HAS DOMESTIC OR FOREIGN NET SAVING DRIVEN THE EXTERNAL ACCOUNTS?

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Abstract

This paper develops an international borrowing and lending framework for examining the relationship between current account imbalances and real interest rates for small open economies. It first establishes how domestic or international net saving may influence external imbalances and interest rates over any given time, deriving the proposition that external imbalances and real interest rates move together whenever net saving shocks are domestically sourced, but move oppositely when net saving shocks emanate abroad. It then shows that in the case of Australia, a small open economy that has persistently experienced large external deficits since the mid 1980's, rising net capital inflow has had a statistically significant negative impact on domestic real long term interest rates. This suggests that foreign factors have mainly been responsible for the rise in Australia's current account imbalance and fall in real interest rates.

Keywords: *saving, investment, international borrowing and lending, Australia, interest rates*

JEL: *F15, F30, F34*

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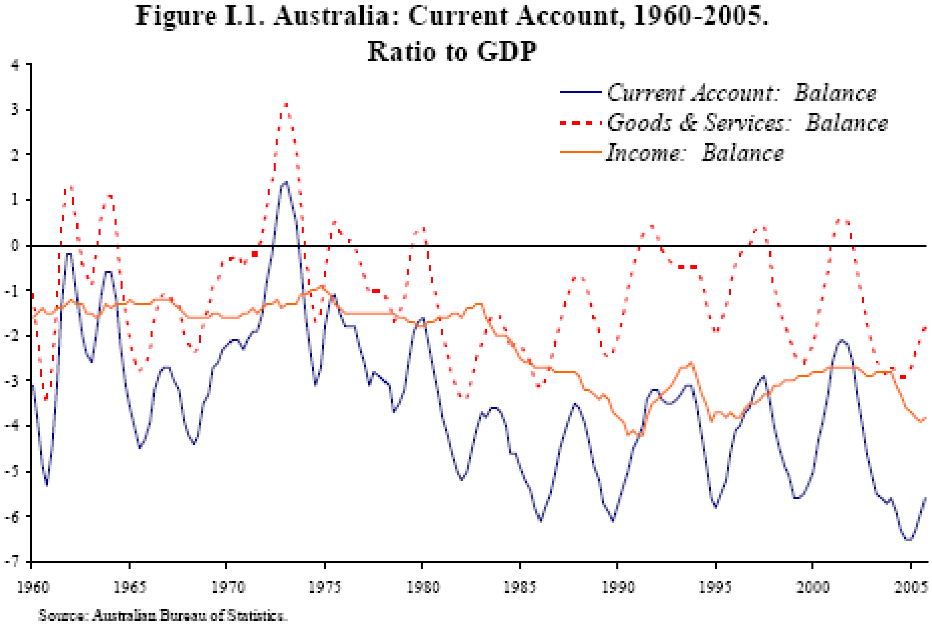
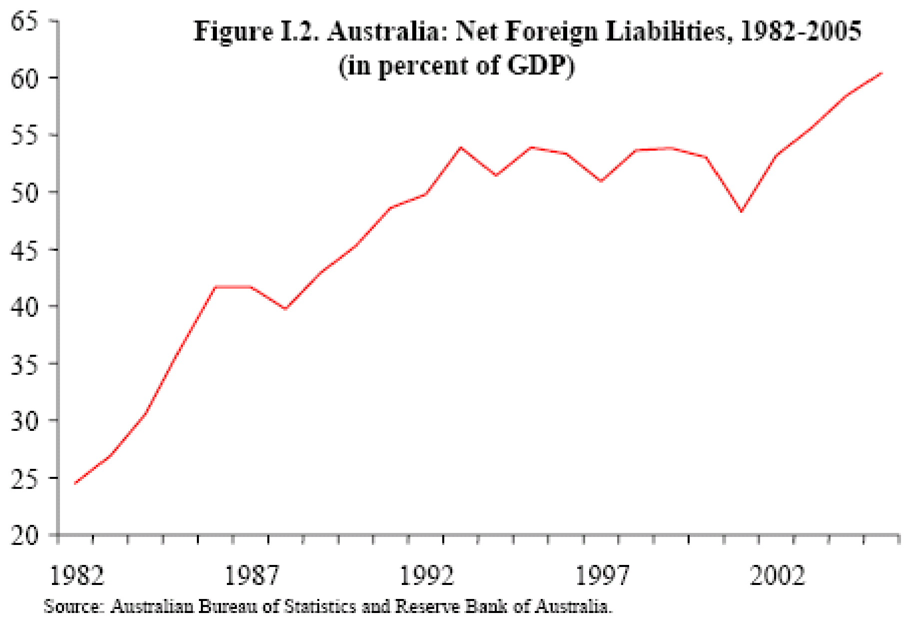
Current account imbalances and international borrowing and lending patterns have changed markedly over recent decades and remain a significant international economic policy concern. The major advanced borrower economies, the United States, Australia, New Zealand, Spain and the United Kingdom, have external deficits largely funded by high saving economies in East Asia, especially Japan and China, the oil exporting nations and various European countries, notably Germany, the Netherlands, Sweden and Switzerland (IMF 2007).

Amongst international borrower countries, Australia's current account deficit has been one of the largest by OECD standards, averaging 4.5 per cent of its GDP since international capital inflows and outflows were liberalized and its exchange rate floated in the mid 1980's. Australia's persistent borrowing has resulted in a net foreign debt level that stands at over 60 percent of GDP, also making it one of the world's biggest international debtors for its size (see Figure 1).

Figure 1: Australia's Current Account and Net Foreign Liabilities





The intertemporal model of international borrowing based on the saving – investment perspective (Sachs 1981, Frenkel and Razin 1987, Obstfeld and Rogoff 1996 and Makin 2004) remains the most popular theoretical model for interpreting the causes and policy significance of external imbalances. This approach demonstrates the effects of fiscal and other shocks assuming a highly interest elastic supply of foreign savings and implies that foreign borrowing by forward looking optimising agents can raise national income and intertemporal consumption. Critically, it also implicitly assumes a well behaved banking and financial system that channels foreign funds to their most productive use. Otherwise, sudden current account reversals may occur with business cycle implications (Edwards 2004, Blanchard, Giavazzi and Sa 2000, Adelet and Eichengreen 2005, Freund 2005), an extreme case being the Asian currency and financial crisis of the late 1990's.

Following Sheffrin and Woo (1992), numerous authors have used intertemporal precepts to estimate the optimal level of current account deficits whether they have been consistent with consumption smoothing behaviour and intertemporal budget constraints (Ghosh and Ostry 1995, Mansoorian 1998, Cashin and McDermott 1998, Otto 2003) As argued by Mercereau and Minane (2004) however, time series analysis of the sustainability of external imbalances that tests consumption smoothing is not a reliable means of assessing whether external imbalances are excessive.

A related stream of research on the relationship between saving, investment and international capital flows inspired by Feldstein and Horioka (1980) suggests that high correlation between domestic saving and domestic investment in post-war OECD economies is indicative of low international capital mobility. Although recent studies (see Obstfeld and Rogoff 2000, amongst others) have shown that capital mobility by this measure has increased over past decades, it remains less than may be expected with highly liberalised international capital markets.

What has not been sufficiently recognized in the expansive literature linking saving, investment and international capital flows is that an economy's net foreign borrowing may be predominantly influenced not by altered saving and investment at home, but by changed saving and investment abroad. Identifying whether most of the variation in net capital inflow matching the external deficit is sourced at home or abroad has important implications for fiscal policy and real interest rates.

Using Australia as a case study, this paper provides a new perspective on external imbalances by examining whether domestic or foreign net saving primarily influences net capital inflow and real interest rates. It is structured as follows. Section 2 introduces an extended loanable funds framework for interpreting the links between regional saving – investment imbalances and international borrowing, lending and real interest rates. Section 3 outlines an econometric approach to test whether domestic or foreign factors have accounted for most of the variation in Australia's external imbalance and real interest rates. The final section concludes with a summary of results and discussion of policy implications.

2. Saving, Investment and the External Imbalance

2.1 An International Borrowing and Lending Framework

The following accounting and behavioral relationships lay the foundations for linking saving, investment and the external imbalance for Australia (the home country) with international borrowing and lending from the rest of the world.

$$S_p = \overline{Y} - T - C_p \tag{1}$$

$$S_g = T - C_g \tag{2}$$

$$S = S_p + S_g = S(\overset{+}{r}; \overset{-}{C_p}, \overset{-}{C_g}) \tag{3}$$

$$I = I_p + I_g = I(\overset{-}{r}; \overset{+}{q}, \overset{+}{I_g}) \tag{4}$$

$$I - S = KAS = B^*(\overset{-}{r}; \overset{+}{C_p}, \overset{+}{q}, \overset{+}{I_g}, \overset{+}{C_g}) \tag{5}$$

where

S_p is private saving

r is the real domestic interest rate

$\overline{Y}$ is given national output

T is government tax revenue

C_p is household consumption

S_g is public saving

C_g is public consumption

S is total domestic saving

I_p is private investment

I_g is public investment

q is the ratio of the market value of private capital to its replacement cost

r^* is the world interest rate

KAS is the capital account surplus

B^* is the external borrowing requirement

Relations (1) to (3) define private and public saving, with private saving determined as a residual between national disposable income and household consumption. Public saving is the difference between government consumption and revenue. Although the Ricardian Equivalence proposition implies that policy-induced changes in public saving can induce an offset in private saving if households anticipate increased future taxes, empirical evidence suggests the offset is well under unity.[1] Hence, in net terms a rise in C_g reduces public saving and lowers national saving.

The demand for funds derives from private and public investment demand (equation (4)). Private investment is positively related to the ratio of the market value of capital to its replacement cost after Tobin's (1969) *q* theory, and negatively related to the real interest rate. Equation (5) shows that a capital account surplus, or net foreign borrowing, funds domestic investment beyond the level of domestic saving.

For borrower countries, the rest of the world acts as a lender of surplus saving over investment. Assuming the same basic factors determine saving and investment abroad as at home, it follows that

$$S^* - I^* = CAS^* = L^*(\overset{+}{r^*};\ \overset{-}{C_p},\ \overset{-}{q^*}, \overset{-}{I_g^*}, \overset{-}{C_g^*}) \qquad (6)$$

where asterisks denote the foreign counterparts of the variables defined above and

CAS^* is the rest of the world's current account surplus against the home country

L^* is lending to the home country

[1] For instance, Gale and Orszag (2004) find the RE offset ranges between 03 and 0.5.

A common interest rate equilibrates the quantum of international borrowing and lending to the home country over any given period. If the home country is too small to affect the world interest rate and if the rest of the world becomes increasingly averse to lending to it as foreign debt rises, then

$$r = r^* + \rho(\overset{+}{F^*}; \overset{+}{R}) \qquad (7)$$

where

ρ is the risk premium above the world interest rate

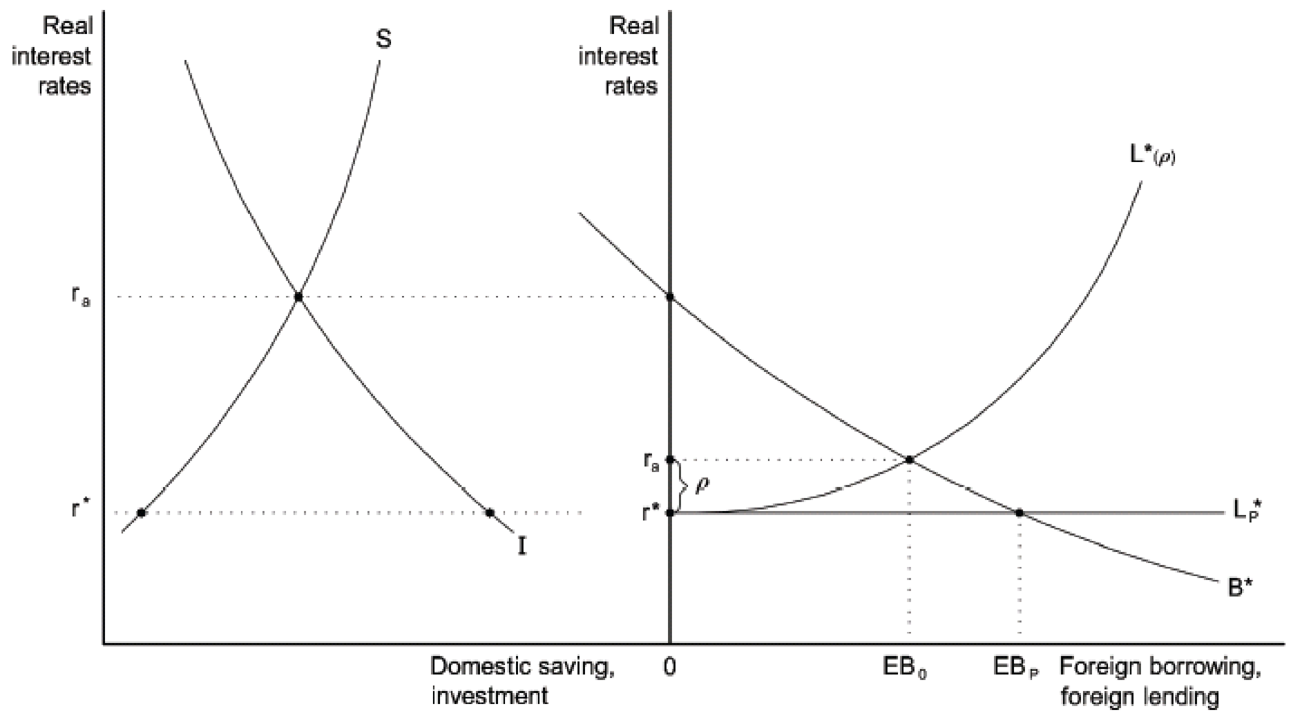
F^* is the stock of foreign debt and

R captures other risk factors such as exchange rate risk and country risk.

Static exchange rate expectations are assumed as the normal case in the absence of any consensus about the short to medium term determinants of the exchange rate.

These relationships are graphically depicted in loanable funds – real interest rate space, as shown in the left panel of Figure 2. The downward sloping schedule conventionally shows the domestic demand for funds arising for net investment purposes while the upward sloping schedule depicts net saving or the supply of domestic funds. The net international borrowing requirement *ex ante* is shown as the horizontal distance between the demand for funds and the supply of domestic saving for a range of interest rates. The investment – saving gap is replicated by the B_0^* schedule in the right panel drawn in real interest rate - international borrowing and lending space.

Figure 2: International Borrowing, Lending and Real Interest Rates



A rise in the economy's borrowing requirement, due for instance to increased real investment opportunities (a rise in *q*) or fall in public saving due to higher public consumption shifts the B^* schedule rightward. Only if international capital mobility is perfect, will foreigners lend at r^*, the going world interest rate, as shown by the horizontal L_0^* schedule. Yet, in reality capital mobility is not infinitely elastic and lenders are averse to default and other forms of risk, including currency depreciation. Hence, the supply of foreign funds the home country can borrow depends not only on the excess of global saving over investment, but on risk perceptions.

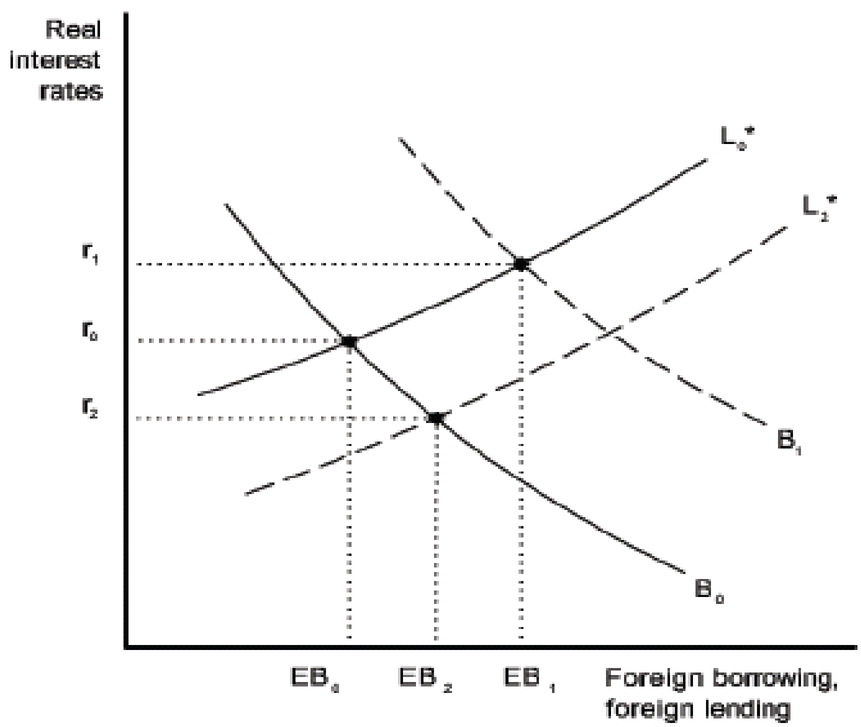
This explains the upward sloping foreign lending or net capital inflow schedule, L^* in Figure 1. The more risk-averse foreign investors are to rising foreign debt, the steeper the slope of the L^*

schedule. Changes in world saving relative to investment affect real global interest rates and shift the L^* schedule, downwards when net global saving rises, upwards when it falls. Other shift factors are expected appreciation/depreciation and heightened perceptions of political/country risk.

2.2 Examining Domestic versus Foreign Net Saving Shocks

This international borrowing and lending framework can now be used to predict the effect of various domestic and foreign saving and investment shocks on both the external imbalance and real interest rates as shown in Figure 3 based on the right panel of Figure 2.

Figure 3: Domestic Versus Foreign Net Saving Shocks



For instance, an increase in domestic investment spending due to an increase in q, other things the same, shifts the *ex ante* foreign borrowing schedule outward. The real domestic interest rate rises from r_0 to r_1 and the external surplus increases from EB_0 to EB_1 *ex post*. Likewise, a rise in public consumption or investment has the same effect. These cases exemplify domestically sourced shocks that simultaneously influence the external imbalance and real interest rates.

Yet, foreign saving and investment shocks emanating from abroad can also influence the home economy's external surplus and real interest rate. For instance, assume the same initial equilibrium as before (at r_0, EB_0) and that, other things equal, private investment overseas falls relative to private saving, raising net foreign saving. In this case, the foreign lending schedule shifts out, the capital account surplus widens from EB_0 to EB_2 and the equilibrium interest rate falls from r_0 to r_2. Alternatively, with lower foreign public spending public saving abroad rises, the external surplus also widens and the real interest rate falls. In the contrary case of reduced net private or public saving abroad due to increased consumption or investment, the home economy's external surplus falls and real interest rate rises.

Table 1 presents all possible saving and investment shocks (domestic and foreign) that increase the external imbalance and vary real interest rates. The interesting general result that emerges is this: If the predominant net saving shock is domestic, the external imbalance and real interest rate move in the same direction, whereas if the predominant net saving shock is foreign, they move oppositely. This central finding makes it possible to identify whether domestic or foreign factors have mainly influenced Australia's external imbalance over recent decades by testing whether and when the external surplus and real interest rates have moved in the same or in opposite directions.

Table 1 – Domestic, Foreign Net Saving, the External Surplus and the Real Interest Rate

Source of Net Saving Shock:	Effect on:	
	Capital Account Surplus	*Real Interest Rate*
Domestic		
Private Saving ↓	↑	↑
Public Saving ↓	↑	↑
Private Investment ↑	↑	↑
Public Investment ↑	↑	↑
Foreign		
Private Saving ↑	↑	↓
Public Saving ↑	↑	↓
Private Investment ↓	↑	↓
Public Investment ↓	↑	↓

Following the theoretical framework outlined above, the estimable model has the following form:

$$r_t = \alpha_0 + \alpha_1 KAS + \varepsilon_t \qquad (9)$$

Here, r is the equilibrium real domestic interest rate. Since we are interested in the long-term interest rate, we proxy this interest rate with the inflation-indexed government bond rate. *KAS* is the external imbalance or capital account surplus, defined as a percentage of gross domestic product.

3. Modelling Framework and Results

We first conduct tests for the integrational properties of real domestic interest rate and current account balance as a percentage of GDP. We use a battery of tests, namely the ADF, PP, ADF-GLS and the KPSS tests. The first three tests examine the null of non-stationarity against mean and trend stationarity, while the KPSS test examines the null hypothesis of stationarity against the alternative that the series contains a unit root.

The results are reported in Table 2. We find that there is mixed evidence on the integrational properties of the two variables. In sum, our results from unit root and stationarity tests are as follows. For the interest rate variable, there is evidence from all four tests of non-stationarity when we do not allow for a time trend. However, when we include a time trend, three of the four tests suggest that real interest rate is trend stationary. For the current account balance series, we find that three of the four tests suggest that it is non-stationary when we do not allow a time trend, while three of the four tests suggest stationarity when we allow a time trend.

In the next step, we run an OLS regression based on the regression model captured by equation (9). The idea behind this exercise was to examine whether the OLS model consisted of ARCH effects. We found the ARCH (1), (2), (3) and (4) having an LM statistic of 57.17, 28.39, 21.48, and 19.54, respectively. In all the four cases, we obtained a p-value of zero, implying that we could not reject the null hypothesis of ‘no ARCH” effects. Thus, it is clear that the OLS regression model depicted by equation (9) suffers from ARCH.

Table 2: Tests for unit root and stationarity

	ADF		PP		ADF-GLS		KPSS	
	NT	T	NT	T	NT	T	NT	T
r	-2.78 [1] (-2.90)	-3.51 [1] (-3.47)	-1.21 [2] (-2.89)	-2.92 [3] (-3.47)	-0.98 [1] (-1.95)	-3.55 [1] (-3.10)	1.07 [6] (0.46)	0.09 [6] (0.15)
KAS	-2.33 [4] (-2.90)	-3.66 [5] (-3.47)	-3.14[2] (-2.89)	-4.33 [0] (-3.47)	-2.40 [4] (-1.95)	-2.98 [4] (-3.10)	0.55 [6] (0.46)	0.11 [6] (0.15)

Notes: For the ADF and ADF-GLS tests, the square brackets contain the lag lengths, while for the PP and KPSS tests, the square brackets contain the selected bandwidths.

To remedy ARCH effects, we employ the EGARCH model proposed by Nelson (1991). We assume a conditional normal distribution and specify an $\mathrm{EGARCH}(1,1)$ model with the following mean and variance structures:

Mean equation:

$$r_t = \text{constant} + \beta KAS + \varepsilon_t$$

Variance equation:

$$\log\left(\sigma_t^2\right) = \omega + \alpha\left(\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| - \sqrt{\frac{2}{\delta}}\right) + \gamma\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + \beta\log\left(\sigma_{t-1}^2\right)$$

Our choice of the EGARCH model over other models from the family of ARCH models, including the GARCH model, is as follows. First, the EGARCH model does not impose any restrictions on α, γ, and β. Second, there is provision for oscillatory behaviour in the conditional variance since the β coefficient can be either negative or positive. The estimate of β allows one to evaluate whether shocks to the variance are persistent or not. Nelson (1991) shows that $|\beta| < 1$ ensures stationarity and ergodicity for the EGARCH(1,1).

Third, the EGARCH model allows one to judge asymmetric volatility, which is captured by the parameter γ. If $\gamma > 0$, the implication is that positive shocks give rise to higher volatility than negative shocks, and vice versa. Fourth, the parameter α represents the magnitude of the conditional shock on the conditional variance.

We estimate three variants of the EGARCH model specified above: (1) an EGARCH-M model, which essentially includes the variance of real interest rate in the mean equation; (2) an EGARCH-ARMA model, which essentially includes the autoregressive moving average components in the mean equation; and (3) the EGARCH-ARMA-M, which in addition to the ARMA terms also includes the variance of the real interest rate variable in the mean equation. The main objective of estimating different variants of the EGARCH model is to examine the robustness of our results.

To obtain robust inference about the estimated models, we compute the robust standard errors as suggested by Bollerslev and Wooldridge (1992). We estimate the models using the maximum likelihood estimation technique, assuming normally distributed errors and the optimal lag lengths are selected using the Schwarz Bayesian Criterion (Schwartz, 1978).

The results from the EGARCH model are reported in Table 3. The results are organised as follows. Column 2 contains results from the basic EGARCH model, column 3 reports results from the mean-EGARCH model, column 4 contains results from the EGARCH model where the mean equation is augmented with the ARMA components, while the final column reports results from the EGARCH-ARMA model but augmented with the log(GARCH) variable in the mean equation.

In other words, columns 3 and 5 test whether the mean interest rate is affected by volatility in the real interest rate. The last four rows contain the ARCH diagnostic test, which examines the null hypothesis of ‘no GARCH’ effect in the estimated EGARCH models.

The main focus of our results from the EGARCH model is based on the estimate of KAS. Given our aim, to examine whether internal or external factors determine Australia’s long-term interest rate and the current account imbalances, the application of more than one model is crucial because it allows us to ascertain the robustness of the results. We find fairly robust results on the impact of the current account imbalance on the real interest rate.

We find that the sign of the KAS variable is negative across all the four models and it is statistically significant at the 1 per cent level in all the four models. This result implies that a rise in current account balance reduces domestic real interest rate. That real interest rate and current account balances move in opposite directions suggests that external factors have been instrumental in determining Australia’s current account balance.

From the point of view of gaining more insights on the relationship between real interest rate and current account imbalance, our modelling framework based on the EGARCH model has two advantages. One advantage is that the mean equation of the real interest rate allows us to examine whether volatility of long term real interest rate influences real interest rate. Two of our estimated models (models 2 and 4) examine this relationship. We find that interest rate volatility has a positive and statistically significant (at the 1 per cent level) effect on the long term real interest rate. The second advantage of the EGARCH model is rooted in the variance equation of the real interest rate, allowing us to better understand the behaviour of the volatility of real interest rate.

Table 3: EGARCH results

	Model 1	Model 2	Model 3	Model 4
Constant	5.1817***	5.4878***	4.1133***	4.8552***
	(0.2034)	(0.1701)	(0.2449)	(0.1555)
KAS	-0.3248***	-0.1026***	-0.1113***	-0.1295***
	(0.0502)	(0.0388)	(0.0409)	(0.0257)
log(GARCH)	-	0.5634***	-	0.2616***
		(0.0863)		(0.0399)
AR(4)	-	-	0.5867***	0.1406
			(0.0813)	(0.2279)
MA(4)	-	-	-0.0299	0.1325
			(0.1131)	(0.2557)
ω	-1.2810*	-0.7083***	-1.8252***	-1.0893***
	(0.0502)	(0.2120)	(0.6129)	(0.1630)
α	1.1600	0.2824***	1.4092**	0.6626***
	(0.7296)	(0.0676)	(0.5655)	(0.0392)
γ	-0.0026	0.5004***	0.0295	0.5054***
	(0.2929)	(0.0756)	(0.2609)	(0.1038)
β	0.6455**	0.8043***	0.6118***	0.8923***
	(0.3419)	(0.0641)	(0.2206)	(0.0355)
Diagnostic test				
$\overline{R}^2$	0.1591	0.8259	0.4477	0.6601
ARCH(1)	0.1975	0.0086	0.7008	0.2839
	(0.6579)	(0.9263)	(0.4053)	(0.5958)
ARCH(2)	1.4743	1.0064	0.3644	0.0233
	(0.2355)	(0.3704)	(0.6959)	(0.9769)
ARCH(3)	0.9459	1.7873	0.4495	0.1858
	(0.4230)	(0.1571)	(0.7184)	(0.9057)
ARCH(4)	1.0643	2.5091	0.7863	0.0887
	(0.3806)	(0.0516)	(0.5381)	(0.9856)

Notes: The standard errors are in parenthesis except for the results on diagnostic tests; for the diagnostic tests the probability values are in parenthesis. * (**) *** denote statistical significance at the 10 per cent, 5 per cent, and 1 per cent levels, respectively.

Essentially, we are able to deduce whether or not shocks to interest rate volatility are persistence and asymmetric in nature. These are important pieces of information given our earlier finding that interest rate volatility raises interest rate. Gamma captures symmetric or otherwise of shocks to interest rate volatility while beta captures persistence or otherwise of shocks to interest rate volatility. Our main findings are as follows. Based on models 2 and 4 which are mean-EGARCH models, evidence suggests that shocks have asymmetric effects on real interest rate volatility, while models 1 and 3, which do not model the impact of volatility in the mean equation, reveal that shocks are symmetric. An issue now is which model should we trust? One way of addressing this issue is to choose the model with the highest explanatory power.

Our results reveal that models 2 and 4 have the most explanatory power, so we conclude that shocks to interest rate volatility have asymmetric effects. The next issue is whether or not shocks have a persistent impact on interest rate volatility. Again, based on models 2 and 4 which have most explanatory power, we find that shocks are highly persistent. The final issue is to examine whether our estimate models are free of ARCH. We report the ARCH LM test in the last 4 rows of Table 2. Our results suggest that we are unable to reject the null hypothesis of 'no ARCH' effects in all the four models, implying that our EGARCH models are well behaved.

4. Conclusion

External account imbalances have increased markedly since worldwide liberalization of financial markets from the early 1980s, especially within the OECD region, and more recently between emerging East Asian and select OECD economies. Accordingly, domestic saving and investment rates for individual economies have become more independent, or less correlated, so that capital mobility in the Feldstein-Horioka (1980) sense has increased. At the same time, real interest rate movements can no longer be properly understood without reference to international borrowing and lending patterns.

Over this time Australia has experienced a persistently large current account deficits matched by capital inflow, attributed usually to factors influencing domestic saving and investment behaviour. For this reason it makes a useful case study of current account behaviour for a small open economy. Using variants of EGARCH models we found evidence that net capital inflow has had a statistically significant negative impact on domestic real interest rates in Australia. This finding implies that external factors have determined Australia's interest rate setting.
The EGARCH model allows us to examine the dynamic characteristic of Australia's long term interest rate, in that we uncover that: (1) interest rate volatility has had a positive impact on interest rate; (2) shocks to interest rate volatility have asymmetric effects, meaning that positive and negative shocks exert different magnitudes of impact on the interest rate; and (3) that the impact of shocks on interest rate volatility are persistence, implying that shocks are long lasting.

However, the above analysis does not suggest that international borrowing and lending is a concern from a macroeconomic policy perspective, nor does it imply that domestic fiscal and monetary policies or international policy co-ordination are powerless to influence the magnitude of external imbalances. It simply shows how domestic and foreign net saving behaviour both contribute to external imbalances and real interest rate variation and provides an approach that may usefully be applied to other significant international borrower countries.

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