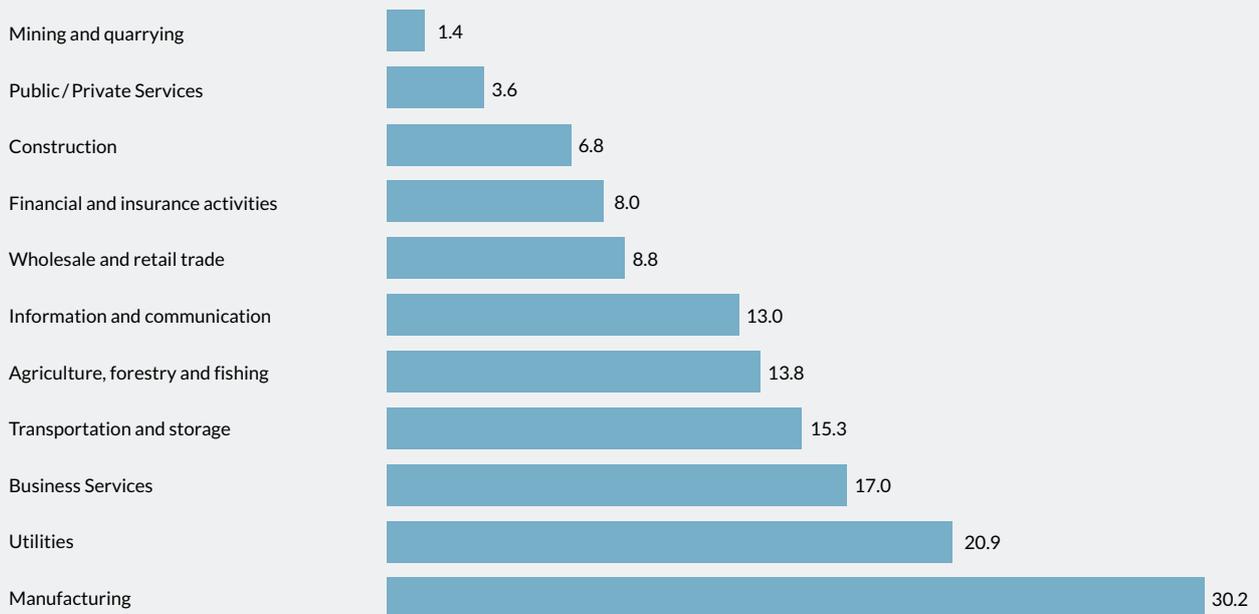
FIGURE 3-7: Share of employment effects in inter-regional intermediate consumption network in 2014



People employed through inter-regional deliveries of intermediate goods:  
 ■ Below 7.5 percent ■ 7.5 to less than 10 percent ■ 10 to less than 15 percent ■ More than 15 percent  
 Sources: Eurostat (2017); WIOD (2016); author's own calculations

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FIGURE 3-8: Employment effects in inter-regional intermediate consumption network by sector



Figures as a percentage of total employees in the industry, weighted average of EU-28  
 Sources: Eurostat (2017); WIOD (2016); author's own calculations

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countries like France and Spain. In the United Kingdom, it also plays a role that the relevance of the manufacturing industry is quite minor there. Nonetheless, an impressive, roughly 1.7 million British jobs depend on sales of their own intermediate goods to European neighbors.

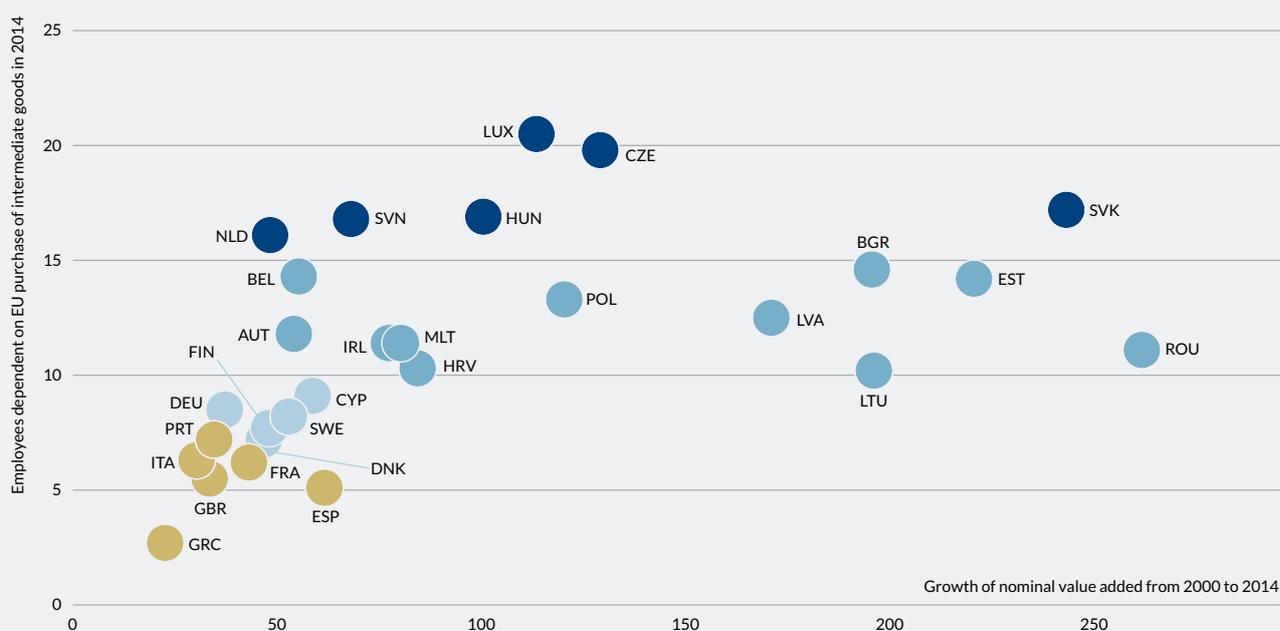
The sector structure of individual countries also potentially has an influence on the employment associated with intermediate deliveries to partner companies in the EU neighbor states (figure 3-7). Accordingly, companies in mining do business especially as suppliers of intermediate goods for other European partner companies. 30.2 percent of the jobs in the sector are based on production in the European abroad. Companies in the manufacturing industry are also intensively integrated into the European value chains. Roughly every fifth job or 20.9 percent is accounted for directly or indirectly by production for European neighbor states. The energy sector, providers of business service and the logistics industry profit most intensively from demand coming from the European abroad.

In the countries of the EU-28, however, there are tremendous difference on the sector level, which relate to direct and indirect employment effects of inter-regional value

chains. If we consider the manufacturing industry, the employment effect is especially high at 38.6 percent of employed people in the Czech Republic. In Hungary, Slovakia and Slovenia, more than every third job in the manufacturing industry depends on production in neighboring European countries. By contrast, the employment effect in the manufacturing industry is again especially low in Greece. Here, only 6.5 percent of employees in the industry are dependent on demand for intermediate goods from the European abroad. In Germany, the amount was at 20.4 percent of employees in the industry in 2014.

If we consider the share of employees dependent on inter-regional ties in relation to the growth of national value added (figure 3-8), a positive connection can be seen between economic growth in individual countries and their inter-regional ties in the EU. Countries where a larger share of the employees depend on demand for intermediate goods from the European abroad have seen stronger growth, generally speaking, over the last 15 years than countries that only have limited employment leverage here. This connection again suggests that integration into European value chains has a positive impact on a country's own economy.

FIGURE 3-9: Distribution of inter-regional employment effects and economic growth



Figures as a percentage: ● Below 7.5 percent ● 7.5 to less than 10 percent ● 10 to less than 15 percent ● More than 15 percent  
Sources: Eurostat (2017); WIOD (2016); author's own calculations

FIGURE 3-10: Fact sheet for the United Kingdom (UK)



Value added in 2014  
€ 2,010 billion



Intermediate consumption ties in 2014

National  
€ 1,533 billion  
+ 31.5 percent



Inter-regional  
€ 326 billion  
+ 48.8 percent



Germany  
€ 69 billion  
+ 41.8 percent



China  
€ 27 billion  
+ 426.8 percent



Growth from 2000 to 2014  
92.2 percent



Dependent employees in regional production networks  
1.7 million employed people  
+ 18.3 percent

Sources: Eurostat (2017); WIOD (2016); author's own calculations

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All in all, it becomes clear once again in these significant employment effects of inter-regional European networks in intermediate consumption how closely the cross-border division of labor in production is and how much Europe has grown together economically in the course of the Single Market and its expansion – for the advantage of all and in particular also employees. Protectionism and new trade barriers would act like sand in the gears of this flowering Factory Europe.

In all likelihood, the United Kingdom will feel this in a negative regard when it leaves the EU Single Market and the Customs Union. The consequences of the Brexit for cross-border value chains between the British Island and the Continent will be even more severe if there is no ambitious free trade agreement, as currently sought, but rather customs are reintroduced after a possible failure of negotiations.

### 3.3 Development of value chains in selected countries

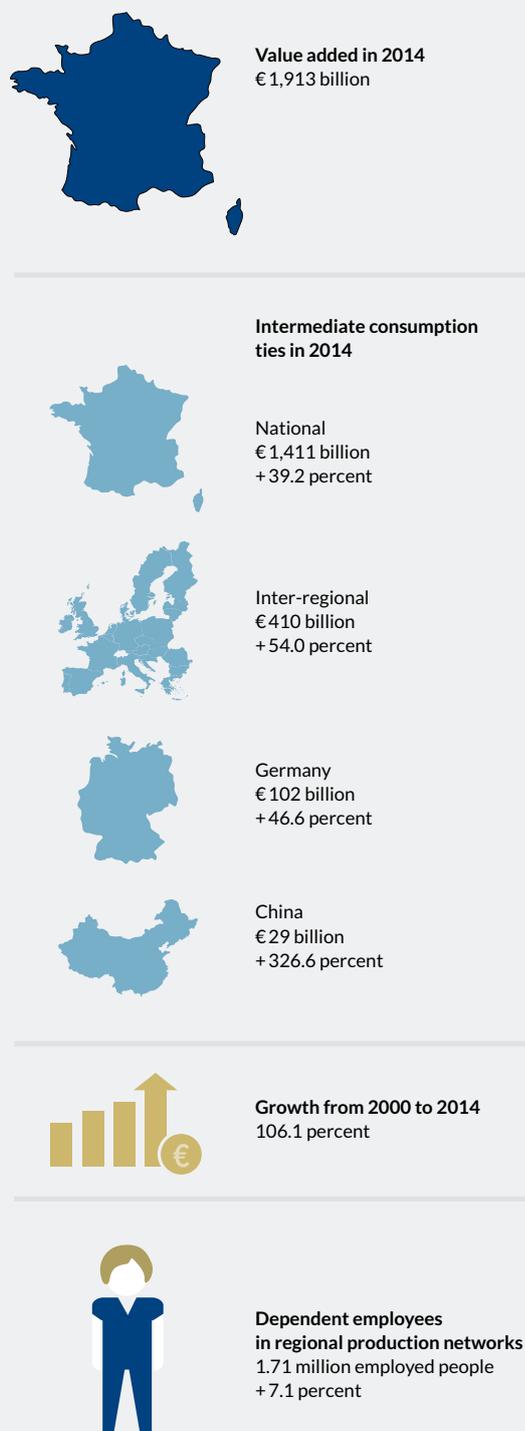
In the following, the status and development of value added networks in individual selected countries will be analyzed. Both the importance of regional networks for intermediate consumption and the role of Germany as a trading partner will be examined in more detail. The results from chapter 3.2 have showed that the regional networks for intermediate consumption can have a strong positive impact on employment through the economic success of the regional partners. Regions using these connections effectively are more successful than others, generally speaking.

#### United Kingdom

The United Kingdom is one of the largest economies in Europe and an important node in the European value added network (also see figure 3-2). € 326 billion or 14.6 percent of the United Kingdom's trade in intermediate goods takes place with other EU countries, although the pure domestic trade in intermediate goods is included in the metric here. In regard to only foreign trade in intermediate goods, the other EU countries account for a share of roughly 47 percent from the perspective of the UK. This shows how much trade barriers that could be set up in the course of the Brexit would damage both sides, but above all the United Kingdom and its integration into European value chains.

At roughly € 69 billion, Germany is the largest regional trading partner in intermediate goods. Trade in intermedi-

FIGURE 3-11: Fact sheet for France



Sources: Eurostat (2017); WIOD (2016);  
author's own calculations

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ate goods with Germany has increased by 41.8 percent over the last few years, somewhat less than with other countries in the EU-28 overall. The bilateral intermediate consumption relations with Germany were described by Busch (2017) in detail. It can be seen that certain sectors such as the British automotive or pharmaceutical industry have an especially strong connection to European neighbors.

Despite the planned departure from the EU, trade with European neighbors possesses particular importance for the British economy. With 1.7 million employees, 5.5 percent of the jobs in the United Kingdom are based on production in neighboring European countries. This figure does not take account of deliveries for consumption and investments. They made up another € 68 billion in 2014. Consequently, the EU is a very important partner both as a supplier of intermediate goods and as a buyer of end products and intermediate products. This shows again how damaging the Brexit may be for both sides.

Outside of the EU, the United States is the United Kingdom's largest trading partner. With a volume of intermediate consumption totaling roughly € 70 billion, the United States is the largest national trading partner. Trade in intermediate goods with China has also developed especially dynamically. Since 2000 intermediate consumption here has grown by 426.8 percent. However, the three largest trading partners, the United States, Germany and France, continue to be from established industrialized nations.

### France

France has the third largest economy in Europe with national value added of € 1,913 billion. With inter-regional purchases and deliveries of intermediate goods in the amount of € 410 billion, just under every fifth euro is accounted for by trading intermediate goods with a European partner. As in other countries of Europe, the inter-regional ties in France have developed more dynamically within the EU than national and international intermediate consumption ties. Roughly 58 percent of trade in international intermediate goods takes place with countries in the EU.

The largest suppliers of France's intermediate goods are Germany, the United States and Italy, making up collectively € 122.3 billion. The largest national buyers of French intermediate goods are Germany, the United Kingdom and Spain, accounting for a collective total of € 94.8 billion. In total, intermediate goods in the amount of € 186 billion are delivered to other countries in the EU. In this way, 1.71 mil-

FIGURE 3-12: Fact sheet for Germany



**Value added in 2014**  
€2,627 billion



**Intermediate consumption ties in 2014**

National  
€1,974 billion  
+35,4 percent



Inter-regional  
€800 billion  
+96.3 percent



China  
€75 billion  
+641.3 percent



**Growth from 2000 to 2014**  
97.6 percent



**Dependent employees in regional production networks**  
3.6 million employed people  
+33.4 percent

Sources: Eurostat (2017); WIOD (2016); author's own calculations

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lion jobs have been secured in France. In addition to this, there are capital expenditures and consumer goods totaling €113.6 billion, which are delivered to EU neighbors and directly secure additional jobs in France.

**Germany**

Germany is not only the largest national economy, but also one of the central hubs in the European value added network with its national value added of €2,627 billion. €800 billion or roughly every fourth euro in inter-regional trade is generated with European partners. As both a supplier and buyer of European intermediate goods, Germany has seen much more dynamic growth here than in the trade of national intermediate goods. Inter-regional ties in intermediate goods have almost doubled, with growth of 96.3 percent. Both purchases and deliveries of inter-regional intermediate goods, at roughly €400 billion, have grown by a comparable amount.

The largest supplier of Germany's intermediate goods is the Netherlands, accounting for €118 billion. France and the United States follow with roughly €41.6 billion and €38.2 billion, respectively. As sales markets for German intermediate products, international markets play a particularly large role. After France, the United States and China, with a collective total of €93.6 billion, are the largest buyers of German intermediate goods. Germany is thus an important supplier for production in the American economy. Protectionist measures could threaten these established value chains and thus increase the costs of American products for the same quality. If trade barriers are set up, the competitiveness of American companies in these value chains will be placed at risk.

**USA**

The United States has the largest national economy in the world with value added of €13,076 billion. In recent years, the US economy has increasingly globalized. While intermediate consumption ties grew only 11.2 percent domestically over the last few years, inter-regional trade with Canada and Mexico has increased by 40.3 percent to €530 billion since 2000. Trade in intermediate goods with Germany also increased by 49.2 percent to €89 billion.

Nonetheless, the United States remains a relatively domestically-oriented country. It has a strong national network, with 82.1 percent of trade in intermediate goods and 89.7 percent of purchases in intermediate goods being domestic. Nonetheless, roughly 1.7 million jobs in the

FIGURE 3-13: Fact sheet for the United States (US)



Value added in 2014  
€ 13,076 billion

Intermediate consumption ties in 2014



National  
€ 9,168 billion  
+ 11.2 percent



Inter-regional  
€ 530 billion  
+ 40.3 percent



Germany  
€ 89 billion  
+ 49.2 percent



China  
€ 148 billion  
+ 530.3 percent



Growth from 2000 to 2014  
68.7 percent



Dependent employees in regional production networks  
1.7 million employed people  
+ 1.8 percent

Sources: OECD (2017); WIOD (2016); author's own calculations

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United States are based on production in the neighboring states of North America. Europe is also an important trading partner. In 2014 intermediate goods totaling € 243.8 billion as well as consumer goods and capital expenditures of € 97.6 billion were delivered to countries in the EU-28. The production ties with Europe consequently secure another two million jobs in the United States indirectly through production in Europe. Half of these employees come from companies in the manufacturing industry and services closely connected to companies. As a result, in terms of the total number of dependent employees, Europe is even more important for the United States than its two geographic neighbors. Consequently, it is clear that the United States would also damage itself by erecting trade barriers against the EU.

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