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Turkey and the Ankara Treaty of 1963: What can Trade Integration Do for Turkish Exports

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by

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Abstract

This paper investigates the trade effects of Turkey's trade integration into the EU. To this end sectoral trade flows to the EU based on panel data from the period 1988 to 2002 are examined concentrating on Turkey's sixteen most important export sectors. Emphasis is placed on the role of price competition, EU protection, and transport costs in the export trade between Turkey and the EU. The empirical model used is an extended version of the gravity model. This study is also a contribution to the current discussion of whether Turkey should be granted full EU membership or a privileged partnership with the EU, which for Turkey would mean improved access to the EU market for its products, among other benefits. Our investigation focuses on the latter policy outcome: the impact of deepening the Customs Union between Turkey and the EU and applying the Common Agricultural Policy (CAP) to Turkish agricultural exports. To this end, the impact of the 1996 Customs Union covering most industrial goods and processed agricultural goods, is evaluated on a sectoral level. We also perform simulations to quantify the impact of the potential inclusion of agricultural goods, as well as iron and steel and products thereof, into the full Customs Union between Turkey and the EU which is still to come.

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1. Introduction

On 1 May 2004, a further round of EU enlargement became a reality, expanding the Union to include a total of 25 member states. At that point in time, Turkey did not yet qualify for EU accession even though promises of a Customs Union (CU) and common market between the EU and Turkey had been made as long ago as 1963 in the Ankara Treaty. On 17 December 2004, the EU heads of state finally decided upon the start of accession negotiations with Turkey based on the recommendation of the EU Commission, which has given a conditional 'yes'. Turkey's chances of EU accession depend more heavily, at the moment, on political factors (fulfilment of Copenhagen criteria[1]) than on economic factors[2] according to EU Commissioner of Enlargement Günter Verheugen's Progress Report (see Presidency Conclusions of Brussels European Council 16/17 December 2004, 1 February 2005). Furthermore, the decision by the European Council of 17 December 2004 to open negotiations with Turkey on 3 October 2005 is conditional on the enlargement of the Customs Union to include Cyprus.

Nonetheless, the EU and Turkey already have well-integrated economies as far as a large part of the trade in goods is concerned. An incomplete CU between the EU-15 and Turkey was created on 1 January 1996, guaranteeing free circulation of industrial goods and processed agricultural products. Quotas were prohibited in the CU with the EU. In addition, Voluntary Restraint Agreements (VRA) concerning trade in textiles were abolished. Turkey's commercial and competition policies had to be harmonised with those of the EU and a level of intellectual property protection similar to that in the EU was agreed upon.

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[1]The 'Copenhagen criteria' have three components: a) political stability: democracy, human rights, protection of minorities; b) economic criteria: a market economy and competition with the older member states in the single market; c) the acquis criteria: adoption of EU law and acceptance of the objectives of the Union.
[2] See Pre-Accession Economic Programme 2003; http://ekutup.dpt.tr/ab/kep/pep2003.pdf.

The CU with the EU-15 does not deal with agriculture or services. Exemptions do apply for iron and steel and products thereof, and textile trade is impeded by EU's antidumping actions and safeguard measures. Nonetheless, there is a commitment on the part of both the EU and Turkey to expand and strengthen the CU. Agriculture will be included through ongoing negotiations on mutual concessions, with the objective of establishing a free trade area (FTA). Turkey and the EU are pushing ahead to extend the CU to cover new areas such as services and public procurement.

In preparing for EU accession, Turkey has concluded free trade agreements with most of the countries that joined in the most recent round of enlargement: Czech Republic, Slovakia, Hungary, Lithuania, Estonia, Latvia, Slovenia, and Poland (Ülgen and Zahariadis, 2004). Nevertheless, it is reasonable to expect Turkey's entrance into the EU no earlier than ten to fifteen years from now according to EU Commissioner for Enlargement Günter Verheugen and Germany's Foreign Minister, Joschka Fischer, (Fischer, 2004).

It is the purpose of this paper to analyse Turkey's most important export sectors, to evaluate the impact of the CU of 1996 on industrial goods (such as plastics and rubber, textiles and clothing, machinery and furniture) and to simulate the impact of a strengthened and expanded CU on Turkey's discriminated sectors (such as agriculture, and iron and steel). For a forecast of future trade flows and Turkey's chances on the EU market, it is necessary to assess underlying trade structures and the determinants of current trade flows. In this study, emphasis will be placed on the role of price competition, protection, and transport costs in the export trade between Turkey and the EU. Relying mainly on EUROSTAT's trade database COMEXT (European Commission, 2003: Intra- and Extra-EU Trade, Annual Data, Supplement 2), we sorted out countries with incomplete data (Austria, Belgium, Finland, Luxemburg, Sweden) and concentrated instead on Denmark, France, Germany, Greece,

Ireland, Italy, the Netherlands, Portugal, Spain, and the UK. We analysed Turkish exports on a two-digit level, based on the Harmonised Systems (HS) classification.

2. Turkey's exports to the EU

According to the Global Trade Negotiations homepage 'Turkey Summary' (2004), Turkey's principal exports are textiles and clothing, followed by agricultural products, iron, steel and machinery. Its largest trading partner worldwide is Germany, followed by Italy. Turkey's agricultural sector is the largest[3] of all the OECD countries, accounting for about 17% of GDP, 20% of exports, and 40% of the labour force. Its production includes tobacco, cotton, grain, olives, sugar beets, pulses, citrus and livestock. Cotton, fruit and vegetable production has increased dramatically in recent years due to irrigation efforts and government support. The government employs multiple incentives to promote exports, including output and input subsidies, tax credits, guarantees, and insurance programs.

As far as agricultural products are concerned, competition comes mainly from the EU. Greece, Spain and Italy are serious competitors with Turkey in the field of edible vegetables (olives, pulses), edible fruit (citrus), and processed agricultural products. Greece has proved to be one of the most significant competitors with Turkey both in terms of agricultural and industrial products (ICAP, 2004).

Steel and iron are produced by a variety of countries, among them China, India, Russia, Ukraine, Brazil, and Australia. Hence Turkey – being a smaller producer – has to deal with stiff competition in the production of iron and steel and products thereof.

With respect to textiles and clothing, a major concern for Turkey is the expiration of quotas on textiles and clothing on 1 January 2005. Abolition of quotas will mainly benefit low-cost producers such as China. Chinese textile exports constitute a third of global trade in textiles and clothing.

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[3] In percentages of GDP, exports, and the labour force employed in the agricultural sector.

When looking at machines, mechanical appliances, and vehicles, Turkey's principal competitors outside the EU are the Central and Eastern European countries (CEECs). Turkey faces stiff competition from Poland in the trade with vehicles.

In Table 1 we list the sixteen largest sectors in which Turkey is exporting to the EU.

Table 1: Turkey's sixteen most important export products in the EU market in 2002[4]

HS code	Sector	Av. export value in mill. current ECU (1988-2002)	Annual percentage change (1988-2002)	Export share[5] in 2002	Serious extra-EU-15 competitor[6]
07	Edible vegetables	126.4	5.5 %	0.5 %	-
08	Edible fruit and nuts	689.0	6.3 %	2.4 %	-
20	Preparations of vegetables, fruit, nuts	288.6	10.3 %	1.1 %	-
39	Plastics and plastic products	100.8	22.8 %	0.7 %	Brazil
40	Rubber and articles thereof	160.8	23.6 %	1.1 %	Brazil
52	Cotton	365.7	5.2 %	2.2 %	China
55	Man-made staple fibres	211.5	7.4 %	0.8 %	China
61	Articles of apparel and clothing; knitted or crocheted	2050.6	14.7 %	12.4 %	China
62	Articles of apparel and clothing; not knitted or crocheted	1405.2	12.5 %	9.0 %	China
63	Other made up textile articles	367.9	16.1 %	3.5 %	China
72	Iron and steel	281.2	34.0 %	5.9 %	China
73	Articles of iron and steel	214.3	22.0 %	3.5 %	China
84	Machinery and mechanical appliance	429.0	30.0 %	5.9 %	CEEC Poland
85	Electrical machinery and equipment	771.6	29.5 %	7.9 %	CEEC Poland
87	Vehicles other than railway or tramway rolling stock	538.2	44.6 %	6.2 %	CEEC Poland
94	Furniture, medical	106.0	29.8 %	0.9 %	CEEC

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[4] In the EU-15 market. EUROSTAT (2003) treats the trade flows of the EU-15 countries with all the other countries as extra-EU trade. Therefore, trade with the CEEC countries is considered extra-EU trade.
[5] Share of EU exports of sector k in total exports to the EU-15.
[6] Based on TradeCAN (Competitiveness Analysis of Nations) 2002 CD-ROM (World Bank, 2002).

	and surgical furniture, bedding, mattresses				Poland

Source: European Commission (2003): EUROSTAT's COMEXT CD ROM, 'Intra- and Extra-EU trade, Annual Data, Combined Nomenclature', own calculations and TÜSIAD (2004).

We consider averages of sectoral export values over the period 1988 to 2002 in order to smooth out peaks and valleys. As far as agriculture is concerned, we selected sectors with an export value of more than 100 million ECU (yearly average 1988-2002). Concerning industrial sectors, the minimum export value was set in most cases at 200 million ECU (yearly average 1988-2002). Pre-selection of the sixteen sectors was based on the 30 largest sectors in 2002.

Table 1 highlights the fact that agricultural production and food processing are not particularly dynamic sectors given their low growth rates. With respect to cotton, the literature suggests a sharp increase resulting from irrigation and government programs, such that the figure of 5.2% export growth presented in Table 1 probably underestimates the future development. Sectors 72 and 73 (iron and steel) and sectors 84-94 (machinery, vehicles and furniture) can be considered the most dynamic export sectors. In terms of export shares, the most important sectors are articles of apparel, motor vehicles, electrical machinery, machinery and mechanical appliances, whereas agriculture's export share was surprisingly low[7] (also compare TÜSIAD (2004).

3. Factors influencing trade according to the gravity model

One of the most established models for empirical studies in international trade is the gravity model. In recent decades, the gravity model has performed remarkably well as an empirical framework for explaining bilateral trade. There exist a huge number of empirical applications of the gravity model that have contributed to the improvement of performance of the gravity equation. Some of them are closely related to our work. First, in recent papers, Mátyás (1997),

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[7] In 2002 agriculture's export share was 6 %, whereas in 1970 it still reached 75 %!

Chen and Wall (1999), Breuss and Egger (1999) and Egger (2000) have improved the econometric specification of the gravity equation and highlight the advantages of using panel data methodology. Second, Bergstrand (1985), Helpman (1987), Wei (1996), Soloaga and Winters (1999), Limao and Venables (2001), Bougheas et al. (1999) and Anderson and Wincoop (2003) among others, have contributed to the refinement of the explanatory variables considered in the analysis and to the addition of new variables.

 According to the generalised gravity model of trade, the volume of exports between pairs of countries, X_{ij}, is a function of their incomes (GDPs), their populations, their geographical distance and a set of dummies,

$$X_{ij} = \beta_0 \, Y_i^{\beta_1} Y_j^{\beta_2} N_i^{\beta_3} N_j^{\beta_4} D_{ij}^{\beta_5} A_{ij}^{\beta_6} \, u_{ij} \tag{1}$$

where Y_i (Y_j) indicates GDPs of the exporter (importer), N_i (N_j) are populations of the exporter (importer), D_{ij} measures the distance between the two countries' capitals (or economic centres) and A_{ij} represents any other factors aiding or preventing trade between pairs of countries. The error term is u_{ij} . An alternative formulation of equation (1) uses per capita income instead of population,

$$X_{ij} = \gamma_0 \, Y_i^{\gamma_1} Y_j^{\gamma_2} YH_i^{\gamma_3} YH_j^{\gamma_4} D_{ij}^{\gamma_5} A_{ij}^{\gamma_6} \, u_{ij} \tag{2}$$

where YH_i (YH_j) are the exporter (importer) GDP per capita. The two models above are equivalent and the coefficients are expressed as: $\beta_3 = -\gamma_3$; $\beta_4 = -\gamma_4$; $\beta_1 = \gamma_1 + \gamma_3$; $\beta_2 = \gamma_2 + \gamma_4$. The second specification is usually chosen when the gravity model is used to estimate bilateral exports for specific sectors (Bergstrand, 1989), whereas the specification given by equation (1) is often used to estimate aggregated exports (Endoh, 2000).

For estimation purposes, model (2) in log-linear form for a single year, is expressed as,

$$lX_{ij} = \gamma_0 + \gamma_1 lY_i + \gamma_2 lY_j + \gamma_3 lYH_i + \gamma_4 lYH_j + \gamma_5 lD_{ij} + \sum_h \delta_h P_{ijh} + u_{ij} \tag{3}$$

where l denotes variables in natural logs. $\sum_h \delta_h P_{ijh}$ is a sum of preferential trade dummy variables. P_{ijh} takes the value one when a certain condition is satisfied (e.g. belonging to a trade bloc, being part of a Customs Union), zero otherwise. Dummy variables for trading partners sharing a common language and common border, as well as trade bloc dummy variables evaluating the effects of preferential trading agreements, are usually considered. The coefficients of all these trade variables (δ_h) are expected to be positive.

A high level of income in the exporting country indicates a high level of production, which increases the availability of goods for exports. Therefore we expect γ_1 to be positive. The coefficient of Y_j, γ_2 is also expected to be positive, since a high level of income in the importing country suggests higher imports. The coefficient estimate for exporter's per capita income, γ_3, is interpreted by Bergstrand (1989) as a proxy for the exporter's K/L ratio. It may carry a positive or negative sign, depending on whether the gravity equation is estimated for a capital- or labour-intensive industry. The coefficient of the importer per capita income, γ_4, also has an ambiguous sign: it may be negative when the products imported are necessities, and positive when they are luxuries (Bergstrand, 1989). The distance coefficient is expected to be negative since it is a proxy of all possible trade cost sources. Traditionally, the gravity model uses distance to model transport costs. However, recently Bougheas et al. (1999) showed that transport costs are a function not only of distance but also of public infrastructure. They augmented the gravity model by introducing additional infrastructure variables (stock of public capital and length of motorway network). Their model predicts a positive relationship between the level of infrastructure and the volume of trade, which is supported using data from European countries.

4. Empirical application of the gravity model to Turkey-EU trade

4.1 Augmented gravity model and estimation techniques

A variant of the gravity equation (see equations (4) and (5) below) is used to model bilateral export flows from Turkey to the EU (see Martínez-Zarzoso, I. and F. Nowak-Lehmann D., 2003, 2004). Due to missing data, we consider only Turkey's exports to Germany (DEU), Denmark (DNK), Spain (ESP), France (FRA), UK (GBR), Greece (GRC), Ireland (IRL), Italy (ITA), the Netherlands (NDL) and Portugal (PRT). Export data, described in Section 2, cover sixteen sectors at the two-digit HS chapters. Sources of the data are outlined in the Appendix. The period covered goes from 1988 to 2002. We have a maximum of 10 cross-sectional[8] trade flows and 15 years, resulting in a maximum of 150 observations per sector. The number of observations varies depending on the product studied. A log-linear specification was selected. We deviate from the gravity model presented in section 3 (equation (3)) in several respects. First, we do not focus on infrastructure and in particular not on terrestrial infrastructure (i.e., the circumstances of arriving at the domestic port and departing from the foreign port), but on maritime transport costs when measuring distance. For this purpose, we scaled geographical distance (actual nautical miles) by using the freight cost index to construct a new transport cost variable. We assumed that merchants would use sea transport whenever possible, given the fact that a certain quantity transported by ship (40-foot containers) costs about one-fifth of the same quantity transported by road (13.6 m trailer). In 2003, maritime transportation was the leading transportation method for Turkish exports, followed by road transport.[9] We do not consider land transport costs here since they are the same for all exporting countries and independent of the export port (Turkey, Bulgaria, Ukraine) once the destination (foreign) port (e.g. Hamburg) has been reached. But still it has to be noted that land transport costs of the

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[8] But not in all sectors! For example, we have a large amount of missing data as far as Portugal's imports in sectors 07 and 20 are concerned.
[9] Maritime transportation was used for 49.2 % of Turkish exports (by value) and road transportation for 43.0 % of Turkish exports (by value) in 2003, with a steady increase in the importance of sea transport in the last decade (IGEME- Export Promotion Center of Turkey, 2004).

exporting country (e.g. Turkey, from Ankara to Istanbul) will differ from exporting country to exporting country (Turkey, Ukraine, Georgia) and should therefore be considered. However, they are partly incorporated into the income variable of the exporting country. A country with higher GDP will also have better public infrastructure.

Second, concerning economic distance, we use differences in incomes between trading countries, a variable similar to that used in Arnon et al. (1996) and in McPherson et al. (2000). Our variable is constructed as the absolute difference in per capita incomes in purchasing power parities (PPP).

We can identify two conflicting effects of this variable on trade. On the one hand, when the trading countries have very different per capita incomes, lower economic distance might foster trade, on the basis of the Linder (1961) model. According to this effect, countries tend to increase their bilateral trade in similar products when their per capita incomes are more similar. We therefore expect more trade to be intra-industry trade (countries should both export and import the same goods) when per capita incomes converge.

On the other hand, higher economic distance might foster inter-industry trade (countries import and export different goods) if we consider the Heckscher-Ohlin (H-O) model. H-O centres on expected trade patterns when countries have different factor endowments, but similar tastes. Per capita income differences can represent inter-country differences in factor scarcity.

We expect present trading patterns to be affected by both factors. For some commodities, the Linder effect will dominate the H-O effect and economic distance will have a negative effect on trade, whereas for others the opposite might occur, in which case economic distance will have a positive effect on trade.

Finally, a real exchange rate variable is added to our specification (Bergstrand, 1985, 1989; Soloaga and Winters, 1999). We calculated Turkey's and its competitors' bilateral real

effective[10] exchange rates (price quotation system) taking into account protection. Average tariffs imposed by the EU and EU subsidies enter the formula (see WTO Trade Policy Review European Union, Vol. 1, 2000, page 101). All the calculations are shown in the Appendix.

Exports from country i to country j in period t of commodity k are then modelled as:

$$lx_{ijkt} = \alpha_{ijk} + \beta_0 lyt_{ijt} + \beta_1 lydiff_{ijt} + \beta_2 lreer_{ijkt} + \beta_3 ltcindex_{ijt} + \mu_{ijkt} \qquad (4)^{11} \text{ or}$$

$$lx_{ijkt} = \alpha_{ijk} + \beta_0 lyt_{ijt} + \beta_1 lydiff_{ijt} + \beta_2 lreer_{ijkt} + \beta_3 lreer_{ijkt}^* + \beta_4 ldtc_{ijt}^* + \mu_{ijkt} \qquad (5)^{12}$$

where lx_{ijkt} is the natural logarithm of exports of sector k from country i to country j in period t. The total income of the trading countries (in purchasing power parities (PPP)) is lyt_{ijt}. This summarizes the impact of the income of trading pairs on exports. The natural logarithm of differences in per capita income in absolute terms and in PPP between the trading countries is $lydiff_{ijt,}$, while $lreer_{ijkt}$ is the real effective exchange rate (price quotation system), taking into account sector-specific protection. Accordingly, $lreer_{ikjt}^*$ is the real effective exchange rate of Turkey's extra-EU competitors. We assume the competitors' (extra-EU price competition) real effective exchange rate to be especially relevant in textiles and clothing (sectors 52-63) and in iron and steel (sectors 72-73), where China is a serious competitor. Concerning plastics and rubber and products thereof (sectors 39 and 40), we treat Brazil as the main competitor, and with respect to machinery, vehicles and furniture (sectors 84, 85, 87 and 94) we presume that Poland is in competition with Turkey. We have information suggesting that extra-EU competition is not very influential in agriculture (sectors 07, 08, 20), but of course intra-EU competition is (ICAP, 2004). $ltcindex_{ijt}$ stands for the natural logarithm of transport costs between countries i and j and $ldtc_{ijt}^*$ is used in equation (5) to signal the difference in transport costs between Turkey and its main extra-EU competitor.

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[10] Effective implies that EU import tariffs and subsidies are taken into account. This definition differs from the IMF definition, which understands real effective exchange rates as multilateral trade-weighted real exchange rates.

[11] partial adjustment model :

$$lx_{ijkt} = \alpha_{ijk} + \beta_0 lyt_{ijt} + \beta_1 lydiff_{ijt} + \beta_2 lreer_{ijt} + \beta_3 ltcindex_{ijt} + \lambda \cdot lx_{ijkt-1} + \mu_{ijkt} \qquad (4)'$$

[12] partial adjustment model:

$$lx_{ijkt} = \alpha_{ijk} + \beta_0 lyt_{ijt} + \beta_1 lydiff_{ijt} + \beta_2 lreer_{ijt} + \beta_3 lreer_{ijt}^* + \beta_4 ldtc_{ijt}^* + \lambda \cdot lx_{ijkt-1} + \mu_{ijkt} \qquad (5)'$$

The construction of the variables is described in the Appendix. α_{ijk} stands for the specific country-pair effects for sector k and allows us to control for all omitted variables that are cross-sectionally specific but remain constant over time, such as contiguity, language and cultural ties.

Expanding the CU between Turkey and the EU is expected to have a noticeable impact on Turkish exports facing high or very high protection in the EU, such as agricultural products, iron and steel. Turkey's price competitiveness is expected to be decisive for export success in all sectors under investigation. Expectations on the role of transport costs, differences in transport costs and differences in per capita income in Turkey's export trade are less conclusive. The importance of those factors is believed to vary from sector to sector.

Panel data methodology is used to estimate equations (4) and (5). We mainly apply the Seemingly Unrelated Regression (SUR) technique, thus controlling for correlation between cross-sections. The Generalised Method of Moments (GMM) is the method of choice for the partial adjustment version of the models. However, in some cases, in which we utilise Pooled Least Squares (PLS), neither the SUR technique nor the GMM technique can be applied, due either to an insufficient number of observations or to the lack of acceptable instruments. The use of panel data methodology has several advantages over cross-section analysis. First, panels make it possible to capture the relevant relationships among variables over time. Second, a major advantage of using panel data is the ability to monitor the possible unobservable trading-partner pairs' individual effects. When individual effects are omitted, OLS estimates will be biased if individual effects are correlated with the regressors. Mátyás (1997), Chen and Wall (1999) and Egger (2000) present a discussion of the advantages of using this methodology to estimate the gravity equation of trade.

Panel unit-root tests are conducted for imports in real terms (aggregated), for the real exchange rate, total income, per capita income differences and transport costs. Stochastic

trends that express themselves as autocorrelation of the error terms[13] are found to prevail in all series analysed.

Due to missing data and possibly an insufficient number of observations, Period SUR[14] cannot be performed. However, we control for autocorrelation of the disturbances by plugging in AR-terms whenever they prove to be significant.

Partial adjustment models are used mainly in agricultural sectors to identify slower reactions in this sector. When running the regressions for the sectors already participating in the CU in 1996, a step dummy variable is plugged in to capture a possible upward shift in exports caused by the CU between Turkey and the EU. This time dummy takes a value of 0 in the period of 1988-1995 and of 1 in the period of 1996-2002. The step dummy was left out of the analysis whenever it was insignificant.

Simulations are based on 1988-95 data in sectors that became part of the CU in 1996 to derive the effect of a CU based on pre-CU coefficients.[15] In contrast, simulations rely on 1988 - 2002 data if the sectors were not yet integrated into a CU by 2002 (or up to now). We assume that a change in tariffs has the same effect on exports as a change in subsidies according to the construction of the real effective exchange rate variable. The coefficients used in simulating agricultural exports (Table 2) are based on the fixed effects (FE) model (sector 07, 08, 20). The coefficients entering the simulations concerning industrial products (Tables 3-6) stem from the long-run model, which does not include a lagged endogenous variable and works with a common intercept to simplify the simulations and alleviate the computations. In the latter model, the real effective exchange rate elasticities differ a bit from the ones computed via the FE-model. All our simulations are based on multiple-regression equations derived

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[13] Non-stationary, integrated series can be corrected in two ways: (1) by taking first, second or third differences of the series or (2) correcting for autocorrelation. This is due to the fact that autocorrelation and non-stationarity are inter-linked.

[14] Which controls for correlation between periods.

[15] It is well known that forecast errors (simulation errors) can be two-fold: (1) regression coefficients might (slightly) change under a CU, (2) the magnitude and distribution of the disturbances under a CU are unknown. We circumvented the second problem by computing regression line values for both actual exports/imports and simulated exports/imports.

from the models described above. Nonetheless, the impact of a change in protection could also be computed by means of standardised real effective exchange rate coefficients[16], thus considering each variable's contribution to changes in exports. To make our simulation results comprehensible, a separate line with the standardised real effective exchange rate coefficients is added in the simulation segment.

4.2 Some caveats

We hope to contribute to the EU-Turkey CU debate by providing the EU demand elasticities for Turkish exports, which enter the simulations performed. Nevertheless, it must be admitted that the simulation results hinge very strongly on the EU tariff and subsidy rates chosen. Simple statements on the 'true' extent of prevailing sectoral tariffs or tariff-like duties are rather difficult. According to Grethe (2004b), there still exist some types of market barriers against Turkish products, even though almost all ad valorem tariffs have been abolished in the agricultural sector. Seasonal tariffs apply to four kinds of fruit and nine vegetables, thus complicating computations of tariffs. High specific duties are imposed on core products of the CAP and specific duties apply to many processed products. Tariff statements are further complicated by the entry price system of the EU, which acts like a tariff on Turkish vegetables and fruit[17], thus erasing preferential tariffs granted to Turkey (CONSLEG, 1984). Besides, some preferential tariffs for Turkish agricultural and industrial goods have also been annulled by EU safeguard measures taking the form of temporary tariffs.

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[16] In a bivariate regression model with only one independent variable (reer) the impact of a change in reer on exports could be calculated by multiplying the reer-elasticity with the change in reer. In the multiple regression model, one must consider reer's relative contribution to a change in exports.

[17] ''.....the introduction of a countervailing charge on imports of fruit and vegetables originating in Turkey is equivalent to finding that the condition provided for in Article 1 (2) of Regulation (EEC) No 562/81 is not fulfilled; whereas application of the preferential tariff should at the same time be suspended for the products in question; …'' (CONSLEG, 1984, 2).

4.3 Main results

Now, we present the empirical findings for Turkey based on equations (4), (4') and (5) and the simulation results concerning the impact of an expanded CU.

When computing the real effective exchange rates for vegetables, fruit and nuts, and preparations thereof, we consider a 20% cut in the prevailing tariffs and a 36% cut in the prevailing subsidies during the 1995-2000 period in the EU, as agreed in the Uruguay Round (OECD, 1997, 25, 41).

Table 2, column 1 presents the results for **edible vegetables exports**. EU protection in this sector amounts to an average tariff of 12% and the subsidy equivalent is supposed to be 5%. Looking at Turkey's vegetable exports in real terms, one notes a quite steady increase of imported vegetables in Denmark, UK and the Netherlands in the period of 1988-2002. In the other EU countries, such as Germany, France, Greece and Italy, we observe a decrease of Turkey's exports starting in 1996 and a modest recovery after 2002. In the full sample, the real effective exchange rate coefficient of 1.14 has the correct positive sign and is significant at the 1% level. However, the coefficients of total income, income differences and transport costs are not significant.

Rerunning the regression for Germany, France, Greece, Italy and Spain[18] with the objective of explaining the drop (and slight recovery) of imports, all independent variables turn out to be significant at α =1% with the real effective exchange rate coefficient being 1.16. The transport cost index coefficient is -1.28, implying that an increase of 10% in transport cost will result in a decrease of 12.8% in EU imports. The income difference coefficient is 2.35, pointing to the relevance of Heckscher-Ohlin trade in the case of trade between the EU and Turkey. Total real income turns out to have a negative sign, implying that export trade in vegetables decreases with increasing income of the trade partners. This could have to do with quality requirements in the EU or a restructuring of Turkish exports with increasing economic

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[18] In Spain we observed a permanent decline of Turkish imports already starting in 1992 and lasting to 2002.

development in Turkey. Finally, we simulate the impact of completing the CU in sector 07. The abolition of tariffs could improve Turkey's exports by 14.0%. Full trade integration[19], implying subsidy payments to Turkey in correspondence with the subsidy equivalent prevailing in the EU, would lead to an increase of Turkey's vegetable exports by 21.0%.

The second column of Table 2 presents the estimation results for **fruit and nuts exports**. Tariff protection in the fruit sector takes on an average value of 12%, with tariffs varying seasonally and from product to product. Subsidies are around 5% in this sector. Fruit imports are characterised by a fairly regular upward movement in Denmark, Spain, France, Greece and Italy, but a decline in Germany, Ireland and the Netherlands starting in 1994, and a decline in Portugal beginning in 1997. What are the factors explaining this evolution? Nuts constitute a very important part of sector 08's exports, the other part being citrus. In the middle of the 1990s, nuts were affected by a very serious disease that made them inedible and non-exportable.

In the framework of the augmented gravity model, transport costs and the real effective exchange rate do, as expected, have a significant impact on Turkish exports: an increase in transport costs decreases Turkish exports and a depreciation of the real effective exchange rate increases Turkish exports. The coefficient of 'per capita income differences' does not carry the expected sign and total income is not significant. According to the simulations performed, the abolition of tariffs in this sector would lead to an increase of the level of exports by 12.5%. The elimination of both tariffs and the payment of subsidies (after full trade integration or EU accession) would enhance exports by 18.7%.

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[19] According to Dervis et al. (2004) and Gros (2004), the net budgetary outlays from CAP and Structural Funds (based on Turkish agricultural production and CAP provisions in 2004) would amount to a maximum of about €15 to €16 billion annually. The CAP receipts would amount to around €9 billion (as an upper bound).

Table 2: Estimation and simulation results for agricultural products and processed agricultural products[20]

	Sector 07 Edible vegetables	Sector 08 Edible fruit and nuts	Sector 20 Preparations of vege- tables,fruit,nuts
EU protection in this sector (T, S)[21]	T=0.12 S=0.05	T=0.12 S=0.05	T=0.25 S=0.05
CU	No	No	No
Regression results based on eq. (4)' or eq. (4)			
Estimation technique	SUR	SUR	SUR
Fixed effects	Yes	Yes	Yes
AR-term[22]	No	No	Yes (0.64***)
Partial adjustment[23] λ	Yes 0.66***(10.48)	Yes 0.15*** (3.80)	No --
Lyt	-6.37***(-8.31)	0.36 (1.72)	0.07 (0.12)
Lydiff	2.35***(4.62)	-0.92***(-8.89)	1.46*** (5.41)
Lreer	1.16***(4.81)	1.04*** (14.80)	1.46***(12.44)
Ltcindex	-1.28***(-3.49)	-0.69***(-3.83)	1.03*** (3.15)
S.E. of regression	1.05	1.05	1.03
R-squared	0.91	0.99	0.97
DW	1.75	1.70	2.07
Obs.	70 (5 EU countries)	140 (10 EU countries)	130 (9 EU countries)
Simulation results based on 1988-2002 data			
Standardised reer elasticity (base period)	1.17	0.94	1.53
Impact of CU (abolition of tariffs)	+ 14.0 %	+12.5 %	+38.5 %
Impact of trade (CAP) integration[24]	+ 21.0 %	+18.7 %	+49.3 %

Note: t-values are stated in brackets. ***, ** and * signal the tolerated error-level and stand for $\alpha = 1$ %, 5 % and 10 % respectively.

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[20] A very thorough discussion of the CU on Turkish agriculture can be found in Grethe (2004a). This dissertation contains computations of changes in prices and output, in producer and consumer surplus and net budget effects due to a CU between Turkey and the EU. In contrast to Grethe, we concentrate on the trade effects of a CU between Turkey and the EU.

[21] T = tariff rate (WTO Trade policy Review EU, 1995, 2000; S = subsidy rate (qualitative information to be found in Supper (2001), converted into a very rough subsidy equivalent).

[22] An AR-term has been included whenever it turned out to be significant, thus correcting for autocorrelation of the disturbances and non-stationarity of the series.

[23] A partial adjustment model has been used whenever the adjustment coefficient was significant, thus modeling the lagged adjustment of exports with respect to changes in transport costs, the real effective exchange rate etc.

[24] Trade integration could imply that Turkish exports are freed from tariffs and are given a support (subsidy) corresponding to the subsidies prevailing in this sector in the EU.

The third column of Table 2 presents the results for the exports of sector 20: **preparations of vegetables, fruit and nuts**. Average tariffs in this sector reach about 25% and subsidies are around 5%. Turkey's exports of processed agricultural products show a regular evolution in Germany, Denmark, UK, Ireland and the Netherlands and an irregular trend with large downturns in Spain, France, Greece and Italy. In the period 1988–2002, we observe a positive and significant impact of per capita income differences of 1.46 and a positive and significant price elasticity of also 1.46, but the wrong sign of transport costs coefficient. The integration into the CU in 1996 might have contributed to an increase of 38.5% in Turkish exports, whereas full trade integration – as one part of EU accession – would enhance Turkish exports by 49.3%. This result must be put into perspective given that only 10% of the products of sector 20 are covered by a tariff, and the rest are free of tariffs.

Table 3 (columns 1 and 2) shows the results for **plastics and rubber exports**. Plastics and rubber exports develop quite steadily over the period 1988–2002. Tariff and non-tariff protection in the EU were low in 1996. Introduction of the CU in 1996 has led neither to a relevant increase in exports nor to a significant change in real effective exchange rate elasticities according to our regressions and simulation results. The hypothesis that Brazil is to be considered as an extra-EU competitor is falsified by the data.[25] Transport costs and real effective exchange rates prove to be significant determinants of Turkish plastics and rubber exports. Given the rather low protection level in these two sectors, abolition of tariffs in 1996 might have possibly enhanced plastics exports (level) by 2.13% and rubber exports (level) by 1.31%. This result is not surprising given the low level of EU protection in these sectors.

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[25] Therefore equation (4) was estimated since equation (5) did not turn out to be relevant.

Table 3: Estimation and simulation results for plastics and rubber trade

	Sector 39 **Plastics and plastic products**	Sector 40 **Rubber and articles thereof**
EU protection in this sector (T, S)[26]	T = 0.07 S = 0.00 (low protection)	T = 0.02 S = 0.00 (low protection)
CU	Yes, since 1996	Yes, since 1996
Regression results based on eq. (5)		
Estimation technique	SUR	SUR
Fixed effects	Yes	Yes
AR-term	No	Yes
Partial adjustment	No	No
Lyt	-0.56 (-1.08)	-0.83 (-1.39)
Lydiff	1.59*** (6.23)	-0.15 (-0.44)
Lreer	0.72*** (6.09)	1.63*** (7.76)
Lreer*	Not significant	Not significant
Ltcindex	-2.20*** (-11.61)	-3.71 ***(-8.87)
Ldtc*	Not significant	Not significant
Time-dummy	Not significant	Not significant
S.E. of regression	1.05	1.04
R-squared	0.77	0.94
DW	1.94	1.98
Obs.	130	140
Simulation results based on 1988-1995 data		
Standardised reer elasticity (base period)	0.31	0.65
Impact of CU (abolition of tariffs)	+ 2.13 % increase in export level	+ 1.31 % increase in export level

Note: t-values are stated in brackets. ***, ** and * signal the tolerated error-level and stand for α = 1 %, 5 % and 10 % respectively.

Table 4 shows the results concerning **textiles and clothing exports**. Turkish exports of textiles and clothing develop quite smoothly during the 1988-2002 period and show mild upward trends in most EU countries except Ireland. According to the evolution over time, the impact of a CU after 1996 is not very pronounced. The time dummies are not significant in the majority of sectors analysed. Differences in transport costs to the EU market between China and Turkey do not always put Turkish textile exporters into an advantageous position.

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[26] The tariff rates are taken from WTO Trade Policy Review EU, 2000. The degree of subsidisation seems to be low according to the information collected in Supper (2001).

Table 4: Estimation and simulation results for textiles and clothing trade

	Sector 52 Cotton	Sector 55 Man-made staple fibres	Sector 61 Articles of apparel and clothing; knitted or crocheted	Sector 62 Articles of apparel and clothing; not knitted or crocheted	Sector 63 Other made up textile articles
EU protection in this sector (T, Quotas)	T = 0.08 Yes, quotas Very high protection	T = 0.09 Yes, quotas Very high protection	T = 0.13 Yes, quotas Very high protection	T = 0.13 Yes, quotas Very high protection	T = 0.10 Yes, quotas Very high protection
CU	Yes, since 1996	Yes, since 1996	Yes, since 1996	Yes, since 1996	Yes, since 1996
Regression results based on eq. (5)					
Estimation technique	SUR	SUR	SUR	SUR	SUR
Fixed effects	Yes	Yes	Yes	Yes	Yes
AR-term	No	No	Yes	No	Yes
Partial adjustment	No	No	Yes	No	No
Lyt	2.55*** (4.18)	8.79*** (15.56)	1.10*** (2.88)	6.33*** (20.32)	0.23 (0.34)
Lydiff	-0.97*** (-2.50)	-1.49*** (-3.66)	0.26 (1.10)	-0.14 (-0.60)	1.44*** (3.39)
Lreer	0.78** (3.05)	3.76*** (17.32)	1.21*** (7.86)	1.96*** (18.37)	1.55*** (11.03)
Lreer*	-0.87*** (-3.73)	-0.37** (-2.34)	0.14 (0.92)	-0.21** (-2.41)	-0.43*** (-5.91)
Ldtc*	-0.09 (-0.30)	2.87*** (10.52)	-0.16 (-0.64)	0.56** (2.04)	-2.46*** (-9.98)
Time-dummy	Not significant	Not significant	Not significant	Significant, but negative	Significant and positive
S.E. of regression	1.03	1.04	1.05	1.04	1.05
R-squared	0.87	0.78	0.98	0.94	0.95
DW	1.77	1.73	2.05	1.80	2.06
Obs.	150	140	130	150	140
Simulation results based on 1988-1995 data					
Standardised reer elast.	0.60	0.71	0.09	0.18	0.72
Impact of abolition of tariffs and quotas	+ 4.8 % increase in export level	+ 6.5 % increase in export level	+ 1.2 % increase in export level	+ 2.4 % increase in export level	+ 7.2 % increase in export level

Note: t-values are stated in brackets. ***, ** and * signal the tolerated error-level and stand for α = 1 %, 5 % and 10 % respectively.

The hypothesis that China should be treated as a serious competitor with Turkish textile exporters finds strong empirical support. A 10% improvement in Chinese price competitiveness could lead to a significant deterioration of Turkish exports in the range of 2.1 to 8.7%. Increased Turkish price competitiveness could trigger a significant increase in Turkish textile and clothing exports.

Due to the rather low real effective exchange rate elasticities prevailing in the 1988-1995 period[27], the impact of the CU of 1996 is rather small. According to our calculations, textiles and clothing exports under the CU between Turkey and the EU might have experienced a level increase in the range of 1.2% and 7.2% under ceteris paribus assumptions (i.e. no change in China's price competitiveness and the other right-hand-side variables). This is of course not a very remarkable increase.

Table 5 presents the results for **iron and steel exports,** the development of which has not been very homogeneous throughout the EU countries. Similar to agricultural products, iron and steel have been exempted from the CU between Turkey and the EU. Tariffs are very low (2.5 and 3.0%), but EU protection through subsidies is quite high. Competition on the iron and steel market is very rough due to low-cost producers such as China and the numerous antidumping actions of the EU (and the USA). With iron and steel, we find very strong price competition from China and high and significant Turkish real effective exchange rate elasticities. Transport costs are not significant for sectors 72 and 73. Abolition of tariffs would increase exports of sector 72 by 1.5%. A CU in sector 73 would enhance exports of sector 73 by 2.5%.

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[27] The base period of the simulations for the textiles and clothing sector.

Table 5: Estimation and simulation results for the iron and steel trade

	Sector 72 **Iron and steel**	Sector 73 **Iron and steel products**
EU protection in this sector (T, S)[28]	T = 0.03 (T$_{max}$[29]=0.07) S = 0.10 (high protection)	T = 0.03 (T$_{max}$ = 0.05) S = 0.10 (high protection)
CU	No, excluded	No, excluded
Regression results based on eq. (5)		
Estimation technique	PLS	SUR
Fixed effects	Yes	Yes
AR-term	Yes	Yes
Partial adjustment	No	No
Lyt	6.62 (1.59)	5.51*** (8.61)
Lydiff	6.89*** (3.92)	1.60*** (5.06)
Lreer	5.19*** (3.77)	1.57*** (9.83)
Lreer*	-2.75*** (-2.60)	0.02 (0.18)
Ldtc*	3.78 (1.40)	-0.55 (-1.07)
Time-dummy	No	No
S.E. of regression	1.11	1.04
R-squared	0.85	0.96
DW	2.18	2.22
Obs.	128	120
Simulation results based on 1988-2002 data		
Standardised reer elasticity (base period)	0.50	0.82
Impact of CU (abolition of tariffs)	+ 1.5% increase in export level	+ 2.5% increase in export level

Note: t-values are stated in brackets. ***, ** and * signal the tolerated error-level and stand for α = 1%, 5% and 10% respectively.

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[28] The tariff rates are taken from WTO Trade Policy Review EU, 2000. The degree of subsidisation seems to be low according to the information collected in Supper (2001).

[29] T$_{max}$ = maximum tariff. According to our information, this tariff is applied to Chinese iron and steel imports.

Table 6 presents the results for **exports of machinery and the like**.

Table 6: Estimation and simulation results for machinery and furniture trade

	Sector 84 Machinery and mechanical appliance	Sector 85 Electrical machinery and equipment	Sector 87 Vehicles other than railway or tramway r.s.	Sector 94 Furniture, medical and surgical equipment…
EU protection in this sector (T, S)	T = 0.02 S = 0.00 Low protection	T = 0.03 S = 0.00 Low protection	T = 0.07 S = 0.00 Low protection	T = 0.02 S = 0.00 Low protection
CU	Yes, since 1996	Yes, since 1996	Yes, since 1996	Yes, since 1996
Regression results based on eq. (5)				
Estimation technique	SUR	SUR	SUR	SUR
Fixed effects	Yes	Yes	Yes	Yes
AR-term	Yes	Yes	Yes	Yes
Partial adjustment	No	No	No	No
Lyt	4.01*** (9.24)	4.83*** (18.58)	2.00* (1.66)	2.98*** (6.02)
Lydiff	2.79*** (6.65)	3.20*** (12.54)	5.68*** (5.81)	3.90*** (9.48)
Lreer	1.16*** (7.76)	0.91*** (9.59)	0.74*** (2.57)	2.01*** (19.89)
Lreer*	-0.68*** (-4.44)	-0.34*** (-3.09)	-1.51*** (-4.55)	-1.23*** (-10.28)
Dtc*	-0.00** (-2.16)	0.00*** (2.82)	0.00** (1.92)	0.00 (0.34)
Time-dummy	Not significant	Not significant	Not significant	Not significant
S.E. of regression	1.07	1.06	1.04	1.08
R-squared	0.96	0.95	0.93	0.94
DW	1.99	2.01	2.11	2.17
Obs.	96	96	88	80
Simulation results based on 1988-1995 data				
Standardised reer elasticity	1.13	0.92	0.74	1.99
Impact of abolition of tariffs	+ 2.3% increase in export level	+ 2.7% increase in export level	+ 5.2% increase in export level	+ 4.0% increase in export level

Note: t-values are stated in brackets. ***, ** and * signal the tolerated error-level and stand for $\alpha = 1\,\%$, 5 % and 10 % respectively.

In the machinery-related sectors, we observe a strong and steady increase of Turkish exports into the EU in the period 1988–2002. Given the fact that tariffs in these sectors were already

low before the CU between Turkey and the EU, the expected impact of a CU is quite low. This expectation is confirmed by our simulations, which predicted an increase in export levels between 2.3% and 5.2%. Polish price competition is significant and serious, as is the impact of Turkey's own price competitiveness. Transport cost differences between Poland and Turkey are not a relevant determinant of Turkish export performance.

5. Conclusions

In this paper, we have investigated the sixteen most important Turkish export sectors and their economic determinants in the framework of an extended gravity model using panel data. An improvement in Turkish price competitiveness (expressed as an increase in the Turkish real effective exchange rate) led to a significant enhancement of Turkish exports in almost all sectors. Ameliorated price competitiveness of Turkey's competitors, in contrast, hampered Turkish export performance in the majority of sectors, except for plastics and rubber. Concerning agricultural goods and products thereof Turkey's main competitors on the EU market are Greece, Spain, Portugal, Italy, and France. It is interesting to note that transport costs (which have been subject to a secular decline) and differences in transport costs between trade competitors did significantly influence exports in such sectors as vegetables and fruit (sector 07 and 08), plastics and rubber (sector 39 and 40), staple fibres (sector 55) and articles of apparel and clothing (sector 62). However, they turned out to be irrelevant for cotton (sector 52), iron and steel (sector 72 and 73), machinery and the like (sector 84, 85, 87 and 94).

According to our simulations, strengthening and expanding the CU between Turkey and the EU to products excluded so far (such as vegetables, fruit, and preparations thereof) would lead to a noticeable increase in export levels in agricultural sectors still suffering from EU tariffs or tariff-like protection. We could expect an increase of +14.0% of vegetable exports, +12.5% of fruit exports, and +38.5% of processed vegetables and fruit, depending on the

specific product and the seasonal tariffs. Iron and steel exports would increase only between 1.5% and 2.5%[30].

An integration of vegetables and fruit into the Common Agricultural Policy (CAP) of the EU would increase Turkish vegetable exports by 21.0% and Turkish fruit exports by 18.7%.

Although a full integration of Turkish agriculture seems quite costly if today's CAP and structural fund rules were applied, the abolition of all tariffs or tariff-like protection would certainly be an effective measure for strengthening and increasing Turkish agricultural exports to the EU. The already existing CU covering industrial goods (plastics and rubber, textiles and clothing, and machinery) has increased Turkish exports to the EU – under ceteris paribus assumptions – only slightly.

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[30] Supposedly France, Greece, Italy, Portugal and Spain would vote against a CU concerning vegetables and fruit. As far as steel is concerned, Turkey is not a major threat to the EU. Measured in thousands of metric tons, China produced 19,390 units of crude steel, whereas the EU-25 produced 15,739, the EU-15 produced 13,795 and Turkey produced 1,657 units of crude steel (see: http://worldsteel.org/csm_text/61 (10/19/2004).

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Appendix

Description of Data

In the following, the variables of equations (5) and (6) : lx, lyt, lydiff, lreer, lreer* , ltcindex and ldtc* will be described in original form (not in logs). All data run from 1988 to 2002.

In our case, 10 cross-sections (10 EU countries: Germany, Denmark, Spain, France, UK, Greece, Ireland, Italy, the Netherlands, and Portugal) had basically complete time series.[31]

(1) Turkish exports to the EU or EU imports from Turkey : x

The export data x (in 1000 ECU) are taken from the COMEXT trade data base of EUROSTAT (Intra- and extra-EU trade, Annual data, Combined Nomenclature, Supplement 2, 2003). They have been converted into real terms data (from the point of view of Turkey) by considering changes of the Turkish Lira exchange rate with respect to the ECU (EUR) and changes in the Turkish price level (as measured by the GDP deflator of Turkey).

(2) Total income of the trading pairs in PPP: yt

The yt data stem from the World Development Indicators CD ROM of 2004. This stands for PPP-income of Turkey plus PPP-income of the relevant EU trading partner.

(3) Per capita income differences of the trading pairs in PPP: ydiff

The ydiff series is taken from the World Development Indicators CD ROM of 2004. It is computed as PPP-per capita income of relevant EU country minus PPP-per capita income of Turkey.

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[31] Due to missing data, Austria, Belgium, Finland, Luxemburg and Sweden were excluded from the analysis.

(4) The Turkish real effective exchange rate: reer

reer is the bilateral real effective exchange rate between Turkey and the EU countries (price quotation system), taking Turkey's point of view. It consists of the real exchange rate (rer) and basic indicators of EU protection such as EU-tariffs (t) and EU-subsidies (s).

It is computed (all data for 'rer' are taken from World Development Indicators CD ROM of 2004) as:

$rer = e \cdot P_{EU}/P_{Turkey}$ with

rer = real bilateral exchange rate between Turkey and relevant EU country

e = nominal exchange rate (x Turkish Lira/1EUR) between Turkey and relevant EU country

P_{EU} = GDP deflator of the EU country under consideration with 1995 as base year (1995 ≘ 100)

P_{Turkey} = GDP deflator of Turkey with 1995 as base year (1995 ≘ 100)

rer has been adjusted for EU tariff protection (in terms of average EU tariff rate (t)) and non-tariff protection (in terms of EU subsidy rate (s). Tariff rates prevailing in the EU can be found in Trade Policy Review European Union, Volume 1, 2000, pp. 88-101 (WTO) and rough subsidy equivalents are based on qualitative information on non-tariff protection collected, explained and nicely put together for UNCTAD by Supper (2001).

So we get:

$reer = rer \cdot (1-s)/(1+t)$

For the simulations, we assume that the CU between Turkey and the EU brings tariffs down to zero. Full trade integration levels off EU subsidies, i.e. s becomes zero, too.

(5) Turkey's competitors real effective exchange rates :reer*

In analogy to (4) the real effective exchange rates of Turkey's main competitors China, Brazil and Poland are computed. Nominal exchange rates, China's, Brazil's and Poland's GDP

deflators are computed from World Development Indicators CD ROM 2004. Tariff and subsidy rates are borrowed from WTO and UNCTAD (see (4)).

(6) Turkey's transport costs to main EU ports : tcindex

The transport cost index consists of two components: 1) the actual distance via available sea routes (not great circle distance) between Turkey and the EU country under consideration, converted from nautical miles into km.[32] Sea distance in km is widely regarded as appropriate because sea transport costs one-fifth of land transport! [33] 2) a freight cost index[34] to be found in Busse (2003) citing Hufbauer (1991), Figure 6: Transport and Communications Costs, 1930-2000 (in 1990 \$US) that is extrapolated for the period of 1988 to 2002. Actual sea distance is multiplied by the freight cost index with base year 2002.

$$tcindex = kmsea \cdot fci$$

tcindex = transport cost (from Turkey to relevant EU port)

kmsea = sea distance in km of Turkey to relevant EU port

fci = freight cost index with 2002 as base year (2002 $\hat{=}$ 1)

(7) Transport cost differential between Turkey and its main competitors: dtc

dtc measures differences in transport costs between Turkey and China/Brazil/Poland to the EU market multiplied through with the freight cost index in the period of 1988 to 2002.

$$dtc* = (kmsea*-kmsea) \cdot fci$$

dtc* = transport cost differential between Turkey and extra-EU competitor *

kmsea* = sea distance in km of main extra-EU competitor (China, Brazil, Poland) to relevant EU port

kmsea = sea distance in km of Turkey to relevant EU port

fci = freight cost index with 2002 as base year (2002 $\hat{=}$ 1)

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[32] http://www.maritimechain.com/port/port_distance.asp
[33] This information was transmitted by fax on 17 August 2004 by the ShortSeaShipping Promotion Center, c/o Bundesverkehrsministerium für Verkehr, Bau- und Wohnungswesen (BMVBW Bonn ABTLG LS).
[34] Average ocean freight and port charges per short ton of import and export cargo.

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