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Impacts of the Real Effective Exchange Rate and the Government Deficit on Aggregate Output in Australia

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Abstract

Based on a simultaneous-equation model consisting of aggregate demand and short-run aggregate supply, this paper estimates a reduced-form equation specifying that the equilibrium real GDP is a function of the real effective exchange rate, the government deficit as a percent of GDP, the real interest rate, foreign income, labor productivity, the real oil price, the expected inflation rate, and the interactive and intercept binary variables accounting for a potential change in the slope of the real effective exchange rate and shift in the intercept. Applying the exponential GARCH technique, it finds that aggregate output in Australia has a positive relationship with the real effective exchange rate during 2003.Q3 – 2013.Q2, the government deficit as a percent of GDP, U.S. real GDP, labor productivity and the real oil price and a negative relationship with the real effective exchange rate during 2013.Q3 – 2016.Q1, the real lending rate and the expected inflation rate. These results suggest that real appreciation was expansionary before 2013.Q3 whereas real depreciation was expansionary after 2013.Q2 and that more government deficit as a percent of GDP would be helpful to stimulate the economy. Hence, the impact of real appreciation or real depreciation on real GDP may change overtime.

Keywords: Exchange Rates, Government Deficit, Interest Rates, Labor Productivity, Oil Prices.

JEL Classification Code: F31, E62.

1. Introduction

Australia has continued to show economic strengths as evidenced by an average annual growth rate of 3.1% in the first quarter of 2016 (Reserve Bank of Australia). There is an area which may deserve more attention. The Australian dollar versus the U.S. dollar fluctuated significantly in recent years, depreciating 42.45% during 2008.Q2 – 2009.Q1, appreciating 37.75% during 2009.Q1 – 2011.Q2, and depreciating 47.87% again during 2011.Q2 – 2016.Q1. The Australian government has also relied on deficit spending to stimulate the economy during times of crisis. For example, the government deficit as a percent of GDP reached 5.73% in 2010.Q3 after the global financial crisis had slowed down the economy significantly.

This paper attempts to examine whether real depreciation /appreciation or more government deficit may help or hurt 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 aggregate supply function. Third, an interactive term is included to detect whether the relationship between real GDP and the real effective exchange rate may have changed in recent years.

2. The Model

This paper specifies that real GDP demanded in Australia is a function of the inflation rate, government spending, government tax revenue, the real interest rate, foreign income, and the real effective exchange rate and that real GDP supplied in the short run is influenced by the inflation rate, labor productivity, the real oil price and the expected inflation rate. We can express real GDP demanded and supplied as:

$$Y^d = h(\pi, G, T, R, Y^f, \varepsilon) \dots\dots\dots(1)$$

$$Y^s = g(\pi, P, E, \varepsilon, \pi^e) \dots\dots\dots(2)$$

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where

Y^d = real GDP demanded,
 π = the inflation rate,
 G = government spending,
 T = government tax revenue,
 R = the real interest rate,
 Y^f = foreign income,
 E = the real effective exchange rate,
 Y^s = real GDP supplied in the short run,
 P = labor productivity,
 E = the real oil price per barrel, 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:

$$\bar{Y} = w(\varepsilon, D, R, Y^f, P, E, \pi^e) \dots\dots\dots(3)$$

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where D stands for the government deficit or $G - T$.

According to economic theory, equilibrium real GDP is positively associated with foreign income and labor productivity and negatively affected by the real interest rate and the expected inflation rate.

The impact of real depreciation on aggregate output has been examined extensively. Real depreciation of the Australian dollar would make Australian-made goods more attractive and competitive, increase exports, and shift aggregate demand to the right. However, real depreciation would make imports more expensive, raise domestic inflation, and shift the short-run aggregate supply curve to the left. The net impact on real GDP is unclear.

Several articles have studied the effect of real depreciation or devaluation on aggregate output based on samples including Australia and other related countries. Kamin and Klau (1998) find that for industrialized countries including Australia, devaluations are contractionary in the short run but are not contractionary in the long run. Kalyoncu, Artan, Tezekici and Ozturk (2008) reveal that real depreciation is neutral in the short run and that there is no long-run cointegration between real output and real depreciation. An, Kim and Ren (2014) and Kim, An and Kim (2015) find that real depreciation may be contractionary or expansionary. Bahmani-Oskooee and Miteza (2003) provide a literature survey.

The effect of the government deficit/debt as a percent of GDP is inconclusive. 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). Some studies indicate that more government deficit/debt would not raise the interest rate (McMillin, 1986; Gupta, 1989; Darrat, 1989, 1990; Findlay, 1990; Ostrosky; 1990). However, other studies show that more government deficit/debt raises real interest rates and tends to crowd out private spending (Feldstein, 1982; Hoelscher, 1986; Cebula, 1997; Cebula & Cuellar, 2010; Cebula, 2014a, 2014b; Cebula, Angjellari-Dajci, & Foley, 2014). Reinhart and Rogoff (2010) show that if government debt as a percent of GDP is greater than 90%, economic growth would decline and that a higher government debt ratio results in a higher inflation rate in emerging economies.

A higher oil price would cause the short-run aggregate supply curve to shift to the left and aggregate output to decline in oil importing countries. Nevertheless, a demand-driven higher oil price may produce 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 Reserve Bank of Australia, the International Financial Statistics published by the International Monetary Fund, and the St. Louis Federal Reserve Bank. Real GDP in Australia is measured in million dollars. The real effective exchange rate is a trade-weighted index based on the consumer price index (CPI), and an increase means real appreciation. Government deficit is measured as a percent of GDP. The real interest rate is equal to the lending rate minus the expected inflation rate. U.S. real GDP is chosen to represent world income. Labor productivity is estimated as total output divided by total employment and measured in the Australian dollar. π^e is estimated as the average inflation rate of the past four quarters. Except for negative values, other variables are expressed on a log scale. The sample ranges from 2003.Q3 to 2016.Q1. Consistent data for the government deficit before 2003.Q3 are not available.

The ADF test shows that all the variables have unit roots in level and are stationary in first difference at the 5% level. According to the ADF test on the regression residual, the test statistic is estimated to be -4.3038 compared with the critical value of -2.6120 at the 1% level. Hence, these time series variables are cointegrated and have a long-term equilibrium relationship.

Figure 1 shows that the relationship between real GDP and the real effective exchange rate changed during the sample period. Therefore, a binary variable B with a value of one during 2013.Q3 - 2016.Q1 and zero otherwise is created. An interactive binary variable and an intercept binary variable are included in the estimated regression:

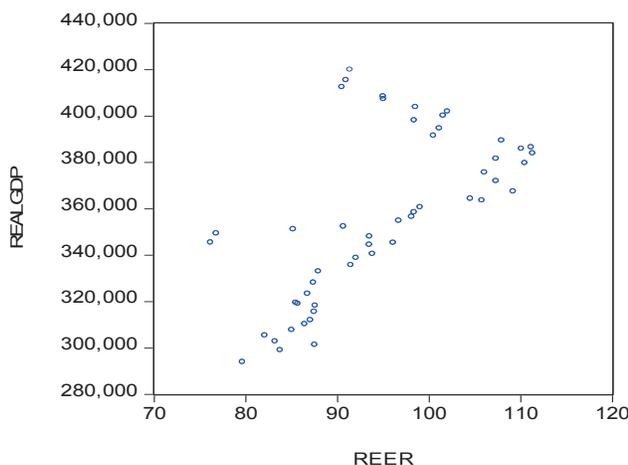
$$\bar{Y} = w(\varepsilon, \varepsilon \times B, B, D, R, Y^f, P, E, \pi^e) \dots\dots\dots(4)$$

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Suppose that β_1 and β_2 are the estimated coefficients for ε and $\varepsilon \times B$. The partial derivative of equilibrium real GDP with respect to the real effective exchange rate is equal to β_1 during 2003.Q3 - 2013.Q2 and $\beta_1 + \beta_2$ during 2013.Q3 - 2016.Q1. A negative relationship between equilibrium real GDP and ε during 2013.Q3 - 2016.Q1 suggests that β_2 is negative and greater than β_1 in absolute values.

The estimated regression and relevant statistics are reported in Table 1. The exponential GARCH model is employed to estimate the variance equation and regression parameters. As shown, approximately 98.75% of the change in real GDP in Australia can be explained by the nine exogenous variables. All the coefficients are significant at the 1% level. Real GDP in Australia is positively affected by the real effective exchange rate during 2003.Q3-2013.Q2, government deficit as a percent of GDP, U.S. real GDP, labor productivity and the real oil price and negatively associated with the real effective exchange rate during 2013.Q3-2016.Q1, the real interest rate, and the expected inflation rate.

Specifically, a 1% real appreciation of the Australian dollar would raise real GDP by 0.1854% during 2003.Q3-2013.Q2, but a 1% real depreciation would increase real GDP by 0.1690% during 2013.Q3-2016.Q1. If the government deficit as a percent of GDP rises 1 percentage point, the log of real GDP would increase 0.0025. When U.S. real GDP rises 1%, Australia's real GDP would increase 0.9236%. A 1% increase in labor productivity and the real oil price would lead to an increase in real GDP by 0.5212% and 0.0220%, respectively.



<Figure 1> Scatter diagram between real GDP (REALGDP) and the real effective exchange rate (REER)

Several other variables are considered. When the real effective exchange rate based on the consumer price index is replaced by the real exchange rate measured as units of the Australian dollar per U.S. dollar times the relative prices in the U.S. and Australia, a 1% real appreciation of the Australian dollar would raise real GDP by 0.1439% during 2003.Q3 - 2013.Q2, but a 1% real depreciation would raise real GDP by 0.0375% during 2013.Q3 - 2016.Q1. Other results are similar. When the real effective exchange rate based on the unit labor cost substitutes for the real effective exchange rate based on the consumer price index, a 1% real appreciation of the Australian dollar would increase real GDP by 0.1479% during 2003.Q3 - 2013.Q2, but a 1% real depreciation would raise real GDP by 0.2641% during 2013.Q3 - 2016.Q1. Other results are similar.

<Table 1> Estimated regression of log (real GDP) in Australia

Variable	Coefficient	z-Statistic
Intercept	-2.333552	-8.950935
Log(real effective exchange rate)	0.185391	13.22736
Log(real effective exchange rate) x Binary variable	-0.354398	-4.789305
Binary variable	1.612299	4.746633
Government deficit as a percent of GDP	0.002463	3.368020
Real interest rate	-0.021024	-9.930724
Log(U.S. real GDP)	0.923575	97.44215
Log(labor productivity)	0.521151	21.22149
Log(real oil price)	0.022026	4.391400
Expected inflation rate	-0.009657	-3.493254
R-squared	0.987518	
Adjusted R-squared	0.984777	
Akaike information criterion	-6.007213	
Schwarz criterion	-5.552665	
Sample period	2003.Q3-2016.Q1	
Methodology	EGARCH	
Mean absolute percent error	0.839908%	

4. Main Results

This study has examined the impacts of the real effective exchange rate, the government deficit and other selected macroeconomic variables on aggregate output in Australia. Real appreciation has a positive impact on real GDP during 2003.Q3 – 2013.Q2, but real depreciation has a positive impact on real GDP during 2013.Q3 – 2016.Q1. A higher government deficit as a percent of GDP, a lower real interest rate, a higher U.S. real GDP, a higher labor

productivity, a higher real oil price or a lower expected inflation rate would raise real GDP.

There are several policy implications. The trend of recent real depreciation of the Australian dollar is expected to increase real GDP. The positive significant coefficient of the government deficit as a percent of GDP suggests that its positive effect is not cancelled out by a negative crowding-out effect. World income as represented by real U.S. GDP is a powerful variable as an increase in exports creates jobs and raises income.

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