THE STRUCTURAL TRANSFORMATION OF BILATERAL TRADE RELATIONS BETWEEN GERMANY AND TURKEY*

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Abstract

The present study demonstrates that there is a structural change in the bilateral trade relationship between Germany and Turkey, and the key to understanding this change lies in the growing importance of production-sharing in which Turkish firms become increasingly integrated in global production chains, and German firms establish assembly bases and production platforms for outsourcing activities. Production sharing gives rise to the emergence of new forms of trade such as parts and components (P&C) trade and vertical intra-industry trade (VIIT). Germany specializes in medium technology sectors such as motor vehicles and machinery and so far has been able to adapt to the changing conditions in the global economy by transforming its production and trade patterns through shifting certain segments of the production processes to low-cost locations and focusing on R&D.

The study focuses on commodity groups in which production sharing is expanding globally, as well as between Germany and Turkey. These commodity groups are classified under HS84-92. Following the methodology in Fontagné & Freudenberg (1997), the study assesses the relative importance of one-way trade and intra-industry trade in bilateral flows between Germany and Turkey. This methodology also enables us to measure and classify intra industry trade flows as horizontal (HIIT) and vertical (VIIT) and lower quality VIIT and higher quality VIIT.

Our calculations at the 6 digit HS classification of trade data reveals that Germany's final good exports are mainly one-way whereas Turkey's final good exports mostly follow a one-way trade pattern or low quality VIIT. We also find that there is a marked rise in P&C trade, and that VIIT is the dominant trade type in this category. German P&C exports are either high quality VIIT or one-way. Conversely, Turkey's P&C exports are mainly VIIT of low quality products.

Among the sectors analyzed in the study, the motor vehicles industry is by far the largest category in both final goods and P&C. Moreover, trade is concentrated in a few commodities in this sector. Ranking HS 84-92 product categories

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in terms of volume shows that the top 20 products Germany imported from Turkey accounted for 64% of the total. The top 20 products Germany exported to Turkey account for 46% of the total; although the total number of traded products was 1,029 in 2013. It is also possible to make inferences on the nature of production sharing in this sector. Turkey exports specific parts of engines to Germany, where they are processed, and then engines and other high value added parts (such as gear boxes and drive axles) are exported to Turkey.

Based on the findings of the study, one can conclude that the structural change in Turkish exports to Germany from low technology-labour intensive sectors like textiles and leather to medium technology sectors like machinery and motor vehicles is realized by specialisation in the low price-low unit value segments of these sectors.

Introduction

Since the rise of Germany as the major economic power in Europe, bilateral trade and specialization patterns between this country and Turkey has always followed the general trend where the biggest and strongest economy, coupled with geographical proximity is the major trading partner of the smaller country. During the past two decades, in line with the changing specialization and trade patterns in the global economy, bilateral trade between Germany and Turkey underwent considerable structural transformation. The aim of this paper is to indicate and provide evidence for the said transformation in terms of trade data.

The analysis is based on three pivotal dates, 1993, 2003 and 2013. These dates represent turning points in the Turkish economy as well as global trade. 1993 is our starting point, where globalization already had significant effects on trade patterns but did not yet cause changes in production patterns such as outsourcing or fragmentation. 1993 also marks the beginning of the Single Market in Europe. This is also a date representing the state of the Turkish economy prior to the EU-Turkey Customs Union Agreement. 2003 marks the beginning of a new era in the Turkish economy where the structural reforms of previous years, coupled with a strong single party (Justice and Development Party or AKP) rule, led to structural changes in industry. The EU enlargement to Central Europe came right after and the four countries in the region (Czech Republic, Hungary, Poland, Slovakia) became the most dynamic group in German trade and production relations. The second half of our period of analysis (2003-2013) is characterized by the influence of the full force of globalization on trade and production patterns, and the full fruition of the EU-Turkey

Customs Union Agreement. The Financial Crisis and the ensuing recession are left outside the scope of our study.

By the year 2013, Germany was the top destination of Turkish exports (9.0 % of total) and the third largest source of Turkey's imports (9.6 %) after Russia and China (TURKSTAT, 2014). Germany was the fourth largest economy in the world. It was also the third largest exporter and importer. In line with the relative sizes of the two economies, Turkey ranked 14th among Germany's export destinations and 18th among countries from which Germany imports. Turkish imports from Germany equaled $24.2 billion, and Turkish exports to Germany equaled $13.7 billion. This trade gap ranked Turkey as 6th among the countries contributing positively to the German trade surplus (Statistisches Bundesamt, 2014).

In the remainder of the study, the first part outlines the position of German and Turkish manufacturing industries in the global economy. The second part presents some stylized facts on German manufacturing production and trade. The third part is about the general features of bilateral trade flows between Germany and Turkey. The fourth part is devoted to an in depth analysis of German-Turkish bilateral trade flows and focuses on a certain segment of the manufacturing industry which constitutes the highest growing component of global trade and is subject to pronounced production shifts worldwide. We end the study with some concluding remarks.

1. The Position of German and Turkish Manufacturing Industries in the Global Economy

The manufacturing sector has a pivotal role in Germany's presence in the global economy. For many years the share of manufacturing value added in GDP is a stable 21%, the highest among the large developed countries. Table 1 reveals that during the two decades covering 1997-2017, the share of manufacturing value added is decreasing in US and in Japan. Similarly, comparison of Germany with US and Japan over over the same period shows that the share of manufacturing exports in the global total decreases for US and Japan but is rather stable for Germany (*Please refer to Table 1*.)

Parallel to the shifting position of large advanced countries as traditional suppliers of manufacturing exports, emerging economies enjoyed increasing shares in world trade. We present South Korean and Mexican figures for comparison purposes in order to asses Turkey's position in manufactures. In 2017, with the exception of US, the share of manufactures in total exports is above 80% in all of the countries in

concern. However, despite the rise of manufacturing exports in emerging economies, the share of these countries in the world market is small. During the two decades, although Turkey's share almost doubled this figure is still below 1% in 2017. South Korea, the prime example of success in industrialization and export led growth, holds a lower share of global manufacturing exports than Japan (4.20% vs 4.96%) which suffered a setback in its position as a major supplier of manufacturing exports.

As for the share of manufacturing value added in GDP, unlike South Korea, Turkey and Mexico underwent a decline. This is an alarming trend since one would expect a growing share of manufactures in a middle income economy which has room for much more industrial development. These figures show that the rise of emerging economies in the global market does not directly translate into improvements in welfare.

Table 1: Selected Country Shares in Manufacturing Value Added and Exports (%)

	Share of MNF in total merchandise exports			**Share of MNF exports in total world MNF exports**			**Share of MVA in GDP (%)**			**Share of MVA in World MVA (%)**		
	1997	**2007**	**2017**	**1997**	**2007**	**2017**	**1997**	**2007**	**2017**	**1997**	**2007**	**2017**
United States	80.78	77.57	61.92	13.72	9.41	9.26	16.08	12.78	11.15	16.76	17.64	15.41
Germany	85.47	82.59	85.62	11.02	11.96	10.38	20.29	21.09	21.06	7.09	6.73	6.84
Japan	94.55	90.08	88.09	9.87	6.72	4.96	23.42	22.07	20.72	13.24	11.49	10.63
Rep. of Korea	90.98	89.21	89.45	2.93	3.46	4.20	24.11	25.46	27.57	1.57	2.39	3.15
Turkey	75.29	81.68	80.20	0.49	0.90	0.98	21.56	16.82	17.55	0.95	1.07	1.62
Mexico	80.82	72.14	82.10	2.20	2.14	2.73	20.20	15.92	17.15	1.75	1.58	1.61

Source: For the share of manufactures (MNF) in total world manufactures exports, authors' own calculations based on WTO. For the share of manufacturing value added (MVA) in GDP and the share of MNF in total merchandise exports, WDI and for the share of manufacturing value added (MVA) in world MVA, authors' own calculations based on WDI.

2. Some Stylized Facts on German Manufacturing Production and Trade

During the period covering 1993 to 2013, the top five items in German exports (Figure 1.a.) are motor vehicles, electrical and optical equipment, machinery, chemicals, and basic metals; each with fairly stable shares. Together, machinery and motor-vehicles account for about 30% of manufacturing employment. In 2007, out of the total of over 37,000 firms in manufacturing, 6042 are in the machinery and 1005 in motor vehicles sectors (Godart & Görg, 2011, p. 337). Over 60% of German manufacturing firms neither export nor import, but this share decreased from 67% in 2001 to 61% in 2005. However, there

is sectoral variation in this indicator, with 48% for motor vehicles, 41% for machinery and 36% for chemicals in 2006 (Godart & Görg, 2011, pp. 338-339).

Industrial composition of German imports (Figure 1.b.) is less concentrated than exports. Nevertheless, leaving aside the surge in imports of mining and quarrying, the top five exporting sectors are also the largest importers, and there was a tremendous decrease in the share of textiles, leather, and footwear. The import trends also reflect the changing pattern of Turkish exports to Germany, which will be taken up in the following part of the study.

Figure 1.a.: Industrial Composition* of German Manufacturing Exports to the World

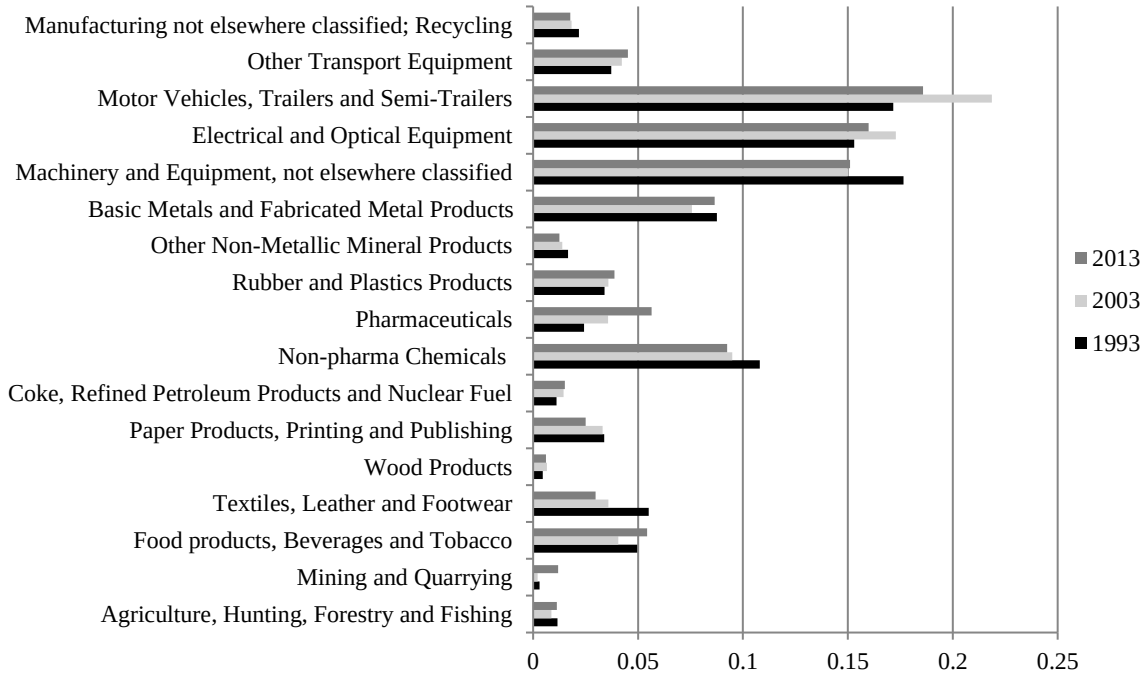
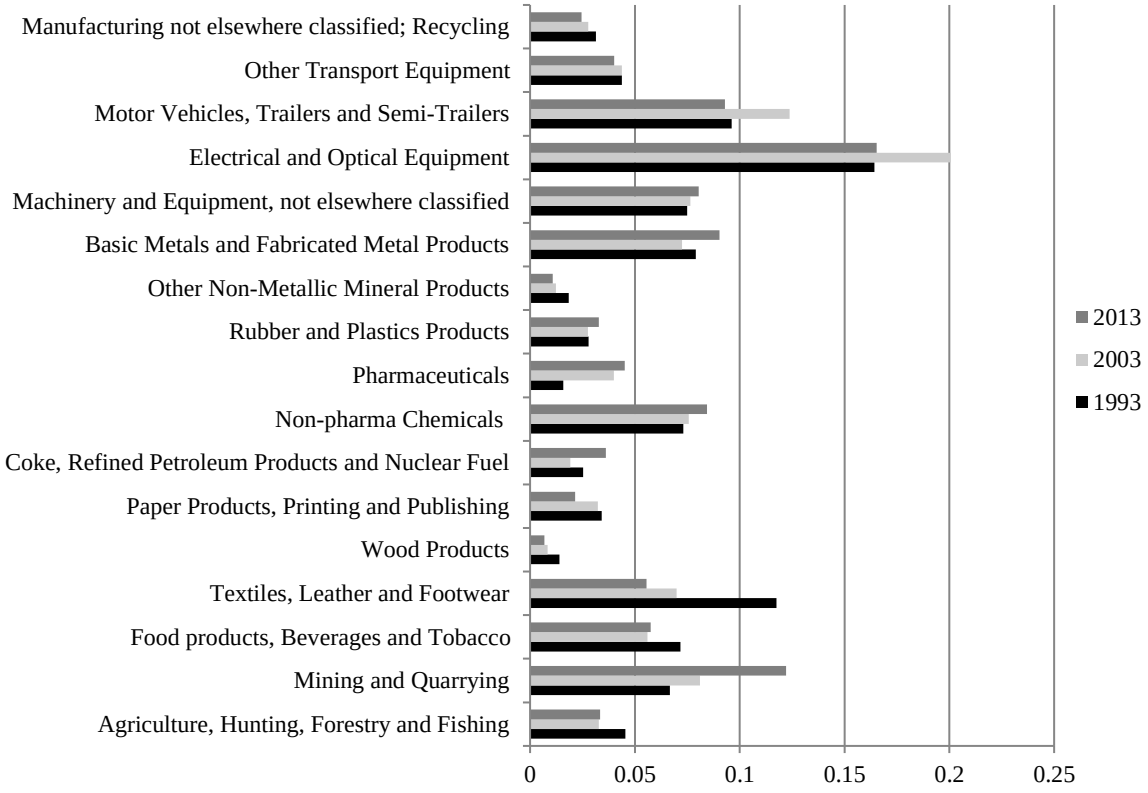


Figure 1.b.: Industrial Composition* of German Manufacturing Imports from the World



Source: OECD STAN Database for Structural Analysis, http://stats.oecd.org/Index.aspx?DataSetCode=STANINDICATORS.
***ISIC Rev.3 2-digits.**

Regional dispersion of German exports (Figure 2.a.) shows that EU-15 is the top destination for German exports, but the share of this region is on a gradually decreasing trend from 56% in 1993 to 44% in 2013. On the other hand, the share of exports to Central & Eastern Europe (CEE) rose from 7% to 14%, and to BRIC from 5% to 11%. In 2013, the shares of both of these two emerging economy groups surpassed those of North America and Japan. A similar geographical pattern change is observed in imports (Figure 2.b.). The combined share of imports from CEE and BRIC increased by 144% (from 11% in 1993 to 29% in 2013), while the shares of imports from EU-15 and from North America & Japan decreased by 22% and 41% respectively.

Figure 2.a.: Dispersion of German Exports among Regions, by percentage

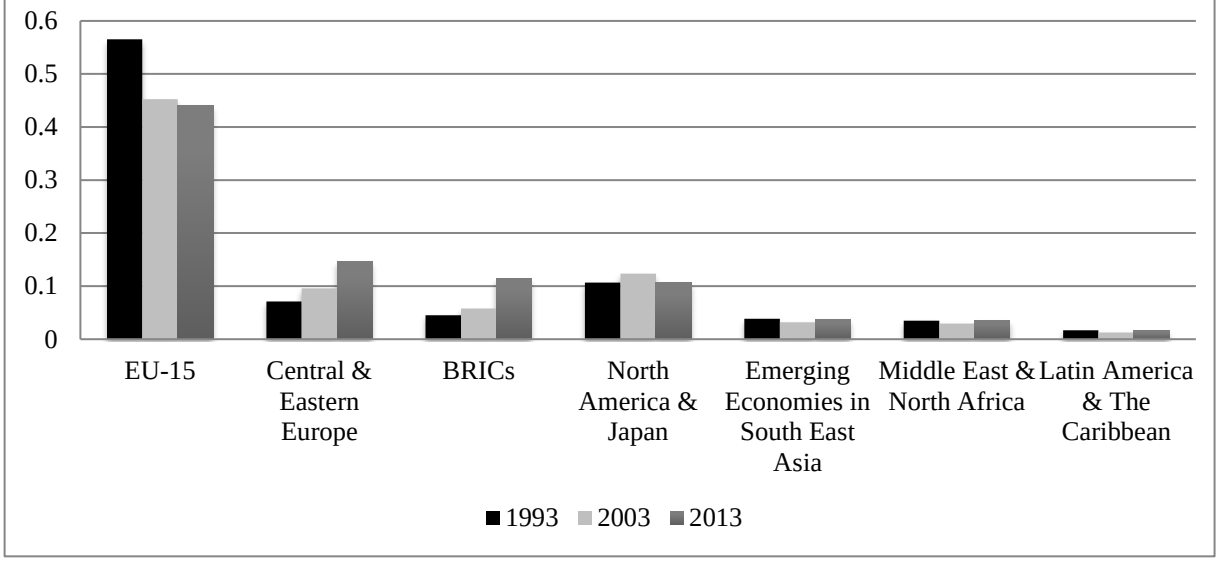
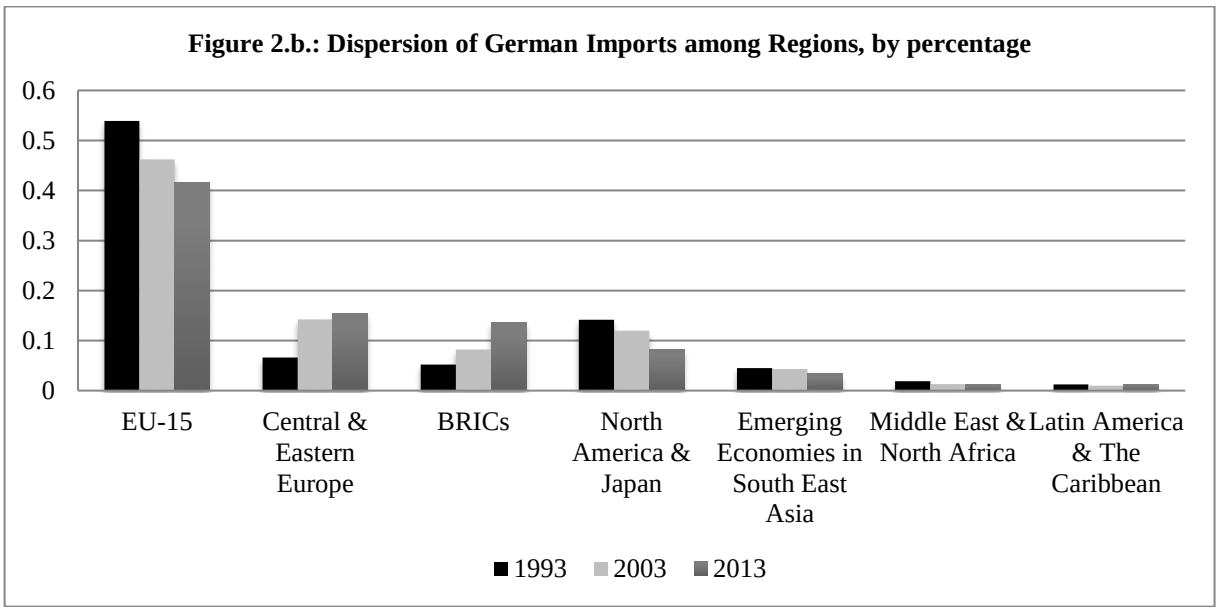


Figure 2.b.: Dispersion of German Imports among Regions, by percentage



Source: OECD STAN Database for Structural Analysis, http://stats.oecd.org/Index.aspx?DataSetCode=STANINDICATORS.
Note: For the country coverage of each region, see Appendix "Countries in Each Geographical Region".

The breakdown of exports by regions and industries (Figure 3.a.) reveals the prominent position of machinery and motor vehicles sectors in all of the German export markets. Since the 1990s, however, German automotive companies began to shift their standardized low-skilled production processes to low-cost locations in CEE and China and focused on core competencies. Foreign production of German car manufacturers thereby increased by 74% during the ten years from 1996 to 2005 (Jürgens, 2008, pp. 51-53). As Figure 2.b. reveals, the shift in the production pattern in machinery and motor vehicles led to an increase in imports in the same categories from CEE. As for BRIC, the composition of Germany's imports changed in favor of electrical & optical equipment, without much of a rise in the share of motor vehicles.

Low motor vehicles import share from BRIC is attributable to the differing nature of German FDI in different regions. In contrast to BRIC, Central Europe (Czech Rep., Hungary, Poland and Slovak Rep.), with its geographical proximity to Western markets, emerged as an export platform rather than a local market for German auto producers (Pavlínek et al. 2009, p. 45). The export-oriented production structure of CEE reveals a process of vertical production sharing. For some products, production sharing involves the manufacture of *parts and components* in CEE and then the export to Western European producers in order to execute the final stage and then the export to Western European markets again. Alternatively, the *final stage* is conducted in CEE and then the products are exported to Western European markets (Ando & Kimura, 2007, p. 57). Since the mid-1990s, about one third of passenger cars produced by German companies in Central Europe were then exported to the German market. Moreover, parts suppliers shifted some of their production stages as well by following the relocation strategies of auto assemblers. Correspondingly, the share of Central European countries in Germany's imported automotive inputs reached 28.7% in 2003 (from 5.6% in 1995) (Nunnenkamp, 2004, p. 8-15).

3. The Structural Change in Manufacturing Trade between Germany and Turkey

Figure 3.a. shows the industrial composition of Turkey's exports to Germany during 1992-2013. In 1992 the top 5 export categories (ISIC 2 digit) were textiles, food products, electrical & optical equipment, agriculture and non-metallic mineral products. Among these sectors, textiles accounted for 65% of the total. Turkey's export composition began to change very rapidly after the EU-Turkey Customs Union Agreement. Along with the diversification in exports, the share of textiles in total exports gradually decreased to 33% in 2013. The share of motor vehicles increased from 1.6% in 1992 to 17% in 2013. Machinery and equipment and food products currently have shares of 9% and 8% in total manufacturing exports.

Figure 3.a.: The industrial composition* of Turkey's exports to Germany, 1992-2013

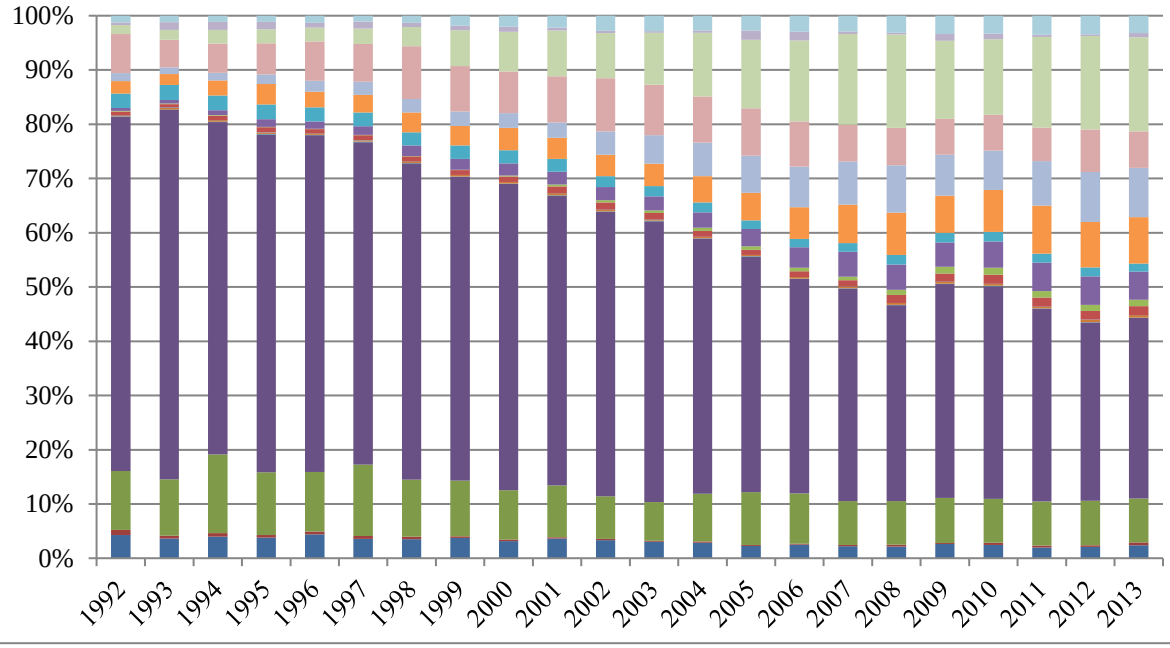
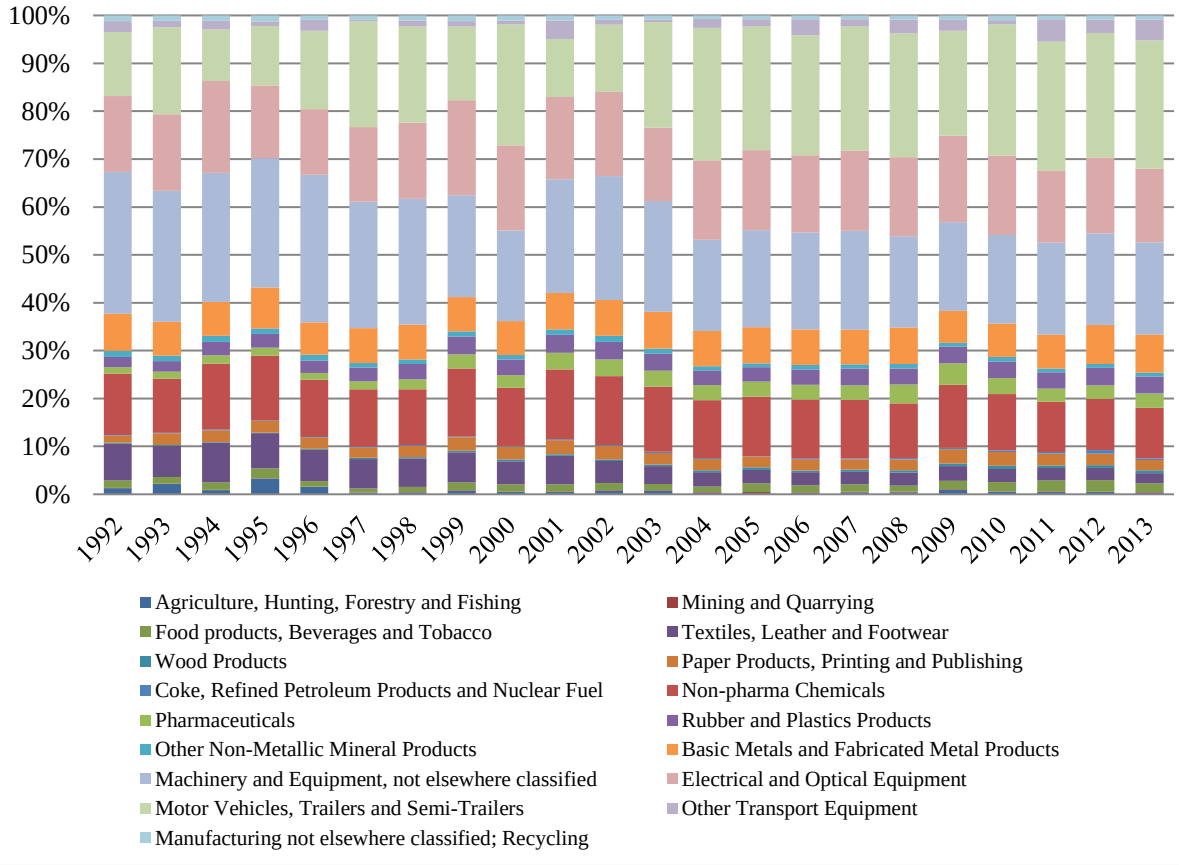


Figure 3.b.: The industrial composition* of Turkey's imports from Germany, 1992-2013



Source: OECD STAN Database for Structural Analysis, http://stats.oecd.org/Index.aspx?DataSetCode=STANINDICATOR
*ISIC Rev. 3 2-digits.

Figure 3.b. shows the industrial composition of Turkey's imports from Germany during 1992-2013.

The top five sectors are the same in 1992 and 2013. These five industries in 1992 were machinery, electrical

& optical equipment, motor vehicles, non-pharmacy chemicals, and manufacture of basic metals, in descending order. In 2013 motor vehicles moved to the top of the list with a share of 27%, followed by machinery with a share of 19%. The shares of the other three sectors remained stable.

The pronounced changes in the export and import shares of motor vehicles and machinery are reflective of the structural change in bilateral trade flows between Germany and Turkey within the past two decades. We analyze this dynamic aspect of trade between the two partners in the next section.

FDI is an important component of trade relations, and German FDI in Turkey is no exception. By 2017, of the total of 58991 firms with foreign capital operating in Turkey, German capital firms ranks first with 7141 firms. In 2017, of the 6004 firms established with foreign capital, the 289 firms with some degree of German ownership rank first. In terms of inflows, FDI from Germany was realized 295 million $ in 2017 and in terms of stock, it reached at 16,5 billion $ by 2017. (Republic of Turkey, Ministry of Science & Technology, 2017, p. 24).

Table 2: Firms with German Capital Share Operating in Turkey

	The Number of Firms with German Capital Share (2014)	Sectoral Share of German FDI stocks in Total Manufacturing in (2011)
Manufacture of chemicals & chemical products	117	13.29
Manufacture of electrical machinery and apparatus n.e.c.	64	8.96
Manufacture of machinery and equipment n.e.c.	120	19.96
Manufacture of motor vehicles, trailers and semi-trailers	77	36.38
Other	941	21.41
Total Manufacturing	1018	100

Source: For the number of the firms; Republic of Turkey, Ministry of Economy. For FDI stock; Authors' own computation based on Kiel Institute for the World Economy.

A broad look at foreign capital firms in Turkey with some degree of German ownership gives further insight into the nature of trade between these two countries (Table 2). As of mid-2014, there are a total of 1018 firms with German origin foreign capital that operate in Turkey's manufacturing sector; 37% of which are in chemicals, electrical machinery, machinery and equipment, and motor vehicles sectors. However, of the total FDI stock originating from Germany and active in the Turkish manufacturing industry, these four

sectors take up 78% of the total. The fact that the share of these firms in German FDI stocks is higher than their share in the number of firms is indicative of the capital-and-R&D oriented aspect of production in these sectors.

Among these sectors, motor vehicles deserves a closer look. In line with structural adjustment and trade liberalization processes put into effect in the 1980s, the FDI stock in the motor vehicles industry was on a rising trend, implying FDI-driven transformation in Turkey's production structure. The ratio of the stock of German FDI in this sector to the total German FDI stocks invested in Turkish manufacturing was 21% in 1983, 36% in 1993, and 39% in 2003. As of 2011, manufacture of automobiles and automotive parts holds the largest share (36%) in the total of German FDI stock invested in Turkey in manufactures (Table 2). Nevertheless, these figures should not be considered to represent a smooth trend. The share of manufactures in German FDI stock in Turkey is subject to changes due to the rising importance of construction and domestic trade.

Despite the importance of German FDI in the Turkish production structure, Turkey's share in total German investment overseas is very small. A comparison between Turkey and other host countries in terms of the share received from the total German FDI stock in the manufacture of automobiles and automotive parts shows that Turkey's role in this network is limited. In 2011 Turkey's share was 1.43% while the shares of Hungary, Czech Republic, Slovakia, and Poland were 9%, 6.6%, 2.8%, and 2.57% respectively (Kiel Institute for the World Economy).

As globalization shapes production and trade, new types of trade emerge. Currently existing trade types are classified into two broad categories as one-way trade and two-way or intra-industry trade (IIT). IIT can be further broken down to horizontal and vertical. Horizontal IIT (HIIT) arises out of the search for variety and is dominant in trade flows among developed countries in goods of similar quality. In contrast to HIIT, vertical IIT (VIIT) refers to trade between developed and developing (or emerging) countries in similar products. The theoretical literature on intra-industry trade flows underlines the importance of product quality differences as a rationale for (VIIT).[*1] Another trend to mention is the surge in P&C trade,

[*] [1] For the theoretical literature on quality differentiation in VIIT, see Falvey (1981); Shaked & Sutton (1984); Falvey & Kierzkowski (1987); Flam & Helpman (1987).

and the trade types described so far are also valid for P&C trade. A notable facet of the new international division of labor is production sharing or fragmentation of production.[2] Fragmentation involves trade in different stages of the production process between developed and emerging economies and gives rise to complex patterns combining one-way trade and IIT in both final goods and P&C. VIIT hence is not only an indicator of trade arising out of quality differences but also the result of fragmentation (Ando, 2006, p. 269; Wakasugi, 2007, pp. 30-31).

In this part of our study we focus on the changes in trade patterns broadly described in the previous two sections, and we analyze the structural change observed in bilateral trade flows between Germany and Turkey in terms of different trade categories. Using disaggregated trade data[3], we concentrate on products that fall under the range of HS 84-HS 92. These products are identified in various empirical studies as categories most open to P&C trade [4] and include:

84: Nuclear Reactors, Boilers, Machinery & Mechanical Appliances, Computers
85: Electrical Machinery & Equip. & Parts, Telecommunications Equip., Sound Recorders, Television Recorders
86: Railway or Tramway Locomotives, Rolling Stock, Track Fixtures & Fittings, Signals
87: Vehicles Other Than Railway or Tramway Rolling Stock
88: Aircraft, Spacecraft, & Parts Thereof
89: Ships, Boats, & Floating Structures
90: Optical, Photographic, Cinematographic, Measuring, Checking, Precision, Medical or Surgical Instruments & Accessories
91: Clocks & Watches & Parts Thereof
92: Musical Instruments, Parts & Accessories

A comparison of the above list with Figures 1.a. and 1.b. reveals that German foreign trade is concentrated in groups that correspond to HS 84, 85 and 87. HS 87 is mainly motor vehicles, and a large part of HS 84 and HS 85 consists of automotive related P&C exports and imports. Figure 2.b. reveals that in Germany's imports from BRIC and CEE, the share of these industries increased the most. Figure 3.a. shows that in Turkish exports to Germany, the share of motor vehicles and machinery (ISIC 34 and 29) increased from 3% in 1992 to 26% in 2013. As for German exports to Turkey (Figure 3.b.), the share of motor vehicles and machinery is the highest in the total and increased from 43% in 1992 to 46% in 2013.

[2] For the theoretical literature on fragmentation of production as a result of the new international division of labor, see Sanyal (1983); Arndt, (1997); Venables, (1999); Deardorff, 2001; Jones & Kierzkowski, (2001); Yi, (2003).
[3] HS 6-digits, obtained from the United Nations (UN) Comtrade database; Germany is the reporting country.
[4] Our industrial coverage HS 84-HS 92 is based on the list in Ando & Kimura (2005). However we pursued our own method of product identification in order to distinguish between final goods and parts with the help of correspondence tables of different HS classification lists as well as the BEC correspondences in line with the methodology and lists suggested by Yamashita (2010) and Athukorala (2010).

Following the methodology in Fontagné & Freudenberg (1997), we measure one-way trade, HIIT and VIIT in final goods and in P&C separately. We classify the trade flow between Germany and Turkey in product j as one-way if the equation below holds, and as IIT if not.[5]

$$\frac{Min(X_j, M_j)}{Max(X_j, M_j)} \leq 0.1$$

Further, we discriminate between HIIT and VIIT by employing the equation below. If the ratio of export to import values of product j lies within the critical values 0.8-1.25, then, the IIT in product j is classified as horizontal. If the ratio lies outside this range, then, the trade-flow is classified under VIIT.

$$0.8 \leq \frac{P_j^x}{P_j^m} \leq 1.25, \textit{ where P: unit value, x: export of good j, m: import of good j}$$

Following Abd-el Rahman (1991) and Greenaway, Hine & Milner (1994), unit values of exports and imports are calculated by dividing values by the corresponding net weight (kg).[6] We classify all products into two broad groups as final goods and P&C and identify one-way trade, HIIT, or VIIT under each group. Aggregating the trade volume under each of the six categories, we show their absolute size (Figure 7.a) and relative importance in the total (Figure 7.b). Following Ando (2006), we further break down trade types based on the following criteria:

One-way trade: if export volume > import volume then export based, otherwise import based

VIIT: if P_j^x / P_j^m > 1.25, then higher quality VIIT or (HQVIIT)

if P_j^x / P_j^m < 0.8, then lower quality VIIT or (LQVIIT)

Based on the way the measure is constructed, HQVIIT implies higher unit values or high-skill factor intensity for German export products, whereas the same indicator implies lower value added in Turkish exports in the same product group (or LQVIIT from Turkey's perspective). Figures 4.a., 4.b. and Table 3 reveal that the dominant trade type between Germany and Turkey is one-way in all of the three years.

[5] In line with the suggestion in Ando (2006, p. 271), exports values are adjusted for FOB-CIF differences between exports and imports by multiplying each export value with 1.05. These adjusted export values are then used in all calculations.

[6] The unit of measure used in the unit value computation varies from one study to another. Furthermore, each unit of measure (such as per tonne, per square metre or per item) has its own weakness. For a detailed discussion, see: Greenaway, Hine & Milner (1994, p. 81). Nonetheless, the choice of "unit of measure" in this study is simply based on practical considerations. The HS 6-digit trade flows between Germany and Turkey suffer from insufficient information on supplementary quantity. For that reason, we prefer to use "Netweight (kg)" instead of "supplementary quantity" in computing unit values of products. However a few number of products still suffered from the lack of information on "Netweight (kg)". Following Ando (2006), we grouped these products as "Not Classified IIT" or "Not Classified IIT parts".

However, the share of one-way trade in the total (sum of final and P&C) decreased from 85% in 1993 to 60% in 2003 and 2013. The rising share of IIT comes from VIIT in P&C, and during the two decades under review, the share of VIIT in P&C in the total increased from 6% to 19%. VIIT in final goods also increased, but to a lesser extent.

Figure 4.a.: Germany-Turkey trade patterns in HS 84-92 (by volume)

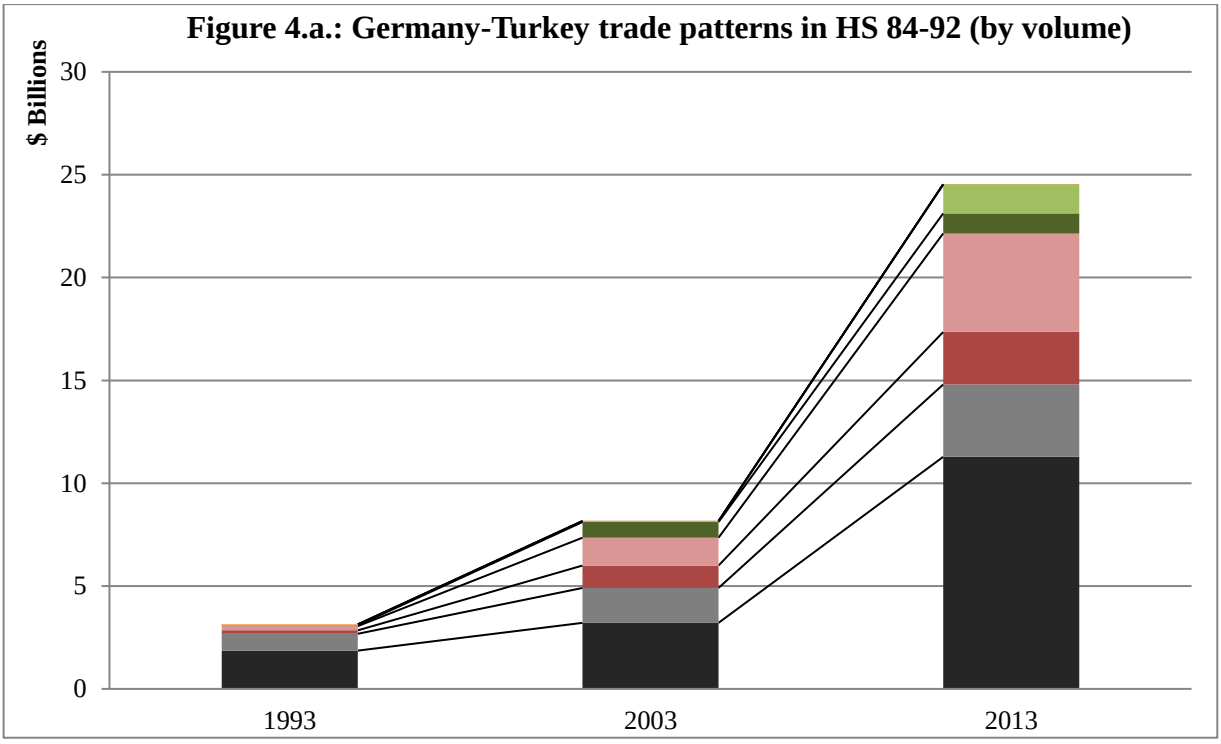
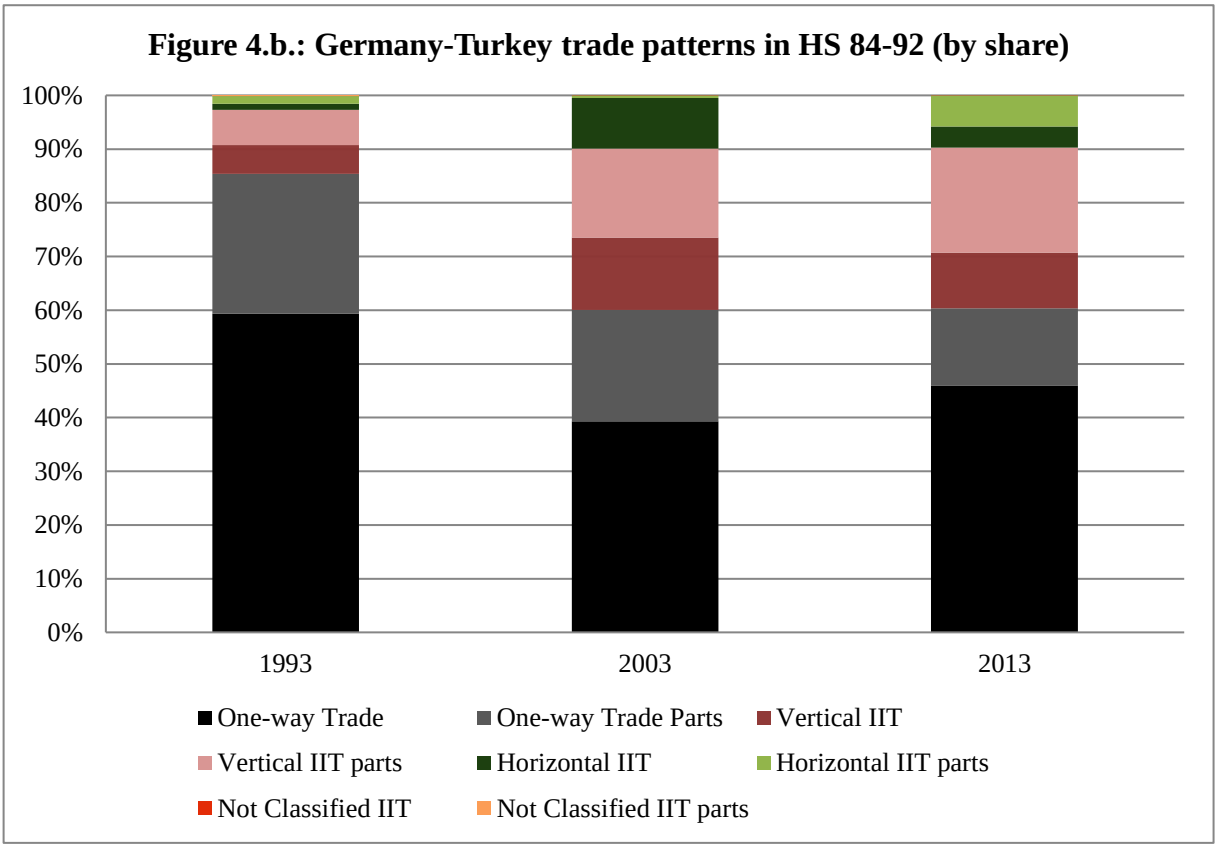


Figure 4.b.: Germany-Turkey trade patterns in HS 84-92 (by share)



Source: Authors' own calculations based on UN Comtrade.
Note: Categories not marked as parts pertain to final goods.

Table 3: A Closer Look at Germany's One-way Trade and IIT with Turkey

	Total Trade in HS84-HS92			Trade in P&Cs		
	1993	2003	2013	1993	2003	2013
[Exports + Imports] ($ millions)	3,136	8,161	24,534	1,071	3,083	9,720
Trade Pattern (%)						
One-way	85	60	60	76	55	36
One-way: exports>imports	81	50	56	65	44	31
Intra Industry Trade	15	40	40	24	45	64
Horizontal IIT	3	10	10	5	1	15
Vertical IIT	12	30	30	19	44	49
Vertical IIT: (export prices > import prices)	10	24	24	15	35	37

Source: Authors' own calculations based on UN Comtrade.

Germany's total one-way trade with Turkey is mainly export-based (93% of total one-way trade and 56% of total trade in 2013). In addition, Germany's one-way trade in P&C is also heavily based on exports, although the share of one-way trade in P&C trade is decreasing and is only 36% in 2013.

Germany's VIIT flows, on the other hand, are predominantly HQVIIT. This trade pattern is different from that observed in East Asia involving countries of different levels of development. Ando (2006, pp. 271-279) reports that Japan and Korea import more expensive products than they export to the world, whereas some lower-income countries like Indonesia export more expensive products than they import from the world. At this point, we need to keep in mind that the nature of German-Turkish vertical trade differs from the East Asian case. In East Asia, global production sharing mainly takes place in Information and Communication Technology sectors (Fukao, Ishido, Ito, 2003, pp. 472-476; Athukorala, 2010, pp. 42-45). Industry-specific characteristics such as product portability and modularization lead to a high degree of product fragmentation and back-and-forth transactions. For instance, Japan re-imports its high value added parts back from foreign affiliates located in China and other developing East Asian countries (Paprzycki & Ito, 2010, pp. 7-8). It is, therefore, plausible to have higher import prices than export prices in the case of Japan's VIIT. In contrast, vertical production networks between Germany and Turkey are mainly concentrated in motor vehicles, whose parts and components are not easily transported, and their

degree of modularization and standardization is rather low and customized to the final product (Paprzycki & Ito, 2010).

Ranking HS 84-92 product categories in terms of volume, we find that the top 20 products Germany imported from Turkey accounted for 64% of the total, and the top 20 products Germany exported to Turkey account for 46% of the total; although the total number of traded products was 1029 in 2013. These products (final goods and P&C) are shown in Tables A.1 and A.2.[7] About three quarters of these top 20 products relates to the auto industry, which indicates that trade is heavily concentrated not only in the auto industry, but also in some specific products of the auto industry. Table A.2 also reveals that in 2013, the component with the highest export volume was compression-ignition internal combustion piston engines (diesel or semi-diesel) (HS 840820), whereas the parts for use with compression-ignition internal combustion piston engines (HS 840999) was the component with the highest import volume.

One can argue that Germany has revealed comparative advantage in transport equipment such as passenger motor vehicles, airplanes, cruise ships and various machinery such as wind powered electricity generating sets and other machinery with specific functions, used as capital goods in various industries. However, Germany's final good imports (or Turkey's final good exports) cannot be labeled with a clear trade pattern. For instance, Turkey's exports of reception apparatus and refrigerators are examples of one-way trade. However Turkey's exports of motor vehicles for the transport of ten or more persons or goods (870210 and 870421) reveal a HIIT pattern. We also see VIIT in exports of some passenger cars, washing machines and electrical and optical appliances.

Figure 5 presents a picture of the three trade patterns in 2013, 2003 and 1993. The left hand side of the figure shows the trade patterns in P&C exports. The right hand side of the figure summarizes the main patterns in final goods exports. Over the course of the two decades, P&Cs trade between Germany & Turkey changed in favor of VIIT, although significant differences appear when these trade flows are decomposed into exports and imports. P&Cs exports of Germany (or imported inputs used in Turkish production) mainly exhibits a one-way trade pattern (80%) in 1993. By 2013, this ratio decreased to 46%, while the share of

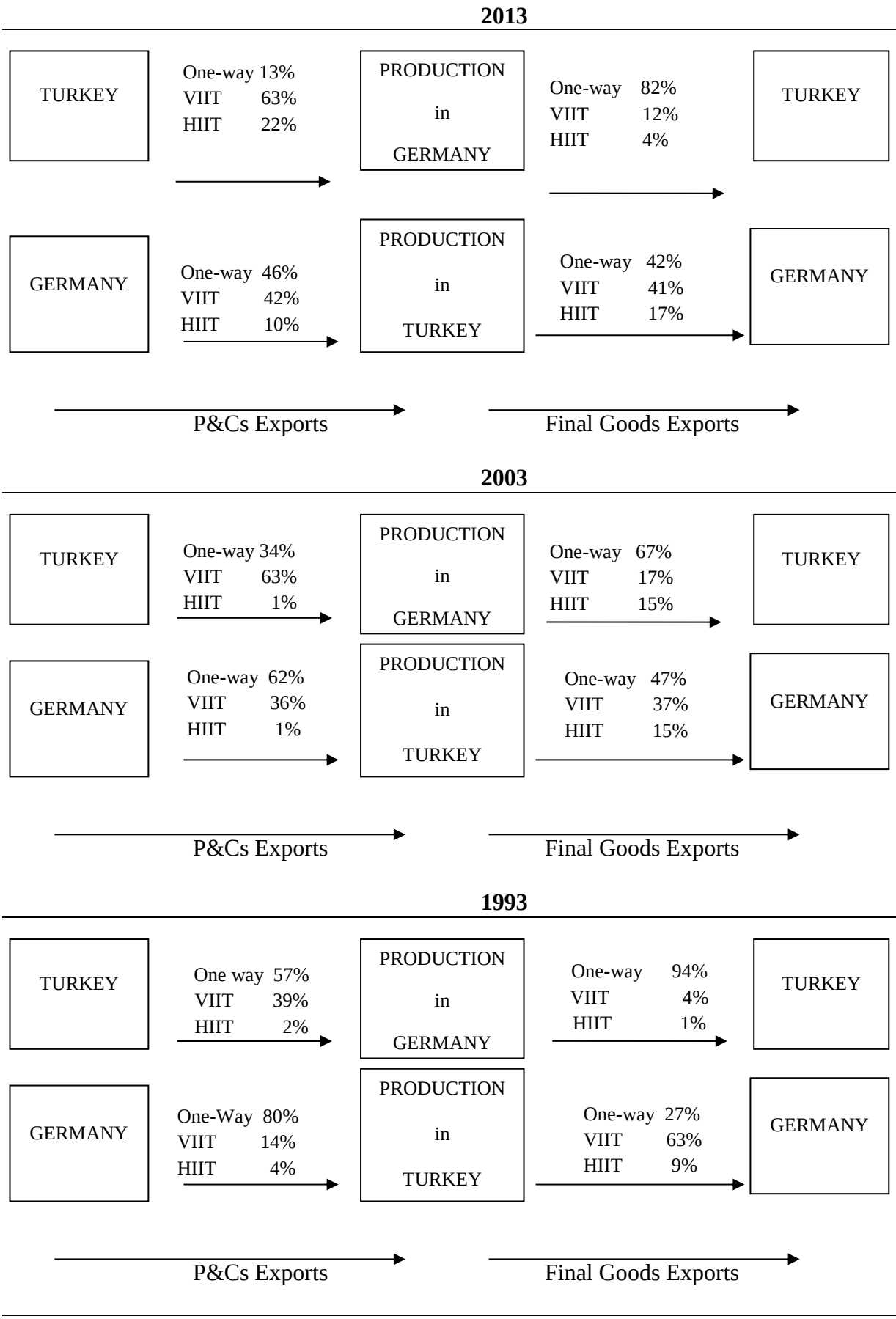
[7] We first ranked parts and final goods together in order to measure the share of top 20 products. Moreover, in the Appendix, we further distinguish between parts and components and final goods and present the top ten traded final goods (Table A.1.) and parts and components (Table A.2.) separately.

VIIT increased to 42% (from 14% in 1993). One can argue that the structure of German P&C exports in 1993 was indicative of Germany's absolute advantage in items the production of which was limited in Turkey. During the period following the customs union agreement, along with the rise of global production sharing, German firms started to shift low-skilled labor intensive stages of production abroad. Consequently, exports of vertical intra-industry gained importance. Nevertheless, one-way P&Cs exports is still the dominant trade pattern for Germany. As for Turkey, the pattern of P&Cs exports changed in favor of IIT, while the share of one-way exports decreased to 13% over the course of the two decades. The fact that a large part of the IIT is vertical supports the argument that the trade pattern is the result of intensive production sharing.

The dominant pattern in Turkish final goods exports is one-way trade 2013. However, this result conflicts with the data presented in Table A.1. A closer look at this table reveals that the top two German export items to Turkey (HS870332 and HS870323) are also among the top ten export items from Turkey to Germany. The reason why the two way trade measures as one way lies in the huge trade deficit Turkey runs against Germany. Hence the metric determining the pattern of trade,

$\frac{Min(X_j,M_j)}{Max(X_j,M_j)} \leq 0.1$, measures the trade flow as one way. Even though Turkey's exports in these items are less than 10% of their imports, they account for a significant share of total exports of final goods.

Figure 5: An illustration of German-Turkish bilateral trade patterns



For German final goods exports, one-way trade is still the dominant pattern, even though the share of VIIT increased from 4% to 12% over the two decades. 58% of Turkey's auto exports is passenger cars, most of which follows either a one-way or HQVIIT pattern in favor of Germany. For instance, HS 870322 ranks fourth in both German exports and German imports and is classified under HQVIIT.

Lastly, the fact that trade flows under HS 84-92 are dominated by the motor vehicles sector enables us to make some infrences on the nature of trade and production sharing in this sector. Turkey exports the parts of engines (HS840999 and 840991) to Germany, where they are processed, and then engines and other high value added parts such as gear boxes and drive axles are exported to Turkey. Following the assembly process in Turkey, 74% of finished motor vehicles are exported to foreign markets, mainly Western Europe (Aksongur, 2014) [8]. The export oriented nature of Germany's production sharing with Turkey resembles that with CEE and is in contrast to that with BRIC where production for the domestic market is the dominant feature.

Concluding Remarks

As the third largest exporter and importer in the world, and the dominant exporter with at least 10% market share in most of Europe as of 2010 (Berentsen, 2012, p. 390), Germany trades with different types of partners. In addition to ongoing trade patterns with advanced economies of similar nature, it also has vibrant production and trade relations with emerging economies.

Trade between Germany and Turkey involves more than the bilateral flow of products between partners. Rather, this trade relationship can be viewed as a venue through which both countries exchange with the rest of the world. Trade between Germany and Turkey provide examples for the dynamics of the new international division of labor. Trade flows with Germany account for about 10% of the total Turkish trade volume, and there is an overall long run decrease in Germany's share in this total. Our study demonstrates that there is a structural change in this bilateral trade relationship, and that the key to understanding this change lies in the growing importance of the motor vehicles and machinery sectors, and

[8] Aksongur (2014) reports that 1125534 units of motor vehicles were produced in 2013 and 828471 units of which were exported to foreign markets. Of these auto exports, 484504 units were related to passenger cars, and 343967 units to commercial vehicles.

the accompanying shifts between one-way trade and IIT. We explore trade in these product groups, and the rising importance of intra firm trade in detail in the final section of this study.

The motor vehicle and machinery sectors have always been the source of Germany's competitiveness in international markets. So far, Germany has been able to adapt to the changing conditions in the global economy by transforming its production and trade patterns through shifting standardized, low-skilled production processes of these leading industries to low-cost locations in CEE and China, and focusing on core competencies while at the same time focusing on R&D in these sectors (Foders & Vogelsang, 2014). The first implication of this adjustment is the industrial upgrading of production and export content. The second implication is increasing motor vehicles & machinery imports from emerging economies (primarily CEE).

Our study reveals that Germany increases its welfare by a high degree of specialization in specific final goods (such as high volume of passenger cars or specific capital goods) or P&C with high unit values/value added and skill content. This specialization pattern is supported by the bilateral trade flows between Germany and Turkey in motor vehicles and machinery industries where Germany's exports are mainly one-way trade in final goods (a reflection of comparative advantage), and both HQVIIT and one-way trade in P&C. Conversely, Turkey's final good exports mostly follow a one-way trade pattern or HQVIIT in favor of Germany, and P&C exports are mainly VIIT of low quality products.

Based on the findings of our study, we can conclude that the structural change in Turkish exports from low technology-labor intensive sectors like textiles and leather to medium technology sectors like machinery and motor vehicles does not by itself promote growth and welfare. Specialization in the low price-low unit value segments of medium technology products limits the gains from trade. One lesson to be learned from Germany's behavior as a successful exporter is that the choice of the sector to specialize in is secondary to the capabilities to create a high value added in the area of specialization.

Bibliography

Abd-el-Rahman, K. (1991). Firms' competitive and national comparative advantages as joint determinants of trade composition. *Weltwirtschaftliches Archiv*, *127*(1), 83–97. Retrieved from http://link.springer.com/article/10.1007%2FBF02707312

Aksongur, G. (2014). *Turkish automotive industry* (TSKB Report November 2014). Retrieved from Automotive Manufacturers Association Web site: http://www.osd.org.tr/yeni/wp-content/uploads/2014/12/TSKB-November-2014.pdf

Ando, M. (2006). Fragmentation and vertical intra-industry trade in East Asia. *The North American Journal of Economics and Finance*, *17*, 257-281. doi:10.1016/j.najef.2006.06.005

Ando, M., & Kimura, F. (2005). The formation of international production and distribution networks in East Asia. *NBER-East Asia Seminar on Economics*, *14*, 177-216. Retrieved from http://www.nber.org/chapters/c0194.pdf

Ando, M., & Kimura, F. (2007). Fragmentation in Europe and East Asia: Evidences from international trade and foreign direct investment data. In B. Ruffini & J.-K. Kim (Ed.), *Corporate strategies in the age of regional integration* (pp. 36-51). Cheltenham, UK: Edwad Elgar.

Arndt, S. W. (1997). Globalization and the open economy. *North American Journal of Economics & Finance*, *8*(1), 71-79. Retrieved from http://www.sciencedirect.com/science/article/B6W5T-45FY4JN-Y/2/078ba9b59e294c7b5c4117c05793a90c

Athukorala, P. (2010). *Production networks & trade patterns in East Asia: Regionalization or globalization?* (ADB Working Paper 56). Asian Development Bank. Retrieved from http://aric.adb.org/pdf/workingpaper/WP56_Trade_Patterns_in_East_Asia.pdf

Berentsen, W. H. (2012). The change in European foreign trade from 1960 to 2010: A geography of leading merchandise exporting partners. *Eurasian Geography and Economics*, *53*(3), 380-399. doi:10.2747/1539-7216.53.3.380

Deardorff, A. (2001). Fragmentation in simple trade models. *North American Journal of Economics and Finance*, *12*(2), 121-137. Retrieved from http://www.sciencedirect.com/science/article/B6W5T-43GH19T-1/2/b5428888c70141230fcc7120a7770722

Falvey, R. E. (1981). Commercial policy and intra-industry trade. *Journal of International Economics*, *11*(4), 495-511. doi:10.1016/0022-1996(81)90031-3

Falvey, R. E., & Kierzkowski, H. (1987). Product quality, intra-industry trade and (im)perfect competition. In H. Kierzkowski (Ed.), *Protection and competition in international trade* (pp. 143-161). New York: Basil Blackwell.

Federal Ministry of Economics and Technology (2013). *Facts about German foreign trade in 2012*. Retrieved from http://www.bmwi.de/English/Redaktion/Pdf/facts-about-german-foreign-trade-in-2012,property=pdf,bereich=bmwi2012,sprache=en,rwb=true.pdf

Flam, H., & Helpman, E. (1987). Vertical product differentiation and North-South trade. *American Economic Review*, *77*(5), 810-822. Retrieved from http://www.jstor.org/stable/1810210

Foders, F. & Vogelsang, M. M. (2014). *Why is Germany's manufacturing industry so competitive?* (Kiel Policy Brief 69). Kiel Institute for the World Economy. Retrieved from https://www.ifw-kiel.de/wirtschaftspolitik/politikberatung/kiel-policy-brief/kpb-2014/KPB_69.pdf

Fontagné, L., & Freudenberg, M. (1997). *Intra-industry trade: Methodological issues reconsidered* (CEPII Working Paper). Retrieved from http://www.cepii.fr/PDF_PUB/wp/1997/wp1997-01.pdf

Fukao, K., Ishito, H., & Ito, K. (2003). Vertical intra-industry trade and foreign direct investment in East Asia. *Journal of the Japanese and International Economies*, *17*(4), 468–506. doi:10.1016/j.jjie.2003.09.004

Godart, O., & Görg, H. (2011). The role of global value chains for German manufacturing. *Trade Policy Research: Global Value Chains - Impacts and Implications*. Retrieved from http://www6.bwl.uni-kiel.de/vwlinstitute/auss/team_godart.php#http://www.international.gc.ca/economist-economiste/analysis-analyse/policy-politique/TPR_2011_GVC_ToC.aspx?view=d&lang=eng

Greenaway, D., Hine, R., & Milner, C. (1994). Country-specific factors and the pattern of horizontal and vertical intraindustry trade in the UK. *Weltwirtschaftliches Archiv*, *130*(1), 77–100. Retrieved from http://www.jstor.org/stable/40440266

Jones, R. W. & Kierzkowski, H. (1990). The role of services in production and international trade: A theoretical framework. In R. W. Jones & A. O. Krueger (Eds.), *The Political economy of international trade : Essays in Honor of Robert E. Baldwin*, (pp. 31-48). Cambridge: B. Blackwell.

Jürgens, U. (2008). Globalization and employment relations in the German auto industry. In R. Blanpain & R. D. Lansbury (Eds.), *Globalization and employment relations in the auto assembly industry* (pp. 49-72). Netherlands: Kluwer Law International BV.

Kiel Institute for The World Economy Database for Stocks of Foreign Direct Investment of the US, Japan, and Germany. Available from https://www.ifw-kiel.de/academy/data-bases/fdi_e

Nunnenkamp, P. (2004). *The German automobile industry and Central Europe's integration into the international division of labour: Foreign production, intra-industry trade, and labour market repercussions*. (IFW Working Paper 9). Retrieved from http://hdl.handle.net/10419/4318

OECD STAN Database for Structural Analysis. Available from http://stats.oecd.org/Index.aspx?DataSetCode=STAN08BIS

Owen-Smith, E. (1994). *The German economy*. London and New York: Routledge.

Paprzycki, R., & Ito, K. (2010). *Investment, production and trade networks as drivers of East Asian integration* (APEC Discussion Paper 67). Columbia University: APEC Study Center. Retrieved from http://www8.gsb.columbia.edu/apec/sites/apec/files/files/discussion/67Paprzycki.pdf

Pavlínek P., Domanski B., & Guzik R. (2009). Industrial Upgrading through foreign direct investment in Central European automotive manufacturing. *European Urban and Regional Studies*, *16*(1), 43-63. doi:10.1177/0969776408098932

Republic of Turkey, Ministry of Economy (Türkiye Cumhuriyeti Ekonomi Bakanlığı). Available from http://www.ekonomi.gov.tr/portal/faces/home/yatirim/istatistiklerYayinlar?_adf.ctrl-state=7tvop57ho_137&_afrLoop=75281912197659&_afrWindowMode=0&_afrWindowId=null#!%40%40%3F_afrWindowId%3Dnull%26_afrLoop%3D75281912197659%26_afrWindowMode%3D0%26_adf.ctrl-state%3D1be3r6g5eh_89

Republic of Turkey, Ministry of Economy (2013). Foreign direct investments in Turkey 2012. *General Directorate of Incentive, Implementation and Foreign Investment* Retrieved from http://www.yoikk.gov.tr/upload/ydk/FDI2012_Report.pdf

Republic of Turkey, Ministry of Science & Technology (2017). Foreign direct investments Report. *General Directorate of Incentive, Implementation and Foreign Investment.* Retrieved from https://tuys.sanayi.gov.tr/Handlers/DokumanGetHandler.ashx?dokumanId=5758cfa4-7120-4281-a722-e40e429ac159

Sanyal, K. K. (1983). Vertical specialization in a ricardian model with a continuum stages of production. *Economica*, *50*(197) 71-78. Retrieved from http://www.jstor.org/stable/2554122

Shaked, A., & Suttan, J. (1984). Natural oligopolies and international trade. In H. Kierzkowski (Ed.), *Monopolistic competition and international trade* (pp. 34-50). Oxford: Clarendon Press.

Statistisches Bundesamt (Federal Statistical Office) (2014). Foreign trade: Ranking of Germany's trading partners in foreign trade 2013. Wiesbaden. Retrieved from https://www.destatis.de/EN/FactsFigures/NationalEconomyEnvironment/ForeignTrade/TradingPartners/Tables/OrderRankGermanyTradingPartners.pdf?__blob=publicationFile

Turkish Statistical Institute (TURKSTAT). Available from http://tuikapp.tuik.gov.tr/disticaretapp/disticaret_ing.zul?param1=4&param2=0&sitcrev=0&isicrev=0&sayac=5908

United Nations Commodity Trade Statistics Database (UN Comtrade). Available from http://comtrade.un.org/db/dqQuickQuery.aspx

Venables, A. J. (1999). Fragmentation and multinational production. *European Economic Review*, *43*, 935-945. Retrieved from http://www.sciencedirect.com/science/article/B6V64-3WRBN38-P/2/7d857fc11613c5d65df027776681cea8

Wakasugi, R. (2007). Vertical intra-industry trade and economic integration in East Asia. *Asian Economic Papers*, *6*(1), 26-45. Retrieved from https://www1.gsec.keio.ac.jp/upload/freepage/file/W-1-09.pdf

World Bank ,World Development Indicators (WDI). Available from http://data.worldbank.org/indicator/NV.IND.MANF.ZS

World Trade Organization, Statistics Database, Time Series on International Trade. Retrieved from http://stat.wto.org/StatisticalProgram/WSDBStatProgramHome.aspx?Language=E

Yamashita, N. (2010). *International fragmentation of production: The impact of the outsourcing on the Japanese economy*. UK: Edward Elgar.

Yi, K. M. (2003). Can Vertical specialisation explain the Growth of world trade, *Journal of Political Economy, 11*(1) 52-102. Retrieved from http://www.journals.uchicago.edu/cgi-bin/resolve?JPE111106PDF

Appendices

A.1. Countries in Each Geographical Region

EU-15: Austria, Belgium, Luxembourg, France, Spain, Portugal, Greece, Finland, Denmark, Netherlands, UK, Ireland, Sweden, Italy

Central & Eastern Europe: Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Hungary, Lithuania, Macedonia, Poland, Romania, Serbia & Montenegro, Turkey, Czech Rep., Estonia, Slovak Rep., Slovenia, Cyprus, Latvia, Malta, Ukraine, Moldova, Belarus

BRICs: Brazil, Russia, India, China

North America & Japan: Canada, USA, Japan

Middle East & North Africa: Algeria, Bahrain, Egypt, Iran, Jordan, Kuwait, Lebanon, Mauritania, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, UAE, Yemen, Israel

Emerging Economies in South East Asia: Brunei Darussalam, Hong Kong, Singapore, Korea, Indonesia, Malaysia, Philippines, Thailand

Latin America & The Caribbean: Mexico, Colombia, Venezuela, Ecuador, Peru, Bolivia, Paraguay, Chile, Argentina, Uruguay, Panama, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Dominican Republic, Jamaica, St. Kitts & Nevis, Aruba, Cuba, Dominica, St. Vincent & Grenadines, Trinidad & Tobago, Guyana, Suriname

Table A. 1.: Top Ten Final Good Imports and Exports of Germany with Turkey, 2013, million US $

HS Code	Product Name	Import Value	Trade Pattern	HS Code	Product Name	Adjusted Export Value	Trade Pattern
852872	Reception Apparatus For Television	378	One-way (import based)	**870332**	Passenger Motor Vehicles With Diesel Engine, Cylinder Capacity btw 1,500 -2,500 Cc	1505	One-way (export based)
870210	Motor Vehicles For The Transport Of Ten Or More Persons, With Diesel Or Semi-Diesel Engine	146	HIIT	**870323**	Passenger Motor Vehicles With Spark-Ignition Int. Comb. Recip. Piston Engine, Cylinder Capacity btw 1,500 - 3,000 Cc	1162	One-way (export based)
841810	Combined Refrigerator-Freezers Fitted With Separate External Doors	141	One-way (import based)	**880240**	Airplanes And Other Aircraft , Of An Unladen Weight Exceeding 15,000 Kg	839	One-way (export based)
870322	Passenger Motor Vehicles With Spark-Ignition Int. Comb. Recip. Piston Engine, Cylinder Capacity btw 1,000 - 1,500 Cc	133	HQVIIT	**870322**	Passenger Motor Vehicles With Spark-Ignition Int. Comb. Recip. Piston Engine, Cylinder Capacity btw 1,000 - 1,500 Cc	496	HQVIIT
870421	Motor Vehicles For Goods Transport, With Diesel Engine, Gvw Not Over 5 Metric Tons	118	HIIT	**870333**	Passenger Motor Vehicles With Diesel Engine	395	One-way (export based)
870323	Passenger Motor Vehicles With Spark-Ignition Int. Comb. Recip. Piston Engine, Cylinder Capacity btw 1,500 - 3,000 CC	109	One-way (export based)	**850231**	Generating Sets, Electric, Wind-Powered	321	One-way (export based)
845011	Household- Or Laundry-Type Washing Machines	108	HQVIIT	**870421**	Motor Vehicles For Goods Transport , With Diesel Engine	316	HIIT
901890	Instruments And Appliances For Medical, Surgical Or Veterinary Sciences, And Parts And Accessories Thereof	107	HQVIIT	**847989**	Machines And Mechanical Appliances Having Individual Functions	215	One-way (export based)
870332	Passenger Motor Vehicles With Diesel Engine, Cylinder Capacity btw 1,500 -2,500 Cc	106	One-way (export based)	**870331**	Passenger Motor Vehicles With Diesel Engine, Cylinder Capacity Not Over 1,500 Cc	184	One-way (export based)
840310	Central Heating Boilers	101	LQVIIT	**842139**	Filtering Or Purifying Machinery And Apparatus For Gases	172	One-way (export based)

Source: Authors' own calculations based on UN Comtrade.

Table A.2.: Top Ten P&Cs Imports and Exports of Germany with Turkey, 2013, million US $

HS Code	Product Name	Import Value	Trade Pattern	HS Code	Product Name	Adjusted Export Value	Trade Pattern
840999	Parts For Use With Compression-Ignition Internal Combustion Piston Engines	604	LQVIIT	**840820**	Compression-Ignition Int. Comb. Piston Engines (Diesel Or Semi-Diesel), For The Propulsion Of Vehicles Except Railway Or Tramway Stock	669	One-way (export based)
840991	Parts For Use With Spark-Ignition Int. Comb. Piston Engines (Including Rotary Engines)	430	HIIT	**870840**	Gear Boxes And Parts Thereof, For Motor Vehicles	464	One-way (export based)
870870	Road Wheels And Parts And Accessories Thereof For Motor Vehicles	319	One-way (import based)	**840734**	Spark-Ignition Recip. Piston Engines For Propulsion Of Vehicles Except Railway Or Tramway Stock, Over 1,000 Cc	357	One-way (export based)
870899	Parts And Accessories For Motor Vehicles	228	HQVIIT	**840999**	Parts For Use With Compression-Ignition Internal Combustion Piston Engines	281	LQVIIT
870829	Parts And Accessories Of Bodies (Including Cabs) For Motor Vehicles	122	HIIT	**870850**	Drive Axles With Differential And Non-Drive Axles And Parts Thereof, For Motor Vehicles	269	HQVIIT
870880	Suspension Systems And Parts Thereof, For Motor Vehicles	116	LQVIIT	**870899**	Parts And Accessories For Motor Vehicles	262	HQVIIT
841391	Parts Of Pumps For Liquids	77	HQVIIT	**870829**	Parts And Accessories Of Bodies (Including Cabs) For Motor Vehicles	216	HIIT
870850	Drive Axles With Differential And Non-Drive Axles And Parts Thereof, For Motor Vehicles	67	HQVIIT	**840991**	Parts For Use With Spark-Ignition Int. Comb. Piston Engines (Including Rotary Engines)	183	HIIT
854430	Insulated Ignition Wiring Sets And Other Wiring Sets For Vehicles, Aircraft And Ships	60	HQVIIT	**853710**	Boards, Panels, Consoles, Etc. With Electrical Apparatus, For Electric Control Or Distribution Of Electricity, For A Voltage Not Exceeding 1,000 V	132	One-way (export based)
870830	Brakes And Servo-Brakes And Parts Thereof , For Motor Vehicles	58	HQVIIT	**848180**	Taps, Cocks, Valves And Similar Appliances For Pipes, Vats Or The Like, Including Thermostatically Controlled Valves	114	HQVIIT

Source: Authors' own calculations based on UN Comtrade.