

Do exchange rates affect the stock performance of Australian Banks?

Authors:

Jing Chi* (Massey University)

Address: Department of Finance, Banking & Property, Massey University, Private Bag 11-222, Palmerston North, New Zealand, Phone: +64-6-3505799-7369, Fax: +64-6-3505651, Email: J.Chi@massey.ac.nz

David Tripe (Massey University)

Address: Department of Finance, Banking & Property, Massey University, Private Bag 11-222, Palmerston North, New Zealand, Phone: +64-6-3505799-2337, Fax: +64-6-3505651, Email: D.W.Tripe@massey.ac.nz

Martin Young (Massey University)

Address: Department of Finance, Banking & Property, Massey University, Private Bag 11-222, Palmerston North, New Zealand, Phone: +64-6-3505799-2482, Fax: +64-6-3505651, Email: M.Young@massey.ac.nz

JEL classification: G12, G21

Keywords: Exchange Rates, Offshore Assets, Stock Returns, Australia banks

* Corresponding author

Do exchange rates affect the stock performance of Australian Banks?

Abstract

There is an expectation that the performance of banks with significant foreign business should be impacted by relative changes in the values of the currencies of the foreign countries in which that business is undertaken. Using data from 1 Jan 1997 to 31 March 2007 and the capital market method, this study explores this relationship for the four major Australian banks, whose stock returns are compared with those of the so-called Australian regional banks, which do not have foreign business. Contrary to expectations, almost no significant relationships between Australian bank stock returns and foreign exchange rates are found, raising questions as to the efficiency of stock markets in recognising banks' foreign exchange exposures arising from their offshore assets and business.

JEL classification: G12, G21

Keywords: Exchange Rates, Offshore Assets, Stock Returns, Australia, bank international expansion

1. Introduction

A number of theories have been proposed as to why banks should expand internationally, although all of these, ultimately, relate to banks' ability to earn profits from doing so. Major theories to explain international expansion include the industrial organization theory, the comparative advantage theory, the international investment theory, portfolio theory, the internalisation theory and the eclectic theory.

The industrial organisation theory has a number of different strands, including banks following their customers into foreign markets, higher concentration in the home country market providing higher profits to support expansion, greater strength or importance of the home country currency and a desire to secure (retail) deposits in the host country. The comparative advantage theory proposes that banks expand from countries with a comparative advantage in the supply of banking services. International investment theory is based on the idea that banks will expand internationally in order to exploit or avoid market externalities, while portfolio theory argues that international expansion is a risk diversification decision. Internalisation theory recognises the market imperfections preventing the efficient operation of international banking, and suggests that a bank expands internationally to overcome externalities. The eclectic theory combines a number of strands, largely from the internalisation theories: these are ownership-specific advantages, internalisation specific advantages and location-specific variables.¹

Within this range of options, relatively little attention has been given to portfolio theory, which could be used to argue that banks ought to expand internationally to reduce the risks of

¹ This summary of the theories and their strengths and weaknesses is very brief. For a more extensive review, please refer to Cho (1985), Williams (1997), and Tripe and Matthews (2003).

investing solely in their home markets. Grosse and Goldberg (1991) found that banks from countries considered risky were more likely to have a foreign office, but an alternative perspective has been that countries can diversify their loan portfolios internationally without an extensive network of foreign offices (although a bank's lending portfolio might then be limited to low-margin, wholesale business). Other studies have considered exchange rates as a factor in banks' foreign investment decisions, but the focus of these has often been on the issue of whether an investment is likely to generate a foreign exchange gain or a loss (e.g. Hultman and McGee, 1989; Moshirian and Pham, 1999; Moshirian, 2001). Relatively little attention has been given to looking at internationally-active banks' assets as a portfolio, with sub-portfolios in different countries exposed to different risks and returns.

This paper attempts to fill some of the gap in the exploration of the portfolio theory of the international expansion of banks by looking at the four major Australian banks, each of which has significant operations outside Australia. The specific focus is on the impact of changes in the exchange rate of the Australian dollar relative to the currencies applying to the main countries into which these major Australian banks have expanded their operations. The effect is measured in terms of the effect on stock returns for those Australian banks; the sample period is from 1 Jan 1997 to 31 March 2007 and the methodology employed is the capital market method. Surprisingly, we find no significant foreign exchange impact on the four major Australian banks' stock returns, or on the stock returns of the five Australian regional banks. Questions are then raised as to the efficiency of stock markets in recognising banks' foreign exchange exposures arising from their overseas assets and business.

The rest of the paper is structured as follows. The next section provides some detail on the international operations of the major Australian banks and their history. The third section

outlines the key hypothesis that will be explored in this study, while section 4 introduces the data that are used for the analysis. Section 5 reports and reviews the results and discusses their implications, while section 6 concludes and identifies issues for further research.

2. The major Australian banks and their international expansion

The Australian banking market is dominated by four major banks, which together control around 67% of the market by assets (as at January 2006). These are the Australia and New Zealand Banking Group Limited (ANZ), Commonwealth Bank of Australia (CBA), National Australia Bank (NAB), and the Westpac Banking Corporation (Westpac). Each of these banks is listed on the Australian Securities Exchange (ASX), where they are among the largest listed companies, and each of them has both retail and other banking business outside Australia.²

The CBA is the youngest of these banks, originally established as a government-owned institution in 1911, but fully privatised since 1996. Like all the major Australian banks, it has offices in the major financial centres of London, New York, Tokyo, Hong Kong and Singapore. It expanded into New Zealand with the acquisition of 75% of ASB Bank in 1989, with the remaining 25% acquired in 2000. Its other significant international expansion has been into Fiji, where it acquired a business with the acquisition of Colonial Limited (an Australian bancassurance group) in 2000. There are some small operations in other countries, but the New Zealand business is the largest outside Australia. The trend in all banks' international activities is shown in Figure 1.

[Insert Figure 1 Here]

² The following summary of Australian banks and their international operations is relatively brief. For a more extensive discussion, please see Tripe and Matthews (2003) and Wilkins (2003).

Westpac is the longest established of the Australian banks, having been originally established as the Bank of New South Wales in 1817. It has had business in New Zealand since the Bank of New South Wales' acquisition of the New Zealand business of Oriental Bank in 1861, with the New Zealand business increasing in importance following the acquisition of Trust Bank New Zealand in 1996. Westpac embarked on an ambitious plan to try and turn itself in to a major multinational bank in the late 1980s, but the somewhat disappointing ensuing performance and lending losses in its home market forced the abandonment of this strategy.³ Its international activities now comprise the standard network of offices in major financial centres and business in New Zealand and a number of smaller countries in the Pacific.

The NAB was originally among the more Australian focused of the major banks, but in 1987 it purchased a network of retail banks in Scotland and Ireland. This was followed by further expansion by acquisition into the United Kingdom, New Zealand and the United States, although in more recent years it has sold both its United States business and that in Ireland. In addition to its network of offices in international financial centres, it thus now has significant business in England and Scotland (trading as the Clydesdale and Yorkshire Banks) and New Zealand (where it trades as Bank of New Zealand).

Some arguments have been put forward to suggest that a major benefit of the NAB's expansion into the UK market was to relieve the bank from the consequences of its previous concentration of exposures in the Australian banking market (Robinson, 1990), consistent with the portfolio theory. For the period from 1988 to 2000, the correlation coefficient

³ For a more extensive discussion of these events, refer to Carew (1997).

between the returns on assets for the Australian and UK businesses was 0.22, which does lend support to the portfolio effect argument.

The ANZ is now the major Australian bank with the greatest proportion of its business outside Australia. All of its major constituent banks, the Union Bank, the Bank of Australasia and the English Scottish & Australian Bank (ES&A), started life as British overseas banks, with both the Union Bank and the Bank of Australasia having operated in New Zealand. The bank sought to increase its international involvement still further in 1984 with the acquisition of Grindlays, although this was not wholly successful, and after successive scaling back of the Grindlays network, the remains of the bank were sold in 2000. In 2003, the ANZ increased the proportion of its business in New Zealand through the acquisition of the National Bank of New Zealand. Its international network now comprises the standard network of offices in major financial centres, its New Zealand business (comprising nearly 25% of assets as at 30 September 2006), and in the smaller countries of the Pacific and through a number of offices in East and South-East Asia.

The position of the preceding big four banks contrasts with that of the other Australian banks listed on the ASX. These other five so-called regional banks, Adelaide Bank (ADB), Bank of Queensland (BOQ), Bendigo Bank (BEN), St George Bank (SGB) and Suncorp Metway (SUN), are much smaller and do not, in general, have any non-Australian business. We would thus not expect these banks to show the same sensitivity to exchange rates for the Australian dollar as the big four, and they have been included in this research in the expectation that there should be different effects for these banks.⁴

⁴ Macquarie Bank is also listed on the Australian Securities Exchange, but its business is primarily in investment banking, and bears only limited resemblance to the banks included in this study.

Against this background, the next two sections of the paper describe the methodology used to explore the significance of any portfolio effects in the international expansion of the Australian banks, and look at the data used to undertake this analysis.

3. Hypothesis

There are in fact three ways in which banks can be exposed to changes in exchange rates. It is common to recognise the short run exposure that arises from foreign exchange trading, and the medium term exposure arising from mismatches between the currencies in which a bank's assets and liabilities are denominated. There is also, however, a longer-term exposure, which might be related to a translation exposure that arise from banks' investments in the banking business in other countries where different currencies are used.

In the case of the major Australian banks, exposures from foreign exchange trading and from asset and liability mismatches are small. Although the banks raise significant portions of their funding in international markets, the vast bulk of this is hedged into Australian dollars (Staff, 2000; 2002). Value-at-risk from trading exposures is also very small (Staff, 2000). The Reserve Bank of Australia further notes that the main foreign exchange exposure of banks arises on the asset side from their equity investment in offshore operations (Staff, 2002). Becker et al. (2005) showed that banks continued to have relatively low levels of foreign currency exposure, other than in respect of their offshore business.

The general principle in this research is to perceive banks as containing a portfolio of assets. Our proposition is that the market performance of banks should respond to changes in the value of their underlying assets making up these portfolios. If these underlying assets are held

in different currencies, changes in the values of these currencies ought to impact on the market value of the banks, except insofar as the net foreign currency position relative to those assets is hedged into Australian dollars. Such hedging would indicate that the bank did not want the relative currency exposures. While the banks we consider primarily in this study do not state precisely their hedging policy in relation to the value of assets held offshore, the common practice is to hedge offshore profits but not the offshore assets themselves.

There are thus alternative hypotheses that may apply to the different scenarios. It may be that banks do not hedge their currency exposures, and that markets are efficient, in which case a strengthening of that foreign currency relative to the Australian dollar will result in an increase in the bank's relative share price (reflected in positive stock returns). Alternatively, if banks hedge their foreign currency positions, we would expect no relationship to be evident. The third possibility is that share markets fail to adequately reflect information about the currencies to which the banks are exposed: this is not the expected outcome, but it is noted that relatively little attention is given to the effects of exchange rate changes in the discussion of bank performance.⁵

In our study, we use the stock returns to evaluate the four major Australian banks, with five regional banks included to provide a comparison (and for which different results might be expected). We hypothesize that three major exchange rates, namely US dollar (USD) to Australian dollar (AUD), Sterling Pound (GBP) to Australian dollar and New Zealand dollar (NZD) to Australian dollar, would have an impact on the bank's stock performance. The higher the exchange rates, the stronger the Australian dollar is and the weaker the foreign currencies are. The weak foreign currencies will reduce the value of the overseas assets of the

⁵ An exception to this is the case of Westpac, where exchange rate differences relative to the New Zealand dollar in particular are identified as impacting on reported results.

Australian banks. Other things being equal and if the banks do not hedge their foreign exchange exposure, we expect banks' stock returns to be impacted negatively when exchange rates increase, due to the high proportion of banks' foreign assets.

In our study, we also consider the impact from the market index returns and interest rate and real GDP differentials between two countries on the bank stock returns. Market index returns are considered directly, but interest rate and GDP differentials are considered through their expected impact on the exchange rate, as outlined in Section 5 below.

4. Data

In this study, we focus the sample of the four major Australian banks (ANZ, NAB, CBA and WBC) and use quarterly data from 1 January 1997 to 31 March 2007. We also study five regional Australia banks as a comparison with the four major banks, since the five regional banks have little overseas assets in comparison with the major four. We start our sample period in January 1997 to avoid possible problems caused by two significant events that took place in 1996, namely Westpac's acquisition of a major New Zealand asset, Trust Bank New Zealand, and the completion of privatisation of CBA.

The stock returns of nine banks, the market index returns (ASX200), foreign exchange rates between the United States dollar, Pound Sterling, New Zealand dollar and Australian dollar, 3-month inter-bank rates of the US, Britain, New Zealand and Australia, and real GDP of these four countries are collected from the Datastream. The summary statistics for our data is provided in Table 1.

[Insert Table 1 Here]

5. Empirical results and their implications

We use the capital market approach to estimate the sensitivity of stock returns to the change of foreign exchange rates while controlling for the market movements. This approach is shown in the Equation 1:

$$R_t = \beta_0 + \beta_m R_{m,t} + \beta_x X_t + \varepsilon_t \quad (1)$$

where R_t is the stock return adjusted for dividend and right issues for time t ; $R_{m,t}$ the market index return for time t ; X_t the exchange rate factor for time t which comes from Equation 2; β_0 the intercept; β_m the market exposure; β_x the foreign exchange exposure; and ε_t is the error term for time t .

Previous efforts to find significant exchange rate exposure have not been very successful, although most research so far has used a trade-weighted exchange rate index. Since in this study, we are interested in how overseas assets and business affect the stock performance of the four major Australian banks, we choose key currency pairs that are most relevant to our study and use them individually in the equation to avoid any offsetting exposure among foreign exchange rates. We also include all three exchange rate factors in the same equation to check how the exchange rate factors impact jointly on banks' stock performance.

Besides using key currency pairs, another adjustment to the traditional approach, following Martin and Mauer (2005), is that the exchange rate factors are constructed to be orthogonal to the interest rate and real economic activity differentials. The orthogonal exchange rate factor

is generated from $x_{j,t}$, the residual or the unexplained part of the exchange rate which is not captured by macroeconomic variables. The model to estimate $x_{j,t}$ is shown in Equation 2:

$$XRT_{j,t} = \alpha_0 + \alpha_1 INT_{j,t} + \alpha_2 GDP_{j,t} + x_{j,t} \quad (2)$$

where $XRT_{j,t}$ is the value of the Australian dollar in terms of country j currency at time t ; $INT_{j,t}$ the difference in 90-day interest rates of country j and Australia at time t ; $GDP_{j,t}$ the ratio of the real economic activity level in country j to Australia at time t ; $x_{j,t}$ residual exchange rate factor for country j currency at time t ; $\alpha_0 - \alpha_2$ are regression coefficients for country j .

The exchange rate factor used in Equation 1 is the residual exchange rate factor, $x_{j,t}$, defined in Equation 2.

Recent studies have also modified the traditional capital market model to allow an asymmetric sensitivity of returns to exchange rate risk. Miller and Reuer (1998) and Koutmos and Martin (2003) argue that stock returns likely respond differently to currency appreciation and depreciation. Koutmos and Martin (2003) find that asymmetric exposure is common in the financial sector. Since our samples are banks, we would also like to employ an asymmetric version of the traditional capital market model, which includes a dummy variable to capture the potential asymmetries. When $X_t > 0$, then $D_t = 1$. The significance of $\beta_{D,X}$ shows the asymmetric exposure:

$$R_t = \beta_0 + \beta_m R_{m,t} + (\beta_X + \beta_{D,X} D_t) X_t + \varepsilon_t \quad (3)$$

The correlation matrix among independent variables in Equations 1-3 is shown in Table 2. The results of the regressions using Equations 2 and 1, which have been corrected for heteroskedasticity whenever necessary, are presented in Tables 3 and 4. Before running

Equation 2, we used the Dickey and Fuller (1979) unit root test to check the stationarity of the data and found the data series of foreign exchange, interest and real GDP differentials to be non-stationary, as were the residuals of the regressions. We therefore took a first difference of all variables and re-ran Equation 2 as a result of which the residuals become stationary. Results from these regressions are reported in Table 3, which show that, looking at quarterly data, a high proportion of exchange rate variability can be accounted for by macroeconomic factors.

[Insert Tables 2 (2.1-2.3), 3 and 4 Here]

The residuals from Equation 2 are then used in Equation 1 to investigate the foreign exchange effects on the bank stock returns. We run Equation 1 for all nine banks. For each bank, there are four regressions, including three regressions with three foreign exchange factors respectively and one with all three factors together.

Full results are reported in Table 4, and we note that the market index has a significant positive impact on the bank returns, except for Bank of Queensland⁶. However, in all individual foreign exchange factor regressions, the coefficients of the foreign exchange factors are insignificant, with no difference between the major four banks and five regional banks. When putting all three foreign exchange factors together in the same regression, the New Zealand dollar factor has some impact on Adelaide Bank and Westpac. The P-values for the two coefficients are 9.69% and 2.39% respectively. Due to the reasonably high correlation between US Dollar effect and Sterling Pound effect, we need to view these results with

⁶ The Bank of Queensland has been subject to some activity by large investors, which would be likely to account for the differences in its share price performance relative to the wider market.

caution. Moreover, because we have run a total of 36 regressions, chance is likely to cause some to appear to be significant, even if there were no valid relationships in reality.⁷

The adjusted R^2 statistics for the regressions reported in Table 4 are, except for Westpac, all below 0.3, and in Westpac's case the highest adjusted R^2 reported was 0.441. A significant proportion of the variability in banks' stock returns is thus not explained, and may thus be attributable to interest rate levels, bank-performance specific factors, etc. Because there is a corpus of literature (e.g. Samuelson, 1945 and Flannery & James, 1984) that has looked at the impact of interest rates on banks' share prices, we tried including interest rate returns as an additional explanatory variable in our regression analyses (Equation 1). Interest rate factors were not in general found to be significant, and there was no clear improvement in the explanatory power of our new regressions.

We also sought to use Equation 3 to test the asymmetric exposure of the three currencies on the bank stock returns. However, when we explored the correlations among the independent variables, we found that each foreign exchange residual and the product of the residual and the dummy variable are highly correlated (Table 2.3). Therefore, we could not use Equation 3 to further our study.

6. Discussion and conclusions

The findings of our research are surprising. There is no evidence that the market reacts to the changing value of bank assets held outside of Australia for the four major Australian banks.

⁷ On the other hand, until 2003, Westpac was the bank with the largest proportion of its assets in New Zealand, although its figures were not much larger than for ANZ. Adelaide Bank has not at any stage had any New Zealand business.

The basic theoretical proposition that we seek to explore is the portfolio theory of the international expansion of banks, which suggests that banks expand internationally to diversify their risks, and to reduce their relative exposure to their home country markets. It also entails a view of banks as a portfolio of businesses operating in different countries, and that banks' market values should reflect the international composition of their portfolios, with share values rising (and positive stock returns) as the home country's currency weakened against those of the foreign countries in which the bank invested.

In presenting our research hypothesis in Section 3 of the paper, however, we identified a number of potential outcomes, not dependent on the portfolio theory of the international expansion of banks. We suggested that banks might not hedge their currency exposures, and that markets are efficient, in which case a strengthening of that currency relative to the Australian dollar would result in an increase in the bank's relative share price (reflected in positive stock returns). Alternatively, if banks hedged their foreign currency positions, we would expect no relationship to be evident. The third possibility is that share markets failed to adequately reflect information about the currencies to which the banks are exposed.

Review of the banks' reported risk management policies and the commentary provided by the Reserve Bank of Australia both suggest that banks do not hedge their structural foreign exchange exposures arising from their international business operations. This would therefore suggest that markets are not efficiently pricing the shares of Australian banks.

We also need to look for ways in which our analysis could be extended, with the objective of seeking out any weaknesses in our approach. The period from 1997 to 2007 (as covered by this research) has been a remarkably positive one for the Australian economy in general, and

for the banks. Banks have also enjoyed positive outcomes in New Zealand. Different results might be found if there were to be some less benign economic experience.

It would also be interesting to look at banks from other countries which have undertaken significant international expansion. Martin & Mauer (2005) have applied an approach similar to this one to look at a group of United States banks, but it would also be possible (and meaningful) to look at banks from Canada, the United Kingdom, Spain and a number of other countries whose banks have expanded into different currency areas.

References:

- Becker, C., Debelle, G., Fabbro, D., 2005. Australia's foreign currency exposure and hedging practices. Reserve Bank of Australia Bulletin December, 1-8.
- Carew, E., 1997. Westpac: The Bank that Broke the Bank. Sydney: Doubleday.
- Cho, K.R., 1985. Multinational banks: Their identities and determinants. Ann Arbor: UMI Research Press.
- Dickey, D.A., Fuller, W.A., 1979. Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association 74, 427-431.
- Flannery, M.J., James, C.M., 1984. The effect of interest rate changes on the common stock returns of financial institutions. Journal of Finance 39(4), 1141-1153.
- Goldberg, L.G., Kabir, R., 2002. The stock market performance of the central banks of Belgium and Japan. Journal of Economics and business 54, 137-152.
- Grosse, R., Goldberg, L.G., 1991. Foreign bank activity in the United States: an analysis by country of origin. Journal of Banking and Finance 15, 1093-1112.
- Hultman, C.W., McGee, L.R., 1989. Factors affecting the foreign banking presence in the U.S. Journal of Banking and Finance 13, 383-396.
- Koutmos, G., Martin, A.D., 2003. Asymmetric exchange rate exposure: theory and evidence. Journal of International Money and Finance 22, 365-383.
- Martin, A.D., Mauer, L.J., 2005. A note on common methods used to estimate foreign exchange exposure. Journal of International Financial Markets, Institutions and Money 15, 125-140.
- Miller, K.D., Reuer, J.J., 1998. Asymmetric corporate exposures to foreign exchange rate changes. Strategic Management Journal 19, 1183-1191.
- Moshirian, F., Pham, T., 1999. Cost of capital and Australia's banking investment abroad. Applied Financial Economics 9, 295-303.
- Moshirian, F., 2001. International investment in financial services. Journal of Banking and Finance 25, 317-337.
- Robinson, D., 1990. Aussie charmers nab the profits. Euromoney August, 44-45.
- Samuelson, P.A., 1945. The effect of interest rate increases on the banking system. American Economic Review March, 16-27.
- Staff, 2000. Foreign exchange exposures of Australian banks. Reserve Bank of Australia Bulletin August, 43-49.

- Staff, 2002. Australia's foreign currency exposure and hedging practices. Reserve Bank of Australia Bulletin August, 56-60.
- Tripe, D., Matthews, C., 2003. The international expansion of Australian banks. In Lönnborg, M; Olsson, M.; Rafferty, M. & Nalson, I (eds), Money and Finance in Transition. Huddinge, Sweden: Södertörns högskola. 155-180.
- Wilkins, S., 2003. The international diversification of Australian banks. In Lönnborg, M: Olsson, M.; Rafferty, M. & Nalson, I (eds), Money and Finance in Transition. Huddinge, Sweden: Södertörns högskola. 181-196.
- Williams, B., 1997. Positive theories of multinational banking: eclectic theory versus internalisation theory. Journal of Economic Surveys 11(1), 71-100.

Figure 1: Percentage of Assets Outside Australia—Four Major Australian Banks

Figure 1 shows that the four major Australian banks all have significant operations outside Australia, which implies that they have long-term foreign exchange exposure due to the high proportion of offshore assets and business.

**Figure 1: Percentage of Assets Outside Australia
- Major Australian Banks**

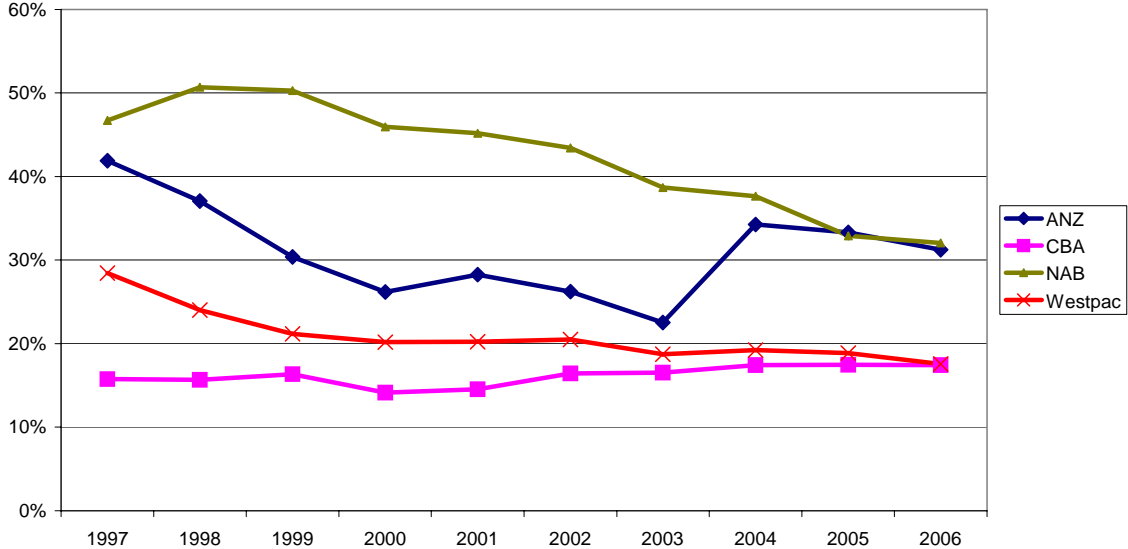


Table 1: Statistical Summary of Variables in the Study

Table 1 provides the statistical summary for the variables in our study. The variables include the stock returns of four major Australian banks (ANZ, NAB, CBA and Westpac) and five Australian regional banks (Adelaide Bank, Bank of Queensland, Bendigo Bank, St George Bank, and Suncorp-Metway); the ASX200 market index returns; three exchange rates (AUD/USD, AUD/GBP, and AUD/NZD); the difference between the 3-month inter-bank rates of New Zealand, US, UK and Australia; and the ratio of the real GDP of New Zealand, US, UK and Australia. Since we use GDP figures, the frequency of our data is quarterly. The sample period is from 1 Jan 1997 to 31 March 2007.

	Mean	Median	SD	Min	Max
ADB	0.037	0.027	0.074	-0.083	0.194
BOQ	0.036	0.040	0.078	-0.132	0.169
SGB	0.048	0.038	0.068	-0.056	0.177
BEN	0.041	0.038	0.108	-0.207	0.254
SUN	0.052	0.071	0.084	-0.152	0.235
ANZ	0.045	0.045	0.085	-0.140	0.282
NAB	0.035	0.047	0.080	-0.219	0.241
CBA	0.047	0.054	0.076	-0.160	0.185
WBC	0.041	0.046	0.079	-0.138	0.248
ASX200	0.032	0.033	0.052	-0.090	0.109
AUD/NZD	0.858	0.864	0.045	0.770	0.938
AUD/GBP	2.537	2.527	0.200	2.076	2.882
AUD/USD	1.547	1.532	0.232	1.280	1.984
Inter-bank (NZ-A)	0.998	1.010	1.070	-0.620	3.960
Inter-bank (US-A)	-1.380	-1.069	1.795	-4.820	0.910
Inter-bank (UK-A)	-0.110	-0.305	1.308	-1.794	2.611
Real GDP (NZ/A)	0.120	0.120	0.007	0.108	0.132
Real GDP (US/A)	19.137	19.010	2.931	15.510	24.766
Real GDP (UK/A)	3.340	3.307	0.267	2.824	3.801

Table 2: Correlations Matrix of Independent Variables in the Study from 1 January 1997 to 31 March 2007

Table 2.1: This table shows the correlation matrix among all independent variables in Equation 2. Since there are three regressions involved in Equation 2, only the three numbers with stars are relevant to test whether there is any multicollinearity in each of the three regressions. The results show that there is no multicollinearity in each of the three regressions using Equation 2. NZ, US, UK and A stand for New Zealand, the US, the UK and Australia.

	<i>NZ-A</i>	<i>US-A</i>	<i>UK-A</i>	<i>NZ/A</i>	<i>US/A</i>	<i>UK/A</i>
Inter bank (NZ-A)	1.000					
Inter bank (US-A)	0.340	1.000				
Inter bank (UK-A)	0.496	0.751	1.000			
Real GDP (NZ/A)	0.266*	-0.494	-0.252	1.000		
Real GDP (US/A)	-0.147	0.197*	0.264	-0.649	1.000	
Real GDP (UK/A)	-0.173	0.064	0.200*	-0.572	0.907	1.000

Table 2.2: This table shows the correlation matrix among all independent variables in Equation 1. When running Equation 1, we have four regressions for each bank. The first three regressions include the independent variables of ASX200 index returns and one of the residuals showing the foreign exchange factor. The fourth regression includes the independent variables of ASX200 index returns and all three foreign exchange residuals. RENZ, REUK and REUS stand for residuals of NZD, GBP and USD. For individual foreign exchange factor regressions, the correlations are low enough to avoid multicollinearity. However, since the correlation between Sterling Pound residual and US dollar residual is 0.6, we need to analyse the regression consisting all three foreign exchange factors with caution.

	ASX200	RENZ	REUK	REUS
ASX200	1.000			
RENZ	-0.052	1.000		
REUK	-0.290	0.433	1.000	
REUS	-0.144	0.336	0.604	1.000

Table 2.3: This table shows the correlation matrix among all independent variables in Equation 3. D stands for the dummy variable showing the asymmetry effect of foreign exchange movement. Due to the very high correlations among the independent variables, we can not use Equation 3 to test the asymmetric foreign exchange exposure on bank stock returns.

	RENZ	REUK	REUS	RENZ*D	REUK*D	REUS*D	ASX200
RENZ	1.000						
REUK	0.433	1.000					
REUS	0.336	0.604	1.000				
RENZ*D	0.858	0.308	0.254	1.000			
REUK*D	0.139	0.816	0.422	0.096	1.000		
REUS*D	0.141	0.404	0.753	0.170	0.413	1.000	
ASX200	-0.052	-0.290	-0.144	-0.165	-0.412	-0.288	1.000

Table 3: Regression Results on Unexpected Factors of Foreign Exchanges

Table 3 shows that regression results on Equation 2.

$$XRT_{j,t} = \alpha_0 + \alpha_1 INT_{j,t} + \alpha_2 GDP_{j,t} + x_{j,t}$$

where $XRT_{j,t}$ is the value of the Australian dollar in terms of country j currency at time t (in our study, they are AUD to NZD, AUD to GBP and AUD to USD); $INT_{j,t}$ the difference in 90-day interest rates of country j and Australia at time t ; $GDP_{j,t}$ the ratio of the real economic activity level in country j to Australia at time t . In order to solve the non-stationary problem of data series, we take the first difference of all variables and obtain the following results.

	Constant	INT	GDP	Adjusted R-square	Durbin-Watson stat
AUD/NZD	0.001 (0.776)	-0.0002 (-0.111)	7.015 (20.555)***	0.915	2.349
AUD/GBP	0.004 (1.944)*	-0.001 (-0.278)	0.737 (28.245)***	0.981	1.999
AUD/USD	0.001 (0.885)	-0.011 (-2.743)***	0.077 (31.736)***	0.987	1.751

Notes: The numbers in the parentheses are t -statistics. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 4: Regression Results on Foreign Exchange Exposure of Australian Banks

Table 4 shows the results on Equation 1: $R_t = \beta_0 + \beta_m R_{m,t} + \beta_x X_t + \varepsilon_t$

where R_t is the stock return adjusted for dividend and right issues for time t of nine banks; $R_{m,t}$ the market index return (ASX200) for time t ; X_t the exchange rate factor for time t which are the residuals from Equation 2. RENZ, REUK and REUS stand for residuals of NZD, GBP and USD. We run the Equation 1 for all nine banks. For each bank, there are four regressions, including three regressions with three foreign exchange factors respectively and one with all three factors together. The numbers in the parentheses are t -statistics. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Constant	ASX200	RENZ	REUK	REUS	Adjusted R-square	Durbin-Watson Stat
ANZ	0.017 (1.257)	0.875 (3.853)***	-0.601 (-0.409)			0.253	2.648
	0.020 (1.432)	0.802 (3.437)***		-0.968 (-1.153)		0.276	2.581
	0.017 (1.257)	0.873 (3.802)***			-0.303 (-0.217)	0.251	2.609
	0.020 (1.412)	0.795 (3.318)***	0.066 (0.040)	-1.340 (-1.190)	0.980 (0.557)	0.241	2.629
NAB	0.013 (1.025)	0.699 (3.412)***	1.664 (0.942)			0.184	2.202
	0.012 (0.841)	0.741 (3.152)***		0.687 (0.811)		0.169	2.333
	0.013 (0.933)	0.704 (3.078)***			0.743 (0.533)	0.161	2.364
	0.012 (0.865)	0.724 (3.013)***	1.422 (0.858)	0.339 (0.300)	-0.037 (-0.021)	0.140	2.239
CBA	0.023 (1.857)*	0.775 (3.807)***	1.006 (0.764)			0.247	2.399
	0.022 (1.756)*	0.803 (3.769)***		0.452 (0.589)		0.242	2.460
	0.024 (1.920)*	0.747 (3.630)***			-0.828 (-0.660)	0.244	2.370
	0.022 (1.758)*	0.802 (3.751)***	1.019 (0.691)	0.941 (0.938)	-2.067 (-1.317)	0.244	2.344
WBC	0.010 (0.875)	0.977 (5.125)***	1.861 (1.510)			0.398	2.312
	0.012 (1.059)	0.900 (4.457)***		-0.768 (-1.057)		0.380	2.290
	0.012 (0.990)	0.930 (4.773)***			-1.350 (-1.136)	0.383	2.208
	0.014 (1.204)	0.868 (4.509)***	3.136 (2.361)**	-1.106 (-1.223)	-1.267 (-0.897)	0.441	2.287

(Table 4 continued)

	Constant	ASX200	RENZ	REUK	REUS	Adjusted R-square	Durbin-Watson Stat
ADB	0.019 (1.483)	0.588 (2.824)***	1.986 (1.476)			0.166	2.020
	0.020 (2.076)**	0.554 (2.483)**		-0.221 (-0.299)		0.118	1.946
	0.019 (1.984)*	0.582 (2.714)***			0.435 (0.399)	0.119	1.984
	0.021 (1.622)	0.518 (2.350)**	2.592 (1.706)*	-1.142 (-1.104)	0.727 (0.449)	0.148	1.966
BOQ	0.026 (1.829)*	0.315 (1.320)	1.496 (0.971)			0.014	2.017
	0.026 (1.800)*	0.307 (1.221)		0.060 (0.067)		-0.011	2.110
	0.027 (1.874)*	0.284 (1.172)			-0.761 (-0.514)	-0.004	2.148
	0.027 (1.824)*	0.292 (1.148)	1.933 (1.104)	0.103 (0.086)	-1.474 (-0.791)	-0.020	2.049
SGB	0.027 (2.447)**	0.656 (3.537)***	1.130 (0.942)			0.221	2.018
	0.027 (2.387)**	0.657 (3.355)***		0.122 (0.173)		0.203	1.979
	0.027 (2.402)**	0.664 (3.523)***			0.719 (0.625)	0.211	2.002
	0.028 (2.411)**	0.638 (3.206)***	1.208 (0.881)	-0.474 (-0.508)	0.798 (0.547)	0.185	2.026
BEN	0.019 (0.988)	0.699 (2.171)**	0.680 (0.327)			0.066	2.035
	0.016 (0.844)	0.786 (2.364)**		1.147 (0.959)		0.086	2.102
	0.019 (0.982)	0.700 (2.154)**			0.303 (0.153)	0.064	2.098
	0.016 (0.810)	0.794 (2.323)**	-0.110 (-0.047)	1.626 (1.013)	-1.245 (-0.496)	0.041	2.123
SUN	0.027 (1.987)*	0.769 (3.349)***	1.884 (1.268)			0.211	2.028
	0.027 (1.921)*	0.770 (3.148)***		0.201 (0.228)		0.178	2.086
	0.027 (1.928)*	0.783 (3.339)***			1.225 (0.856)	0.192	2.170
	0.029 (1.996)*	0.738 (3.011)***	2.012 (1.190)	-0.808 (-0.702)	1.374 (0.764)	0.182	2.076