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The Effect of Economic Reforms of 1980s and of the Customs Union 1996 upon the Turkish Intra-Industry Trade

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The effect of economic reforms of 1980s and of the Customs Union 1996 upon the Turkish intra-industry trade[¶]

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Abstract

In this paper we analyze the impact of the economic reforms implemented in 1980s and of the Custom Union Agreement of 1996 on the intra-industry trade in Turkey. Using the panel data for 15 trading partners of Turkey and the sample period 1970-2005, we record the positive impact of both reforms with the former reforms exercising stronger influence on the intra-industry trade measured either by the Grubel-Lloyd or the Brülhart's indices. We also control for other factors like economic size, difference in income per capita and in economic size between Turkey and its trading partners in our empirical regressions.

Keywords: Intra-industry trade; Customs Union Agreement; panel data estimation.

JEL classification: C23; F14

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1 Introduction

In this paper we are trying to assess the effect of two major trade liberalizing reforms, which took place in Turkey in 1980s and 1996, upon the intra-industry trade between Turkey and the European Union.

The first reform package was implemented in the early 1980s when the profound revision of the earlier pervasive growth strategy, which was based on import substitution and characterized by fixed exchange rates, import regulation based on quotas, and high protection measures of the domestic industries, was undertaken. In response to the severe economic crises during the period of 1978-1980, which led to the political and social tensions in the society, the Turkish government adopted the export-led growth strategy accompanied by gradual import liberalization, more flexible exchange rate regime, and more effective export incentive programs. Other measures such as reduction of nominal tariff rates, substantial reduction of quantitative import restrictions and of bureaucratic controls over imports were introduced gradually during 1983-1984. An excellent and very detailed account of these reforms is given in Arıcanlı and Rodrik (1990) and in Krueger and Aktan (1992).

The export performance of the Turkish economy following these reforms was impressive. It manifested itself not only in rapidly expanding total volume of exports (2.9 billion USD in 1980 and 11.7 billion USD in 1988) but also in significant changes in the export decomposition in favor of manufactured goods (share of manufactured goods in total export rose from 36% in 1980 to 79% in 1988). The impact of the reform package introduced in 1980 not only on trade but on the whole Turkish economy is well documented in Arıcanlı and Rodrik (1990) and in Krueger and Aktan (1992) using purely descriptive analysis. Utkulu et al. (2004) using the error-correction models with step dummy for 1980 analyze the effect, which the reforms of 1980s had exerted on the export supply, and come to a conclusion that these reforms were indeed successful in encouraging Turkish exports.

The second major reform aimed at economic liberalization was put in action on January 1, 1996 when a bilateral Customs Union Agreement (CUA), pursuant to the 1963 EU-Turkey Association Agreement, came into force. This agreement constitutes another important milestone on the long path of Turkey to economic integration with the countries of the European Union (EU) and to the ultimate goal of acquiring the membership in EU. According to the CUA, Turkey has abolished all custom duties, quantitative restric-

tions, and charges having equivalent effect to quantitative restrictions for industrial products and the processed components of agricultural products in trade with EU. Moreover, a common external tariff policy against third countries imports was adopted. The CUA also promoted further integration measures undertaken by Turkey such as the adoption of the EU commercial policy towards third countries as well as of the free trade agreements with all the EU's preferential trade partners. Also a number of legislative changes affecting such areas as agriculture, restrictions on trade in services, competition policy, state aid, anti-dumping, intellectual and industrial property rights, public procurements and technical barriers to trade were introduced with the purpose of harmonization of those with those of the European Community (Seymen, 1998).

The CUA had also noticeable effect on Turkish trade with EU. This mainly manifested itself in a tenfold increase in imports from EU-10 and a more than fivefold increase of Turkish exports to EU-10 over 1996-2005, both figures being significantly higher than the increase in total imports and exports of Turkey. The investigation of the overall effect of the CUA on Turkish economy (e.g., welfare, production, and employment) has been mainly conducted using the general equilibrium models (Mercenier and Yeldan, 1997; Harrison et al., 1997; Togan, 1997; De Santis, 2001, *inter alia*). The specific effect of CUA upon the Turkish exports and imports is analyzed in Neyapti et al. (2004). When estimating the exports and imports equations, apart from the standard independent variables, they use two step dummies: one for the reforms of the 1980s and another for the CUA of 1996. Neyapti et al. (2004) conclude that the Customs Union between Turkey and the EU has led to a significant increase in the Turkish trade.

Thus, there exists a vast literature that measures the impact of these two trade liberalization reforms on the Turkish export and import performance as well as on the Turkish economy as a whole. At the same time, there is rather limited number of studies that go a step further in analysis of the (changing) trade pattern in Turkey by assessing the impact of these reforms on the intra-industry trade (IIT), as one can see from Table 1.

Based on the empirical evidence for the developed countries one would expect that trade liberalization between the economic partners leads to a closer economic integration and as a consequence promotes the intra-industry rather than inter-industry trade (Balassa, 1966; Grubel and Lloyd, 1975). A rising share of intra-industry trade suggests that the adjustment costs incurred during the structural changes in the foreign trade will be smaller.

This is because the large share of IIT means that the trade partner countries are specialized in different varieties of the same goods rather in completely different goods. When the trade structure changes, capital and labor, which were formerly employed in the declining firms, can relatively easier move to expanding firms within the same industry as compared to moving to the firms in the other expanding industries. Thus, an increase in the IIT share in the aftermath of the liberal trade reforms implies that the balance between the costs and benefits of these reforms would be more beneficial for the liberalizing country.

The tendency of the IIT to increase in the wake of economic integration is known as the "smooth adjustment hypothesis" — see Greenaway and Milner (2006) — and has special importance for Turkey. Like in Europe in 1960s the creation of the European Economic Community raised concerns about the potential adjustment frictions, the current economic integration between Turkey and European Union may lead Turkish public to fear that the economic toll of this integration may be so high that the game will not be worth the candles. Our objective is to investigate whether these concerns are justified by checking the hypothesis that the economic reforms of 1980s and Customs Union Agreement of 1996 led to a significant increase in the IIT.

To the best of our knowledge, there are only two studies that assess the impact of the economic reforms of 1980s on the Turkish intra-industry trade. Kösekahyaoğlu (2002) uses the 1975-1990 data in order to investigate the changes in the intra-industry trade brought about by the reform of the 1980s. For this purpose, he uses the Grubel-Lloyd (GL) index and Brülhart's index A. His main conclusion is that the reform resulted in increase not only of the level but also of the proportion of the intra-industry trade. Erlat and Erlat (2003b) elaborate further on the analysis of Kösekahyaoğlu (2002) considering much wider selection of the indices that measure the extent of the intra-industry trade, like the unadjusted GL, weighted GL, Brülhart's weighted A, B, C indices, and the Menon's index for unmatched changes in trade (UMCIT), as well as the horizontal and vertical IIT measures. Their main results can be summarized as follows: 1) According to the aggregated GL index, the rate of IIT is greater in the post-1980 period, but the Turkey's trade has still an inter-industry nature. 2) According to the aggregated Brülhart's A index, there had been a significant change in marginal IIT (MIIT) between the pre- and post-1980 periods. The number of sectors with Brülhart's index B exceeding 0.5 in absolute value has considerably increased

since 1980 and for most of these sectors the increase in exports dominates the increase in imports. 3) For the sectors with the highest MIIT, it is found that decrease in adjustment costs after 1980 due to changes in IIT, measured by the Brülhart's C index, was larger than the increase in these costs due to changes in net trade, measured by UMCIT.

Note that these two studies present their conclusions about the impact of the reform of 1980s on the intra-industry trade based on a purely descriptive analysis of the calculated indices for the pre- and post-reform periods. In doing so, they do not control for other factors that might have influenced the developments of the IIT, e.g., relative economic size of the trading partners, per capita income difference, distance, etc. (for the detailed overview of the potential factors see Ekanayake (2001)). Moreover, these two studies do not investigate the consequences of the CUA 1996.

In addition to the literature that tries to detect the changing pattern of the IIT in the aftermath of the trade liberalizing reforms, there also exists a number of studies that address the determinants of the intra-industry trade between Turkey and its partners, represented by Çepni and Köse (2003), Emirhan (2002, 2005), and Türkcan (2005), *inter alia* — see Table 1. These studies employ the panel data estimation techniques in order to determine factors shaping the IIT pattern. However, none of these studies tries to measure the impact of the trade liberalization reforms initiated either in 1980s or in 1996 or both on the pattern of the intra-industry trade for Turkey. Given that these reforms might have caused changes in the pattern of the IIT — as argued in Kösekahyaoğlu (2002) and in Erlat and Erlat (2003b) — not allowing for this possibility on the *a priori* grounds may be questionable.

Thus, the novelty of this paper is that it constitutes the first attempt in the related literature on Turkish trade to carry out the econometric analysis in order to test the statistical hypotheses on whether the trade liberalization reforms of the 1980s and the CUA of 1996 had any impact on the pattern of the intra-industry trade of Turkey with its trading partners. For this purpose, we employ the panel data estimation techniques used also in previous studies but, in addition, we allow for the existence of structural breaks in the pattern of the IIT that might have been caused by these two major reforms. We employ the panel data that cover Turkish external trade with the OECD countries (12 EU countries plus Canada, Japan, and USA) for the period from 1970 through 2005.

The rest of the paper is organized as follows. Section 2 discusses the measures of the IIT that will be employed in this study. In section 3 a brief

review of the literature on the IIT in Turkey is made. Section 4 contains the description of the econometric model, which we apply to assess the effects of the trade reforms of the 1980s and of the CUA upon the Turkish IIT, and the estimation results. Finally, section 5 concludes the paper.

2 IIT measures

The intra-industry trade is defined as the difference between the total trade (sum of exports and imports) and the absolute value of the net trade, or inter-industry trade. More formally:

$$IIT_{it} = (X_{it} + M_{it}) - |X_{it} - M_{it}| \tag{1}$$

where X_{it} and M_{it} are respectively the exports and imports of industry i in period t, $X_{it} + M_{it} \equiv TT_{it}$ is the total trade, and $|X_{it} - M_{it}| \equiv NT_{it}$ is the net trade.

There exist numerous measures of the degree of intra-industry trade. However, we are going to concentrate here on two of them: the Grubel-Lloyd index suggested by Grubel and Lloyd (1975) and the Brülhart's A index proposed by Brülhart (1994).

The **unadjusted Grubel-Lloyd index** (GL index) is defined as:

$$GL_{it} = 1 - \frac{|X_{it} - M_{it}|}{X_{it} + M_{it}} \tag{2}$$

By construction the Grubel-Lloyd index varies in the interval between 0 and 1. An index value of 0 indicates complete inter-industry trade. In this case either the value of exports or imports is zero. Higher index values are associated with greater proportion of the intra-industry trade in total trade. When the index value is equal to 1, the exports and imports are equal.

Below, in our empirical model we use the **aggregated unadjusted Grubel-Lloyd index** encompassing several industries and which is computed as the weighted average of the industry indices formulated in (2), where the weights are based on the share of each particular industry in total trade:

$$GL_t = 1 - \frac{\sum_{i=1}^{I} |X_{it} - M_{it}|}{\sum_{i=1}^{I} (X_{it} + M_{it})} \tag{3}$$

where I is the number of industries or commodities. This number reflects the level of aggregation used to identify the industries, for which the individual GL indices are to be computed. As Vona (1991) shows, the magnitude of the aggregated GL index depends on the level of aggregation. This is known as categorical aggregation problem and may lead to the wrong conclusions — underestimation (overestimation) of the degree of IIT when the aggregation level is too low (high) — if the industries are not properly defined.

The literature, especially that concerned with the Turkish IIT, also makes an extensive use the so-called **adjusted GL index**. It is adjusted for the trade imbalances, i.e., for the overall trade deficits. The need of such an adjustment was justified by Grubel and Lloyd (1975) and Aquino (1978), who came up with two different adjusted indices. However, as Vona (1991) argued, the correction for the trade imbalance is not needed at all because it "raises more empirical problems than it solves and does not present any clear link with theoretical considerations..." (Vona (1991), p. 690). Therefore in our analysis we will confine ourselves only to the unadjusted GL index.

The second IIT measure we are going to use in this paper is the marginal IIT index of Brülhart, or more specifically **Brülhart's index A**, which was suggested in Brülhart (1994) and is formulated as:

$$BA_{it} = 1 - \frac{|\Delta^h X_{it} - \Delta^h M_{it}|}{|\Delta^h X_{it}| + |\Delta^h M_{it}|} \tag{4}$$

BA_{it} also varies between 0 and 1 and has similar interpretation to that of the Grubel-Lloyd index, i.e., the higher (lower) is this index the more (less) important is the intra-industry trade compared to the inter-industry trade. Brülhart (1994) claims that GL index is "static", that is, its changes between two period do not necessarily imply corresponding changes in the intra-industry trade, since they can be also caused by the changes in the inter-industry trade. In contrast, his index is "dynamic" and comparing its values across different periods conveys trustworthy information about the evolution of the intra-industry trade.

The aggregated Brülhart's index A, that is used below in our empirical model, can be obtained as a weighted average of the individual Brülhart's A indices:

$$BA_t = \sum_{i=1}^{I} \left[BA_{it} \times \frac{|\Delta^h X_{it}| + |\Delta^h M_{it}|}{\sum_{i=1}^{I} \left(|\Delta^h X_{it}| + |\Delta^h M_{it}| \right)} \right] \tag{5}$$

Oliveras and Terra (1997) found that like the aggregated GL index the aggregated Brülhart's index A is also subject to the categorical aggregation problem. However, unlike the GL index it is not necessarily growing with the level of aggregation. The effect of the aggregation level upon the value of aggregated index can be either positive or negative depending on the signs of the sub-period indices and of the changes in exports and imports.

3 Empirical studies of Turkish IIT

The up-to-date studies concerning the Turkish IIT have been summarized in Table 1. The table reports the time span, the range of traded commodities, Turkish trade partners, measures, and methodologies, which have been used in the studies, as well as the final results, which were obtained by the researchers.

From the technical point of view, most of the papers on Turkish IIT listed in Table 1 (7 out of 12) are of a descriptive nature. It means that they are simply computing various IIT measures explained in section 2 and comment on them. Authors of two papers (Emirhan (2002) and Çepni and Köse (2003)) run simple linear regression using IIT as dependent variable and trying to identify its determinants. Yet another paper (Erlat and Erlat (2003b)) uses simple linear regression, where IIT plays a role of independent variable, to figure out if IIT does really affect the employment in the related industries. Finally, there are two papers (Emirhan (2005) and Türkcan (2005)) that take advantage of the cross-section and time dimensions of the available data and estimate the panel data models in order to determine the variables affecting IIT as a whole as well as horizontal and vertical IIT.

From the viewpoint of data used, most of the papers deal with the exports and imports data classified according to the SITC. 2 papers use the 5-digit data, 6 papers use the 3-digit data, whereas the remaining 4 papers work with the 2-digit data. Most of the papers consider all the industries (from 0 to 8), while few papers concentrate exclusively on the manufacturing (groups 5-8 of SITC).

The coverage of the trade partners of Turkey included into analysis varies substantially. However, most (8 of 12) of the papers examine the IIT between Turkey and some or all the EU members. This reflects the importance of Europe for Turkish foreign trade.

The earliest period considered in all these papers is 1965, whereas the

latest is 2002.

Finally, most of these studies agree upon a general increase of the IIT in Turkey over the last years.

4 Panel data estimation

The paper uses the 3-digit SITC annual data on Turkish imports and exports with 15 industrialized countries — 12 EU countries (Austria, Belgium-Luxemburg, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, and United Kingdom) plus three developed economies outside of Europe (Canada, Japan, and USA) — over the period 1970-2005. In addition, the data on the real GDP of Turkey and its trade partners, their total exports and imports in the trade with Turkey as well as geographical distance are used. The data are described in Table 2.

The selection of the countries was motivated based on several grounds. Firstly, all these countries enter the list of the top 40 trade partners of Turkey and account together for about 50% of Turkish trade, according to the 2005 data available at the website of the Turkish Undersecretariat of the Prime Minister for Foreign Trade. Secondly, most of them belong to the EU, which is important, since the CUA was signed between Turkey and the EU and is expected to be a step towards the integration of Turkey into the EU, whereas other countries were taken to represent the rest of the world. Thirdly, all these countries are developed economies, which guarantees certain homogeneity of the sample and controls for the level of economic development.

Consider first the overall dynamics of the IIT as measured by the GL and Brülhart's A indices — see Table 3. The IIT measures for the 12 EU countries are slightly higher than those for the whole sample. In addition, the GL and Brülhart's A indices computed for the manufacturing goods trade only (groups 5-8) are higher than those computed for the whole trade. It can also be concluded from the table that the IIT, regardless of the index used, has been increasing from 1970 until 2005. The increase was not, however, steady and was interrupted two times: in the 1970s — most probably due to the oil shocks — and in the early 1990s — due to the 1994 crisis that hit Turkish economy. After 1995 there has been a remarkable increase in the IIT, which by far exceeded its development during the preceding 25 years. Thus, the increasing importance of IIT in the Turkish foreign trade stresses the utility of the econometric analysis that we are going to undertake.

The model we used to assess the impact of the two liberalization episodes — the reforms of the 1980s and the Customs Union Agreement — contains both the country determinants of the IIT and the dummy variables controlling for the economic reforms in 1980s, CUA 1996, and membership in the EU. The country determinants are as those in Ekanayake (2001), where probably the most comprehensive list of determinants is presented, except that our model does not include the trade orientation, common language, and common language variables. The original model is defined as follows:

$$ln(\frac{IIT_t^i}{1-IIT_t^i}) = \beta X_t^i + \epsilon_t^i \tag{6}$$

where IIT_t^i is a measure of IIT between Turkey and its trade partner i. Since the dependent variable is bounded within the interval between 0 and 1, we had to apply to it the logit, or log-odds, transformation as in left-hand side of equation (6). This transformation is common in the literature and is used, for instance, in Balassa and Bauwens (1988). It is applied because the original IIT index is bounded within the interval [0,1], whereas the predictions of the model on the right-hand side in principle are not bounded. We do not use here the logit or probit model, which are suggested as an alternative to log-odds transformation in Balassa and Bauwens (1988), because the dependent variable in these models is binary and thus they are inappropriate in our case.

Four different dependent variables were constructed: two GL indices (one for the whole Turkish trade covering the SITC categories 0 through 8 and one for the Turkish manufacturing trade covering the SITC categories 5 through 8) and two BA indices (one for the whole trade and one for the manufacturing trade).

X_t^i is the matrix of regressors and it contains the following independent variables:

1. $RGDP_t^i$ is the real GDP of the Turkey's trade partner i;
2. $Size_Ineq_t^i$ is the size inequality between Turkey and its trade partner i defined as in Balassa and Bauwens (1988) to take values between 0 and 1: $Size_Ineq_t^i = 1 + \frac{w_t ln(w_t) + (1-w_t) ln(1-w_t)}{ln(2)}$, where $w_t = \frac{RGDP_t^{TUR}}{RGDP_t^{TUR} + RGDP_t^i}$;
3. $RGDP_PC_t^i$ is the real GDP per capita of the Turkey's trade partner i;

4. $Income_Ineq_t^i$ is the indicator of income inequality between Turkey and its trade partner i defined in exactly the same way as the size inequality variable with $w_t = \frac{RGDP_PC_t^{TUR}}{RGDP_PC_t^{TUR}+RGDP_PC_t^i}$;

5. $TINT_t^i = \frac{X_t^i+I_t^i}{X_t+I_t}$ is the trade intensity variable for the trade partner i;

6. $DIST_t^i = DIST_KM_t^i \times \frac{RGDP_t^i}{\sum_j RGDP_t^j}$, where $DIST_KM_t^i$ is the distance in kilometers between Ankara and the capital city of its trade partner i.

7. $SD1980$ is the step dummy variable capturing the reforms of 1980s, which is equal to 0 up to 1979 and 1 otherwise;

8. $SD1996$ is the step dummy capturing the Customs Union Agreement, which is equal to 0 up to 1995 and 1 otherwise;

9. SD_EU_i is the step dummy variable for EU membership of the Turkey's trade partner i, which is equal to 1 since the moment this particular country entered the EU and is equal to 0 otherwise (obviously, for Canada, Japan, and USA this variable is always equal to 0).

10. $EU_SD1996 = SD1996 \times SD_EU_i$ is the step dummy capturing the effect of CUA upon the EU countries.

The model (6) was estimated using the panel data regression with fixed effects. All the estimations were conducted using the panel data module of PcGive 10.3 — see Doornik and Hendry (2001).

The results of estimation of the corresponding four models are reported in Table 4. The model specification includes three economic variables[1] and two step dummy variables. The former group of variables corresponds to the economic determinants of the degree of intra-industry trade, whereas the latter group of variables captures the effects of the economic reforms undertaken in early 1980s and in 1996.

The coefficient estimates of the real GDP of Turkey's trade partner, size inequality, and income inequality appear to be different from zero at the usual significance levels and that holds true for all model specifications reported in Table 4, whereas the real GDP per capita of Turkey's trade partner,

[1]The economic variables $TINT_i$ and $DIST_i$ turned out to be insignificant and were left out from the model specification.

trade intensity, distance, and the dummy variable SD_1996 turned out to be statistically not significant. The signs of the estimates are as implied by the economic theory. Thus, our estimation results suggest that the greater the discrepancy in per capita incomes between Turkey and its trading partners the lower intra-industry trade will be observed. The large difference in per capita incomes correspondingly indicates large differences in demand structure and/or in the resource endowments and, as a consequence, the diminishing scope for the intra-industry trade potential between these countries. Next, the average country size is positively correlated with the degree of the intra-industry trade. Thus, a larger country has more possibilities to explore economies of scale in production of the differentiated goods, and because of its size it may also have greater demand for foreign differentiated goods. Both these factors exert promoting influence on the potential for the IIT. Lastly, the difference in the economic sizes of Turkey and its trading partners exerts negative influence on the degree of the intra-industry trade. As there is larger scope for the IIT when both trading partners are large economies. Hence, differences in economic size tend to yield lower volume of intra-industry trade. Our results largely correspond to those reported in Emirhan (2002, 2005); Türkcan (2005) for Turkey.

The estimates of the second group of the variables (step dummies) are positive and they are also significantly different from zero either at the 5% or the 10% levels, depending on the type of index and on the industries used. This is an important result as it provides the first statistical evidence that the economic reforms of 1980s and the CUA enforced in 1996 had a profound positive impact not only on the total volume of trade of Turkey with its partners but also they spurred significant increase in the intra-industry trade. Thus, our findings confirm the earlier reported results of the descriptive studies such as Kösekahyaoğlu (2002); Erlat and Erlat (2003b), who investigated the impact of the reform of 1980s on the IIT in Turkey. Moreover, our further contribution to the literature is that we show that omitting the effects of the CUA of 1996 while investigating the determinants of the intra-industry trade of Turkey with its trading partners seems to be unwarranted and may have biased the results reported in Çepni and Köse (2003); Emirhan (2002, 2005); Türkcan (2005).

The comparison of the absolute sizes of the estimates of the coefficients that correspond to the step dummies SD1980 and EU_SD96 reveals that the reforms of 1980s exercised more profound effect on the degree of the IIT than the latter reform. This observation conforms with the fact that

the reforms of 1980s have been more radical in their nature as the former growth strategy based on the import substitution was abolished and instead an export-led growth strategy was promoted which resulted in rapid growth not only of the total trade volume but also of the intra-industry trade. The impact of the reforms of 1980s may appear more noticeable because they were the first reforms that lifted the intra-industry trade from the initial rather negligible levels that prevailed during the pre-reform period to the levels that would match the development of the Turkish economy. From this perspective, it is no longer surprising that the positive effect that the Custom Union Agreement exerted on the development of the intra-industry seems to be somewhat lower than that of the reforms of 1980s. For the CUA can be considered as the natural consequence of and the follow-up to the reforms of 1980s, which were already rather successful.

5 Conclusions

In this paper we have provided the first statistical evidence based on the panel data regression model that the economic reforms of 1980s and the Customs Union Agreement of 1996 exerted positive impact on the intra-industry trade between Turkey and its trading partners. Furthermore, we find that the impact of the former reforms is more strong as it affects the intra-industry trade of Turkey with all partners, whereas the impact of the CUA is only noticeable in the IIT with the EU member states, as expected.

We also find that, although the CUA covers mainly the industrial goods, it appears to exert similar effect upon the IIT computed both for the whole trade and for the trade in manufacturing goods only.

The drastic increase in IIT after 1980s and especially after 1996 confirms the "soft adjustment hypothesis" implying that the ongoing economic integration between the EU and Turkey is accompanied by the decreasing adjustment costs. It justifies thus the further integration of Turkey into the European market.

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Appendix

Table 1: Literature review

Paper	Data (indicator, period, & country)	Tools (measure & model)	Results
Erzan and Laird (1984)	1) SITC 3-digit, industries 5-8 2) 1965, 1970, 1975, 1980 3) 9 principal developing exporters of manufactures (including Turkey) vs. the ASEAN countries, the developed market economies, the socialist countries of Eastern Europe, and other developing countries.	1) The unadjusted GL index and Aquino index 2) Descriptive analysis of IIT measures	Turkey's IIT was the highest among the DMECs, followed by the other developing countries.
Schüler (1995)	1) SITC 5-digit, industries 5-8, excl. 68 2) 1973-1991 3) World, EU-12, developing countries, and other OECD countries	1) The unadjusted GL index 2) Descriptive analysis of IIT for consumer, investment, and intermediate goods	1) In the first phase of industrial development IIT expanded primarily in trade of intermediates with industrial countries. 2) In a later phase intra-industry trade expanded in consumer goods.

Table 1: Literature review (continued)

Paper	Data (indicator, period, & country)	Tools (measures & models)	Results
Doğaner Gönel (2001)	1) SITC 3-digit industries 0-8 2) 1992-1997 3) EU, Central Asia Turkic republics, and world	1) The unadjusted GL, adjusted GL, and Acquino indices 2) Descriptive analysis of IIT measures	1) Turkey's share of IIT in total trade is lower with the EU than with the world for whole period. 2) Turkey's trade with the EU is still of inter-industry type. 3) The increase in adjusted GL index is more pronounced than in other two indices. 4) In trade with EU iron and steel as well as manufactures have the highest unadjusted GL index.
Kösekahyaoğlu (2002)	1) SITC 2-digit, industries 0-8 2) 1975-1990 3) EU-12	1) The unadjusted GL and Brülhart A indices. 2) Descriptive analysis of IIT for non-manufactured, manufactured goods, and overall trade.	1) Not only the level (GL index) but also the proportion of IIT (measured by marginal IIT index) has increased over the period. 2) The liberalization attempt in the 1980s was a step in the right direction and the further liberalization of trade (i.e. joining the EU) may lead to further reductions in adjustment costs.
Lohrmann (2002)	1) SITC 2-digit, industries 5-8 2) 1991, 1995, and 1999 3) EU	1) The unadjusted GL, Brülhart A and B indices; HIIT and VIIT measures. 2) Descriptive analysis of IIT measures.	1) The GL index shows an increase in IIT during the 1990s for Turkey vis-à-vis the EU, but the MIIT indicators reveal a much lower level of IIT and a negative performance in many sectors classified as human-capital intensive. GL index underestimates the adjustment cost. 2) The pattern of specialization shows that the most part of Turkey's trade with the EU is vertical.

Table 1: Literature review (continued)

Paper	Data (indicator, period, & country)	Tools (measures & models)	Results
Emirhan (2002)	1) SITC 3-digit transformed into ISIC 2-digit, industries 1-8 2) 1999 3) 44 developed and 35 developing countries	1) The unadjusted GL index 2) OLS estimation of determinants of IIT using country- and industry-specific variables and OLS estimation of determinants of HIIT and VIIT	1) The share of the IIT in Turkey bilateral trade is highest for EU members, which are followed by EU candidates. 2) While the industry specific variables exert very big influence on horizontal IIT, they do not have any impact on vertical IIT. 3) Vertical IIT levels are affected by country-specific variables and these variables have only a limited impact on horizontal IIT.
Çepni and Köse (2003)	1) SITC 2-digit, industries 0-8 2) 1988-1998 3) Canada, China, Egypt, France, Germany, Greece, India, Italy, Israel, Japan, Russia, South Korea, Spain, UK, and USA.	1) The adjusted GL index 2) OLS estimation of determinants of IIT using country-specific variables	1) Turkey's IIT is the highest with the EU (around 50%). The IIT with other countries ranges between 20% (Russia) to 40% (USA). 2) The average and relative per capita income, distance, trade orientation, and economic integration are all important factors explaining trends of IIT for Turkey. 3) Difference of per capita income variable has a wrong sign and is statistically significant.

Table 1: Literature review (continued)

Paper	Data (indicator, period, & country)	Tools (measures & models)	Results
Erlat and Erlat (2003a)	1) ISIC 3-digit (Rev.2), industries 0-8 2) 1969-2001 3) World	1) The unadjusted GL, weighted GL, Brülhart A, and weighted A indices. 2) OLS regression the employment changes on IIT measures to test the smooth adjustment hypothesis.	1) Both IIT and MIIT indices increase, and the primary mover is the manufacturing. 2) A significant negative relationship between employment changes and IIT was found.
Erlat and Erlat (2003b)	1) SITC 3-digit (Rev.3), industries 0-8 2) 1969-1999 3) World	1) The unadjusted GL, weighted GL, Brülhart A, weighted A, B, C indices, and the UMCIT index for unmatched changes in trade; HIIT and VIIT measures. 2) Descriptive analysis of IIT measures.	1) According to aggregated GL index, the rate of IIT is greater in the post-1980 period, but the Turkey's trade has still an inter-industry nature. 2) According to aggregated A index, there had been a significant change in MIIT between the pre- and post-1980 periods. The number of sectors with $B < -0.5$ or $B > 0.5$ has considerably increased since 1980 and for most of these sectors the increase in exports dominates the increase in imports. 3) For the sectors with the highest MIIT, it is found that decrease in adjustment costs after 1980 due to changes in IIT, measured by the C index, was larger than the increase in these costs due to changes in net trade, measured by UMCIT.

Table 1: Literature review (continued)

Paper	Data (indicator, period, & country)	Tools (measures & models)	Results
Emirhan (2005)	1) SITC 3-digit, industries 3-8 2) 1989-2002 3) Belgium, France, Germany, Greece, Italy, Netherlands, Spain, UK, USA	1) The unadjusted GL index 2) Panel data estimation of determinants of VIIT	A positive relationship is found between the levels of VIIT and GDP levels and per capita GDP differences among Turkey and selected countries. International transportation costs are found to discourage vertical IIT.
Türkcan (2005)	1) SITC 4-digit (Rev.2), industries 0-8 2) 1985-2000 3) Selected OECD countries	1) The adjusted GL index 2) Panel data estimation of determinants of IIT with country- and industry-specific variables.	1) The determinants of IIT for final goods are not much different from those for intermediate goods 2) Country-specific factors are the most important determinants of IIT between Turkey and OECD in final and intermediate goods between.

Table 2: Data

Variable	Description	Source
Exports	SITC 3-digit exports per countries and per commodities, US $	Turkish Statistical Institute
Imports	SITC 3-digit imports per countries and per commodities, US $	Turkish Statistical Institute
GL	aggregated unadjusted Grubel-Lloyd index	own calculations
BA	aggregated Brülhart's index A	own calculations
Real GDP	Gross domestic product (expenditure approach); US $, constant prices, constant exchange rates, OECD base year, millions	OECD
Population	1000 persons	World Market Monitor
Real GDP per capita	1000 × Real GDP / Population	own calculations
Distance	Distance between Ankara and capitals of the trade partners of Turkey, kilometers	Great Circle Distances Between Capital Cities

Table 3: Alternative IIT measures of Turkish trade with industrialized countries, 1970-2005

Year	All 15 countries				EU-12 countries			
	GL total	GL 5-8 total	BA total	BA 5-8	GL total	GL 5-8	BA total	BA 5-8
1970	0.04	0.10	0.02	0.08	0.04	0.12	0.03	0.12
1975	0.05	0.03	0.03	0.01	0.05	0.03	0.03	0.02
1980	0.07	0.08	0.02	0.02	0.06	0.07	0.02	0.02
1985	0.16	0.17	0.10	0.10	0.16	0.18	0.11	0.11
1990	0.18	0.20	0.12	0.11	0.19	0.21	0.12	0.12
1995	0.22	0.13	0.18	0.06	0.24	0.13	0.21	0.06
2000	0.29	0.28	0.16	0.16	0.30	0.29	0.16	0.16
2005	0.37	0.38	0.24	0.27	0.39	0.40	0.28	0.30

Table 4: Estimation results:
Fixed effects panel data model, 1970-2005

Dep. variable / Regressors	GL total	GL 5-8	BA total	BA 5-8
Income_Ineq	-8.18***	-8.93***	-7.15***	-6.26**
	(2.95)	(2.71)	(2.64)	(2.51)
GDP	2.42***	2.50***	1.95***	2.28***
	(0.44)	(0.35)	(0.42)	(0.40)
Size_Ineq	-5.70**	-5.89**	-6.44***	-5.28**
	(2.35)	(2.85)	(2.18)	(2.14)
SD1980	0.69***	0.65***	0.90***	0.76***
	(0.23)	(0.23)	(0.22)	(0.24)
EU_SD1996	0.67**	0.45*	0.56*	0.45*
	(0.28)	(0.26)	(0.26)	(0.27)
R^2	0.50	0.47	0.49	0.42

Notes: 1) numbers in parentheses denote the heteroskedasticity corrected standard errors; 2) ***, **, and * indicate that the corresponding coefficient is significant at 1%, 5%, and 10% levels, repectively.