

The Extent of Intra-Industry Trade between Turkey and the European Union: The Impact of Customs Union

Ali Koçyiğit* & Ali Şen**

Abstract. This study explains the extent of intra-industry trade (IIT) in Turkey's foreign trade, especially its main trading partner, the European Union (EU). The results show that, parallel to Turkey's trade with the world, her trade with the EU is moving towards intra-industry type trading. Moreover, the growth of IIT between Turkey and the EU shows that Turkey's industrial base is dramatically changing from low-technology products to high-technology industries, specially since the Customs Union agreement with the EU was put into effect in 1996.

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1. Introduction

For more than four decades theoretical and empirical researchers in the field of international trade have been keenly interested in two-way trade of products belonging to the same industry, that is intra-industry trade (IIT), with theories of comparative advantage, or Heckscher-Ohlin factor endowment, focussing on inter-industry trade. Ricardo's comparative advantage model states that countries with different comparative advantages engaging in trade will profitably benefit from it. The Heckscher-Ohlin model describes the basis of comparative advantage in terms of factor endowments. A country will export a commodity which utilizes its abundant factor and import a commodity which utilizes its scarce factor. Both types of trade models assume that goods traded are homogeneous, and that a country

* Associate Professor. Inonu University. Faculty of Economic and Administrative Sciences. Department of Economics. Malatya – Turkey. Address: Malatya Oto Tic. A.Ş., Ankara asfaltı, 6. km., Bostanbaşı, Malatya, Turkey. E-mail: kocyigita@gmx.net

** Associate Professor. Inonu University. Faculty of Economic and Administrative Sciences. Department of Economics. Malatya – Turkey.

will therefore either only export goods within the same industry, or only import these goods, but not simultaneously export and import goods within the same industry. However, a large portion of the output of modern economies involves differentiated rather than homogeneous products of the same industry, that is intra-industry trade as opposed to inter-industry trade in completely different products. Therefore, conventional trade theories are deficient in this respect and cannot explain this type of emerging trade pattern.

Instead of specialization in an entire industry or activity, that is, inter-industry specialization, intra-industry specialization involves a country specializing in a narrow range of products within a given industry. Another corollary of IIT theory is related to economies of scale, principally because IIT occurs when each country with economies of scale produces only a limited range of products within an industry. Thus, IIT represents a simultaneous movement towards specialization in separate differentiated goods and achieves economies of scale in production, and thereby leads to two-way trade in products similar enough to be grouped in the same industry in standard industry classification schemes. As Krugman and Obstfeld (1988) pointed out, IIT with these features produces extra gains from international trade because it creates a larger market. As a consequence, this suggests that a country engaged in a narrower form of specialization can via IIT increase both productivity and the variety of goods available to domestic consumers.

The IIT phenomenon was first considered empirically when a group of European countries formed the European Common Market, which has now grown into the European Union and currently consists of twenty five countries.¹ A large number of theoretical and empirical studies have been conducted to measure the size and importance of IIT, and also to investigate the determinants of it since that time.² In addition to the desirable welfare effects mentioned before, trade analysts also noted another positive aspect of IIT from the investigation of the European experience after the formation of the EC, namely, the adjustment cost of economic integration. It was shown from the actual experience of the EC in the late 1950s and 1960s that IIT

¹ Among the most notable studies in this context are Verdoorn (1960) and Balassa (1965).

² After the pioneering study of Grubel and Lloyd (1975) the initial key contributions in the theory of IIT study include Krugman (1979), Lancaster (1980) and Brander (1980).

reduced the adjustment costs of an economy opening up to foreign trade as domestic industries could remain intact while moving to specialize only in a limited range of products. The proposition is that intra-industry trade increases as a nation's economy develops has found general support and is now widely accepted. Accordingly, the bulk of empirical studies has focused on the IIT of developed countries. However, an increasing number of studies have also been done on developing country IIT, or on the IIT between developed and developing countries.³ Some of the studies in attempting to identify the determinants of IIT have focused on country-specific determinants while others have concentrated on industry-specific ones. However, there are some studies which focus on both types of determinants. IIT studies in recent times have also estimated the extent of horizontal and vertical intra-industry trade and identified their determinants.⁴

In this article, we aim to estimate the extent of Turkey's intra-industry trade, to identify the determinants of its IIT pattern, and to test a number of country-specific hypotheses concerning the determinants of intra-industry trade between Turkey and the EU. Only a handful of studies have focused on Turkish intra-industry trade, and on Turkey and the EU in particular.⁵ This study tries to make a modest contribution to the relatively small stock of research on Turkish IIT. Given that nearly half of Turkish foreign trade is with the EU and that a Customs Union between these two sides was introduced in 1996, this study pays particular attention to the Turkish IIT pattern with the EU.

The remainder of the article is organized as follows: Section II presents a brief discussion of the general performance of Turkey's foreign trade over the past three decades. Measurement alternatives of IIT are discussed in section III. The extent of intra-industry trade in Turkey's foreign trade is provided in section IV, and section V stresses the extent of intra-industry trade between Turkey and the European Union. The main findings are summarized in section VI.

³ Among this type of IIT studies are Aquino (1978), Balassa (1979), Havrylshyn and Civan, (1983), Monrique (1987), and Nilson (1999).

⁴ See, Abd-El-Rahman (1991) and Greenaway, Hine and Milner (1994).

⁵ Examples of these studies include Erlat and Erlat (2003), Lohrmann (2002) and Doğaner (2001).

2. General Performance of International Trade in Turkey

Turkey's total foreign trade of goods (exports + imports) increased considerably from \$1.5 billion in 1970 to \$190.3 billion in 2005, an increase of approximately 12583 percent during this period. Owing to the far greater external orientation of the economy since the beginning of the 1980s, when Turkey embarked on a trade liberalisation program, foreign trade has represented a much higher proportion of the national income in comparison to the pre-1980s. As a percentage of GDP, total trade increased from 8.5 percent in 1970 to 53 percent in 2005. The increase in this ratio resulted from the increase in both exports and imports shares: exports/GDP share rose from 3.2 percent in 1970 to 20.5 percent in 2005 while the corresponding imports/GDP share increased from 5.3 percent to 32.5 percent, respectively (Table I).

Table 1. Turkey's External Trade 1970-2005

Year	Exports as % of GDP	Imports as % of GDP	Total Trade as % of GDP
1970	3.2	5.3	8.5
1975	3.0	10.0	13.0
1980	4.2	11.4	15.6
1985	11.7	16.8	28.5
1990	8.6	14.8	23.4
1995	12.7	21.0	33.7
1996	12.7	24.0	36.7
1997	13.8	25.5	39.3
1998	13.4	22.9	36.3
1999	14.3	21.9	36.2
2000	13.9	27.3	41.2
2001	21.5	28.3	49.8
2002	19.6	28.1	47.7
2003	19.3	28.4	47.7
2004	20.8	32.2	53.2
2005	20.5	32.5	53.0

Source: For 1970-2004 GDP data, United Nations National Accounts Main Aggregates, UN Website Database.

For 2005 GDP data is an Economist Intelligence Unit estimate. (The Economist Intelligence Unit Website)

For 1970-2005 Annual Exports and Imports Data, SPO and UFT Websites.

Turkey's foreign trade gained momentum in the 1990s. In particular, the Customs Union agreement which started with the EU on January 1996 contributed to a further surge in Turkey's trade volume. Exports which were \$12.9 billion in 1990 increased to \$21.6 billion in 1995, \$27.7 billion in 2000, and \$73.1 billion in 2005. Imports which were \$22.3 billion in 1990 rose to \$35.5 billion in 1995, \$54.5 billion in 2000, and \$116.8 billion in 2005. Turkey showed great performances in exports in 2001, 2002, 2003 and 2004. Turkey's exports grew by 12.8, 15.1, 31.0 and 33.6 percent respectively. Although slowing down in relation to the previous years, export growth kept on rising, to 15.8 percent in 2005. Imports in this period decreased first by 24 percent in 2001 due to the great contraction in the economy. However, when the economy recovered and grew again in the years between 2002 and 2005, imports also improved considerably, increasing 24.5 percent in 2002, 34.5 percent in 2003, 40.7 percent in 2004 and 19 percent in 2005 (www.foreigntrade.gov.tr).

Apart from the quantitative increase in foreign trade, the most striking change that has occurred is in the sectoral share of Turkish exports since 1980. There has been a shift towards industrial goods, in contrast to the situation before 1980 when Turkey's agricultural exports typically accounted for about two-thirds of total exports. The share of manufactured products in total exports rose from 67.7 percent 1990 to 94 percent in 2005, while the share of exports of agricultural products fell from 25.5 percent in 1990 to 4 percent in 2005 (www.tcmb.gov.tr).

However, there has been a minor changes in imports structure in the last decade. Basically, the impact of intermediate goods has constituted an important part of total imports, with its share of 72.4 percent in 1990 and 81.3 percent in 2005. The other major sectoral parts of imports showed slight changes: investment goods were 18.1 percent in 1990 and 20.2 percent in 2005 while consumption goods were 9.5 percent and 13.9 percent during the same period (www.foreigntrade.gov.tr).

Turkey's international trade has been dominated by the OECD countries for decades, within which the EEC/the EU has constituted nearly half of both Turkish exports and imports (Table II). Among the country groups, therefore, the European Union with its geographical proximity and the level of economic development has been the most important group. Conventionally, another important group in Turkey's foreign trade has been Middle East Countries although their share decreased after the 1980s. On

an individual basis, except with the major countries of the EU (Germany, the United Kingdom, France and Italy), the shares of Turkish exports and imports with the USA have been important although they diminished in terms of percentage in 2005. The share of Turkish imports with the Russian federation has been striking over the last a couple of years due to Turkey's dependence on gas (Table II).

Table 2. Turkey's Trade by Selected Export Destinations and Import Resources (%)

Regions	Exports					Imports				
	1973	1980	1990	2000	2005	1973	1980	1990	2000	2005
OECD Countries	72.0	57.7	69.9	68.3	60.5	77.9	46.7	66.7	69.6	56.7
The EEC / The EU	46.4	42.7	55.4	52.2	48.9 ^a	54.8	28.7	44.4	48.9	42.2 ^a
The Other OECD	25.6	15.0	14.5	16.1	11.6	23.1	18.1	22.3	20.7	14.5
USA	9.9	3.4	7.5	11.3	6.7	8.9	5.8	10.2	7.2	4.6
Non OECD Countries	28.0	42.7	30.1	31.7	39.5	22.1	53.3	33.3	30.4	43.3
Middle Eastern Countries	12.3	18.9	13.8	8.0	13.8	9.9	39.5	12.1	5.7	6.8
Other Countries	15.7	18.0	16.3	15.7	22.5	12.2	11.5	21.2	17.6	25.5
USSR / Russian Fed.	-	5.8	-	2.3	3.2	-	2.3	-	7.1	11.0

Source: For 1973 data, Hiç (1980), pp.138-141; For 1980 data, Aklin (1983), pp. 90-93, and Kepenek and Yentürk (2000), p.294. For 1990-2003 data authors' calculations based on UFT-Foreign Trade Bulletins, Various Years; UFT Website Database. ^a The EU (15).

3. Measurement of Intra-Industry Trade

The Grubel-Lloyd Index

Several alternative measures have been developed in the literature to estimate the degree of intra-industry trade (IIT). To measure the extent of IIT, this study uses the most widely preferred index, Grubel-Lloyd (G-L). This index measures intra-industry trade as a percentage of a country's total trade which is assumed to be balanced, that is exports equal imports. For an individual product group or industry i the share of IIT is formulated as

$$GL_i = 1 - (|X_i - M_i| / (X_i + M_i)) \quad (1)$$

where X_i and M_i stand, respectively, for the exports and imports of industry i . If all trade was balanced GL_i would equal 1. On the other hand, if all trade was one-way, GL_i would equal zero. Thus, the closer GL_i is to 1 (that is, $X_i = M_i$), the more trade in industry i is intra-industry trade. The closer GL_i is to zero (that is, either $X_i = 0$ or $M_i = 0$), the more trade in industry i is inter-industry trade. Therefore, the index of intra-industry trade takes values from 0 to 1 as the extent of intra-industry trade increases, that is, $0 \leq GL_i \leq 1$.

The GL index in equation (1) can be modified to obtain the average level of intra-industry trade for a country j . Grubel-Lloyd proposed calculating a weighted mean, using the relative size of exports and imports of a particular product group as weights. The formula written as

$$GL_j = \Sigma GL_i (X_i + M_i) / \Sigma(X_i + M_i) \quad (2)$$

where the sigma (Σ) refers to all the GL_i s weighted by total trade ($X + M$) of that industry (or product group). J stands for the j th country and i is the i th of n industries. For simplicity, the Grubel-Lloyd measure may be written as follows:

$$GL_j = (\Sigma (X_i + M_i) - \Sigma |X_i - M_i|) / \Sigma (X_i + M_i) \quad (3)$$

or

$$GL_j = 1 - (\Sigma |X_i - M_i| / \Sigma(X_i + M_i)) \quad (4)$$

for n set of industries.

Since the share of some products are higher than others within total exports and imports, taking the simple average of all GL_i 's would give misleading results; hence the GL formula is a weighted mean.

The GL_j index in equation (2), as Grubel and Lloyd stressed (1975), does not allow for any imbalance in a country's total trade. In the presence of a large trade imbalance in a country's commodity trade, GL_j will be biased downwards and the share of intra-industry trade will likely be underestimated. To correct this deficiency Grubel and Lloyd proposed an alternative formula by incorporating trade imbalance into equation (2) as follows:

$$GL_j^a = (\Sigma(X_i + M_i) - \Sigma|X_i - M_i|) / (\Sigma(X_i + M_i) - |\Sigma X_i - \Sigma M_i|) \quad (5)$$

where GL_j^a is the adjusted GL index. Comparing equation (5) with equation (3), it can be seen that the denominator in equation (3) has been reduced by the amount of country j 's overall trade imbalance. Thus, when a country's trade imbalance increases, the difference between GL_j^a and GL_j also increases. This also tells us that whenever a country's trade is imbalanced, the formula in equation (5) should be used as a corrective formula. Since this adjusted measure of GL index incorporates the total trade imbalance, it is measured with respect to total balanced trade.

The Aquino Index

Aquino (1978) stressed that the adjusted GL formula failed to correct for an imbalance in a country's overall trade and underestimated the true extent of intra-industry specialization. According to Aquino, each GL_{IIT} needs to be adjusted for the trade imbalance, not just the weighted average of the GL_{IIT} . Therefore, Aquino proposed adjusting each GL_{IIT} whenever a country's total trade is unbalanced and then estimating the overall average for the country using the adjusted GL_{IIT} ratios. Then the measure of the share of IIT is computed as

$$AQ_{jk}^a = 1 - \{ \Sigma_i |(X_{jki} / M_{jk}) - (M_{jki} / M_{jk})| / \Sigma_i [(X_{jki} / X_{jk}) + (M_{jki} / M_{jk})] \} \quad (6)$$

where

$$X_{jki}^e = X_{jki} [(X_{jk} + M_{jk}) / 2X_{jk}]$$

and

$$M_{jki}^e = M_{jki} [(X_{jk} + M_{jk}) / 2M_{jk}]$$

Here, X_{jki}^e and M_{jki}^e refer to the adjusted exports and imports of industry i goods in trade between countries of k and j .

The Balassa Index

Balassa (1974) assessed intra-industry trade by taking the sum of the ratios of trade balance to total trade for each product group and then dividing by the number of product groups:

$$BL_{ij}^a = [1 - \Sigma |X_{ij}^e + M_{ij}^e|] / [\Sigma (X_{ij}^e + M_{ij}^e)] \quad (7)$$

where

$$X_{ij}^e = X_{ij} [(X_j + M_j) / 2X_j]$$

and

$$M_{ij}^e = M_{ij} [(X_j + M_j) / 2M_j].$$

Here, X_j and M_j denote total exports to, and total imports from, country J . According to Balassa, when the share of intra-industry trade increases, BL_{ij}^a tends to go from one to zero. Thus, a fall in BL_{ij}^a is taken as evidence for intra-industry specialization by Balassa.

The Bergstrand Method

Bergstrand (1983) stated that intra-industry trade should be measured as a proportion of a country's trade with each of her trading partners. He proposed the adoption of a bilateral intra-industry trade index adjusted for each country's multilateral trade imbalance as:

$$BG_{jk}^{ai} = 1 - |(|X_{jk}^i - X_{kj}^i|) / (X_{jk}^i + X_{kj}^i)| \quad (8)$$

where

$$X_{jk}^i = \frac{1}{2} |((X_j + M_j) / (2X_j)) + ((X_k + M_k) / (2M_k))| * X_{jk}^i,$$

$$X_{kj}^i = \frac{1}{2} \left| \left(\frac{X_k + M_k}{2X_k} \right) + \left(\frac{X_j + M_j}{2M_j} \right) \right| * X_{kj}^i$$

Here, X_{jk}^i refers to the value of bilateral exports from country j to country k in industry i . Similarly, X_{kj}^i refers to the value of bilateral exports from country k to country j in industry i .

4. The Extent of Intra-Industry Trade in Turkey's Foreign Trade

About one-fourth of world trade consists of intra-industry trade, that is, two-way exchange of goods within standard industrial classifications. Particularly for advanced industrial nations, intra-industry trade plays a large role in trade in manufactured goods which accounts for most of world trade. Over time, industrial countries have become increasingly similar in their levels of technology and in the availability of capital and skilled labor. Since the major trading nations have become similar in technology and resources, there is often no clear comparative advantage within an industry, and much of international trade therefore takes the form of two-way exchanges within industries, probably driven by comparative advantage.

We have estimated the extent of intra-industry trade in Turkey's total trade of detailed products for years 1997-2005, at three digit level of the Harmonized System (HS). The data is limited to products of top chapters in Turkey's exports and imports. The type of industries covers a variety of product groups. The measure shown is intra-industry trade/total trade. The measure would be zero for an industry in which the Turkey was only an exporter or only an importer, not both; it would be one in an industry for which Turkey's exports were exactly equal to her imports. Table III shows measures of the importance of intra-industry trade for a number of Turkey's industries with the world from 1997 to 2005. For these major (top) product groups, intra-industry index changed drastically from 1997 to 2005. This may reflect the structural change of the Turkish economy after the instigation of the Customs Union with EU.

As seen in Table III, the industries which account for a major part of Turkey's trade are intra-industry (closer to one) rather than inter-industry (closer to zero). The industries are ranked by the relative importance of intra-industry trade, those with higher intra-industry trade coming first. Industries with high levels of intra-industry trade tend to be sophisticated manufactured goods, such as vehicles other than railway (Chapter Code Number 87), electrical machinery and equipment (Chapter Code Number 85), iron and

steel (Chapter Code Number 72), nuclear reactors, boilers, machinery, mechanical appliances (Chapter Code Number 84). These goods are exported principally by developed countries and are probably subject to important economies of scale in production. On the other hand, the industries with very little intra-industry trade for Turkey are typically labor-intensive products as seen for the most of the advanced nations, such as cotton, cotton yarn and cotton fabric (Chapter Code Number 52), man-made staple fibres (Chapter Code Number 55) where comparative advantage is clear cut and is the primary determinant of Turkey's trade with these countries.

Table 3. Indices of Intra-Industry Trade for Turkey's Industries

No.	1997	No.	1998	No.	1999	No.	2000	No.	2001	No.	2002	No.	2003	No.	2004	No.	2005
55	0.992	73	0.990	84	0.954	85	0.994	72	0.940	39	0.991	87	0.969	87	0,895	87	0,950
73	0.891	55	0.977	72	0.927	84	0.955	54	0.930	54	0.877	39	0.945	40	0,883	40	0,913
72	0.807	52	0.881	39	0.903	39	0.832	85	0.928	84	0.866	84	0.893	84	0,883	73	0,897
52	0.784	40	0.819	87	0.899	27	0.827	84	0.924	87	0.828	27	0.852	85	0,882	84	0,868
40	0.741	72	0.729	85	0.891	72	0.795	27	0.907	27	0.801	40	0.773	72	0,800	39	0,725
71	0.736	54	0.650	54	0.857	54	0.738	39	0.886	40	0.794	54	0.769	27	0,762	85	0,720
54	0.643	71	0.628	27	0.774	40	0.491	87	0.878	72	0.771	72	0.756	55	0,728	72	0,691
85	0.547	85	0.591	40	0.491	87	0.451	40	0.769	85	0.726	85	0.746	73	0,588	55	0,586
39	0.365	39	0.368	73	0.375	71	0.425	71	0.611	71	0.590	71	0.453	54	0,469	54	0,485
87	0.287	87	0.352	55	0.331	73	0.372	73	0.521	73	0.444	55	0.451	71	0,441	71	0,474
84	0.194	84	0.231	71	0.325	55	0.306	55	0.433	55	0.415	73	0.445	39	0,435	52	0,459
27	0.061	27	0.109	52	0.118	52	0.067	52	0.101	52	0.140	52	0.156	52	0,180	27	0,219

Source: Authors' calculations based on *Foreign Trade Statistics*, SIS (various years)

Table 3a: Sectoral Codes

No.	
87	Vehicles Other Than Railway
40	Rubber and Articles Thereof
55	Man-Made Staple Fibres
54	Man-Made Filaments
85	Electrical Machinery and Equipment
72	Iron and Steel
52	Cotton, Cotton Yarn and Cotton Fabric
73	Articles of Iron and Steel
71	Pearls, Precious Stones, Coin
84	Nuclear Reactors, Boilers, Machinery, Mechanical Appliances
39	Plastic and Articles Thereof
27	Mineral Fuels and Oils

5. Trade between Turkey and the European Union

After the 1980's export oriented policies, trade between Turkey and European Union increased dramatically. This increase is specially significant following the Customs Union agreement in 1996. The share of European Union in Turkey's total exports rose from 40 percent in 1980 to 51.2 percent in 1995 and to 52.3 in 2005. In the meantime, the share of the European Union in Turkey's imports shifted from 33 percent in 1980 to 47.2 percent in 1995 and became 42.1 percent in 2005 (see Table IV).

In the sectoral base of Turkey's trade with European Union, textile and clothing products are the main group of exports, whereas machinery, electric and electronic and motor vehicles are the main products of imports with shares of 48.1 percent of trade with the European Union (see Table V) in 2005. Table V shows a steady increase of exports of machinery, electric and electronic and motor vehicles in the 1990's. Table V also shows that the rate of increase was faster especially after the Customs Union agreement with EU in 1996. Even though there is still a comparative advantage in labor-intensive trade, such as textile and clothing, we can see a tendency of alternation. Since Turkey has failed to create internationally well-known

brands and designs in these industries, mainly labor-intensive goods of textile and clothing and agriculture have lost their importance against capital and skill-intensive sectors since 1996. This may be also an indication of the changing production structure of Turkey toward the European Union industrial base.

Table 4. Turkish Trade with European Union and its Share in Total Turkish Trade

	Exports	%	Imports	%
1992	7,602	48.4	10,049	56.1
1993	7,599	49.5	13,875	47.1
1994	8,635	47.7	10,915	46.9
1995	11,078	51.2	16,861	47.2
1996	11,549	49.7	23,138	53.0
1997	12,248	46.6	24,870	51.2
1998	13,498	50.0	24,075	52.4
1999	14,348	54.0	21,401	52.6
2000	14,510	52.2	26,610	48.8
2001	16,118	51.4	18,280	44.2
2002	18,459	51.2	23,321	45.2
2003	24,485	51.8	31,695	45.7
2004	34,417	54.6	45,434	46.7
2005	38,394	52.3	49,220	42.1

Source:

www.dtm.gov.tr/dtadmin/upload/AB/EuomedEntegrasyonDb/genel.xls

Table V. Sectoral Distribution of Trade between Turkey and European Union (%)

	Agriculture		Textile-Clothing		Iron and Steel (Code 72,73)		Machinery,Elect.,Electrnc, Motor Vhcl. (Code 84, 85, 87)		Other Manufacturing Goods	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
1992	16.2	2.8	55.9	6.0	2.5	11.0	10.0	45.0	15.4	35.2
1993	19.2	2.4	50.4	4.1	1.8	12.1	8.3	46.0	20.6	38.4
1994	20.1	2.1	48.1	4.6	3.4	12.4	9.1	42.6	19.4	40.8
1995	17.7	4.7	48.3	4.9	4.6	11.0	11.2	39.2	18.2	40.2
1996	16.1	2.9	49.0	6.0	3.6	9.0	13.0	43.9	18.3	38.2
1997	13.9	1.9	42.0	6.5	5.1	7.5	12.7	47.2	25.7	37.3
1998	12.1	1.9	42.1	5.6	5.2	6.0	15.5	48.6	24.5	37.8
1999	11.0	2.1	39.2	5.9	5.7	4.5	18.8	48.8	24.7	38.8
2000	8.8	1.6	39.8	5.0	6.3	5.0	19.7	51.4	25.0	36.8
2001	8.9	1.6	37.5	6.6	6.2	5.5	23.3	42.3	23.8	43.9
2002	7.6	1.8	37.6	6.6	5.1	6.4	26.7	42.4	22.6	42.8
2003	7.0	1.7	35.8	5.4	5.8	7.6	29.1	44.1	21.9	41.1
2004	7.0	1.4	30.5	4.5	7.5	6.7	33.7	48.3	20.9	39.1
2005	4.7	1.2	25.9	3.8	6.0	7.6	34.0	48.1	25.0	38.8

Source: www.dtm.gov.tr/dtmadmin/upload/AB/EuromedEntegrasyonDb/Sektorl_ab.xls

Table VI. Intra-Industry Trade Indices of Major Industry Groups for Turkish Trade with the EU

Industry (SITC-Rev. 3)	Grubel-Lloyd IIT Index														Trade Share 2005
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	
Food and live animals (0-09)	0.284	0.371	0.193	0.563	0.562	0.342	0.315	0.366	0.417	0.267	0.363	0.397	0,530	0,397	3,81 %
Beverages and tobacco (1, 12)	0.407	0.245	0.276	0.268	0.210	0.286	0.400	0.201	0.256	0.345	0.375	0,504	0,627	0,614	0,47 %
Animal and vegetable oils, fats, waxes (4)	0,571	0,458	0,576	0,900	0,825	0,609	0,561	0,908	0.308	0,676	0,641	0,860	0,557	0,703	0,55 %
Textile fibres and their wastes (26)	0.564	0.680	0.672	0.496	0.609	0.444	0.550	0.514	0.441	0.544	0.470	0,507	0,441	0,414	0,99 %
Crude animal and vegetable materials (29)	0,535	0,659	0,554	0,588	0,752	0,790	0,944	0,923	0,982	0,989	0,959	0,969	0,816	0,735	0,13 %
Metalliferous ores and metal scrap (27-28)	0.677	0.362	0.448	0.434	0.416	0.502	0.741	0.957	0.893	0.931	0.672	0.473	0,370	0,406	2,32 %
Mineral fuels, lubricants and related materials (3)	0.758	0.842	0.886	0.865	0.901	0.577	0.461	0.574	0.358	0.990	0.827	0,619	0,180	0,215	11,14 %
Petroleum, petroleum products and rld. mat. (33)	0.672	0,853	0,871	0,830	0,929	0.598	0.475	0.620	0.402	0,907	0,913	0,749	0,228	0,267	6,84 %
Non-ferrous metals (68)	0.664	0.465	0.552	0.577	0.537	0.493	0,751	0,755	0,784	0,931	0,755	0,820	0,457	0,475	1,84 %
Iron and steel (67)	0.277	0.114	0.488	0.585	0.398	0,599	0,730	0,968	0,877	0,923	0,847	0,833	0,937	0,931	5,90 %
Chemicals (51,52,53,54,55,56,57,58,59)	0.190	0.150	0.215	0.165	0.124	0.129	0.123	0.140	0.140	0.183	0.160	0.143	0,306	0,313	9,32 %
Plastics (57, 58)	0.236	0.170	0.126	0.145	0.083	0.094	0.094	0.093	0.103	0.176	0.137	0.120	0,312	0,330	2,98 %
Pharmaceuticals products (54)	0.092	0.068	0.114	0.094	0.143	0.140	0.108	0.096	0.115	0.129	0.112	0.099	0,174	0,183	1,67 %
Other chemicals (51, 52, 53,55,56,59)	0.190	0.157	0.263	0.187	0.139	0.143	0.142	0.178	0.168	0.208	0.195	0.180	0,354	0,348	4,67 %
Leather, leather manufactures, dressed furskins (61)	0.073	0.034	0.186	0.194	0.199	0.247	0.276	0.374	0.222	0.169	0.123	0.169	0,469	0,552	0,18 %
Rubber manufactures (62)	0,854	0,750	0,800	0,870	0,912	0,940	0,950	0,883	0,926	0,696	0,803	0,821	0,912	0,846	0,84 %
Cork and wood manufactures (63)	0.062	0.026	0.084	0.078	0.082	0.444	0.341	0.475	0.243	0.531	0.500	0,508	0,779	0,661	0,32 %
Paper, paperboard and articles of paper pulp (64)	0.181	0.112	0.313	0.173	0.119	0.070	0.093	0.082	0.089	0.215	0.213	0.170	0,472	0,489	1,09 %
Manufactures of metals (69)	0.427	0.362	0.532	0.516	0.476	0.518	0.583	0,739	0,714	0,822	0,821	0,909	0,835	0,836	1,88 %

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Automotive products (781, 782, 783, 784, 7132, 7783)	0.220	0.128	0.280	0.394	0.293	0.140	0.177	0.520	0.331	0.947	0.908	0.758	0,893	0,966	9,29 %
Office machs., telecommunications equipment (75, 76)	0.519	0.309	0.371	0.344	0.317	0.378	0.498	0.354	0.353	0.645	0.890	0.993	0,811	0,738	3,93 %
Other machinery and transport equipment (71-77)	0.221	0.154	0.283	0.278	0.224	0.243	0.300	0.429	0.395	0.504	0.454	0.531	0,629	0,644	6,81 %
Power generating machinery (71-713)	0.099	0.119	0.387	0.433	0.323	0.225	0.260	0.192	0.211	0.144	0.111	0.358	0,542	0,531	2,37 %
Other non-electrical machinery (72, 73, 74)	0.062	0.042	0.096	0.094	0.082	0.089	0.105	0.200	0.177	0.260	0.201	0.220	0,383	0,415	6,37 %
Other transport eqp. (79, 785, 786, 7131, 7133, 7138, 7139)	0.307	0.185	0.444	0.414	0.282	0.461	0.708	0.895	0.778	0.878	0.899	0.910	0,819	0,981	1,46 %
Electrical machinery and apparatus (77- (776+7783))	0.614	0.483	0.642	0.693	0.632	0.569	0.590	0.667	0.647	0.858	0.874	0.936	0,671	0,705	4,44 %
Textiles (65)	0.479	0.575	0.458	0.575	0.811	0.788	0.709	0.659	0.660	0.610	0.728	0.679	0,787	0,771	5,51 %
Clothing (84)	0.012	0.020	0.016	0.017	0.059	0.069	0.072	0.061	0.067	0.054	0.053	0.057	0,706	0,128	6,05 %
Prefabricated. builds.: sanitary, heating, lighting (81)	0.733	0.913	0.791	0.861	0.816	0.764	0.672	0.756	0.774	0.959	0.814	0.748	0,563	0,623	0,57 %
Furniture and parts thereof (82)	0.553	0.464	0.680	0.635	0.490	0.441	0.538	0.782	0.795	0.904	0.798	0.678	0,637	0,686	0,51 %
Footwear (85)	0.615	0.960	0.533	0.905	0.475	0.435	0.419	0.611	0.524	0.778	0.857	0.977	0,806	0,672	0,32 %
Professional, scientific and controlling instrs. (87)	0.089	0.041	0.077	0.052	0.082	0.071	0.093	0.090	0.077	0.099	0.116	0.139	0,188	0,169	0,85 %
Other manufactured articles (88, 89- (891))	0.423	0.377	0.452	0.375	0.331	0.311	0.374	0.416	0.359	0.471	0.485	0.543	0,864	0,886	2,41 %

Source: Authors' calculations based on Foreign Trade Statistics, SIS (various years).

6. The Importance of Intra-Industry Trade between Turkey and the European Union

Table VI presents the products that have values of the index of GL_{IIT} in Turkey's trade with the EU. Table VI indicates that throughout the entire period, animal and vegetable oils, fats, waxes (with the exception of 2000) (Chapter Code Number 4), crude animal and vegetable materials (Chapter Code Number 29), rubber manufactures (Chapter Code Number 62), textiles (Chapter Code Number 65), prefabricated buildings: sanitary, heating and lighting fixtures (Chapter Code Number 81) and footwear (Chapter Code Number 85) show high degree of IIT index, where IIT levels in these products are 0.703, 0.735, 0,846, 0,771, 0.623, 0,672 in 2005, respectively.

Also, for the industries of non-ferrous metals (Chapter Code Number 68), iron and steel (Chapter Code Number 67), manufactures of metals (Chapter Code Number 69), other transport equipment (Chapter Code Number 79, 785, 786, 7131, 7133, 7138, 7139), and furniture and parts, thereof (Chapter Code Number 82), the GL index indicates continuously increasing degree of IIT after the Customs Union agreement with the EU. In 1996 the IIT levels for these industries were 0.537, 0.398, 0.476, 0.282, 0.490 and they went up to 0.820 (2003), 0.931, 0.836, 0.981, and 0,686 in 2005, respectively.

On the other hand, beverages and tobacco (Chapter Code Numbers 1, 12), products of petroleum, petroleum products and related materials (Chapter Code Number 339), automotive products (Chapter Code Numbers 781, 782, 783, 784, 7132, 7783), office machines and telecommunications equipment (Chapter Code Numbers 75, 76) and electrical machinery and apparatus (Chapter Code Numbers 77-(776+7783)) and other manufactured articles (Chapter Code Numbers 88, 89-(891)) show higher degree of IIT levels after 2001 when the Turkish economy experienced one of the deepest economic crises (the so-called "Banking Crisis") in the country's history.

Table VII. Intra-Industry Indices Over Time for Turkey's Foreign Trade

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
GL_{IIT}	0.373	0.352	0.402	0.398	0.389	0.309	0.314	0.528	0.510	0.554	0.514	0.527	0.550	0.520
GL^{adj}_{IIT}	0.477	0.516	0.493	0.515	0.544	0.517	0.535	0.668	0.755	0.644	0.625	0.650	0.854	0.741

Source: Authors' calculations based on Foreign Trade Statistics, SIS (various years).

Table VIII. Intra-Industry Indices over Time for Trade with the European Union

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
GL_{IIT}	0.257	0.212	0.285	0.308	0.283	0.277	0.314	0.381	0.348	0.462	0.454	0.471	0.504	0.484
GL^{adj}_{IIT}	0.367	0.379	0.388	0.468	0.521	0.509	0.525	0.555	0.574	0.571	0.604	0.619	0.812	0.693

Source: Authors' calculations based on Foreign Trade Statistics, SIS (various years).

This study also focuses on the development of the IIT pattern between Turkey and the European Union within the period 1992-2005 using the Grubel-Lloyd formula (Table VIII). These indices were compared with the same calculations of Turkey's trade with the world (Table VII). The Customs Union brought Turkey's relationship with the European Union another step forward in 1996. This agreement is one of the most important events to affect Turkish economy since the adoption of liberalization measures in the 1980's and 1989. By entering into a Customs Union with the European Union, Turkey became the first and only country to enter into such an advanced form of economic integration without being a full member.

The first observation from the tables above is that the share of IIT in the total trade of Turkey is much higher with the rest of the world than with the European Union for the whole period. Second, the share of IIT in the total trade of Turkey shows a steadily increasing trend both with the world and the EU. Moreover, as revealed by Table VI, the Customs Union agreement with the EU appears to have motivated increase of IIT in the total trade of Turkey.

7. Conclusion

Since Grubel and Lloyd (1975), many studies stressed that there is strong empirical support for the hypothesis that countries that have common borders and have eliminated or lowered barriers on trade with each other will have relatively high levels of intra-industry trade. Moreover, the extent of intra-industry trade will be positively correlated with trade intensity. That is, as the trade volume with trade partners increases, there will be more opportunity for more differentiated products to be traded. As shown by Grubel and Lloyd (1975), the average level of intra-industry trade for European Community countries rose from 54% in 1959 to 67% in 1967 as opposed to OECD countries over the same period: 36% and 48%, respectively. Balassa (1979), on the other hand, found that the level of intra-industry trade is higher between the members of the Latin America Free Trade Area (LAFTA) and between members of the Central American Common Market (CACM) compare to these countries and the rest of the world.

This study shows that Turkey's external trade with the European Union is significantly composed of the intra-industry type, especially so after the instigation of the Customs Union agreement with the EU in 1996. This result

is, at the same time, parallel to Turkey's trade with the rest of the world. On the other hand, even though the EU is Turkey's main trading partner, Turkey's share of IIT in total trade is lower with the European Union than with the rest of the world for the entire period. However, economic integration (Customs Union) with European Union has changed the production structure of Turkey toward the European Union industrial base. As stated by Astrid-Marina Lohrmann (2000), the production structure adjustment is an outcome of free trade. That is, the free trade between Turkey and the European Union led to adjustment of the production structure in the Turkey's economy. As a result of this, Turkey's IIT is increasingly changing from low-technology product to high-technology industries as indicated in Tables III and VI.

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