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Is Currency Depreciation or Appreciation Expansionary in Turkey?

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Abstract

Based on an extended IS-MP-AS model (Romer, 2000), this paper finds that real appreciation raised real GDP in Turkey during 2002.Q2-2011.Q2 whereas real depreciation helped increase real GDP during 2011.Q3-2017.Q1. In addition, a lower government debt-to-GDP ratio, a lower lagged world real interest rate, a lower real oil price or a lower expected inflation rate helped raise real GDP. These results suggest that the relationship between aggregate output and exchange rates may be subject to structural changes and that a prudent fiscal policy would be more appropriate.

Keywords: IS-MP-AS model, currency depreciation or appreciation, government debt, world interest rates, oil prices

JEL Classifications: F41

1. Introduction

Turkey's economy exhibits both progress and concerns. According to the International Monetary Fund (2017), its economic growth rate of 3.184% in 2016 was higher than many other industrialized countries. Its government net borrowing as a percent of GDP declined from a recent high of -5.881% in 2009 to -2.316% in 2016. Its general government gross debt as a percent of GDP dropped from a recent high of 76.401% in 2001 to 28.131% in 2016, which was well below the EU threshold of 60%. The inflation rate has been on the decline from a recent high of 104.54% in 1994 to 7.775% in 2016, which was slightly higher than the 5% inflation target (Central Bank of the Republic of Turkey, 2017). The Turkish lira had depreciated as much as 132.05% versus the U.S. dollar during 2008-2016, suggesting that its potential impacts on aggregate output may need to be investigated.

Several studies including Turkey in the sample have examined the effect of currency depreciation or appreciation on aggregate output. Gylfason and Risager (1984) report that a 10% devaluation would result in a 3.4% increase in real output in Turkey. Nunnenkamp and Schweickert (1990) devaluation is expansionary in the 22 countries including Turkey in the low middle-income group.

Morley (1992) finds that devaluation is contractionary mainly because of a substantial decrease in investment. Domac (1997) indicates that there is lack of evidence of contractionary devaluation. Kalyoncu, Artan, Tezekici, and Ozturk (2008) show that devaluation is contractionary in the short run and that there is cointegration in the long run. Sencicek and Upadhyaya (2010) reveal that devaluation is contractionary in the short run, expansionary in the medium run and neutral in the long run. Tavakoli and Kheradmand (2013) point out that the impact of a currency crash on economic growth in Turkey is statistically insignificant. Gülay and Pazarlioğlu (2016) find that real appreciation has negative effects on economic growth. Yildirim and Ivrendi (2016) discover that significant currency depreciation causes a deep recession, high inflation, and an improved trade balance. Some of these studies have different findings mainly because different models, methodologies and sample periods are used.

This paper focuses on the impacts of exchange rate movements on aggregate output in Turkey based on an extended IS-MP-AS model (Romer, 2000). Other relevant economic variables will also be considered. Several studies of the effect of real depreciation on aggregate output select the money supply as a proxy for monetary policy (Agenor, 1991; Morley, 1992; Moreno, 1999; Bahmani-Oskooee, 1998; Bahmani-Oskooee, Chomsisengphet and Kandil, 2002; Kim and Ying, 2007; Ratha, 2010; An, Kim and Ren, 2014; Kim, An and Kim, 2015). Romer (2000) proposes that a monetary policy function incorporating inflation targeting (Taylor, 1993, 1999; Ege Yazgan and Yilmazkuday, 2007; Yilmazkuday, 2008; Akyurek, Kutun and Yilmazkuday, 2011) would be more appropriate as many countries including Turkey has adopted inflation targeting in setting the policy rate. The innovation of this paper is the consideration of several new variables such as the real effective exchange rate, the world real interest rate and the real oil price in the extended IS-MP-AS model in order to explore the impacts of international trade and finance, an open economy and supply shocks on aggregate output.

2. The Model

Extending Romer (2000), we can express the IS, MP and AS functions as:

$$\begin{aligned} Y &= f(Y, G, T, L, \varepsilon) & (1) \\ R &= g(\pi - \pi^*, Y - Y^*, \varepsilon, R^*) & (2) \\ \pi &= h(\pi^e, Y - Y^*, E, \varepsilon) & (3) \\ L &= w(R) & (4) \end{aligned}$$

where

Y = real GDP in Turkey,

G = government spending,

T = government tax revenue,

L = the real lending rate,

ε = the real effective exchange rate (An increase means real appreciation.),

R = the real policy rate,

π = the inflation rate,

π^* = the inflation target,

Y^* = potential real GDP,

R^* = the world real interest rate,

π^e = the expected inflation rate, and

E = the real oil price.

Suppose that the inflation target and potential real GDP are constants in the short run. Solving for the three endogenous variables, we can express equilibrium real GDP as:

$$\bar{Y} = x(\varepsilon, G - T, R^*, E, \pi^e) \quad (5)$$

The Jacobian for the endogenous variables can be written as:

$$|J| = [(1 - f_Y) - f_L w_R g_\pi h_Y - f_L w_R g_Y] > 0. \quad (6)$$

The partial derivative of \bar{Y} with respect to ε can be expressed as:

$$\partial \bar{Y} / \partial \varepsilon = (f_\varepsilon + f_L w_R g_\pi h_\varepsilon + f_L w_R g_\varepsilon) / |J| > \text{ or } < 0. \quad (7)$$

Note that the first term in the numerator tends to be negative whereas the second and third terms in the numerator tend to be positive. Real appreciation tends to hurt exports, reduce import costs and domestic inflation, and increase international capital inflows. Conversely, real depreciation is expected to help exports, increase import costs and domestic inflation (Yilmazkuday, 2015; Alvarez, Shoja, Uddin, and Yilmazkuday, 2017), and reduce international capital inflows. Therefore, the sign in equation (7) is unclear.

An analysis of the data in Figure 1 shows that real GDP and the real effective exchange rate seemed to have a positive relationship during 2002.Q2-2011.Q2 and a negative relationship during 2011.Q3-2017.Q1, suggesting that real appreciation raised real GDP during 2002.Q2-2011.Q2 whereas real depreciation increased real GDP during 2011.Q3-2017.Q1. Because government debt is an accumulation of the government budget deficit and because investors are more concerned about potential default of government debt, the budget deficit ($G - T$) is replaced with government debt (D).

Figure 1. Scatter Diagram between real GDP (RGDP) and the Real Effective Exchange Rate (REER)

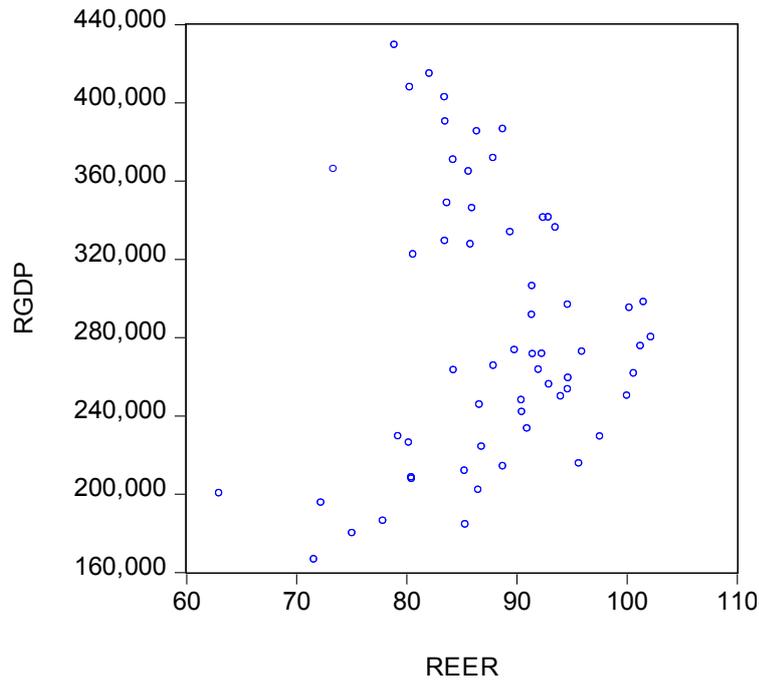


Figure 2. Scatter Diagram between real GDP (RGDP) and the Government Debt-to-GDP Ratio (DEBTY)

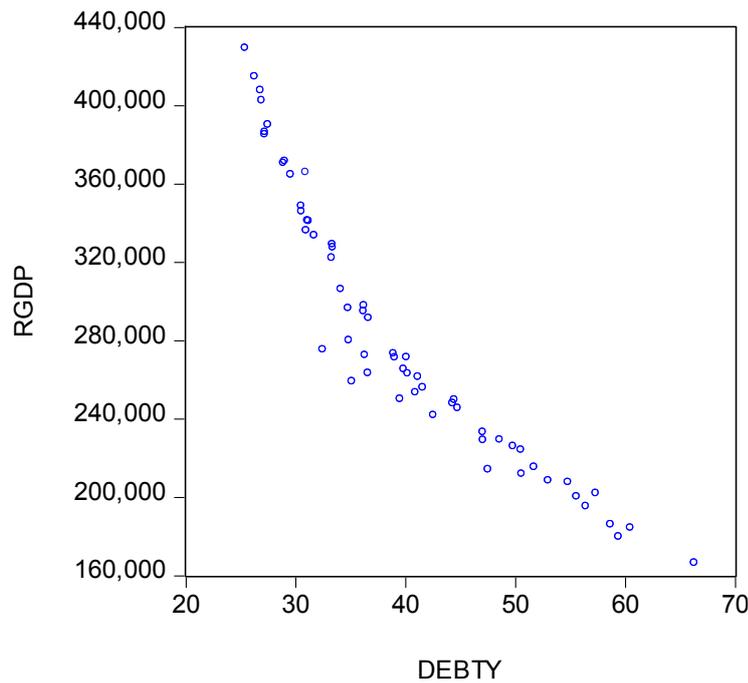


Figure 2 seems to suggest that real GDP and the debt-to-GDP ratio had a negative relationship during the sample period. Real GDP also exhibited seasonal variations. Hence, an interactive binary variable, an intercept binary variable, and three seasonal binary variables are included in the estimated equation:

$$\bar{Y} = z(\varepsilon, \varepsilon \times B, B, D, R^*, E, \pi^e, Q2, Q3, Q4) \tag{8}$$

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Where B = 0 during 2002.Q2-2011.Q2, B = 1 during 2011.Q3-2017.Q1, and Q2, Q3 and Q4 are binary variables for the second, third and fourth quarters, respectively. The sign beneath each of the independent variables shows the partial derivative of \bar{Y} with respect to a change in an independent variable. As Turkey imports most of the

energy needs from abroad, a higher real oil price is expected to shift aggregate supply left and reduced real GDP (Aydın and Acar, 2011; Gülay and Pazarlioğlu, 2016).

3. Empirical Results

The data were collected from the *International Financial Statistics* published by the International Monetary Fund, Eurostat published by the European Commission, the Federal Reserve Bank of St. Louis, the Central Bank of the Republic of Turkey, and the Undersecretariat of Treasury of the Republic of Turkey. Real GDP is measured in million lira. The real effective exchange rate is chosen to represent the real exchange rate, and an increase means real appreciation of the lira. Government debt is measured as the central government debt as a percent of GDP.

A lagged government debt-to-GDP ratio is used to avoid potential endogeneity or to account for a potential impact lag on real GDP. The world real interest rate is represented by the U.S. real federal funds rate, which is the policy rate affected by the Federal Reserve Bank. A lagged real federal funds rate is used as there may be a time lag for the Central Bank of the Republic of Turkey to respond to any change in the real federal funds rate. The real oil price is measured in the lira per barrel and adjusted by the consumer price index. The inflation rate is calculated as the percent change in the consumer price index. The expected inflation rate is represented by the weighted inflation rate of past four quarters.

The weights assigned to the first, second, third and fourth lagged inflation rates are 0.4, 0.3, 0.2 and 0.1, respectively (Pretorius, 1994). Except for the binary variable, the real federal funds rate and the expected inflation rate with zero or negative values, other variables are measured on a log scale. The sample ranges from 2002.Q2 to 2017.Q1 and has a total of 60 observations. The data for the central government debt as a percent of GDP are not available before 2002.Q2.

The DF-GLS unit root test shows that each of the variables has a unit root in level and is stationary in first difference and that the value of the test statistic for the regression residuals is estimated to be -3.9456, which is greater than the critical value of -2.6047 in absolute values at the 1% level. Thus, these time series variables are cointegrated.

Table 1 presents the estimated regression. Approximately 97.16% of the variation in real GDP can be explained by the ten right-hand side variables. All the coefficients are significant at the 1% or 5% level. Real GDP has a positive relationship with the real effective exchange rate during 2002.Q2-2011.Q2, the intercept binary variable, and the three seasonal binary variables and a negative relationship with the real effective exchange rate during 2011.Q3-2017.Q1, the lagged debt-to-GDP ratio, the lagged U.S. real federal funds rate, the real oil price and the expected inflation rate. Specifically, a 1% rise in the real effective exchange rate caused real GDP to increase.

Table 1. Estimated Regression of Log(Real GDP) in Turkey

Variable	Coefficient	z-Statistic	Probability
Constant	14.40426	888.9646	0.0000
Log(real effective exchange rate)	0.107066	4.824326	0.0000
Log(real effective exchange rate) × binary variable	-0.521523	-4.078963	0.0000
Binary variable	2.453062	4.304185	0.0000
Log(lagged debt-to-GDP ratio)	-0.644046	-43.73279	0.0000
Lagged real federal funds rate	-0.003748	-2.091705	0.0365
Log(real oil price)	-0.033358	-2.349744	0.0188
Expected inflation rate	-0.001519	-4.623477	0.0000
Q2	0.200320	26.26689	0.0000
Q3	0.222969	22.40331	0.0000
Q4	0.151036	25.09831	0.0000
R-squared	0.971640		
Adjusted R-squared	0.965852		
Akaike info criterion	-3.771092		
Schwarz criterion	-3.317317		
Methodology	EGARCH		
Sample period	2002.Q2- 2017.Q1		
Number of observations	60		
Mean absolute percent error	2.870478%		

Notes: The binary variable equals 0 during 2002.Q2-2011.Q2 and 1 during 2011.Q3-2017.Q1. An increase in the real effective exchange rate is a real appreciation of the lira, and a decrease in the real effective exchange rate is real depreciation of the lira.

By 0.1071% during 2002.Q2-2017.Q1 whereas a 1% decrease in the real effective exchange rate would raise real GDP by 0.4145% during 2011.Q3-2017.Q1. The impact of the government debt-to-GDP ratio is relatively large as a 1% increase in the debt-to-GDP ratio would reduce real GDP by 0.6440%. When the lagged U.S. real federal funds rate rises 1 percentage point, the log of real GDP will decline by 0.0037.

There are several comments. The recent decline in the value of the Turkish lira versus the U.S. dollar seems to be consistent with empirical findings that real depreciation would be beneficial to aggregate output after 2011.Q2 as the positive effect of increased exports may dominate the negative effect of higher import costs and domestic inflation. The declining trend in the government debt-to-GDP ratio appears to help aggregate output as the government pursued fiscal prudence and reduced the negative crowding-out effect. In setting its monetary policy, the Central Bank of the Republic of Turkey appears to consider the world real interest rate such as the lagged U.S. real federal funds rate. As Turkey imports most of its energy needs from abroad, a higher real oil price tends to shift aggregate supply to the left and reduce real GDP. In comparison, the positive relationship between real GDP and the real effective exchange rate during 2002.Q2-2011.Q2 and the negative relationship between real GDP and the real effective exchange rate during 2011.Q3-2017.Q1 found in this study are different from the previous studies.

Several other versions have been considered. If the lagged real prime lending rate in the U.S. replaces the lagged U.S. real federal funds rate, the estimated coefficient of -0.0038 is significant at the 1% level. The value of R-squared is estimated to be 0.9716, which is slightly less than the value of R-squared reported in Table 1. Other results are similar. If the lagged real lending rate in the euro area replaces the lagged U.S. real federal funds rate, the estimated negative coefficient is significant at the 1% level and is much smaller than the one reported in Table 1 in absolute values. The value of R-squared is estimated to be 0.9697 and is slightly less than that reported in Table 1. Other results are similar. When the expected inflation rate is replaced with the simple lagged inflation rate, the estimated coefficient of -0.0012 is significant at the 1% level. Other results are similar.

4. Summary and Conclusions

This paper has examined whether real depreciation or appreciation of the Turkish lira and other related variables would affect real GDP in Turkey. An extended IS-MP-AS model is employed. The EGARCH process is used in empirical estimation. Real appreciation raised real GDP during 2002.Q2-2011.Q2 whereas real depreciation increased real GDP during 2011.Q3-2017.Q1. In addition, a lower lagged government debt-to-GDP ratio, a lower lagged world real interest rate, a lower real oil price, or a lower expected inflation rate would raise real GDP.

The results suggest that either real appreciation or real depreciation may raise real GDP depending upon the level of the development stage. Since 2011.Q3, it seems that real depreciation of the lira would be conducive to economic growth. It appears that the continual trend of a lower government debt-to-GDP ratio moves in the right direction and that fiscal discipline works well in Turkey. Turkey's money policy function and aggregate supply are affected by external factors. Monetary tightening by the Federal Reserve Bank or a higher real crude oil price is expected to raise the domestic interest rate, shift aggregate demand and aggregate supply to the left, and reduce real GDP.

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