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Is Real Depreciation Contractionary? The Case of South Korea

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Abstract

Applying the AD/AS model, this paper finds that real appreciation of the Korean won has a greater positive impact on aggregate output in South Korea during 2000.Q4 - 2008.Q3 than that during 2008.Q4 - 2016.Q1 and that more government deficit spending as a percent of GDP does not increase aggregate output. In addition, aggregate output has a positive relationship with change in productivity and the real oil price and a negative relationship with the real interest rate and the expected inflation rate. These results suggest that during or after the recent financial crisis, the positive impact of the real effective exchange rate on aggregate output has declined and that more government deficit as a percent of GDP would not lift up the economy.

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1. Introduction

The exchange rate of the Korean won fluctuated significantly during times of crisis. During the Asian financial crisis, it depreciated 84.36% from 870.98 won per U.S. dollar in 1997.Q1 to 1605.72 won per U.S. dollar in 1998.Q1. During the recent financial crisis, it depreciated 53.72% from 921.23 in 2007.Q4 to 1416.07 in 2009.Q1. After the financial crisis, the won appreciated 27.48% from 1416.07 in 2009.Q1 to 1027.00 in 2014.Q3. Recently, the won depreciated 17.05% from 1027.00 in 2014.Q3 to 1202.13 in 2016.Q3. Whether real depreciation or appreciation of the Korean won may help or hurt economic growth remains to be seen.

This paper attempts to address the impact of real depreciation or appreciation on aggregate output and has several different aspects. First, a simultaneous-equation model consisting of aggregate demand and aggregate supply is applied. Second, labor productivity and the energy cost are considered in the short-run aggregate supply function. Third, an interactive dummy variable and an intercept dummy variable are considered to detect whether the relationship between real GDP and the real effective exchange rate may have changed during and after the recent global financial crisis.

2. The Model

This paper specifies that aggregate demand in South Korea is determined by the inflation rate, government spending, government tax revenue, the real interest rate and the real effective exchange rate and that short-run aggregate supply is a function of the inflation rate, labor productivity, the real oil price, the real effective exchange rate and the expected inflation rate. We can express the aggregate demand and short-run aggregate supply functions as:

$$Y^d = f(\pi, G, T, R, E) \tag{1}$$

$$Y^s = g(\pi, P, O, E, \pi^e) \tag{2}$$

where
Y^d = aggregate demand,
π = the inflation rate,
G = government spending,
T = government tax revenue,
R = the real interest rate,
E = the real effective exchange rate (An increase means real appreciation.),
Y^s = short-run aggregate supply,
P = labor productivity,
O = the real oil price, and
π^e = the expected inflation rate.

In equilibrium, $Y^d = Y^s$. Solving for the two endogenous variables, Y and π, we have the equilibrium real GDP:

$$\overline{Y} = h(E, G-T, R, P, O, \pi^e) \tag{3}$$

To measure the impact of fiscal policy, we replace G – T with the government deficit as a percent of GDP (D):

$$\overline{Y} = v(E, D, R, P, O, \pi^e) \qquad (4)$$
$$? \; ? \; - \; + \; ? \; -$$

We expect that equilibrium real GDP has a positive relationship with labor productivity and a negative relationship with the real interest rate and the expected inflation rate.

Real depreciation tends to make domestic-made goods and services cheaper and more competitively globally, increase exports, and shift aggregate demand upward. On the other hand, real depreciation tends to make imports more costly, raise domestic inflation, and shift the short-run aggregate supply curve leftward. The net effect on aggregate output is uncertain.

Using the samples including South Korea and other countries, several studies have examined the impact of real depreciation or devaluation on real output. Gylfason and Risager (1983) and An, Kim and Ren (2014) find that real depreciation is expansionary. Morley (1992) and Kim, An and Kim (2015) show that real depreciation tends to be contractionary whereas Nunnenkamp and Schweickert (1990) reject the contractionary devaluation hypothesis. Kamin and Klau (1998) reveal that for Asian countries including South Korea, devaluations have a short-run contractionary effect but no long-run contractionary effect and that impacts of devaluations on output are not significantly different among the Asian, Latin American and industrialized countries. Bahmani-Oskooee (1998), Bahmani-Oskooee, Chomsisengphet, and Kandil (2002) and Kalyoncu, Artan, Tezekici and Ozturk (2008) report that the impact of real depreciation is neutral or that there is no cointegration between real output and real depreciation. Bahmani-Oskooee and Miteza (2003) provide a literature survey.

The expected sign of the deficit/GDP variable is unclear and depends on the potential positive impact of increased deficit spending on aggregate demand and the possible negative impact of increased deficit spending on private spending and net exports caused by a higher interest rate and a stronger currency. When the government deficit as a percent of GDP is relatively small, the positive effect tends to dominate the negative effect; and when the government deficit as a percent of GDP is relatively large, the negative effect tends to overwhelm the positive effect (Lau, Mansor and Puah, 2010; Mohammadi and Moshrefi, 2012; Aisen and Hauner, 2013). The Ricardian equivalence hypothesis suggests that debt- or deficit-financed government spending has a neutral effect on real output because people tend to save more in anticipation of more taxes in the future to pay off the debt (Barro, 1974, 1989). Studies by McMillin (1986), Gupta (1989), Darrat (1989, 1990), Findlay (1990), Ostrosky (1990) and others indicate that more government deficit/debt would not raise the interest rate. However, Feldstein (1982), Hoelscher (1986), Cebula (1997), Cebula and Cuellar (2010), Cebula (2014a, 2014b), Cebula, Angjellari-Dajci, and Foley (2014) and others show that more government deficit/debt raises real interest rates and tends to crowd out spending by households and businesses. Reinhart and Rogoff (2010) show that economic growth declines if government debt as a percent of GDP is above 90% and that a higher government debt ratio leads to a higher inflation rate in emerging economies.

For an oil importing country, a higher real oil price tends to shift the short-run aggregate supply curve to the left, causing aggregate output to decline. However, a higher real oil price driven by strong aggregate demand may generate a positive impact in the short run and a negative impact in the long run (Hamilton, 1996; Kilian, 2008a, 2008b).

3. Empirical Results

Data sources came from the Bank of Korea, the International Financial Statistics published by the International Monetary Fund, and the St. Louis Federal Reserve Bank. Real GDP in South Korea is measured in billion won. The real effective exchange rate is a trade-weighted measure based on the consumer price index. An increase in the real effective exchange rate means real appreciation of the won, and vice versa. The government deficit is measured as a percent of GDP. The real interest rate is equal to the corporate bond yield minus the expected inflation rate. Labor productivity is estimated as real output in million won per worker. To avoid potential multicollinearity problems, lagged real oil price per barrel measured in the won is used. The expected inflation rate is estimated as the average inflation rate of the past four quarters. Except for negative or zero values, other variables are measured on a log scale. The sample ranges from 2000.Q4 to 2016.Q1. The data for the corporate bond yield before 2000.Q4 are not available.

An analysis of the data (Figure 1) shows that the relationship between real GDP and the real effective exchange rate changed during 2008.Q4 - 2016.Q1. Hence, a dummy variable B with a value of one during 2008.Q4 - 2016.Q1 and zero otherwise is created. An interactive dummy variable and an intercept dummy variable are included in the estimated regression:

$$\overline{Y} = w(E, E \times B, B, D, R, P, O, \pi^e) \qquad (5)$$
$$+ \quad - \quad + \quad ? \quad - \quad + \quad ? \quad -$$

Taking partial derivative of $\overline{Y}$ with respect to E, we have:

$$\frac{\partial \overline{Y}}{\partial E} = \alpha_1 + \alpha_2 \times B \qquad (6)$$

where α_1 and α_2 are the coefficients for E and $E \times B$. It suggests that the impact of a change in E on $\overline{Y}$equals α_1 during 2000.Q4 - 2008.Q3 and $\alpha_1 + \alpha_2$ during 2008.Q4 - 2016.Q1. Figure 2 reveals that the relationship between real GDP and the government deficit as a percent of GDP seems to be positive.

The ADF test shows that except for the government deficit as a percent of GDP and the real interest rate, other variables have unit roots in level and that all the variables are stationary in first difference. According to the ADF unit root test on the regression residual, the test statistic is estimated to be -2.5631 compared with the critical value of -1.9463 at the 5% level. Hence, these time series variables are cointegrated and have a long-term equilibrium relationship.

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

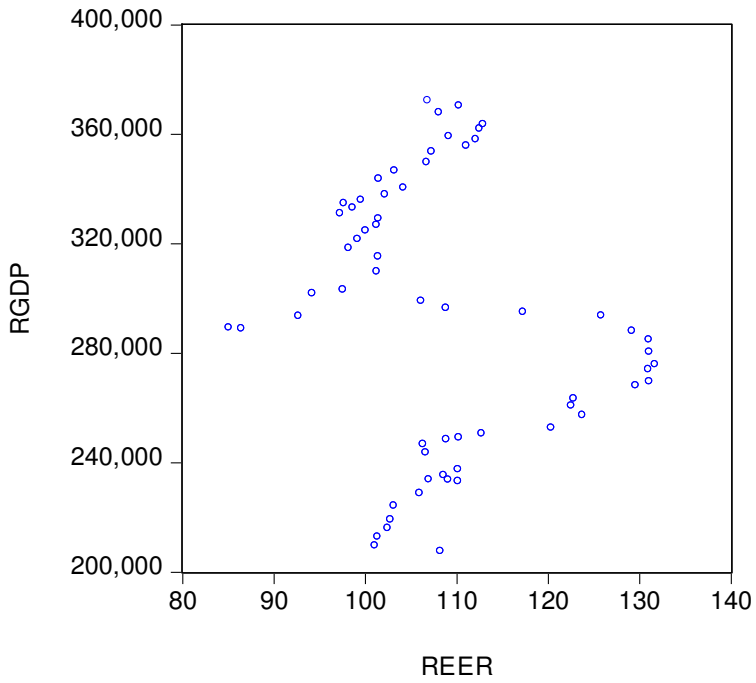

Figure 2. Scatter Diagram between Real GDP (RGDP) and the Government Deficit as a Percent of GDP (DEFICITY)

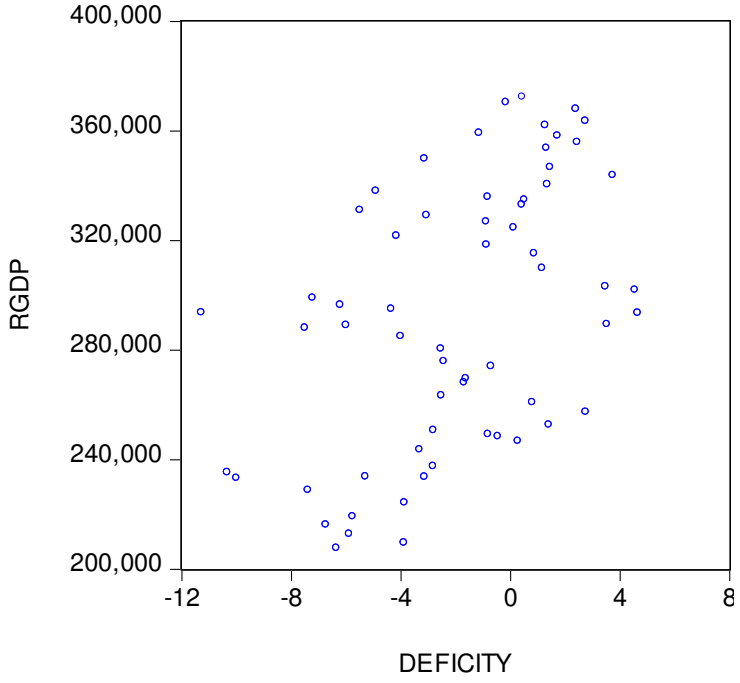

Table I presents the estimated regression and related statistics. The EGARCH model (Nelson, 1991) is applied in empirical work to estimate the variance equation and has several advantages. There are no restrictions on the parameters. The conditional variance is always positive even if the parameters are negative. The EGARCH model is stationary. As shown, approximately 90.0% of the variation in real GDP in South Korea can be explained by the right-hand side variables. Except that the coefficient of the government deficit as a percent of GDP is insignificant at the 10% level, all other coefficients are significant at the 1% or 5% level. Real GDP in South Korea is positively affected by the real effective exchange rate during 2000.Q1 - 2008.Q3, change in labor productivity and the real oil price and is negatively associated with the real interest rate and the expected inflation rate. The positive impact of the real effective exchange rate on real GDP declines during 2008.Q4 - 2016.Q1.

Specifically, a 1% real appreciation of the Korean won would increase real GDP by 0.4187% during 2000.Q4 - 2008.Q3 and by 0.2773% during 2008.Q4 - 2016.Q1. A unit increase in the difference in the log of labor productivity would result in an increase in the log of real GDP by 0.1116. A 1% increase in the lagged real oil price would lead to an increase in real GDP by 0.1097%.

Table I. Estimated Regression of Log(Real GDP) in South Korea

Variable	Coefficient	z-Statistic
Intercept	9.459589	3608.588
Log(real effective exchange rate)	0.418735	26.55401
Log(real effective exchange rate) x dummy variable	-0.141370	-8.504686
Dummy variable	0.881366	11.15601
Government deficit as a percent of GDP	0.000474	0.729107
Real interest rate	-0.037781	-19.44466
Change in log(productivity)	0.111591	2.120729
Log(lagged real oil price)	0.109661	15.89298
Expected inflation rate	-0.045505	-21.11348
R-squared	0.895151	
Adjusted R-squared	0.879325	
Akaike information criterion	-4.010865	
Schwarz criterion	-3.599161	
MAPE	3.282415%	
Sample period	2000.Q4-2016.Q1	
Methodology	EGARCH	
Number of observations	62	

Notes: MAPE is the mean absolute percent error. The estimated variance equation and the z-statistic in the parenthesis are as follows:

LOG(GARCH) = -4.5509 + 2.6176 *ABS(RESID(-1)/@SQRT(GARCH(-1))) + 0.6652 *LOG(GARCH(-1))
(-3.2920) (4.4597) (3.2232)

Attempts were made to consider other relevant variables. If U.S. real GDP as a proxy for world income is included in the regression, its positive coefficient is significant at the 1% level. However, due to a high degree of multicollinearity, the coefficients of five other exogenous variables change the signs. When the real exchange rate defined as units of the won per U.S.

dollar times the relative prices in the U.S. and South Korea replaces the real effective exchange rate, its coefficient is significant at the 1% level. A 1% real appreciation increases real GDP by 0.5492% during 2000.Q4 - 2008.Q3 and by 0.0912% during 2008.Q4 - 2016.Q1. It seems that the real effective exchange rate would be a better measure as South Korea engages in international trade with many trading partners.

4. Summary and Conclusions

This paper has focused on the impact of the real effective exchange rate on aggregate output in South Korea. Real appreciation of the Korean won, a lower real interest rate, a higher productivity, a higher real oil price or a lower expected inflation rate would raise real GDP. The positive impact of real appreciation of the won on real GDP declines during 2008.Q4 - 2016.Q1. More government deficit as a percent of GDP does not increase real GDP.

The recent trend of real depreciation of the won is likely to hurt its real GDP because the negative impacts such as higher import costs, higher domestic inflation and capital outflows would outweigh the positive impact of more exports. The Korean government may need to be more prudent in pursuing expansionary fiscal policy. The trends of declining real interest rate and expected inflation rate are conductive to economic growth.

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