QUARTERLY MACROECONOMETRIC MODEL OF TURKEY: FOREIGN TRADE BLOCK

by

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This study presents the foreign trade block of the Quarterly Macroeconometric Model for Turkey. We estimate goods export and import functions by using error-correction methodology for the period of 1987-2006. Different empirical studies on Turkish exports and imports functions found quite different results concerning relative significance of variables. In this study, we showed that parameter instability and inconsistent forecasting that were reported in the previous empirical studies on Turkey may be due to omitted variables in the model and we can actually estimate both long and short run export and import functions for Turkey if those shift variables are appropriately incorporated into the model. This argument is further supported by the poor forecast performance of the formulation of export and import functions that only use variables suggested by literature compared to the forecasts produced by our extended specification that takes into account the structural breaks in the economy.

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* Central Bank of the Republic Turkey. Views expressed in this paper are those of authors' and should not be attributed to the Central Bank of Turkey. All errors and omissions are authors'.

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I. INTRODUCTION

A macroeconometric model for the Turkish economy is currently being under developed at the Central Bank of the Republic of Turkey. The model aims to provide inputs to be used in the monetary policy decisions of the Bank. This paper introduces the foreign trade[1] block of the quarterly model and the general features of the model are provided in Graph A.I.1. The most simplified version of the macroeconometric model only estimates demand side by ignoring supply side at the time being. Modeling experiences of both developed countries and developing countries as well as country specific conditions of Turkey are taken into account. In this study, we present estimation results of export and import functions for the Turkish economy with discussion on possible empirical problems researchers face when they work with developing country data and our remedies to overcome some of the difficulties in the Turkish case.

One of the biggest challenge for an empirical researcher working with a developing country data is to estimate a macroeconometic model which not only represents economic relationships for the estimation period but also gives satisfactory within and out of sample forecast performance. Frequent shocks to a developing economy such as financial crisis or external developments, or major policy changes such as extensive tariff cuts may cause shifts in the economic relationships within a short period of time. These are significant problems for empirical researchers who are working on macroeconomic modeling for forecasting purpose. Similar problems exist in the Turkish case as well. Frequent financial crises and altering trade policies hinder empirical research on foreign trade for forecasting purpose in Turkey. Supporting the previous empirical findings on Turkey, we found simple formulation of foreign trade equations, which only include income and competitiveness indicator, are inadequate to explain neither long nor short run dynamics of the Turkish foreign trade developments. The reason for this is that these specifications omit the frequent structural breaks in the Turkish economy due to financial crises, political instability, and foreign trade policy shifts (e.g. inward processing regime and customs union with EU). Some major external events in the region (e.g. trade with Iraq and Russia) also have to be taken into account.

Value of exports and imports in Turkey were 10 billion USD and 14 billion USD in 1987, whereas these figures have reached to 107 billion USD and 170 billion USD at the end of 2007, respectively. The rate of growth of both exports and imports were not uniform over this period as well. Relatively modest annual growth rates in both exports and imports in the second half of 1980s and 1990s are followed by almost 27 percent growth rate for exports and 23 percent growth rate for imports in the post-2001 period. These sharp changes in the growth rates and frequent changes in public policies coupled with financial instabilities hinder researchers' efforts to obtain consistent and powerful forecasts of the foreign trade variables.

There are various policy and structural changes that affected not only the foreign trade variables but also the other macroeconomic variables in Turkish economy. After the Turkish economy started to implement trade liberalization at the beginning of 1980s, both export and import growth rate had accelerated. However, compared to the 1981-1988 period, 1989-2001 period is characterized by relatively strong domestic demand that caused export growth rate to slow down. After the economic crisis in 2001, export and import growth rates had accelerated

[1] We estimated goods exports and goods imports. Exports and imports of services would be taken exogenously at the current version of the macroeconometric model.

once again. These changes make it difficult to get an equation that incorporates coefficient estimates of the whole sample period. We consider this data environment as a fruitful research area and start the estimation by using whole sample rather than analyzing the periods that structural changes had happened. Analyzing and understanding how the structural changes affected exports and imports of Turkey are also useful in answering how these changes may affect foreign trade in the future. Understanding these events also lets the modeler to pick variables that helps to capture relations in the economy more successfully. This approach is expected to help the success of the forecasts.

We present two long run and two short run equations for exports[2]. Long run equations for exports are considered as reduced form equations as they are not purely supply or demand equations. We obtain foreign demand elasticity as 1.86. We use volatility of CPI and potential industrial production for our long run equations. Even though these variables are not employed frequently at the macroeconometric literature, these are crucial variables to get specific conditions of the Turkey that cannot be captured by variables used in other countries.

Similar to exports, we estimate long run and short run equations for the demand of imports. Three long run and two short run equations are demonstrated in this paper. We get demand elasticity of imports as 1,7, 1,8 and 2,2 in the three long run equations. We incorporated a variable capturing a practice called Inward Processing Regime (IPR) that has been in effect since 1996. This regime lets a firm to import intermediate goods free of import duties if the intermediate goods are used in the production of export goods. World trade is a variable that captures the results of globalization and integration in the world in our import functions.

We compare and contrast short run equations according to their within sample and out of sample forecasts after we check for extensive diagnostic tests on these equations. We present forecasts and compare the equations by their forecast performance.

We give a brief summary of foreign trade of Turkey in the next section and then discuss methodology and data. Estimation of exports and imports are presented in the following sections. Last section concludes the paper.

II. TURKISH TRADE: A BRIEF SUMMARY

Turkish economy was relatively closed from 1930s to 1980[3]. From early 1960s to the beginning of 1980, Turkey implemented import substitution policy similar to other developing economies[4]. Import substitution policy was abandoned, following major economic

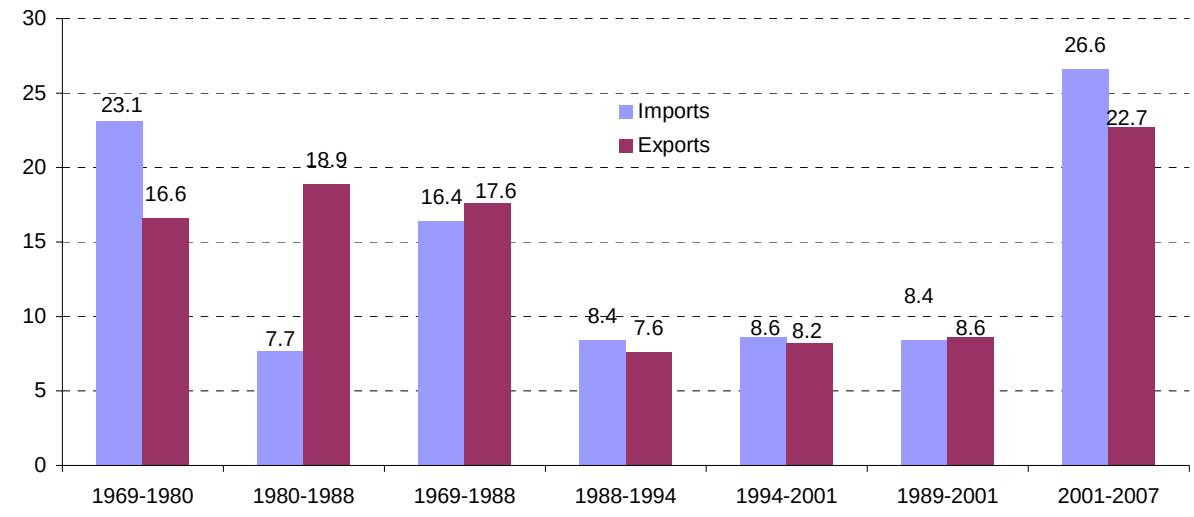
[2] We estimate several alternative long run equations and short run equations from these long run equations. However, we present some of the equations here and keep other equations. When we run the complete model, we will make use of other alternative equations depending on the results of the model. For instance, in case we have divergence problem that cannot be foreseen while estimating single equations, we will try other formulations. Also, depending on the problem, we will try different equations containing variables related to the problem at hand in the final model

[3] For further information see, Globalization, http://www.tcmb.gov.tr/yeni/evds/yayin/kitaplar/global.doc

[4] Import substitution policy aims at increasing international competitiveness of some sectors at the first step. As intermediate and capital goods may not be available domestically, firms are expected produce consumption goods using imported intermediate and capital goods. At the second step, this policy aims at production of intermediate goods domestically through targets in the process and checks of the system. Final step aims at producing capital goods domestically. Whole process, thorough import substitution policy, is designed to increase value added in the Turkish economy.

crises caused by oil price shocks, at the end of 1970s, which confirm current account deficit to be unsustainable, and replaced by export-oriented growth strategy in the following period. This new policy focus on increasing competitiveness of the Turkish firms through repressing real wages, depreciation of Turkish Lira, exports incentives and liberalization of the import regime. As a result, export growth rates were higher than import growth rate in 1980-1988 (Graph II.1). However, it may be argued that export growth in 1980s was not sustainable since firms were not able to achieve international competitiveness. Turkey could not complete all the steps of the import substitution policy so export performance depended to temporary developments like export incentives and exchange rates depreciations, unlike South Korea case.

Graph II.1. Exports and Imports (Dollar, Current Prices, Average Annual Percentage Change)



Source: TURKSTAT

Another major change in the trade regime was the liberalization of capital accounts in 1989 that allowed flow of capital in and out of country. After 1989, domestic demand was stronger than 1980-1988 period and export incentives were reduced. Hence, in 1989-1994 period, export growth rate decreased considerably, whereas average import growth rate almost did not changed at this period relative to the period between 1980-1988.

The 1994-2001 period was rich in terms of changes an economy could face. In 1994, there was a financial crisis that resulted in sharp devaluation of the Turkish lira. Turkey signed Uruguay Round Treaties in 1994 and became a member of WTO in 1995. Moreover, Turkey joined customs union with European Union in 1996. After the Custom Union, the Inward Processing Regime was adopted as an instrument for promoting exports. The regime allows exporter firm to import intermediate inputs free from custom duties if they export the final good. Other major events in this period were the Asian and Russian crises in 1997 and 1998, respectively. These crises had severe effects on the Turkish economy as well as the world economy. In addition to these international events, in 1999 an earthquake damaged the Turkish economy, especially the major industrialized zones. Despite these changes, we do not observe much change in average growth rates of imports and exports in 1994-2001 relative to 1989-1994 period.

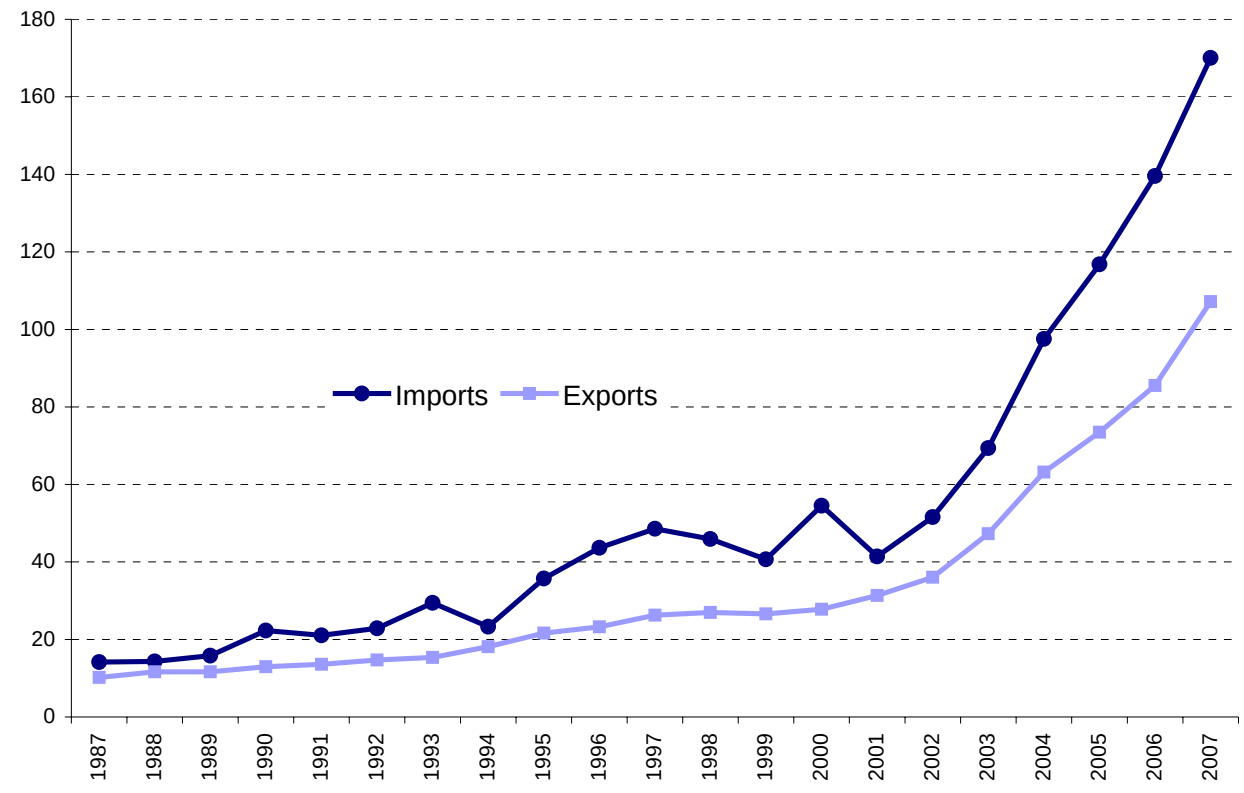
In 2001 there was another financial crisis. Export and import growth rates accelerated substantially after 2001. A number of structural reforms were adopted after the crisis. These include banking sector reforms, privatization, establishment of regulatory authorities, public finance reform, etc. Besides, the fixed-exchange rate policy, implemented in 2000, was abandoned after the crisis and foreign exchange rates are let to float freely. As part of the structural reforms, Central Bank was given the right of instrumental independence in its policies to strengthen its credibility in reducing inflation. After the crisis in 2001, exports and imports growth rates had accelerated. The recent upturn in growth of Turkish exports is due to several reasons: First of all, domestic firms responded to decline in domestic demand by increasing their sales abroad. Secondly, the acceleration of foreign direct investments to Turkey, due to Turkey's candidacy to the EU, especially to the export oriented sectors e.g. transportation vehicles sector. Thirdly, there has been significant increase in trade with neighbors such as Iraq after the second Gulf war and Russia after the oil price hikes. Fourth reason is a more intensive integration of Turkish firms to worldwide trade networks in parallel with the acceleration of globalization.

As a result of these developments in the Turkish economy, imports increased from 14 billion in 1987 to 41 billion in 2001, and from 41 billion in 2001 to 170 billion in 2007 period (Graph II.2). Similarly, exports increased from 10 billion to 31 billion in 1987-2001 period and from 31 billion to 107 billion in 2001-2007 period.

These events had gradually affected the dynamics and structure of the Turkish export and import growths. As a result, it is difficult to estimate a single equation for the 1987-2006 period as a whole since each of three sub-periods (1987-1996, 1996-2001 and 2002-2006) has different economic aspects. There seems to be a major change of the structure of the foreign trade after 1996. Customs Union and Inward Processing Regime seem to be the main reasons of the change in foreign trade. However, we were able to get estimations without using dummy variables in long run equations for structural breaks. We have achieved this result by using certain variables that are not used in other studies that capture the effect of changes in the economy to exports and imports.

We need to be cautious about our findings as well. Despite our efforts to incorporate major policy shifts in the Turkish data, some others are still missing. As it is reported by Aydin et. al. (2007), there is a secular increase in the import dependence of exports in Turkey over our estimation period. This trend is accelerated especially after the customs union with the EU in 1996 and the last financial crisis in 2001. The increase in import dependence of exports indicates increased integration of the Turkish economy to the world trade system. This trend is not unique in Turkey but rather a general global economic trend. Global competition, and "slicing up the value chain" (as named by Krugman 1995) and shipping different processes of production activity to different economies are few causes of this global trend in international trade.

Graph II.2 Imports and Exports
(Current Prices, Billion Dollar)



Source: TURKSTAT

III. METHODOLOGY and DATA

Our estimation strategy is Error Correction Mechanism based on Engle and Granger (1987)[5]. In this regard, we estimate long run and short run equations for export and import functions. In the long run equation; we obtain a cointegrated relation among variables and use the residual of the long run equation in the short run specification as error correction process. As a general strategy, in estimating the short run equation, initially, 4 lags of (sometimes 8 lags) long run and additional short run variables are included. Then, we applied general to specific methodology(Hendry 1995) by dropping insignificant variables from our list of potential determinants sequentially depending on their level of significance. At the end, we complete our estimation by performing extensive diagnostic tests and within and out of sample forecast exercises.

We start estimation of long run equations with the variables suggested by theory, inspect residuals, identify periods that residuals altered behavior and check the sign and size of the coefficients. If there is any problem with the residuals or the coefficients, analyzing economic history, we come up with possible variables that can solve problems related with structural beaks or improve estimations. Hence, we adjust the initial equation to find a specification that

[5] We do not use Johansen cointegration, as our aim is not to identify cointegration relations among variables but to get forecasts by imposing some economic relationship based on both formal economic theory and previous empirical studies on the field.

passes several diagnostics tests and obtain a function that is acceptable both econometrically and theoretically.[6]

It is necessary to determine the degree of integration of variables to do cointegration analysis. We apply the unit root analysis of variables using Augmented Dickey Fuller (ADF, Dickey and Fuller 1979) and Phillips-Perron (PP, Phillips and Perron 1988) unit root tests. Statistics of ADF for variables are presented in Table A.III.1 for the variables in export equation and A.III.2 for the variables in import equation.
ADF test can be found from a regression as

$$\Delta Xt = \beta_0 + \beta_1 t + \beta_2 X_{t-1} + \sum_{i=1}^{k} \beta_i \Delta X_{t-i} + \varepsilon_t$$

Test statistic is obtained by dividing the estimate of β_2 by its standard deviation. Critical values for ADF statistic are presented by MacKinnon (1991). Null hypothesis is the variable has a unit root. If the test statistic is less than the tabulated value (in terms of p-value), we reject the null hypothesis and, X is said to be stationary or in other words X is integrated of order zero. If test statistic is greater than tabulated value, difference of X is checked and if the first difference is stationary, then X is said to be integrated of order 1.

As defined by Engle and Granger (1987), stationarity of a variable determines the degree of integration. In other words, if X becomes stationary after differencing *d* times, X is said to be integrated of order d. If there are two variables with same degree of integration, say d, and if there is a linear combination of these variables that is integrated of order less than *d*, these variables are cointegrated. Error Correction Mechanism is built on this idea. Residuals from an OLS equation are taken as a linear combination of the cointegrated variables in an OLS regression. When the variables in the OLS equation are integrated of order 1 and residuals of the equation is stationary, a short-run equation can be constructed by using the error-correction mechanism (ECM) in order to achieve long-run equilibrium. The ECM can be shown as,

$$\Delta Y_t = \alpha_0 + \alpha_1 ECM_{t-1} + \sum_{i=1}^{M} \beta_i \Delta Y_{t-i} + \sum_{i=1}^{N} \theta_i \Delta X_{t-i} + \varepsilon_t$$

where Δ denotes the first difference operator and the error-correction term ECM is the stationary residual from the cointegration equation.

The model utilizes quarterly data for the 1987-2006 period, as quarterly national income statistics for Turkey are available only after 1987[7]. Table A.III.3 and Table A. III.4 presents the sources of the data we utilized. We used seasonally unadjusted data, as there is no officially announced seasonally adjusted data and deterministic seasonal dummies are added to capture seasonality in the variables. Current US dollar export and import figures are deflated by using export and import price indexes, respectively and they are used as the

[6] See for example Cserháti and Varga (2000) for a similar discussion.
[7] GDP figures were available from 1987 onwards at 1987 prices when this study is conducted. After the study is finished new GDP figures starting from 1998 at 1998 prices are provided by TURKSTAT. We will do our estimations with new GDP series but at this preliminary version of the paper, we have used the old series.

dependent variables. We convert these real dollar imports to real YTL values, calculate net exports in domestic currency and get net export part of GDP.

In the short run, we check the adjusted R-squared and F-statistics for each alternative equation. Normality of the residuals is tested by Jarque-Bera test (Bera and Jarque 1981). Ramsey RESET test (Ramsey, 1969) is used to check the possibility of omitted variables and incorrect functional form We checked several lags of Breusch-Godfrey test for possible auto-correlation in the residuals (Bruesuch 1978, Godfrey 1978). We checked heteroskedasticity in residuals by White Test (White 1980) and ARCH effect in the residuals are inspected for several lags.

We further check for structural break in the coefficients of the system by examining the recursive residuals graphs. In order to do that, we applied CUSUM and CUSUM square (Brown, Durbin, and Evans, 1975)) tests and also by one-step and N-step forecast tests. Recursive coefficients are inspected to correct the model for possible non-stable coefficients.

Forecast performance of the short run equations are checked by root mean square error and mean absolute error. We prefer a specification with lower of these errors, however visual inspection is also considered in cases where these two statistics are not conclusive enough.

We used Ordinary Least Squares technique (OLS) and estimations and diagnostics tests are performed using EVIEWS version 6.

IV. LITERATURE

As building a macroeconometric model requires a general equilibrium framework, we think it will be beneficial to learn from macroeconometric model experience of other countries. Hence, we focused on macroeconometric models of the countries rather than studies that solely look at exports or imports. Our strategy is to focus on three types of countries while analyzing what the literature does on modeling and forecasting foreign trade (Table A.IV.1). First group of countries may be named as developing countries, which may have more similarities with Turkey in terms of economic structure and data availability. Second group of countries are leading Central Banks of developed countries; namely Bank of England (BOE), Federal Reserve System of the United States (FED), and European Central Bank (ECB). Last group of countries are Euro-Area countries. By doing so, we can deal with challenges particular to developing economies and Turkey and at the same time going parallel with the developed countries and be compatible with the recent literature.

We know from the microeconomics that when there are two goods, demand for each of these goods will be function of the consumers' income and the relative price of these two goods. Within this framework, macroeconometric-modeling literature uses a demand (income) indicator and a competitiveness variable (relative price).

In the export estimation, models use an indicator for foreign demand like world trade or trading partner's GDP, and a competitiveness indicator such as export price or real exchange rate. However, it should be noted that supplementary explanatory factors may be included if it is thought to be necessary. For example, Portugal uses private consumption as a variable in

the short run estimation of exports to capture the effect of domestic demand on the motivation of firms to export.

Imports are explained by final demand (like GDP corrected for imports) and relative price indicator. Ratio of import deflator to GDP deflator is used in some country models to get relative price effect. Another alternative is to use import prices as a competitiveness indicator for import goods. Short run equations are modified in accordance with the special conditions of the economy.

There are macroeconometric-modeling experiences of two Turkish institutions that we analyzed, namely models of the Treasury and State Planning Organization (Table IV.1). Other than common variables used in the literature, the Treasury model uses imports of Russia in the export estimation and State Planning Organization model uses share of exports in GNP in the import estimation.

Table IV.1. Export and Import Estimation in Macroeconometric Models on Turkish Economy

Model	Export	Import
Turkish Treasury Model	i. World Trade Index ii. Imports of Russia iii. PPI/(World Manufacturing Price Index*Exchange Rate) iv. Time Trend	i. Domestic Demand ii. PPI/(World Manufacturing Price Index*Exchange Rate) iii. Time Trend
State Planning Organization of Turkey	i. OECD GDP (Turkish GDP deducted) ii. Relative Industrial Goods Export Price Index iii. OECD Price Index	i. GNP ii. Relative Import Price iii. Share of Exports in GNP

There are some other studies which focus on exports and imports. Aydın et al (2004) estimate export supply and import demand functions for Turkey for 1987-2004. They find that exports are determined by real unit labor costs, export prices, and national income. Import demand is determined by real exchange rate and national income. Ulaşan and Şahinbeyoğlu (1999) conclude that traditional export functions are not sufficient to forecast post 1994 period in Turkey. They note that uncertainty indicators and investment have crucial role in explaining exports. In a recent article, Aydın et al. (2007) analyze the structural change in the Turkish exports. Yukseler and Turkkan (2008) analyze the dependence of exports to imports and conclude that dependence of exports to imports increased in recent years.

V. ESTIMATION OF EXPORTS

This section provides empirical results of the export function estimation. Ideally, we need to estimate either export supply or export demand function in order to identify behavioral equations correctly. However, pure supply and demand functions performed poorly in forecasting both within and out of sample forecasts. Yet, a reduced form model that incorporates both demand and supply elements seem to give better results in terms of forecasting and still provide us theoretically consistent coefficient estimates.

International literature and studies on Turkey suggest using a demand indicator, a competitiveness indicator, an indicator capturing uncertainty and an indicator capturing the relation between investment and exports in the economy. Foreign demand can be captured by several alternative variables such as OECD GDP, world import and industrial countries import. For the same equation, we can have alternative competitiveness indicators as well, such as terms of trade, export prices, export prices of Turkey relative to import prices of Turkey's export markets and real unit labor cost. By using various combinations of these variables, we estimated two alternative export functions (Table V.1).

In the first equation exports are explained by import price index, CPI volatility, real unit labor cost, and potential industrial production. These variables capture the cost of imported inputs, economic uncertainty, competitiveness, and relation of exports with investment, respectively. The second equation replaces import price index by OECD income variable, as a proxy of foreign demand. The foreign demand elasticity of exports is 1.86. CPI volatility and potential industrial production have expected signs, that is increase in uncertainty reduces exports, whereas increase in potential industrial production increases exports. As a cost variable, real unit labor cost and import prices have negative coefficients. We discuss estimation process in detail below by focusing on choice of variables.

Table V.1. Long Run Estimation of Exports

Least Squares Estimation for Export Function (XFOB)

Sample: 88Q4-06Q4

Newey-West HAC Standard Errors and Covariance (lag truncation=3)

	Coefficient		t-Stat.		Probability	
	I	II	I	II	I	II
Constant	8.034	7.946	150.96	143.20	0.000	0.000
Potential Industrial Production	1.428	0.518	10.72	1.89	0.000	0.063
Real Unit Labor Cost	-0.509	-0.403	-7.33	-5.66	0.000	0.000
CPI Volatility	-0.131	-0.081	-5.51	-5.27	0.000	0.000
Import Price Index	-0.330	-	-3.72	-	0.000	-
OECD Income	-	1.863	-	4.21	-	0.000
	I	II				
Adjusted R-squared	0.984	0.986				
F-statistic	632.68	705.05				

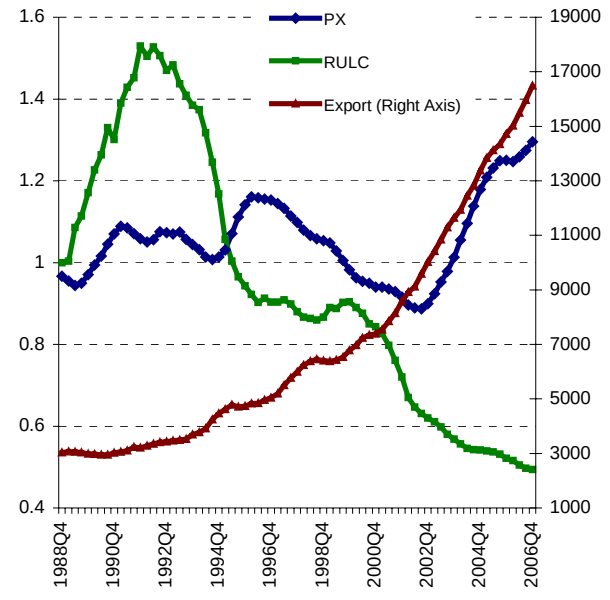
As we estimate reduced form models, we provide evolution of the estimation of the second model above to illustrate the logic of using these variables rather than sticking with the theory and literature. Export prices, real unit labor cost and exports are depicted in Graph V.1. In the post 2001 era, exports and export prices increase and real unit labor costs decrease significantly. Increase in export prices may put a downward pressure on exports as export goods become more expensive for foreigners to buy. On the other hand, increase in prices may motivate firms to sell abroad. We should note that increase in export prices, in this period, is thought to be mostly due to increase in commodity prices. Therefore, we need to control the export prices of the competitors of Turkey. In this respect, we run regressions with export price of Turkey and import prices of Turkey's export markets. Yet, we could not get satisfactory long run equations in this specification. Decrease in real unit labor cost after 2001

is mostly due to increase in productivity, which increase competitiveness of firms in international markets. Increased competitiveness of firms will enable them increase their sales abroad and export performance supported by productivity gains will help this performance to be sustainable. Therefore, using real unit labor costs will capture the productivity and real wage developments in the economy in our export functions.

As we mentioned, an ideal export equation should involve variables either reflecting demand for home goods by foreigners like OECD income or supply indicators like import price index reflecting cost of production. However, as noted by Sahinbeyoglu and Ulasan (1999), traditional export functions are not sufficient for the Turkish case. Therefore, we need to modify traditional equations. CPI volatility is a nontraditional variable that we utilized in this regard. Macroeconomic stability is considered as a variable that can affect exports. Firms can be able to do investment as demand may be more foreseeable in the economy and finance opportunities may increase and get cheaper in stability. So, it is expected that more stable economic environment helps firms to develop more stable and stronger link with the external world both in terms of exports and imports. Investment is another non-common variable that we utilized in estimations.

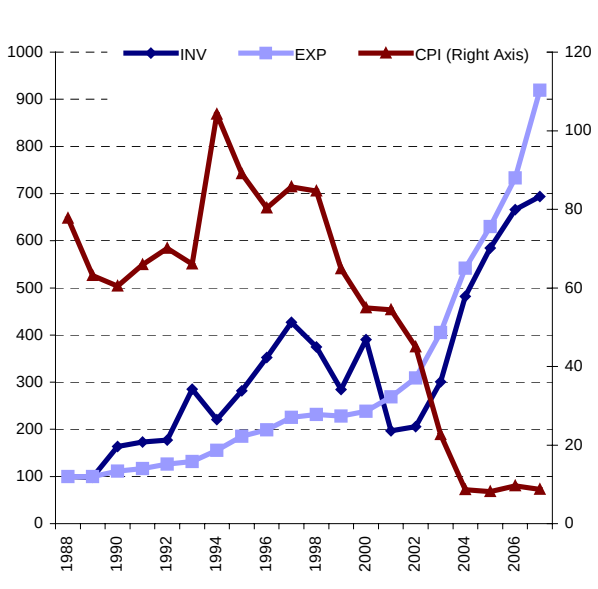
Graph V.2 illustrates machinery and equipment investment of private sector, inflation and exports. After 2001, exports and investment move together and both increase at high rates, at the same period inflation declines and becomes more stable. Correlation between exports and machinery and equipment investment is 0.9 while the correlation between exports and inflation is –0.9. Turkey has experienced high and volatile inflation till 2001. In the post-2001 era, Central Bank followed implicit inflation targeting until 2006 and from 2006 onwards, it followed full-fledged inflation targeting. Among others, this policy led sharp reduction in inflation and hence more stable economic environment. In this regard, we included the volatility measure in the export function to account for the effect of macroeconomic stability on the export and import decision of firms.

Graph V.1. Export Prices (1987=1,Dollar), Real Unit Labor Cost (1988=1) and Exports (Million Dollar)



Source:TURKSTAT

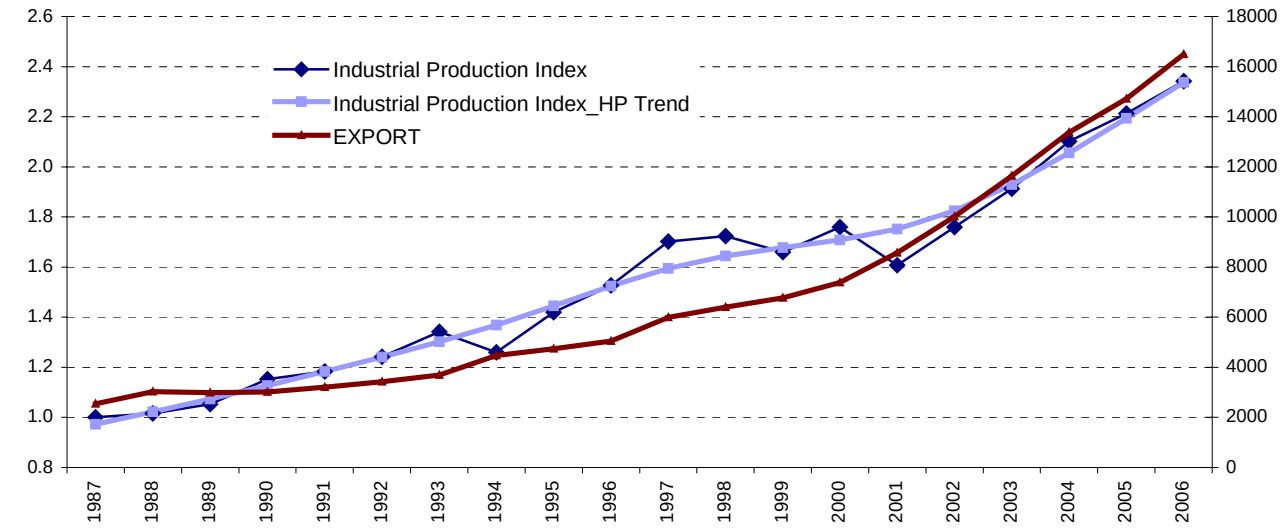
Graph V.2. Investment (1988=100, At 1987 Prices,YTL), Export (1988=100, Dollar) and CPI (Yearly Average)



Source: TURKSTAT

Rather than using investment as noted by Sahinbeyoglu and Ulasan (1999) as an indicator of the sustainability of exports in the estimations, we used potential industrial production. The reason for this is to emphasis the constraint that home country cannot supply more than its capacity. There may be periods with high export performance backed by higher capacity utilization but if the total capacity is not increased, high export performance of the home country will not be sustainable. Another support for using this variable is the changing structure of the Turkish exports as the share of non-agricultural exports increased from 23 percent in 1969 to 79 percent in 1987 and to 96 percent in 2007. Therefore developments in industrial production will have effects on exports. To proxy production capacity, we estimated trend (or potential industrial production) by applying HP trend method on actual industrial production data (Graph V.3).

Graph V.3 Industrial Production Index, Trend Of Industrial Production Index and Exports (Million Dollars, Current Prices)



Source: TURKSTAT

We provide residuals of an equation when we use OECD income and export prices as regressors, as a first regression. Regression using the suggested variables by theory and literature yields unsuccessful results for Turkish data. Residuals indicate a systematic error as seen in the Graph V.4 and as also suggested by statistical tests. We may continue to short run with these residuals provided that they are stationary. However, we take systematic errors in the residuals as a signal of possible omitted variables and structural breaks. Moreover, we have unstable coefficients. For instance coefficient of OECD income starts at around 1.5 and increases to 3.7. However, information content of the residuals is high. Residuals signal three different periods. From 1987 to 1989, from 1989 to 2001 and from 2001 onwards. As discussed above, these are periods with different foreign trade policy and economic structure. Our task is, therefore, to find variables capturing changes in these periods and get residuals with less systematic error.[8]

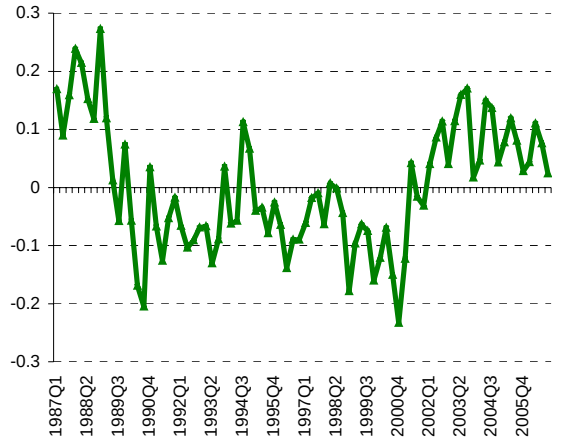
[8] We also tried real exchange rate instead of export prices, but it does not change results much.

We tried real unit labor costs instead of export prices as a competitiveness indicator and it solves some of the problems we encountered by using export prices (Graph V.5). With this specification, we have lowered error bands and we have reached "better shaped" residuals. However, we are still not at a good specification as there are still systematic errors in the residuals. This specification indicates another three periods. First period is from 1988 to 1995, second period is from 1996 to 2001 and the last period is from 2001 onwards.

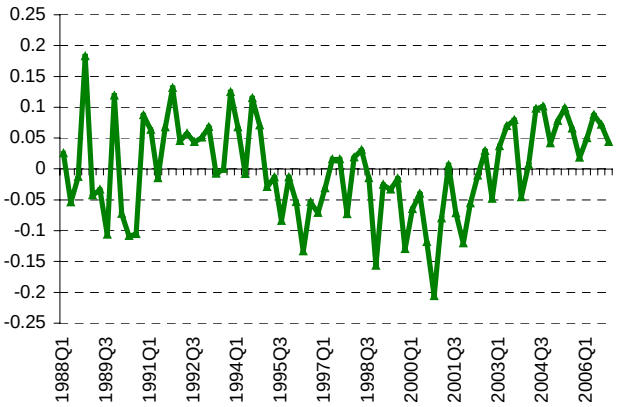
Potential industrial production and CPI volatility seem to be solving some of the problems stemming from omitted variables and structural breaks (Graph V.6 and Graph V.7). We get stationary residuals and we move to short run estimation with these residuals. There are still periods with serially correlated errors in the residuals and we will try to correct these in the short run estimation.

Residuals of Long-Run Equation

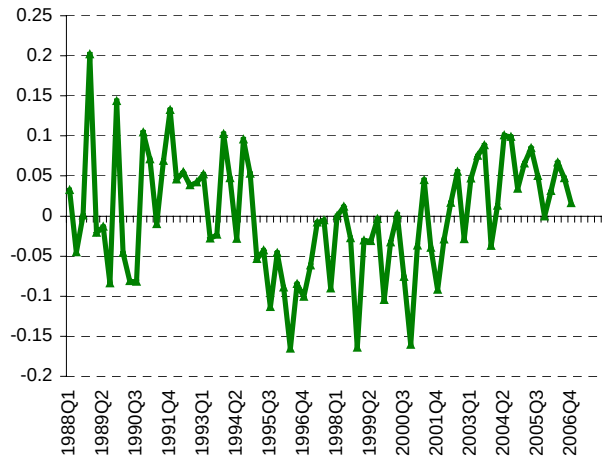
Graph V.4. OECD GDP and Export Prices as Regressors



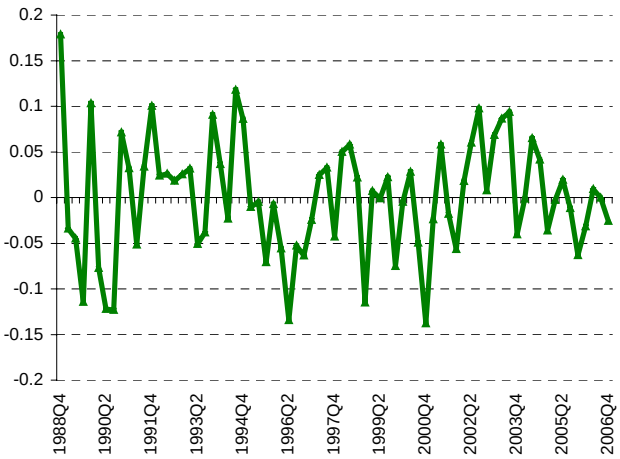
Graph V.5 OECD GDP and Real Unit Labor Costs as Regressors



Graph V.6 OECD GDP, Real Unit Labor Costs and Potential Industrial Production as Regressors



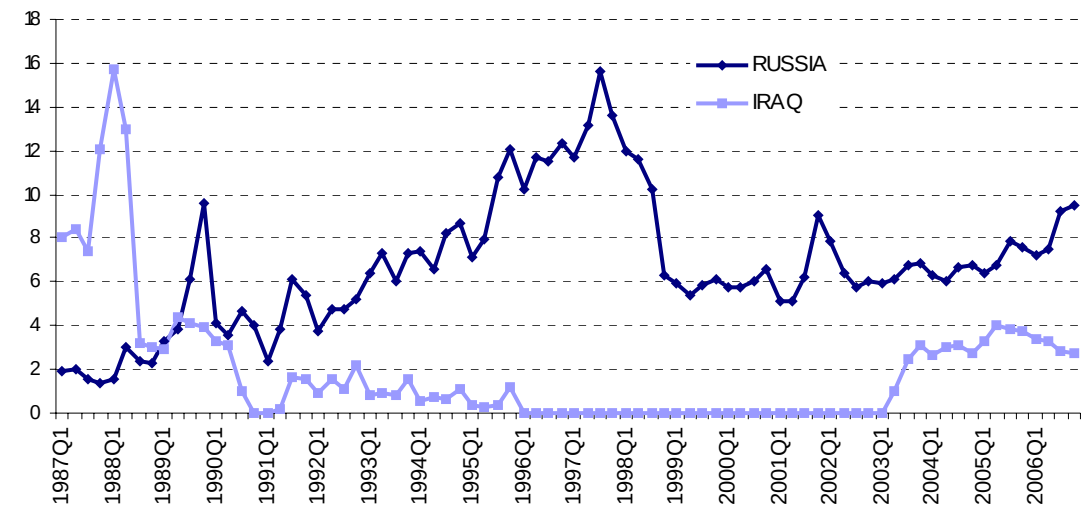
Graph V.7 OECD GDP, Real Unit Labor Costs, Potential Industrial Production and CPI Volatility as Regressors



In the short run estimation, in addition to long run variables; we considered real exchange rate and capacity utilization as additional explanatory variables. Moreover, we employed two

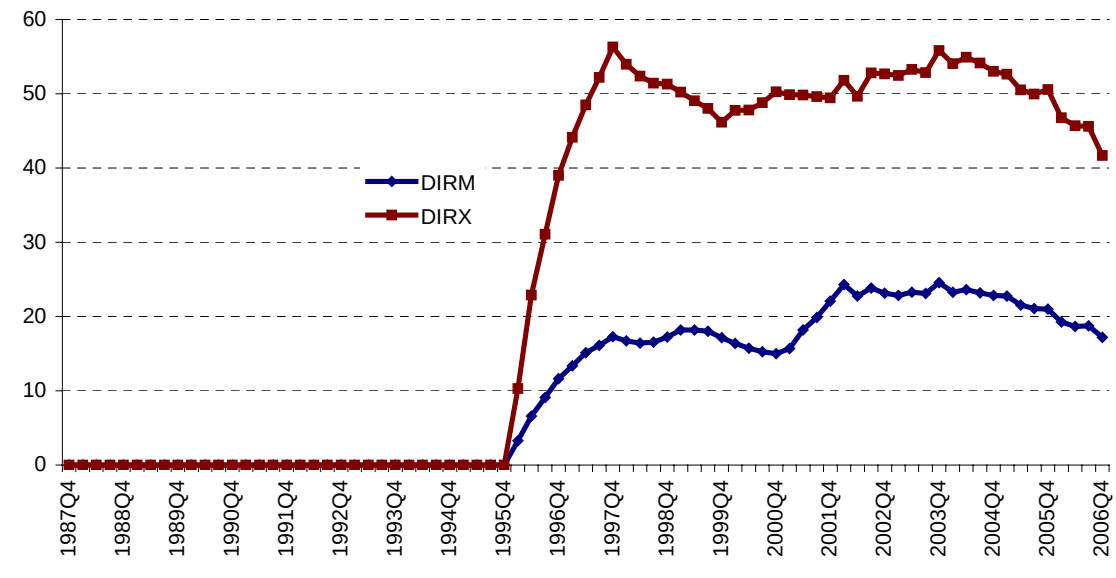
additional variables to catch some of the significant changes in the export markets, namely Iraq and Russia, and export incentives. The share of exports to former Soviet Union countries was 2 percent in 1987, peaked to 15 percent in 1997 and declined after Russian crises to 5 percent and moderately increased afterwards (Graph V.8). Another neighbor Iraq got a share of 8 percent in 1987, reached to 16 percent in 1988 and declined to zero in the 1996-2003 period due to embargo imposed on Iraq by the UN and rose gradually to 3 percent in 2006. These are developments that cannot be captured by any other variable in our model. Therefore we utilized sum of export shares of these two countries as a variable to improve explanatory power of the model.

Graph V.8 Share of Exports to Iraq and Russia in Total Exports



Source: TURKSTAT

Graph V.9 Share of Exports Claimed Under Inward Processing Regime to Total Exports (DIRX) and Share of Imports Claimed Under Inward Processing Regime to Total Imports(DIRM)
(Annualized)



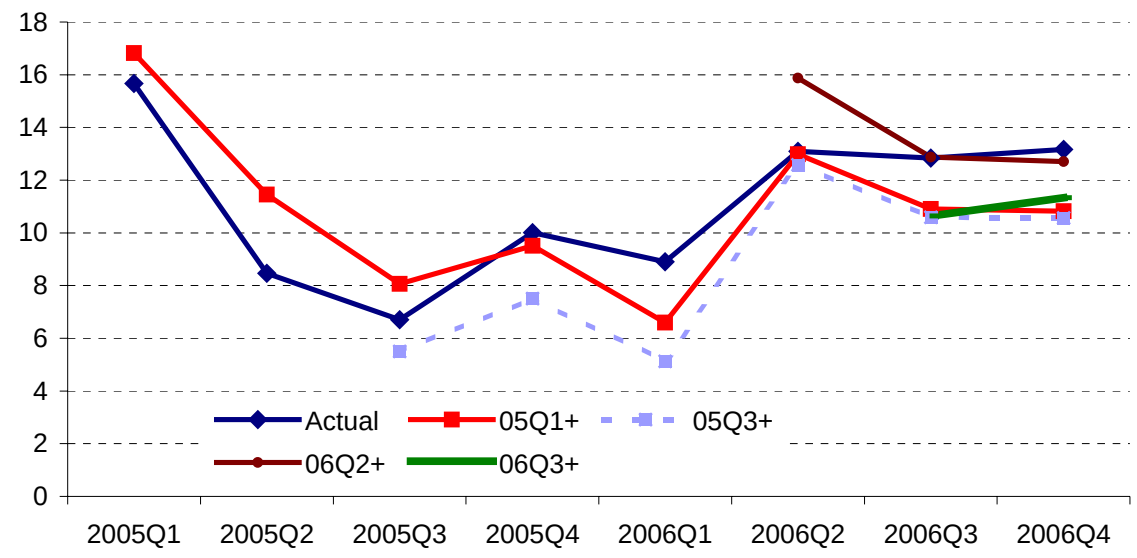
Source: Undersecretariat of Foreign Trade

As it is mentioned before, the introduction of Inward Processing Regime (IPR) as an export promotion system in parallel to the Custom Union with the EU, was an important trade policy change (Graph V.9). As a result, this policy has led to a stronger link between exports and imports in Turkey. The share of exports within the regime in total exports increased sharply after the implementation of the regime and reached to around 50 percent in recent years. Our empirical results show that this regime is a significant determinant of foreign trade in Turkey.

We present two short run equations. Estimation results (Table A.V.1 and Table A.V.2), residuals (Graph A.V.1 and Graph A.V.2) and within sample forecasts (Graph A.V.3 and Graph A.V.4) are presented in Appendix. Here, we discuss out of sample forecast performance of the two equations. In the first equation, real exchange rate and capacity utilization are used as additional short run variables. In the second equation, real exchange rate, capacity utilization, exports to Iraq and Russia and share of claimed exports under inward processing regime are used as additional variables.

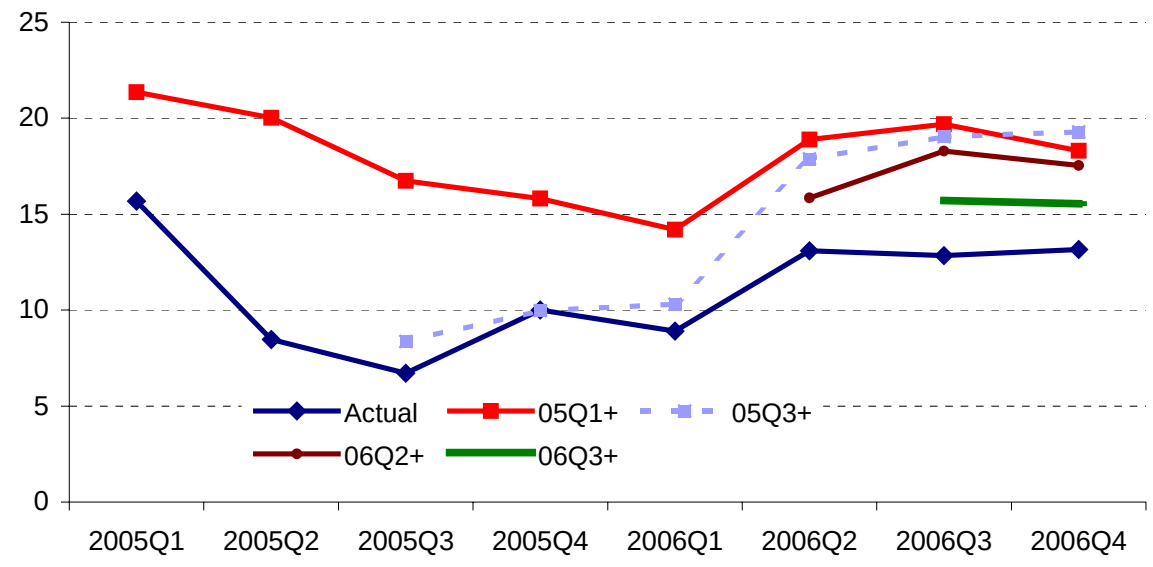
In Graph V.10, actual annual growth rate of exports and out of sample forecasts for different periods are pictured. In a two-year horizon, out of sample forecasts move parallel with real values. Moreover, forecasts and realizations are close to each. However, first equation underestimates in the last two quarters, whereas second equation overestimates in the last three quarters.

Graph V.10 Out of Sample Forecast of Export-I
(Annual Percentage Change)



Note: 05Q1+ means, estimating model until 2004Q4 and getting out of sample forecasts after that period.

Graph V.11 Out of Sample Forecast of Export-II
(Annual Percentage Change)



Note: 05Q1+ means, estimating model until 2004Q4 and getting out of sample forecasts after that period.

VI. IMPORTS

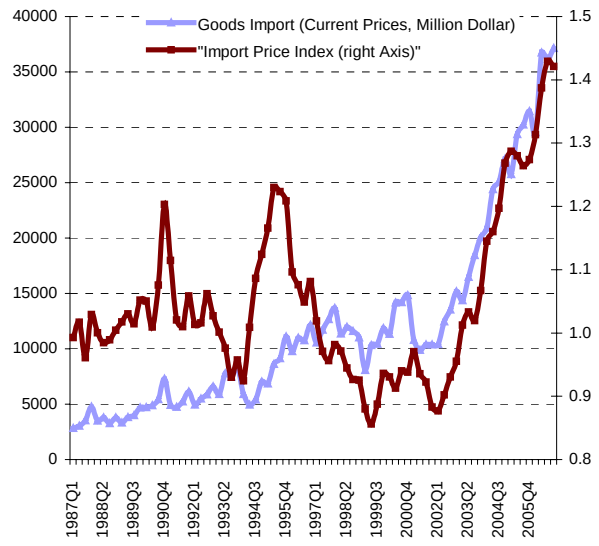
In this section we discuss the estimation of import demand for Turkish economy. We deducted import taxes from GDP and used the resulting series as the final demand variable for imports. This approach helps to reduce the endogeneity as GDP data also includes tax revenue from imports. [9] We modify import prices in two dimensions and use the modified version as the relative price of imported goods with respect to domestic goods. Firstly, we model real imports hence we deflate import prices. Also, we correct for taxes on import goods by multiplying import prices with average taxes on imports and we get relative tax adjusted import prices as the relative price indicator.

We expect a negative relation between price of imports and import demand by home consumers due to substitution effect. A first look at the data shows that correlation between import prices and imports is 0,67, whereas correlation between real goods import and relative import price is –0,80 (Graph VI.1). A closer look at the data shows that, goods imports and import prices increase significantly after 2000 and they move together. Correlation in 1987-1999 between imports and import prices is –0,10. Sign and magnitude of the correlation between these variables change after 2000. Correlation increases to 0,98 in 2000-2006. Import prices rise mainly because of the increase in commodity prices due to global developments. Hence, contribution of the price increase is much higher than contribution of increase in quantity in the increase in imports. However, quantity change is also an important factor for Turkish economy due to increased dependence of production and exports to imports as

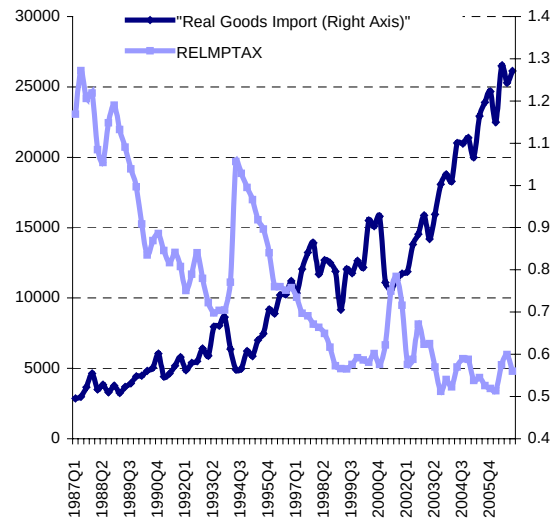
[9] Absorption and GDP including import taxes are also used as variables in the long run specification but the results were not preferable to the equations we presented.

documented by Yükseler and Turkan (2008) and Aydın et al (2007). Correlation between real goods import and relative tax adjusted import price is negative for the whole sample and also for 1987-1999 and 2000-2006 sub-samples which supports the view that this variable can serve as a relative price indicator.

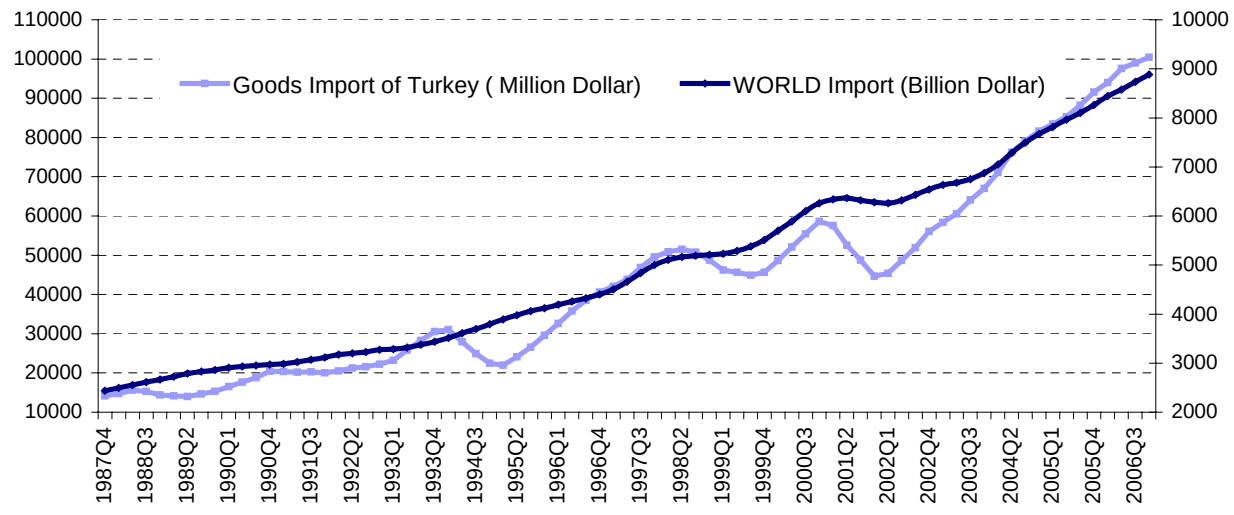
Graph VI.1 Goods Import (Million Dollar) and Import Prices



Graph VI.2 Real Goods Import (Million Dollar) and Tax Adjusted Relative Price of Imports



Graph VI.3 World Imports and Imports of Turkey (Real, Annualized)



There may be other important factors in addition to income and relative price which are common variables used in the literature. World import captures the effect of globalization on Turkish imports. As a result of globalization, importance of multinational firms in production has increased. These firms produce different parts (intermediate goods) of a final good in different countries and sell the final goods in the world. Foreign direct investment rises in the world as a result of the changing production schemes. As a result of these developments world trade increases and we prefer to use world trade rather than a time trend in our estimations (Graph VI.3).

Visual inspection of the Graph VI.4 shows that change in world trade and Turkish imports are more similar after 1997. The similarity is also evident in basic statistical tests. Period of change in the relation corresponds to the entry of Turkey to the customs union and start of inward processing regime. This can be interpreted as the increased integration of Turkish economy with the rest of the world. We look at the correlation as a first step in the analysis of the relation. Analysis of the year on year change in the real world imports and real Turkish imports shows that correlation is negative for 1988-1997 period (-.38) and positive and greater in absolute amount for 1997-2006 period (.72).

Graph VI.4 World Imports and Imports of Turkey (Annual Percentage Change, 1987 Dollars)

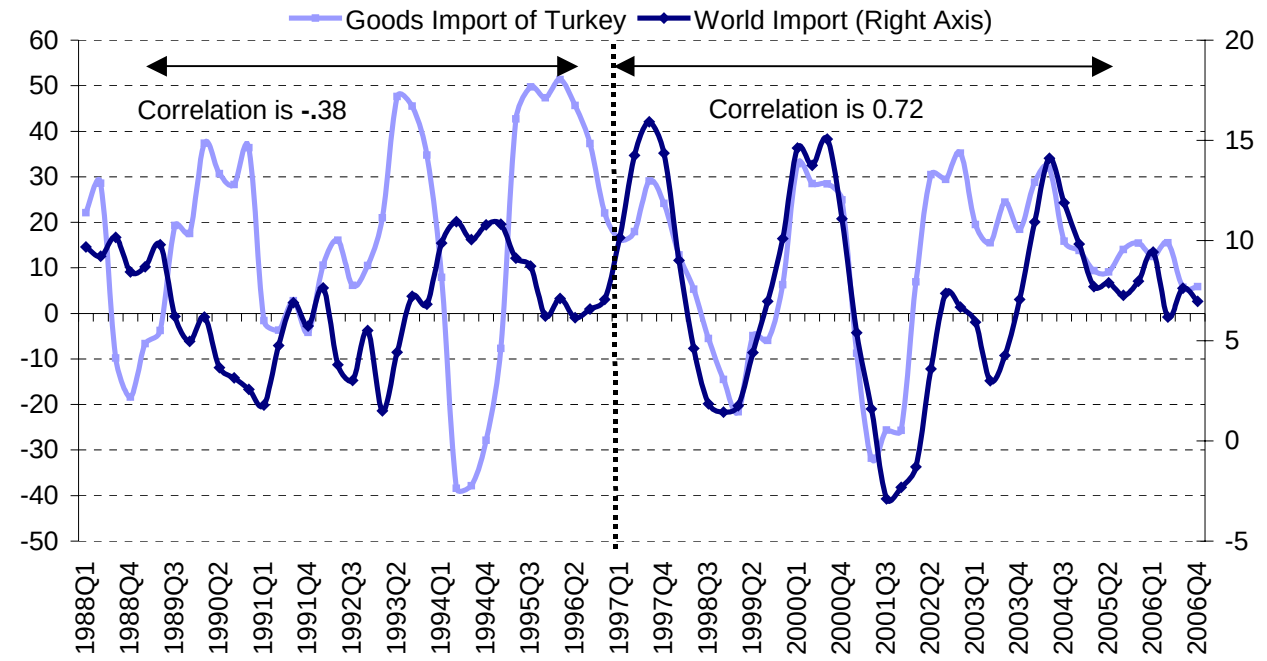


Table VI.1 Long Run Equations for Import

Least Squares Estimation for Import Function (MCIF)

Sample: 87Q1-06Q4

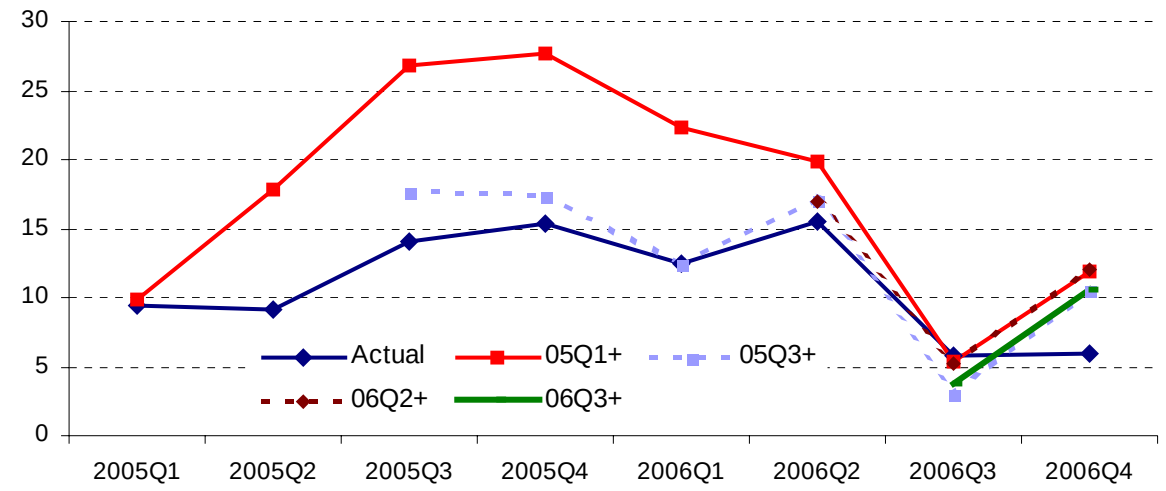
Newey-West HAC Standard Errors and Covariance (lag truncation=3)

	Coefficient			**t-Stat.**			**Probability**		
	I	**II**	**III**	**I**	**II**	**III**	**I**	**II**	**III**
Constant	-28.90	-22.53	-24.82	-12.64	-6.86	-5.70	0.00	0.00	0.00
GDP-Import Tax	2.209	1.673	1.830	16.33	7.237	6.077	0.000	0.000	0.000
Tax Adj. Rel. Import Prices	-0.441	-0.454	-	-4.015	-3.585	-	0.000	0.001	-
World Import Volume	-	0.406	0.390	-	3.459	2.505	-	0.001	0.015
DIRM	0.617	-	-	3.274	-	-	0.002	-	-
REER	-	-	0.466	-	-	2.524	-	-	0.014
Tax on Imports (TIM)	-	-	-1.279	-	-	-1.554	-	-	0.125

	I	**II**	**III**
Adjusted R-squared	0.98	0.982	0.978
F-statistic	644.01	708.34	499.89

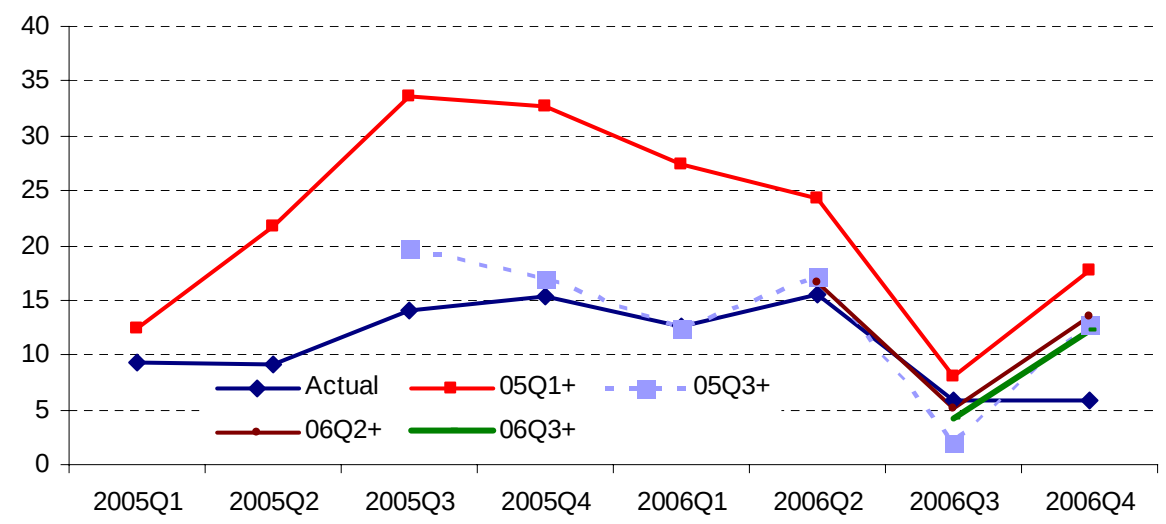
We present three long-run equations (Table VI.1). All three equations have final demand (GDP-import taxes) as a regressor. We used relative tax adjusted import prices as relative price variable in two of the equations. Real exchange rate and average tax rates on imports are used as another relative price variable in the third long-run equation. World import is used in two equations to capture effect of globalization. We used ratio of imports claimed under import processing regime to total imports as another variable that can capture changes in the foreign trade after 1996.

Graph VI.5. Out of Sample Forecast of Import-1
(Annual Percentage Change)



Note: 05Q1+ means, estimating model until 2004Q4 and getting out of sample forecasts after that period.

Graph VI.6. Out of Sample Forecast of Import-2
(Annual Percentage Change)



Note: 05Q1+ means, estimating model until 2004Q4 and getting out of sample forecasts after that period.

Out of three long run equations we present two short run equations, as the long run equation with real exchange rate did not perform well. In the first short run equation, we have volatility of nominal exchange rate in addition to the variables used in the long run. Second short run equation is based on the long run equation with final demand, relative price and world import as regressors. Coefficients, diagnostics tests (Table A.VI.1 and Table A.VI.2), residuals (Graph A.VI.1 and Graph A.VI.2) and within sample forecasts (Graph A.VI.3 and Graph A.VI.4) are presented in Appendix. Error correction term's coefficient is slightly higher in the second short run equation indicating a faster adjustment to the equilibrium.

In terms of root mean square error and mean absolute error, first equation has less error. Visual inspection signals that in a 6-quarter horizon we produce successful out of sample forecasts.

VII. CONCLUSION

This paper introduces foreign trade block of a macroeconometric model for Turkey. We estimated long run and short run equations for goods exports and goods imports. We try to get practical equations to be used for forecasting. There have been major changes in the post 1989 period, two of which are major events, namely increased integration with the world economy after 1996 and increased volumes of exports and imports after the last financial crisis in 2001.

We found that simple export and import equations that only include income and competitiveness indicator does not perform well in explaining both long and short run dynamics in the Turkish foreign trade figures. Couple of country specific factors as well as some general instability measures had to be included in order to deal with parameter instability and poor forecasting performance. In particular, we found IPR and Turkey's customs union with EU countries particularly significant determinants of trade. Turkey's trade with neighboring countries such as Iraq and Russia are also important variables that are subject to swift changes due to political instability in the region. Using a measure of economic instability e.g. CPI inflation volatility, also improved our forecasting performance. Similar to previous studies on Turkey, we did not find foreign exchange rate statistically significant but instead unit labor costs. Insensitivity of trade variables to exchange rates is puzzling to us, but as Aydin et al (2007) pointed out, increase in import dependence of exports may also explain why exports are not sensitive to exchange rates but its domestic costs. We also report increase in correlation between Turkish imports and world trade especially after 1996 customs union with EU which may indicate increased integration of the Turkish economy to the world economy.

Macroeconometric modeling is a continuous process. Every new data and results of new research that brings fresh perspective on the dynamics will help to improve the model. We used 1987-based GDP series. After we completed the estimations, 1998 based GDP figures became available. As a further research agenda, we will adjust our work with new GDP series.

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APPENDIX

Graph A.I.1. Structure of the Quarterly Macroeconometric Model of the Turkey

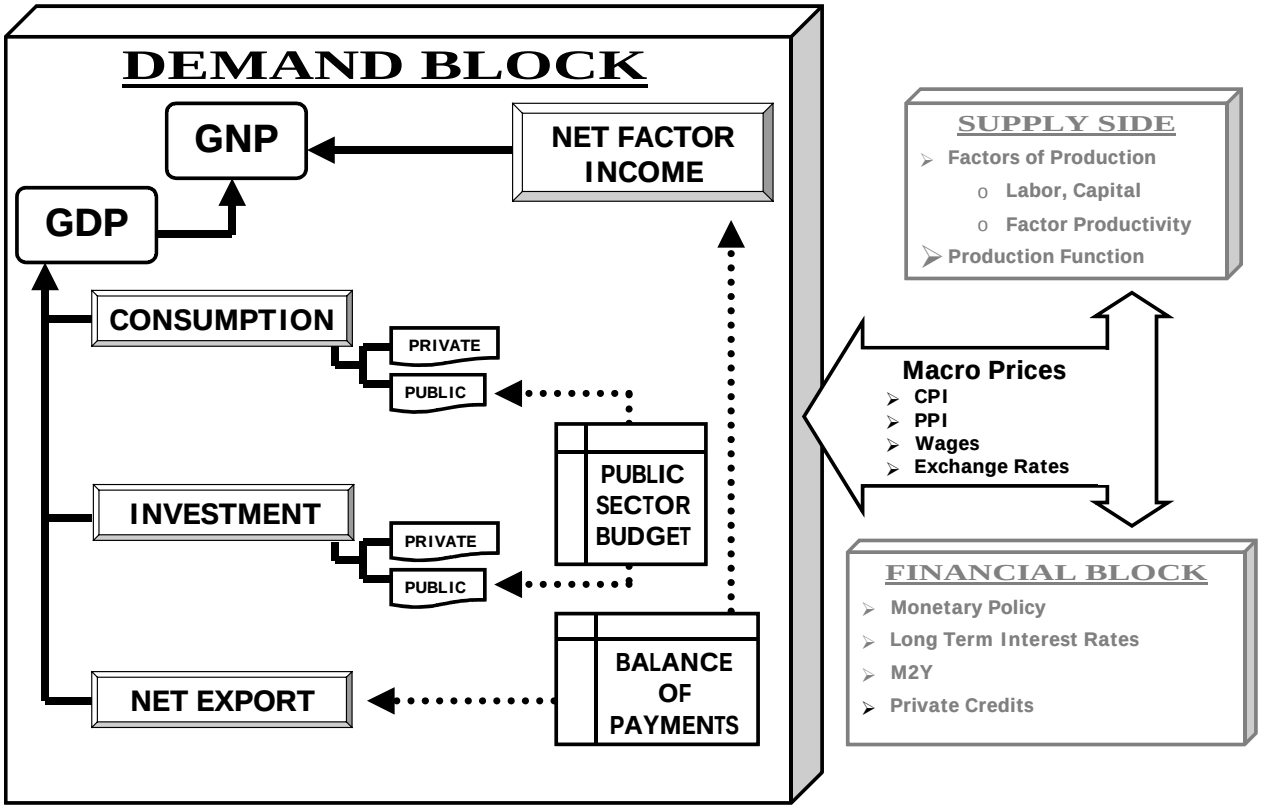


Table A.III.1 Unit Root Tests for Long-Run Variables of Export Equation (Mac-Kinnon (1996)One Sided p-Values)					
Variable in Export Long Run Equation		4th Lag	3rd Lag	2nd Lag	1st Lag
Potential Industrial Production	Level	1.00	1.00	1.00	1.00
	First Difference	0.99	0.88	0.94	0.00
	Second Difference	0.01	0.00	0.02	0.00
Real Unit Labor Cost	Level	0.84	0.92	0.95	0.94
	First Difference	0.18	0.03	0.00	0.00
Volatility of CPI	Level	0.99	0.96	0.89	0.67
	First Difference	0.13	0.00	0.00	0.00
Import Price Index	Level	0.74	0.88	0.90	0.85
	First Difference	0.01	0.02	0.00	0.00
OECD Income	Level	1.00	1.00	0.99	0.99
	First Difference	0.05	0.01	0.00	0.00

Table A.III.2 Unit Root Tests for Long-Run Variables of Import Equation (Mac-Kinnon (1996)One Sided p-Values)					
Variable in Import Long Run		4th Lag	3rd Lag	2nd Lag	1st Lag
Final Demand	Level	0.99	1.00	0.54	0.00
	First Difference	0.00	0.01	0.00	0.00
Relative Tax Adjusted Price	Level	0.43	0.15	0.26	0.10
	First Difference	0.00	0.00	0.00	0.00
World Import	Level	1.00	1.00	1.00	1.00
	First Difference	0.01	0.10	0.00	0.00
Inward Processing Regime Ratio	Level	0.70	0.79	0.75	0.59
	First Difference	0.08	0.00	0.00	0.00
Real Exchange Rate	Level	0.86	0.70	0.61	0.31
	First Difference	0.00	0.00	0.00	0.00
TIM	Level	0.75	0.75	0.75	0.56
	First Difference	0.02	0.00	0.00	0.00

Table A.III.3 Data Used at the Estimation of Exports			
Variable Code	*Description*	*Source**	*Explanation*
PX	Export Prices of Turkey	TURKSTAT	
PM	Import Prices of Turkey	TURKSTAT	
PMIND	Import Prices of Industrialized Countries	IMF-IFS	
YOECD	OECD GDP	IMF-IFS	
IMPIND	Industrial Countries' Import	IMF-IFS	
POTIND	Potential Industrial Production	TURKSTAT, Own Calculations	HP trend of industrial production index
WIMP	World Import	IMF-IFS	
REERCPI	CPI Based Real Exchange Rate	CBRT-EDDS	Increase means appreciation of the domestic currency.
REERPPI	PPI Based Real Exchange Rate	CBRT-EDDS	Increase means appreciation of the domestic currency.
RULC	Real Unit Labor Cost	TURKSTAT	(Nominal Wages in Manufacturing/(CPI))/Productivity
CPIVOL	Volatility of CPI	TURKSTAT	
$/Euro	Dollar/Euro Parity	CBRT-EDDS	
DIRX	Share of Claimed Inward Processing Exports in Total Exports	Undersecretariat of Foreign Trade	
CU	Capacity Utilization	TURKSTAT	
EXPRUS	Exports to Russia	TURKSTAT	Share of exports to Russia in total exports.
EXPIRQ	Exports to Iraq	TURKSTAT	Share of exports to Iraq in total exports.
*: TURKSTAT: Official Statistics www.tuik.gov.tr/ CBRT-EDDS: Central Bank of Turkey-Electronic Data Distribution System www.tcmb.gov.tr/ IMF-IFS:			

Table A.III.4 Data Used at the Estimation of Imports			
Variable Code	*Description*	*Source**	*Explanation*
PM	Import Prices of Turkey	TURKSTAT	
RELPMTAX	Relative Tax Adjusted Import Prices	TURKSTAT	Import Prices *(1+Average Import Tax Rate)*Exchange Rate/CPI
WORLDM	World Imports	IMF-IFS	
Y	Gross Domestic Product	TURKSTAT	At 1987 Prices and at 1987 Dollars
YTAX	Gross Domestic Product minus Import Taxes	TURKSTAT	At 1987 Prices and at 1987 Dollars. GDP-Import Tax
ABS	Absorption	TURKSTAT	Consumption+Investment
IPI	Industrial Production Index	TURKSTAT	1997=100
TIM	Tax on Imports	TURKSTAT	Import Tax Revenue/GDP (at current prices)
REERPPI	PPI Based Real Exchange Rate	CBRT-EDDS	Increase means appreciation of the domestic currency.
REERCPI	CPI Based Real Exchange Rate	CBRT-EDDS	Increase means appreciation of the domestic currency.
DIRM	Inward Processing Regime Imports	Undersecretariat of Foreign Trade	Claimed Imports Under Import Processing Regime/Total Imports
EVOL	Volatility of Nominal Exchange Rate	CBRT-EDDS	Standard Deviation of Exchange Rate for a Quarter/Mean of the Exchange Rate
CU	Capacity Utilization	TURKSTAT	

*: TURKSTAT: Official Statistics www.tuik.gov.tr/
CBRT-EDDS: Central Bank of Turkey-Electronic Data Distribution System www.tcmb.gov.tr/
IMF-IFS:

Table A.IV.1	Macroeconometric Literature on Exports and Imports	
Country	Export	Import
Brazil	World Imports Real Exchange Rate Export Price	GDP
Macedonia	World Trade Export Price World Export Price Imports	GDP Import Deflator/GDP Deflator
Chile	Trading Partner's GDP Real Exchange Rate GDP	
Thailand	Trading Partner's GDP Export Price/US CPI Exchange Rate	Domestic Demand Exports Import Price/GDP Deflator
Bundesbank		Final Demand Demand Deflator/Import Deflator
FED	Foreign GDP Real Exchange Rate	GDP Relative Price of Import
Bank of England	World Trade Export Price/World Export Price	Income Relative Prices
ECB	World Demand Competitiveness	Final Demand Weighted by Import Content GDP Deflator Import Deflator
Spain	World Demand Competitiveness	Final Demand Weighted by Import Content Competitiveness
France	World Demand Competitiveness	Final Demand Weighted by Import Content Competitiveness Time Drift Capacity Utilization
Portugal	World Demand Competitiveness Private Consumption	Final Demand Weighted by Import Content Relative Prices
Italy	World Demand Competitiveness Output Gap	Final Demand Weighted by Import Content Competitiveness
Belgium	Export Markets Competitiveness Capacity Utilization	Final Demand Weighted by Import Content Competitiveness

Table A.V.1 Short Run Equation of Export Function-1

Least Squares Equation for Export Function-I

Sample: 89Q3–06 Q4

Newey-West HAC Standard Errors and Covariance (lag truncation=3)

	Coefficient	t-Statistic	Probability
Constant	0.256	1.925	0.060
Δ XFOB $_{t-1}$	-0.202	-2.751	0.008
Δ XFOB $_{t-2}$	-0.346	-3.266	0.002
Δ XFOB $_{t-4}$	0.314	3.604	0.001
Δ XFOB $_{t-7}$	-0.251	-4.554	0.000
Δ Real Unit Labor Cost	-0.298	-5.055	0.000
Δ REER	-0.234	-2.564	0.013
Δ Import Price Index $_{t-4}$	-0.482	-3.444	0.001
Capacity Utilization	0.877	1.882	0.066
Capacity Utilization $_{t-1}$	-1.179	-2.397	0.020
CPI Volatility $_{t-2}$	-0.247	-3.535	0.001
CPI Volatility $_{t-3}$	0.214	2.568	0.013
ECM $_{t-1}$	-0.457	-5.290	0.000

Diagnostics	
Adjusted R-squared	0.924
F-statistic	49.710
Residual Tests	**Probability**
Normality Test (Jarque-Bera)	0.87
Ramsey's RESET (h=1)	0.54
Breusch-Godfrey LM Test (lag 1)	0.42
Breusch-Godfrey LM Test (lag 5)	0.72
ARCH (lag 1)	0.47
ARCH (lag 4)	0.95
White Heteroskedasticity Test	0.83
Stability Tests	**outside error bands**
CUSUM	None
CUSUM Squares	03Q2-04Q1

Table A.V.2 Short Run Equation of Export Function-2

Least Squares Equation for Export Function-II

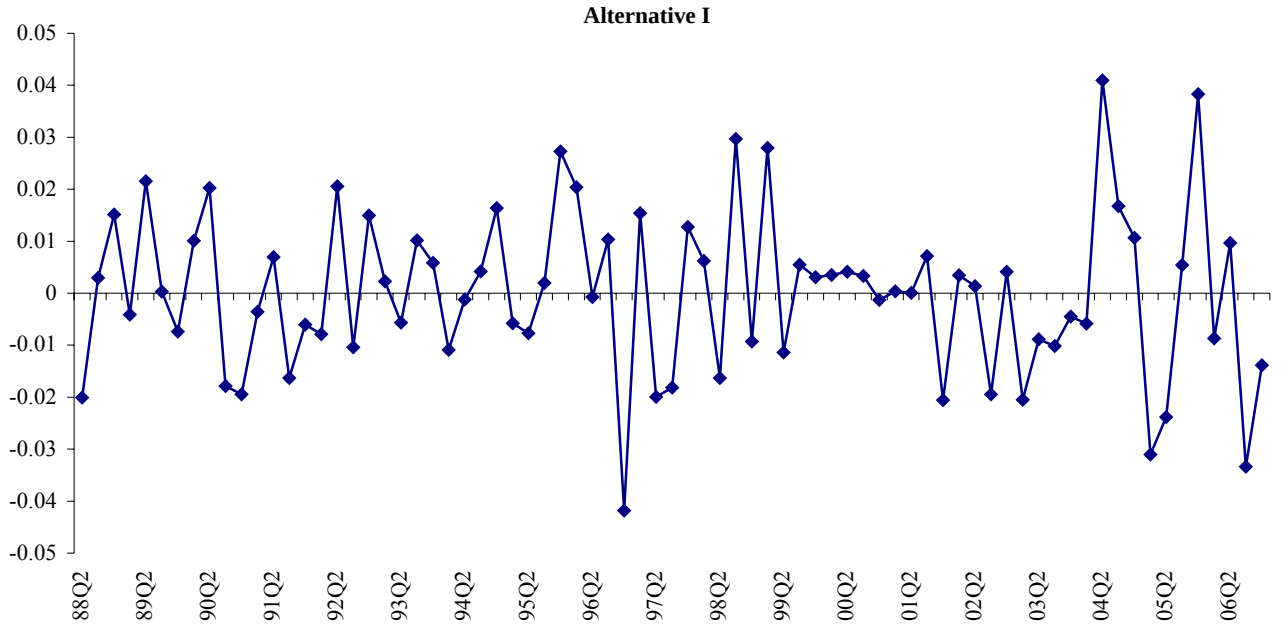
Sample: 89Q3–06 Q4

Newey-West HAC Standard Errors and Covariance (lag truncation=3)

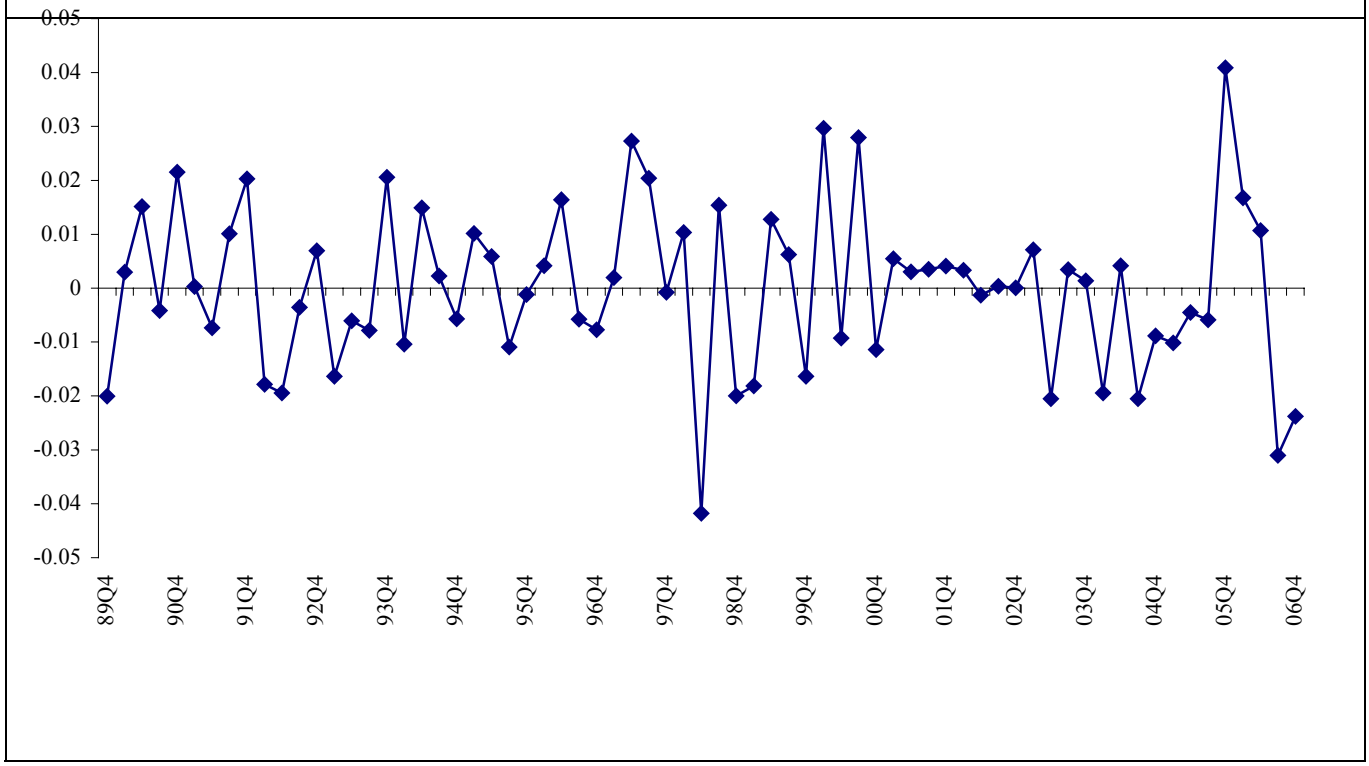
	Coefficient	**t-Statistic**	**Probability**
Constant	0.170	0.998	0.323
Δ XFOB $_{t-1}$	-0.207	-1.857	0.069
Δ XFOB $_{t-2}$	-0.295	-2.148	0.037
Δ XFOB $_{t-4}$	0.343	3.256	0.002
Δ XFOB $_{t-7}$	-0.285	-3.732	0.001
Δ Real Unit Labor Cost	-0.356	-5.351	0.000
Δ REER	-0.277	-2.486	0.016
Δ Import Price Index $_{t-4}$	-0.470	-3.713	0.005
Capacity Utilization	0.924	1.960	0.055
Capacity Utilization $_{t-1}$	-1.097	-2.074	0.043
CPI Volatility $_{t-2}$	-0.133	-2.477	0.017
Iraq+Russia	0.830	2.170	0.035
DIRX	0.173	1.807	0.077
ECM $_{t-1}$	-0.408	-3.288	0.017

Diagnostics	
Adjusted R-squared	0,912
F-statistic	40,744
Residual Tests	**Probability**
Normality Test (Jarque-Bera)	0,56
Ramsey's RESET (h=1)	0,26
Breusch-Godfrey LM Test (lag 1)	0,17
Breusch-Godfrey LM Test (lag 5)	0,40
ARCH (lag 1)	0,12
ARCH (lag 4)	0,41
White Heteroskedasticity Test	0,26
Stability Tests	**outside error bands**
CUSUM	None
CUSUM Squares	None

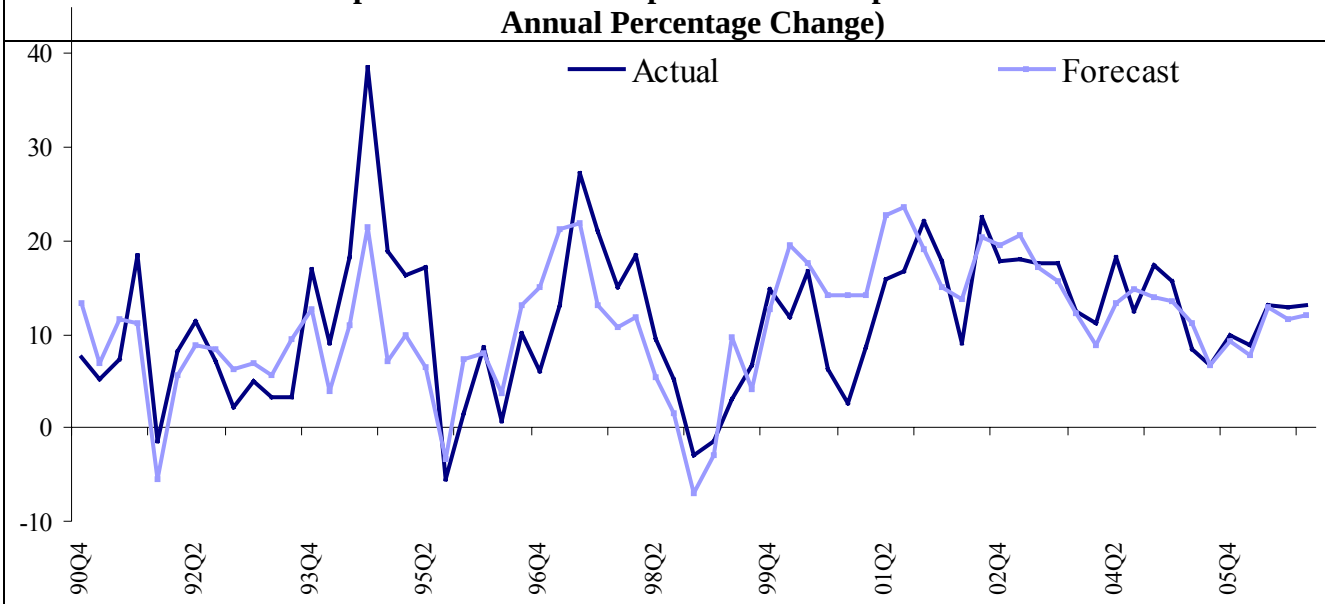
Graph A.V.1 Residuals of the First Short Run Export Equation



Graph A.V.2 Residuals of the Second Short Run Export Equation

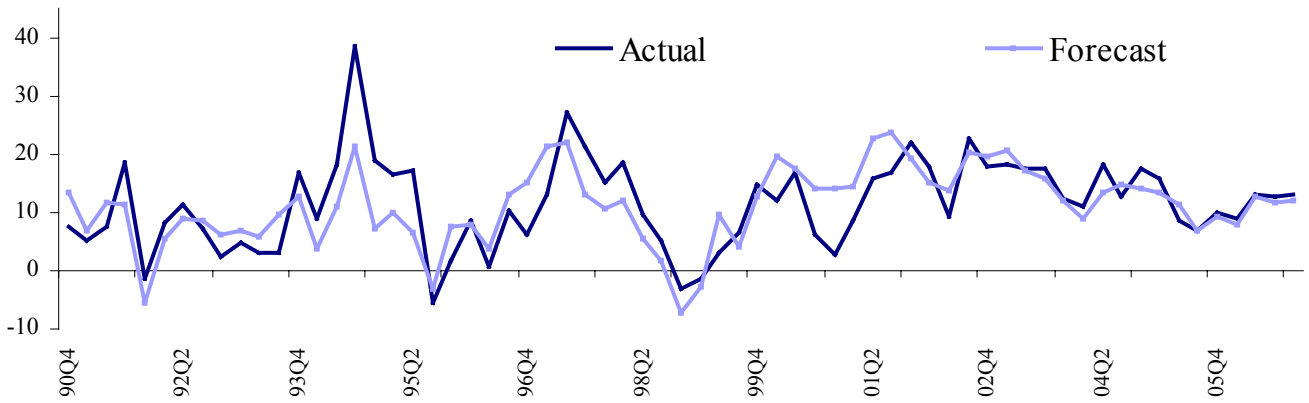


Graph A.V.3 Within Sample Forecasts Export Function-1
Annual Percentage Change)



Root Mean Square Error: 286.73
Mean Absolute Error: 232.17

Graph A.V.4 Within Sample Forecasts Export Function-2
(Annual Percentage Change)



Root Mean Square Error: 342.79
Mean Absolute Error: 260.67

Table A.VI.1 Short Run Equation of Import Function-1

Least Squares Equation for Import Function-I

Sample: 88Q2–06 Q4

Newey-West HAC Standard Errors and Covariance (lag truncation=3)

	Coefficient	**t-Statistic**	**Probability**
Constant	-0.056	-0.945	0.349
Δ MCIF $_{t-2}$	0.186	1.976	0.053
Δ (GDP-Import Tax)	1.306	5.417	0.000
Δ (GDP-Import Tax) $_{t-1}$	0.749	5.286	0.000
Δ (GDP-Import Tax) $_{t-2}$	0.377	2.174	0.034
Δ (GDP-Import Tax) $_{t-4}$	-0.541	-2.328	0.023
Δ Tax Adj. Real Import Prices	-0.450	-4.589	0.000
Δ DIRM	0.504	4.085	0.000
Δ DIRM $_{t-2}$	0.378	2.233	0.029
Δ DIRM $_{t-3}$	0.331	1.748	0.086
Exchange Rate Volatility	-0.622	-2.683	0.010
Exchange Rate Volatility $_{t-2}$	0.777	2.944	0.005
Exchange Rate Volatility $_{t-4}$	-0.850	-3.618	0.001
ECM $_{t-1}$	-0.462	-4.611	0.000

Diagnostics	
Adjusted R-squared	0.859
F-statistic	29.151
Residual Tests	**Probability**
Normality Test (Jarque-Bera)	0.62
Ramsey's RESET (h=1)	0.22
Breusch-Godfrey LM Test (lag 1)	0.54
Breusch-Godfrey LM Test (lag 5)	0.24
ARCH (lag 1)	0.23
ARCH (lag 4)	0.38
White Heteroskedasticity Test	0.75
Stability Tests	**outside error bands**
CUSUM	None
CUSUM Squares	99Q1-00Q3

Table A.VI.2 Short Run Equation of Import Function-2

Least Squares Equation for Import Function-II

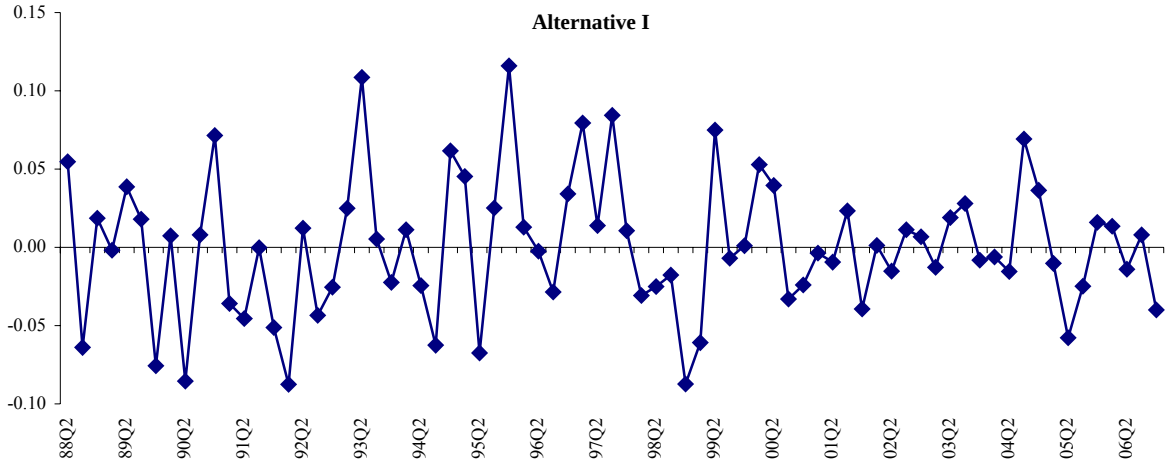
Sample: 88Q2–06 Q4

Newey-West HAC Standard Errors and Covariance (lag truncation=3)

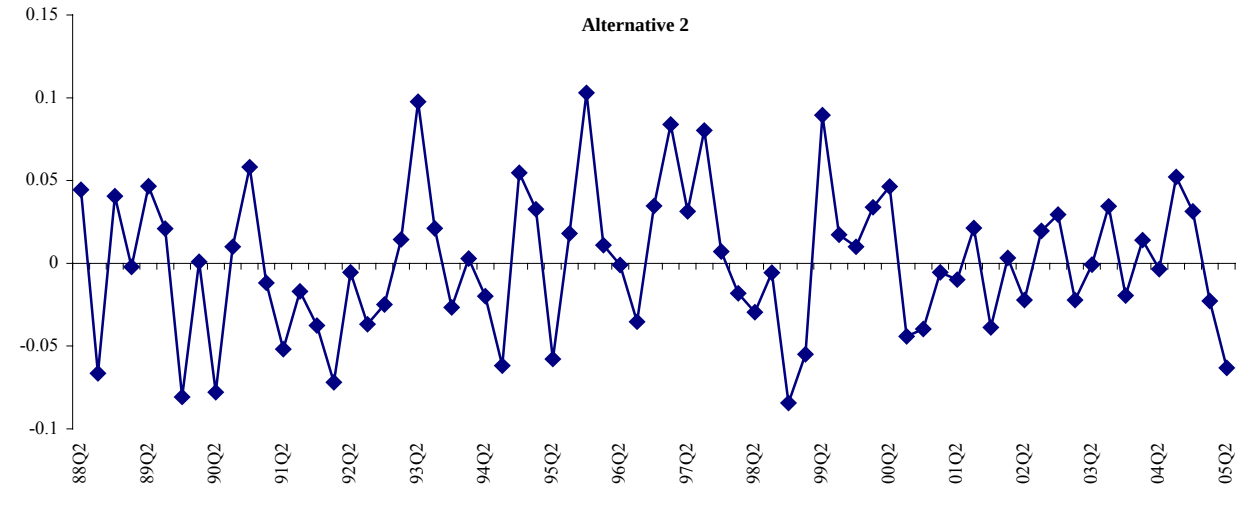
	Coefficient	t-Stat.	Probability
Constant	-0,069	-0,978	0,332
Δ MCIF $_{t-2}$	0,216	2,306	0,053
Δ MCIF $_{t-3}$	0,135	1,640	0,107
Δ (GDP-Import Tax)	1,256	5,216	0,000
Δ (GDP-Import Tax) $_{t-1}$	0,783	4,775	0,000
Δ (GDP-Import Tax) $_{t-2}$	0,416	2,477	0,016
Δ (GDP-Import Tax) $_{t-4}$	-0,568	-2,548	0,014
Δ Tax Adj. Real Import Prices	-0,496	-4,990	0,000
Δ (Tax Adj. Real Import Prices) $_{t-3}$	0,210	1,694	0,096
Δ DIRM	0,550	4,003	0,000
Δ DIRM $_{t-2}$	0,447	2,815	0,007
Δ DIRM $_{t-3}$	0,398	2,070	0,043
Exchange Rate Volatility	-0,731	-3,215	0,002
Exchange Rate Volatility $_{t-2}$	0,905	3,122	0,003
Exchange Rate Volatility $_{t-4}$	-1,029	-4,070	0,000
ECM $_{t-1}$	-0,520	-4,278	0,000

Diagnostics	
Adjusted R-squared	0.863
F-statistic	26.880
Residual Tests	**Probability**
Normality Test (Jarque-Bera)	0.71
Ramsey's RESET (h=1)	0.30
Breusch-Godfrey LM Test (lag 1)	0.32
Breusch-Godfrey LM Test (lag 5)	0.56
ARCH (lag 1)	0.12
ARCH (lag 4)	0.07
White Heteroskedasticity Test	0.64
Stability Tests	**outside error bands**
CUSUM	None
CUSUM Squares	99Q2-00Q2

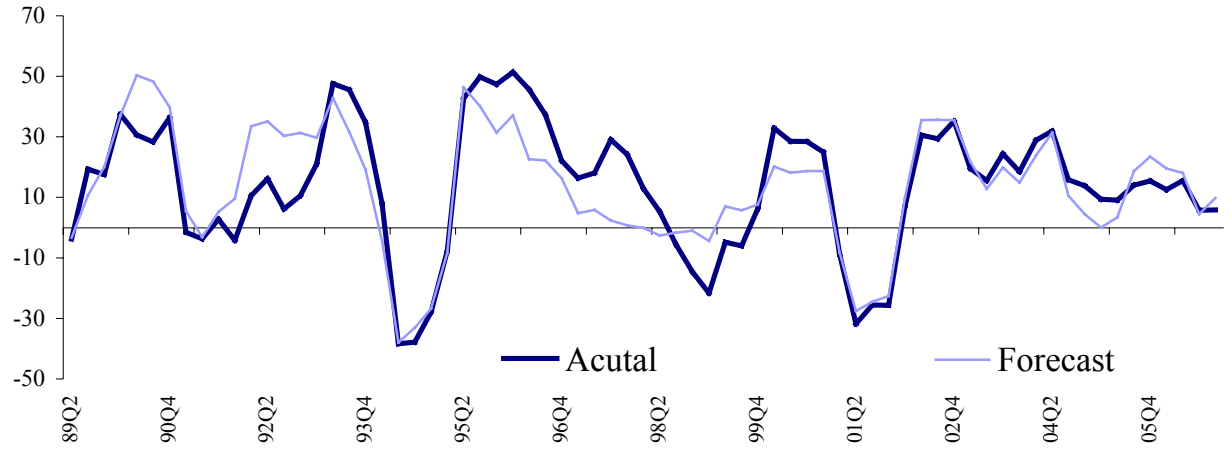
Graph A.VI.1 Residuals of the First Short Run Import Equation



Graph A.VI.2 Residuals of the Second Short Run Import Equation

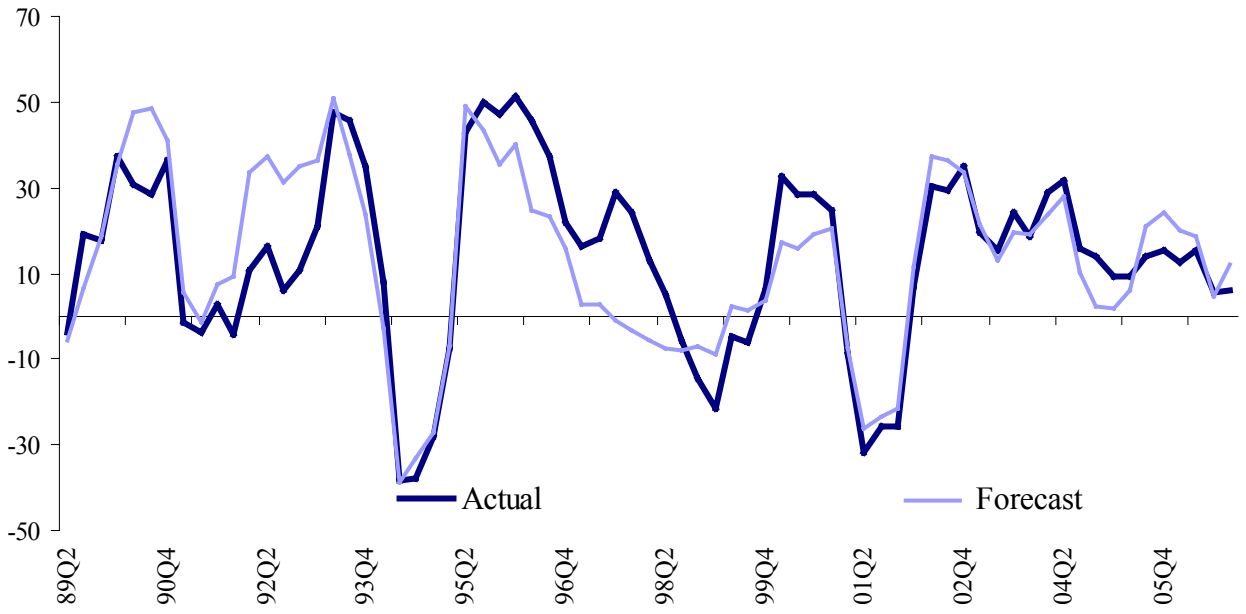


Graph A.VI.3 Within Sample Forecasts Import Function-1
(Annual Percentage Change)



Root Mean Square Error: 1092.,97
Mean Absolute Error: 842.39

Graph A.VI.4 Within Sample Forecasts Import Function-2
(Annual Percentage Change)



Root Mean Square Error:1455.82
Mean Absolute Error:1209.04