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Abstract

In this study, we analyze Turkey's manufacturing industry trade by estimating sectoral import and export demand equations for 1980-2000. The study aims to understand whether the trade in the manufacturing industry complies with pollution haven hypothesis, and whether the free trade environment provided by the customs union (CU) agreement altered the trade pattern of the clean and dirty industries. Results of our econometric models have shown that while CU positively affects the import demand, it does not have any significant impact on the export demand of Turkish manufacturing industry. In terms of the environmental impact, distinction between clean and dirty industries turns out to be significant for both import and export demand. In general, our findings suggest that both clean and dirty industries' import demand increase during the study period. In terms of export demand, clean industries' export demand declines whereas dirty industries' export demand increases compared to the total demand.

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1. Introduction

Turkey signed a customs union (CU) agreement with the European Union (EU) harmonizing her tariff structure with that of the EU in 1995 which started to be implemented on January 1st, 1996. With the implementation of CU, Turkey reduced her nominal protection rates (NPR) on industrial imports from the EU to zero (Togan, 2000). Turkey also adopted a Common Customs Tariff (CCT) against third countries. Therefore with this agreement Turkey became more open to international competition compared to her other developing country counterparts. The CU agreement has reduced the nominal rate of protection that Turkey had with the EU countries from approximately 10% to zero and brought down the overall rate for third countries from approximately 16% to 4.2% for the year 2004 (Secretariat of Foreign Trade, 2005). Therefore CU not only liberalized Turkey's trade with the EU but also through CCT it also liberalized her trade with other major trade partners.

In this study we will look into the impact of CU on the manufacturing industry trade from an environmental perspective. The interactions between trade and environment have been investigated since the early 1970s in economics literature. There are different lines of arguments discussing the impact of free trade on the environment. Conventional economics view argues that free trade, specialization on the basis of comparative advantage and growth imply optimal use of natural resources and a greater protection of the environment (Liodakis, 2000). Alternatively, it is also argued that liberalized trade regimes and market determined exchange rates will increase the incentive for exports which at the end will cause greater exploitation of natural resources. At the same time, free trade will undermine environmental legislation, agreements, and protection and increase industrial pollution in developing countries, through movement of dirty industries from developed countries having strict environmental regulation to developing countries where such regulations are lax or non-existent. Strict regulations are hypothesized to lead to industrial flight whereas lax regulations are feared to turn the country into a "pollution haven" (Smarzynska and Wei; 2001). Shortly, trade liberalization has been criticized on the grounds that domestic environmental policies can be negatively affected in developing countries, particularly when the governments of these countries are a party to international trade agreements like the NAFTA and the CU.[1]

Consequently, in terms of the impact of trade liberalization on the environment Turkey could be a noteworthy showcase. From this viewpoint in this study, we focus on the impact of CU on the environment by considering the dirtiness and cleanness of manufacturing industry sectors. This distinction of trade in dirty and clean industries enables to assess the impact of trade liberalization on the industrial pollution. In this aspect, one of the main questions we try to answer is whether free trade promotes clean or dirty trade.

To consider this issue we examine Turkey's manufacturing industry trade by estimating import and export demand equations using ISIC revision 2, 4 digit import and export data. Our study uses an unbalanced panel of 81 sectors and 20 years covering 1980-2000 period. In the study, export and import demand equations are modeled as in Goldstein and Khan (1985). The basic structure of the demand equations includes the relative price and income variables, and the exchange rate. By using these baseline equations, we expand

[1] For the empirical studies of the impact of free trade agreements on the environment see Gallagher (1999), Strutt and Anderson (2000), Frankel and Rose (2002) as examples.

the demand equations by including the CU and dirty and clean industry dummies, and their interaction terms.

When we look into the literature, the current study is unique in terms of its approach to the Turkish trade. In terms of manufacturing trade at the disaggregate level the only other study is Thomakos and Ulubaşoğlu (2002). They estimate import demand elasticities for Turkey for the period 1970-1995 using disaggregated 3-digit SITC industry level data and consider the impact of the trade reforms of the 1980s. In terms of the impact of CU on the Turkish trade, Neyaptı et al (2004) estimate export and import demand functions of Turkey in terms of the EU and non-EU countries to search for the possible effects of CU agreement between 1980 and 2001. Finally, Utkulu and Seymen (2004) examine the demand for exports and imports for Turkey in relation to the EU for 1963-2002 period.

The rest of the study is organized as follows; in the next section manufacturing industry trade in Turkey within the context of CU and environment is reviewed. The theoretical background of the empirical model will be discussed in section three. In section four, we will present the data set. Sections five and six discuss the empirical findings of the export demand and import demand estimations, respectively. Finally, section seven concludes the model.

2. Manufacturing Industry Trade in Turkey: Customs Union and Environment

Turkey's trade in manufacturing industries has shown tremendous improvement after 1980 due to trade liberalization policies that were adopted. Total volume of trade has grown from 780 million $ in 1980 to 17728 million $ in 2001. In Figure 1 this development in the volume of trade is shown. However, the growth rate is not stable as shown in Figure 2; there are large swings in the growth rate of the volume of trade. The exchange rate crisis of 1994, and the banking and financial crisis of 2001, both during which TL depreciated largely, have lowered trade volume by 20%. In general trade volume has grown by 160% in the 1980-1985 period, 182% in the 1985-1990 period, 64% in the 1990-1995 period and 136% in the 1995-2000 period.

[Figure 1 and 2 here]

Turkey's trade balance in the manufacturing industry during the period of 1980-2001 has always been in deficit as seen in Figure 3. The deficit has grown after 1988, and again the crisis years 1994 and 2001 appear to be the breaks in this trend as well as the Marmara earthquake in 1999. In terms of exports and imports as the deficit data imply we see that exports have grown relatively less than the imports during the period. Figure 4 shows that total imports have grown especially in the 1990's at a higher pace.

[Figure 3 here]

In terms of Turkey's trade with the EU we can say that EU is one of the major trade partners of Turkey[2]. Turkey's trade with EU constitutes more than 50% of total manufacturing industry trade on average during the period. However, as in the case of total volume we see that the trade with EU also is always in deficit and this deficit has grown during 1990's. This is also apparent when we look at imports from and exports to EU in Figure 4. Especially the CU period, appears to have a major impact on imports rather than on exports.

[Figure 4 here]

In terms of trade in dirty and clean industries, in the literature the distinction between clean and dirty industries are made by using two different methods. One way of classifying the dirtiness of the industries is looking at the pollution abatement costs[3]; in this method industries with high abatement costs are dirty industries and low abatement costs

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[2] Here our definition of EU refers to the EU 15, i.e. Belgium, Luxembourg, France, Netherlands, Italy, UK, Germany, Ireland, Denmark, Sweden, Portugal, Greece, Austria, Spain, Finland.
[3] For example Tobey (1990), Jaffee et al (1995).

are clean industries. Alternatively, levels of toxic pollutants emitted during the production process could be used in ranking industries' dirtiness[4]. In this method each sector's pollutant emission is divided to total output of that sector to normalize the differences in sizes of different sectors. In this study, we are going to use the classification of Akbostancı et al (2005) for the selection of clean and dirty industries of Turkish manufacturing industry, which utilizes the latter method. In that study authors use solid and liquid waste statistics for Turkish manufacturing industry to form pollution indices. We use the averages of the indices developed in Akbostancı et al (2005) to rank the manufacturing industries from dirtiest to the cleanest. The dirty industries in this study refer to the industries that have the highest 20 ranks, and clean industries refer to the industries that have the lowest 20 ranks. List of these industries can be seen in Tables A and B of the Appendix.

[Figure 5 here]

Trade in dirty and clean industries is shown in Figure 5. When we look at dirty and clean imports we see that these follow a similar pattern as the total imports. There is an increasing trend during the study period and this is more pronounced after 1995 which is the CU period. We can also observe the major declines during the 1994 and 2000 crises, similar to the developments in the total imports. In terms of clean and dirty exports, we can see that there is a tendency of clean exports to increase relatively more than dirty exports especially during the CU period. But in the period before the CU figure 5 shows that dirty exports increase at a higher pace than clean exports.

[4] For example Mani and Wheeler (1997), Eskeland and Harrison (2003)

3. Model

In this study we modeled the export and import demand equations in the spirit of imperfect substitutes model of Goldstein and Khan (1985) where the underlying assumption is that neither imports nor exports are perfect substitutes for domestic goods.

$$M^d = f(P_M, P, Y, e), \qquad f_1, f_4<0, \qquad f_2, f_3>0, \tag{1}$$

$$X^d = g(P_X, P^*, Y^*, e), \qquad g_1<0, \qquad g_2, g_3, g_4>0, \tag{2}$$

where M^d is the quantity of imports, P_M is the import price, P is the price of domestically produced goods, Y is the domestic income, and e is the domestic price of foreign currency. Similarly in equation (2) X^d is the quantity of exports demanded by the rest of the world, P_X is the export price, P^* is the price level of the rest of the world, and Y^* the income level of the rest of the world. These equations suggest that demand for imports will increase if the price of imports decline, domestic currency gains value, domestic goods price and/or income increases. Demand for exports rise if the price of exports fall, domestic currency loses value, foreign price level and/or income rises.

To convert the equations into the estimable form we use the log-linear format. Also since we work with panel data, equations have both the cross-section and time series dimensions.

$$m_{it} = \alpha_{it} + \alpha_1 (p_M/p)_{it} + \alpha_2 y_{it} + \alpha_3 e_t + \alpha_4 H_{it} + \nu_{it} \qquad i=1, ..., N ; t=1, ..., T \tag{3}$$

$$x_{it} = \beta_{it} + \beta_1 (p_X/p^*)_{it} + \beta_2 y^*_t + \beta_3 e_t + \beta_4 H_{it} + \varepsilon_{it} \qquad i=1, ..., N ; t=1, ..., T \tag{4}$$

From now on variables in small letters represent variables in logarithms. Equations (3) and (4) represent the baseline equations of the import demand and export demand of Turkish manufacturing industry, respectively. Both in these equations we have added the variable H[5], measuring the concentration in industries. Industrial concentration variable is added to the model to control for market condition variations among different sectors. Therefore, the sign of α_4 and β_4 would indicate the effect of the level of competitiveness in the sector on the demand for imports and exports respectively. In these baseline equations α_1, α_2, and α_3 are the relative import price, income and exchange rate elasticities of demand for imports. Similarly β_1, β_2, and β_3 are the relative export price, foreign income and exchange rate elasticities of the demand for exports, respectively. Equations (1) and (2) are called model 1.

To these baseline equations we first add DCU which is the customs union dummy that takes the value of 1 for the years 1996-2000 and zero otherwise. We have also added a dummy for 1994 crisis; D94, which is the year in which Turkey has experienced a large real exchange rate and real income shock. To accommodate the environmental impact of trade and CU agreement we have added dirty and clean industry dummies. Clean and dirty industries are chosen by using the ranking given by the pollution intensity indices developed in Akbostancı et al (2005) as explained in section 2. Therefore DC represents the clean industry dummy where it takes the value of 1 for the clean industries, and 0 otherwise, and DD represents the dirty industry dummy where it takes the value of 1 for the dirty industries and 0 otherwise[6]. So the second model modifies the baseline equations by including these four dummies.

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[5] $H = \sum_{i=1}^{n} s_i^2$, H is the Herfindahl index where s_i is the market share of firms in a sector where there are n firms. By definition $0 \leq H \leq 1$, and H=1 indicates a monopolistic market structure whereas H=0 is a perfectly competitive market.

[6] The list of dirty and clean sectors that are used in the construction of dummies DD and DC are given in the appendix.

$$m_{it} = \alpha_{it} + \alpha_1(p_M/p)_{it} + \alpha_2 y_{it} + \alpha_3 e_t + \alpha_4 H_{it} + \alpha_5 DCU_t + \alpha_6 D94_t + \alpha_7 DC_i + \alpha_8 DD_i + \nu_{it} \quad (5)$$

$$x_{it} = \beta_{it} + \beta_1(p_X/p^*)_{it} + \beta_2 y^*_t + \beta_3 e_t + \beta_4 H_{it} + \beta_5 DCU_t + \beta_6 D94_t + \beta_7 DC_i + \beta_8 DD_i + \varepsilon_{it} \quad (6)$$

To see the environmental impact of the CU agreement we have included the interaction dummies DCU*DC and DCU*DD which are expected to account for the developments in the dirty and clean trade after the CU agreement.

$$m_{it} = \alpha_{it} + \alpha_1(p_M/p)_{it} + \alpha_2 y_{it} + \alpha_3 e_t + \alpha_4 H_{it} + \alpha_5 DCU_t + \alpha_6 DC_i + \alpha_7 DD_i + \alpha_8 (DCU*DC)_{it} + \alpha_9(DCU*DD)_{it} + \nu_{it} \quad (7)$$

$$x_{it} = \beta_{it} + \beta_1(p_X/p^*)_{it} + \beta_2 y^*_t + \beta_3 e_t + \beta_4 H_{it} + \beta_5 DCU_t + \beta_6 DC_i + \beta_7 DD_i + \beta_8 (DCU*DC)_{it} + \beta_9(DCU*DD)_{it} + \varepsilon_{it} \quad (8)$$

Therefore, equations (7) and (8) constitute the model 3. Next we have analyzed the impact of CU agreement on the elasticities of the baseline equations by again using the DCU dummy interactively.

$$m_{it} = \alpha_{it} + \alpha_1(p_M/p)_{it} + \alpha_2 y_{it} + \alpha_3 e_t + \alpha_4 H_{it} + \alpha_5 DCU_t + \alpha_6 DC_i + \alpha_7 DD_i + \alpha_8 (DCU*(p_M/p))_{it} + \alpha_9 (DCU*y)_{it} + \alpha_{10} (DCU*e)_t + \alpha_{11} (DCU*H)_{it} + \nu_{it} \quad (9)$$

$$x_{it} = \beta_{it} + \beta_1(p_X/p^*)_{it} + \beta_2 y^*_t + \beta_3 e_t + \beta_4 H_{it} + \beta_5 DCU_t + \beta_6 DC_i + \beta_7 DD_i + \beta_8 (DCU*(p_X/p^*))_{it} + \beta_9 (DCU*y^*)_{it} + \beta_{10} (DCU*e)_{it} + \beta_{11}(DCU*H)_{it} + \varepsilon_{it} \quad (10)$$

Equations (9) and (10) represent the model 4 in which the impact of CU agreement on the coefficients of the import and export demand equations are investigated. Finally the environmental impact of trade is examined by model 5 in which dirty and clean industry dummies are used interactively.

$$m_{it} = \alpha_{it} + \alpha_1 (p_M / p)_{it} + \alpha_2 y_{it} + \alpha_3 e_t + \alpha_4 H_{it} + \alpha_5 DCU_t + \alpha_6 DC_i + \alpha_7 DD_i +$$

$$\alpha_8 (DC*(p_M / p))_{it} + \alpha_9 (DC*y)_{it} + \alpha_{10} (DC*e)_t + \alpha_{11} (DC*H)_{it} +$$

$$\alpha_{12} (DD*(p_M / p))_{it} + \alpha_{13} (DD*y)_{it} + \alpha_{14} (DD*e)_t + \alpha_{15} (DD*H)_{it} + \nu_{it} \qquad (11)$$

$$x_{it} = \beta_{it} + \beta_1 (p_X / p^*)_{it} + \beta_2 y^*_t + \beta_3 e_t + \beta_4 H_{it} + \beta_5 DCU_t + \beta_6 DC_i + \beta_7 DD_i +$$

$$\beta_8 (DC*(p_X / p^*))_{it} + \beta_9 (DC* y^*)_{it} + \beta_{10} (DC*e)_{it} + \beta_{11} (DC*H)_{it} +$$

$$\beta_{12} (DD*(p_X / p^*))_{it} + \beta_{13} (DD* y^*)_{it} + \beta_{14} (DD*e)_{it} + \beta_{15} (DD*H)_{it} + \varepsilon_{it} \qquad (12)$$

We have estimated above equations by using panel equation techniques. In the estimation process we have utilized a feasible generalized least square (GLS) specification with cross section weights, and assumed a common intercept for all pool members. Using cross section weights corrects for cross-section heteroskedasticity. In terms of assuming a common intercept, we have also tried using fixed effects (FE) model which assumes that intercept differs for each pool member and is fixed, and the random effects (RE) model which treats the intercept as a random variable. Baseline equations i.e. model 1 is robust to different specifications of the intercept. However since our panel consists of 20 time series and 81 cross section observations, i.e. we have more cross-section observations than time series observations, alternative specifications for the intercept turns out to be impossible to use. For models 2-5 FE and RE specifications caused the residual correlation matrix to be singular. In all our estimations we have used E-Views 4.1.

4. Data Set

In this study we apply the above model to the Turkish manufacturing industry data in 4-digit International Standard Industrial Classification (ISIC) Revision 2 detail. The study covers 1980-2000 period for 81 sectors. The variables used in the study and their definitions are given below:

X: Value of Turkey's exports to the world in 4-digit International Standard Industrial Classification (ISIC) revision 2, in US$ divided by export prices. Source of the series is the State Institute of Statistics of Republic of Turkey (SIS), Foreign Trade Statistics.

M: Value of Turkey's total imports in 4-digit ISIC revision 2, in US$ divided by import prices. Source of the series is the SIS, Foreign Trade Statistics.

P_X: Export price index in 4-digit ISIC revision 2 (1987=100). Source of the series is the SIS, Foreign Trade Statistics.

P_M: Import price index in 4-digit ISIC revision 2 (1987=100). Source of the series is the SIS, Foreign Trade Statistics.

P: Domestic output price index in 4-digit ISIC revision 2 (1987=100). Source of the series is the SIS, Manufacturing Industry Statistics.

P*: World commodity prices, originally 1995=100, converted to 1987=100. Source of the series is the IMF-IFS data base.

E: TL/$ exchange rate[7]. Data is taken from the Central Bank of Republic of Turkey online database (http://tcmbf40.tcmb.gov.tr/cbt.html)

Y: Turkish manufacturing industry output in ISIC revision 2, 4-digit, in million TL, converted to US$. Source of the series is the SIS, Manufacturing Industry Statistics.

Y*: World GDP in 1995 prices in billions of $'s. World consist of 208 economies plus Taiwan. Data is taken from the World Bank World Development Indicators.

(http://devdata.worldbank.org/dataonline)

[7] We have also tried using a nominal effective exchange rate measure calculated as trade weighted average of $, DM, French Frank, Italian Lire and £ exchange rates of TL. Import demand estimations are robust to the exchange rate variable choice. However TL/$ rate gives better results for the export demand equation, therefore we choose to use this variable.

H: Herfindahl index in 4 digits ISIC revision 2. Source of the series is the SIS, Manufacturing Industry Statistics.

5. Estimation Results: Import Demand Models

We have estimated the import demand equations for 5 models represented by equations (3), (5), (7), (9) and (11). Results of these estimations are given in Table 1. Model 1 gives the baseline equation, in which all of the variables turned out to be significant at 99% level. When we look at the coefficient of the import price relative to domestic price, it has a negative sign as expected and the elasticity is close to 1. A Wald test is conducted to test whether the relative price elasticity is equal to unity and this is not rejected[8]. The coefficient of the exchange rate is also negative as expected, which indicates that depreciation of TL causes a decline in the import demand of manufacturing sector goods. Exchange rate elasticity however is less than 1 in absolute value terms; therefore import demand turns out to be exchange rate inelastic. The coefficient of the domestic income variable is positive which indicates that an increase in domestic production would cause an increase in demand for imports, and its elasticity is also less than one. The coefficient of the Herfindahl index variable is positive, indicating that lower the competitiveness of sectors (i.e. higher the H) more will be imported. Therefore lack of sectoral competition causes an increase in the import demand of that sector according to the findings of this study.

In Model 2 we add the clean and dirty dummies as well as CU and 1994 crisis dummies. It turns out that all the dummies except the 1994 dummy are significant at 99%. The CU agreement turns out to have a positive impact on Turkish manufacturing sector imports. In terms of environmental concerns both being dirty and clean have a positive

[8] F-statistic has a value of 0.26 with a probability of 0.61.

impact on import demand. This finding is not exactly in line with the pollution haven hypothesis which basically suggests that developing countries will increasingly become importers of clean industries and exporters of dirty industries as production in dirty industries shift from developed countries to developing countries.

[Table 1 here]

In the third model, we look into the environmental impact of the CU agreement by using CU dummy with dirty and clean industry dummies interactively. In this model our finding is that CU has no significant impact on the imports of the clean sectors, however it affects the dirty sectors negatively. Therefore demand for dirty industry imports has declined after the CU.

In the fourth model, we examine the impact of the CU on the elasticities of the import demand. In this case we have used the customs union dummy interactively with the variables of the baseline model. Our results show that CU only significantly affects the relative price and exchange rate elasticities. We find that during the CU period both of these elasticities decline by 0.5 points.

Finally we look into the difference between the clean and dirty industries in terms of the import demand elasticities, by using clean and dirty industry dummies interactively with the variables of the baseline model. Being a clean industry and dirty industry affects the income elasticity of export demand significantly. Clean industries are 0.4 point less income elastic, however dirty industries are 0.3 point more income elastic than the average. In terms of the competitiveness, being clean significantly lowers the coefficient of the H variable however being dirty significantly increases the coefficient of H. This implies that clean industries are relatively more competitive than dirty industries.

Therefore from our estimations we can conclude that free trade increased the import demand overall, however the demand for dirty imports declined during the CU period in general.

6. Estimation Results: Export Demand Models

As in the case of the import demand here we have estimated the export demand equations under 5 models represented by equations (4), (6), (8), (10) and (12). Results of these estimations are given in Table 2. Model 1 gives the baseline equation, in which all the variables turned out to be significant at 99% level of significance. The signs of the variables are as theoretically expected; an increase in relative price of exports lowers the demand for exports, however depreciation of TL increases the demand for exports. Increase in world income increases the demand for Turkish manufacturing exports. With respect to the relative price and exchange rate export demand is inelastic; however with respect to the income of the rest of the world export demand is elastic. Here we should note that the value of exchange rate elasticity is very low. This indicates that export demand in Turkey is not very responsive to exchange rate changes. The coefficient of the Herfindahl index is negative, which indicates that more competitive sectors have higher demand for their exports. So in this case, contrary to the importing sectors the more competitive the industry is the more it exports.

In the second model we include the CU, 1994 crisis, clean and dirty dummies to the baseline equation. Similar to the import demand equations we find that 1994 crisis dummy is not significant. Customs union dummy, DCU however is significant at 95% level, and it shows that during the CU period exports of Turkey actually declines compared to the average of the sample period. Another interesting result that comes up in this model is that being a clean industry significantly affects the export demand negatively; however being a dirty industry significantly increases the demand for exports. Therefore the export demand equation provides positive evidence for the pollution haven hypothesis.

[Table 2 here]

In model 3 we look at the environmental impact of the CU period, by using DCU and DC and DD dummies interactively. It turns out that both of these interactive terms are not significant. Therefore the CU agreement does not alter the export demand pattern of clean and dirty industries significantly.

In model 4 impact of the CU period on the export demand elasticities are examined again by using cross terms. We find that during the CU period only the relative price elasticity of export demand is significantly affected. CU agreement seems to lower the price elasticity of exports by 0.5 points.

Finally, in model 5 impact of environmental differences between sectors on the export demand elasticities are questioned. This model shows that clean industries' exchange rate elasticities are 0.4 points lower, but foreign income elasticities are 8 points higher than the average. In terms of dirty industries, only their relative price elasticity differs significantly from the average. Being a dirty industry increases the price elasticity of exports by 0.5 points. Finally, for clean industries coefficient of H is significantly lower which means that clean sectors' competitiveness is higher.

7. Conclusion

In this study export and import demand equations for a panel of Turkish manufacturing industry for ISIC revision 2, four digit industry detail, are estimated for 1980-2000 period. Baseline export demand and import demand equations are formed by using relative prices, income and exchange rate variables. To these baseline equations dummy variables that account for CU agreement and environmental aspect of the manufacturing industry are added. In terms of the environmental aspect we distinguish between clean and dirty industries by using the ranking given by the pollution indices developed in Akbostanci et al (2005). Here our aim is to understand whether the free trade environment provided by the CU agreement altered the trade pattern of the clean and dirty industries.

Our findings from the baseline equations show that the import demand is unit elastic with respect to the relative price. We also find that income and exchange rate elasticities are less than zero in absolute value terms. That is a change in relative prices affects the import demand proportionately but changes in domestic income and exchange rate affect the import demand less than proportionately. Estimated export demand equation on the other hand is price and exchange rate inelastic, but foreign income elastic. An important point to note here is that the exchange rate elasticity of import demand is -0.78 but the exchange rate elasticity of export demand is 0.15. Therefore depreciation of Turkish Lira will lower the imports considerably but would not increase the exports that much. This characteristic is also apparent from the graphs shown in section 2. The exchange rate shocks received in 1994 and 2001 does not seem to affect the export series as much as the import series.

We also look at the effect of competitiveness of industries on export and import demands by using the Herfindahl index and find that increase in competitiveness of sectors increases the demand for exports but decreases the demand for imports.

In terms of the impact of the CU agreement on the manufacturing industry trade estimation results show that it has a positive impact on the import demand of Turkey. However there is only weak evidence that the impact of CU on export demand is negative. When we consider the impact of CU period on the elasticities our models show that during the CU period relative price and exchange rate elasticities of import demand are lower than the period average. On the other hand CU only significantly lowers the relative price elasticity of export demand relative to the period average.

When we consider the trade in clean and dirty industries, our findings show that both clean and dirty trade is significant in terms of export and import demand. Estimation results show that import demand increases for both the clean and dirty sectors; however export demand of clean sectors decline and dirty sectors increase during the study period. This last result could be taken as evidence for the trade effect of pollution haven hypothesis. When we look into the effect of trade liberalization on the clean and dirty industries' trade, our findings suggest that the CU agreement has no significant effect on the export demand of clean and dirty industries. In terms of the import demand of clean industries, we find no significant impact of the CU period on the demand for clean imports and we only find weak evidence that the demand for dirty imports declines slightly during the CU period.

Appendix: List of Dirty and Clean Industries

Table A Dirty Industries

ISIC Code	Description
3512	Manufacture of fertilizers and pesticides
3511	Manufacture of basic industrial chemicals except fertilizers
3720	Non ferrous metal basic industries
3710	Iron and steel basic industries
3411	Manufacture of pulp, paper and paperboard
3691	Manufacture of structural clay products
3311	Sawmills, planing and other wood mills
3813	Manufacture of structural metal products
3610	Manufacture of pottery, china and earthenware
3819	Man. of fabricated metal products except machinery and equipment not elsewhere classified
3529	Manufacture of chemical products not elsewhere classified (n.e.c.)
3699	Manufacture of non metallic mineral products n.e.c.
3319	Manufacture of wood and cork products n.e.c.
3121	Manufacture of food products not elsewhere classified
3240	Manufacture of footwear, except vulcanized or molded rubber or plastic footwear
3513	Manufacture of synthetic resins, plastic materials and man made fibers except glass
3320	Manufacture of furniture and fixtures, except primarily of metal
3419	Manufacture of pulp, paper and paperboard articles n.e.c.
3118	Sugar factories and refineries
3211	Spinning, weaving and finishing textiles

Note: Industries are ranked from dirtiest to less dirty

Table B Clean Industries

ISIC Code	Description
3214	Manufacture of carpets and rugs
3522	Manufacture of drugs and medicines
3841	Ship building and repairing
3831	Manufacture of electrical industrial machinery and apparatus
3131	Distilling, rectifying and blending spirits
3851	Manufacture of professional and scientific, and measuring and controlling equipment, n.e.c.
3842	Manufacture of railroad equipment
3901	Manufacture of jewelry and related articles
3540	Manufacture of miscellaneous products of petroleum and coal
3839	Manufacture of electrical apparatus and supplies n.e.c.
3852	Manufacture of photographic and optical goods
3843	Manufacture of motor vehicles
3821	Manufacture of engines and turbines
3122	Manufacture of prepared animal feeds
3551	Tire and tube industries
3133	Malt liquors and malt
3119	Manufacture of cocoa, chocolate and sugar confectionery
3832	Manufacture of radio, television and communication equipment and apparatus
3134	Soft drinks ad carbonated waters industries
3825	Manufacture of office, computing and accounting machinery

Note: Industries are ranked from cleanest to less clean

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Figures

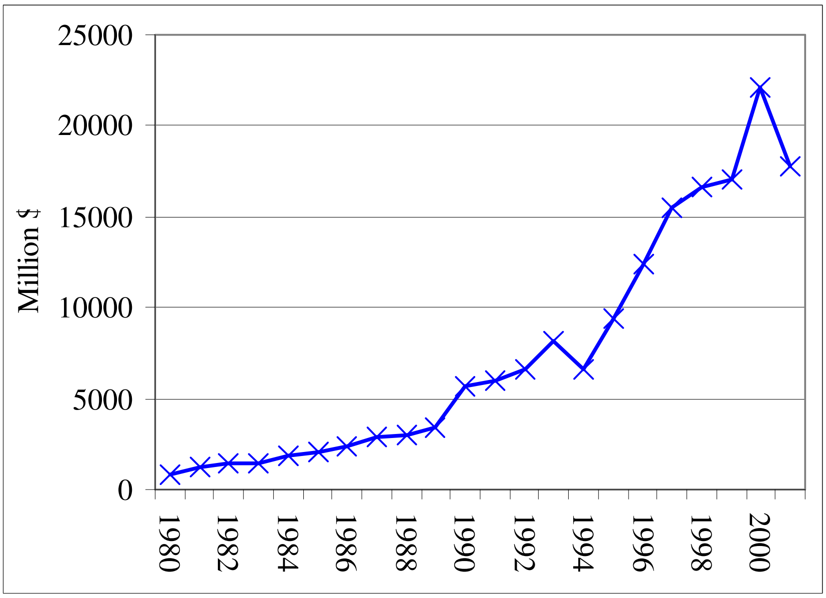

Figure 1 Volume of Trade

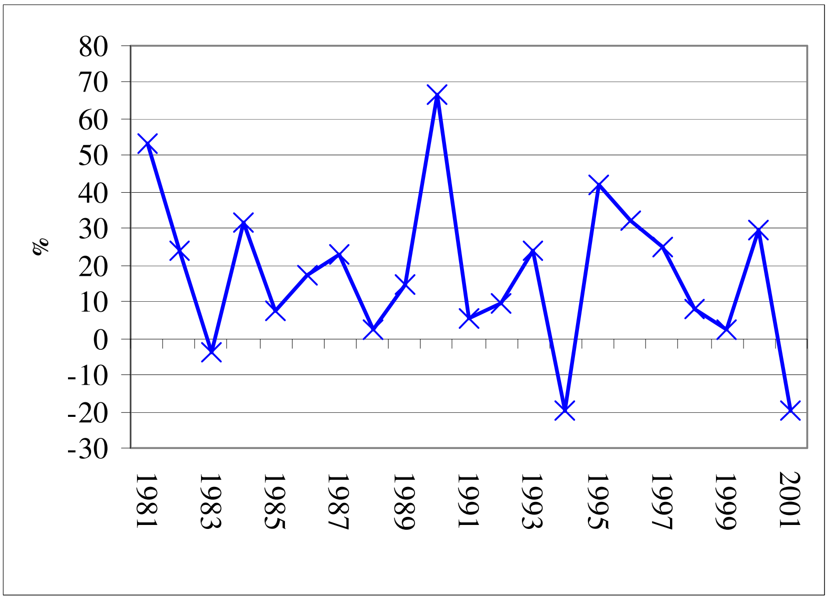

Figure 2 Growth Rate of Volume of Trade

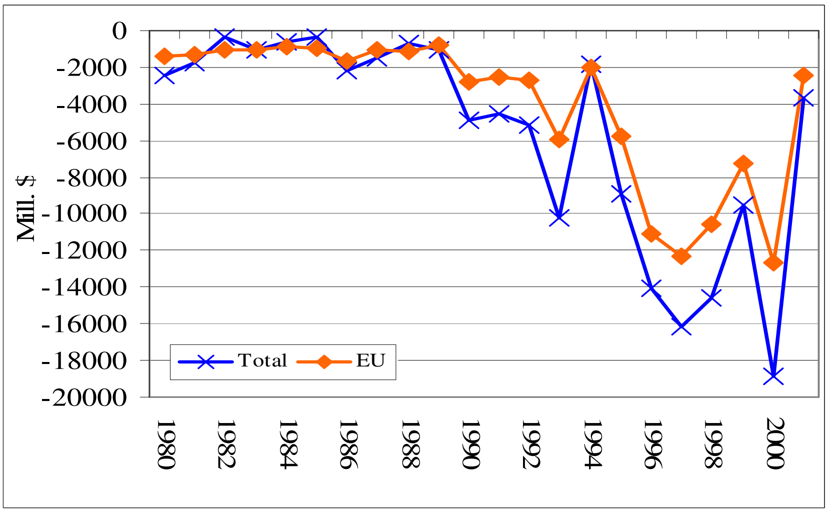

Figure 3 Trade Deficit

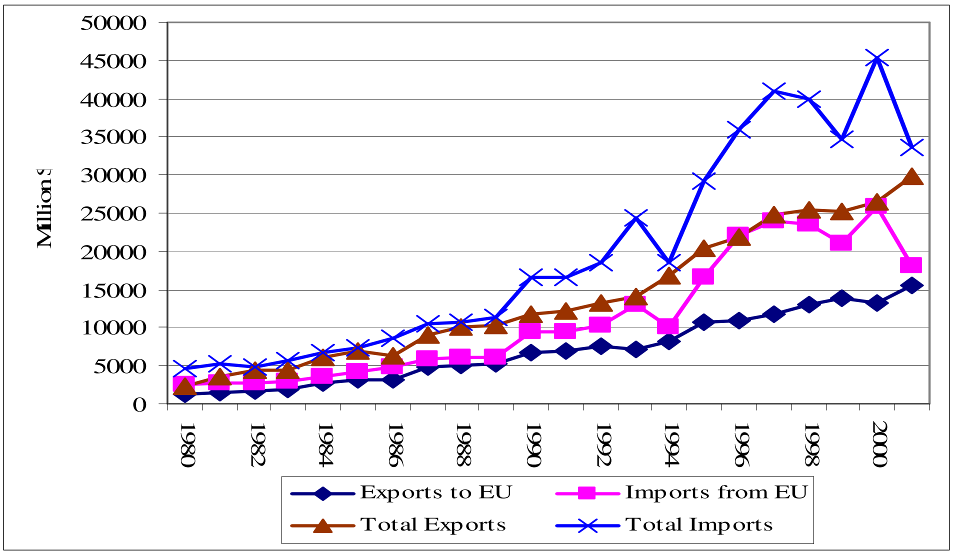

Figure 4 Turkey's Exports and Imports in Manufacturing Industry

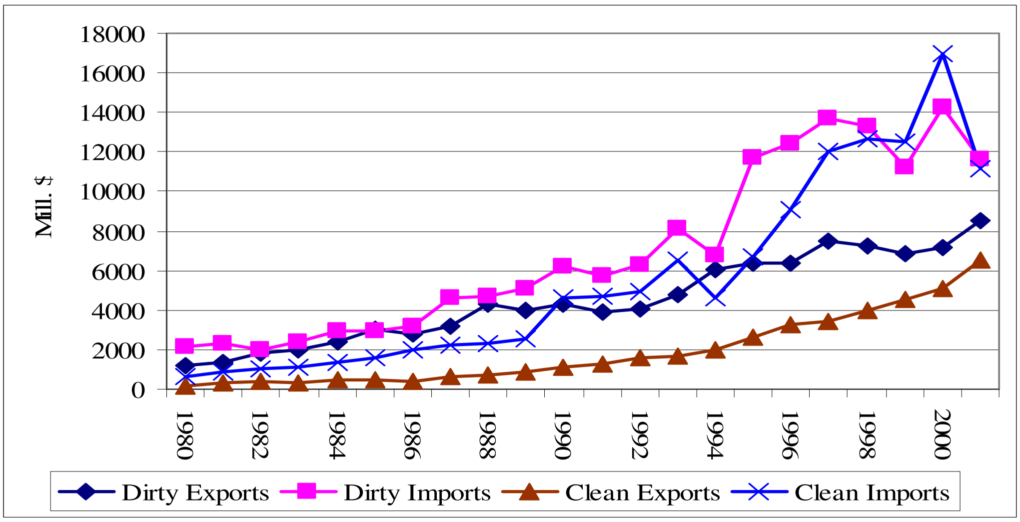

Figure 5 Turkey's Trade in Dirty and Clean Industries

Tables

Table 1 Import Demand Equations

m / p_M	Model 1	Model 2	Model 3	Model 4	Model 5
C	3.44** (0.46)	2.54** (0.45)	2.41** (0.46)	0.11 (0.50)	1.85** (0.59)
p_M / p	-0.98** (0.05)	-0.89** (0.04)	-0.88** (0.04)	-0.65** (0.05)	-0.83** (0.06)
E	-0.78** (0.05)	-0.73** (0.05)	-0.72** (0.05)	-0.49** (0.05)	-0.64** (0.06)
Y	0.72** (0.02)	0.71** (0.01)	0.70** (0.01)	0.71** (0.01)	0.67** (0.02)
H	0.65** (0.24)	1.48** (0.22)	1.55** (0.23)	1.48** (0.23)	1.63** (0.29)
DCU		0.31** (0.10)	0.39** (0.10)	5.97** (1.31)	0.32** (0.09)
D94		-0.01 (0.11)			
DC		0.78** (0.08)	0.76** (0.09)	0.75** (0.08)	2.88** (0.97)
DD		0.54** (0.06)	0.61** (0.06)	0.56** (0.06)	-1.41 (1.14)
DCU*DC			0.01 (0.20)		
DCU*DD			-0.25* (0.12)		
DCU* p_M / p				-0.52** (0.09)	
DCU*e				-0.54** (0.12)	
DCU*y				-0.03 (0.03)	
DCU*H				0.78 (0.51)	
DC* p_M / p					-0.06 (0.10)
DC*e					0.06 (0.10)
DC*y					-0.39** (0.04)
DC*H					-3.94** (0.67)
DD* p_M / p					0.10 (0.12)
DD*e					-0.04 (0.11)
DD*y					0.34** (0.04)
DD*H					2.61** (0.57)
Adjusted R^2	0.75	0.81	0.80	0.80	0.80
F-Statistic	823.17	579.62	506.97	415.20	302.03

* significance at 95% ** significance at 99%

Table 2 Export Demand Equations

x / p_X	Model 1	Model 2	Model 3	Model 4	Model 5
C	-27.50** (7.64)	15.93 (10.20)	-19.61* (9.59)	-9.10 (9.60)	-12.83 (11.67)
p_X / p^*	-0.74** (0.04)	-0.72** (0.04)	-0.71** (0.04)	-0.56** (0.04)	-0.76** (0.05)
E	0.15** (0.05)	0.25** (0.08)	0.21** (0.07)	0.27** (0.07)	0.22** (0.08)
Y*	2.53** (0.79)	1.32 (1.07)	1.71† (1.00)	0.63 (1.00)	1.03 (1.21)
H	-5.28** (0.25)	-5.39** (0.25)	-5.34* (0.25)	-5.61** (0.29)	-5.08** (0.29)
DCU		-0.29* (0.15)	-0.16 (0.14)	6.07 (62.19)	
D94		-0.20 (0.15)			
DC		-0.48** (0.08)	-0.49** (0.09)	-0.47** (0.07)	-80.74** (23.14)
DD		0.22** (0.06)	0.27** (0.07)	0.23** (0.06)	12.03 (17.01)
DCU* DC			0.20 (0.19)		
DCU* DD			-0.18 (0.14)		
DCU* p_X / p^*				-0.46** (0.08)	
DCU* e				-0.15 (0.41)	
DCU* y*				-0.46 (6.48)	
DCU*H				1.01 (0.65)	
DC* p_X / p^*					-0.16† (0.09)
DC*e					-0.37** (0.15)
DC*y					8.26** (2.40)
DC*H					-2.69** (0.90)
DD* p_X / p^*					0.49** (0.09)
DD*e					0.02 (0.11)
DD* y*					-1.15 (1.76)
DD*H					-0.13 (0.89)
Adjusted R^2	0.54	0.53	0.52	0.54	0.53
F-Statistic	453.68	220.76	185.63	168.40	126.97

† significance at 90% * significance at 95% ** significance at 99%