DETERMINANTS OF THE AUD/USD EXCHANGE RATE AND POLICY IMPLICATIONS

Yu Hsing[1]

[1]*Professor of Economics, Department of Management & Business Administration, College of Business, Southeastern Louisiana University, Hammond, USA*

ABSTRACT

This paper examines short-run determinants of the Australian dollar/U.S. dollar (AUD/USD) exchange rate based on a simultaneous-equation model. Applying the EGARCH method, the paper finds that the AUD/USD exchange rate is positively associated with the 10-year U.S. real government bond yield, U.S. real GDP, the U.S. real stock price and the expected exchange rate and negatively influenced by the Australian real government bond yield, Australian real GDP, and the real Australian stock price.

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Contribution/ Originality

This study's primary contribution is to apply demand and supply analysis in determining the AUD/USD exchange rate. Among other findings, a higher Australian interest rate would cause the Australian dollar to appreciate whereas a higher U.S. interest rate would lead to a stronger U.S. dollar.

1. INTRODUCTION

Australian dollar/U.S. dollar (AUD/USD) exchange rates have been affected by several major events. During the Asian financial crisis, the Australian dollar had depreciated as much as 35.48% against the U.S. dollar from 1.2534 in 1996.M12 to 1.6981 in 1998.M9. Due to widening interest rate differentials between the U.S and Australia, the Australian dollar had depreciated as much as 32.17% from 1.5103 in 1999.M5 to 1.9961 in 2001.M4. In the recent global financial crisis, the

Australian dollar also depreciated as much as 48.31% against the U.S. dollar from 1.0389 in 2008.M7 to 1.5408 in 2009.M2 but had recovered most of the losses and stood at 1.1024 as of 2014.M3. While a depreciating currency is expected to lead to more exports, it would cause less imports, higher domestic inflation, decreasing international capital inflows, rising costs of foreign debt measured in the domestic currency, and other related negative impacts.

This paper attempts to examine short-run determinants of the AUD/USD exchange rate based on a simultaneous-equation model of demand and supply. Monetary models of exchange rates are based on the validity of purchasing power parity in the long run and may not hold in the short run. The choice of the Australian dollar/U.S. dollar exchange rate as a case study is mainly because the Australian dollar is classified as an independently floating regime, which provides an ideal condition for the exchange rate to be determined by market demand and supply.

2. LITERATURE SURVEY

There have been many studies examining the determinants of exchange rates for Australia or related countries. Using a structural state-space model, Cayen *et al.* (2010) find that 88% of the variance in the difference of the real AUD/USD exchange rate can be explained by the two major factors, namely, world commodity prices and the ratio of the U.S. debt to GDP ratio.

Based on a structural VAR model, Sun and An (2011) examine the exchange rate for three advanced countries including Australia. They find that for the Australia dollar, the interest rate differential and capital flows are important explanatory variables and that portfolio investment is the most important factor.

Yuan (2011) examines the volatility of exchange rates for four advanced countries including the Australian dollar. He shows that economic fundamentals can influence exchange rate dynamics in a nonlinear manner via the transition probability and that exchange rate volatility is correlated with ARCH effects which are associated with regime changes.

Garton *et al.* (2012) analyze why the Australian dollar had appreciated and provided several reasons including strong economic performance, high terms of trade, rising resource prices, low risk of government debt, widening differential between the Australian interest rate and the interest rates in some advanced countries.

Based on a sample of 1970-2009, Kamrul Hassan and Salim (2011) apply several advanced econometric techniques to examine whether the PPP apples to the Australian dollar. They find that the PPP holds for the Australian dollar because they cannot reject the non-stationarity of the real exchange rate.

In the monetary models, the sign of the interest rate differential may be negative or positive, depending upon whether the Bilson (1978) model or the Dornbusch (1976) and Frankel (1979) models would apply. Furthermore, the traditional view suggests that an increase in the interest rate would cause a currency to appreciate due to capital inflows for higher returns on domestic assets whereas the revisionist view argues that a higher interest rate would cause a currency to depreciate

due to a higher default probability, a weaker financial position and a higher exchange rate risk premium (Dekle *et al.*, 2002).

Empirical results for selected Asian countries are inconclusive. Furman *et al.* (1998) show that a higher interest rate leads to currency depreciation whereas Basurto and Ghosh (2001) find that a higher interest rate leads to a currency appreciation. Dekle *et al.* (2002) reveal that a higher interest rate stabilizes depreciating currencies. Gould and Kamin (2000), Huang *et al.* (2010) indicate that no significant evidence in favor of the traditional view that a higher interest rate leads to currency appreciation.

Lin (2012) finds that comovements between stock prices and exchange rates in Asian emerging markets are stronger during the crisis period, mostly running from stock price changes to exchange rate changes and are not strong for export-oriented sectors. These findings suggest that comovements are attributable to capital account balance instead of trade.

3. THE MODEL

We can express the demand for and supply of the U.S. dollar versus the Australian dollar in the foreign exchange market as:

$$D^d = F(\varepsilon, Y^{AUS}, R^{US}, S^{US}, \varepsilon^e) \tag{1}$$

$$\qquad\quad - \quad ? \quad ? \quad + \quad +$$

$$D^s = H(\varepsilon, Y^{US}, R^{AUS}, S^{AUS}) \tag{2}$$

$$\qquad\quad + \quad ? \quad ? \quad +$$

where

D^d	= demand for the U.S. dollar,
D^s	= supply of the U.S. dollar,
ε	= the AUD/USD (Australian dollar/U.S. dollar) exchange rate,
Y^{US}	= U.S. real GDP,
R^{US}	= the real interest rate in the U.S.,
S^{US}	= the real stock price in the U.S.,
ε^e	= the expected AUD/USD exchange rate,
Y^{AUS}	= real GDP in Australia,
R^{AUS}	= the real interest rate in Australia, and
S^{AUS}	= the real stock price in Australia.

We expect that the demand for the U.S. dollar has a negative relationship with the AUS/USD exchange rate and a positive relationship with the real stock price in the U.S. and the expected AUD/USD exchange rate. The supply of the U.S. dollar is expected to be positively associated with the AUS/USD exchange rate and the real stock price in Australia.

A higher U.S. real GDP would increase U.S. imports from Australia and the supply of the U.S. dollar and reduce the UAS/USD exchange rate. However, if the increase in real GDP involves an

increase in import-substitute goods, U.S. imports from Australia may decline (Bahmani-Oskooee, 1986; Bahmani-Oskooee and Mitra, 2009). Monetary models of exchange rates also suggest that a higher real GDP would increase the demand for money, raise the U.S. interest rate, attract capital inflows, and increase the AUD/USD exchange rate. Hence, the sign of Y^{US} is unclear. This analysis applies to a change in real GDP in Australia.

According to the traditional view, a higher real interest rate in the U.S. tends to attract Australian people to invest in U.S. financial assets and to increase the demand for the U.S. dollar and the AUD/USD exchange rate. However, according to the revisionist view, a higher U.S. real interest rate would reduce the demand for the U.S. dollar and cause the U.S. dollar to depreciate due to a higher default probability, a weaker financial position and a higher exchange rate risk premium (Dekle *et al.*, 2002). This analysis applies to a change in the interest rate in Australia.

Solving for the equilibrium values of the two endogenous variables simultaneously, we can express the equilibrium exchange rate as a function of all the exogenous variables in equation (3). According to comparative static analysis, the sign beneath an exogenous variable shows the impact of a change in the exogenous variable on the equilibrium AUD/USD exchange rate.

$$\overline{\varepsilon} = X(R^{US}, R^{UAS}, Y^{US}, Y^{AUS}, S^{US}, S^{AUS}, \varepsilon^e) \qquad (3)$$
$$\quad\quad\quad\; ? \quad\;\; ? \quad\;\; ? \quad ? \quad\;\; + \quad\; - \quad\;\; +$$

4. EMPIRICAL RESULTS

The data were collected from IMF's *International Financial Statistics*. The AUD/USD exchange rate measures units of the Australian dollar per U.S. dollar. Hence, an increase means a depreciation of the Australian dollar and an appreciation of the U.S. dollar. The real interest rate in the U.S. is represented by the 10-year U.S. government bond yield minus the inflation rate in the U.S. The real interest rate in Australia is represented by the Australian government bond yield minus the inflation rate in Australia. Real GDP in the U.S. or Australia is an index with 2005 as the base year. The expected exchange rate is represented by the average AUD/USD exchange rate of past four quarters. The stock price in the U.S. or Australia is represented by the share price index with 2005 as the base year and divided by the CPI to derive the real value. Except for the AUS/USD exchange rate and the real government bond yields with negative values before or after log transformation, other variables are transformed to the log scale.

The sample consists of quarterly data ranging from 1984.Q1 to 2013.Q4 and has a total of 120 observations. The selection of 1984.Q1 as the beginning period is because on December 12, 1983, Australia removed all foreign exchange controls, and the exchange rate is determined by market demand and supply. Currently, the AUD is classified as independently floating. However, the Reserve Bank of Australia reserves the right to intervene in the foreign exchange market to avoid excessive fluctuations of the Australian dollar.

The DF-GLS test on the regression residuals is employed to determine whether these time series variables in equation (3) are cointegrated. The value of the test statistic is estimated to be -

3.3216, which is greater than the critical value of -2.5847 in absolute values at the 1% level. Therefore, these variables have a long-term stable relationship.

Table 1 reports the estimated regression and related statistics. The EGARCH method is applied in empirical work in order not to place any restriction on the parameters and to yield a positive conditional variance. As shown, approximately 82.77% of the change in the equilibrium AUD/USD exchange rate can be explained by the seven right-hand side variables. The forecast error of 5.0238% is relatively small. All the coefficients are significant at the 1% level. The equilibrium AUD/USD exchange rate is positively associated with the 10-year U.S. real government bond yield, U.S. real GDP, the U.S. real stock price, and the expected AUD/USD exchange rate. It is negatively affected by the Australian real government bond yield, Australian real GDP, and the Australian real stock price.

Specifically, a 1 percentage-point increase in the 10-year U.S. real government bond yield would raise the AUD/USD exchange rate by 0.0240 whereas a 1 percentage-point increase in the Australian real government bond yield would reduce the AUD/USD exchange rate by 0.0261. According to the Wald test, the null hypothesis that the coefficients of the 10-year U.S. real government bond yield and the Australian real government bond yield in absolute values are the same cannot be rejected at the 1% or 5% level.

Table-1. Estimated Regression of the AUD/USD Exchange Rate

Dependent variable: the AUD/USD exchange rate	Coefficient	z-statistic
Constant	0.8279	5.2332
10-year U.S. real government bond yield	0.0240	10.0084
Australian real government bond yield	-0.0261	-12.4544
U.S. real GDP	1.1836	7.0216
Australian real GDP	-1.2272	-9.5486
U.S. real stock price	0.2490	13.1640
Australian real stock price	-0.3120	-16.7485
Expected AUD/USD exchange rate	0.7518	53.6266
R^2	0.8277	
Sample period	1984.Q1-2013.Q4	
Sample size	120	
Mean absolute percent error (MAPE)	5.0238%	

Notes: The AUD/USD exchange rate refers to the units of Australian dollar per U.S. dollar.

All the coefficients are significant at the 1% level.

A 1 unit increase in the log of U.S. real GDP would raise the AUD/USD exchange rate by 1.1836 whereas a 1 unit increase in the log of Australian real GDP would reduce the AUD/USD exchange rate by 1.2272. According to the Wald test, the null hypothesis that the coefficients for the log of U.S. real GDP and the log of Australian real GDP in absolute values are the same cannot be rejected at the 1% or 5% level.

A one unit increase in the log of the U.S. real stock price would increase the AUD/USD exchange rate by 0.2490 whereas a one unit increase in the real Australian stock price would reduce

the AUD/USD exchange rate by 0.3120. The null hypothesis that the coefficients of the U.S. real stock price and the real Australian stock price in absolute values are the same can be rejected at the 1% level. If the expected exchange rate rises by 1, the actual exchange rate would increase by 0.7518.

5. SUMMARY AND CONCLUSIONS

This paper has examined the determinants of the AUD/USD exchange rate in the short run based on a simultaneous-equation model consisting of the demand for and supply of the U.S. dollar versus the Australian dollar. A reduced-form equation is estimated by the EGARCH method. The paper finds that a higher 10-year U.S. real government bond yield, a higher U.S. real GDP, a higher U.S. real stock price, and a higher expected exchange rate would raise the AUD/USD exchange rate whereas a higher Australian real government bond yield, a higher Australian real GDP, and a higher Australian real stock price would reduce the AUD/USD exchange rate.

There are several policy implications. It seems that demand and supply analysis appears to apply to the AUD/USD exchange rate in the short run because it can explain approximately 82.77% of exchange rate movements and the forecast error of 5.0238% is relatively small. Interest rates, real GDP, stock prices and the expected exchange rate in the U.S. and Australia play significant roles in exchange rate movements in the short run. Holding other factors constant, the recent rise of the 10-year U.S. government bond yield from a low of 1.53% in July 2012 to 2.56% in May 2014 and the rising trend of U.S. stock market indexes since March 2009 would cause the AUD/USD exchange rate to rise. The use of the differential form such as the real interest rate or real GDP differential between two countries may be considered because the null hypothesis that the two coefficients in absolute values are the same cannot be rejected.

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