The Australian Journal of Agricultural and Resource Economics, 41:2, pp. 227–261

Risk premia in Australian interest rates

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The level of and movements in interest rates and the exchange rate can have a substantial impact on the economic performance of Australia's primary industries. Whether a country and/or exchange risk premium has resulted in higher interest rates and increased volatility in the exchange rate is therefore important to these industries. There is some evidence that a small country risk premium may have emerged during the early 1990s. In line with earlier studies, however, no evidence was found of such a premium during the 1980s. A further finding is that any exchange risk premium may have declined over the last decade or so. Possible links between risk premia and Australia's foreign debt and current account deficits are also examined.

The level of, and movements in, interest rates and the exchange rate can have a major bearing on the economic performance of Australia's primary industries. The rural and resource sectors are highly sensitive to changes in the exchange rate because of the very strong export orientation of these two sectors. In addition, a significant share of the inputs to these sectors is imported. Not only is the level of the exchange rate important in influencing the level of returns to these sectors but movements in the exchange rate can also have an important role in influencing the stability of those returns. Interest rates are important because of the capital-intensive nature of production in the rural and resource industries. For example, total rural debt was estimated to be around $18 billion in June 1995 (ABARE, 1996, p. 428). A sustained 1 percentage point change in interest rates in 1994–95, flowing through all components of rural debt, would have been worth about $180 million or 7 per cent of the net value of farm production. Although data on the indebtedness of the resource sector are not readily

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available, it is likely that debt levels would be of at least a similar magnitude.

Given the significance of interest rates and exchange rates to the returns of the rural and resource sectors, factors which might cause interest rates to be higher than otherwise, or cause interest rates and exchange rates to be more volatile than otherwise, are of considerable significance for these sectors. For these reasons, the issue of whether foreign investors are imposing a risk premium on the Australian interest rate structure and the source of any such premia are of some importance. Indeed, the argument that foreign investors are charging a risk premium on their Australian dollar assets has proved to be a popular explanation for the fact that Australian interest rates have been higher than those prevailing in many other OECD economies for most of the period since the early to mid-1980s. For example, in figure 1 the differential between interest rates in Australia and the United States are plotted over the period since the early 1980s, with rates being consistently higher in Australia since the mid-1980s.

This article investigates the argument that Australia's interest rates are higher than in many other developed economies as a result of a risk premium. In section 1 two types of risk premia are discussed, along with a brief overview of some of the factors which might contribute to the

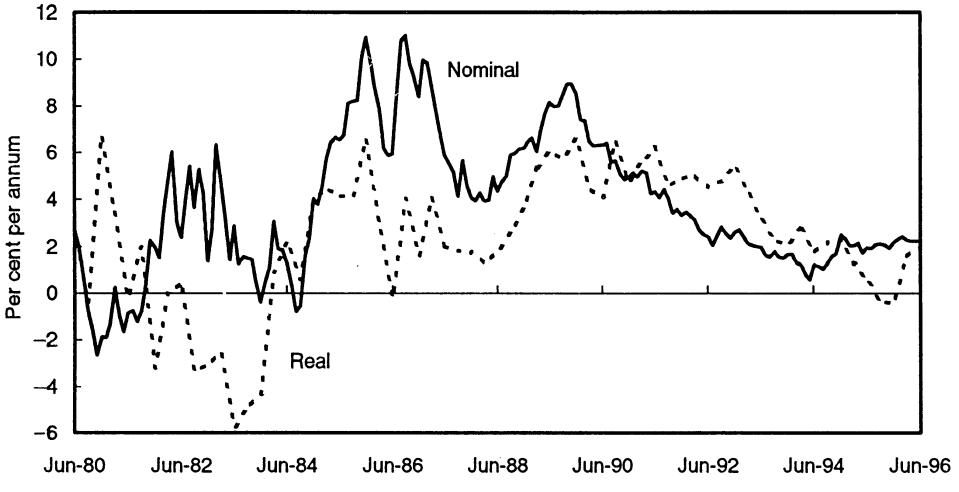

Figure 1 Real and nominal interest differential between Australia and the United States[a]

Note: [a] Real interest rates have been calculated by subtracting through the year changes in the consumer price index from the relevant interest rate (see Appendix).

existence of such premia, with a particular focus on the role of Australia's foreign debt and current account deficit. In section 2, a simple capital market model for a small open economy is presented and the key assumptions underlying the model are discussed. Evidence as to the existence of a country risk premium and/or an exchange risk premium is presented in sections 3 and 4. The link between any such premia and Australia's current account deficit and foreign debt is explored in section 5. Some concluding comments are presented in section 6.

1. The country and exchange risk premium hypotheses

Country risk, alternatively known as sovereign risk, default risk or political risk, derives from the institutional characteristics of a country which may currently, or in the future, impact on the return on debt to a foreign lender. It arises, it is argued, because of a perception that there is a greater probability that the lender may face some form of default in lending to the country in question than to other countries on average. This perceived increased probability of default includes the possibility that future capital outflows may be taxed or restricted in some way which will reduce the return to the lender. Examples of potential policy changes for which foreign lenders may require a country risk premium include increases in withholding tax rates or restrictions on foreign exchange or capital flows as well as, in more extreme cases, rescheduling of debt, confiscation or nationalisation of assets.

An exchange risk premium is a somewhat different concept to a country risk premium although they may be influenced by the same factors. Many countries currently have floating exchange rates. In those countries in particular, currency traders' expectations about the future level of the exchange rate will be surrounded by a degree of uncertainty. As a consequence, the size of any capital gains or losses which a foreign lender might make on Australian dollar denominated debt, or an Australian borrower might make on foreign currency denominated debt, will also be uncertain — a concept referred to here as exchange risk. If traders in foreign exchange markets are risk neutral, then it should be possible to costlessly diversify exchange risk by spreading it among the risk-neutral traders. However, if traders are risk averse then markets will not be able to completely diversify exchange risk and may require a premium to compensate for exchange risk, particularly if the exchange rate in question is more volatile and difficult to predict than exchange rates in general. This premium is in addition to any differential associated with expected exchange rate movements and with country risk, as discussed above.

1.1 Sources of country and exchange risk premia

Risk premia can potentially arise in response to a range of influences which lead to uncertainty about the returns an investor might receive from investing in a particular country or currency. Some factors which have been cited in the literature include political instability, current account deficits and foreign debt; fiscal deficits and public debt; uncertainty regarding taxation arrangements and the imposition of capital controls; and monetary policy and inflation. In the case of exchange risk, factors which influence the volatility of the exchange rate may also contribute to the existence of a risk premium.

The two factors most commonly cited as causing either a country or exchange risk premium in Australian interest rates are Australia's persistently large current account deficits and the size of its foreign debt. Partly for this reason Australia's foreign debt and current account deficit have been an important focus of economic policy since the mid-1980s. Australia's fiscal position has attracted less attention as a source of potential risk premia, except to the extent that the level of public saving contributes to the size of the current account deficit and foreign liabilities. This probably reflects the fact that Australia's fiscal position is relatively sound in comparison with other OECD economies. In Australia's case, the inherent volatility in commodity prices and the terms of trade may also result in the existence of an exchange risk premium due to the close correspondence between changes in these variables and changes in the exchange rate. However, while this link is well acknowledged, it has received less attention from a policy perspective because it is largely beyond the influence of government.

Concerns about Australia's current account deficit and foreign debt emerged as recently as the mid-1980s, reflecting marked changes in these aggregates. Since 1980-81 the current account deficit has averaged around 4.5 per cent of GDP, compared with an average of around 2.5 per cent of GDP over the 1960s and 1970s. In line with the larger current account deficit, Australia's net foreign liabilities increased from approximately 25 per cent of GDP in 1980-81 to close to 60 per cent of GDP in the mid-1990s. The composition of Australia's liabilities also changed dramatically around the mid-1980s with a marked rise in the proportion of debt. Several lines of argument have been forwarded as to the ways in which these factors might influence the existence and size of country and exchange risk premia.

Corden (1991) argued that markets could perceive that persistent large current account deficits and growing foreign liabilities might increase the risk associated with lending to a particular country due to what he

referred to as the 'contamination effect'. As each private agent or government increases its borrowing, and therefore becomes more highly geared, the risk associated with lending to that particular borrower is increased. In itself, this should not affect the risk associated with lending to other borrowers in that country. However, as Corden (1991, p. 9) noted, higher levels of private sector indebtedness may increase the risk that governments will need to rescue the highly leveraged private agents, which may have implications for government solvency, particularly if one high profile collapse triggers others. Alternatively, rising levels of foreign liabilities may increase the incentive for the government to appropriate some income from payments against those liabilities, such as in the form of higher withholding taxes.

FitzGerald (1993) argued that there are risks inherent in a high external debt since a high level of debt increases a country's exposure to financial or other external shocks. While FitzGerald (1993) does not explicitly draw the link between a risk premium and the current account, the size of the current account deficit provides an indication of the way in which a country's net external liabilities are changing. The larger the current account deficit, the more likely it is that external liabilities are rising as a share of GDP. Hence, large persistent current account deficits might cause investors to impose a country risk premium, even if prevailing levels of foreign liabilities are not excessive by international standards. If market participants are sensitive to the size of the current account deficit, financial market volatility may also increase with the size of the current account deficit, leading to a higher exchange risk premium. FitzGerald noted that sustained access to foreign savings requires that these savings are used to finance investment in import-competing or export sectors or to provide infrastructure which increases earnings in those two sectors, otherwise debt service ratios would tend to increase. FitzGerald (1993, p. 12) claimed that 'in the past, much of Australia's foreign borrowing has been directly or indirectly used for speculation or other "unproductive" purposes', such as consumption or investment in housing, implying that Australia's foreign debt has increased without a corresponding improvement in the country's ability to service its debt. One mechanism through which the economy can be restored to a sustainable net external debt/GDP path is for domestic savings to rise relative to domestic investment, complemented by a depreciation of the Australian dollar. Financial market participants may perceive that large current account deficits signal an increased probability that a country is borrowing for unproductive purposes and hence an increased probability of an eventual decline in the exchange rate, although the size and timing of any such decline are likely to be very difficult to predict. In other words, periods of high current account deficits may be

associated with greater uncertainty about future exchange rate outcomes, leading market participants to demand a higher exchange risk premium.

2. Modelling interest rate differentials

A number of assumptions are frequently made when analysing modern capital markets. A key assumption is that capital is perfectly, or at least highly, mobile between countries. This is because of the high degree of integration between the major international financial markets and the substantially deregulated nature of these markets. The lack of impediments to capital mobility should allow asset holders to move substantial amounts of capital between countries, within very short time periods, as they seek to maximise the return on their capital. A second important assumption is that capital markets are efficient, in that costs are minimal relative to the amounts being transacted, market participants do not suffer from information asymmetries and that information is used rationally by market participants in formulating their expectations. Together, these two assumptions imply that capital markets should adjust rapidly to changed market conditions and new information. In such circumstances, any short-term deviation from equilibrium should be quickly dissipated as participants seeking to make arbitrage profits drive the expected yield on substitutable assets towards a common rate of return in all capital markets.

An additional assumption which is often made for Australia is that, because Australian capital markets are small relative to the size of overseas capital markets, changes in the Australian supply or demand for capital should have little or no effect on world interest rates. A consequence of the small country assumption is that Australia is a price taker and interest rates charged on Australian borrowers are determined on world capital markets.

2.1 The simple model

If capital markets are efficient and capital is perfectly internationally mobile, then capital flows should equalise expected returns across countries. The expected return to a foreign lender on foreign currency denominated debt should, in equilibrium, equal the world interest rate, regardless of the home country of the borrower. Combined with the small country assumption, this implies that the supply curve of capital facing Australia, denominated in foreign currency, is horizontal at the world interest rate (i^*), as illustrated in figure 2. Under such circumstances foreign capital will satisfy any demand for capital which is not met by domestic savings.

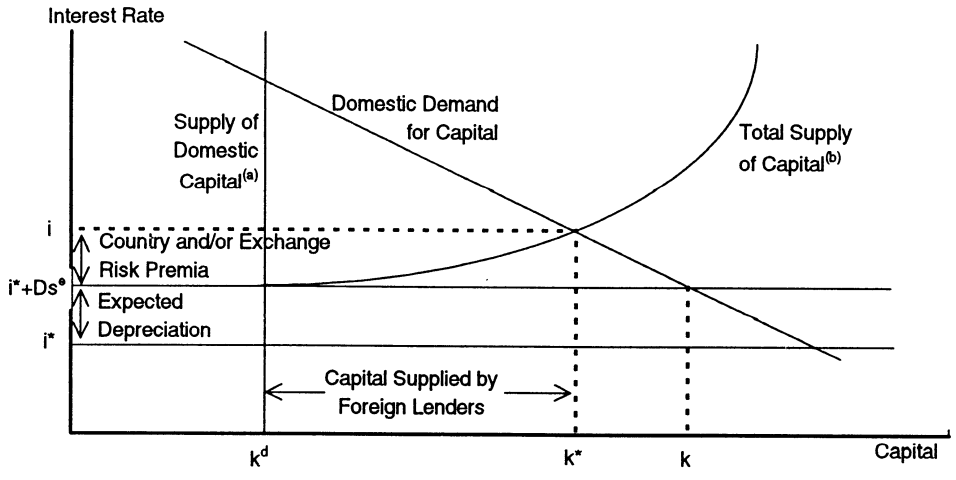

Figure 2 A small open economy facing a risk premium

Notes: [a] The domestic supply of capital has been drawn as a vertical schedule for convenience. It is possible that this schedule is either upwards or downwards sloping, depending on the relative size of the income and substitution effects. However, the arguments presented in this section are unaffected by the assumed slope of the domestic supply schedule.
[b] Makin (1996a) argued that foreign lenders may be less willing to lend the higher is the borrowing country's current account deficit. The cost of borrowing may become prohibitive at some point where the foreign lending schedule becomes vertical.

Australian borrowers and foreign lenders may choose to transact in Australian dollars rather than the foreign currency. When this occurs, the interest rate required by the lender should include any expected capital gains or losses caused by anticipated movements in the exchange rate, in addition to the world interest rate. In this case, there should be an interest rate differential between Australian dollar denominated and foreign currency denominated debt equal to the capital gain or loss caused by expected exchange rate movements. Under the small country assumption, the domestic interest rate will be $i^* + \Delta s^e$ and capital inflow would correspond to $k - k^d$.

2.2 The concepts of covered and uncovered interest parity

To analyse the effects of relaxing the strict assumptions about perfect substitutability of debt and perfect capital markets, it is necessary to make

reference to the concepts of covered and uncovered interest parity. The difference between the covered and uncovered interest parity conditions is in their treatment of exchange risk, as defined above. The covered interest parity hypothesis states that international capital flows should equalise interest rates across countries when contracted, either explicitly or implicitly through the use of forward contracts, in a common currency. Uncovered interest parity is a stricter condition and adds the requirement that traders are risk neutral, or can costlessly insure against exchange risk, so that capital flows equalise expected rates of return after account is taken of expected exchange rate movements, despite exposure to exchange risk.

The covered interest parity condition can be expressed as:

$$\frac{(1 + \mathrm{i})}{(1 + \mathrm{i}^*)} = \frac{F}{S} \qquad (1)$$
$$\Rightarrow i_{\mathrm{t}} \approx i_t^* + fp_t$$

where i is the interest rate on Australian dollar debt, i^* is the foreign interest rate on foreign currency debt, F and S are the forward and spot exchange rates respectively, and fp is the forward premium.

Under the uncovered interest parity condition, foreign exchange traders are assumed to be risk neutral. This means that the forward premium should equal the expected depreciation in the currency, a condition known as speculative efficiency. This gives rise to the approximate form of the uncovered interest parity condition:

$$i_t \approx i_t^* + \Delta s_t^e \qquad (2)$$

where Δs_t^e is the expected rate of depreciation in the exchange rate. The 'speculative efficiency' condition describes the relationship between the forward premium and the expected depreciation in the absence of exchange risk, or where traders are assumed to be risk neutral or can costlessly insure against exchange risk. The speculative efficiency condition may be written:

$$fp_t \approx \Delta s_t^e \qquad (3)$$

2.3 Nominal versus real interest rate parity

The above relationships are usually expressed and empirically evaluated in terms of nominal interest rate and exchange rate data. However, in principle it is possible to express the same relationships in terms of real interest rate and exchange rate data — a concept referred to as real interest parity. The real interest parity relationship involves an implicit assumption

that purchasing power parity holds over the timeframe for which the data are representative. In other words, differences in domestic and foreign inflation are assumed to be fully reflected in the nominal exchange rate, thereby leaving the real exchange rate unaffected. However, the majority of the literature concludes that purchasing power parity does not hold over most practical timeframes, although Olekalns and Wilkins (1996) find some evidence that purchasing power parity may hold in the long run. As Frankel and MacArthur (1987 p. 8) note, violations of real interest parity could be due to imperfect integration of goods markets rather than imperfect integration of financial markets.

A more intuitive explanation of why nominal interest parity is a more appealing approach than real interest parity is that foreign investors who lend funds to an Australian borrower are concerned about the return they get measured in terms of their home currency. This is a function of the nominal interest rate which they are paid, movements in the nominal exchange rate and their home country inflation rate. A domestic borrower is concerned about the difference between the nominal interest rate and the Australian inflation rate. From the perspective of the foreign investor and the domestic borrower, whether purchasing power parity holds is immaterial.

2.4 The simple model augmented for risk

The presence of risk premia caused by either country or exchange risk leads to a breakdown of the covered interest parity and speculative efficiency conditions respectively. The covered and uncovered interest parity conditions and the speculative efficiency condition, augmented for these risk premia, can be written respectively as:

$$i_t = i_t^* + fp_t + crp_t \tag{4}$$

$$i_t = i_t^* + \Delta s_t^e + erp_t + crp_t \tag{5}$$

$$fp_t = \Delta s_t^e + erp_t \tag{6}$$

where crp_t is the country risk premium and erp_t is the exchange risk premium.

A country or exchange risk premium will shift the supply curve of foreign capital upwards in the case of a small country and inwards in the case where the small country assumption does not hold. If either (or both) of these risk premia increases with the size of the current account deficit, then the supply curve for foreign capital may also be upward-sloping even for a small country. These concepts are illustrated graphically in figure 2. In the presence of such premia the domestic interest rate would be i, above $i^* + \Delta s^e$, and foreign capital inflow would be $k^* - k^d$.

2.5 Other factors influencing the nominal interest differential

An observation that the domestic interest rate is above the foreign interest rate, augmented for expected changes in the exchange rate, is not sufficient to conclude the existence of a country or exchange risk premium. A range of other factors may also lead to a wedge being driven between domestic and foreign interest rates. Some of these are discussed below. If transaction costs in Australian capital markets exceed transaction costs in overseas capital markets, the interest rate on offer will need to cover that differential. It is commonly assumed that these costs are negligible because of the economies of scale resulting from the huge volume of capital transactions undertaken, combined with the relatively small number of currencies and instruments traded. The existence of government regulations also has the potential to affect the mobility of capital and hence interest differentials. A large number of government activities have the potential to impact either directly or indirectly on capital mobility. In Australia's case, the withholding tax on interest payments to foreign lenders and restrictions on the use of imputation credits by foreign shareholders are two examples of taxes which could potentially affect capital mobility, although the impact is also dependent on the relevant tax arrangements overseas and the existence of double taxation agreements.

Efficient capital and foreign exchange markets are needed for the simple model described in the previous section to apply. In reality there is a diverse range of factors which may impinge on market efficiency. It is commonly assumed that modern data processing and communications systems result in these costs being negligible relative to the size of the capital transactions involved. However, if the cost of gathering and processing information on Australian assets and economic parameters exceeds the corresponding costs in the domestic market of the foreign investor, then the interest rate on offer in Australia will need to cover that differential in order to attract foreign capital inflow. If the time taken to gather and process information is not negligible, potential arbitrage positions could exist, at least for short periods. Imperfect information may also encourage investors to prefer investing in their home economy, at least to some extent. The hypothesis that lenders prefer to invest in their own country is supported by the observation in French and Poterba (1991) that the world's five largest stock markets are substantially owned by domestic investors. According to modern portfolio theory, these data indicate a sub-optimal diversification of risk. Such preferences are likely to require interest rates in net capital-importing countries to be higher than in net capital-exporting countries, other factors unchanged. Ng and Fausten (1993) argued that only the smallest countries should be thought of as

satisfying the small country assumption. This is because, unless a small subset of potential lenders with similar expectations and attitudes to risk can flood a country's capital market, the supply curve of foreign capital for that country will be upward-sloping. In other words, if potential lenders have different information sets on which to base their expectations or form different expectations about economic variables (such as the exchange rate) or differ in the certainty which they attach to their expectations, then these potential lenders will differ with respect to the returns which they require on the capital they supply to that country. This, in turn, may cause the foreign supply curve of capital to be upwards-sloping as Australian borrowers obtain funds from the cheapest source first, and then from progressively dearer sources. If the foreign capital supply curve is upward-sloping in this way, an increase in the current account deficit will cause interest rates to rise in Australia, even in the absence of any risk premia.

Differences in risk aversion may result in a distribution of risk premiums over lenders rather than a single risk premium across all lenders. Assuming Australian borrowers first exhaust funds available from those lenders demanding the lowest country or exchange risk premium, the average size of the country or exchange risk premium could be expected to increase with the amount of capital borrowed. In other words, the observed average level of the country or exchange risk premium would increase with the size of the current account deficit, again causing the supply of foreign capital to be upward-sloping.

3. A country risk premium?

FitzGerald (1993, p. 11) argued that Australia's foreign debt and persistent large current account deficits have led to foreign investors imposing a 'small — but positive and rising' country risk premium on Australia's interest rate structure. FitzGerald (1993) cited Fane and Applegate (1992), Whitelaw and Howe (1992) and Applegate (1993), in arguing that Australian borrowers are paying a country risk premium of between one quarter and one half of a per cent per annum. Both Fane and Applegate (1992) and Applegate (1993) derived their estimates of the country risk premium by comparing the interest rates paid by borrowers from different countries on debt which is denominated in the same currency. Rather than finding strong evidence of a risk premium, Fane and Applegate (1992, p. 20) concluded that, 'the risk premia on loans to Australia were very small, and were probably dominated by transactions costs'. Applegate (1993) estimated the size of the risk premium by using the average interest rate differential on six-, seven- or eight-year US$ Eurobonds for Australian

borrowers relative to the IMF/World Bank and US and Japanese borrowers. He concluded that, over the period examined, Australian borrowers paid a small risk premium of about 0.25 per cent per year relative to the United States. However, the reported average risk premium can be reduced to 11 basis points by omitting a single outlying observation in the sample of data. A premium of that order of magnitude could be accounted for by other factors such as capital market inefficiencies and differences in the maturity structure of the debt. Whitelaw and Howe (1992) stated that Australia's downgrading by Moody's in 1991 'could have added about 15 basis points to interest rates on our sovereign debt'. In their report they do not appear to provide a justification for such a figure and fail to describe the methodology used to derive their estimate.

In contrast to Fane and Applegate (1992) and Applegate (1993), most other researchers have tested for the existence of country risk premia in the form of systematic deviations from covered interest parity using interest rates payable on debt denominated in the domestic currency of each country. A significant benefit of this approach is that both countries' interest rates can be measured in their domestic markets and in their domestic currencies. This avoids the bias that might arise from any differential charged according to whether the debt is domiciled offshore or onshore (*Economist* 1995). Applegate (1993, p. 15) argued that 'sovereigns should face a lower interest rate premia when borrowing in their own currency'. A further benefit of this approach, relative to that used by Fane and Applegate (1992) and Applegate (1993), is that it is based on formal statistical tests and monthly data, rather than a few observations selected at different points in time. However, a key limitation of this approach is the need for forward exchange rate data which restricts tests for the existence of risk premia to relatively short-term interest rates, and it is arguable whether such premia are likely to exist on short dated instruments because the factors leading to such risk are unlikely to change over such a horizon. In practice, the covered interest parity test for the existence of a country risk premium will only be completely reliable when the data are strictly contemporaneous. Interest rates and spot and forward exchange rates can vary significantly from month to month, day to day or even minute to minute. If the data which are used to measure deviations from the interest parity or speculative efficiency conditions are not strictly contemporaneous, it is possible that measured deviations from covered interest parity may simply reflect changes in the market occurring between the times when each of the datum were measured. From a study of covered interest parity using high frequency data (10-minute intervals), Taylor (1987) concluded that studies which have reported empirical deviations from covered interest parity almost certainly reflect data imperfec-

tions. He argued that 'studies that use data from published sources (often averages of one kind or another) are not really providing a test of whether profitable arbitrage opportunities existed because it is unlikely that any market trader ever faced those prices' (p. 431).

The implication of the above is that small deviations from covered interest parity derived using published data may not be sufficient to reject the covered interest parity hypothesis. However, if data inaccuracies are the source of such deviation, then it would seem reasonable to expect such deviations to be distributed both positively and negatively. Hence, in the absence of other explanations, *persistent* positive (negative) deviations might thus be indicative of the existence of a country risk premium (discount).

Blundell-Wignall, Fahrer and Heath (1993) is one of the most frequently quoted amongst the studies which reject the country risk premium hypothesis for Australia using a covered interest parity test. They compared three-month interest rates in Australia and the United States and concluded that covered interest parity held between January 1984 and March 1993. Although their reported statistical tests suggest that covered interest parity did not hold during that period, they argued (p. 72) that 'the economic (as distinct from statistical) departure from [covered interest parity] appears to be very small' and that the failure of the statistical test 'possibly reflects transaction costs or measurement error'.

The Blundell-Wignall, Fahrer and Heath (1993) conclusion that covered interest parity holds is consistent with other recent research, such as Makin (1996b), who also failed to find empirical evidence to support the existence of a country risk premium. Makin based his conclusion on a comparison of the weighted implicit interest rate paid on Australia's total outstanding foreign debt with the 'relatively riskless' (p. 245) long-term bond rate in the United States. Makin (1996b, p. 246) reported a high degree of co-movement between these interest rates since the mid-1980s.

The general conclusion that covered interest parity holds for Australia, and hence that there is no significant country risk premium imposed on Australia, is also consistent with overseas studies. Taylor (1987) concluded that covered interest parity holds for the United States, the United Kingdom and Germany. Blundell-Wignall and Browne (1991) concluded that covered interest parity holds for most developed countries with internationally integrated financial systems. Frankel and MacArthur (1987, p. 7) stated the general consensus even more strongly, with the claim that 'it is no longer interesting to test covered interest parity . . . other than to test for errors in the data'.

However, although the general conclusion in the literature is that covered interest parity holds on average, this does not mean that short-

term deviations from covered interest parity do not occur. Karfakis and Phipps (1994) concluded that, although the interest differential and forward premium are cointegrated, '[covered interest parity] appears not to hold exactly' (p. 69). They suggested that possible explanations for short-run deviations from covered interest parity may include inefficiencies in the Australian dollar forward market, adjustment costs and/or the existence of a variable country risk premium.

3.1 A further analysis of covered interest parity in Australia

In this section the covered interest parity tests conducted by Blundell-Wignall, Fahrer and Heath (1993) are replicated and extended using a more up-to-date dataset. The covered interest parity relationship is tested using forward rate data derived from the Australian market and domestic three-month interest rate data applying to US and Australian Treasury Notes sourced from the respective countries (see Appendix for more detail regarding data).

As illustrated in figure 3, there has been a close relationship between the US/Australia three-month interest rate differential and the three-month forward premium for the period since mid-1983, just prior to the floating of the Australian dollar. The apparent country risk premium, as measured by the difference between these two series, is illustrated in figure 4. As can be seen in figure 3, the annualised forward premium and interest differen-

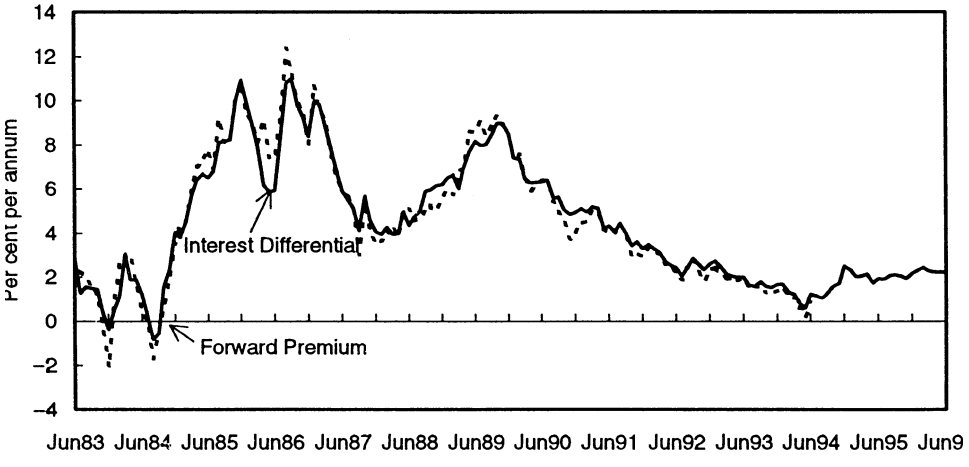

Figure 3 US–Australia three-month interest differential and the forward premium

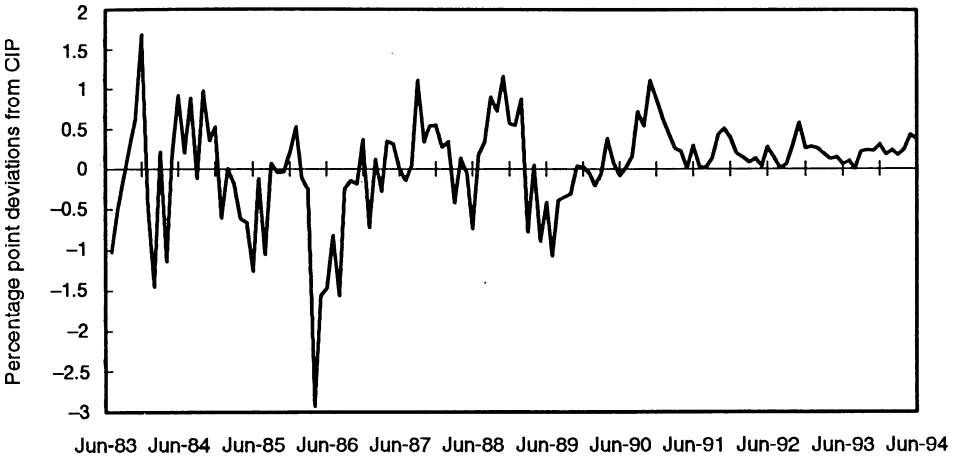

Figure 4 Deviations from covered interest parity

tial have, on the whole, moved closely together over the period examined. However, deviations between the two series have at times been reasonably large. In particular, deviations between the two series tended to be more pronounced over the period up until late 1989/early 1990.

During the 1980s, both large positive and negative deviations were experienced. The largest deviations from covered interest parity (both positive and negative) correspond to periods of increased financial market volatility. During periods of high financial market volatility, measurement errors and market inefficiencies may be more significant. Although daily data have been used wherever possible, in order to minimise timing differences, large intra-day movements in exchange rates or interest rates may have occurred during periods when markets were relatively volatile leading to significant measurement errors. During periods of high volatility in financial markets, participants may also be slow to observe and arbitrage away excess profit opportunities. Moosa (1996) cited Taylor (1989) and Branson (1969) in arguing that speculative activity and deviations from covered interest parity are more likely to occur during turbulent periods in the foreign exchange market. However, it is arguable whether these influences can fully explain those deviations from covered interest parity, both positive and negative, which persisted for periods of six to nine months. In other words, it is possible that temporary risk premia may have existed during those periods.

In contrast to the 1980s, the measured deviations from covered interest parity were consistently positive over the first half of the 1990s, although they were smaller in magnitude. The average deviation from covered interest parity over the 1990s' data was around 0.25 percentage points, expressed in annualised terms. This is broadly consistent with the results obtained by Applegate (1993) in his analysis of long-term interest rates payable on common currency borrowings by domestic and foreign institutional borrowers.

Econometric tests of covered interest parity were conducted based on a regression of the form:

$$fp_t = a + b \times interest\ differential_t \tag{7}$$

The existence of covered interest parity is assessed by performing a test of the joint hypothesis that $\hat{a} = 0$ and $\hat{b} = 1$. The joint test was performed using both the standard F test and a Wald (χ^2) test (see table 1). These tests led to the rejection of the covered interest parity hypothesis at the 5 per cent level of confidence for the full sample period January 1984 to June 1994. However, it should be noted that OLS estimation over this period is unreliable as there is evidence of significant structural breaks and non-independently distributed residuals in the estimated equation.

In order to test whether periods of excessive volatility or other temporary

Table 1 Regression results for covered interest parity tests[a]

		Coefficients		Joint tests for CIP[c]		Regression diagnostics[d]		
Sample	Method[b]	*a*	*b*	*F*	Wald (χ^2)	R^2	White	ARCH
1984:3–1994:6	OLS	**–0.32**	**1.059**	**5.26**	**10.52**	0.96	1.31	**6.10**
		(0.11)	*(0.019)*	*(0.006)*	*(0.005)*		*(0.52)*	*(0.01)*
1984:3–1994:6	MA(2)	–0.24	1.033	0.55	1.40	0.98	1.07	0.22
		(0.21)	*(0.035)*	*(0.580)*	*(0.495)*		*(0.59)*	*(0.87)*
1984:3–1989:12	MA(2)	–0.02	1.011	0.05	0.12	0.96	0.81	0.00
		(0.40)	*(0.056)*	*(0.953)*	*(0.943)*		*(0.67)*	*(0.99)*
1990:3–1994:6	MA(2)	–0.19	0.974	**4.20**	**11.99**	0.99	4.09	0.29
		(0.13)	*(0.039)*	*(0.021)*	*(0.002)*		*(0.13)*	*(0.59)*

Notes: [a] Figures in parentheses are standard errors for coefficients and p-values for test statistics. Figures in bold are significant at the 5 per cent level of significance.
[b] The presence of an MA process (due to the presence of overlapping variables) in the residuals means that the OLS standard errors are biased. This was overcome by explicitly allowing for MA(2) residuals and using GLS.
[c] F and Wald test statistics are joint tests of the null hypothesis that a = 0 and b = 1 in equation (7). A large test statistic supports rejection of the null and hence the conclusion that covered interest parity does not hold.
[d] The White test statistic is a test of the null hypothesis that heteroskedasticity does not exist. The ARCH test statistic is a Lagrange multiplier test with a null hypothesis of no ARCH process. In both cases a significant test statistic supports rejection of the null hypothesis.

factors were affecting the regression results, equation (7) was estimated for two sub-periods. These are also reported in table 1 and are likely to be more reliable than the estimates based on the full sample from 1984 to 1994. These results support the existence of covered interest parity for the period 1984 to 1989 and reject the existence of covered interest parity for the period 1990 to 1994.

In the absence of other explanations, the existence of statistically significant deviations from covered interest parity over the 1990s would be consistent with a positive country risk premium. However, as was noted above, such deviations from covered interest parity may not necessarily reflect a risk premium. Other possible sources of such deviations include measurement errors and transaction costs. Nevertheless, the average size of the deviations and their persistent sign suggest the presence of more than just measurement errors and transaction costs.

4. An exchange risk premium?

The presence of exchange risk means that risk-averse currency traders will demand a price for accepting exchange risk. Other factors unchanged, this price will be equal to the difference between the expected change in the exchange rate and the forward premium. Unless this price is zero, the speculative efficiency condition will break down (as will the uncovered interest parity condition). Hence, a popular way of testing for the existence of an exchange risk premium is to test for deviations from speculative efficiency. To do so requires an assumption that markets are efficient and a reliable measure of exchange rate expectations. Due to difficulties in measuring exchange rate expectations, attempts to use this approach are at best indicative of the existence of an exchange risk premium.

Typically, studies which have tested the speculative efficiency and uncovered interest parity conditions, both for Australia and for other countries, have concluded that neither condition holds (Froot and Frankel 1989, p. 139). Blundell-Wignall, Fahrer and Heath (1993, p. 73), who argued that covered interest parity holds for Australia, put the general result strongly, claiming that, 'No economic hypothesis has been rejected more decisively, over more time periods, and for more countries, than [uncovered interest parity]'. A contrasting result is that of Bhatti and Moosa (1995, p. 478) who used cointegration-based tests to conclude that uncovered interest parity may hold over the longer term for a group of twelve currencies, including the Australian dollar.

McCallum (1993) attempted to explain the empirical failure of uncovered interest parity. He concluded that the empirical result could be explained as an outcome of either systematic expectation errors or a monetary policy

response function where authorities manage interest rate differentials so as to resist rapid changes in the exchange rate and the interest rate differential. Of these two possible explanations McCallum considered the monetary policy response hypothesis the more plausible. An implication of McCallum's conclusion is that measuring deviations from speculative efficiency would not provide reliable estimates of exchange risk premia since the speculative efficiency residual would embody monetary authority policy actions.

4.1 Estimates of the exchange risk premium

In principle, using the speculative efficiency approach the exchange risk premium can be estimated by subtracting (adding) the expected depreciation (appreciation) from (to) the forward premium. However, in practice, decomposing the forward premium into these two components is difficult because exchange rate expectations cannot be observed directly. Attempts to measure the exchange risk premium for Australia using this approach include Tease (1986), Thorpe, Hogan and Coote (1988), Smith and Gruen (1989), Blundell-Wignall, Fahrer and Heath (1993), Bhatti and Moosa (1995) and Felmingham (1996). Frankel and MacArthur (1987) and Frankel (1989) present the results of attempts to estimate the exchange risk premium for groups of countries which include Australia.

One common approach (for example, Tease 1988 and Felmingham 1996) has been to assume 'rational expectations' and then substitute the observed outcome in a particular period for the expected outcome for that same period. This measure of the expected depreciation is then compared with forward rate data compatible with the 'forecast' horizon. While this approach is valid if testing whether speculative efficiency has held 'on average', it requires a somewhat unrealistic assumption if estimates of the exchange risk premium at particular times are being calculated. An alternative approach to measuring the exchange rate expectation has been to use exchange rate forecasts obtained from market surveys. One deficiency with this approach is that the survey data may not accurately reflect the expectations which underlie transactions in the forward exchange market. Smith and Gruen (1989) noted that market participants may use the forward rate as an 'anchor' for their expectations of the future spot rate. As a consequence, the exchange rate forecasts may be biased towards the forward premium. If the survey expectations data are biased towards the forward premium, then the exchange risk premium would tend to be understated. In using survey-based exchange rate forecast data, Blundell-Wignall, Fahrer and Heath (1993, p. 50) argued that 'it is difficult to believe that responses to the MMS survey questions . . . are (or indeed can be) independent of the forward rate'.

Thorpe, Hogan and Coote (1988) used four-week ahead forecast data obtained from a survey by Money Market Services (MMS) to perform a disaggregation of the forward prediction error into the exchange risk premium and the expectations error along the lines of Frankel and Froot (1986). Using this data they estimated that the average risk premium for Australia between November 1984 and March 1988 was 0.78 per cent per month against the pound, 0.48 per cent per month against the German mark, 0.44 per cent per month against the US dollar and 0.36 per cent against the Japanese yen. In annualised terms the Thorpe, Hogan and Coote (1988) estimate of the average risk premium against the pound is nearly 10 per cent, which is considerably higher than the average interest differential between Australia and the United Kingdom over the same period.

A comparison of the one-year forward exchange rate and the one-year ahead Consensus Economics (1996) forecast of the exchange rate led Access Economics (1995) to conclude that Australian borrowers were paying a risk premium between mid-1991 and November 1995. Their estimates of the risk premium (Access Economics 1995, p. 23) show considerable volatility, varying from –2 per cent in late 1990 to nearly 7 per cent by the end of 1992. The premium fell back to zero in early 1994 before peaking in early 1995 at about 6.5 per cent and falling again, temporarily, in September 1995.

In contrast to Thorpe, Hogan and Coote (1988) and Access Economics (1995), Smith and Gruen (1989) presented the results of statistical tests which led them to accept the null hypothesis that there was no exchange risk premium between March 1985 and September 1987. Their analysis was based on the results of an exchange rate expectations survey reported in Hunt (1987). Like the MMS survey used by Thorpe, Hogan and Coote (1988), these data also measured the four-week ahead expected exchange rate, but only over the period March 1985 to September 1987.

Using a statistical approach to decompose expectations data into expectations errors and risk premia, Froot and Frankel (1989) concluded that none of the forward rate bias between the US dollar and the pound sterling, mark, yen, and Swiss and French francs reflected an exchange risk premium. Blundell-Wignall, Fahrer and Heath (1993) followed the same approach using MMS four-week ahead expectations data for Australia. Their results led them to conclude that 'the MMS-measured risk premium is responsible for essentially none of the $A forward bias' (p. 50).

4.2 A further analysis of speculative efficiency in Australia

In common with the literature reviewed above, the exchange risk premium is estimated in this section using deviations from speculative efficiency,

measured using three different sources of survey-based expectations data — namely, Consensus Economics (1996), MMS and Hunt (1987). The Consensus Economics data are three-month ahead forecasts, whereas both the MMS and Hunt data are four-week ahead forecasts.

Actual changes in the exchange rate are compared with expected changes reported in the MMS survey and the forward premium in figure 5. As is evident from figure 5, exchange rate forecasts do not appear to be particularly reliable in terms of indicating exchange rate outcomes. For example, the forecasts have the same sign as the corresponding exchange rate movement in less than half of the months in which a change in the exchange rate was forecast. When the forecasters did predict the direction of the change in the exchange rate correctly, they usually underestimated the magnitude of the change. These results are also evident for the Hunt and Consensus Economics data.

Although changes in the forecasts do not appear to be significantly correlated with the forward premium in the short term, there appears to be some relationship between exchange rate forecasts and the forward premium over the longer term. (The correlation between these two series is 0.45.) As can be seen in figure 5, the size of the forward premium tended to vary in magnitude in accordance with the 'trend' exchange rate forecast. That is, during periods when large depreciations were forecast, the forward

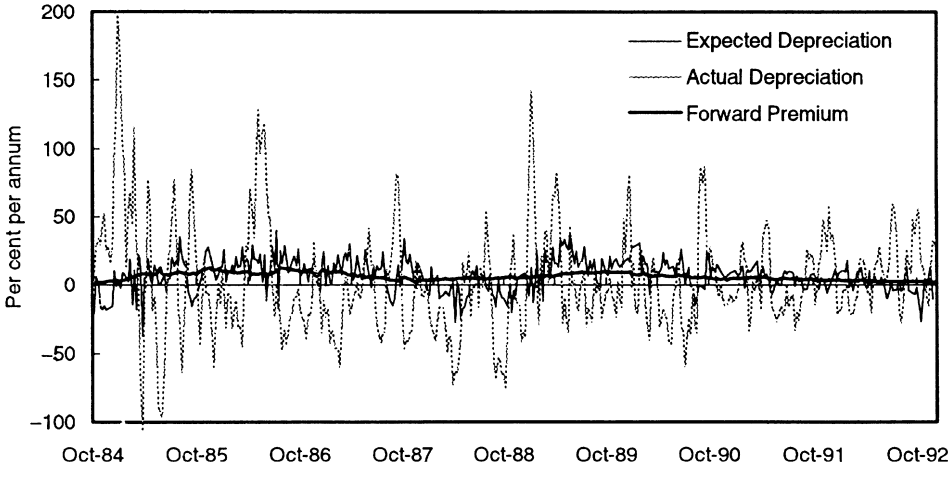

Figure 5 Observed and expected depreciations and the forward premium — four-week horizon

premium was higher than during periods when appreciations were forecast. However, this relationship is one that appears to operate at the margin. For example, the forward premium was always positive over the period October 1984 to October 1992 even though the exchange rate was at times expected to appreciate over a sustained period.

As is typically found with such data, the forecasts and the forward premium were biased relative to the observed exchange rate outcome. That is, over the period considered, the average expected depreciation in the exchange rate was larger than the average observed depreciation. The average depreciation implied by the forward premium was of similar magnitude to that implied by the survey forecasts.

As is evident from figure 5, the MMS forecasts were substantially more volatile than movements in the forward premium. This observation also applies to the Hunt and Consensus Economics data. Given the stability of the forward premium relative to the forecasts, estimates of the exchange risk premium derived as deviations from speculative efficiency will tend to be volatile. Exchange risk premium estimates calculated using deviations from speculative efficiency using the MMS data are presented as annualised rates of return in figure 6. The exchange risk premium estimates, calculated using each of the various sets of forecast data, are both highly volatile and unrealistically large for many observations. For example, the MMS risk premium estimates range from –45 to 31 per cent over the

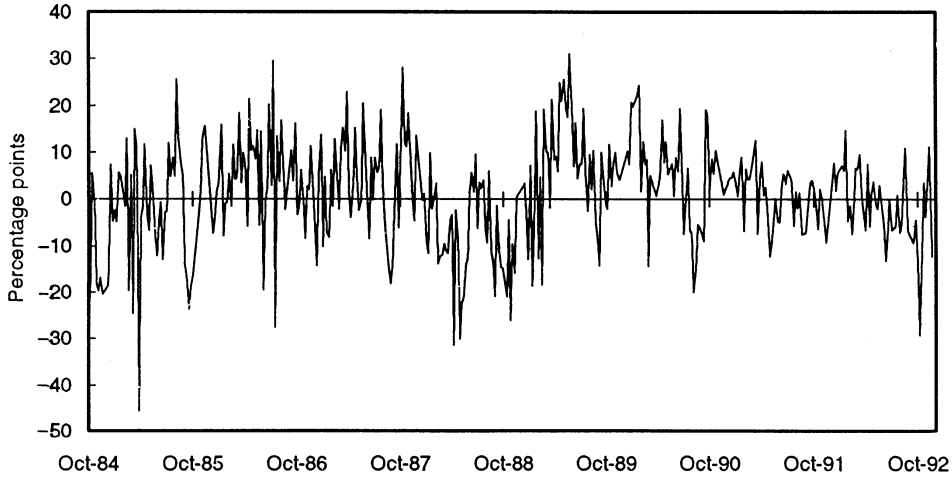

Figure 6 Annualised deviations from speculative efficiency (four-week forecasts)

sample period October 1984 to October 1992. The high degree of volatility in deviations from speculative efficiency obtained from the four-week expectations data is at least partly a consequence of annualising the volatility inherent in that data. Nevertheless, the average *change* in the implied risk premium was 10 percentage points (measured in annualised terms). Given the relative stability in the forward premium, particularly in the short term, accepting that the estimates of the exchange risk premium derived above as plausible implies that the exchange risk premium fell whenever the Australian dollar was expected to depreciate and rose when the dollar was expected to appreciate, a somewhat counter-intuitive result for risk-averse agents. Overall, it seems that the speculative efficiency approach to estimating exchange risk premia using exchange rate forecast data is unlikely to yield useful results. The relative volatilities in the forecast and forward premium data also call into question the statistical approach to decomposing deviations from uncovered interest parity into expectations errors and risk premia. The nature of the survey data biases the result towards one of rejecting the exchange risk premium hypothesis.

The nature of the longer-term relationship between the exchange rate forecasts and the forward premium tends to suggest that the forecasts are only somewhat representative of traders' expectations and that there are other important influences contributing to the determination of the forward premium. The existence of an exchange risk premium would not be inconsistent with the observed relationship. However, the observed relationship could also reflect the type of behaviour postulated by McCallum (1993).

The greater volatility in exchange rate forecasts than in the forward premium may reflect a different expectations formation process for traders dealing in the forward exchange market to that of survey participants. Smith and Gruen (1989, p. 5) reported that a no-change forecast based on a random walk is a better predictor of the spot rate four weeks later than either the average market participants' forecast or the forward rate (judged using the root mean square error). Smith and Gruen (1989, p. 6) also noted that this observation is consistent with the results of other studies such as Lowe and Trevor (1986), Hunt (1987) and Manzur (1988) in which it was also concluded that 'over a short horizon, market participants' forecasts of the future exchange rate are often worse, but never significantly better than a "no-change forecast" '.

The relatively better performance of a no change forecast in predicting exchange rate movements may influence the way in which dealers in the forward exchange market behave. Traders' expectations of future exchange rate movements might reflect a no change assumption or a relatively stable rate of depreciation or appreciation, at least over the short term. If the

expected rate of depreciation/appreciation is relatively stable in the short term, *changes* in the forward premium may be indicative of short-run *changes* in the exchange risk premium, at least more so than deviations from speculative efficiency. For example, if the expected depreciation, $\overline{\Delta s}$, was relatively constant in the short term, then the exchange risk premium would be given by $fp_t - \overline{\Delta s}$ and the change in the risk premium would be given by Δfp_t. However, the assumption of constant exchange rate expectations is less plausible over the longer term. As was noted above, there is a broad correlation between movements in the forward premium (at the margin) and the 'trend' expected change in the exchange rate.

4.3 An indicator of the relative size of the exchange risk premium

As discussed in section 2, the exchange risk premium is what the market demands to compensate for uncertainty surrounding the expected exchange rate. Hence, the exchange risk premium should be related to the degree of uncertainty about the future level of the exchange rate. The exchange rate is likely to be more volatile when there is uncertainty about the effect of other factors on the exchange market and exchange rate uncertainty is likely to be greater when the exchange market is more volatile. Hence, it is plausible that a measure of exchange rate volatility might be a useful indicator of the relative size of the exchange risk premium. A key issue which arises in using this approach is how to measure volatility appropriately so as to be representative of the exchange risk premium demanded by traders. That is, should volatility be measured as a lagged index or contemporaneously, or is expected volatility more appropriate? In this case a weighted three-month moving average was used but the results were not found to be particularly sensitive to the length of the moving average (see Appendix).

As shown in figure 7, there is some broad correlation between exchange rate volatility and the forward premium. Over the period between 1985 and 1991, the main peaks in volatility corresponded with the peaks in the forward premium. However, between 1992 and mid-1994, the forward premium fell while volatility increased. To the extent that exchange rate volatility is a reasonable indicator of the exchange risk premium, it would appear that in the early 1990s the exchange risk premium was well below its peaks in the mid- and late 1980s. However, the exchange rate volatility index does not provide any indication of the absolute size of the exchange risk premium. Hence, it is not possible to even roughly determine the size of the exchange risk premium at any point in time, or the amount by which it might have changed since the mid-1980s.

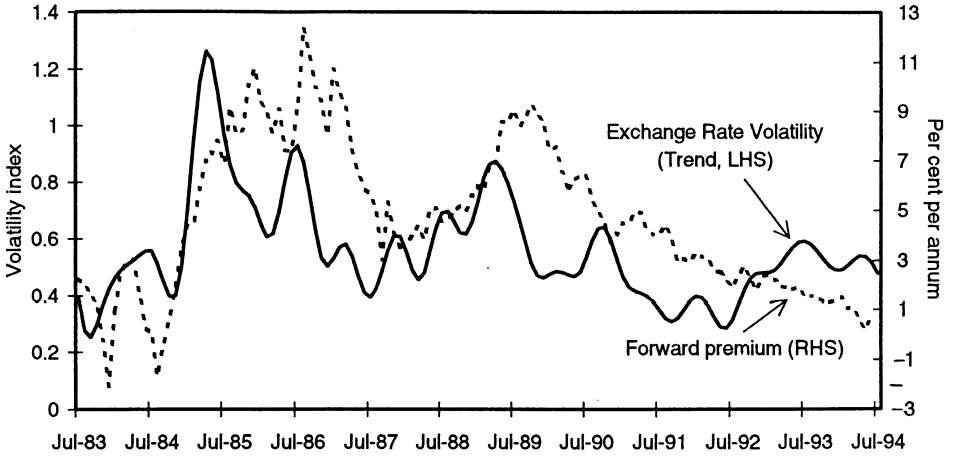

Figure 7 Correlation between exchange rate volatility and the forward premium

5. Factors influencing country and exchange risk

FitzGerald (1993) argued that Australia's interest rates include a country risk premium because of the need to compensate overseas lenders for the risks which they may perceive to be associated with Australia's high external debt. One implication of this argument is that the country risk premium should be a function of the level of, or rate of growth in, Australia's foreign debt. Jüttner and Luedecke (1991) found a statistically significant positive relationship between Australia's gross and net foreign debt and deviations from covered interest parity for the period December 1983 to June 1986. During that period Australia's net foreign debt was rising rapidly as it adjusted towards equilibrium in the newly deregulated Australian financial market. However, one significant limitation of the Jüttner and Luedecke analysis is that it was restricted to a relatively short period immediately following the floating of the Australian dollar. It is possible that the correlation noted by Jüttner and Luedecke was merely a result of the adjustments taking place in Australia's financial markets during that period rather than a longer-term relationship. Further, their conclusions are inconsistent with the deviations from covered interest parity presented in figure 4 of this article which were both positive and negative over the period they examined.

Whitelaw and Howe (1992) argued that 'the downgrading from Aa1 to Aa2 (by Moody's) could have added about 15 basis points . . . to interest

rates'. The reasons given by the ratings agencies for their downgrading of Australia's credit rating were concerns about the sustainability of Australia's persistent current account deficits and mounting foreign debt. While Whitelaw and Howe provided no justification for their claim, it is notable that the persistently positive deviations from covered interest parity shown in figure 4 of this article emerged in about 1990, shortly after Australia's credit rating was downgraded by Moody's to Aa2 (August 1989) and Standard and Poors to AA (October 1989). The assessments provided by the rating agencies may have reflected and even reinforced existing market concerns about Australia's relatively large current account deficit and foreign debt.

The current account deficit and its contribution to Australia's relatively high foreign debt are also often cited as a factor contributing to periods of exchange rate instability and weakness. As noted earlier, FitzGerald (1993, p. 12) argued that 'exchange rate risk is . . . a function of a country's external debt' and warned that if a country undertakes sustained borrowing for unproductive purposes, 'the market would eventually impose adjustment principally by way of exchange rate depreciation' (p. 13).

Smith and Gruen (1989) presented evidence which supports the argument that exchange risk is related to the current account deficit and Australia's net foreign debt. For example, they argued that five of the ten largest weekly depreciations of the Australian dollar between January 1986 and April 1989 appear to have been related to the need for a lower real exchange rate to put the economy on a sustainable net external debt/GDP path. This suggests that the current account deficit and the ratio of net foreign debt to GDP may be associated with an increased likelihood of a sudden and significant depreciation. Hughes (1995, p. 2) also found some evidence of a link between the current account deficit and the exchange rate.

Orr, Edey and Kennedy (1995) examined the factors influencing real interest rates across OECD economies. Among the factors they considered in their analysis were the current account and fiscal deficits, both of which were included as risk premium variables. When evaluated across a sample of OECD economies they concluded that both deficits have a significant effect in raising a country's domestic real long-term interest rate. However, when the same regressions were conducted individually for each OECD country in the sample, these two variables were found to be significant in only a small number of cases and both were found to be insignificant in the case of Australia.

If the foreign debt to GDP ratio was of principal concern to investors, exchange rate volatility and any exchange risk premium might be expected

to have increased over the period since the mid-1980s, other things constant. If changes in the debt to GDP ratio are the main concern of investors then a declining trend might be expected, while if the current account deficit is important, the exchange risk premium might be expected to cycle with changes in the deficit, other things constant. It is also possible that the debt to GDP ratio and the current account deficit might interact such that when the debt ratio is changing more quickly, markets will be more sensitive to the current account.

If, as is suggested in the previous section, exchange rate volatility can be considered an indicator of the relative size of the exchange risk premium, then a strong correlation between exchange rate volatility and the current account deficit or movements in the foreign debt to GDP ratio might provide some evidence of a relationship between the exchange risk premium and those variables. As shown in figure 8, after rising sharply in the mid-1980s there appears to have been a downward trend in exchange rate volatility. Further, over the post-float period in the 1980s, cycles in exchange rate volatility tended to correspond broadly with changes in the current account deficit. However, while the amplitude of cycles in the current account deficit (measured as a share of GDP) remained similar in magnitude over the 1980s and early 1990s, the amount of change in the level of volatility in the exchange rate diminished. These observations are consistent with, but not necessarily evidence in support of, the hypothesis

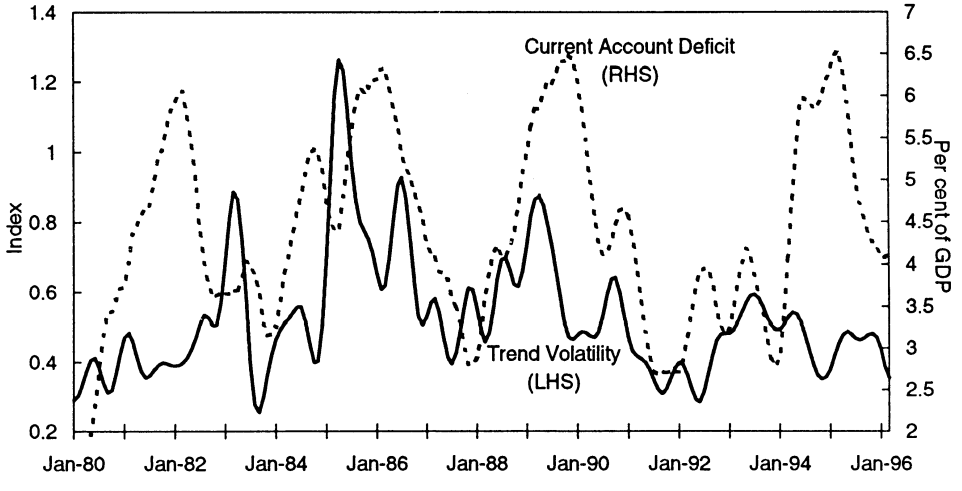

Figure 8 Trend movements in exchange rate volatility and the current account deficit

that market participants are concerned about changes in the debt to GDP ratio and the contribution of the current account deficit to such changes.

The combination of the apparent downward trend in exchange rate volatility since the mid-1980s and the reduced amplitude of cycles in exchange rate volatility (and implicitly, the exchange risk premium) may reflect declining uncertainty in the minds of investors regarding the outlook for Australia's current account deficit and foreign debt position over the period since the mid-1980s. For example, the sudden rise in Australia's foreign debt to GDP ratio in the mid-1980s and the 1985–86 peak in the current account deficit may have led to considerable uncertainty regarding the prospects for the Australian dollar which subsequently culminated in a sudden and very marked depreciation in 1985 and 1986 (one that may have exceeded levels justifiable in terms of economic fundamentals — O'Mara 1990). By the time the current account deficit was again on the increase, towards the end of the 1980s, the increase in Australia's foreign debt to GDP ratio had begun to moderate and much of the mid-1980s' depreciation had been reversed. Hence, market participants may have been less concerned about the exchange rate implications of a rise in the current account deficit. The foreign debt to GDP ratio broadly stabilised over the first half of the 1990s, and this may have further reduced anxiety about the exchange rate implications of the rise in the current account deficit in 1994–95.

However, it is possible that the changes in exchange rate volatility shown in figure 8 may largely reflect other influences. For example, the downward trend in exchange rate volatility may be a consequence of a gradual increase in the liquidity and sophistication of the Australian foreign exchange market over the period since the float. This process of maturation may have contributed to a reduction in the level of exchange rate volatility occurring in response to adverse economic news. Papuc (1996) presents anecdotal evidence to suggest that the quadrupling of the size of the A$ foreign exchange market over the last ten years has been accompanied by an expansion in the range of Australian dollar products which are available, thereby allowing greater control over exposure to exchange risk.

Two interpretations could be placed on this type of argument. One is that the current account deficit and foreign debt may still be of concern to investors, but that in a more sophisticated market those concerns do not tend to translate into exchange rate volatility or exchange risk premia to the same extent because of the ability to diversify risk more efficiently. An alternative interpretation is that the observed correlation between exchange rate volatility and the current account deficit shown in figure 8 is spurious, although the correspondence of the cycles in exchange rate volatility and

the current account deficit in the 1980s raises some questions about the validity of this argument.

Another factor which may have reduced the degree of volatility in foreign exchange markets is the trend towards greater policy stability. Greater transparency in the operation of monetary policy may have had a role in reducing financial market volatility. Blundell-Wignall, Fahrer and Heath (1993) argued that increased uncertainty about the outlook for inflation, particularly after the M3 target was abandoned in January 1985, may have contributed to the large depreciation in February 1985. Fiscal policies specifically aimed at reducing budget deficits may have also contributed to lower exchange rate volatility and therefore a lower exchange risk premium during the 1990s. Nevertheless, as noted above, the fiscal deficit was not found to be a significant factor influencing long-term real interest rates in Australia by Orr, Edey and Kennedy (1995).

6. Concluding comments

The evidence presented in this article provides some support for the hypothesis that Australian interest rates may include a risk premium due, in part, to Australia's high foreign debt and persistent current account deficits. An analysis of covered interest parity revealed the existence of persistently positive deviations from parity, averaging in the order of 0.25 percentage points per year, between early 1990 and mid-1994. Such deviations are consistent with, but not necessarily proof of, the existence of a *small* country risk premium at that time. However, it is not possible to rule out that the observed deviations were due to factors other than a risk premium. There is no evidence to suggest that a systematic country risk premium existed during the 1980s, although such premia may have existed for short periods of time.

It is difficult to discern a relationship between the observed deviations from covered interest parity and Australia's current account deficit or foreign debt since data problems limit any conclusions about how risk premia might have changed over the 1980s and 1990s. However, the emergence of persistently positive deviations from covered interest parity in about 1990 is consistent with the argument by Whitelaw and Howe (1992) that the downgrading of Australia's credit rating by Moody's to Aa2 (August 1989) and Standard and Poors to AA (October 1989) may have led to a country risk premium for Australia. These downgradings probably reflected, and may have reinforced, existing market concerns about Australia's current account deficit and foreign debt.

The analysis of conventional approaches to estimating exchange risk premia presented in this article led to the conclusion that such approaches

are unlikely to provide reliable estimates of exchange risk premia. It was argued that, in the absence of any reliable estimates of exchange risk premia, an index of exchange rate volatility might be of use in providing some indication of movements in the relative size of any exchange risk premia.

Exchange rate volatility has trended down since the mid-1980s and changes in exchange rate volatility since the mid-1980s appear to exhibit some correlation with changes in the current account deficit. These two features may indicate a relationship between the existence and size of exchange risk premia and changes in Australia's foreign debt to GDP ratio and the contribution of the current account deficit to such changes.

One interpretation of the decline in the amplitude of cycles in exchange rate volatility, relative to those in the current account deficit, is that the current account deficit has become less significant in influencing exchange risk premia since the mid-1980s. However, this outcome may simply reflect the fact that the debt to GDP ratio has gradually stabilised over that period, in which case any decline in the exchange risk premium might be reversed should Australia's foreign debt to GDP ratio begin to rise again. An alternative interpretation is that the observed relationships simply reflect the influence of greater liquidity and improved risk management in the exchange market rather than a reduction in market sensitivity to the current account deficit and foreign debt. In either case, an implication might be that the size of any exchange risk premia might have declined since the mid-1980s.

Overall, it is not possible to draw any firm conclusions about how the total risk premium might have changed over the period since the floating of the Australian dollar, due to data limitations. However, given the relatively small size of the estimated country risk premium in the 1990s, if any, it is possible that a decline in the size of the exchange risk premium may have been dominant in determining any change in the total risk premium. As a consequence, Australian interest rates may currently be lower than would otherwise be the case. Volatility in the exchange rate, which may have been due, in part, to factors leading to the existence of an exchange risk premium, has also declined since the mid-1980s. Both these developments would have contributed to lower production and marketing costs in the rural and resource sectors.

Appendix: data issues

One of the most significant difficulties for conducting empirical research into risk premia and the covered and uncovered interest parity conditions is overcoming data limitations. Interest rate, exchange rate and forward

margin data need to be compatible when testing covered and uncovered interest parity and speculative efficiency. If this is not the case, the deviations from covered interest parity and speculative efficiency may provide an inaccurate measure of the country and exchange risk premia.

The most significant data issues are as follows.

- Interest rate data must relate to the yield on securities with similar characteristics. For example, the securities chosen as the source of the interest rate data should be identical in terms of perceived risk and maturity. In practice, risk will only be identical (or nearly so) on government-backed instruments such as Treasury bills or bonds.
- Financial variables can vary significantly over short periods of time. Arbitrage conditions such as covered and uncovered interest parity and speculative efficiency only govern relationships between variables at particular moments in time. If data are not strictly contemporaneous, measured deviations from covered interest parity and speculative efficiency may reflect these data limitations rather than any country and exchange risk premia (see discussion in section 3).
- The covered interest parity and speculative efficiency conditions are most likely to hold in well-traded markets, since it is in these markets that arbitrage opportunities will be most rapidly dissipated. Hence the most reliable tests of these conditions are those based on data from markets which are well traded. If data are obtained from a relatively thinly traded market, the observed deviations from covered interest parity and speculative efficiency might reflect market inefficiencies rather than risk premia.
- The issue of how to measure the exchange rate expectations of traders in the forward exchange market is particularly significant when seeking to estimate the exchange risk premium. Traders may not explicitly quantify their expectations when trading, so that a range of measurement issues may arise. Poorly measured exchange rate expectations can lead to grossly inaccurate estimates of exchange risk premia (these measurement issues are considered in detail in section 4).

Interest rate data

The yields on 13-week Australian Treasury Notes and three-month US Treasury Bills were chosen as the interest rates on which the estimates of the country risk premium were based. These are the same interest rates which were used by Blundell-Wignall, Fahrer and Heath (1993) to test covered interest parity. The Australian interest rate data (*i*) used in this article were obtained from McMillan and Martin (1993) while the US data

(i^*) were obtained from the Federal Reserve Bank of Chicago (Board of Governors of the Federal Reserve System 1996b). End-of-month values were chosen to avoid the timing problems associated with monthly average data.

Weighted average yields on 13-week Treasury Notes issued at tender from December 1979 to November 1985 and daily assessed yields in the secondary market for the period December 1985 to September 1993 were obtained from a daily Reserve Bank of Australia (RBA) database (McMillan and Martin 1993). This series was extended to July 1996 using the 'weighted average yield of notes allotted at the last tender of the month', as published in the RBA *Bulletin* (table F.1). Slight timing differences may have existed during the period prior to December 1985 and after September 1993 since tenders were typically on a Wednesday and did not necessarily occur every week, although on those days prior to October 1993 when tenders took place, the interest rates published in the RBA *Bulletin* were identical to those published in McMillan and Martin (1993). Daily US interest rate data were available from January 1962 to July 1996, from which the rate on the last trading day of each month was extracted.

One potential issue which arises when US interest rate data is compared with Australian interest rate data is that time zone differences reduce the contemporaneity of the data. However, this does not appear to be a significant factor in explaining the covered interest parity deviations which are reported in this article, since the results are not significantly different if month average data from the RBA *Bulletin* is used. Three-month securities were chosen since they are the most widely traded securities for which forward margin data were available. The Australian Treasury Notes have a maturity of 13 weeks, or 91 days. The US Treasury Bills are three-month securities, which could vary in maturity between 89 and 92 days. However, this difference is relatively small and would be unlikely to have a significant impact on the results.

Exchange rate data

For the purposes of conducting covered interest parity tests, forward (F) and spot (S) US$/A$ dollar exchange rate data were obtained from the RBA's daily exchange rate database (Sharratt 1994) for the period July 1983 to June 1994. This series is consistent with the monthly data series published in the RBA *Bulletin*, with the exception of December 1993, where the value in the *Bulletin* appears to be a misprint. The US$/A$ exchange rate was chosen because the US dollar is the currency against which the Australian dollar is most heavily traded (Reserve Bank of Australia 1995).

For the purposes of calculating historical exchange rate volatility, the data in Sharratt (1994) were extended back to January 1980 and forward to July 1996 using daily exchange rate data obtained from the Federal Reserve Bank of Chicago (Board of Governors of the Federal Reserve System 1996a). The main differences between the two series is that the Sharratt (1994) data are more precise (the Federal Reserve data has only 2 decimal places prior to 1994) and time zone differences between the Australian and US markets. The two data series are extremely close, although deviations of up to 5 per cent exist for some days. The larger differences correspond to periods when the exchange rate was most volatile (for example, February 1985) which is when the time zone difference is likely to have had its greatest effect.

Forward margin data

Daily forward margin data for the US$/A$ exchange rate were obtained for the period July 1983 to June 1994 from Sharratt (1994). The forward premium was calculated using the three-month forward margin in all cases except where the forward premium was being compared with four-week exchange rate forecasts. In calculating the annualised one-month forward premium a scaling factor of 12 (months per year) was used whereas the expected appreciation/depreciation was based on a scaling factor of 13 (four-week periods per year).

Covered interest parity differentials

As was noted in section 2, equations (1) and (2) are approximations. In calculating deviations from covered interest parity, an exact specification was used. This required calculating the interest differential (using annualised data) as $100*[\log(1 + i/100)-\log(1 + i^*/100)]$ rather than simply $i - i^*$. The annualised three-month forward premium was calculated using a log specification, $\log(S/F)*400$. The covered interest parity differential was then calculated as the interest differential minus the annualised forward premium.

Speculative efficiency differentials

Deviations from speculative efficiency were calculated as the expected annualised percentage depreciation (in log form) less the forward premium. In the case of the Consensus Economics three-month forecasts the formula $\log(S^e/F)*400$ was used. For the four-week ahead MMS and Hunt (1987) forecasts the annualised expected depreciation was calculated as

$\log(S^e/F)$*1300. The annualised four-week expected depreciation was compared to the annualised one-month forward premium, calculated as $\log(S/F)$*1200. The slight maturity difference between the four-week data and the one-month data was reduced by comparing each in terms of an annualised rate of change.

Exchange rate volatility

The exchange rate volatility index used in this article is based on the Schwert (1989) index. The index was calculated as the standard deviation of the daily percentage changes in the exchange rate during each month. Trend exchange rate volatility was obtained by using a three-month weighted moving average. Linearly declining weights (that is, 3,2,1) were used.

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