TESTING FOR THE STRUCTURAL BREAK IN THE TURKISH FOREIGN TRADE

Murat DOĞANLAR*

ABSTRACT

It has been claimed that the majority of the macroeconomic time series has a unit root. On the other hand, Perron (1989) claims that the macroeconomic time series are stationary around a deterministic trend if allowance is made for the possibility of a single break in either the intercept and/or the slope of the trend function. This paper examines whether a segmented trend-stationary process or a difference-stationary process best models the basic foreign trade variables for the Turkish economy.

1. INTRODUCTION

The serious deterioration in the performance of the Turkish economy in the second half of the 1970s forced the Turkish authorities to announce a new economic programme in January 1980. The program aimed at changing Turkey's development strategy away from the inward-oriented import substitution policy of the previous two decades to an outward-oriented export promotion strategy. The main components of the programme concerning the foreign sector of the economy were a devaluation of Turkish Lira against the US dollar, abolition of the multiple exchange rate regime, liberalisation of trade and payment regimes, measures to promote exports and adoption of a new exchange rate regime which aims at reflecting the inflation differential between Turkey and her major trading partners in order to maintain international price competitiviness.

It has been claimed on the basis of empirical evidence mostly provided by the test of Dickey and Fuller (1979, 1981) that the majority of the macroeconomic time series has a unit root. On the other hand, Perron (1989) claims that most of the macroeconomic time series can be interpreted as stationary around a deterministic trend function if allowance is made for the possibility of a single break in either the intercept and/or the slope of the trend function.

In this paper, we claim that the major foreign trade variables of the Turkish economy under the 1980 economic program can be more adequately characterised as a segmented trend-stationary process than as a difference-stationary process. There have not been any studies that search for the structural break in the Turkish foreign trade. This is the first study that fills a gap on this subject.

The remainder of the paper is organised as follows: Section two briefly describes the concepts of unit roots and trend breaks; section three reports the empirical findings, and final section summarises the conclusions.

* Assistant Professor of Economics University of Çukurova Faculty of Economics and Administrative Sciences Department of Economics

2. UNIT ROOTS AND TREND BREAKS

We analyse whether a segmented trend-stationary process or a difference-stationary process best models the basic foreign trade variables for the Turkish economy. These sets of variables are exports, imports, and terms of trade. The data is quarterly and it covers the period 1975.1-1994.1.

In order to provide a benchmark for our results, we run the standard Augmented Dickey-Fuller (ADF) tests on the series. The ADF test is applied by regressing the first difference of each variable on a constant, trend, its lagged level and k lagged first differences.

$$\Delta y = \mu + \beta t + \alpha y_{t-1} + \sum_{i=1}^{k} \delta \Delta y_{t-k} + e_t \quad \text{..... ..... (2.1)}$$

The choice of k in equation 2.1 is very critical. There are several criteria, which have been used in the literature. However, different criteria may lead to different results. Therefore, it is preferable to use more than one criterion in choosing the order of k. Following Fox (1997) and Schlitzer (1996), three most commonly applied criteria are utilised for this purpose.

The first criterion is based on Perron (1989). We set k_{max}=12 and reduce k by one until the last lag becomes significant at 10 percent significance level (approximately 1.60). If no lags are significant we set k=1.

The second criterion is a test of randomness on the residuals of the ADF regression. We adopt F version of the Lagrange Multiplier test. We start with one lagged term and continue by adding an extra lagged term until the residuals are white noise.

The third criterion is based on Schwert's (1987) rule which consists in setting $k=int(4(T/100)^{1/4})$. "T" and "int " denote number of observations and integer part of the term in brackets respectively.

In Perron (1989), three different models are considered. The first model permits an exogenous change in the level of the series (Model A), second one permits an exogenous change in the rate of growth of the series (Model B), and the last one allows both changes (Model C). These hypothesis are written as follows:

Null Hypotheses:

Model (A) $y_t = \mu + dD(TB)_t + y_{t-1} + e_t$ (2.2)

Model (B) $y_t = \mu_1 + y_{t-1} + (\mu_2 - \mu_1)DU_t + e_t$ (2.3)

Model (C) $y_t = \mu_1 + y_{t-1} + dD(TB)_t + (\mu_2 - \mu_1)DU_t + e_t$ (2.4)

where $D(TB)_t = 1$ if $t = T_b + 1$, 0 otherwise,

$DU_t = 1$ if $t > T_b$, 0 otherwise.

Alternative Hypotheses:

Model (A) $y_t = \mu_1 + \beta t + (\mu_2 - \mu_1)DU_t + e_t$ (2.5)

Model (B) $y_t = \mu + \beta_1 t + (\beta_2 - \beta_1)DT_t^* + e_t$ (2.6)

Model (C) $y_t = \mu_1 + \beta_1 t + (\mu_2 - \mu_1)DU_t + (\beta_2 - \beta_1)DT_t + e_t$ (2.7)

where $DT_t^* = t - T_b$, and $DT_t = t$ if $t > T_b$ and 0 otherwise.

The break point T_b is treated as known[1]. In this study, T_b is chosen as the first quarter of 1980.

3. RESULTS

The results of the ADF tests under three different criteria are reported in table 3.1. All series are considered in natural logarithms. The results in Table 3.1 are based on equation (2.1). The data are seasonally adjusted by using X11 ARIMA methodology, in order to avoid any bias due to the seasonal adjustment. Terms of trade is defined as the ratio of export price index to import price index. Export and import figures are defined in real terms. Official series are obtained by the publications of the Central Bank of Turkey and Undersecretariat of Foreign Trade.

Table 3.1
Augmented Dickey-Fuller Tests (1975.1-1994.1)

Series	I(0)			I(1)		
	Perron	LMF	Schwert	Perron	LMF	Schwert
Import	-3.13(12)	-3.05(2)	-3.66(3)*	-4.15(7)*	-8.05(1)*	-4.69(3)*
Export	-0.36(7)	-2.01(1)	-2.10(3)	-5.01(7)*	-5.01(7)*	-6.20(3)*
TOT	-2.06(9)	-2.30(1)	-1.71(3)	-2.90(8)**	-7.34(1)*	-5.65(3)*

TOT denotes the terms of trade. * Significant at 5%, **significant at 10%.

The general impression observed by these three different criteria is that all of the variables have a unit root in levels. The only exception is imports under the Schwert criterion. In general, the unit root null cannot be rejected even at the ten-percent level for all of the series. However, the series in their first differences I(1) are stationary.

Since all the series contain a unit root, the next issue is the choice of the model that is either the series are trending or the breaks occur instantly. In other words, it will be decided if an additive outlier model or an innovational outlier model is more appropriate. Since breaks appear to be instantaneous, an additive outlier model is utilised (see Figures 3.1 - 3.3). The break occurs within the first quarter of 1980 (21st observation). Visual inspection of figures 3.1 to 3.3 indicate us to utilise, both model (A), which allows for a one time shift in the intercept, and the model (C), which allows both a change in the intercept and the slope of the trend function. Because, there is not any statistically accepted procedure for choosing between the two models, both models are estimated. After detrending the raw series according to Models (A) and (C)[2], the results are reported in Table 3.2.

[1] See Perron (1997), Zivot and Andrews (1992), and Perron and Vogelsang (1992) if date of the break is unknown.

[2] See Perron (1989), pg. 1373 and Enders (1995), chp.4 for details.

Figure 3.1

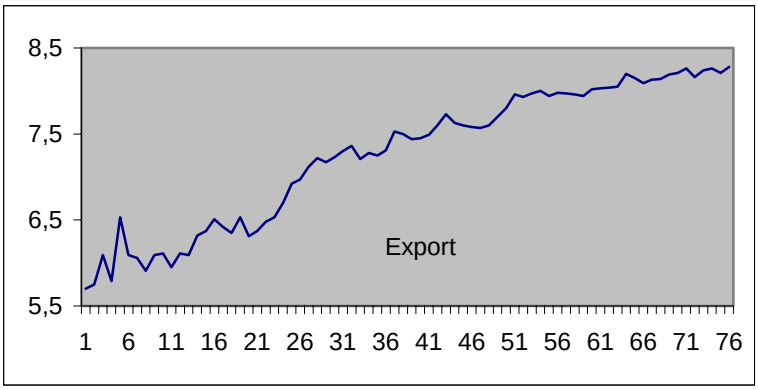

Figure 3.2

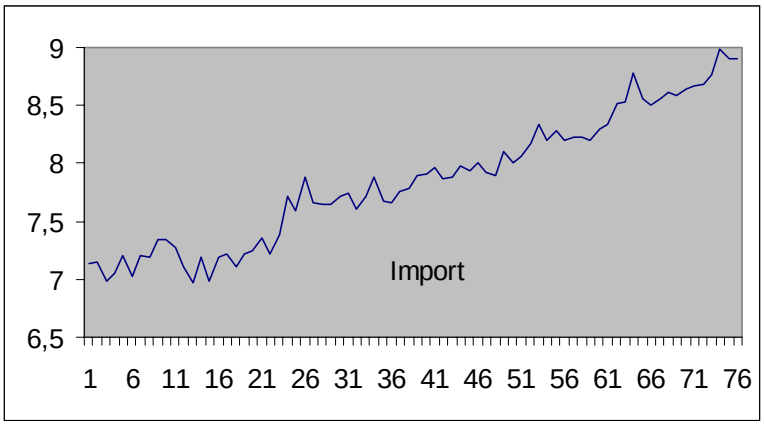

Figure 3.3

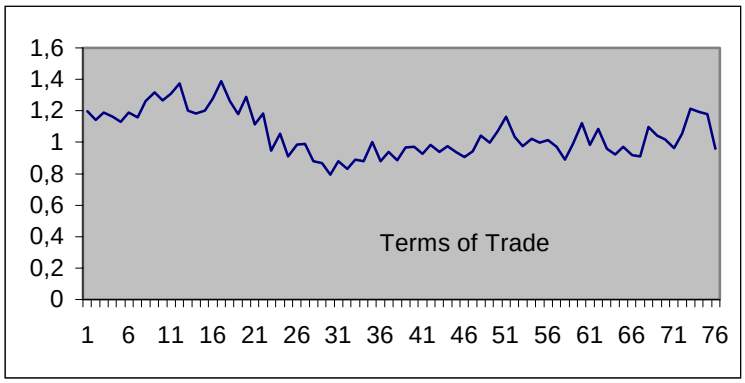

Table 3.2
Perron Tests

	Model (A)	Model (C)
Series	tα	tα
Import	3.66(3)***	1.86(3)
Export	4.97(8)*	5.21(8)*
Terms of Trade	3.84(0)**	3.67(0)***

*Significant at 1%. **Significant at 5%. ***Significant at 10 %.
Critical values are from Perron (1989).

Using model (A), the unit root null can be rejected in favour of the trend-break stationarity alternative for all of the series. However, using model (C), the unit root null can be rejected in favour of the trend-break stationarity alternative for export, and terms of trade, but the unit root null cannot be rejected for imports. Furthermore, Perron and Vogelsang (1993), and Perron (1994) suggested including one-time "crash" dummy to the models in the detrended series. Therefore, we estimated models (A) and (C) by including the "crash" dummy (the dummy associated with a change in intercept) as in Perron and Vogelsang (1993). The results with the dummy are reported in Table 3.3. The choice between including the "crash" dummy or excluding it makes little difference. The results are the same as in Table 3.2.

Table 3.3
Perron Tests

	Model (A)	Model (C)
Series	tα	tα
Import	3.91(3)**	2.35(3)
Export	4.46(8)*	4.40(8)**
Terms of Trade	3.90(0)**	3.84(0)***

*Significant at 1%. **Significant at 5%. ***Significant at 10 %.
Critical values are from Perron (1989).

Tables 3.2 and 3.3 report the results of the Perron tests in which models (A) and (C) are used. They provide evidence against the unit root hypothesis for Turkish exports, imports, and terms of trade for the period 1975.1-1994.1. These findings are opposite of those found in Table 3.1, in which ADF tests are used. When model (C) is used, the same conclusion can be reached for exports, and terms of trade, except for imports, which is rejected.

In other words, there is a one-time shift in the intercept of imports, exports, and terms of trade series as well as the slope of the trend function changes for exports, and terms of trade series. The satisfactory explanation for the breaks can be found in the announcement of the economic program in January 1980.

The economic interpretation of our findings can be summarised as follows:

- The series are specified to be additive outlier model which means that the effect of 1980 programme on export, import and terms of trade are instantaneous.

- It was also found that intercept of the trend function for imports changed, but slope of the trend function did not change. Slope of the trend function for any series is interpreted as the change in the growth of the series (Perron, 1994). Therefore, we can claim that Turkish imports did not follow a different growth path after 1980. A possible explanation for unchanging slope i.e. growth for the trend function of imports might be explained by failure to change the composition of imports radically. Although, the share of investment and intermediate products in total imports decreased, they still constitute over 90 percent of imports (Table 3.5). Possible explanations for the change in the intercept can be explained by measures to liberalise imports after 1980 as well as increased ability to finance imports. We can see this jump in the level of imports as a share of GNP after 1980 (Table 3.4). The import share in GNP before 1980 was around 8.5 percent and it increased to 15 percent after 1980. So we can claim that amount of Turkish imports increased but the growth path of imports did not change.

- Finally, it was found that both the intercept and the slope of the trend function changed for exports. This means that a sudden change in level followed by a different (a new) growth path. The sudden change in level i.e. intercept of the exports can be found in export promoting policies of 1980 programme. We can observe the jump in exports similar to imports by looking at the share of exports in GNP. The share of exports in GNP before 1980 was around 3.5 percent, but the share of exports in GNP increased to 9-10 percent after 1980 (Table 3.4). On the other hand, we found that the slope of the trend function changed which means that Turkish exports followed a different growth path after 1980. It might be possible to explain the change in the growth of exports after 1980 by finding new export markets such as Middle East and North Africa, adoption of a new exchange rate policy or the transformation in the composition of Turkish exports from agricultural products towards industrial products. A remarkable change was realised in the composition of Turkish exports after 1980 which might be a possible reason for the change in the growth of Turkish exports. The industrial exports of Turkey exceeded her agricultural exports for the first time after 1980. The share of industrial products in total exports was about 30 percent before 1980, while that of agricultural products was about 60 percent. The share of industrial products increased to over 60 percent after 1980, while that of agricultural products decreased to under 20 percent (Table 3.6). Taylor (1988) claims that the drastic increase in the share of industrial

products after 1980 can be explained by a successful search for new markets and import-substitution policy prior 1980.

Table 3.4
Share of Exports and Imports in GNP

	Exp./GNP	Imp./GNP
1971-1975	3.7	8.3
1976-1980	3.3	8.7
1981-1985	9.6	15.3
1986-1990	10.7	15.1
1991-1996	10.9	17.7

Source: SPO, Economic and Social Indicators. The figures in the table are the five year averages

Table 3.5
Import

	Investment/Intermediate	Consumption
1971-1975	95.4	4.6
1976-1980	97.4	2.6
1981-1985	96.1	3.9
1986-1990	94.4	5.6
1991-1996	91.8	8.2

Source: SPO, Economic and Social Indicators. The figures in the table are the five year averages.

Table 3.6
Export

	Industrial	Agricultural
1971-1975	30.5	63.2
1976-1980	32.3	61.5
1981-1985	63.9	32.7
1986-1990	77.2	19.6
1991-1996	84.4	13.6

Source: SPO, Economic and Social Indicators. The figures in the table are the five year averages.

4. CONCLUSION

This study examined whether a segmented trend-stationary process or a difference-stationary process best models the basic foreign trade variables of the Turkish economy under the 1980 economic programme. It was found that the series could be characterised as a segmented trend-stationary process with a one-time permanent shift either in the intercept or in both the intercept and the slope of the trend function. The series are not found to be difference-stationary process. Therefore, it is advised to consider this evidence in modelling the behaviour of the foreign trade variables for the Turkish economy. After 1980 Turkish exports and terms of trade

followed a different growth path while Turkish imports did not change its growth path. It can be concluded that 1980 programme succeeded in changing the growth path of Turkish exports.

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ÖZET

Bir çok makroekonomik zaman serisinin birim kök içerdiği iddia edilmektedir. Buna karşın Perron(1989), eğer trend fonksiyonun sabit ve/veya eğiminde tek bir kırık ihtimali dikkate alınırsa, makroekonomik zaman serilerinin deterministik bir trend etrafında durağan olduklarını iddia etmiştir. Bu çalışma parçalı trend-durağan bir sürecin mi yoksa fark durağan bir sürecin mi Türk dış ticaret verilerini en iyi modeller konusunu araştımıştır. Bulunan sonuçlar 1980 kırığın oluştuğu tarih olarak seçildiği zaman, ithalatın ve ihracatın miktar olarak artmasının yanısıra, ihracatın farklı ve yeni bir büyüme yoluna girdiğini göstermektedir.