Export Supply and Trade Reform: The Turkish Evidence

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Abstract

The paper argues that a traditional model of export supply with explanatory variables such as export prices (relative contribution of improved export profitability), variable home and foreign costs, and productive capacity can be further extended by taking the effects of trade reform which consists of measures to reduce anti-export bias. In this sense, trade reform leads to the reduction of anti-export bias and thus strong supply response. Our extended model of export supply also includes import compression factor and technological innovation together with trade reform. The empirical analysis focuses on the Turkish case. In an imperfect substitutes model, Turkey's long-run export supply function is estimated. The cointegration and error correction type of modeling are employed by taking special care of structural breaks, nuisance parameters, endogeneity, and assymetric adjustment in the sense of TAR and MTAR types of threshold cointegration. Some policy implications are also drawn.

Keywords: Export supply, trade reform, import compression, technological innovation, structural break, cointegration, error-correction, threshold.

JEL Classification: *F10, F31, C32*

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1. Introduction

Does trade reform lead to an expansion in export supply? What are the main determinants of an export supply function? The potential answers of these questions have important policy implications. Standard models of export supply include explanatory variables such as export prices (relative contribution of improved export profitability), variable home and foreign costs, and productive capacity (Goldstein and Khan, 1978; Bond, 1985; Faini, 1994). In recent empirical literature, however, some researchers (Muscatelli *et.al*., 1990; Muscatelli *et.al.,* 1991; Muscatelli *et.al.,* 1992; Muscatelli, 1991; Muscatelli, 1994; Athukorala and Riedel, 1994) have contributed to the empirical modelling and the issue of developing country export supply significantly.

The aim of this paper is to empirically investigate the behaviour of the Turkish export supply as regards the trade reform and related issues. What are the main factors behind Turkey's export drive in the long run? Since the major trade reform/opening up operation of the early 1980's, the Turkish economy has experienced gradual import liberalisation, more flexible exchange regime, less intervention in the trade sector, to a certain extent. Thus, we first focus on estimation of a standard export supply function. Then, the base model is extended in three dimensions including trade reform, import compression, and technological innovation. In an imperfect substitutes model, Turkey's long-run export supply function is estimated. The cointegration and error correction type of modelling are employed by taking special care of structural breaks.

The organization of the paper is as follows. The next section addresses the model and theoretical issues. Section 3 highlights the Turkish experience as regards trade reforms. Section 4 describes the econometric methodology employed. Section 5 provides the data and reports the results of the empirical work. The last section offers some conclusion and implications.

2. A Model of Export Supply and Extension

We consider an imperfect substitutes model of trade; the key underlying assumption is that neither exports nor imports are perfect substitutes for domestic goods (Goldstein and Khan, 1985, 1044-50). Assuming that the producer maximizes profits subject to a cost constraint, our model determines an export supply equation.[1] In the long run, export supply traditionally depends on the relative prices, input prices, and productive capacity.

[1] At the end of 2001, Turkey's share in world exports is 0.42 per cent. Thus, we have a "small country assumption" for Turkey. In this case, in order to model a single export supply function, corresponding price elasticity for export demand needs to be elastic.

Accordingly, the general form of the long-run (steady-state) export supply function is expressed as:

$$X_s = f_1(P_x/P_d,\ C,\ K) \qquad (1)$$

where X_s represents the volume of exports, Px/Pd is relative the export price (export prices divided by domestic absorption deflator, C is a variable cost, and K is the capacity of production. In equation (1), export supply depends positively on the price of exports, negatively on input prices, and positively on productive capacity.

Export supply is thought to be negatively related to the internal pressure of demand. The theory behind this is the division of output between home and foreign sales depending on the assumptions made about firm behaviour, on the shape of the demand curve facing firms in foreign markets. Since we assume in this work that Turkish firms are price-makers in the domestic market and price-takers in foreign markets, the demand curve facing the representative firm is downward-sloping at home and horizontal abroad (Thirlwall, 1986, 223-4). *If the domestic demand for output increases, the quantity available for exports will fall; and if the domestic demand falls, the quantity available for exports increases. That is, the quantity of exports will vary inversely with the internal pressure of demand*.[2]

The model outlined in equation (1) is a standard export supply function that is used by many empirical works in the literature to an extent.[3] This model can further be extended in three aspects (see equation 2). This is what the present study is trying for the Turkish case by the help of data available and of recent econometric techniques as well.

$$X_s = f_1(\ P_x/P_d,\ C,\ K,\ TR, IC, TI\ ) \qquad (2)$$

where TR, IC, and TI represent the trade reform, import compression effect, and technological innovation.

A trade reform in the form of less protectionism, more openness, movement to trade liberalization, less distorted prices as a whole leads to the reduction of anti-export bias and thus strong supply response. Trade liberalization may embody a number of different aspects of trade policy reform. Whether a less interventionist trade regime results in a less distorted,

[2] If the internal pressure of demand is excessive, this leaves insufficient capacity to supply exports that would be readily be absorbed by the world at the ruling market price.
[3] See esp. Muscatelli *et. al*., 1991; Bond (1985), and Goldstein and Khan (1978)

more open, or outward oriented economy depends critically on the detailed characteristics of the pre- and post-reform trade and exchange rate regimes and their impacts on the pattern of incentives and production (Ghatak, *et. al*., 1995; Utkulu and Özdemir, 2003). It is well known that unrealistic exchange rate does not reflect relative scarcity of foreign exchange; a rigid exchange rate regime rejects market forces in exchange rate adjustments, and causes exchange rates fail to signal and guide economic agents to efficient resource allocation (Zhang, 2001).

Different dimensions of trade reform/orientation may impose on neutrality, interventionism or openness of a reforming economy. Many countries at past and present employ(ed) interventionist policies in the tradable sector; import tariffs and non-tariff controls in the importable sector; over-valuation of the exchange rate, and export taxes in the export sectors. Lowering of non-tariff barriers combined with uniform exchange rate depreciation may increase the neutrality of the trade regime, without increasing the actual openness of the economy. Despite these theoretical complications, there exists often considerable scope for reforming trade regimes so as to make them less interventionist, more neutral, and more open (Ghatak, *et. al*., 1995).

Based on the above theoretical background, one may suggest that the more movement towards trade reform is the less import compression. As explained governments may engage in direct controls on imports through tariffs, quotas, and licensing schemes; engage in deflationary policies; or depreciate the currency for the purpose of servicing external debt or rebuilding foreign exchange reserves. This type of interventionist policies causes the import compression. It can adversely affect export supply due to the fact that imports of capital and intermediate goods are critical inputs in the exports production. The theory behind this is simply that imports are constrained by the availability of foreign exchange and export performance depends on the supply of imported inputs. [4]

As regards the technological innovation, the theoretical argument is simply that foreign imported technology is potentially an important factor in determining an expansion in the export supply. In order to capture this effect, one can use cumulative sum of net foreign direct investments in to the economy. Besides, in line with the theory, in terms of greater economies of scale in high-technology sectors, an export commodity composition type of index may yield significant results (Muscatelli, *et. al*., 1991; Utkulu and Seymen, 2003).

[4] For the use of import compression in explaining export supply both in theory and practice, see esp. Goldstein and Khan, 1985; Khan and Knight, 1988.

3. A Brief Look at the Turkish Experience

Pre-1980 Experience

Turkey's economic policy and particularly trade policy has been significantly changed since the Turkish Republic was formed in 1923. During the fist years of its establishment, Turkey was practising more liberal economic policies. This gradually changed, after the 1930s, and more governmental control of economy was adopted. For half a century, from the 1930s to the beginning of the 1980s, except for short periods of relaxed trade controls in 1950-1953 and 1970-1973, Turkey followed inward-oriented development strategy. During this period, Turkey's economic policies are characterised as interventionist and protectionist (Wagstaff, 1989). Accordingly, policies were mainly designed to protect domestic industry from foreign competition (i.e. "infant industry" argument) and increase the government controls over the allocation of resources and production of goods. In the frame of the inward oriented development strategy, the trade regime exhibited the characteristics of imports substituting industrialisation (ISI) with high rates of trade protection using quantitative restrictions, high tariffs, licensing requirements and other measures which biased incentives away from the export sector to the domestic sector (Utkulu and Özdemir, 2003:10-12). Government interventions in the price mechanism, strict controls in the foreign exchange market and the maintenance of fixed exchange rates -which results in overvalued domestic currency- were the main features of the economic policy (Saracoglu, 1987).

National planning years of the 1960s and the 1970s mark an intensive import-substitution drive in Turkey. Import-substitution was primarily adopted by the first five-year plan (1963-67) as means of reaching the industrialisation goal, But, by the time of the second five-year plan (1968-72) the motivation for inward-looking import-substitution policies stemmed much more from balance-of-payments difficulties (Krueger, 1974).

The policies started to be criticised from mid 1970s onwards when the inward-looking industrialisation process had reached its more difficult phase and when at the same time there were external and internal shocks to the economy (Uygur, 1993:4) Instead of adjusting to these external shocks Turkey attempt to preserve its growth momentum trough rapid reserve decumulation and massive external borrowing. As a result of the oil price shock the inefficiencies of the long standing inward looking development strategy and inflationary financing of growing public sector deficits, the country faced crisis towards the end of the 1970s. Unable to pay her debts, Turkey fell in to the international insolvency in 1978. During the period 1978-1980, the manufacturing industry was especially hard hit, investment declined sharply and unemployment increased. In the same period average GNP growth was 0.5 percent

with negative rates in 1979 and 1980 (See Table1). Social and political tensions increased in the country. It was apparent that the strategy of economic growth based on import substitution and characterised by fixed exchange rates, regulation of imports through quotas, and high nominal and effective protection rates was no longer sustainable (Togan, 1995:108)

Table 1: Stages of Import-Substitution Industrialisation (ISI), 1963-80

	Average annual growth rate (%)						
	GNP	Agriculture	Manufacturing Industry	Exp/GNP	Imp/GNP	Exp./Imp.	Manu.Exp/Total Exp.
1963-70 **(a)**	6.4	2.6	10.4	4.1	6.8	0.68	17.6
1971-77 **(b)**	7.2	4.3	10.1	3.5	10.9	0.45	30.9
1978-80 **(c)**	0.5	2.4	-2.7	3.4	9.4	0.43	32.6

(a) Positive ISI financed with domestic savings.
(b) Negative ISI financed with foreign deficit.
(c) Economic crisis years.
Sources: Pamuk (1984:53); SPO Annual Programs.

Before the 1980, trade regime remained heavily biased against exports. As illustrated in Table 1, exports were not very important in the Turkish economic agenda. At the beginning of the 1960's the GNP shares of Turkish exports was 4.1%, while the manufacturing share of it was only 17.6%. Export structure of the country were depending on mainly traditional agricultural crops-with a low demand elasticities- like cotton, tobacco, hazelnuts, dried figs and raisins.(Kazgan, 1993:72;).

"1980 Economic Reform" and After

A turning point in Turkish economic policy came in January 1980. At the time, the government announced an economic reform program, after several unsuccessful attempts in 1978-1979 and several failed IMF programs. Import substitute industrialization strategy was replaced by an export-led growth (ELG) strategy, which is relied on more market-based economy.

The programme has imposed some radical changes to the Turkish economy. Gradual import liberalization, more flexible exchange rate regime, more effective export promotion to encourage rapid export growth were general objectives of this reform program. Accordingly, The series of reforms started: after a near 50 per cent devaluation, the exchange rate has been adjusted on a daily basis since May 1981, and direct export incentive were increased to reduce anti-export biased of previous policies. The liberalisation of imports and the capital account

were, however, approached gradually and at later phases of the 1980 adjustment programme[5] nominal tariff rates were reduced remarkably; quantitative restrictions were abolished and bureaucratic controls over imports were also relaxed especially in and after 1983-84. There were also changes in the administrative system; only goods explicitly listed as prohibited could not now be imported, where previously imports were banned if not explicitly listed as liberalised. Some commodities were shifted from the more restrictive to the less restrictive list, and in 1981 some licensed imports were liberalised and the explicit import quota system was abolished. The system remained dominated by licensing, QRs and a protective tariff structure until the beginning of 1984, when about 60 per cent of previously licensed imports were liberalised.

What distinguishes the 1980 reform program from earlier liberalisation attempts is that, "...for the first time the Turkish government demonstrated that it would use economic policies to create a more liberal market-oriented economy..." (Baysan and Blitzer, 1991)[6]. Although there is a consensus on the success of the Turkish experience in the post-1980 period[7] the driving forces behind it have remained a matter of debate. Some have stressed Turkey's liberal provision of export incentives. Others have concentrated on the macroeconomic and import liberalisation policies that caused Turkey's aggressive nominal exchange rate policy to result in sustained real depreciation (see, e.g., Anand et al., 1990). However, Celasun and Rodrik (1989) suggest that at most 30% of the increase in exports during the 1980s can be attributed to real depreciation, and find little empirical support for any effect of export incentives. They argue that Turkey's export boom in the 1980s had only little to do with the incentive regime or exchange rate policy, but mostly as a result of Turkey's proximity to the Middle East. As Balkır (1993) puts it: "...The internal factors which contributed to this performance were export promotion policy, depressed domestic demand, exchange rate policy and the government's strong commitment to export growth…". Arıcanlı and Rodrik (1990a) suggest that the success of Turkish exporters in OECD market has less to do with macroeconomic policies than with

[5]Relying on the theoretical framework for policy options for reducing anti-export bias by Milner (1990:92-94), one can reasonably suggest that the Turkish government, during the 1980s, has utilised the following policy options: a) raising "export subsidies", b) lowering the "effective protection of importables".

[6] Note that in a World Bank study on foreign trade liberalisation, Baysan and Blitzer (1991) focus on developments in the Turkish foreign trade sector between 1950 and 1984. They identify four attempts of trade liberalisation, namely the years 1950, 1958, 1970 and 1980. The authors conclude that the liberalisation was not sustained in the first three cases. Only the 1980 liberalisation attempt is viewed as the start of a more fundamental and sustained liberalisation. Unlike the earlier stabilisation packages of the 1950s and the 1970s, the 1980 program marked the beginning of a committed major program of economic liberalisation and trade reform. It is also worth noting that like all Turkey's previous liberalisation episodes (i.e. 1950-53 and 1970-73), its roots lay in balance-of-payments difficulties.

[7] For more information and evaluation of the Post-liberalisation period see also; Arıcanlı and Rodrik (eds)(1990b), Nas and Odekon (eds.)(1992), Krueger and Aktan (1992)

(p.1347): "...(a) the natural learning process of Turkish merchants set off by exports to the Middle East; and (b) diplomatic efforts to alter quota restrictions in favour of Turkish exports...".

There is little doubt that the Turkish economy has achieved an impressive transformation from an inward-looking economy to an outward-oriented one. The most successful aspect of Turkish experience has, most probably, been the considerable growth in exports during the 1980s (Ghatak *et al*., 1995:153). Export performance has been impressive, especially in the first half of the 1980s. Exports rose from 2.9 billion US dollars in 1980 to 11.7 billion US dollars in 1988 (see Tables 2). The export composition changed in favour of manufactured goods and the export/import ratio improved (i.e. the share of manufactured goods in total export rose from 36% in 1980 to 79% in 1988). In addition to the leading sub sectors like textiles and clothing, iron and steel, several other sub sectors also enjoyed remarkable expansion. Along with the manufactured sectors, many service export industries such as tourism, transportation and contracting also expanded their shares. The export growth rate of Turkey has been above the world export growth rate leading to an increase in Turkey's share in world exports

Table 2 : Some Key Trade Indicators of Turkey (1963-2002) (Billion US dollars)

	1980	**1983**	**1985**	**1987**	**1988**	**1989**	**1990**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Exports	2.910	5.728	7.908	10.190	11.662	11.625	12.959	15.345	18.105	21.637	23.225	26.261	26.974	26.588	27.775	31.334	35.762
Imports	7.909	9.235	11.343	14.158	14.335	15.792	22.302	29.428	23.270	35.708	43.627	48.559	45.921	40.687	54.503	41.399	51.270
Tarde Deficit	-4.999	-3.507	-3.435	-3.967	-2.673	-4.167	-9343	-14.083	-5.164	-1 4.071	-20.402	-22.298	-18.947	-14.099	-26.728	-10.065	-15.508
Exports/ Import (%)	36,8	62.0	70,2	72.0	81.4	73.6	58,1	52.1	77.8	60,6	53,2	54,1	58,7	65,3	51,0	75,7	69,8
Export/GNP(%)	4,2	9.2	11.7	11.7	12.8	10.7	8,5	8.4	13.8	12,6	12,5	13,6	13,5	14,5	13,9	21,2	19,9
Import/GNP (%)	11,6	15.3	17,0	16.5	15.8	14.7	14,6	16.2	17.8	20,8	23,1	24,1	23,0	22,1	27,3	28,0	28,5
Trexp/WORLDexp (%)	0,152	0.320	0,437	0.410	0.410	0.380	0,389	0.408	0.424	0,423	0,440	0,447	0,498	0,477	0,438	0,512	0,561
Indst.Exp/Total Exp(%)	36,0	63.9	75,3	79.1	76.7	78.2	79,0	83.4	85.7	88,2	87,1	88,1	88,5	89,3	91,2	91,5	93,1
Real GNP Growth (%)	-1.1	3.3	5.1	7.5	3.6	1.9	9.4	8.1	-6.1	8.0	7.1	8.0	3.9	-6.1	6.3	-9.5	7.8
Inflation Rate (%) (1)	107.2	30.5	43.2	32.0	68.3	69.6	52.3	58.4	120.6	88.5	74.6	81.0	64.0	52.2	51.4	61.6	50.1
FDI, mill$ (2)	18	46	99	115	354	663	684	636	608	885	772	805	940	783	982	3266	-
TED/GNP (%) (3)	23.5	29.6	37.4	46.1	44.8	38.4	32.2	37.0	50.1	42.6	42.9	43.3	46.8	54.9	58.9	-	-

(1) Average annual change in wholesale price Index
(2) FDI: Foreign Direct Investment Realisations
(3) TED: Total external dept
Sources: State Planing Organisation (SPO), IMF Financial Statistics, several years.

Starting in late 1988, however, Turkish government implicitly started to use exchange rate as part of an anti-inflationary strategy, without committing themselves to an explicit plan

(Aşıkoğlu and Uçtum, 1992). Some exogenous factors together with the endogenous factors worsened economic conditions in the domestic market in the second half of the 1980s (Kazgan, 1993). 1987-1989 period had witnessed relatively small increases in export.

Turkey's export performance slowed significantly especially during the 1989-1993 period due to the expansionary monetary policies and the appreciation of the Turkish lira. By the end of 1993, however, the economy was overheating. Domestic demand rose by about 12 per cent in 1993, import volumes jumped by 36 per cent and GDP grew by 8.1 per cent. Following years of high fiscal deficits and inflation in excess of 50 per cent a year, a sharp deterioration in public sector (PSBRs are 12 per cent of GDP in 1993) and external deficits caused a loss of confidence in the Turkish lira and a financial crisis in early 1994.

A stabilization program was announced in 1994 with the aim to reduce the domestic demand and rate of inflation and to increase exports through the real depreciation of the Turkish lira. As a result of the program, exports increased in this period the growth tendency of exports continued till 1997 when the export performance decreased due to the crisis in the Southeast Asia and the Russian Federation. The earthquakes occurred in 1999 also affected the economic conditions negatively (Coşar, 2002).

In the second half of the 1990s, Turkish economy has enjoyed high growth rates although high inflation rates and structural problems have remained unresolved. The Turkish economy has witnessed a new recession recently (in 2001). The major challenge facing the new government is to put the macroeconomic balances in order, to be able get rid of the ongoing recession, also to establish a credible strategy for achieving sustainable internal and external deficits, lower inflation and sustainable economic growth in the medium term.

Trade Reforms after 1996: CU process with the EU

Another turning point in Turkish trade policy came with the CU decision with the EU. Turkey joined the CU of the EU in January 1996 after a long process of the Association Agreement. As a member of the CU, Turkey eliminated all custom duties, quantitative restrictions, and all charges, which have equivalent effect to quantitative restrictions for industrial product and processed components of agricultural product in trade with the EU and adopted the common external tariff against third country imports. However, The CU between Turkey and the EU goes far beyond a basic custom union and has given new impetus to the liberalisation process in Turkey. Apart from the liberalisation of tariffs and adoption by Turkey of the EU's common external tariff, agreement also embraces a number of integration elements; these include the adoption of the Community's commercial policy towards third countries including textile quotas, the adoption of the free trade agreements with all the EU's

preferential partners including EFTA, Central and Eastern European and Mediterranean countries; co-operation on the harmonisation of agricultural policy, mutual minimisation of restriction on trade in services, harmonisation of Turkey's legislation to that of the EU in the area of competition policy, state aids, anti-dumping, intellectual and industrial property rights, public procurement and technical barriers to trade(Seymen, 1998:7-8).

Economic relations between two parties have been strong since the early 1950s, but were intensified over recent decades. The long-standing preferences between Turkey and the EU have resulted in the EU being not only the most important market for Turkey (50,5% of Turkey's exports in 2002) but also one of the main sources for imported goods (45,1% of Turkey's imports in 2002).

The CU Decision caused some changes in Turkish trade. Turkey's imports from the EU in 1996 (the first year of the CU implementation) reached $23 billion, with an increase of 37.2%. Considering the 22.2% increase in Turkeys total import in 1996, it is clear that the CU had a certain impact on the increase in imports. Turkey's export to the EU totalled $11.5 billion with an increase of 4.2%, below the 7.3% increase in total exports in 1996. Consequently, Turkey's foreign trade deficit with the Union doubled and increased to $11.6 billon in 1996. In 1999 and 2001 economic stagnation affected Turkey's trade negatively, so imports from the EU decreased as well. With the exception of periods of economic crises, increase in imports was greater than the exports increases. So, resulting trade deficit was high. In 2002 Turkey's trade deficit with the Union was $5.1 billion. Figures show that the EU shares in the Turkish exports and imports have always been around 50 per cent. This shows that Turkey and the EU have been traditional and stable trade partners over time. This fact has not changed even in the years of economic crises of 1999, 2000 and after (Utkulu and Seymen:2003:6-8).

4. Econometric Methodology

In order to model the export supply function, we use basically cointegration and error correction mechanism approaches. To take into account some recent debates in time series econometrics, we employ other different modelling strategies described below, as well.

The appeal of the cointegration analysis for economists is that it simply provides a formal framework for testing and modelling long-run economic relationships from actual time series data. This involves the 'two-step procedure' suggested by Engle and Granger (1987) (EG hereafter). As a first step, we first check for the cointegrating properties of the series

involved. The next step is to test whether error-correction models (ECMs) work, i.e. to see if the coefficient of the error-correction term is statistically significant or not.[8]

We apply the integration and cointegration analyses in the EG sense; that is, a time series, say, X_t is said to be integrated of order d if, after differencing d times, it becomes stationary, denoted as $X \sim I(d)$. Moreover, two time series, X_t and Y_t are said to be cointegrated of order d, b where $d \geq b \geq 0$, denoted as $X_t, Y_t \sim CI(d, b)$ if both are $I(d)$, and their linear combination $\alpha_1 X_t + \alpha_2 Y_t$ is $I(d - b)$; that is, the residuals of the long-run regression should be stationary (i.e. integrated of order zero). The vector $[\alpha_1, \alpha_2]$ is referred to as the 'cointegrating vector'.

The static cointegrating estimates with small samples need very cautious evaluation. Due to non-stationarity of the variables and thus non-normal distribution, test statistics of the EG type of static cointegrating regression may be biased upward and thus no judgement on the statistical significance can be made using standard critical value tables. As regards the cointegrating EG regression estimations, as a rule, the higher the R^2 statistic, the less biased the estimated static long-run estimates are. The EG type of static cointegrating regression has become a widely applied method since 1987. One of its benefits is that the long-run equilibrium relationship can be modelled by a simple regression involving the levels of the variables. The estimates of the EG type static cointegrating regression parameters are super consistent, i.e. it converges to the true value at a rate faster than in normal asymptotics (see Stock, 1987).

There exists, however, concerns regarding the static cointegration regression. Some (e.g. Banerjee *et al.,* 1986) emphasise that small sample size is likely to create two main concerns regarding the static cointegrating regression: (i) possible bias in the long-run estimates, (ii) low power of cointegrating statistics. That is, although the dynamics are asymptotically irrelevant in the first step of the EG type of modelling, ignoring the lagged terms (dynamics) may lead to substantial bias in finite samples. Others (esp. Park and Phillips, 1988) are more sceptic about the fact that the OLS estimator in the first step has an asymptotic distribution which is non-normal and depends on nuisance parameters. This makes inference difficult, and the standard t-statistics will not even be valid asymptotically.

[8] This is well known the Granger Representation Theorem (GRT). See Engle and Granger (1987). According to the GRT, if two time series are cointegrated, then there exists an error-correction representation (i.e. error-correction mechanism is well determined) and vice versa.

Since these two groups of criticisms emphasize different aspects of the problem, they naturally recommend different solutions. Banerjee *et al.* (1986) and many others are in favour of estimating long-run parameters in an unrestricted error correction model (ECM) form, including all the dynamics. Stock (1987) also recommends this, describing the estimator as nonlinear least squares (NLS). Phillips and Hansen (1990) (following Park and Phillips, 1988), on the other hand, advocate using semi-parametric corrections to the OLS estimator to eliminate dependency on nuisance parameters, and also to provide an estimator, which follows a normal distribution asymptotically. They refer to this as "the fully modified OLS estimator".

Recent papers by Phillips and others have claimed a strong case for modified OLS in preference to what Inder (1993) describe as the unrestricted ECM estimator. Phillips (1988) shows that the latter approach is not asymptotically optimal, as it takes no account of the possible endogeneity of the explanatory variables. A Monte Carlo study reported in Phillips and Hansen (1990) showed the ECM estimator to perform fairly well compared with modified OLS, but t-statistics on the long-run parameters can be quite misleading in the former case.

Inder (1993) makes the following contributions to the debate: i) it is shown that Phillips and Hansen (1990) Monte Carlo design is biased in favour of modified OLS, and when a more realistic Monte Carlo is undertaken, the unrestricted ECM estimator performs far better than OLS or modified OLS; ii) the semi-parametric corrections applied to OLS can also be applied to the ECM estimator, giving a fully modified unrestricted ECM estimator which is asymptotically optimal; iii) the effects of endogeneity on the bias and distribution of the ECM estimator are minimal.

In the present paper, we empirically investigate the multivariate version of the relationship stated, i.e. single equation multivariate cointegration analysis. Here, we mainly rely on the econometric methodology of the EG outlined above with some necessary corrections/modifications to deal with the nuisance parameter and the endogeneity problems, i.e. fully modified unrestricted ECM (Inder, 1993), and fully modified OLS estimator (Phillips and Hansen, 1990).

One drawback of the EG type of single equation modelling is that it assumes uniqueness of the cointegrating vector. However, in a multivariate context the number of cointegrating vectors could be more than one (i.e. $r > 1$). If $r > 1$, there is no longer a unique long-run relationship towards which the error-correction model (ECM) is adjusting. In this case, a single equation cointegrating regression will estimate the linear combination of the existent vectors. Although the existence of multiple cointegrating vectors is seen as an

identification problem, applied researchers overcome this problem by choosing the cointegrating vectors, which makes 'economic sense'. This implies choosing the cointegrating vector where the estimated long-run elasticities correspond closely (in both magnitude and sign) to those predicted by economic theory.

Single equation based cointegration approaches have two main drawbacks in common: first, they all assume the unique cointegrating vector; second, explanatory variables in the cointegrating vector are assumed to be "weakly exogenous". Otherwise, long-run estimates suffer from "endogeneity" bias. Johansen (1988) and Johansen and Juselius (1990) provide a system-based VAR approach to overcome these difficulties. The main advantage of the Johansen Maximum Likelihood (ML) VAR method is that it enables one to determine the number of existing cointegrating (i.e. long-run) relationships among the variables in hand. It provides not only the direct estimates of the cointegrating vectors but also enables researchers to construct tests for the order (or rank) of cointegration, r. It is worth noting that, in a VAR model explaining N variables, there can be at most r = N-1 cointegrating vectors.

It is commonly acknowledged that the statistical properties of the Johansen procedure are generally better and the cointegration test is of higher power compared to the EG one (Charemza and Deadman, 1997). It is, however, important to point out that they are grounded within different econometric methodologies and thus cannot be directly compared. *In this regard, the Johansen method can be used for single-equation modelling as an auxiliary tool, testing the validity of the endo-exogenous variable division. This may also be used as a confirmation test of the single-equation model.* Following Charemza and Deadman (1997), we believe that single-equation-based and systems-based methods should be seen complementary rather than substitutes. Let us assume that the Johansen results suggest the existence of unique cointegrating vector. Then, if the estimated cointegrating coefficients have economically sensible signs and are roughly similar in size to those estimated by, say, the EG method, this could be taken some confirmation of the single-equation model to which the EG method was applied.

Despite its theoretical advantages, the Johansen estimating procedure is, in practice, also subject to some shortcomings. First, given the small sample size, the method cannot be accepted as an appropriate one since the point estimates obtained for cointegrating vector, may not be particularly meaningful. Second, some additional problems occur if we do not have a unique cointegrating vector. The problem of multiple long-run relationship is presumably best seen as an identification problem (Granger, 1986), and can be resolved in, basically, two ways: either rejecting all but one such cointegrating vectors as economically

meaningless or if the model is consistent with the underlying economic theory, it should consists of not one but two or more single equations. In this respect, Phillips and Loretan (1991) favour for the use of equation-by-equation approach of the single-equation error-correction model since such a possibility is not available in complete systems-methods such as the Johansen approach.

In this study, we employ a multivariate single-equation type model.[9] The validity of conditional models relies on the exogeneity of the variables on which we condition. Alternatively, if they cannot be treated as weakly exogenous, then one should use the appropriate correction mechanism to tackle the endogeneity bias. A number of tests for weak exogeneity in cointegrated variables have been proposed in recent years (for an evaluation of these tests and definitions, see Urbain, 1993). Among them we follow the EG (1987). Within their two-step framework, EG argues that a simple way to check the weak exogeneity of, say, explanatory variable X_t for the long run and short-run parameters of interest is to estimate an ECM for X_t and test the statistical significance of the error-correction term using a traditional t-test. If the t-test is significant, then X_t can no longer be treated as weakly exogenous.[10]

In addition to this debate, recently in the econometric literature, the examination of nonlinear adjustment mechanism became popular. Standard models of cointegrated variables such as EG and Johansen approaches assume linearity and symmetric adjustment. For example, the alternative hypothesis in the EG test of cointegration assumes symmetric adjustment. The point is that cointegration tests and their extensions are misspecified if adjustment is asymmetric. Enders and Granger (1998) and Enders and Siklos (2001) considered an alternative specification of the error correction model, called the threshold autoregressive (TAR) model, such that cointegration test equation can be written as:

$$\Delta u_t = I_t \rho_1 u_{t-1} + (1-I_t) \rho_2 u_{t-1} + \varepsilon_t$$

where I_t is the Heaviside indicator function such that;

$$I_t = \begin{array}{l} 1 \text{ if } u_{t-1} \geq \tau \\ 0 \text{ if } u_{t-1} < \tau \end{array}$$

and τ is the value of the threshold. This model is referred to as threshold autoregression model, while the test for threshold behaviour of the equilibrium error is term threshold

[9] It is important to note that the choice between system-based models and conditional (single-equation) models is not straightforward, and is also open to debate. Urbain (1993) points out that if some exogeneity conditions are satisfied, a single equation models, from a practical point of view, enjoy nice asymptotic properties.

[10] The standard orthogonality tests (such as the Hausman test) in the presence of cointegrated variables may well be invalid due to nonstationary nature of the variables in levels, and the null hypothesis is usually not sufficient for weak exogeneity in cointegrated models (for this point, see Urbain, 1993).

cointegration test. Assuming the system is convergent, $u_t = \tau$ can be considered as the long run equilibrium value. If ut is above its long run equilibrium value the adjustment is ($\rho_1 u_{t-1}$) and if ut is below its long run equilibrium the adjustment is ($\rho_2 u_{t-1}$). The equilibrium error therefore behaves like a threshold autoregression. The case in which adjustment is symmetric (i.e. $\rho_1 = \rho_2$) is just the EG way of cointegration test. Enders and Granger (1998) point out that when adjustment is asymmetric such that the series exhibits more "momentum" in one direction than the other, taking the Heaviside indicator as following is valuable:

$$I_t = \begin{array}{l} 1 \text{ if } \Delta u_{t-1} \geq \tau \\ 0 \text{ if } \Delta u_{t-1} < \tau \end{array}$$

This model now is called Momentum-Treshold Autoregression Model (M-TAR). The TAR model can capture asymmetrically "deep" movements in a series, while the M-TAR model captures the possibility of asymmetrically sharp or "steep" movements in the series (for details see Enders and Granger (1998) and Enders and Siklos (2001)).

5. Empirical Findings

Data

We use annual data for the period 1950-2000 for our single equation multivariate cointegration analysis with ECM. Definitions of the variables used in our export supply cointegrating regression are given in the appendix as well as data sources. They are all in the logarithmic forms and seem integrated of order 1 when we used conventional unit roots tests, i.e. augmented Dickey-Fuller and Phillips-Perron tests. We also checked the order of integration with the Perron Additive Outlier test. Again, taking 1980 as possible break time exogenously, the tests results indicates that all variables are I(1) at conventional levels.[11]

We employ two dummies to capture the effects of the possible structural breaks in the export supply cointegrating regressions, namely DU58, DU80. This is due to the fact that breaks may result in spurious roots regarding residual-based cointegration tests. We use the natural logarithm of the relevant variables (prefixed with the letter L), since their first differences reflect the rate of change of each variable.

Cointegration Analysis

We apply EG sense cointegration analysis to our model. To capture the effects of the structural break(s), additional dummy variables for 1958 and 1980 years are employed and some of them are meaningful.

[11] Results of the unit root tests are not given here but available on request. They are all made with standard econometric package programs such as Eviews and Microfit.

We begin first by the model in which LX regressed on relative prices (LRER or LRP), real wages, import prices and capacity (proxied by either investment share of real GDP or trend GNP using Hodrick-Prescott filtering). *We have not found any cointegration relation when we use relative prices in any form of equation*. We apply fully modified Phillips-Hansen methodology and Autoregressive Distributed Lag Modelling suggested by Pesaran and Shin (1995) to the equations involving relative prices as well as Treshold Autoregressive (TAR) and Momentum TAR (M-TAR), but still no cointegration relation arises. Johansen type test of cointegration indicates one cointegrating relation but ECMs are not valid.

So we concluded that in the long run relative prices do not matter concerning export supply. When we analyse split sample (1980-2000 period), we found a plausible cointegration relation. But this result is questionable because the power of any test is so small to inference due to the degrees of freedom. We do not report the results because they are not valuable. We can say that not in the long run but after 1980 period it seems to be important that relative prices affect export supply.

Discarding the relative prices, we now turn to analyse the export supply functions involving variable costs, capacity and the trade reform variables. In this step, our main focus is on the long run cointegration modelling and the short run dynamics. Capacity variables LGNPT and LINV are not significant in the export supply in the long run. But we still have a variable representing productive capacity of the economy: Time TREND. Together with real wages (LRWL) and trade reform variables such as LMYH (imported capital goods and raw material) and exchange rate distortion index LERDI or LOPENK we estimate the long run relationship and the corresponding short run dynamics. Results are given in the Table 3.

Table 3: Estimates of the long rung parameters and ECMs of the basic model

	EG LR		EG ECM [g]		FMPH [h]		ARDL [i]		ARDL ECM [g]	
Constant	8.96	5.4	0.07	0.046	9.72	5.38	7.2	3.77	3.2	2.2
LRWL	-2.53	-1.19	-1.05	-0.82	-2.95	-1.26	-2.04	-0.72	-0.9	-0.42
LMYH	0.71	0.642	0.34	0.416	0.81	0.688	0.76	0.68	0.34	0.4
TREND	0.055	0.032			0.049	0.027	0.046	0.024	0.02	0.14
DU80		0.56		0.0327		0.61		0.59		0.35
ECM[a]			-0.44 (-4.01)	-0.59 (-4.37)					-0.44 (-5.24)	-0.586 (-6.98)
Coint. ADF[b]	-4.46	-4.93								
LM $\chi 2$[c]			0.16	0.27						
RESET $\chi 2$ [d]			0.83	0.55						
Normality $\chi 2$ [e]			0.714	0.68						
Heterosce-dasticity $\chi 2$ [f]			0.024	0.439						

Notes:
a) Parameters of lagged residuals with t-statistics in parenthesis (all significant at %1 level)
b) Engle-Granger cointegration test statistics (all significant at %5 level)
c) Lagrange multiplier test of residual serial correlation (probability values for the relevant statistics)
d) Ramsey's RESET test using the square of the fitted values (probability values for the relevant statistics)
e) Based on a test of skewness and kurtosis of residuals (probability values for the relevant statistics)
f) Based on the regression of squared residuals on squared fitted values (probability values for the relevant statistics)
g) Differenced series
h) Fully Modified Phillips-Hansen long-run parameters estimates, Parzen weights, truncation lag=2, tranded case
i) Autoregressive distributed lags modeling approaches to cointegration (Pesaran and Shin, 1995, for details see Pesaran and Pesaran, 1997); ARDL (1 0 0) without dummy and ARDL (2 0 0) with dummy selected according to Schwarz Bayesian Criterion (SBC).

The issue of weak exogeneity is questioned in the EG (1987) sense and we found that real wages may not be weak exogenous, so we employed Inder (1993) approach to correct the endogeneity bias in the long run equilibrium (t-statistics in parenthesis):

LX= 7.45Constant-2.158LRWL+0.794LMYH+0.044TREND
(4.11) (-4.08) (6.9) (2.8)
R2=0.97; LM $\chi 2$=1.65(0.20); RESET $\chi 2$=0.03(0.86);
Normality $\chi 2$=1.51(0.47); Heteroscedasticity $\chi 2$=0.81(0.37)

This approach indicates about 20 percent correction as regards especially real wages.

When we investigated the structural breaks, we found that two dummy variables namely for 1958 and 1980 are statistically significant. EG(1987) cointegration results with ECM and cointegration DF test statistics are given below:

LX= 5.13 C-0.31 DU58+ 0.5 DU80-0.9LRWL+0.53LMYH+0.05TREND

Unit root test statistic for the residual of this long run equation with no augmentation is -6.81 and smaller then the critical value, -5.094, indicating the cointegration relation exists. ECM term coefficient in the short run dynamics is -0.79 with t-statistic (-5.045) and thus implies a speed adjustment.

Taking care of the two break years, we employed Stock and Watson (1993) approach to include two structural breaks in the long run equation:

$$LX=\beta_0+\beta_1 LRWL+\beta_2 LMYH+\beta_3 TREND+\beta_4 DU+\beta_5 S1+\beta_6 S2+\beta_7 S3+u$$

Table 4 : Stock and Watson OLS model with breaks

parameter	β_0	β_1	β_2	β_3	β_4	β_5	β_6	β_7
Coeff.	4.84	-0.9	0.6	0.035	-0.2	0.51	-0.25	0.031
t-stat.	3.9	-2.27	10.27	2.99	-2.32	1.32	-1.28	1.99
R2=0.99; LM $\chi 2$=0.03(0.87); RESET $\chi 2$=1.48(0.23);Normality $\chi 2$=1.21(0.55); Heteroscedasticity $\chi 2$=0.89(0.35)								

Notes: DU=0 up to 1958 and 1 thereafter. S1=0 up to 1980 and S11*LRWL thereafter, with S11=0 up to 1980 and 1 thereafter. S2=0 up to 1980 and S21*LMYH thereafter, with S21=0 up to 1980 and 1 thereafter. S3=0 up to 1980 and S31*TREND thereafter, with S31=0 up to 1980 and 1 thereafter.

To summing up the above findings, one can conclude that the main determinants of the export supply function of Turkey in the long run are seemed to be real wages, imported capital goods and raw materials and productivity trend. The two structural breaks seem to be significant to modelling the long run behaviour. Results seem to be robust to different modelling approaches.

In order to take into account the effects of the technological innovations we introduce two variables namely FDI (Foreign Direct Investment) and XCC (Commodity Composition Index). Results are given in the following Table 5 and 6.

Table 5: Estimates of the long rung parameters and ECMs of the extended model (1)

	EG LR		EG ECM [g]		FMPH [h]		ARDL [i]	ARDL ECM [g]
Constant	4.84	2.65	0.06	0.033	5.47	3.42	3.36	1.27
LRWL	-1.68	-0.5	-0.88	-0.67	-1.91	-0.9	-1.21	-0.46
LMYH	0.98	0.76	0.36	0.45	0.98	0.83	1.02	0.38
LFDI	0.12	0.064	0.037	0.044	0.16	0.085	0.086	0.033
DU80		0.67		0.033		0.507		
ECM [a]			-0.37 (-3.33)	-0.6 (-4.04)				-0.38 (-4.72)
Coint. ADF [b]	-4.61	-5.54						
LM $\chi 2$ [c]			0.05	0.12				
RESET $\chi 2$ [d]			0.04	0.21				
Normality $\chi 2$ [e]			0.19	0.83				
Heterosce-Dasticity $\chi 2$ [f]			0.001	0.04				

Notes as earlier except:
i) ARDL (2 0 0 0) selected according to SBC.

Table 6: Estimates of the long rung parameters and ECMs of the extended model (2)*

	EG LR		EG ECM [g]		FMPH [h]		ARDL [i]		ARDL ECM [g]	
Constant	8.33	5.03	0.095		8.23		6.77		2.07	
LRWL	-1.38	-0.55	-0.89		-1.55		-0.77		-0.234	
LMYH	0.31	0.35	0.034		0.426		0.64		0.196	
LXCC	0.29	0.127	0.32		0.277		0.65		0.196	
TREND	0.077	0.06			0.067					
DU80		0.44								
ECM[a]			-0.74 (-4.89)						-0.305 (-3.78)	
Coint. ADF[b]	-4.71[j]	-6.21								
LM $\chi 2$[c]			0.70							
RESET $\chi 2$ [d]			0.003							
Normality $\chi 2$ [e]			0.58							
Heterosce-Dasticity $\chi 2$ [f]			0.43							

Notes as earlier except:
*Estimation period 1961-2000 due to the lack of data for XCC.
i) ARDL (1 0 0 0) selected according to SBC.
j) 95% critical value for the Dickey-Fuller statistic = -4.8473

We also investigate the different variables representing import compression effects to the export supply equation. In addition to the imported capital goods and raw material (LMYH), we insert the total foreign debt stock (LDEBT) and foreign exchange reserves (LFX) to the equation. We cannot found any long run relation with foreign exchange reserves (LFX) but LDEBT seems to have significant but small effect on the export supply. For this reason only cointegration results with LDEBT are reported below in Table 7.

Table 7: Estimates of the long rung parameters and ECMs of the extended model (3)

	EG LR		EG ECM [g]		FMPH [h]		ARDL [I]		ARDL ECM [g]	
Constant	7.52	5.16		0.055	5.62	4.16	3.9		1.73	
LRWL	-2.31	-1.19		-0.64	-2.1	-1.34	-1.45		-0.64	
LMYH	0.70	0.643		0.412	0.732	0.75	0.314		0.33	
LDEBT	0.158	0.046		0.007	0.37	0.205			-0.004	
TREND	0.033	0.027								
DU80		0.53				0.37				
ECM[a]				0.599 (-4.6)					-0.44(-5.74)	
Coint. ADF[b]	-5.04	-4.99[j]								

Notes as earlier except:
i) ARDL (1 0 0 1) selected according to SBC.
j) 95% critical value for the Dickey-Fuller statistic = -5.086

Tables 8 and 9 below report the cointegration analysis results of the export supply function when we include two different trade reform proxies, namely exchange rate distortion index (LERDI) and openness index (LOPENK). Results suggest that the exchange rate distortion and openness have significant effects on the export supply.

Table 8: Estimates of the long rung parameters and ECMs of the extended model (4)*

	EG LR		EG ECM [g]		FMPH [h]		ARDL [I]		ARDL ECM [g]	
Constant	4.72	4.65	0.07	0.08	6.2	4.17	7.27	3.84	3.5	2.63
LRWL	-1.68	-0.78	-0.79	-0.82	-2.25	-0.79	-1.93	-0.57	-0.94	-0.39
LMYH	1.05	0.52	0.37	0.36	1.1	0.63	0.67	0.56	0.33	0.38
LERDI	-0.03	-0.01	-0.006	-0.004	-0.03	-0.002	-0.01	-0.007	-0.005	-0.005
TREND		0.044		-0.001		0.03	0.056	0.038	0.027	0.026
DU80		0.56		0.05		0.622		0.58		0.4
ECM[a]			-0.34 (-3.54)	-0.77 (-4.69)					-0.484 (-4.7)	-0.686 (-6.81)
Coint. ADF[b]	-4.05[j]	-5.67								
LM $\chi 2$[c]			0.049	0.59						
RESET $\chi 2$ [d]			0.057	0.96						
Normality $\chi 2$ [e]			0.12	0.11						
Heterosce-Dasticity $\chi 2$ [f]			0.005	0.82						

Notes as earlier except:
*Estimation period 1955-2000 due to the lack of data for ERDI.
i) ARDL (1 0 0 0) without dummy and ARDL(2 0 0 0 0) with dummy selected according to SBC.
j) 95% critical value for the Dickey-Fuller statistic = -4.368

Table 9: Estimates of the long rung parameters and ECMs of the extended model (5)

	EG LR			EG ECM [g]			FMPH [h]	
Constant	2.15	4.16	1.43	0.063	0.054	0.043	2.99	0.79
LRWL	-0.94	-0.87		-0.61	-0.71		-1.27	
LMYH	0.91	0.61	0.59	0.28	0.35	0.35	0.94	0.71
LOPENK	0.422	0.17	0.27	0.34	0.19	0.246	0.44	0.28
TREND		0.027	0.012		0.002	0.003		
DU80		0.55	0.69		0.029	0.038		0.66
ECM[a]				-0.34 (-3.6)	-0.58 (-4.1)	-0.5 (3.67		
Coint. ADF[b]	-3.77[j]	-4.97[k]	-4.81[l]					
LM $\chi 2$[c]				0.09	0.33	0.29		
RESET $\chi 2$ [d]				0.30	0.55	0.54		
Normality $\chi 2$ [e]				0.51	0.55	0.27		
Heterosce-dasticity $\chi 2$ [f]				0.09	0.48	0.87		

Notes as earlier except:
j) k) l) 95% critical value for the Dickey-Fuller statistic are -4.338; -5.094; and -5.094 respectively

6. Conclusion

Based on our basic theoretical model (equation 1) and employing sophisticated time-series techniques, we have robust empirical evidence that prices, relative prices, and real exchange rates have no significant effect on the Turkish export supply in the long run (steady-state). Results of the basic model suggest that the Turkish export supply has been significantly driven by variable cost especially real wages. The productive capacity has also proved to be one of the main contributors on the Turkish export supply. These results are validated in the

presence of structural breaks, nuisance parameters, and endogeneity. As regards the extended theoretical model (equation 2), we have further empirical evidence that factors including trade reform, import compression, and technological innovation have significant effects on the Turkish export supply.

These findings have some important policy implications; Our extended models, which include trade reform proxies such as exchange rate distortion index and openness index, show that trade reform works in the Turkish case. Trade reform looks successful in decreasing anti-export bias and thus causing a strong export supply response. The extended model, which involves imported capital goods and raw materials, suggests that the import compression has a significant effect on export supply in Turkey. This result implies that Turkish export supply heavily depends on the imported inputs.

Our extended models also include export commodity composition index and foreign direct investment to see the effects of technological innovation on export supply. These none price factors are valuable to explain the export supply behaviour. So that changing nature of exports towards more technological products may be considered as a success of the trade reform in Turkey.

APPENDIX

Data Sources

The Turkish data used in this study are annual for the period of 1950-2000. The "L" prefix indicates the natural logarithm of the relevant variable, while "D" prefix indicates that the first difference of the variable has been taken. Data are taken from the following sources:

(i) International Monetary Found (MF), International Financial Statistics.
(ii) State Planning Organisation, Turkey.
(iii) State Institute of Statistics, Turkey.
(iv) Cowitt, P.P., World Currency Yearbook (previously known as Pick's Currency Yearbook), various issues, International Currency Analysis, Brooklyn.
(v) Undersecretariat of Treasury, Turkey.
(vi) Penn World Table (Heston et al., 2002).
(vii) Ministry of Trade, Turkey.
(viii) US Bureau of Labor Statistics.

Definition of the Variables

X: Exports of goods (fob), millions of US dollars, source (i).
M: Imports of goods (cif), millions of US dollars, source (i).
PEX: Export price index expressed in US dollars, 1980=100, taken from Ghatak et al. (1995), sources (i) and (ii).
PIM: Import price index expressed in US dollars, 1980=100, source (i) and (ii).
MYH: Imports of capital goods and raw material, millions of US dollars, 1950-1982 data are from SIS (2001), since then based on UN-Broad Economic Categories (BEC) classification, source (iii).
DEF: Gross National Product (GNP) Implicit Deflator, 1980=100, source (ii) and (iii).
RWL: Real average annual wages per worker in the private manufacturing industry, constructed as RWL=(W/L)/DEF where W and L are annual payments (millions TL) made to employees and annual

average number of employees respectively in the private sector manufacturing industry (establishments with 10 or more employees), source for 1950-1994 data SIS (2001), for 1995-2000 data SIS (2000).
OF: Official nominal exchange rates expressed in TL per US$, source (i).
ERDI: Exchange rate distortion index of Turkey, constructed as ERDI = (BM/OF)/BM where BM is annual average black market exchange rate expressed in TL per US$, source (iv).
GNP: Gross National Product, billions TL, at 1987 Prices, source (i) and (ii).
DEBT: Foreign Debt Stock, millions of US dollars, source (v).
OPENK: Openness index, defined as exports plus imports divided by RGDPL (Real GDP per capita, Las Payres, 1996 prices), expressed in US dollars, source (vi).
INV: Investment in GDP, expressed in US dollars, constructed as INV= (KI/100)*RGDPL where KI is the investment share of RGDPL, source (vi).
WPI: Wholesale Price Index, 1980=100, data are collected from (v) and (vii) for 1950-1987, and from (iii) for 1988-2000.
RER: Real Exchange Rate, constructed on the basis of RER=OF*PPI / DEF, where PPI is the producer price index of US (1980=100), source (viii).
FDI: Foreign Direct Investment Realisations, source (ii).
XCC: The commodity composition index, XCC, is constructed in the following way: first, export goods is divided into four commodity groups, (C_1,...C_4). These groups are selected in such a way as to include products with increasing technological content, as we move from C_1 to C_4. The second stage is to construct an index, XCC_t, which lies over interval [0,1]. We follow Muscatelli *et al*. (1991b and Utkulu (1995) in constructing the index, and in choosing a symmetric distribution for the weights, i.e. the weights chosen are: $a_1=0, a_2=0.33, a_3=0.67, a_4=1$, over the interval [0,1]:

$$XCC_t = \frac{\sum_{t=1}^{4} a_t C_t}{\sum_{t=1}^{4} C_t}$$

Commodity Groups for the Index, XCC (the difference between the two versions of SITC, namely SITC Revised 2 and SITC Revised, has also been taken into account by converting SITC Revised into SITC Revised 2):

> **C_1:** Total exports of agricultural products and crude materials, (SITC Revised 2 groups, 0 and 2).
>
> **C_2:** Total exports of traditional manufacturing sectors, (SITC Revised 2 groups, 61, 62, 63, 64, 65, 69, 84, 85, 89).
>
> **C_3:** Total exports of scale-intensive sectors, (SITC Revised 2 groups, 51, 58, 66, 67, 68, 76, 78, 79).
>
> **C_4:** Total exports of specialised supply and science-based sectors, (SITC Revised 2 groups, 71, 72, 73, 74, 75, 87, 88).

DU1958: $DU1958_t = 1$ if $t>T_{1958}$ and 0 otherwise.

DU1980: $DU1980_t = 1$ if $t>T_{1980}$ and 0 otherwise.

REFERENCES

Anand, R., A. Chhibber, R. Rocha and S. Wijnbergen (1990), "External Balance and Growth in Turkey: Can They Be Reconciled?", in *The Political Economy of Turkey: Debt, Adjustment and Sustainability*, T. Aricanli and D. Rodrik (eds.), MacMillan, London.

Aricanli, T. and D.Rodrik (1990a), "An Overview of Turkey's Experience with Economic Liberalisation and Structural Adjustment", *World Development*, Vol 18(10).

Aricanli, T. and D. Rodrik (eds.) (1990b), *The Political Economy of Turkey: Debt Adjustment and Sustainability*, MacMillan, London.

Arslan, I. and S. Wijnbergen (1993), "Export Incentives, Exchange Rate Policy and Export Growth in Turkey", *The Review of Economics and Statistics* 75 (1), 128-133.

Asikoglu, Y. and M. Uctum (1992), "A Critical Evaluation of Exchange Rate Policy in Turkey", *World Development*, 20(10), 1501-14.

Athukorala, P. and J. Riedel (1994), "Demand and Supply Factors in the Determination of NIE Exports: A Simultaneous Error-Correction Model for Hong Kong: A Comment", *The Economic Journal*, 104, 1411-14.

Bahmani-Oskooee, M. (1986), "Determinants of international trade flows: The case of developing countries", *Journal of Development Economies* 20, 107–125.

Balkır C. (1993), " Turkey and the European Community: Foreing Trade and Direct Investment in the 1980s", in *Turkey and Europe,* C.Balkır, A.M.Williams (eds), Pinter Publishers Ltd, London.

Banerjee, A., J. Dolado, D.F. Hendry and G. Smith (1986), "Exploring equilibrium relationships in econometrics through static models: some Monte Carlo evidence", *Oxford Bulletin of Economics and Statistcs*, 48, 253-77.

Baysan, T. and C. Blitzer (1991), 'Turkey", in *Liberalising Foreign Trade: The New Zealand, Spain and Turkey: Vol.6*, D. Papageorgiou, M. Michaely and A.M. Choksi (eds.), A research Project of the World Bank, Basil Blacwell, Cambridge, MA.

Bond, M.E. (1985), "Export Demand and Supply for Groups of Non-Oil Developing Countries", *IMF Staff Papers*, March, 56-77.

Celesun and D. Rodrik (1989), "Debt, Adjustment and Growth: Turkey", in *Developing Country Debt and Economic Performance, Country Studies*, Vol.3, J.D. Sachs and S.M. Collins (eds.), NBER and University of Chicago Press, Chicago.

Charemza, W.W. and D.F. Deadman (1997), *New Directions in Econometric Practice*, Edward Elgar, 2nd ed., England.

Coşar, E.E., (2002), 'Price and Income Elasticities of Turkish Export Demand: A Panel Data Application', *Central Bank Review 2*.

Dickey, D.A. and W.A. Fuller (1979), "Distribution of the Estimators for Autoregressive Time Series with a Unit Root", *Journal of the American Statistical Association* 74, 427–431.

Enders, W. and Granger, C.W.J. (1998), "Unit root Tests and Asymetric Adjustment with an example Using the Term Structure of Interest Rates", *Journal of Business and Economic Statistics 16*, 304-11.

Enders, W. and P. L. Siklos (2001), "Cointegration and Treshold Adjustment", *Journal of Business and Economic Statistics 19(2)*, 166-76.

Engle, Robert F. and C.W.J. Granger (1987) "Co-integration and Error Correction: Representation, Estimation, and Testing", *Econometrica* 55, 251–276.

Faini, R. (1994), "Export Supply, Capacity and Relative Prices", *Journal of Development Economics*, 45(1), 81-100.

Faini, R., F. Clavijo and A. Senhadji-Semlali (1992), "The Fallacy of Composition Argument: Is it Relevant for the LDCs' Manufactures Exports?", *European Economic Review* 36, 865-82.

Ghatak, S., C. Milner and U. Utkulu (1995), "Trade Liberalisation and Endogenous Growth: Some Evidence for Turkey", *Economics of Planning,* 28, 147-67.

Goldstein, M. and Khan, M.S. (1978), "The supply and demand for exports: A simultaneous approach", *The Review of Economics and Statistics* 60, 275–286.

Goldstein, M. and M.S. Khan (1985), "Income and Price Effects in Foreign Trade", in *Handbook of International Economics*, ed. R.W. Jones and P.B. Kenen, Elsevier Science Publishers Amsterdam..

Granger, C.W.J. (1986), "Developments in the study of cointegrated economic variables", *Oxford Bulletin of Economics and Statistics*, 48(3), 213-28.

Heston, A., R. Summers and B. Aten (2002), *Penn World Table Version 6.1*, Center for International Comparisons at the University of Pennsylvania (CICUP), October 2002.

Hill, H. and S. Suphachalasai (1992), "The Myth of Export Pessimism (even) under the MFA: Evidence from Indonesia and Thailand", *Weltwirtschaftliches Archiv* 128 (2), 310-29.

Inder, B. (1993), "Estimating longrun relationships in economics: a comparison of different approaches", *Journal of Econometrics*, 57, 53-68.

Johansen, S. (1988), "Statistical analysis of cointegrating vectors", *Journal of Economic Dynamics and Control*, 12, 231-54.

Johansen, S. and K. Juselius (1990), "Maximum Likelihood Estimation And Inference On Cointegration: With Application To The Demand For Money", *Oxford Bulletin of Economics and Statistics*, 52, 169-210.

Kazgan, G. (1993), " External Pressures and the New Policy Outlook", in *Turkey and Europe* C.Balkır,A.M.Williams (eds), Pinter Publishers Ltd, London.

Khan, M.S. and M.D. Knight (1988), "Import Compression and Export Performance in Developing Countries", *The Review of Economics and Statistics,* 70, 315-21.

Krueger A.O. and O.H.Aktan (1992), *Swimming Against the Tide*, *Turkish Trade Reform in the 1980s,* ICS Press, California.

Krueger, A. (1974), *Foreign Trade Regimes and Economic Development: Turkey*, NBER, New York.

MacKinnon, J.G. (1991) "Critical Values for Cointegration Tests," Chapter 13 in *Long-run Economic Relationships: Readings in Cointegration*, edited by R.F.Engle and C.W.J. Granger, Oxford University Press.

Madsen, J. and D. Damania (1994), "Accounting for supply, integration and income in foreign trade", *Applied Economics* 26, 53-63.

Marquez, J. and McNeilly, C. (1988), "Income and price elasticities for exports of developing countries", *The Review of Economics and Statistics* 70, 306–314.

Milner, C. (1990), "The Role of Import Liberalisation in Export Promotion", in *Export Promotion Strategies: Theory and Evidence from Developing Countries*, C. Milner (ed.), Harvester Wheatsheaf, London.

Muscatelli, V.A. (1991), "Modeling Exports from the Asian NIEs to the European Community: Trade Patterns and Problems of Estimation", *Discussion Papers in Economics*, No: 9110, University of Glasgow.

Muscatelli, V.A. (1994), "Demand and Supply Factors in the Determination of NIE Exports: A Reply", *The Economic Journal*, 104, 1415-17.

Muscatelli, V.A., A.A. Stevenson and C. Montagna (1991), "Modelling Aggregate Manufactured Exports for Some Asian NIEs", *Discussion Papers in Economics*, No: 9118, University of Glasgow.

Muscatelli, V.A., Stevenson, A.A. and Montagna, C. (1995), "Modelling aggregate manufactured exports for some Asian newly industrialized economies", *The Review of Economics and Statistics* 77, 47–55.

Muscatelli, V.A., T.G. Srinivasan and D. Vines (1990), "The Empirical Modeling of NIE Exports: An Evaluation of Different Approaches", *CEPR Discussion Paper*, No:426.

Muscatelli, V.A., T.G. Srinivasan and D. Vines (1992), "Demand and Supply Factors in the Determination of NIE Exports: A Simultaneous Error-Correction Model for Hong Kong", *The Economic Journal*, 102, 1467-77.

Nas, T.F. and M. Odekon (eds.) (1992), *Economics and Politics of Turkish Liberalisation*, Associated University Presses, London.

Pamuk, S. (1984), *The Ottoman Economy and World Capitalism, 1820-1913 (in Turkish)*, Yurt Yayinevi, Ankara.

Perron, P. (1990), 'Testing for a unit root in a time series with changing mean', *Journal of Business and Economic Statistics*, 8(2), 153-62.

Perron, P. and T.J. Vogelsang (1992), "Testing for a unit root in a time series with a changing mean: corrections and extensions", *Journal of Business and Economic Statistics*, 10(4), 467-70.

Pesaran, M.H. and B. Pesaran (1997), *Working with Microfit 4.0: Interactive Econometric Analysis*, Camfit Data Ltd., Cambridge.

Pesaran, M.H. and Y. Shin (1995), "An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis", *DAE Working Paper No. 9514*, Department of Applied Economics, University of Cambridge.

Phillips, P.C.B. (1988), "Reflections on Econometric Methodology", *The Economic Record*, 64, 344-59.

Phillips, P.C.B. and B.E. Hansen (1990), "Statistical Inference in Instrumental Variables Regression with I(1) Processes", *Review of Economic Studies*, 57, 99-125.

Phillips, P.C.B. and M. Loretan (1991), "Estimating Long Run Equilibria", *Review of Economic Studies*, 58, 407-36.

Phillips, P.C.B. and P. Perron (1988) "Testing for a Unit Root in Time Series Regression", *Biometrika* 75, 335–346.

Riedel, J. (1988), "Strategy wars: the state of debate on trade and industrialisation in developing countries", *Paper Presented at a Symposium in Honour of J. N. Bhagwati*, ERASMUS University, Rotterdam, November 1988.

Rouis, M., Razzak, W. and Mollinedo, C. (1994), 'The supply response to exchange rate reform in Sub-Saharan Africa: empirical evidence', *Policy Research Working Papers* 1311, The World Bank.

Şahinbeyoğlu G. and B. Ulaşan (1999), "An Empirical Examination of the Structural Stability of Export Function: The Case of Turkey", The Central Bank of the Republic of Turkey, Discussion Paper, No: 9907, September.

Saracoglu, R. (1987), "Economic Stabilisation and Structural Adjustment: The Case of Turkey", in *Growth-Oriented Adjustment Programs*, V. Corbo, M. Goldstein and M. Khan (eds.), Proceedings of a Symposium Held in Washington DC, February 25-27, 1987, Published by the IMF and the World Bank, Washington, D.C.

Seymen D.(1998), "The Effects of the Customs Union on Turkish Foreign Trade", *One Day Conference on: European Union's Policy Towards Turkey Aftermath of the Luxemburg Summit*, University of Birmingham, October.

State Instıtute of Statistic (SIS), (2000), *Manufacturing Industry Statistics*, Ankara (in Turkish).

State Instıtute of Statistic (SIS), (2001), *Statistical Indicators: 1923-1998*, Ankara (in Turkish).

Stock, J.H. (1987), "Asymptotic properties of least squares estimators of cointegrating vectors", *Econometrica*, 56, 1035-56.

Stock, J.H. and M. Watson (1993), "A Single Estimator of Cointegrating Vectors in Higher Order Integrated Systems", *Econometrica*, 61, 783-820.

Tansel, A. and S. Togan (1987), "Price and Income Effects in Turkish Foreign Trade", *Weltwirtschaftliches Archiv* 123 (3), 521-34.

Thirlwall, A.P. (1986), *Balance-of-Payments Theory*, Mc Millan Press.

Togan, S. (1995), *Trade Policy Review of the Republic of Turkey,* The World Economy Global Trade Policy, Sven Arndt, Chris Milner (eds) Blackwell Publishers Ltd., Oxford.

Urbain, J.P. (1993), "Exogeneity in Error Correction Models", *Lecture Notes in Economics and Mathematical Systems*, No.398, SpringerVerlag.

Utkulu, U. and D. Özdemir (2003), "Does Trade Liberalization Cause a Long-run Economic Growth in Turkey", presented at the EcoMod, *Economic Modeling Annual Conference*, 3-5 July, 2003, Istanbul.

Utkulu U. and D.Seymen (2003), "Trade and Competitiveness between Turkey and the EU: Time Series Evidence", Europe in Global World-blending differences, *OPEN MINDS Conference*, University of Lodz, Lodz-Polond, September.

Uygur, E. (1993), "Liberalization and Economic Performance in Turkey", *UNCTAD Discussion Paper*, No.65, August.

Wagstaff, J.M. (1989), *The Role of the Government in the Industrialisation of Turkey, 1938-1980*, Centre of Near and Middle Eastern Studies, School of Oriental and African Studies (SOAS), Occasional Paper, No.2, University of London.

Zhang, Z. (2001), "China's Exchange Rate Reform and Exports", *Economics of Planning*, 34, 89-112.