REAL EXCHANGE RATE AND ECONOMIC GROWTH: TURKEY[1]

Instructor Erginbay UĞURLU
Hitit University Faculty of Economics and Administrative Sciences
E-mail: erginbayugurlu@hitit.edu.tr

Abstract

This paper assesses the relationship with real exchange rate and growth using quarterly data of 1989:Q1-2005:Q2. Two groups of models are used in the study that is held. The first model, which was considered as the core model RER, PPI, and GDP, are involved whereas import and export are added on former variables in the expanded model. Integration level of the variables are investigated using with DF, PP, KPSS, Ng-Perron Tests and according to the test results, it is decided that all series are first order integrated. The empirical analysis is started with the application of bivariate data analysis held for RER and GDP variables to study the relationship between them. RER and GDP series are used together with different transformations of these series and seasonally adjusted version of these series are used so that cross correlation values of these variables are calculated as full sample and for a sub-sample. The attained results showed that 1989:Q1-2001:Q3 sub-sample and full sample had differentiations in values and in terms of statistically significance. Using Johansen Cointegration Test this paper finds evidence that one cointegration vector based on two groups of variables. Vector Error Correction Models were estimated that incorporates the long run behavior variables and short run adjustment dynamics for both two models. For both of these models Impulse-Response Functions and Variance Decomposition Analysis studied. Formed impulse-response functions, a positive RER shock increases GDP in the core model for the first three periods but then decreases. In the other model on the other hand, it increases during the first four periods and after the observed decrease it continues its movement in the seasonal fashion. Before Variance Decomposition is started, series are aligned by using Block Exogeneity Test the alignment of the series in the model effects the results of this analysis. Impulse-response functions shows that the positive RER shock increases GDP in the core model for the first three periods but then decreases successor periods. In Variance Decomposition Analysis, it is evident that the sources of variance in output are the own shocks and also observed that RER's explanatory ratio on GDP does not disappear in the long run.

Key words: Real Exchange Rate, Economic Growth, Vector Error Correction, Turkey.

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REEL DÖVİZ KURU VE EKONOMİK BÜYÜME: TÜRKİYE

Özet

Bu çalışma Türkiye için reel döviz kuru ve büyüme arasındaki ilişkiyi üç aylık 1989:Q1-2005:Q2 verileri kullanarak araştırmaktadır. Çalışmada iki grup değişken kullanılmıştır. Çekirdek model olarak adlandırılan model RDK, ÜFE ve GSYİH değişkenlerinde oluşturulurken, genişletilmiş model dışalım ve dışsatım önceki değişkenlere eklenerek oluşturulmuştur. Serilerin durağanlıkları DF, PP, KPSS, Ng-Perron testleri kullanılarak incelenmiş ve birinci dereceden bütünleşen oldukları sonucuna varılmıştır. Görgül uygulamaya RDK ve GSYİH değişkenleri arasındaki ilişkiyi araştıran iki değişkenli analiz ile başlandı. RDK ve GSYİH serileri, değişkenlerinin farklı dönüşümleri ve bu serilerin mevsimsel düzeltilmiş hallerinin farklı dönüşümleriyle bu analizde tüm dönem ve alt dönem için kullanıldı. Elde edilen sonuçlar 1989:Q1-2001:Q3 alt döneminin istatistiksel anlamlılık açısından tüm dönemden farklılaştığını gösterdi. Johansen Eşbütünleşme Testi uygulanarak yapılan uzun dönemli ilişki araştırmasında iki grupta da tek eşbütünleşen vektör olduğu bulundu. Uzun dönemli ilişkinin ve kısa dönem düzeltme dinamiklerinin belirlenmesi için Vektör Hata Düzeltme Modelleri her iki model için tahmin edildi. Bu modeller için Etki-Tepki Fonksiyonları ve Varyans Ayrıştırması Analizleri uygulandı. Birinci etki-tepki fonksiyonunda çekirdek modeldeki pozitif RDK'daki şokla ilk üç dönemde GSYİH'nın artmakta ardından azalmaktadır. Varyans Ayrıştırma Analizi'ne başlanmadan önce serilerin diziliminin sonucu etkilemesinden DOLAYI seriler Blok Dışsallık Testi kullanarak sıralandı Diğer modelde ise ilk dört dönemde artış görülürken daha sonra azaldığı ve mevsimsel bir görünümle devam ettiği görülmektedir. Varyans ayrıştırması Analizi üretimin değişkenliğinin kaynağının kendi şokları olduğunu ve RDK'nın GSYİH'yı açıklama oranının uzun dönemde kaybolmadığı gözlemlendi.

Anahtar sözcükler: Reel Döviz Kuru, Ekonomik Büyüme, Vektör Hata Düzeltme, Türkiye.

1. Introduction

Exchange rate management is one of the most important challenges for developing countries. This issue is most often framed as a choice between fixed and flexible exchange rates or maintenance of an exchange rate regime. The classical wisdom, the real depreciations are contractionary and discouraging imports in favor of domestically produced goods, and subsequently increase output.

Turkey has experienced two major economic crises in 1994 and 2001. The first one that surprisingly attracted very limited international interest occurred at the beginning of 1994, the second crisis is more severe as the Turkish currency lost more than half of its original value. After these crises the nominal domestic currency depreciated 62% and 53% respectively, such as large devaluations or high levels of depreciation in domestic currency were experienced after both the 1994 and the 2001 crises. The 2001 crisis was probably caused by dollarization and weaknesses in the banking system during these two crises the major economic problem had been inflation, and many stabilization programs had been implemented.

The mentioned crises have similar effects which caused huge exchange rate depreciation, output declines and high interest rates. Because the fact that this paper assesses effects of real exchange rate on the economic growth of Turkey by considering quarterly data from 1989: Q1 to 2005: Q2.

Kamin and Rogers (2000), Berument and Pasaogullari (2003) testing the contractionary devaluation hypothesis focus on Mexico and Turkey respectively. This study mainly uses the method proposed by these two papers which found empirical evidence for contractionary devaluation for investigated countries by analyzing the output and inflation response to real exchange rate movements.

This study allows us to observe the effect of real exchange rate movements on import and export of Turkey that RER depends on them according to macroeconomic models which defined in section two, theoretical framework. Another importance of this study is that investigated long-run relationship of RER and GDP. This study shows that real devaluation is contractionary effect on output for Turkey although the capital account regime is liberalized.

There is little theoretical consensus on how inflation affects economic performance. Much of the empirical literature looks for a negative influence of inflation on growth. Apart from the effect of trend inflation, inflation uncertainty may also influence output growth. This paper does not take into account the potential existence of Balassa-Samuelson effect, RER misalignment or PPP. These are beyond the scope of this paper.

This rest of the paper is organized as follows. Section 2 contains a brief review of the real exchange rate measurement, macroeconomic importance of the real exchange rate and historical analysis of exchange rate movements in Turkey. Section 3 reviews the existing literature on real exchange rate on economic growth. Section 4 presents the empirical results and finally section 5 concludes.

2. Real Exchange Rate and Theoretical Framework

The nominal exchange rate is the rate at which a person can trade the currency of one country for the currency of another. The real exchange rate (RER) is the relative price of the goods of two countries. That is, the real exchange rate tells us the rate at which we can trade the goods of one country for the goods of another. The real exchange rate is sometimes called the terms of trade and rate can be defined as the nominal exchange rate that takes the inflation differentials among the countries into account. RER[2] is calculated as:

$$RER = \frac{eP^*}{P} \tag{2.1}$$

In this definition, P, P* and e are for the domestic and international prices nominal exchange rate respectively. Thus, the real exchange rate depends on the nominal exchange rate and on the prices of goods in the two countries measured in the local currencies. If the real exchange rate is high, foreign goods are relatively cheap, and domestic goods are relatively expensive. If the real exchange rate is low, foreign goods are relatively expensive, and domestic goods are relatively cheap. In practical usage, there are many foreign currencies and price level values to take into consideration. Correspondingly, the model calculations become increasingly more complex.

[2] The various definitions of the real exchange rate. See Kipici and Kesriyeli 1997.

2.1. Theoretical Framework

A famous hypothesis in economics, called the law of one price, states that the same good cannot sell for different prices in different locations at the same time, namely purchasing-power parity (PPP). Although the doctrine of purchasing-power parity does not describe the world perfectly, it does provide a reason why movement in the real exchange rate will be limited. There is much validity to its underlying logic: the farther the real exchange rate drifts from the level predicted by purchasing-power parity, the greater the incentive for individuals to engage in international arbitrage in goods. Although we cannot rely on purchasing-power parity to eliminate all changes in the real exchange rate, this doctrine does provide a reason to expect that fluctuations in the real exchange rate will typically be small or temporary.

Second hypothesis in economics about exchange rate is Marshall-Lerner Condition. The condition says that, for a currency devaluation to have a positive impact in trade balance, the sum of price elasticity of exports and imports (in absolute value) must be greater than one. As a devaluation of the exchange rate means a reduction on price of exports, demand for these will increase. At the same time, price of imports will rise and their demands diminish. Given the export elasticity e_X , and import elasticity e_M, the inequality above can be written as follows:

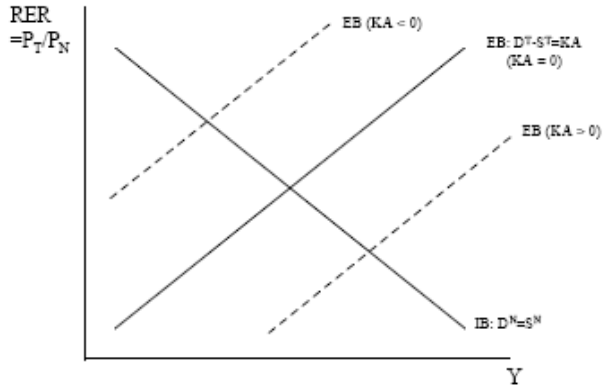
$$(e_X + e_M - 1)>0 \quad \text{or} \quad (e_X + e_M) > 1 \tag{2.2}$$

In the textbook open economy macro model, real depreciations are growth enhancing. They stimulate the external demand for a country's exports and increase the internal demand for the country's products relative to imported goods. The leading theory is Balassa- Samuelson[3] hypothesis (Balassa, 1964; Samuelson, 1963). It is argued that the traded goods sector has a higher productivity growth than the non-traded goods sector. Therefore the relative slower rate of growth in the non-traded goods sector result in higher relative non-traded goods prices.

The diagram of ''Salter–Swann'' presented in Kamin and Rogers (2000) is called a useful heuristic device to sort out the various factors underlying the observed relationship between real exchange rates and output in Mexico. In figure 1 real exchange rate is plotted against the level of real income in a small open economy. The internal balance curve IB represents the locus of points in which the supply of non-traded goods is equal to its demand. The external balance curve EB represents combinations of real exchange rates and income that equate the trade deficit with the capital account surplus.

[3] The Balassa-Samuelson hypothesis assumes that purchasing power parity holds for the market of traded goods, but that ratio of prices of traded and non-traded goods may evolve differently in one country than in another, as productivity in poorer countries grows faster in the traded-goods sector than in the nontraded goods sector. In poor economies is primarily due to productivity growth in the tradable goods sector where prices tend to be equal across all countries.

Figure 1: Salter-Swan Diagram



Increases in income raise the demand for non-traded, thereby raising their price relative to that of traded goods and appreciating the real exchange rate along the IB curve. The real exchange rate that used the scheme represents the ratio of traded to non-traded prices. For a given capital account, increases in income expand the demand for traded and require an offsetting depreciation of the real exchange rate to keep the trade balance constant. Increases in the capital account surplus allow the economy to run larger trade deficits and shift the EB curve to the right and vice versa.

2.2 Historical Analysis of Exchange Rate Movements in Turkey

The period since the late 1980's is characterized by increasing inflation and several stabilization programs. Nominal anchoring and monetary tightening were used in these programs without any serious effort to reduce the public sector borrowing requirement. In 1989, Turkey applied to the IMF for the full convertibility of the Turkish and the capital account was fully liberalized. The initial effect of the liberalization of the capital account was a rapid capital inflow to the Turkish economy. The Gulf Crisis created uncertainties about the exchange rate and The Central Bank of the Republic of Turkey (CBRT) aimed at keeping these uncertainties to minimum levels. However, the real exchange rate depreciated 8.3% in 1991. In 1992, the exchange rate policy was quite different from the 1989-1990 period and CBRT did not allow the exchange rate to appreciate in real terms. The exchange rate basket (1 US dollar + 1.5 Deutsche Mark) depreciated by 1.4% in 1992. In 1993, the real exchange rate did not appreciate much and stayed approximately around the same level during the year, but at the end of 1993 there was a 19% appreciation of Turkish Lira (TRL) stemming from the 1989-1990 period. By the end of 1994, about 50 percent of the total deposit base was held in the form of foreign-currency deposits, up from 1 percent in 1993. The downgrading by credit-rating agencies and a lack of confidence in the government's budget deficit target of 14 percent of GDP for 1994 triggered large-scale capital flight and the collapse of the exchange.

After the general elections, and the earthquakes of 1999, the fiscal balance deteriorated. In December of 1999, a stand-by agreement was signed with the IMF with the crawling

peg regime being the major disinflation tool. In this year an overvalued exchange rate and high real interest rates were still a problem in terms of causing increased imports.

From January 2 of 2000 to February 22 of 2001, the CBRT publicly announced the daily quotations of the nominal exchange rates every morning and committed itself to intervene in the exchange rate market. With the 2000 Disinflation Program, a crawling peg regime in the exchange rate policy was adopted starting on January 2, 2000. The 2000 Disinflation Program was an exchange rate-based disinflation strategy with prudent fiscal measures and an ambitious structural reform agenda. The CBRT announced the path of the nominal exchange rate basket (1 US dollar + 0.77 Euro) on a sliding 12-month scale every three months.

In 2002 and 2003 high growth rate attained along with the declining inflation. Achievement of inflation target, the quality of inflation target as a reliable nominal anchor has improved for 2004 and later. The downward trend in inflation continued in 2005, albeit at a lower pace compared with the preceding four years. However, inflation expectations maintained their favorable course under the cautious stance of monetary policy and budget discipline. CBRT adopted an inflation targeting regime starting in January 2006. The Inflation Report is one of the main communication tools of the Monetary Policy Committee (MPC) under the new regime.

3. Previous Empirical Studies

Generally there are many empirical studies investigating the effect of changes in the real exchange rate on output. Specifically in Turkish economy least squares analyses and VAR models have been used previously to investigate empirically the effects of the real exchange rate on macro economical variables. Literature review of this paper generally focused on Bilgili (2000), Berument and Pasaliogullari (2003) used least squares analysis and VAR models respectively for Turkish economy.

Domac (1997), found that unanticipated devaluations increase output but anticipated devaluations do not exert any significant effect on Turkey by using nonlinear three-stage-least-squares for the 1960-1990 period. Ozmen and Furtun (1998) investigated "export-led growth" hypothesis based on Turkish quarterly data for the 1970:Q1-1995:Q4. They used seasonally adjusted series and found that there were no cointegration with real export and real income. Upadhyaya (1999) used ADL (Autoregressive Distributed Lag) models for six Asian countries[4] using annual data 1963–1993 with the RER and GDP data. They found that all variables are first order integrated. The main results of this paper are devaluation is contractionary for long run in Pakistan and Thailand, expanditionary in other investigated countries.

Kamin and Rogers (2000) found that once interest rates and income were included in money demand equations for Mexico, other variables such as inflation or the rate of exchange rate depreciation were not significant. Kamin and Rogers (2000) examined Mexican data by a VAR model with four endogenous variables where they employed the US interest rate, the real exchange rate, inflation and output for 1980:Q1–1996:Q2 period on a quarterly basis and found that although the variation of output is explained mostly by its own innovations, the response of output is permanent and negative. Kandil (2000) studied the effect of the exchange rate fluctuations on output using cross country

[4] India, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand

data. She found that an unanticipated positive exchange rate shock leads to output contraction due to the significant increase in inflation and decrease output.

Bilgili (2000) examines the effect of reel exchange rate misalignment (RERMIS) on economic growth in Turkey. She estimated regression models for 1978–1998 annual data. According to the textbook model she found that Turkish data did not confirm any positive or negative effects of RERMIS on growth and trade balance was not sensitive to changes in RER. Bilgili (2000) has a some contradictions with econometric theory about methods that used. She investigated integration level of the variables and decided that all series are first order integrated. In contrast the unit root tests, she used level series in regression models. When the stochastic error of a regression is unit root nonstationary, the regression is called a spurious regression[5]. This is because the standard t test tends to be spuriously significant even when the regressor is statistically independent of the regressand in Ordinary Least Squares. Second negation is interpreting statistically insignificant coefficients of models. If the coefficient is statistically insignificant it cannot be interpret.

Bleaney and Greenaway (2001) investigated effects of terms of trade and RER volatility on growth and investment in fourteen sub-Saharan African countries[6] using GARCH models. They used annual data for 1980-1995. According to GARCH model volatility of RER has a negative impact on growth and investment.

Berument and Pasaogullari (2003) adapted Kamin and Rogers (2000) model and investigated the effects of real depreciation on the economic performance of Turkey by considering quarterly data from 1987:Q1 to 2001:Q3. They constructed five alternative VAR models one of were named as a core. They used the real exchange rate, the real GDP, inflation and the nominal US interest rate in the core model. The real exchange rate is computed by the nominal exchange rate basket, which is chosen in line with the official definition of the exchange rate basket adopted in the sample period and which is deflated by the inflation used in the study. In the bivariate analysis, for most of the transformations and lags, they found a negative correlation between output and the real exchange rate. The empirical findings of this analysis suggest that the response of output is negative and permanent after a real devaluation.

Faria and Ledesma (2003) investigating Balassa- Samuelson effects on growth and PPI[7]. His results showed that RER has a strong impact on relative growth. They used Pesaran at al bounds test for quarterly data from 1960:Q1 - 1996:Q4.

Vinh and Fujita (2006) examined the impact of the real depreciation on economic performance in Vietnam using VAR approach. They found that although the main sources of variance in output and price level are “own shocks” and real devaluation has positive impact on both output and inflation. Ardic (2006) investigated the link between the real exchange rate, output and crises in Turkey. She found that as a result of a devaluation, these imported intermediate goods become so expensive that production declines.

[5] Time series econometric study is not complete without performing stationarity test on variables used for the study. Regression run on non-stationary time series variables produces spurious results, which are meaningless. Therefore, it is important to make sure that variables are stationary.

[6] Botswana, Burkina Faso, Cameroon, Cote d’Ivoire, Gambia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, Tanzania, Togo and Zimbabwe

[7] In this study he used Germany, United Kingdom, USA and Japan.

4. Data and Empirical Application

4.1 Data

Our study included import, export data and RER because; the real exchange rate is related to net exports. When the real exchange rate is lower, domestic goods are less expensive relative to foreign goods, and net exports are greater. To analyze the relationships between output and the real exchange rate in Turkey, we have used the real exchange rate, the real GDP, inflation in the core model and import and export are added on former variables in the expanded model. All variables are obtained from the web page database (http://tcmbf40.tcmb.gov.tr/cbt.html) of the Central Bank of Turkey (see Appendix A for extensive information about data). The real exchange rate is calculated as Real Effective Exchange Rate[8], GDP used as a growth, WPI[9] used as inflation, and other variables are export and import. The sample period covers quarterly data from 1989:QI to 2005:Q2. In addition we form four dummies for crises and structural break as a D94Q2, D00Q4, D01 and D01Q1. Dummy variable D94Q2 is associated with the 1994 currency crisis in Turkey and designed in the following way: 1 for t=1994:Q2 and 0 otherwise. The second crisis which named as "The Turkish Liquidity Crisis of 2000" [10] is incorporated in the model by dummy variable D00Q4 designed in the following way: 1 for 2000:Q4 0 otherwise. Models contains dummy variable D01 that is included in order to take care of structural break is mentioned in cross correlation analysis which equals 0 prior to 2001:Q3, thereafter 1 Dummy variable D01 is tested and determined by Perron's (1989) testing procedure[11]. We described D01Q1 which equals 1 for 2001:Q1 0 otherwise as a 2001 crisis. Logarithmic transformation was applied to all series and "L" denotes (for example LRER) the log of variables. All series are seasonally adjusted using additive moving averages method which is shown by "SA" at the end of the name of the variable (for example LRERSA).

Table 1 presents scaling factors of series. Scaling factor shows effect of seasonality on variables for each period. If the factor is 0 in any period we are able to say there is no seasonality in that period. If it is not equal to zero, the difference (from zero) shows the seasonal effect in percentage terms.

Table 1: Scaling Factors

	Variable				
Period	LEX	LGDP	LIM	LRER	LWPI
1	-0.024	-0.220	-0.094	0.011	0.005
2	-0.069	-0.071	-0.014	-0.013	0.023
3	-0.037	0.290	-0.001	-0.003	-0.015
4	0.130	0.000	0.109	0.005	-0.013

Table 1 shows that the most important source of seasonality is GDP and export variables. GDP has a great seasonality in first and third period and export has a in fourth period as a %22, %29, %13 respectively.

[8] It is not eq. 2.1. Method: http://www.tcmb.gov.tr/yeni/evds/yayin/reel_efktf/YontemselAciklama.pdf
[9] The name, contents and the weight of goods in the Wholesale Price Index has been changed in 2005. We calculated chained index by using the quarterly percentage change of the new index.
[10] Alper. C. Emre, Russian and East European Finance and Trade (2001). Vol. 37, No. 6, pp. 51-71.
[11] Null hypothesis cannot be rejected at the %5 level.

4.2 Statistical Preliminaries

In order to properly estimate any relationship between the real exchange rate process and output, we must determine the order of integration of the series, choose models for each series, and then construct a methodology.

4.2.1. Order of Integration

Integration levels of the variables are investigated with the using DF, PP, KPSS (Kwiatkowski, D., et al, 1992.) and Ng-Perron (Ng S. and Perron P., 2001.) tests. Lags are selected using SIC. Based on the test results, we have decided that all series are first order integrated.

Table 2: Unit Root Tests-I

	ADF		KPSS		Phillips – Perron	
	Constant	Constant + trend	Constant	Constant + trend	Constant	Constant + trend
	τ_μ	τ_T	η_μ	η_T	Z_α	Z_t
LEXSA	1.686	-1.802	1.011***	0.117	2.229	1.845
LGDPSA	-1.242	-3.200*	1.000***	0.126*	-1.073	-3.164
LIMSA	-0.597	-2.712	0.987***	0.082	-0.519	-2.392
LRERSA	-2.261	-2.603	0.429*	0.213**	-2.266	-2.622
LWPISA	-2.326	2.578	1.037***	0.220**	-2.285	1.815
Δ LEXSA	-10.794***	-11.102***	0.500**	0.187**	-9.729***	-15.537***
Δ LGDPSA	-8.192***	-8.133***	0.114	0.107	-8.708***	-8.632***
Δ LIMSA	-6.377***	-6.341***	0.075	0.068	-2.392***	-6.353***
Δ LRERSA	-9.023***	-9.035***	0.131	0.087	-10.012***	-10.889***
Δ LWPISA	-4.749***	-5.542***	0.568**	0.228***	-4.891***	-5.646***

Table 2: Continues

	Ng-Perron					
	Constant			Constant + trend		
	MZt	MSB	MPt	MZt	MSB	MPt
LEXSA	0.868	0.543	27.853	-6.784***	0.071***	1.296***
LGDPSA	0.796	0.657	35.267	-2.430	0.203	7.699
LIMSA	0.880	0.591	31.195	-2.725*	0.175*	6.233*
LRERSA	-1.484	0.211	4.757	-2.381	0.192	7.938
LWPISA	-0.830	0.370	9.379	-0.357	0.337	31.627
Δ LEXSA	-0.391 ***	0.751 ***	30.500	-0.944***	0.529	51.013
Δ LGDPSA	-4.963***	0.100**	0.497***	-4.494***	0.111***	2.261***
Δ LIMSA	-3.887***	0.128***	0.810****	-3.921***	0.127***	2.967***
Δ LRERSA	-1.358	0.366	6.609	-3.429***	0.143**	3.978***
Δ LWPISA	-3.543***	0.134***	1.202***	-3.699***	0.132***	3.458***

*, **, *** denote rejection of the null hypothesis at the 10%, 5%, and 1% level, respectively

Table 2 gives the unit root tests of these variables. The Ng-Perron test states that export is stationary when model has constant and trend and RER is I(2) with constant model. KPSS and Ng-Perron found that export is stationary with constant and trend model. GDPSA is stationary according to ADF test which contains constant and trend.

Figure 2: Real GDP and Real Exchange Rate in 1989:Q1-2005:Q2 period

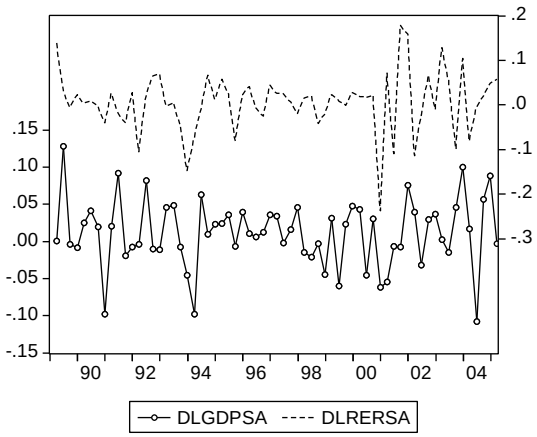


Figure 2 shows the first differenced real GDP and the first differenced RER on a quarterly basis. As seen in the figure, declines in RER are coupled with declines in output. The figure suggests a mostly positive relationship between those two variables.

4.2.2. Cross Correlation between the RER and Output

To analyze relationships between real exchange rate and output, we first perform the cross correlations between LRER - LGDP and LRERSA-LGDPSA. We repeat the cross correlation analysis with different transformations.

In Table 3, we show the cross correlations between the quarterly real GDP and the real exchange rate after various transformations. We have evaluated the cross correlations up to four periods. The lag number indicates the number of quarters by which the LRER is lagged relative to the LGDP. (-) values for periods indicate that the LRER is lagged relative to the LGDP. We use different transformations, namely level, first difference, deviation from a linear trend, deviation from a quadratic trend, deviation from a cubic trend and trend obtained by HP filter (see Hodrick J.R. and Prescott E.C., 1997) because there is no general agreement about equilibrium values of the variables.

Table 3: Cross correlations between LRER LGDP

Lags	Level	First difference	Deviation linear trend	Deviation quadratic trend	Deviation cubic trend	HP filtered
1989:Q1-2005:Q2						
0	0.224*	-0.142	-0.038	0.073	0.049	0.026
-1	0.206*	-0.060	0.013	0.088	0.080	0.063
-2	0.241*	0.213*	0.129	0.206*	0.213	0.206*
-3	0.170	0.079	0.054	0.145	0.132	0.126
-4	0.030	-0.181	-0.108	-0.074	-0.100	-0.111
1989:Q1-2001:Q3						
0	-0.086	-0.033	0.006	0.127	0.121	0.095
-1	-0.099	-0.108	-0.031	0.019	0.032	0.011
-2	-0.051	0.096	0.010	0.031	0.058	0.046
-3	-0.033	0.042	-0.015	0.061	0.072	0.068
-4	-0.158	-0.109	-0.123	-0.069	-0.067	-0.074

*, **, *** denote rejection of the null hypothesis at the 10%, 5%, and 1% level, respectively

Thus different assumptions of equilibrium variables for the real exchange rate and output tested. We performed the analysis for sub-sample and full sample. We used sub-sample to compare results with Berument and Pasaogullari (2003). Thus, the sub-sample is chosen to be the period from 1989:Q1 the beginning period of our full sample to 2001: Q3.

The attained results showed that 1989:Q1-2001:Q3 sub-sample and full sample had differentiations in values and in terms of statistically significance. Considering the fact that this differentiation can be an indicator for structural break in economy, dummy variable D01 which represents this type of break in the established models is used in the upcoming subsections. But we have to have more data for investigating structural break. It may have done successor researches. In sub-sample there is no transformation that gives a statistically significant results. It is evident that there is a positive correlation between the real exchange rate and output. It seems contradiction with Berument and Pasaogullari but our index is calculated such that an increase is a real appreciation their study RER was calculated such that an increase is real depreciation. These findings are parallel to Berument and Pasaogullari (2003). Then we used seasonally adjusted logarithmic real GDP and seasonally adjusted logarithmic RER because GDP displays an apparent seasonality and the LRER and LRERSA has a nearly same figure . In Table 4, we show the cross correlations between LRERSA and LGDPSA. In table (-) values indicate same sense.

Table 4: Cross correlations between LRERSA LGDPSA

Lags	Level	First difference	Deviation linear trend	Deviation quadratic trend	Deviation cubic trend	HP filtered
1989:Q1-2005:Q2						
0	0.454**	0.279**	0.254**	0.611**	0.578**	-0.612
-1	0.391**	0.321**	0.275**	0.575**	0.557**	-0.596
-2	0.002**	-0.095	0.139	0.318**	0.289**	-0.291
-3	0.224	0.104	0.080	0.230	0.181	-0.181
-4	0.147	-0.068	-0.030	0.063	-0.012	0.028
1989:Q1-2001:Q3						
0	-0.0456	-0.3381**	0,2769**	0.724**	0.697**	-0.721
-1	-0.0296	0.3119**	0.1935	0.540**	0.545**	-0.574
-2	-0.0977	0.0058	0.0165	0.219	0.247*	-0.250
-3	-0.1351	0.0185	-0.1789	-0.034	-0.000	0.008
-4	-0.210	-0.107	-0.265	-0.158	-0.143	-0.074

*, **, *** denote rejection of the null hypothesis at the 10%, 5%, and 1% level, respectively

Table 4 shows that full sample have more significant values and level of significance stronger than sub-sample. These results can be an indicator for structural break in economy too. Significant values are evident that there is a positive correlation between the real exchange rate and output except first difference zero lag variable of sub-sample.

4.2.2. Granger Causality between RER and Output

To capture any relevant relationship between the mean of the real exchange rate and growth we test the relationship between the real exchange rate and output in a VAR setting and compute the relevant p-values. Granger causality test is held both for level and also for seasonally adjusted data using various transformations of these data for two samples. The Granger causality tests will indicate whether a set of lagged variables has explanatory power on the other variables. If the null hypothesis rejected, then we can safely claim that one variable does Granger cause the other variable. It is observed that obtained results are nearly same when series are seasonally adjusted and also when the sample are studied for two different periods.

First of all, .in the first full-sample, the first difference and transformation of deviation from a cubic trend reveal that LGDP Granger causes the LRER at the 7% and the 5% levels of significance respectively. There is no other transformation that gives a statistically significant causal relationship in direction LGDP to LRER in full-sample. In the first sub-sample, there is no statistically significant causality from LGDP to LRER. The null hypothesis that the level series LRER does not Granger cause LGDP is rejected at the 5% level of significance and all transformation at the %1 level of significance in full sample and sub-sample. After seasonally adjusted series are used level of significance and number of significant values decrease. It shows that seasonality increases correlation values. Finally, when the full table is considered in the majority of the transformations, it is evident that the real exchange rate Granger causes real output.

Table 5: Granger Causality Tests

	Level	First difference	Deviation linear trend	Deviation quadratic trend	Deviation cubic trend	HP filtered
1989:Q1-2005:Q2						
LGDP—LRER	0.121(5)	0.100(4)	0.077(5)*	0.048(5)**	0.048(5) **	0.055(5)*
LRER—LGDP	0.000(5)***	0.000(4)***	0.000(5)***	0.000(5)***	0.000(5)***	0.000(5)***
1989:Q1-2001:Q3						
LGDP—LRER	0.418(5)	0.335(4)	0.506(5)	0.177(5)	0.136(5)	0.202(5)
LRER—LGDP	0.000(5)***	0.003(4)***	0.006(5)***	0.004(5)***	0.002(5)***	0.005(5)***
1989:Q1-2005:Q2						
LGDPSA-LRER	0.202(4)	0.611(4)	0.125(3)	0.353(3)	0.443(5)	0.062(2)
LRER-LGDPSA	0.004(4)***	0.002(4)***	0.152(3)	0.106(3)	0.003(5)***	0.005(2)***

Table 5: Continues

1989:Q1-2001:Q3						
LGDPSA-LRER	0.099(4)*	0.197(2)	0.079(3)*	0.084(4)*	0.063(4)*	0.143(4)
LRER-LGDPSA	0.002(4)***	0.107(2)	0.237(3)	0.013(4)**	0.010(4)**	0.009(4)***
1989:Q1-2005:Q2						
LGDPSA-RERSA	0.665(5)	0.725(4)	0.394(5)	0.419(3)	0.453(5)	0.486(3)
LRERSA-LGDPSA	0.003(5)***	0.002(4)***	0.012(5)**	0.109(3)	0.003(5)***	0.015(3)**
1989:Q1-2001:Q3						
LGDPSA-LRERSA	0.407(4)	0.421(2)	0.412(1)	0.207(1)	0.131(1)	0.478(1)
LRERSA-LGDPSA	0.003(4)***	0.095(2)*	0.390(1)	0.027(1)**	0.050(1)*	0.001(1)***

*, **, *** denote rejection of the null hypothesis that says there is no causality at the 10%, 5%, and 1% level, respectively. Lags are reported next to p-values, in parentheses.

We have possible explanations for the results of the Granger causality tests. When the TRL appreciates the cost of the import goods become cheaper in terms of TRL and the volume of the import increases. Although the appreciated TRL against the export goods, if the imported goods are the major cost component of the export goods, appreciated TRL decreases the whole cost of the export goods. Because the fact that the 80-85 % of the Turkish export belongs to Turkish manufacturing industry, the production level of Turkish manufacturing industry highly depends on the imports (including energy). Consequently, appreciated TRL increase the production level of the output.

4.3. Co-integration Tests

In order to analyze whether there exists any long-run relationship among variables, we perform Johansen co-integration test and compute the trace and max eigenvalue test statistics. To explore for a long-run relationship among the real exchange rate, inflation and output and then expanded model. In these models D94Q2, D00Q4, D01 and D01Q1 are kept exogenous.

Table 6: Johansen Cointegration Tests

Core Model			Expanded Model		
Hypothesized No. of CE(s)	Trace Stat.	Max Eigenvalue Star.	Hypothesized No. of CE(s)	Trace Stat.	Max Eigenvalue Star.
None	53.424**	44.284**	None	88.289**	44.782**
At most 1	9.139	8.743	At most 1	43.507	28.445*
At most 2	0.396	0.396	At most 2	15.061	12.261
			At most 3	2.799	2.448
			At most 4	0.351	0.351

*, **, *** denote rejection of the null hypothesis at the 10%, 5%, and 1% level,

Table 6 shows there exists a long-run relationship among the core model variables and expanded model variables. The λ-trace and λ-max test statistics also show that there is only one co-integrating vector in this setting. Normalized cointegration vectors are:

Normalized cointegrated vector of core model;

LGDPSA = 11.78445 +4.467LRERSA + 0.095LWPISA

t stat. [-8.16619] [-4.38383]

Normalized cointegrated vector of expanded model;

LGDPSA=11.812+ 4.086LRERSA+ 0.074LWPISA- 3.289LIMSA+ 3.700LEXSA

T stat [-3.94742] [-0.91609] [5.86445] [-4.97357]

The numbers in parentheses under the estimated coefficients are the t statistics. In the core model, coefficients are statistically significant. In the core model WPI and RER are observed to have positive effects on GDP The interpretation of first model is that holding other variables constant, 1 percent increase in RERSA leads on the average to about 4.5 percent increase in the GDPSA and 1 percent increase in WPISA leads on the average to about 0,1 percent increase in the GDPSA.

In the second model, WPI seemed to be statistically insignificant. In the second model, it is observed that real exchange rate had positive effects on GDP whereas import has negative effects. The interpretation of second model is that holding other variables constant, 1 percent increase in RERSA leads on the average to about 4 percent increase in the GDPSA, 1 percent increase in IMSA leads on the average to about .3,3 percent decrease in the GDPSA and 1 in EXSA leads on the average to about 3,7 percent decrease in the GDPSA. A result shows that in long run relationship among variables, generally LRERSA, LEXSA and LWPISA has a positive impact on LGDPSA and LIMSA has a negative impact.

4.4. Vector Error Correction Models

Vector Error Correction (VEC), models can lead to a better understanding of the nature of any nonstationarity among the different component series and can also improve longer term forecasting over an unconstrained model. In this study lags determined by LR criteria. Johansen estimates of the cointegrating vector based on the eigenvector identification, and the corresponding adjustment coefficients; then the normalized estimates treating the first variable as the dependent variable, (series ordered with two different approaches, see section 4.6.) which are the same as the ones given above.

We found that two groups of variables supported in the long run relationship and one cointegrated vector but only second group of variables adjust. The cointegration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. Our core model adjustment coefficient does not work.. Ordering of the long run model variables depends on aim of this paper. This paper assesses the relationship with real exchange rate and growth and GDP which used as a growth dependent variable of long run model. The adjustment coefficients of VEC2 are shown in Table 7. A vector error correction model for VEC 2 is:

$$\Delta LGDPSA_t = \delta_{10} + \phi_1(LGDPSA_{t-1} - \alpha_1 LRERSA - \alpha_2 LUFESA - \alpha_3 LEXSA - \alpha_4 LIMSA) + \delta_{11}\sum_{i=1}^{3}\Delta LGDPSA_{t-1}$$
$$+ \delta_{12}\sum_{l=1}^{3}\Delta LRERSA_{t-i} + \delta_{13}\sum_{l=1}^{3}\Delta LUFESA_{t-i} + \delta_{14}\sum_{l=1}^{3}\Delta LIMSA_{t-i} + \delta_{15}\sum_{l=1}^{3}\Delta LEXSA_{t-i}$$
$$+ \theta_{11}K94Q2 + \theta_{12}K00Q4 + \theta_{13}KO1Q1 + \theta_{14}KO1 + u_{1t}$$

$$\Delta LRERSA_t = \delta_{10} + \phi_2(LGDPSA_{t-1} - \alpha_1 LRERSA - \alpha_2 LUFESA - \alpha_3 LEXSA - \alpha_4 LIMSA) + \delta_{21}\sum_{i=1}^{3}\Delta LGDPSA_{t-1}$$
$$+ \delta_{22}\sum_{l=1}^{3}\Delta LRERSA_{t-i} + \delta_{23}\sum_{l=1}^{3}\Delta LUFESA_{t-i} + \delta_{24}\sum_{l=1}^{3}\Delta LIMSA_{t-i} + \delta_{25}\sum_{l=1}^{3}\Delta LEXSA_{t-i}$$
$$+ \theta_{21}K94Q2 + \theta_{22}K00Q4 + \theta_{23}KO1Q1 + \theta_{24}KO1 + u_{2t}$$

$$\Delta LUFESA_t = \delta_{30} + \phi_3(LGDPSA_{t-1} - \alpha_1 LRERSA - \alpha_2 LUFESA - \alpha_3 LEXSA - \alpha_4 LIMSA) + \delta_{31}\sum_{i=1}^{3}\Delta LGDPSA_{t-1}$$
$$+ \delta_{32}\sum_{l=1}^{3}\Delta LRERSA_{t-i} + \delta_{33}\sum_{l=1}^{3}\Delta LUFESA_{t-i} + \delta_{34}\sum_{l=1}^{3}\Delta LIMSA_{t-i} + \delta_{35}\sum_{l=1}^{3}\Delta LEXSA_{t-i}$$
$$+ \theta_{31}K94Q2 + \theta_{32}K00Q4 + \theta_{33}KO1Q1 + \theta_{34}KO1 + u_{3t}$$

$$\Delta LIMSA_t = \delta_{40} + \phi_4(LGDPSA_{t-1} - \alpha_1 LRERSA - \alpha_2 LUFESA - \alpha_3 LEXSA - \alpha_4 LIMSA) + \delta_{41}\sum_{i=1}^{3}\Delta LGDPSA_{t-1}$$
$$+ \delta_{42}\sum_{l=1}^{3}\Delta LRERSA_{t-i} + \delta_{43}\sum_{l=1}^{3}\Delta LUFESA_{t-i} + \delta_{44}\sum_{l=1}^{3}\Delta LIMSA_{t-i} + \delta_{45}\sum_{l=1}^{3}\Delta LEXSA_{t-i}$$
$$+ \theta_{41}K94Q2 + \theta_{42}K00Q4 + \theta_{43}KO1Q1 + \theta_{44}KO1 + u_{4t}$$

$$\Delta LEXSA_t = \delta_{50} + \phi_5(LGDPSA_{t-1} - \alpha_1 LRERSA - \alpha_2 LUFESA - \alpha_3 LEXSA - \alpha_4 LIMSA) + \delta_{51}\sum_{i=1}^{3}\Delta LGDPSA_{t-1}$$
$$+ \delta_{52}\sum_{l=1}^{3}\Delta LRERSA_{t-i} + \delta_{53}\sum_{l=1}^{3}\Delta LUFESA_{t-i} + \delta_{54}\sum_{l=1}^{3}\Delta LIMSA_{t-i} + \delta_{55}\sum_{l=1}^{3}\Delta LEXSA_{t-i}$$
$$+ \theta_{51}K94Q2 + \theta_{52}K00Q4 + \theta_{53}KO1Q1 + \theta_{54}KO1 + u_{5t}$$

In this model it is the adjustment coefficients on the error correction mechanism that are of particular interest, ϕ_i are the adjustment coefficients. They indicate how each of the five variables in the system adjust to restore equilibrium following a shock to the error correction mechanism. The error correction (or adjustment) coefficient must be significant and it has the expected negative sign. In the core model returning to equilibrium in the short run is not observed whereas in the second expanded model in the short run the vector adjusts.

Table 7: Adjustment Coefficients of VEC2

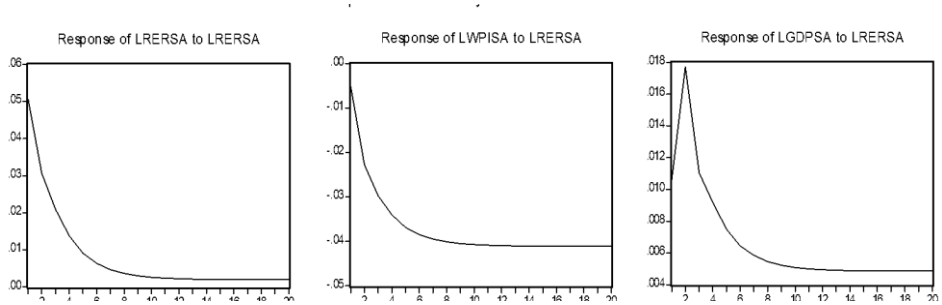
LGDPSA=11.812+ 4.086LRERSA+ 0.074LWPISA- 3.289LIMSA+ 3.700LEXSA					
Dependent Variable	Δ LGDPSA	Δ LRERSA	Δ LWPISA	Δ LIMSA	Δ LEXSA
Coefficient	-0.016	0.031	0.054	-0.162	-0.049
T stat	[-1.135]	[1.151]	[3.063]	[-3.731]	[-1.575]

For the VEC 2; the error correction term is statistically significant in the import equation (where ΔLIMSA is dependent) it enters with a negative sign and is significant in the inflation equation (where ΔLWPISA is dependent) where it enters with a positive sign. Table 7 shows adjustment coefficients. This equation shows that system dynamics are strongly adjusting to the long-run relation with import, such that 16 percent of disequilibrium is corrected in each period and adjusts in six (1/0.16) periods.

4.5 Impulse-Response Functions

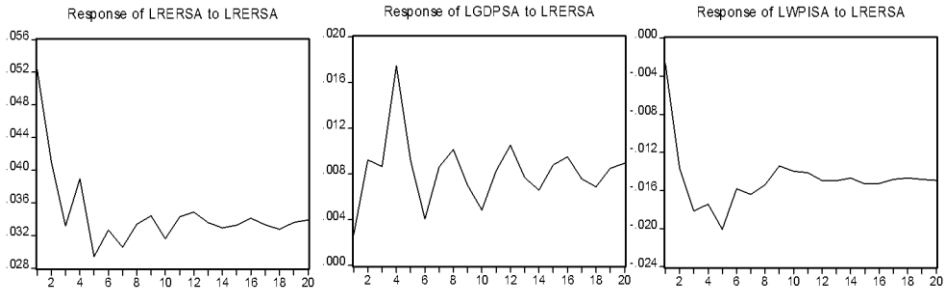
In Figure 3, the impulse responses of the core VEC model, which includes the real exchange rate, output and inflation for 20 periods are presented. (See Appendix B)

Figure 3: VEC1 Impulse-Response Functions



In Figure 3, we present the responses of inflation and growth to the real exchange rate shocks of impulse of LRERSA. A positive real exchange rate shock increases the growth for the first three quarters, decreasing effect occurs after the 4th quarter, but the effect of the real exchange rate on output is not negative any period. A positive real exchange rate shock decreases the inflation for the first four quarters.

Figure 4: VEC2 Impulse-Response Functions



In figure 4, a positive real exchange rate shock increases the growth for the first four quarters, decreasing effect occurs after the 4th quarter and after the observed decrease it continues its movement in the seasonal fashion and the effect not negative any period. A positive real exchange rate shock decreases the inflation for the first fifth quarters inflation occurs after the fifth quarter. A positive real exchange rate shock decreases the inflation for the first forth quarters.

This is parallel to the findings of Kamin and Rogers (2000) and Berument and Pasaogullari[12] (2003), which supports the contractionary devaluation hypothesis for Mexico and Turkey respectively.

4.6 Variance Decomposition

The variance decomposition of the variables will give information about shocks that have explanatory power to forecast of variables. In Ugurlu (2006) before Variance Decomposition was calculated, series ordered with two different approaches since the alignment of the series in the model effects the results of this analysis. The first approach is Block Exogeneity Test whereas second approach is observation of variables and in which order they will react to an economic shock based on economic policy. In this paper only block exogeneity test approach is used. (see Ugurlu, 2006 for second approach results)

Table 8: Block Exogeneity Tests Results

Core Model				Expanded Model			
Dependent Variable	Chi-Sq	df	p-value	Dependent Variable	Chi-Sq	Df	p-value
Δ_{LGDPSA}	6.6039	2	0.0368**	Δ_{LGDPSA}	54.883	12	0.0000***
Δ_{LWPISA}	1.3072	2	0.5201	Δ_{LWPISA}	24.9526	12	0.0150**
Δ_{LRERSA}	6.1079	2	0.0472**	Δ_{LRERSA}	23.0414	12	0.0274**
				Δ_{LEXSA}	18.4759	12	0.1020
				Δ_{LIMSA}	29.1791	12	0.0037***

*, **, *** denote rejection of the null hypothesis at the 10%, 5%, and 1% level. The statistic is the chi-squared statistic for joint significance of all other lagged endogenous variables in the equation.

[12] Don't forget; in this article, index is calculated such that an increase is a real depreciation.

According to block exogeneity test results, ordering of variables; LWPISA, LRERSA, LGDPSA and EXSA, LRERSA, LWPISA, LIMSA, LGDPSA in core model and expanded model respectively.

There is one important result in block exogeneity test. It shows that export is exogenous for Turkish economy. This is the important finding about Turkish export industry. Planners hoped Turkey could experience export-led growth over the long run but in this analysis we found that export is exogenous. We claim that it depends on Turkish production process. Production has become more dependent on intermediate imports of an increased variety in Turkish economy after liberalization programs.

Table 9 and 10 present the variance decompositions of GDP. These give the fraction of the forecast error variance for each variable that is attributable to its own innovations and to innovations in the other variables in the system. First column provides period, other columns provide the variance decompositions estimated from two models; results are reported for 1, 2, 3, 4 quarter as a first year and 8, 12, 16, 20 quarter as a second, third, fourth and fifth year respectively.

Table 9: VEC1 LGDPSA Variance Decomposition

Period	LGDPSA	LRERSA	LWPISA
1	94.903	3.848	1.2475
2	90.173	8.5812	1.245
3	86.716	12.090	1.193
4	84.570	14.295	1.133
8	82.330	16.592	1.077
12	82.108	16.541	1.350
16	81.564	16.634	1.800
20	80.765	16.911	2.322

Table 10: VEC2 LGDPSA Variance Decomposition

Period	LGDPSA	LRERSA	LWPISA	LIMSA	LEXSA
1	68.817	0.9325	0.188	22.919	7.141
2	62.108	6.7046	0.960	26.363	3.862
3	59.691	10.036	1.630	25.257	3.384
4	43.193	19.248	3.846	22.484	11.228
8	38.743	18.484	10.178	20.764	11.828
12	38.168	17.945	11.529	21.152	11.204
16	37.375	17.732	12.691	21.607	10.593
20	36.935	17.555	13.498	21.877	10.132

In all models, the predominant source of variation in GDP forecast errors are ‘‘own shocks’’ to GDP. These are account for %94 in core model and %68 in second model.

Conclusively, it is observed that RER first period to explain GDP 1% especially after eighth period and finally reaches 16% at the last analyzed period in the core and expanded model. It is also observed that this explanatory ratio does not disappear in the long run. Innovations in the GDP account for 1-2% of the variance of inflation in the core model.

In the second model; import shocks are third most important source of variation in GDP errors, accounting for about 22%–26%. However, in model, export shocks explain 7%–10% of GDP. Although the export is the third important and inflation is the fourth source of variation in GDP in first quarter, at the twentieth period inflation is third variable. This results suggest that inflation has a stronger impact that import on GDP variations.

5. Summary and Conclusion

In this study, we have investigated the relationship between the real exchange rate and growth in Turkey. Integration levels of the variables are investigated with the using DF, PP, KPSS and Ng-Perron tests. Based on the test results, it is decided that all series are first order integrated.

The application of bivariate data analysis held for RER and GDP variables to study the relationship between them. The attained results showed that 1989:Q1-2001:Q3 sub-sample and full sample had differentiations in values and in terms of statistically significances. Considering the fact that this differentiation can be an indicator for structural break in economy and structural break dummy was defined. Granger causality test is held both for level and also for seasonally adjusted data using various transformations of these data for two samples. Causality runs from RER to GDP rather than vice-versa.

Using Johansen Cointegration Test, one cointegration vector is detected based on two groups of variables. We found that two groups of variables supported in the long run relationship and one cointegrated vector but only second group of variables adjust. When long run relationship is studied all variables in the core model are found to be statistically significant. In the second model, WPI seemed to be statistically insignificant. In the core model WPI and RER are observed to have positive effects on GDP. In the long run linear regression model real exchange rate is found to be the most effective policy tool on GDP. In the core model returning to equilibrium in the short run is not observed whereas in the expanded model in the short run the vector adjusts in six periods by import changes.

For both of these models Impulse- Response Functions and Variance Decomposition Analysis studied. Formed impulse-response functions, a positive RER shock increases GDP. It is also observed that this explanatory ratio does not disappear in the long run and the variation of output is explained mostly by its own innovations .

Our findings suggest that an overvalued domestic currency may initially result in increased output in the short run but in the long run detrimental effect occurs. Growth can be controlled by not only RER but also import. Import is found crucial for upgrading growth of the economy.

References

Ardic O. P.(2006) Output, the Real Exchange Rate, and the Crises in Turkey, Topics in Middle Eastern and North African Economies, MEEA Online Journal, Volume VIII

Balassa, B. (1964) The Purchasing Power Parity Doctrine., Journal of Political Economy 72 (6): 584-596

Berument, H. and Pasaogullari, M. (2003) Effects of the real exchange rate on output and inflation: evidence from Turkey, Developing Economies, 41(4), 401–35.

Bilgili, E. (2000) Reel Döviz Kuru ve Ekonomik Büyüme, İktisat İşletme ve Finans, 176, 56-73

Bleaney, M. and Greenaway, D. (2001) The Impact Of Trade And Real Exchange Rate Volatility On Investment And Growth In Sub-Saharan Africa, Journal of Development Economics, 65, 491–500.

Domac, I., (1997) Are Devaluations Contractionary? Evidence from Turkey, Journal Of Economic Development, 22(2) , 145-163

Engle R. F. ve Granger J. W., (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing, Econometrica, 55(2), 251-276

Faria, J.R and Leon-Ledesma M. (2003) Testing the Balassa–Samuelson effect: Implications for growth and the PPP, Journal of Macroeconomics 25: 241–253

Hodrick J. R. and Prescott E. C. (1997). Postwar U.S. Business Cycles: An Emprical Investigation, Journal of Money, Credit and Banking, 29 (1), 1-16

Kamin, S.,and Rogers J. (2000) Output and the Real Exchange Rate in Developing Countries: An Application to Mexico, Journal of Development Economics, 61, 85-109

Kandil, M. (2000) The Asymmetric Effects of Exchange Rate Fluctuations: Theory and Evidence from Developing Countries, IMF Working Paper, WP/00/184

Kipici, A.N. and Kesriyeli M., (1997) The Real Exchange Rate Definitions and Calculations, Central Bank Of The Republic Of Turkey, Research Department Publication No: 97/1

Kwiatkowski, D., et al. (1992) Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root, Journal of Econometrics, 54, 91-115

Neto, D. F. (2004) Real exchange rate and human capital in the empirics of economic growth, European Economic Association & Econometric Society, Universidad Carlos III, Madrid, Spain 20 - 24 August

Ng S. and Perron P. (2001) Lag Length Selection and The Construction of Unit Root Test With Good Size and Power, 69(6), 1519-1554

Ozmen, E and Furtun G. (1998) Export-led Growth Hypothesis and the Turkish Data: An Emprical Investigation, METU Studies in Development 25(3), 491-503

Perron, P. (1989), "The Great Crash, the Oil Price Shock, and The Unit Root Hypothesis," Econometrica, 57, 1361-1401.Samuelson, P.A. (1964) Theoretical Notes on Trade Problems, The Review of Economics and Statistics, 46 (2): 145-154.

Ugurlu, E. (2006) Reel Döviz Kuru ve Ekonomik Büyüme: Türkiye, Unpublished Msc. Dissertation, Istanbul Technical University,

Upadhyaya K.M. (1999) Currency Devaluation, Aggregate Output, And The Long Run: An Empirical Study, Economic Letters, 64, 197–202

Vinh N.G.T. and Fujita S. (2006) The Impact of Real Exchange Rate on Output and Inflation in Vietnam: A VAR approach, Graduate School of Economics Discussion Paper, No.0625

Appendix A: Data Sources

EX	Export, Broad Economic Categorization (BEC) (TURKSTAT) (Monthly, $ Millions)
GDP	GDP at Fixed (1987) Prices (TURKSTAT) (Quarterly, YTL Thousand)
IM	Import, Broad Economic Categorization (BEC) (TURKSTAT) (Monthly, $ Millions)
RER	WPI based real effective exchange rate index .Weights for 19 countries including Germany, USA, Italy, France, United Kingdom, Japan, Netherlands, Belgium, Switzerland, Austria, Spain, Canada, Korea, Sweden, Taiwan, Iran, Brazil, China and Greece. (1995=100). An increase in the index denotes an appreciation
WPI	Wholesale Prices Index (1987=100) (TURKSTAT) (Monthly), 2005: Wholesale Prices Index (2003=100)(Wholesale Prices Index) (Monthly)

Appendix B: Emprical Results

Johansen Cointegration Test 1 - Lag Length Criteria

VAR Lag Order Selection Criteria

Endogenous variables: LGDPSA LRERSA LWPISA

Exogenous variables: C K94Q2 K00Q4 K01Q1 K01

Sample: 1989Q1 2005Q2

Included observations: 61

Lag	LogL	LR	FPE	AIC	SC	HQ
0	58.17566	NA	4.88e-05	-1.415595	-0.896528	-1.212168
1	343.6630	496.0928*	5.66e-09*	-10.48075*	-9.650247*	-10.15527*
2	349.8865	10.20240	6.25e-09	-10.38972	-9.247773	-9.942181
3	356.2957	9.876446	6.89e-09	-10.30478	-8.851387	-9.735179
4	366.5070	14.73116	6.76e-09	-10.34449	-8.579664	-9.652840
5	378.2844	15.83191	6.36e-09	-10.43556	-8.359286	-9.621846

* indicates lag order selected by the criterion

Johansen Cointegration Test 2 - Lag Lenght Criteria

VAR Lag Order Selection Criteria

Endogenous variables: LRERSA LWPISA LGDPSA LIMSA LEXSA

Exogenous variables: C K94Q2 K00Q4 K01Q1 K01

Sample: 1989Q1 2005Q2

Included observations: 61

Lag	LogL	LR	FPE	AIC	SC	HQ
0	171.9802	NA	5.57e-09	-4.819025	-3.953912	-4.479979
1	510.5010	566.0512	1.94e-13	-15.09840	-13.36817*	-14.42030
2	545.9980	53.53635	1.42e-13	-15.44256	-12.84722	-14.42542*
3	579.4204	44.92846*	1.16e-13	-15.71870	-12.25825	-14.36252
4	606.7904	32.30563	1.23e-13	-15.79641	-11.47085	-14.10118
5	641.3510	35.12720	1.11e-13*	-16.10987*	-10.91920	-14.07560

* indicates lag order selected by the criterion