Elif Nuroğlu / Ela Sibel Bayrak Meydanoğlu /
Enes Bayraklı (eds)

Turkish German Affairs from an Interdisciplinary Perspective

PETER LANG
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Nihal Tuncer Terregrossa* & Ferda Karagöz**

The Structural Transformation of Bilateral Trade Relations Between Germany and Turkey: Causes and Consequences

Abstract: The aim of the present study is to identify, quantify, and explain the changing pattern of bilateral trade flows between Germany and Turkey from 1993 to 2013. One noteworthy facet of this relationship is 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). The present 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. It is found that German-Turkish trade flows are dominated by one-way trade. As of 2013, in 93% of one way trade between the two countries, Germany's exports exceed Turkey's exports. The study also reveals that there is a marked rise in P&C trade, and that VIIT is the dominant trade type in this category. The motor vehicles industry is by far the largest category in both final goods and P&C trade, and is concentrated in a few commodities. The study also finds that in VIIT flows, Turkey specializes in low unit value products while Germany specializes in products with high skill content.

Keywords: Bilateral Trade between Germany and Turkey, Intra-Industry Trade, New International Division of Labor, One-Way Trade, Production Sharing

1. Introduction

The aim of the present study is to identify and quantify the changing pattern of bilateral trade between Germany and Turkey over the period from 1993 to 2013. During these two decades, trade and specialization patterns of both of these partners underwent structural transformation subject to the changing conditions in the

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global economy, which is occasionally labelled as the new international division of labour (Fröbel et al., 1980). The study aims to provide evidence in the newly developing areas of the world trade in the context of these two traditional trade partners.

The choice of the time frame was in large part determined by the availability of the most recent data. Three dates ten years apart are chosen; representing turning points in the Turkish economy as well as global trade. 1993 is the starting point, when globalization had begun to have pronounced effects on trade, but had not yet given rise to changes in global production patterns, such as outsourcing or fragmentation. 1993 also marks the beginning of the Single Market in Europe.

It is also a date that marks 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 single party (Justice and Development Party or AKP) rule, led to structural changes in Turkish industry. In the EU, the largest enlargement movement took place in 2004, with ten new members having joined. Among these new members, the four countries in Central Europe (Czech Republic, Hungary, Poland, and Slovakia) are the most dynamic group in German trade and production relations. The second half of the period of analysis 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 the present study.

In the remainder of the study, the first part provides a background for the bilateral trade relations between Turkey and Germany. The second part outlines Germany's position in the global economy as the largest manufacturer among the G7 countries, and the third largest economy in world trade flows. The study displays general trends in Germany's trade patterns and identifies the changes that took place during the period under review. The third part is about the general features of bilateral trade flows between Germany and Turkey.

The last 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. The study ends with some concluding remarks.

2. Historical backdrop for bilateral trade relations between Germany and Turkey

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

A comparison of European trade patterns in 1960 and 2010 reveals that in the span of fifty years, political developments were a major determinant of changes in the dominant positions of the major economies in European markets. Berentsen (2012) highlights the point that in 1960 the geographical distribution of trade flows reflected the political blocs of the Cold War. In 1960, the USSR was the main source of imports for its "satellite" countries, and Democratic Republic of Germany was the main source of imports for the USSR. Similarly, the US was the main source of imports for the UK, Spain, Federal Republic of Germany and Turkey. For most of the core countries of today's EU, the main source of imports in 1960 was Federal Republic of Germany. By 2010, the US had lost its leading position as exporter in the whole of Europe. Germany, on the other hand, had become the leading source of imports in almost all of the European countries, including Turkey. Russia had still retained its dominant position with some of its former bloc partners, and the main source of imports for Russia as of 2010 is Germany (Berentsen, 2012).

Within this context, the German-Turkish bilateral trade pattern fits the overall trend where the biggest and strongest economy, coupled with geographical proximity, becomes the major trading partner of the smaller country. The starting point for a study of the trade flows between these two partners requires first an assessment of the role played by Germany in the ever expanding and evolving nature of world trade. The role played by Germany has been shaped by significant developments that affected world trade patterns over the past thirty years, such as liberalization and expansion in global trade, further steps in European integration, and the rise of emerging countries as a major force in manufacturing.

The data covering 1992–2013 reveals the main trends in the significant transformation in bilateral trade flows between these two partners. In 1992, over 80% of Turkish manufacturing exports to Germany consisted of food, textiles and agriculture; whereas in 2013, this figure fell to 44%. During these two decades, there was a significant increase in Turkish exports of motor vehicles and machinery. The changing commodity composition of these bilateral trade flows was accompanied by the emergence of trade patterns different from one-way trade in final goods. During these past two decades, Turkish firms became increasingly integrated in global production chains. German firms established assembly bases for outsourcing activities, which was facilitated by the EU-Turkey Customs Union

Agreement. Consequently, intra-industry trade (IIT) in parts-and-components (P&C) gained momentum.

3. Germany as a major player in global trade

The post Cold-war era witnessed a surge in Germany's share in world trade flows. The share of German exports in total world exports rose from 3.5% to over 12% by the mid-1990s, and a similar trend is observed in imports. Moreover, in 1987 the Federal Republic of Germany held the top position in fifteen out of the thirty five 2-digit SITC groups ahead of US and Japan (Owen Smith, 1994, pp. 500, 504, 518). Currently, these past characteristics of the German economy are still broadly valid.

In 2013, Germany accounted for 7.7% of global exports and 6.3% of global imports. Although a prime example of export-led growth, Germany is also very open to imports, and the share of trade in German GDP increased from 36% in 1993 to 56% in 2003 and to 81% in 2012 (see Table 1). By 2012, Germany ranked fifth in the world in terms of openness after small economies (Federal Ministry of Economics and Technology, 2013).

Table 1: German Merchandise Trade with the World

	1993	2003	2013
Exports **(billions of dollars)**	380.0	751.6	1,452.7
Imports **(billions of dollars)**	342.6	604.6	1,188.9
(Exports)/GDP (%)	18.9	30.8	44.0*
(Exp+Imp)/GDP (%)	35.8	55.6	81.4*

Source: World Trade Organization and Federal Ministry of Economics and Technology.
* 2012 figures.

The manufacturing sector has a pivotal role in Germany's presence in global trade, and for many years its share in GDP is a stable 22%, the highest among the large developed countries. Along with the rise of emerging economies as a major force in manufacturing, however, Germany's manufacturing share in output now ranks third in the world after China and South Korea (World Bank, WDI).

US, Japan and Germany, the largest advanced countries and traditional suppliers of merchandise exports, experienced a setback in exports from 1993 to 2013. The share of these three countries in total merchandise exports fell from 32% in 1993 to 20% in 2013 (Table 2), and their share in total world manufacture exports fell from 37% to 25%. Germany, among these three, suffered the least decline in its share. China and Korea, on the other hand, enjoyed increasing shares in world trade over the course of the past two decades. To sum up, Germany became a

more open economy, but at the same time experienced a setback in its prominent position as an exporter.

Table 2: Selected Country Shares in World Exports and Imports (%)

	Share in total world merchandise exports			Share in total world manufactures exports		
	1993	2003	2013	1993	2003	2013
United States	12.26	9.55	8.39	13.35	10.71	9.49
Germany	10.03	9.90	7.72	11.19	11.92	10.44
Japan	9.56	6.22	3.80	12.96	7.98	5.28
Rep. of Korea	2.17	2.55	2.97	2.86	3.23	4.06
China	2.42	5.77	11.74	2.77	7.22	17.53

Source: Authors' own calculations based on WTO.

In all of the years under analysis, the top five sectors in German exports (Figure 1.a.) are motor vehicles, electrical and optical equipment, machinery, chemicals, and basic metals. These five sectors together account for 55% of total exports. 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 during the period under review.

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

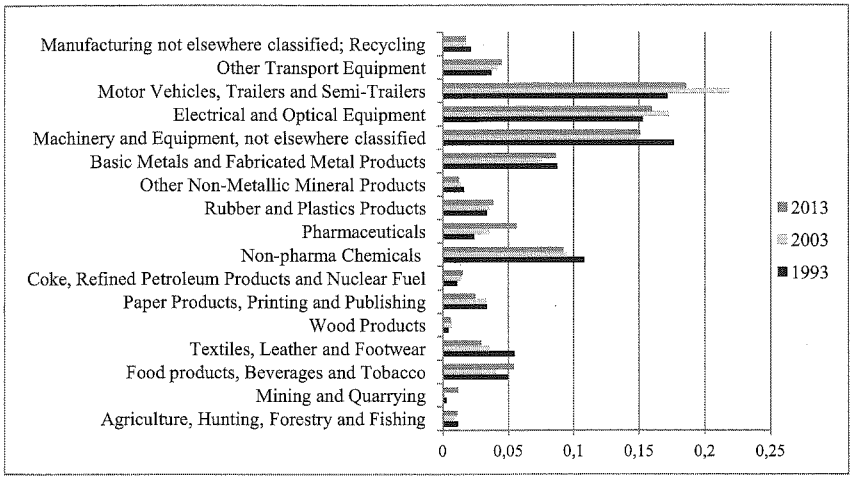
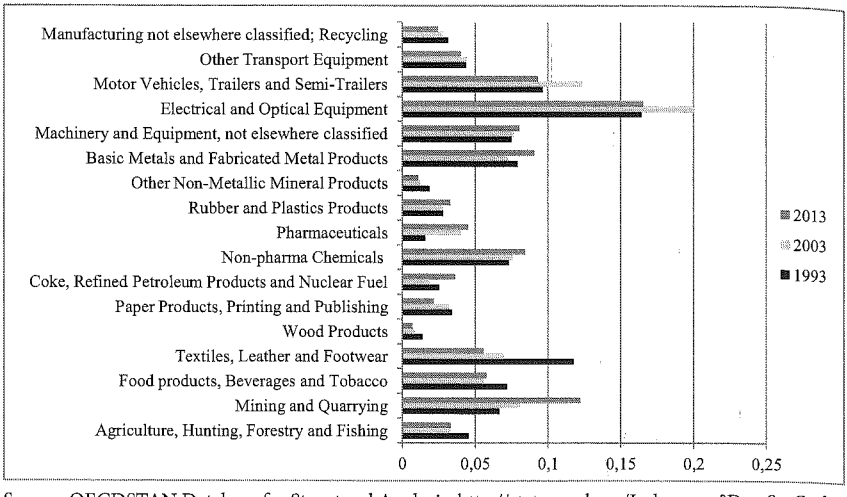


Figure 1.b: Industrial Composition of German Manufacturing Imports from the World*



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

The top five exporter and importer sectors hold a significant place in the German manufacturing industry and account for 64% of total value added and 55% of employment in 2007. (Godart & Görg, 2011, p. 337, Table 2). Despite the predominance of foreign trade in the economy, only 39% of the firms in German manufacturing engaged in exports, imports or both in 2006. The remaining firms operated in the domestic market only. There is, however, sectoral variation in this indicator. In machinery and motor vehicles, the sectors where production sharing is the most widespread, firms that solely operate in the domestic market constitute merely 41% and 48% of the total respectively. In these two sectors, firms that engage in only exports or only imports are around 10% of the total each. About a third of the firms in these two sectors both export and import which is indicative of the two-way nature of trade in motor vehicles and machinery (Godart & Görg, 2011, pp. 338–339, Tables 3 and 4.).

Regional dispersion of exports (Figure 2.a.) shows that EU-15 is the top destination, but the share of this region is on a gradually decreasing trend from 56% in 1993 to 44% in 2013. During the same two decades, the share of exports to Central & Eastern Europe (CEE), including Turkey, 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.). Throughout the two decades under review,

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*

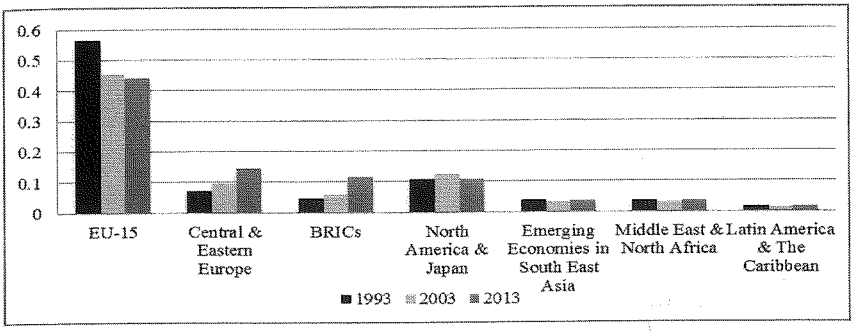
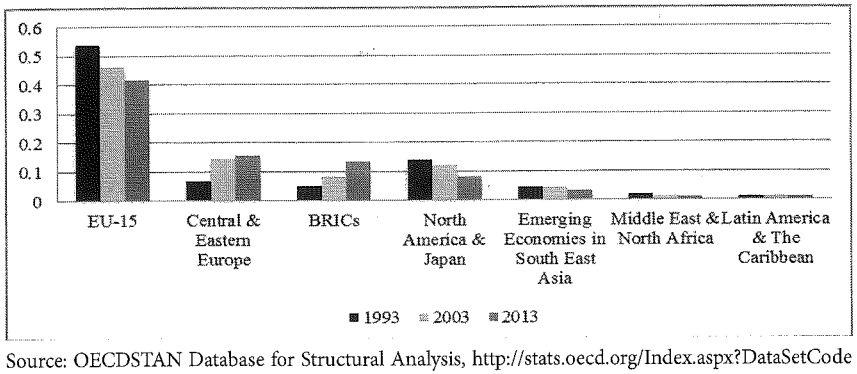


Figure 2.b: Dispersion of German Imports among Regions, by percentage*

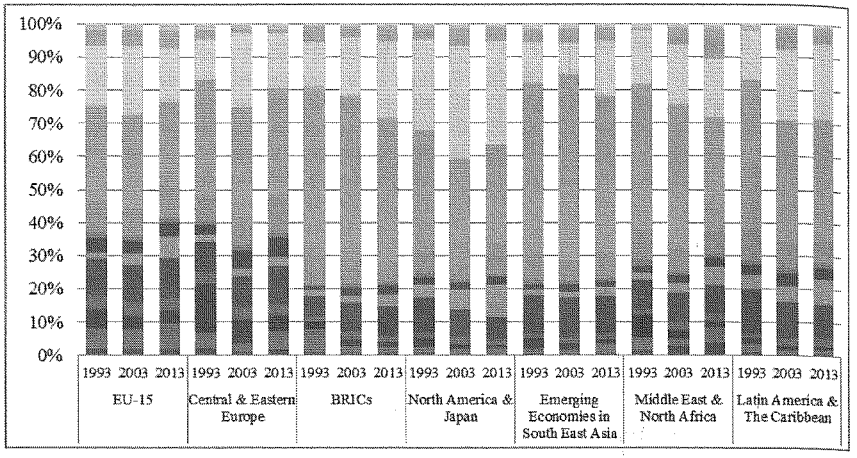


Source: OECDSTAN Database for Structural Analysis, http://stats.oecd.org/Index.aspx?DataSetCode=STANINDICATORS.

*For the country coverage of each region, see Appendix Table A.1. Countries in Each Geographical Region.

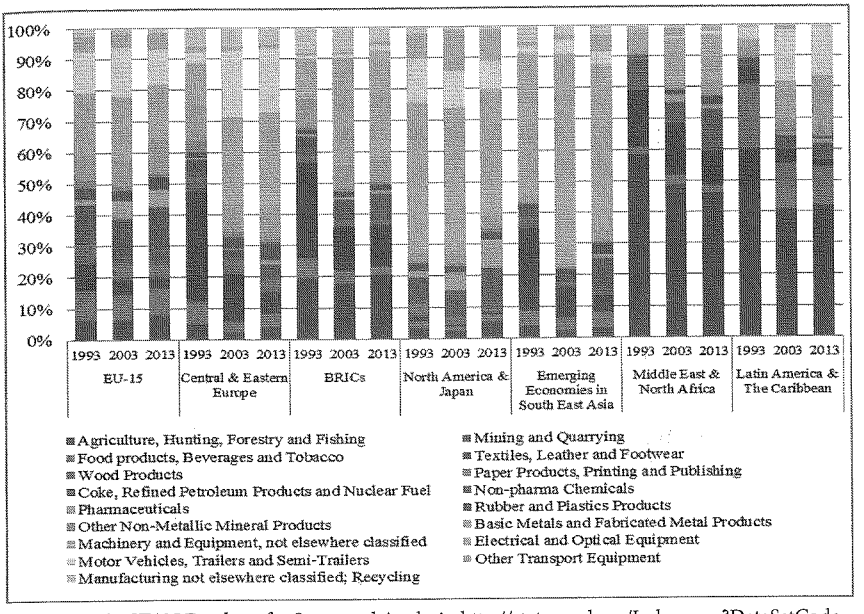
The breakdown of exports by regions and industries (Figure 3.a.) reveals the prominent position of machinery and motor vehicles sectors in all of the German export markets.

Figure 3.a: Dispersion of German Exports among Regions & Industries, by percentage share*



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 3.b. reveals, the changing 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 favour 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.

Figure 3.b: Dispersion of German Imports among Regions & Industries, by percentage share*



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

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. 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).

4. Bilateral trade flows between Germany and Turkey

In 2013, the trade volume between Germany and Turkey added up to $37.9 billion and accounted for 9.4% of the total value of Turkish trade. Germany was the top destination of Turkish exports and the third largest source of Turkey's imports (TURKSTAT, 2014). Figure 4 shows Turkey's exports to and imports from Germany and the resulting trade deficit during 1977–2013.

Figure 4: Trade between Germany and Turkey, 1977–2013, billion $

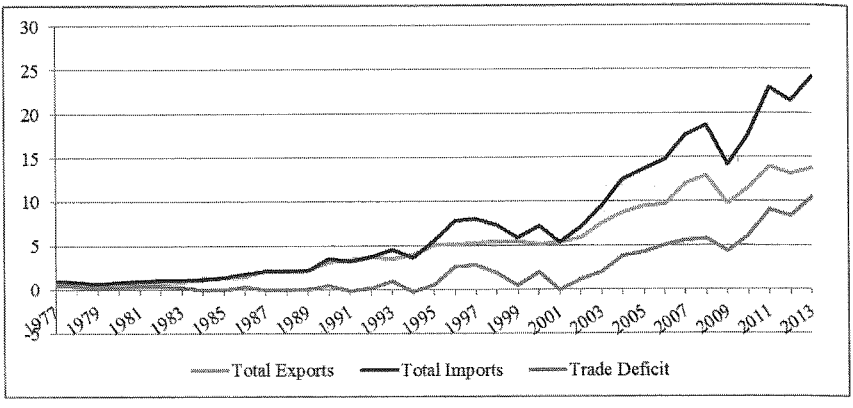
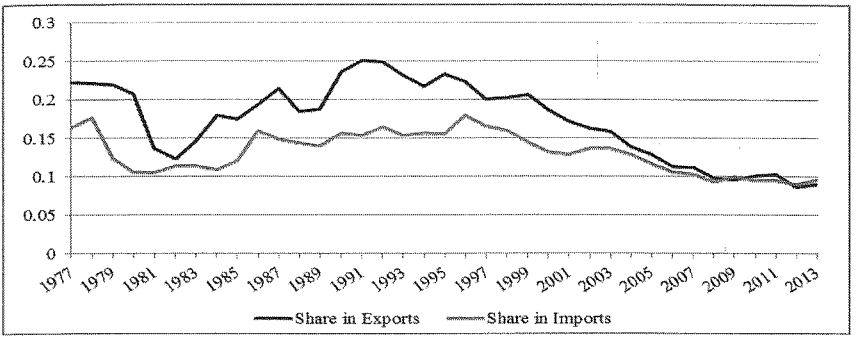


Figure 5 depicts Germany's share in Turkey's exports and imports. Although Germany has always been Turkey's largest export market, its share in Turkish exports decreased from 23% in 1993 to 9% in 2013. There is a similar downward trend in imports where Germany's share decreased from 15% in 1993 to 9.6% in 2013. This change is in line with the general diversification trends in world trade (Berentsen, 2012). The decreasing share in Turkish imports is also attributable to the general decrease in the dominance of Germany in global industrial exports.

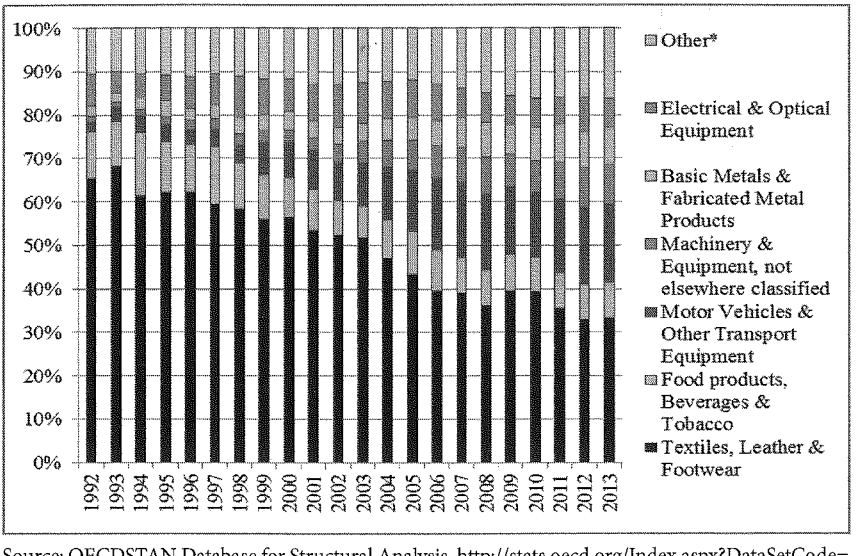
Figure 5: The Share of Germany in Turkey's Exports & Imports



Source: Authors' own calculations based on TURKSTAT, http://tuikapp.tuik.gov.tr/disticaretapp/disticaret_ing.zul?param1=4&param2=0&sitcrev=0&isicrev=0&sayac=5908

Figure 6.a. shows the industrial composition of Turkey's exports to Germany during 1992–2013.

Figure 6.a: The industrial composition of Turkey's exports to Germany, 1992–2013*



Source: OECDSTAN Database for Structural Analysis, http://stats.oecd.org/Index.aspx?DataSetCode=STANINDICATOR

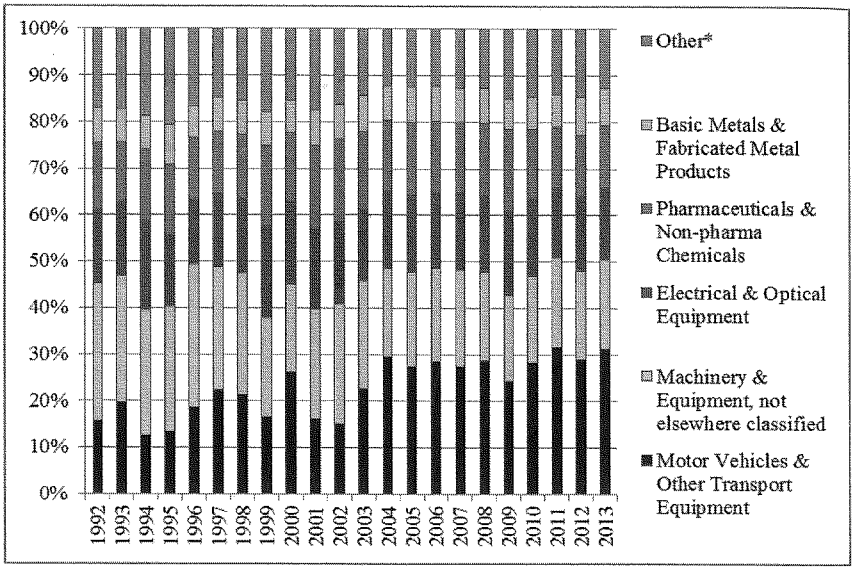
*"Other" consists of Agriculture, Hunting, Forestry and Fishing; Mining & Quarrying; Wood Products; Paper Products, Printing and Publishing, Coke, Refined Petroleum Products and Nuclear Fuel; Other Non-Metallic Mineral Products; Non-pharma Chemicals; Pharmaceuticals; Manufacturing not elsewhere classified-Recycling; Rubber and Plastics Products.

**ISIC Rev. 3 2-digits.

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 6.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 industries are 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.

Figure 6.b: The industrial composition of Turkey's imports from Germany, 1992–2013*



Source: OECDSTAN Database for Structural Analysis, http://stats.oecd.org/Index.aspx?DataSetCode=STANINDICATOR

*"Other" consists of Agriculture, Hunting, Forestry and Fishing; Mining & Quarrying; Food products, Beverages and Tobacco; Wood Products; Paper Products, Printing and Publishing; Coke, Refined Petroleum Products and Nuclear Fuel; Other Non-Metallic Mineral Products; Manufacturing not elsewhere classified- Recycling; Rubber and Plastics Products; Textiles, Leather and Footwear.

**ISIC Rev. 3 2-digits.

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. This dynamic aspect of trade between the two partners is analysed in the next section.

FDI is an important component of trade relations, and German FDI in Turkey is no exception. In 2012, of the total of 33,439 firms with foreign capital operating in Turkey, German capital ranks first with 5,270 firms. In 2012, of the 3895 firms established with foreign capital, the 445 firms with some degree of German ownership rank first. However, of the total FDI flows of $66.9 billion from Germany to the world, Turkey's share of $551 million is minute (Republic of Turkey, Ministry of Economy, 2013, pp. 22–51). (However, a caveat is in order here in that not all of FDI flows to the manufacturing sector).

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 3). As of mid-2014, there are a total of 1018 firms with German 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 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 intensive aspect of production in these sectors.

Table 3: 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 (2014). For FDI stock; Authors' own computation based on Kiel Institute for the World Economy, Database for Stocks of Foreign Direct Investment of the US, Japan, and Germany.

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 3). 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 Database).

5. The structural change in manufacturing trade between Germany and Turkey

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. Vertical IIT (VIIT) refers to trade between developed and emerging countries in similar products. The theoretical literature on intra-industry trade flows emphasises the importance of product quality differences as a rationale for (VIIT).[1] Another trend to mention is the surge in P&C trade, and the trade types described so far are also valid for P&C trade. A notable facet of the new international division of labour is production sharing or fragmentation of production.[2]

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

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, (1990, 2001); Yi, (2003).

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 order to analyse the structural change observed in bilateral trade flows between Germany and Turkey, the present study employs disaggregated trade data[3] in 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 (HS) with Figures 1.a. and 1.b.(in ISIC Rev. 3) reveals that German foreign trade is concentrated in groups that correspond to HS 84, 85 and 87. Figure 3.b. reveals that in Germany's imports from BRIC and CEE, the share of these industries increased the most. Figure 6.a. shows that in Turkish exports to Germany, the share of motor vehicles and machinery (ISIC 34–35 and 29) increased from 4% in 1992 to 27% in 2013. As for German exports to Turkey (Figure 6.b.), the share of motor vehicles and machinery is the highest in the total and increased from 45% in 1992 to 50% in 2013.

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).

In this section trade flows between Germany and Turkey are classified into one-way trade, HIIT and VIIT in final goods and in P&C by employing the methodology in Fontagné & Freudenberg (1997). Trade flows between Germany and Turkey in product j are classified as one-way if the equation below holds, and as IIT if not.[5]

$$\frac{Min(X_j, M_j)}{Max(X_j, M_j)} \leq 0.1 \quad (1)$$

In order to identify HIIT and VIIT, equation 2 is employed. 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.

$$0.8 \leq \frac{P_j^x}{P_j^m} \leq 1.25, \textit{ where P: unit value, x: export of good j, m: import of good j} \quad (2)$$

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] All products are classified into two broad groups as final goods and P&C and identified as one-way trade, HIIT, or VIIT under each group. After aggregating the trade volume under each of the six categories, the absolute sizes of these categories are depicted in Figure 7.a and their relative importance in the total is depicted Figure 7.b. Following Ando (2006), trade types are further categorized in the following manner:

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".

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) (3)

if $P_j^x / P_j^m < 0.8$, then lower quality VIIT or (LQVIIT) (4)

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).

Figure 7.a: Germany-Turkey trade patterns in HS 84–92 (by volume)*

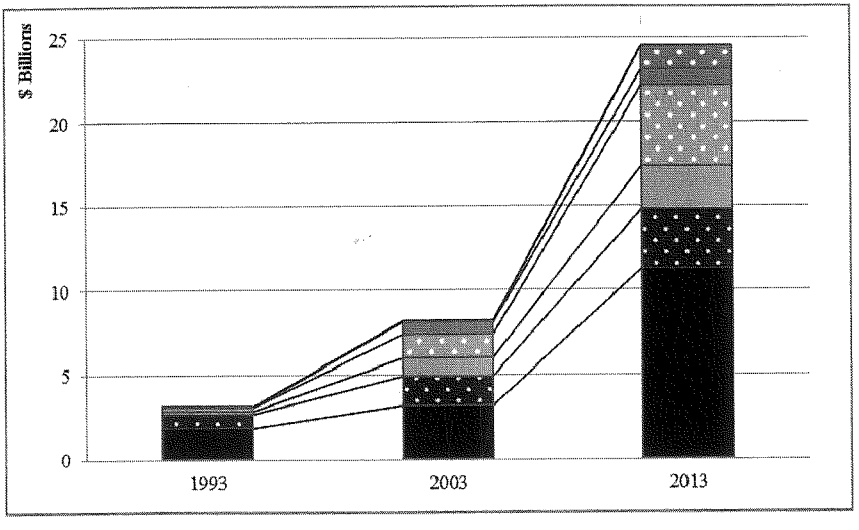
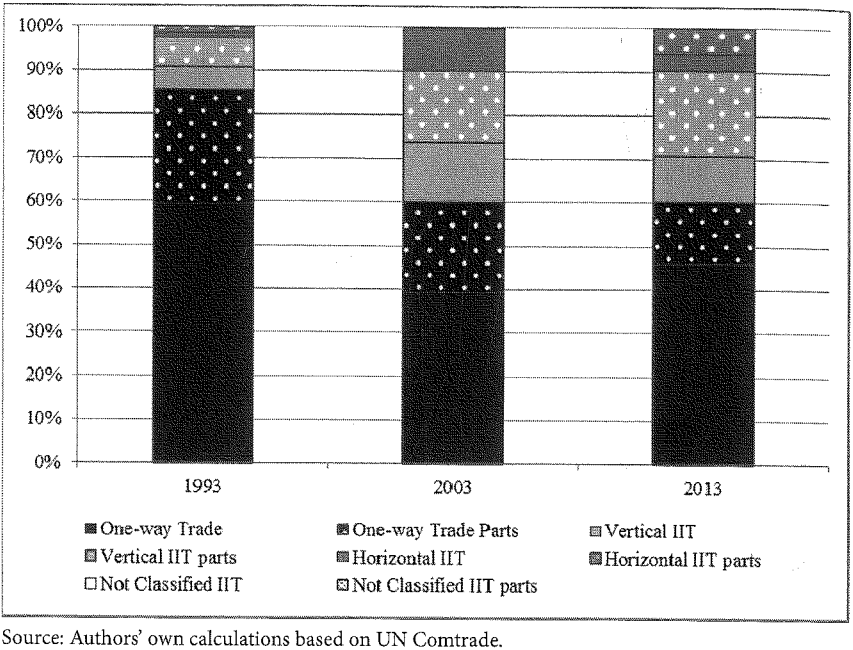


Figure 7.b. reveals that the dominant trade type between Germany and Turkey is one-way in all of the three years. However, the share of one-way trade in total (the sum of final goods and P&C) decreased from 85% in 1993 to 60% in 2003 and 2013. The rising share of IIT comes from VIIT in P&C, and during the two decades under review, VIIT P&C share in total trade increased from 6% to 19%. VIIT in final goods also increased, but to a lesser extent.

Table 4 further shows that 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, it should be kept 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 (Athukorala, 2010, pp. 42–45; Fukao et al., 2003, pp. 472–476).

Figure 7.b: Germany-Turkey trade patterns in HS 84–92 (by share)*



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

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).

Table 4: A Closer Look at Germany's One-way Trade & 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.

Sectoral composition of VIIT is shown in Figure 8 by aggregating commodities into four major groups:

84: General Machinery
85: Electrical Machinery
86–89: Transport Equipment
90–92: Precision Machinery

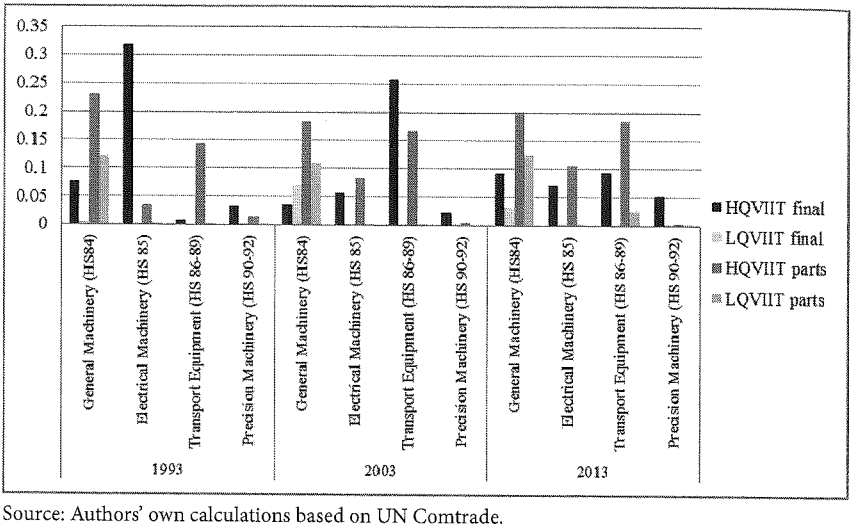
The leading category in VIIT is General Machinery, with a 45% share in total VIIT in HS 84-HS 92 in 2013. From 1993 to 2013, this indicator for Transport Equipment increased from 15% to 31%, while there was a decrease from 36% to 18% in Electrical Machinery. Digging deeper, however, Table A.2 reveals that the auto industry uses P&C from general and electrical machinery.[7] After making the necessary adjustments[8], Transport Equipment becomes the leading product category in VIIT with a 46% share in 2013.

7 For instance, HS 840820(engines for motor vehicles) is classified under "General Machinery" and HS 854430(electrical parts of autos) is classified under "Electrical Machinery".

8 The US Department of Commerce, Office of Transportation and Machinery Automotive Parts Product Listings are used for checking the concordance of P&Cs with auto industry.

Ranking HS 84–92 product categories in terms of volume shows 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 1,029 in 2013. These products (final goods and P&C) are shown in Tables A.1 and A.2.[9] 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. Nearly half of these top 20 products consist of P&C. 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.

Figure 8: Industrial Composition of VIIT



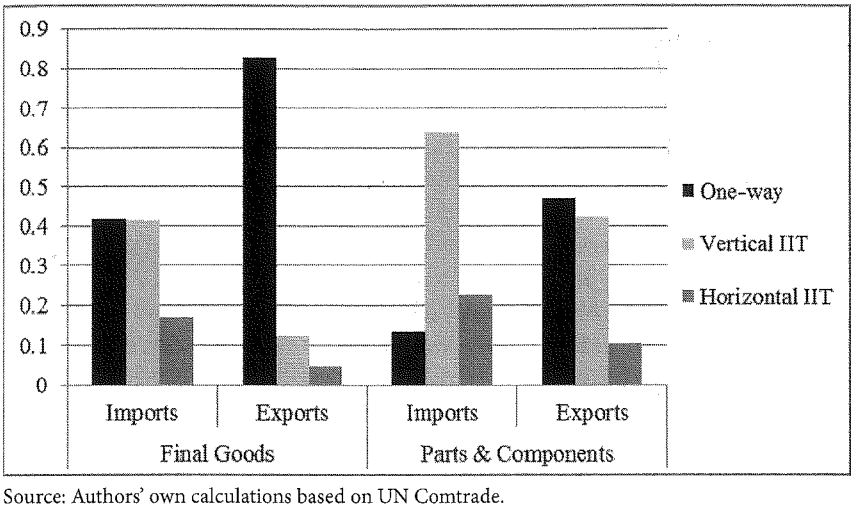
Source: Authors' own calculations based on UN Comtrade.

Figure 9 shows the breakdown of exports and imports in final goods and in P&C into the three types of trade. The figure shows that in final goods, 83% of Germany's

9 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.

exports to Turkey are one-way trade. One can argue that Germany has 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, Turkey's final good exports cannot be labelled 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 & 870421) display an HIIT pattern. VIIT is observed in exports of some passenger cars, washing machines, and electrical and optical appliances. Tables A.1 and A.2 also show the type of trade in the top-ten ranking of final goods and P&C.

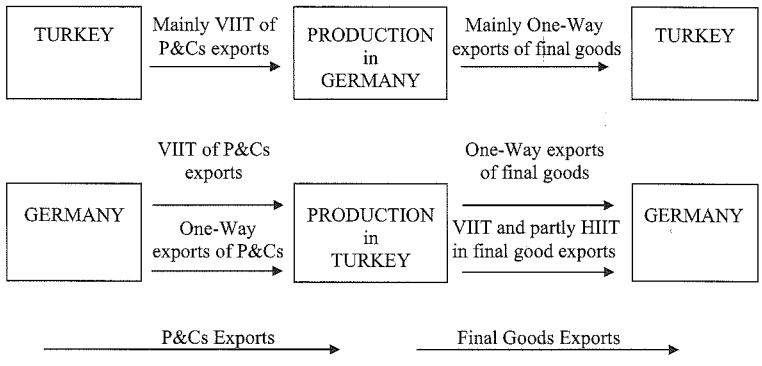
Figure 9: The Dispersion of Germany's Imports and Exports among Trade Patterns, 2013



Source: Authors' own calculations based on UN Comtrade.

Combining Figure 9 with these two tables, one can get further insight into the patterns in final goods and P&C flows. Figure 10 illustrates trade patterns identified in this study. The right hand side of the figure summarizes the main patterns in final goods exports. Germany's final good exports to Turkey are mainly one-way trade.

Figure 10: An illustration of German-Turkish bilateral trade patterns



Source: Authors' own illustration based on their calculations from UN Comtrade.

Turkey's final good exports to Germany consist of one way trade, VIIT and to a lesser extent, HIIT. The left hand side of Figure 10 summarizes trade in P&C. As shown in the upper-left hand corner, Turkey's P&C exports follow mainly a VIIT pattern (64% of total P&C exports). These flows mostly consist of parts of transport equipment such as parts of bodies and engines, suspension systems, brakes and wiring sets. Conversely, Germany's P&C exports to Turkey fall under the categories of both VIIT and one-way trade (42% and 47% of total P&C exports, respectively). While the high value added parts of auto vehicles such as gear boxes, drive axles[10] and engines follow a one-way trade pattern, other parts such as parts of bodies and engines display a VIIT pattern.

Trade flows under HS 84–92 are dominated by the motor vehicles sector, and it is possible to make inferences on the nature of trade and production sharing

10 For drive axles, parts of bodies and parts of chassis and wheels (including 870850, 870829 and 870899), which are significant in both exports and imports of P&C, we further measured the trade patterns at the HS 12 digit level. The detailed measurement of trade pattern somewhat differed from the HS 6 digit level calculations shown in Table A.2. For instance, drive axles (870850) follow a pattern of one-way trade in favor of Germany, whereas we identify mainly a HQVIIT pattern for parts of bodies (870829). For the parts of chassis and wheels (870899), the main trade pattern was HQVIIT, although one-way trade and LQVIIT were also valid with relatively small shares. HQVIIT in the highly disaggregated product categories may be an indication of quality differentiation of the same parts. Conversely it may also be a result of fragmentation in tiny parts that even the most disaggregated trade statistics cannot identify. Further research is needed in order to make a better judgment.

in this sector. Turkey exports parts of engines (840999 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)[11].

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. 58% of Turkey's auto exports is passenger cars, most of which follows either a one-way or HQVIIT pattern in favour of Germany. For instance, Table A.1 reveals that the top two German export items to Turkey (HS 870332 and HS 870323) are also within the top ten export items from Turkey to Germany, but because $\frac{Min(X_j, M_j)}{Max(X_j, M_j)} \leq 0.1$, the trade flow is one way. HS 870322 ranks fourth in both German exports and German imports and is classified under HQVIIT. The remaining 42% of Turkey's auto exports consists of commercial vehicles, and is classified under HIIT.

As a final remark, it should be noted that Germany's final good exports are not limited to transportation equipment and include one-way exports of other capital goods as well.

6. 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 different products 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. 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 provides examples for the dynamics of the new international division of labour. 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 in line with the general diversification trends in world trade. The present study demonstrates that there is a structural change in this bilateral trade relationship,

11 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.

and that the key to understanding this change lies in the growing importance of the motor vehicles and machinery sectors, and the accompanying shifts between one-way trade and IIT. Germany specializes in the production of goods with medium technology such as motor vehicles and machinery. This is an atypical specialization pattern since developed countries specialize in high technology goods. Motor vehicles 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).

The present 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 favour of Germany, and P&C exports are mainly VIIT of low quality products.

Based on the findings of the study, one can conclude that the structural change in Turkish exports from low technology-labour 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 behaviour as a successful exporter is that the choice of the sector to specialize in, ie, medium technology products, is secondary to the capabilities to create a high value added in the area of specialization.

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Appendix

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

HS Code	Product Name	Import Value	Trade Pattern	HS Code	Product Name	Adjusted Export Value	Trade Pattern
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)

HS Code	Product Name	Import Value	Trade Pattern	HS Code	Product Name	Adjusted Export Value	Trade Pattern
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.