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The Contractionary and Expansionary Effects of Devaluation: Empirical Evidence from Turkey

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Main aim of this study to examine the effect of real devaluation on domestic output for Turkey over the period 1987Q1-2008Q4 by using unit root and cointegration tests. The results show that, increasing money supply has no effect on output; both foreign income and government spending are neutral in short run but has positive effect on output. Real devaluation is contractionary in the short run but it is expansionary in the long run for Turkey.

1. Introduction

The large external imbalances are the most important cause of the currency crisis in developing countries. The countries which face up to the currency crisis lose out their external positions because of decreasing export volumes. The devaluation is an effective and noteworthy economic policy tool for increasing export volumes and ameliorating the external position of countries. By raising the exchange and increasing the relative prices of imports, devaluation or currency depreciation switches demand imports to domestically produced goods (Sencicek and Upadhyaya, 2008).

It is assumed that the devaluation has "expansionary impacts" on total output. According to the traditional theory, it is expected that depreciation in domestic currency generally decreases the relative price of domestically produced goods and thereby stimulates demand for domestic export. Hence, currency depreciation can be expected to have expansionary effects on real output (Bahmani-Oskooee *et al*., 2002).

Although it is expected and assumed that the devaluation has expansionary effects on total output, some of the empirical studies refer

the results that the devaluation has "contractionary impacts" on total output decreasing the channels of aggregate supply and aggregate demand. The foreign demand on relatively inexpensive domestic goods provides to increase exports and decrease imports and these circumstances boost the aggregate demand. However, Krugman and Taylor (1978) argue that the currency depreciation can shift the distribution of income from the groups the marginal propensity to save to the groups the high marginal propensity to save. This would decrease the consumption and in consequence, the aggregate demand. On the other hand, raising the exchange rates reduces the cost of external (imported) goods then this declines the aggregate supply. Thereby a decrease in aggregate demand and aggregate supply cause a decrease in total output.

The aim of this study is to examine the impacts of devaluation for Turkish economy over the period 1987Q1-2008Q4. During the period 1987Q1-2008Q4 Turkey experienced two financial crises and devaluations. The first of the financial crises occurred in 1994 because of the large current account deficit. A sharp and sizeable increase in the current account deficit along with massive requirements for public sector borrowing and, serious policy errors in financing the deficit culminated in the currency crises of 1994 (Sencicek and Upadhyaya, 2008). The large current account deficit forced the devaluation of Turkish lira nearly 39% with the stabilization program named as "5th April decisions". The decision of devaluation has yielded successful results just for one year because of early elections in 1995.

The second of the financial crisis which the one of the important causes was "the pre-determined exchange rate regime" occurred in 2001. This condition forced the changing exchange rate regime policy the pre-determined to free float and the devaluation of Turkish lira nearly 40%. The devaluation caused successful results with "implied inflation targeting" monetary and free float exchange rate regime policy.

The linkage between output and devaluation has been investigated by a number of studies which give conflicting results. Edwards (1986) examined the effect of real exchange changes on real output using annual data for twelve developing countries over the period 1965-1980. He concluded that devaluations have negative effect on output in the

short run and in the long run devaluations are neutral. Bahmani-Oskooee (1998) used the Engle-Granger cointegration test to analyze the relationship between output and nominal effective exchange rates of 23 less developed countries and found no significant long-run relationship.

Upadhyaya (1999) analyzed the relationship for six countries using annual data over the period 1963-1993 by employing methodology proposed by Wickens and Breusch and found that devaluation has contractionary effect only in Pakistan and Thailand in the long run. Chou and Chao (2001) using annual data for the period 1971 to 1998 found devaluation have contractionary effect on output in the short run for Indonesia, Malaysia, Philippines, South Korea and Thailand.

Bahmani-Oskooee et al. (2002) employed Augmented Dickey- Fuller unit root test and Johansen cointegration test to examine the impact of currency depreciation on output in 5 Asian countries using quarterly data over the period 1976Q1- 1999Q4. The results reveal that the real depreciation is contractionary for Indonesia and Malaysia, expansionary for the Philippines and Thailand and neutral for the real output growth of Korea in the long run.

Upadhyaya et al. (2004) examined the effect of currency depreciation on output using ADF and Phillips-Perron unit root test and Johansen cointegration test using annual data from 1969 to 1998 for Greece and Cyprus. The results show exchange rate depreciation expansionary only in the short run. Bahmani-Oskooee and Kutan (2008) investigated the same issue using bounds test approach to cointegration in nine countries. They found real depreciation is expansionary in Belarus, Latvia, Poland and Slovak Republic, contractionary in Czech Republic, Estonia, Hungary, and Russia and neutral in Lithuania. Kalyoncu et al. (2008) investigated the same issue for 23 OECD countries using ADF unit root test and Engle-Granger cointegration test. They concluded that currency depreciation has negative effect in 6 countries, while has positive effect in 3 countries and no effect in remaining 14 countries. Sencicek and Upadhyaya (2008) examine the contractionary devaluation hypothesis in Turkey using annual data forum 1970 to 2004. They concluded while devaluation is contractionary in the short run, it is expansionary in the medium run and neutral in the long run.

2. Model

We consider the model specification that given by Narayan and Narayan (2007) and Bahmani-Oskooee *et al*. (2002) examining the devaluation has expansionary or contractionary impacts on total output for Turkish economy. The form of the model is as following:

$$Y_t = f\left(M_t, G_t, REER_t, FY_t\right) \quad (1)$$

In the model as expressed (1) Y_t, M_t, G_t, $REER_t$ and FY_t [1] denote the log of real gross domestic product (domestic income), the log of real money supply, the log of real government spending, the log of real effective exchange rate and the log of real foreign income index, respectively.

The variables, M_t and G_t represent the monetary and fiscal policies respectively that measure the impacts of devaluation on the internal sector of economy. If the money supply and government expenditure are expanded, the expectations for the monetary and fiscal policies are affirmative thus M_t and G_t would have positive coefficients. Moreover $REER_t$ and FY_t capture the external sector of economy. The expectation for $REER_t$ is unclear. The relationship between $REER_t$ and Y_t depends on the expansionary or contractionary impacts of devaluation. If devaluation has expansionary impacts on output $REER_t$ should carry a positive coefficient. On the other hand, if devaluation has contractionary impacts on output, $REER_t$ should carry a negative coefficient. The expectation for the relationship between FY_t and Y_t is affirmative. Increase of foreign income provides an increase in foreign demand on relatively inexpensive domestic goods. Consequently, increasing the production of domestic goods has positive effect on domestic income and FY_t should carry a positive coefficient.

[1] The foreign income index is obtained by following the method of Bahmani-Oskooee *et al*. (2002). The best of 14 trading partners are that Germany, Italy, USA, UK, Sweden, France, Spain, Austria, Japan, Netherlands, Denmark, Belgium-Luxembourg, Canada, Bulgaria.

3. Data, Methodology and Empirical Results

In this study, we employed quarterly data over the period 1987Q1-2008Q4 which obtained from International Financial Statistics database and Central Bank of the Republic of Turkey Electronic Data Delivery System. We consider five variables to examine effect of devaluation on economic growth as mentioned above.

As stated by Granger and Newbold (1974), the variables in a regression must be either stationary or cointegrated to avoid of a spurious regression problem. We used the Augmented Dickey Fuller (ADF) unit root test to determine the integration properties of the variables. Table 1 shows the results of the unit root test.

Table 1: ADF Unit Root Test Results

	Level		First Difference	
Variable	Constant, No Trend	Constant, Trend	Constant, No Trend	Constant, Trend
LnFY	-0.97 (3)	-1.60 (3)	-9.48 (2)*	-9.49 (2)*
LnG	-1.20 (3)	-1.79 (3)	-11.27 (2)*	-11.23 (2)*
LnM	0.85 (0)	-1.30 (0)	-10.00 (0)*	-10.38 (0)*
LnREER	-1.54 (0)	-3.39 (0)	-9.56 (0)*	-9.50 (0)*
LnY	-0.30 (7)	-1.93 (7)	-4.61 (6)*	-4.56 (6)*

Notes: Optimal lag orders, determined by Schwarz criterion are given in parentheses. * indicates rejection of the null hypothesis at 5% significance level.

Results of the ADF unit root test show all the variables are integrated of order 1, namely they become stationary after taking a difference. After deciding that series are integrated of the same order, we used Johansen's cointegration test to examine whether there is any long-run relationship among the variables. The Johansen's procedure is based on an unrestricted vector autoregression model transformed into the following error correction form:

$$\Delta Y_t = \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \Pi Y_{t-1} + AZ_t + \varepsilon_t$$

Where Δ is the first-difference operator, Y_t denotes a p vector of nonstationary *I(1)* variables, Z_t shows a vector of deterministic variables. Γ_i contains information on short run adjustment and Π captures the long run relationships in the series. In Johansen's method, we are interested in rank of the Π matrix. If rank of this matrix is 0, we conclude the variables in Y_t are not cointegrated. If Π has rank (r) < p, there exist α and β matrixes both have dimension p with rank r and here Π can be represented as $\Pi = \alpha \times \beta'$. β is the matrix of the cointegration vectors and α is the matrix of the adjustment coefficients to the long disequilibrium.

Johansen (1988) suggests 2 test statistics to examine the rank of Π, trace and maximum eigenvalue tests. The trace statistic tests the null hypothesis r=0, against the alternative of r>0 while maximum eigenvalue statistic tests the null hypothesis the number of cointegration vectors (c) = r against the alternative of c=r+1.

Table 2 summarizes the results of the Johansen cointegration test. We select the order of Vector Autoregressive (VAR) as 3 lags using Schwarz information criterion (SIC) in Johansen's test. Both trace and maximum eigenvalue tests show only one cointegration equation at the 5% level.

Table 2: Johansen Cointegration Test Results.

Null Hypothesis	Statistic	%5 Critical Value	%1 Critical Value
Trace Test			
$r = 0$ *	118.92	87.31	96.58
$r \leq 1$	57.89	62.99	70.05
$r \leq 2$	32.00	42.44	48.45
$r \leq 3$	12.41	25.32	30.45
$r \leq 4$	5.30	12.25	16.26
Max. Eigenvalue			
$r = 0$ *	61.03	37.52	42.36
$r \leq 1$	25.89	31.46	36.65
$r \leq 2$	19.58	25.54	30.34
$r \leq 3$	7.11	18.96	23.65
$r \leq 4$	5.30	12.25	16.26

Notes. * indicates significant at the 5% level.

We reported estimate of this cointegration vector as normalized on Y in Table 3 along with X^2 test statistic for exclusion from cointegration space. The degree of freedom of the X^2 test is 1, equals to the number of cointegrating vector.

Table 3: Estimate of cointegrating vectors

	LnY	LnREER	LnM	LnG	LnFY
Cointegrating Equation	1	-1.87	-0.05	-1.22	0.57
	(14.22)*	(25.85)*	(0.37)	(17.77)*	(7.30)*
%95 Critical Value:	3.84				

Notes: * denotes rejection of null hypothesis at t he 5% level.
Values in parentheses show the critical values.

We presented the cointegration equation in Table 3, as follows;

$$Y = -6.17 + 1.87 LnREER_t + 0.05 LnM_t - 0.57 LnFY_t + 1.22 LnG_t - 0.02 (trend)_t$$

Where trend = 1987Q1. Since the results show that only the M has an insignificant coefficient, we can state increasing money supply has no

effect on output. Except FY, all significant variables have positive effect on economic growth. As long as government spending increases, it will stimulate the economic growth. On the other hand, the foreign income carries a negative coefficient so we infer that when foreign income increases it decreases output. The coefficient of REER shows the devaluation in Turkey is expansionary in the long run.

If the series are not stationary and there is at least one cointegrating relationship among them, we estimate the Vector Error Correction Model (VECM) with the cointegration terms, are known as the error correction terms, to capture short-run dynamics and long-run equilibrium between the variables. In this study, we estimated the VECM as following

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} \Delta Y_{t-i} + \sum_{i=1}^{k} a_{2i} \Delta Z_{t-i} + \beta ECT_{t-1} + \varepsilon_t$$

where ECT_{t-1} is the error correction term derived from the long-run cointegrating relationship, Y_{t-i} is the vector of the log of real gross domestic product (domestic income). Z_{t-i} is the matrix of the vectors the log of real money supply, the log of real government spending, the log of real effective exchange rate and the log of real foreign income index. We present the estimation of VECM in Table 4

We choose the optimal lag for the VECM using SIC. The LM test statistic and RESET test show that there is no autocorrelation problem and no specification error in the model respectively. We focus on the coefficients of REERs in Table 4. Only one quarter lag effect of REER is found significant and negative while 2-quarter and 3-quarter lag effects are insignificant. These results show currency devaluation in Turkey is contractionary only in short-run. Besides we found G statistically significant at 10% level which shows that government spending has negative effect on output in short run. EC term is statistically significant and takes negative coefficient implying deviations from the equilibrium diminish in the long run.

Table 4: Estimate of VECM

Dependent Variable: Y		
Error Correction:	Coefficient	t-statistics
ECT*	-0.2528	[-3.55677]
D(LNY(-1))*	-0.2037	[-1.96371]
D(LNY(-2))*	-0.7458	[-13.4848]
D(LNY(-3))*	-0.2677	[-2.61930]
D(LNRDK(-1))*	-0.2779	[-2.03876]
D(LNRDK(-2))	-0.0909	[-0.68449]
D(LNRDK(-3))	0.1085	[0.88067]
D(LNM2(-1))	-0.0596	[-0.65985]
D(LNM2(-2))	-0.101	[-1.11303]
D(LNM2(-3))	-0.0617	[-0.70610]
D(LNG(-1))**	-0.1744	[-1.86311]
D(LNG(-2))*	-0.216	[-2.81852]
D(LNG(-3))	0.0466	[0.70789]
D(LNF(-1))	-0.1701	[-1.47614]
D(LNF(-2))	-0.0455	[-0.37249]
D(LNF(-3))	-0.0449	[-0.55769]
C*	0.0327	[3.26875]
Adj. R^2 =0.8687		
LM=27,4688 (0,3329)		
RESET F= 0,1946(0.6605)		

Note: *, ** indicates significiant at 5% and 10% critical levels respectively.
Values in parentheses show probability values of the relevant test statistics.

4. Summary and Conclusion

In this article, we employed Johansen cointegration test to examine the effect of real devaluation on domestic output for Turkey using quarterly data over the period 1987Q1-2008Q4. Following Narayan and Narayan (2007) and Bahmani-Oskooee *et al*. (2002), we used an empirical model that incorporates monetary, fiscal variables, foreign income in addition to real exchange rate. We can sum up our results as follows; increasing money supply has no effect on output both in short and long runs; foreign income is neutral in short run while it decreases output in long run; government spending is not effective in the short run, but it stimulates economic growth in the long run and finally while real devaluation is contractionary in the short run, it is expansionary in the long run for Turkey.

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