EXCHANGE RATE REGIMES AND THE VOLATILITY OF FINANCIAL PRICES: THE AUSTRALIAN CASE

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Research Discussion Paper

8608

July 1986

* The views expressed herein and any remaining errors are our own and should not be attributed to our employer.

ABSTRACT

Much has been written about the choice of exchange rate regimes from a theoretical perspective. A conclusion of this literature is that, *ceteris paribus*, interest rates should exhibit less volatility (and exchange rates more volatility) under a floating than under a fixed exchange rate regime. Equivalently, interest rates should be relatively easier (and exchange rates relatively harder) to predict (in the statistical sense) under a floating exchange rate. Further, the unexpected volatility in interest rates due to external impulses should be reduced, and that in exchange rates increased, relative to a fixed exchange rate regime.

This study analyses the question of interest rate and exchange rate volatility before and after the floating of the Australian dollar in December 1983. The paper adopts an atheoretical methodology of vector autoregressions (VAR's) to calculate the forecast-error variance for interest rates and exchange rates (at different horizons) and to decompose these forecast-error variances into those parts attributable to domestic and external sources. A VAR model is estimated for both the pre- and post-float periods, on daily data for the Australian trade-weighted index, the Australian 90 day bank accepted bill rate, the US trade-weighted index, the US 90 day prime bankers' acceptances rate, the DM trade-weighted index, the West German 90 day interbank deposits rate, the Japanese trade-weighted index and the Japanese 90 day Gensaki rate. This is the minimum configuration that can capture both domestic and foreign sources of volatility in financial prices. The analysis supports the hypothesis that interest rates have become relatively less volatile (and the exchange rate relatively more volatile) with the move to a floating exchange rate regime. However, the evidence suggests that this has been due to a change in the nature of the relationship between the Australian interest rate and exchange rate; rather than to a shift in the incidence of external shocks. This supports the notion that a more independent monetary policy is possible under a floating exchange rate regime.

<u>TABLE OF CONTENTS</u>

EXCHANGE RATE REGIMES AND THE VOLATILITY OF FINANCIAL PRICES: THE AUSTRALIAN CASE

Robert G. Trevor and Stephen G. Donald

1. Introduction

The collapse of the Bretton Woods Agreement in 1973 and the subsequent failure of the Smithsonian agreement, ushered in a world-wide shift to floating exchange rates. At the time, the weight of the academic literature supported floating exchange rate regimes. However, after more than a decade of experience of (dirty) floating exchange rates, there has been an increasing interest in, and analysis of, arguments for intervention of one form or another - especially in the form of co-ordinated action by a number of countries. The reasons for this are varied. Some are purely technical (e.g., the recent development of techniques that allow for the incorporation of forward-looking expectations into models and the development of game theoretic analysis). Others are experiential, including concern over the volatility of exchange rates and interest rates, the incidence of persistent current account imbalances and the world debt situation.

Tobin (1978), for example, has argued that the advent of floating exchange rates and the subsequent increase in international capital substitutability and mobility have exacerbated the transmission of international disturbances, causing relative price volatility.[1]

On the other hand, theory suggests that when price flexibility is constrained in one part of a simultaneous system, the remaining flexible prices will initially respond more to shocks than if the constrained prices are free to adjust.[2] One implication of this argument is that the volatility of interest rates should be less (and that of exchange rates greater) under a floating exchange rate.[3]

This paper addresses the issue of the empirical volatility of exchange rates and interest rates under different exchange rate regimes. The Australian dollar was floated (and controls on capital flows removed) on 12 December 1983. If the theoretical analysis is correct, interest rates should exhibit less volatility and

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1. Subsequent work has suggested that an increase in capital substitutability and mobility can have this effect only when disturbances are monetary in nature. See, for example, Driskill and McCafferty (1982), Eaton and Turnovsky (1982) and Turnovsky and Bhanderi (1982).

2. Such applications of Le Chatelier's principle are common in international economics. The overshooting literature stimulated by Dornbusch (1976) is an example of variability in floating exchange rates being induced by slowly adjusting wages or prices.

3. Kenen (1985) has formulated a model which addresses this issue in the Australian context.

exchange rates more volatility under the float than under the "fixed" exchange rate regime.[4] Equivalently, interest rates should be relatively easier (and exchange rates relatively harder) to predict (in the statistical sense) under a floating exchange rate regime. Moreover, the volatility in interest rates due to external impulses should be reduced, and that in exchange rates increased, relative to a fixed exchange rate regime.

In order to analyse this question of pre- and post-float volatility of Australian interest rates and exchange rates, we adopt the atheoretical methodology of vector autogressions (VARs). There are two main reasons for taking this approach. Firstly, VARs are well suited to examination of forecasting and forecasting errors.[5] Secondly, the lack of adequate data on price and scale variables, which are typically measured quarterly, prevents a more structural approach.[6]

A VAR model is estimated for both the pre- and post-float periods, on daily data for short-term interest rates and exchange rates for Australia, the US, West Germany and Japan. This allows the forecast error variances of Australian interest rates and exchange rate to be calculated and decomposed into the parts attributable to domestic and foreign sources in each of the two periods.

The results are consistent with one of our two theoretical priors. They support the hypothesis that Australian interest rates have become relatively less volatile (and the exchange rate relatively more volatile) with the move to a floating exchange rate regime. However, there is little evidence to support the hypothesis that this change in volatility has been due to a shift in the incidence of external disturbances. Rather, the results suggest that it was due to a change in the relationship between Australian interest rates and exchange rates. Since the float, the interest rate has been relatively independent of the exchange rate; this has reduced the volatility of the interest rate. This supports the notion that a more independent monetary policy is possible under a floating exchange rate.

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4. Prior to the floating of the Australian dollar, the exchange rate was pegged to a trade-weighted index. The value of this TWI was set each morning by the Australian authorities. To simplify the exposition, we shall refer to this regime as a "fixed" exchange rate.

5. There is some controversy over the usefulness of the VAR approach. In particular, Cooley and LeRoy (1985) argue that they are of limited usefulness for counter-factual policy analysis. Nevertheless, the participants of this debate seem to agree that VARs are useful in the realm of forecasting.

6. This is not a major limitation. Bilson (1984), for example, shows how a vector autoregression for exchange rates and interest rates can be derived from a discrete time, two country version of the Dornbusch (1976) model.

2. The VAR Methodology

In general we will be concerned with an (nxl) vector of n endogenous variables Y_t containing domestic and foreign financial price variables. We assume that Y_t is generated by the m^{th} order vector-autoregression,

$$(1) \qquad Y_t = D_t + \sum_{j=1}^{m} B_j Y_{t-j} + \varepsilon_t$$

where D_t is a (nxl) vector representing the deterministic component of Y_t (generally a polynomial in time), B_j are (nxn) matrices and ε_t is a (nxl) vector of multivariate white noise residuals (or innovations). Equation (1) is specified and estimated as an "unrestricted reduced form". As is the hallmark of VARs, there are no exclusion restrictions within the B_j matrices. Rather, the B_j's are uniquely determined under the orthogonality conditions $E(\varepsilon_t) = 0$ and $E(Y_{t-j}\varepsilon_t) = 0$, j=1, ..., m, and are estimated by ordinary least squares. Given the choice of variables in Y_t, the only pretesting involved with the fitting of equation (1) is in choosing the appropriate lag length m. In general we choose the smallest m such that ε_t is indistinguishable from a multivariate white noise process.[7]

Tests which are commonly applied to VARs are tests for Granger-causality which test whether a variable, say Y_{1t} is useful in forecasting another variable, say Y_{2t}. The variable Y_{1t} is said to be useful in forecasting Y_{2t} if the inclusion of lags of Y_{1t} in the equation for Y_{2t} significantly reduces the forecast variance. Thus it tests whether lags of Y_{1t} contain any additional information on Y_{2t} which is not already contained in the lags of Y_{2t} itself.

The model presented in equation (1) is difficult to describe in terms of the B_j coefficients. The best descriptive devices are the innovation accounting techniques suggested in Sims (1980, p.21) and described by Litterman (1979, pp.74-85). The first of these techniques of innovation accounting are the impulse response functions which describe the dynamic response of variables in the VAR to an impulse in one of the variables. To understand these impulse response functions, consider the moving average representation of equation (1), obtained by repeated back substitution for Y_{t-j},

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7. On the basis of tests for within, and across, equation serial correlation and tests for the significance of B_m from the zero matrix. The inverse autocorrelation function (i.e., the autocorrelation function of the dual model) is used to test for non-stationarity of the residuals. (See, for example, Priestley (1981).) All of the empirical work is done using the macro facilities of version 5 of SAS.

$$Y_t = D_t^* + \sum_{j=0}^{\infty} M_j \epsilon_{t-j} \tag{2}$$

where M_j is a (nxn) matrix of moving average coefficients. The response of the i^{th} variable to a unit innovation in the k^{th} variable j periods earlier is given by the ik^{th} element of M_j. In general, however, there is likely to be some contemporaneous correlation among innovations, which is not taken into account in equation (2). If one can assume some contemporaneous causal ordering of the variables in Y_t (such that contemporaneous causality is one way, i.e., recursive) one can obtain orthogonalised innovations u_t, where $u_t = G\epsilon_t$, so that $E(u_t u_t') = \phi$ where ϕ is a diagonal (nxn) matrix. For example, if we have a VAR with a foreign variable and a domestic variable and assume that the domestic variable does not contemporaneously cause the foreign variable, then the foreign variable will be ordered above the domestic variable in Y_t and G will be of the form,

$$G = \begin{vmatrix} 1 & 0 \\ -\rho & 1 \end{vmatrix}$$

where ρ is the estimated coefficient in the regression equation,

$$\epsilon_{2t} = \rho\epsilon_{1t} + u_{2t}$$

ϵ_{1t} is the innovation in the foreign variable, ϵ_{2t} the innovation in the domestic variable and u_{2t} the orthogonalised innovation in the domestic variable (in the sense that it is orthogonal to $u_{1t} = \epsilon_{1t}$).

In terms of orthogonalised innovations, u_t, the moving average representation is,

$$Y_t = D_t^* + \sum_{j=0}^{\infty} M_j G^{-1} u_{t-j}$$

$$= D_t^* + \sum_{j=0}^{\infty} A_j u_{t-j} \tag{3}$$

where the ik^{th} element of A_j gives the response of variable i to an orthogonalised unit impulse in variable k, j periods earlier.

For the purposes of this paper, however, the second device of innovation accounting will be used. This relates to the decomposition of the k-step ahead forecast variance of each variable in the VAR, into percentages contributed by the innovations in each variable. A variable whose <u>own</u> innovations account for all or most of its own forecast variance would be said to be exogenous (in the Sims sense) to the system.

The k-step ahead forecast variance may best be seen by considering the k-step ahead forecast error induced by forecasting Y_t linearly from its own past,

$$(4) \qquad Y_{t+k} - E_t(Y_{t+k}) = A_0 u_{t+k} + \dots + A_{k-1} u_{t+1}$$

(in terms of orthogonalised innovations) where $E_t(Y_{t+k})$ is the linear least squares forecast of Y_{t+k} given all information at time t. The k-step ahead forecast variance is,

$$(5) \qquad E[(Y_{t+k}-E_t(Y_{t+k}))(Y_{t+k}-E_t(Y_{t+k}))'] = A_0\phi A'_0 + \dots + A_{k-1}\phi A'_{k-1}$$

Because of the extensive orthogonality conditions built into the model, the k-step ahead forecast variance of each variable will be a weighted sum of the variances of the innovations to each variable. Thus we can obtain the percentage contribution of each variable's innovations to the variance of any other variable.

3. Some Econometric Issues

(a) Pre-Filtering

This discussion of the methodology of VARs assumes that the variables are covariance-stationary (ie., that the variance-covariance structure of the data does not change over time). However, it is well known that many macro-economic variables exhibit trends and are thus non-stationary. Under such conditions, some 'pre-filtering' of the data may be necessary to induce stationarity. The main limitation of this strategy is that the same filter needs to be applied to each series in the VAR - otherwise interpretation of the results is difficult.

Three types of filters are used in this study. Firstly, a polynomial in time is included in each estimated VAR (the D_t term in equation (1)). This is equivalent to pre-filtering the data by the removal of a polynomial (normally linear or quadratic) time trend. Each VAR is also re-estimated on data pre-filtered by the difference filter (which is (1-L) where L is the lag operator). This filter is likely to induce stationarity where the data has a random walk component - a situation commonly encountered in interest rate and exchange rate studies. Finally, the VARs are re-estimated on data pre-filtered by the "Sims filter" (which is $(1-1.5L+.5625L^2)$). This filter tends to flatten the spectrum of most macroeconomic variables.

The results obtained from the de-trended data are presented in the tables accompanying the text. Those from data pre-filtered by the difference filter and the Sims filter are presented in Appendices B and C respectively. A comparison of these tables shows that the essential results of the paper are robust to these alternative methods of inducing stationarity.

(b) Time-Trend Order

While a polynomial in time may be a useful way of inducing stationarity in a VAR, its order needs to be chosen. In general, the order of this polynomial, D_t, has been chosen such that it is the minimum order polynomial that satisfies two criteria. Firstly that the vector of coefficients (across equations) of its highest order term is significantly different from zero. Secondly, that there are no significant spikes in the inverse autocorrelation function (i.e., the autocorrelation function of the dual model) of the residuals of the VAR.

These criteria were satisfied by a first-order polynomial (i.e., a linear time trend) for each of the VARs presented below.

(c) Lag Length

Perhaps the most important decision that is made in estimating a VAR is the choice of a criteria for deciding the lag length (m in equation (1)). Four main types of criteria have been suggested in the literature. Firstly, m may be chosen to minimise the residual variance (Theil (1961)). Alternatively, the criteria may be the minimisation of the Kullbeck-Leibler information criteria. (Differing assumptions produce the AIC of Akaike (1974), the BIC of Sawa (1978) and the PC of Amemiya (1980).) Thirdly, one may use a Bayesian information criteria which chooses m to maximise the posterior likelihood (Schwartz (1978)). Finally, m may be chosen by applying a log likelihood test (Sims (1980)).

Nickelsburg (1985) uses Monte Carlo techniques to examine the sensitivity of these alternative criteria to the shape of the lag distribution of a VAR. The residual variance and log likelihood test are found to be only moderately sensitive to lag structure, but biased towards large models (i.e., long lags). The information based criteria yield results which are much more sensitive to the lag structure and tend to be overly parsimonious. Nickelsburg's results suggest that unless the sample size is so small that the degrees of freedom loss (from estimating too many lags) inhibits statistical inference, the residual variance or log likelihood criteria may be the best for choosing the lag length of a VAR.

Accordingly, criteria which fall into this class has been adopted for the estimation of the VARs. The lag length is chosen to be the shortest (i.e., the smallest m) such that there is no within, or across, equation serial correlation and the matrix of coefficients on the longest lag (B_m) is significantly different from the zero matrix. Because of the tendency for these criteria to be biased towards large models, each of the VARs is re-estimated with a lag length reduced by one. In no instances are the results found to be sensitive to this underfitting of the models.

(d) Orthogonalisations

As shown in Section 2, once the VARs have been estimated, some assumptions are required to induce orthogonality amongst the residuals prior to the calculation of impulse response functions or variance decompositions. The problem is essentially one of mapping the n(n-1)/2 different elements of the contemporaneous correlation matrix of the VAR residuals, ε_t, into a matrix, G,

(6) $$G\varepsilon_t = u_t$$

such that the new residuals, u_t, have a diagonal variance-covariance matrix.

The choice of a G matrix is comparable to giving a causal interpretation to contemporaneous correlations. There are no statistical tests which allow discrimination between the various (exactly identified) alternatives. As Cooley and LeRoy (1985) argue in their critique, the orthogonalisation must be justified a priori if a VAR is to be given a structural (as opposed to a data summary) interpretation.

The most commonly used method of choosing an orthogonalisation is the Choleski decomposition, which results in a lower triangular, recursive G matrix. Under this method, the orthogonalisation is "determined" by the order of the various variables in the Y_t vector. There are thus n factorial different Choleski decompositions.

Bernanke (1986) has recently suggested that the orthogonalisation can be determined from economic theory. A structural model for the contemporaneous disturbances is postulated and estimated,

$$(7) \qquad \epsilon_t = \Gamma\epsilon_t + \Omega u_t$$

which yields,

$$(8) \qquad G = \Omega^{-1}(I-\Gamma)$$

While this method does little to reduce the large number of possible orthogonalisations, it does provide an alternative way of considering the available choices.

Th orthogonalisation that is used for the VARs in this paper is essentially of the form of Bernanke (1986). The matrix Ω is restricted to the identity matrix and structure is imposed on the Γ matrix by two assumptions derived from our theoretical priors. Firstly, it is assumed that Australia is a "small country". That is, that the Australian variables do not contemporaneously affect any foreign variable. Secondly, for reasons discussed more fully in Section 4, we assume that the Australian interest rate does not contemporaneously (i.e., within a day) affect the Australian trade-weighted index of the exchange rate.

Operationally, these assumptions are given empirical content by ordering the Y_t vector such that the foreign variables occur first, then the Australian exchange rate followed by the Australian interest rate. The Choleski decomposition is used to calculate the G matrix, but the variance decompositions are only calculated for the net, rather than the individual, effects of the foreign variables.

4. Empirical Results

(a) Some Preliminaries

In estimating the VARs for the pre- and post-float sample periods we have included all interest rates in levels and all exchange rates as trade weighted indexes in natural logarithms. The data used are on a daily basis from 16 November 1981 until 31 December 1985. As there may have been some turbulance in Australian financial markets just prior to and just after the floating of the Australian dollar on 12 December 1983, we have omitted observations around the float to give pre- and post-float sample periods which are more homogeneous within exchange rate regimes and more suitable for comparison across regimes. The sample periods used are 16 November 1981 to 31 October 1983 for the pre-float period and 2 April 1984 to 31 December 1985 for the post-float period - sample sizes of 503 and 447 observations respectively.

Using the methodology described in Section 2 we have fitted to each sample period VARs comprising the following eight financial prices: the Australian trade-weighted index (AUSTWI); the Australian 90 day bank accepted bill rate (AUSRATE); the United States TWI (USTWI); the U.S. 90 day prime bankers' acceptances rate (USRATE); West Germany's TWI (DMTWI); the West German 90 day interbank deposits rate (DMRATE); Japan's TWI (JAPTWI); and the Japanese 90 day Gensaki rate (JAPRATE).[8] The VAR for the pre-float sample period required five lags and a first order time trend to induce multivariate white noise residuals (innovations), while for the post-float sample period four lags and a first order time trend were required.

(b) The Estimated VARs

Convenient summaries of the estimated VARs are provided in Tables 1 and 2 for the pre- and post-float periods. These tables contain the results of F tests for the significance of blocks of coefficients in each equation of the VARs (i.e., tests of Granger-causality). Each entry is the minimum level of significance required to reject the null hypothesis that the column variable does not help forecast (Granger-cause) the row variable. As we are more concerned in this paper with the behaviour of Australian financial prices in the two periods, the marginal significance levels in the first two rows of the tables are the most important (i.e., the significance levels for the tests for Granger-causality running from each variable to the two Australian variables).

From Table 1 we note that, with one exception, the hypothesis that each of the foreign variables does not Granger-cause either Australian interest rates or TWI cannot be rejected, at commonly used levels of significance, in the pre-float period. The exception is the lags of US interest rates which appear to feed strongly into the AUSTWI. A test for the joint significance of all foreign variables (the marginal significance levels for which are in the final column) indicates that the null hypothesis can be rejected at the 5 per cent level in the case of the AUSTWI, while it can't be rejected for AUSRATE. There is, however, strong evidence that AUSRATE Granger-causes AUSTWI while there is weaker evidence of feedback from the AUSTWI into AUSRATE.

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8. These data are more fully described in Appendix D. The Gensaki rate is only available for the post-float period. Prior to this, the rate for unconditional call money is used. The results of the analysis without Japan, presented in Appendix A, are essentially the same as those to be presented below. All the trade weighted indexes are expressed in natural logarithms and then scaled up by a factor of 100. Interest rates are in level form and unscaled, i.e., an interest rate of 10 per cent is expressed as 10.0.

Table 1
Granger-Causality Test Results: Pre-Float
(Marginal Significance Levels)

Equation	Explanatory Variable								
	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	JAPTWI	JAPRATE	FOREIGN
AUSTWI	-	.0001	.5309	.0089	.4716	.9568	.8757	.1811	.0233
AUSRATE	.0497	-	.3647	.2852	.3364	.9248	.9483	.2875	.1230
USTWI	.7019	.7618	-	.0267	.1024	.4381	.0009	.3211	-
USRATE	.1830	.1397	.0211	-	.3524	.7380	.3286	.2823	-
DMTWI	.0871	.0522	.4122	.8078	-	.0718	.7618	.0161	-
DMRATE	.0366	.5848	.0857	.2161	.0857	-	.1589	.8164	-
JAPTWI	.7371	.7655	.1624	.2071	.5879	.2700	-	.4794	-
JAPRATE	.2008	.3097	.4017	.2413	.8646	.0244	.6255	-	-

Table 2
Granger-Causality Test Results: Post-Float
(Marginal Significance Levels)

Equation	Explanatory Variable								
	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	JAPTWI	JAPRATE	FOREIGN
AUSTWI	-	.4268	.0003	.4258	.0335	.0087	.0780	.4703	.0004
AUSRATE	.1394	-	.0772	.0116	.2192	.1303	.0631	.2211	.1267
USTWI	.1340	.3757	-	.2198	.7930	.7603	.8947	.8079	-
USRATE	.9746	.5160	.8024	-	.5855	.2924	.9207	.8874	-
DMTWI	.0779	.0078	.0001	.0287	-	.2424	.0009	.5315	-
DMRATE	.6932	.8161	.0026	.0325	.1318	-	.0052	.0001	-
JAPTWI	.8751	.4613	.0641	.7060	.4434	.6947	-	.9394	-
JAPRATE	.4051	.6766	.0037	.0061	.0081	.0632	.2889	-	-

By comparison, the results in Table 2 for the post-float period indicate much stronger effects of foreign variables on AUSTWI and a relatively exogenous AUSRATE. Both the USTWI and DMRATE strongly Granger-cause AUSTWI while there is also evidence, although not as strong, that both DMTWI and JAPTWI have some influence on AUSTWI. Moreover, the null hypothesis that the foreign variables have no joint impact on AUSTWI is easily rejected. The evidence for this appears stronger than for the corresponding test in the pre-float VAR, suggesting that AUSTWI is relatively more endogenous under a floating exchange rate regime, as one would anticipate.

From the corresponding tests for AUSRATE presented in the second row of Table 2, we can note that there is slightly stronger evidence of individual foreign variables having some impact on AUSRATE than in the pre-float period. The USTWI, USRATE and JAPTWI all Granger cause AUSRATE at the 10 per cent level of significance. However, the hypothesis that the foreign variables have no joint impact on AUSRATE cannot be rejected, as in the case of the pre-float VAR. The results with respect to the relationship between AUSRATE and AUSTWI indicate no significant impact of one upon the other for the post-float VAR. Taken together, these results suggest that in the post-float period AUSRATE is relatively exogenous - there is no net effect from the foreign variables and no effect from AUSTWI. They also support the notion that floating exchange rates allow an independent monetary policy.

As one might anticipate, there is little or no evidence of feedback from either Australian variable into any foreign variable. This accords with the idea of Australia being relatively unimportant in world financial markets. There is, however, fairly strong evidence of relationships among the individual foreign variables.

The results of these Granger-causality tests provide limited evidence to suggest a greater impact of foreign financial prices upon the Australian dollar (as measured by AUSTWI) under a floating exchange rate regime compared to that under a fixed exchange rate regime. The evidence with respect to the Australian interest rate, however, is inconclusive. It suggests that foreign financial prices had little direct, net impact on Australian short-term interest rates under either regime, although they may have had an impact via the exchange rate in the fixed rate regime.

Another important finding of these Granger-causality tests is the change in relationship between AUSTWI and AUSRATE in the move from a fixed exchange rate regime to a floating exchange rate regime. While there appears to be a strong relationship between the two variables in the pre-float period, with AUSRATE strongly Granger-causing AUSTWI and some evidence of feedback, this relationship appears to have been broken by moving to a floating exchange rate regime where neither variable Granger-causes the other.

(c) The Variance Decompositions

As noted in Sections 2 and 3 above, in order to decompose the k-step forecast variance into percentage contributions from the individual variables, we are required to make assumptions regarding the contemporaneous causal ordering of the variables. The sensitivity of the results (for the percentage contributions, though not the forecast variances themselves) to the ordering assumed will depend on the degree of contemporaneous correlation among the innovations - i.e., the contemporaneously non-forecastable part of each variable. Since these are of some interest in themselves, we present the correlations in upper-triangular matrix form for the pre- and post-float periods in Tables 3 and 4 respectively. Examination of these tables will help identify possible areas of sensitivity with regard to assumed causal ordering.

The correlations presented in Tables 3 and 4 indicate very little in the way of contemporaneous correlation between the innovations in Australian and foreign variables. This is especially the case for AUSRATE, while the exchange rate appears to be correlated to a certain extent with the DMTWI in the post-float period. This reflects a greater endogeneity in the floating exchange rate regime than under the fixed exchange rate regime, as one would expect. These correlations suggest that the variance decompositions are likely to be insensitive to our maintained hypothesis that the Australian variables do not contemporaneously cause the foreign variables.[9]

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9. This is the standard "small country" assumption. Since, for the purposes of this paper, we are only interested in the net foreign contribution to volatility, we do not need to be concerned about the ordering of the foreign variables themselves. The net foreign contribution is invariant to the ordering of these foreign variables.

Table 3
Correlation Matrix: Pre-Float

	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	JAPTWI	JAPRATE
AUSTWI	1	.4641	-.0479	.0482	-.0366	.1322	.0248	.0421
AUSRATE		1	-.0118	.0802	.0035	.0062	-.0034	.0019
USTWI			1	.4248	-.5167	.0208	-.5159	.0105
USRATE				1	-.3281	.0035	-.2605	-.0247
DMTWI					1	-.0195	.2898	.0082
DMRATE						1	.0041	-.0936
JAPTWI							1	-.0488
JAPRATE								1

Table 4
Correlation Matrix: Post-Float

	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	JAPTWI	JAPRATE
AUSTWI	1	-.1918	-.0197	-.0276	.1547	-.0154	.0489	.0273
AUSRATE		1	-.0017	-.0065	.0098	-.0527	.0018	.0225
USTWI			1	.2571	-.7985	-.0128	-.2739	-.0458
USRATE				1	-.2072	.0236	-.1424	-.1144
DMTWI					1	-.0322	.0497	.0225
DMRATE						1	.0646	.0709
JAPTWI							1	.0206
JAPRATE								1

However, the correlation between innovations in AUSTWI and AUSRATE in the pre-float period suggests that some caution is required in ordering these two variables. The differences in these correlations (.46 for the pre-float period and -.19 for the post-float period) also suggests that the relationship between interest rate and exchange rate movements has changed in the move to a floating exchange rate regime.[10] This concurs with the findings of the Granger-causality tests in the previous section in suggesting that the interdependence between interest rates and exchange rate movements has been reduced in a floating exchange rate regime - i.e., that the independence of monetary policy has been increased.

As the correlations presented above suggest, the variance decomposition for the pre-float period are sensitive to the causal ordering assumption for AUSTWI and AUSRATE. However, the nature of the AUSTWI variable in the pre-float period suggests that assuming AUSRATE does not contemporaneously cause AUSTWI makes more sense on a priori grounds. Observation of the AUSTWI variable on a given day is calculated on the basis of the previous day's trading in New York. In the pre-float period, the authorities used this to set the US$/$A exchange rate each morning for that day's trading. The AUSRATE variable, by comparison, is measured during the current day's trading; hence, the AUSTWI is intertemporally prior to it. Moreover, this ordering accords with the exchange rate regime in the pre-float period. The exchange rate was not determined by market forces; it was relatively fixed. We maintain this contemporaneous causal ordering for the post-float VAR for consistency; however, it makes little difference to the post-float results.

We present the variance decompositions for AUSTWI and AUSRATE for both the pre- and post-float periods in Tables 5 through 8. To simplify the analysis, we have aggregated the foreign contribution to avoid the need for assumptions about causal ordering for these variables. The total foreign contribution is independent of the relative ordering of the individual foreign exchange and interest rate variables.

The decomposition for AUSTWI for both periods, presented in Tables 5 and 6, indicate little differences in the source of the forecast variance in percentage terms between the two exchange rate regimes. Over short horizons (with which we are more concerned since for longer horizons income and relative price variables are likely to be important) most of the variance

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10. Bilson (1984) argues that such a negative correlation is predicted by the Dornbusch (1976) model of floating exchange rates.

Table 5
Variance Decomposition for AUSTWI: Pre-Float

Days Ahead	Forecast Variance	Per cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSTWI / ROWTWI
0	.21	3.1	96.9	-	1.21
1	.39	4.6	95.3	.1	1.21
2	.57	5.8	92.7	1.5	1.22
3	.74	6.9	91.0	2.3	1.21
4	.85	7.9	89.7	2.4	1.17
5	.95	8.9	88.4	2.7	1.14
6	1.03	9.7	87.1	3.2	1.11
7	1.11	10.6	85.3	4.1	1.09
8	1.20	11.4	83.2	5.4	1.07
9	1.29	12.2	80.8	7.0	1.06
10	1.39	13.1	78.1	8.8	1.06
15	1.87	16.4	64.0	19.6	1.05
20	2.40	18.5	52.7	28.8	1.07
30	3.34	21.5	40.7	37.8	1.09

Table 6
Variance Decomposition for AUSTWI: Post-Float

Days Ahead	Forecast Variance	Per cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSTWI / ROWTWI
0	.71	4.1	95.9	-	2.40
1	1.32	9.5	90.4	.1	2.26
2	1.81	8.6	91.1	.3	2.12
3	2.23	9.0	90.8	.2	1.97
4	2.58	8.8	91.0	.2	1.87
5	2.90	8.9	90.9	.2	1.80
6	3.18	9.2	90.6	.2	1.74
7	3.45	10.2	89.4	.4	1.70
8	3.70	10.7	88.6	.7	1.67
9	3.94	11.5	87.6	.9	1.64
10	4.17	12.2	86.6	1.2	1.62
15	5.29	15.3	81.8	2.9	1.57
20	6.40	18.9	75.4	5.7	1.57
30	8.73	25.0	63.0	12.0	1.62

comes from its own innovations. The percentage contribution of the foreign sector appears marginally higher in the post-float period whereas the percentage contribution of AUSRATE is marginally higher in the pre-float period. These margins, however, are very small over horizons of up to 10 days (two market weeks).

Much more noticeable in Tables 5 and 6 are the forecast variances at various horizons - the measures of the predictability of AUSTWI. The forecast variance in the post-float period is about three times larger than that in the pre-float period, over all horizons. While this is strongly supportive of the theoretical prior that exchange rates are more volatile under a floating exchange rate regime, there is still a possibility that world exchange rates have similarly been more volatile in the post-float period. To obtain a measure which corrects for this possibility, we have constructed a variable which measures the standard error of the forecast of AUSTWI relative to the average standard error of forecasts for exchange rates in the rest of the world (i.e., USTWI, DMTWI and JAPTWI). This is presented in the final column of Tables 5 and 6.

These standardised measures show that for all horizons the forecast variance is larger under the floating exchange rate regime than under the fixed exchange rate regime. Even allowing for possible changes in volatility of world exchange rates, AUSTWI is relatively more volatile under a flexible exchange rate regime. It is also interesting to note that the differences in volatility are much larger over short horizons, falling as the horizon lengthens. This suggests that over longer horizons the flexible peg (or fixed, as we have called it) exchange rate may be considered approximately flexible; an assumption often encountered in the literature.

Turning to the results for AUSRATE in Tables 7 and 8, it can be seen that the interest rate is relatively more exogenous in the post-float period. For short horizons of up to seven days, some 10 per cent less of its variance comes from its own innovations in the pre-float period (than in the post-float period), with the bulk of this being attributed to AUSTWI. At longer horizons the difference disappears and reverses for horizons of 15 days and over. The contribution of foreign variables is relatively small in both periods, with no sizable differences apparent until the horizon exceeds ten days.

Table 7
Variance Decomposition for AUSRATE: Pre-Float

Days Ahead	Forecast Variance	Per cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSRATE / ROWRATE
0	.08	1.0	21.6	77.4	2.48
1	.21	1.2	16.3	82.5	2.81
2	.34	2.9	14.8	82.3	3.01
3	.49	4.0	14.4	81.6	3.15
4	.67	5.1	14.6	80.3	3.33
5	.86	5.9	14.6	79.5	3.50
6	1.04	6.6	14.4	79.0	3.63
7	1.21	7.4	14.1	78.5	3.73
8	1.37	8.1	13.8	78.1	3.81
9	1.52	8.8	13.5	77.7	3.85
10	1.65	9.4	13.2	77.4	3.89
15	2.11	12.6	11.7	75.7	3.84
20	2.35	15.2	10.7	74.1	3.69
30	2.60	17.9	9.7	72.4	3.42

Table 8
Variance Decomposition for AUSRATE: Post-Float

Days Ahead	Forecast Variance	Per cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSRATE / ROWRATE
0	.03	1.0	3.6	95.4	2.65
1	.06	3.0	3.4	93.6	2.94
2	.09	3.8	4.3	91.9	2.94
3	.12	4.9	5.4	89.7	2.98
4	.15	6.3	6.3	87.4	2.96
5	.18	7.7	7.2	85.1	3.01
6	.21	9.2	7.9	82.9	3.01
7	.23	10.5	8.7	80.8	3.01
8	.26	11.8	9.3	78.9	3.04
9	.28	13.1	9.8	77.1	3.03
10	.31	14.3	10.3	75.4	3.02
15	.42	19.9	11.8	68.3	3.04
20	.51	24.5	12.4	63.1	3.03
30	.67	32.2	12.2	55.6	3.00

Again, while there are only modest differences in the variance decompositions, the sizes of the k-step forecast variances are very different between the two periods. The forecast variance in the pre-float period is some three to four times larger than that in the post-float period, for all horizons. This suggests that the interest rate is relatively less volatile under a floating exchange rate regime, as theory suggests. This conclusion is supported by the measure of the standard error of the forecast relative to the average of that for the rest of the world. At all horizons apart from the first two, the ratio has fallen with the move to a floating exchange rate regime.

Further evidence, which supports this result that the interest rate has become relatively exogenous (with respect to the other variables in the VAR) since the float, is presented in Table 9. This table shows the marginal significance levels for the test of the null hypothesis that the variable concerned is a random walk. The random walk hypothesis is soundly rejected for the exchange rate in both the pre- and post-float periods, and for the interest rate in the pre-float period. However, at least at levels of significance of two per cent or less, the random walk hypothesis can not be rejected for the interest rate during the post-float period.[11]

Table 9
Test that VAR Equation is a Random Walk
(Marginal Significance Levels)

	Pre-Float	Post-Float
AUSTWI	.0003	.0001
AUSRATE	.0001	.0205

11. Each entry in Table 9 is the minimum level of significance required to reject the null hypothesis that, in the given equation of the VAR, the coefficient on the first lag of the own variable is unity and all other coefficients are zero. These tests are biased against the null hypothesis of a unit root. However, essentially the same values were obtained from an unbiased sequential procedure. Under this procedure, we first tested the null hypothesis that the relevant VAR equation was a first order univariate autoregressive model. This hypothesis could not be rejected for the post-float interest rate at a level of significance of less than 2.8 per cent. An AR(1) model for this variable was then estimated. The null hypothesis that the parameter was unity could not be rejected at a level of significance less than 2.5 per cent, using the table of adjusted significance levels in Fuller (1976, p.371). For a discussion of this adjustment, see Fuller (1976, pp.366-385).

5. Conclusions

The empirical results presented for the pre- and post-float VARs containing the eight domestic and foreign financial variables suggest a number of conclusions. The most striking and important one concerns the relative volatility of Australian financial prices under the two exchange rate regimes. It was quite clearly the case that, in terms of the variance of k-step ahead conditional forecasts, the exchange rate was relatively less volatile under the fixed exchange rate regime than under the floating exchange rate regime, while the short-term interest rate was relatively more volatile under the fixed exchange rate regime. These results accord with the first of our two theoretical priors.

The second theoretical prior related to the source of these changes in volatility. The volatility in interest rates due to external impulses was expected to have been reduced, and that in exchange rates increased, in the move to a floating exchange rate regime. Our results do not support this hypothesis. There is little difference in the <u>percentage</u> contribution of foreign shocks to the forecast variance for either the interest rate or the exchange rate in the two periods. At most, there is a slight increase in the percentage contributed to the variance of the exchange rate by the foreign variables under a floating exchange rate regime compared to a fixed regime - especially when considered over very short forecasting horizons. The tests for Granger-causality also indicate that foreign variables (both individually and jointly) had a greater impact on the exchange rate under the floating exchange rate regime. The equivalent tests for the interest rate indicate little difference between the two periods.

The data do not support this hypothesis that external shocks have (directly) affected interest rates less and exchange rates more since the float. They do, however, suggest a change in the nature of the relationship between the exchange rate and interest rate. There was a stronger relationship between these variables under a fixed exchange rate (and capital controls) regime both in terms of the contemporaneous correlation of innovations and the tests for Granger-causality. The result of this was that a larger percentage of the forecast variance of the interest rate was due to innovations in the exchange rate under the fixed exchange rate regime, than under the floating exchange rate. The variance decompositions for the exchange rate also indicate a much weaker relationship between interest rate and exchange rate movements under the floating exchange rate regime. These results support the notion that a floating exchange rate allows a more independent monetary policy, than does a fixed exchange rate regime.

The results are, of course, derived from a reduced form model of relatively few variables. Data limitations prevent a more structural approach and the inclusion of scale (e.g., income) and relative price variables in the VARs. The extent to which our conclusion that exchange rates are relatively more volatile, and interest rates relatively less volatile, under a floating exchange rate regime, is robust to such alternative specifications may remain unknown until sufficient observations become available. It may be possible, however, to proxy some of the activity and relative price effects by adding stock price indexes to the analysis. These are available on a daily basis and probably capture some influences which are absent from the current analysis. Whether our conclusions will be confirmed by this modification remains an area for further research.

APPENDIX A

EXCLUDING JAPAN*

Table A1
Granger-Causality Test Results: Pre-Float
(Marginal Significance Levels)

Equation	Explanatory Variable						
	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	FOREIGN
AUSTWI	-	.0001	.4620	.0256	.3873	.2825	.0092
AUSRATE	.0569	-	.1350	.3499	.3579	.6165	.0281
USTWI	.5934	.9417	-	.2877	.1627	.7813	-
USRATE	.2198	.2038	.0003	-	.1545	.3601	-
DMTWI	.0566	.0256	.4195	.8703	-	.0540	-
DMRATE	.0229	.4551	.5871	.0235	.0065	-	-

Table A2
Granger-Causality Test Results: Post-Float
(Marginal Significance Levels)

Equation	Explanatory Variable						
	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	FOREIGN
AUSTWI	-	.1710	.0016	.7709	.0086	.0004	.0001
AUSRATE	.5762	-	.2104	.2333	.8548	.1370	.0906
USTWI	.8869	.3872	-	.0862	.8400	.7260	-
USRATE	.8445	.1784	.9837	-	.4730	.7251	-
DMTWI	.4607	.0102	.0002	.0231	-	.5759	-
DMRATE	.3470	.0074	.0533	.0055	.1038	-	-

* The pre-float VAR has five lags and no time trend; the post-float VAR has two lags and a linear time trend.

Table A3
Correlation Matrix: Pre-Float

Equation	Explanatory Variable					
	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE
AUSTWI	1	.4691	-.0325	.0433	-.0360	.1229
AUSRATE		1	.0000	.0769	.0075	.0052
USTWI			1	.4160	-.5139	.0100
USRATE				1	-.3164	.0101
DMTWI					1	-.0227
DMRATE						1

Table A4
Correlation Matrix: Post-Float

Equation	Explanatory Variable					
	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE
AUSTWI	1	-.1674	-.168	-.0362	.1421	-.0219
AUSRATE		1	.0391	-.0078	-.0059	-.0315
USTWI			1	.4160	-.7882	.0065
USRATE				1	-.2009	.0515
DMTWI					1	-.0749
DMRATE						1

Table A5
Variance Decomposition for AUSTWI: Pre-Float

Days Ahead	Forecast Variance	Per Cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSTWI / ROWTWI
0	.22	2.3	97.7	-	1.53
1	.40	3.5	96.4	.1	1.50
2	.60	4.6	93.9	1.6	1.51
3	.78	5.4	92.2	2.4	1.49
4	.89	6.4	91.1	2.5	1.44
5	1.00	7.2	90.1	2.7	1.40
6	1.09	8.1	88.9	3.0	1.37
7	1.17	8.9	87.5	3.6	1.34
8	1.27	9.6	86.0	4.4	1.33
9	1.36	10.4	84.1	5.5	1.31
10	1.46	11.0	82.1	6.9	1.31
15	1.94	14.1	70.1	15.8	1.30
20	2.47	16.5	58.7	24.8	1.33
30	3.52	19.4	44.0	36.6	1.41

Table A6
Variance Decomposition for AUSTWI: Post-Float

Days Ahead	Forecast Variance	Per Cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSTWI / ROWTWI
0	.76	2.9	97.1	-	2.31
1	1.39	6.7	93.0	.3	2.15
2	1.93	6.9	92.8	.3	2.07
3	2.43	7.0	92.7	.3	2.02
4	2.88	7.2	92.5	.3	1.99
5	3.29	7.6	92.2	.2	1.96
6	3.67	8.0	91.8	.2	1.94
7	4.02	8.4	91.3	.3	1.91
8	4.34	9.1	90.6	.3	1.90
9	4.64	9.6	89.9	.5	1.87
10	4.93	10.3	89.0	.7	1.86
15	6.18	13.9	83.3	2.8	1.80
20	7.30	16.9	76.3	6.8	1.77
30	9.56	20.5	62.3	17.2	1.75

Table A7
Variance Decomposition for AUSRATE: Pre-Float

Days Ahead	Forecast Variance	Per Cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSTWI / ROWTWI
0	.09	.7	22.1	77.2	2.23
1	.21	1.1	16.8	82.1	2.51
2	.35	2.7	15.5	81.8	2.60
3	.50	3.7	15.2	81.1	2.69
4	.69	4.8	15.5	79.7	2.84
5	.89	5.5	15.8	78.7	2.98
6	1.08	6.1	15.8	78.1	3.08
7	1.27	6.5	15.8	77.7	3.16
8	1.45	7.8	15.7	77.5	3.20
9	1.61	8.2	15.5	77.3	3.25
10	1.76	8.5	15.3	77.2	3.26
15	2.31	8.8	14.4	76.8	3.22
20	2.60	9.9	13.6	76.5	3.09
30	2.90	11.8	12.5	75.7	2.84

Table A8
Variance Decomposition for AUSRATE: Post-Float

Days Ahead	Forecast Variance	Per Cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSTWI / ROWTWI
0	.03	.4	2.7	96.9	2.35
1	.07	1.8	2.2	96.0	2.60
2	.10	2.0	2.2	95.8	2.70
3	.14	2.0	2.2	95.8	2.71
4	.17	1.9	2.3	95.8	2.70
5	.20	1.7	2.5	95.8	2.74
6	.23	1.7	2.6	95.7	2.71
7	.25	1.5	2.8	95.7	2.72
8	.28	1.4	3.0	95.6	2.70
9	.30	1.5	3.1	95.4	2.70
10	.33	1.4	3.3	95.3	2.71
15	.43	1.7	4.1	94.2	2.63
20	.51	1.4	4.9	92.7	2.59
30	.65	4.9	6.1	89.0	2.53

Table A9
Test that VAR Equation is a Random Walk
(Marginal Significance Levels)

	Pre-Float	Post-Float
AUSTWI	.0001	.0001
AUSRATE	.0001	.0028

APPENDIX B

DIFFERENCED SERIES*

Table B1
Granger-Causality Test Results: Pre-Float
(Marginal Significance Levels)

Equation	Explanatory Variable								
	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	JAPTWI	JAPRATE	FOREIGN
AUSTWI	-	.0001	.7701	.1598	.2312	.5499	.8894	.1622	.0391
AUSTRATE	.0742	-	.5935	.4106	.5967	.9486	.9655	.4562	.3563
USTWI	.6997	.9889	-	.1019	.0780	.1354	.0011	.1212	-
USRATE	.5587	.2248	.0981	-	.9262	.5197	.3351	.2660	-
DMTWI	.0584	.1596	.5905	.8940	-	.0247	.3025	.0188	-
DMRATE	.1202	.9287	.2335	.1152	.0110	-	.2151	.6208	-
JAPTWI	.9647	.9735	.2545	.2429	.6608	.2429	-	.4635	-
JAPRATE	.4587	.5926	.5124	.7220	.5837	.0037	.2771	-	-

Table B2
Granger-Causality Test Results: Post-Float
(Marginal Significance Levels)

Equation	Explanatory Variable								
	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	JAPTWI	JAPRATE	FOREIGN
AUSTWI	-	.0597	.0003	.1201	.0258	.0108	.2137	.6083	.0011
AUSRATE	.0451	-	.1301	.0306	.3968	.7530	.2066	.3236	.4193
USTWI	.0513	.4981	-	.4244	.7811	.2582	.6994	.9415	-
USRATE	.7274	.0910	.6858	-	.8999	.0484	.7434	.8222	-
DMTWI	.0119	.0191	.0001	.0705	-	.1577	.0151	.5444	-
DMRATE	.7727	.9890	.0108	.1364	.1086	-	.6041	.0002	-
JAPTWI	.8957	.7350	.1221	.4972	.1707	.6919	-	.7046	-
JAPRATE	.7785	.5126	.0294	.0929	.0325	.2909	.3950	-	-

* The data were pre-filtered by the (1-L) transformation. All results refer to these pre-filtered data. The pre-float VAR has five lags and no time trend; the post-float VAR has three lags and a linear time trend.

Table B3
Correlation Matrix: Pre-Float

	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	JAPTWI	JAPRATE
AUSTWI	1	.4591	-.0563	.0440	-.0415	.1694	.0216	.0618
AUSRATE		1	-.0139	.1096	.0060	.0169	.0078	.0026
USTWI			1	.4090	-.5064	.0059	-.5230	-.0008
USRATE				1	-.3333	.0150	-.2459	-.0117
DMTWI					1	-.0346	.2786	.0389
DMRATE						1	.0019	-.0764
JAPTWI							1	-.0273
JAPRATE								1

Table B4
Correlation Matrix: Post-Float

	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	JAPTWI	JAPRATE
AUSTWI	1	-.2106	-.1919	-.0569	.1587	-.0528	.0761	.0582
AUSRATE		1	.0184	-.0220	.0232	-.0267	.0225	.0304
USTWI			1	.2529	-.8004	-.0067	-.2634	-.0554
USRATE				1	-.1967	.0303	-.1408	-.1431
DMTWI					1	-.0419	.0432	.0346
DMRATE						1	.0915	.0621
JAPTWI							1	.0617
JAPRATE								1

Table B5
Variance Decomposition for AUSTWI: Pre-Float

Days Ahead	Forecast Variance	Per cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSTWI / ROWTWI
0	.21	4.7	95.3	-	1.21
1	.28	6.2	93.6	.2	1.21
2	.29	6.9	91.0	2.1	1.22
3	.29	7.6	90.2	2.2	1.21
4	.30	8.6	88.5	3.1	1.23
5	.32	10.1	84.1	5.8	1.23
6	.32	10.3	83.7	6.0	1.24
7	.33	11.2	82.7	6.1	1.24
8	.33	11.5	82.4	6.1	1.24
9	.33	11.9	81.9	6.2	1.24
10	.33	12.1	81.7	6.2	1.24
15	.34	12.7	80.8	6.5	1.24
20	.34	13.2	80.2	6.6	1.24
30	.34	13.6	79.7	6.7	1.24

Table B6
Variance Decomposition for AUSTWI: Post-Float

Days Ahead	Forecast Variance	Per cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSTWI / ROWTWI
0	.68	4.3	95.7	-	2.43
1	.92	6.8	93.1	.1	2.46
2	.99	12.9	87.0	.1	2.49
3	1.01	14.3	85.3	.2	2.45
4	1.03	15.0	84.4	.6	2.46
5	1.05	15.9	83.1	1.0	2.46
6	1.07	16.5	81.2	2.3	2.46
7	1.08	16.8	80.9	2.3	2.58
8	1.10	17.2	79.5	2.3	2.58
9	1.11	18.7	79.0	2.3	2.58
10	1.12	18.9	78.8	2.3	2.58
15	1.14	19.5	77.7	2.8	2.58
20	1.15	19.7	77.2	3.1	2.58
30	1.16	19.9	76.7	3.4	2.58

Table B7
Variance Decomposition for AUSRATE: Pre-Float

Days Ahead	Forecast Variance	Per cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSTWI / ROWTWI
0	.08	1.7	21.0	77.3	2.43
1	.09	4.3	24.6	71.1	2.52
2	.09	5.9	24.5	69.6	2.55
3	.10	6.9	24.1	69.0	2.55
4	.10	7.3	23.6	69.1	2.57
5	.10	7.7	23.5	68.8	2.56
6	.10	8.1	23.5	68.4	2.56
7	.10	8.7	23.3	68.0	2.57
8	.11	9.1	23.3	67.6	2.57
9	.11	9.4	23.2	67.4	2.57
10	.11	9.5	23.2	67.3	2.57
15	.11	10.2	22.9	66.9	2.57
20	.11	10.4	22.8	66.8	2.57
30	.11	10.6	22.7	66.7	2.57

Table B8
Variance Decomposition for AUSRATE: Post-Float

Days Ahead	Forecast Variance	Per cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSRATE / ROWRATE
0	.027	.9	4.7	94.4	2.65
1	.031	2.5	4.4	93.1	2.74
2	.032	3.4	4.9	91.7	2.74
3	.033	5.5	4.9	89.6	2.72
4	.034	5.9	5.4	88.7	2.72
5	.034	6.2	5.8	88.0	2.72
6	.035	7.7	5.7	86.6	2.72
7	.035	7.8	6.4	85.8	2.72
8	.036	8.3	6.3	85.4	2.72
9	.036	8.7	6.5	84.8	2.72
10	.036	9.2	6.5	84.3	2.72
15	.037	10.0	6.9	83.1	2.72
20	.038	10.5	7.1	82.4	2.72
30	.038	11.2	7.2	81.6	2.72

APPENDIX C

SIMS FILTERED SERIES*

Table C1
Granger-Causality Test Results: Pre-Float
(Marginal Significance Levels)

Equation	Explanatory Variable								
	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	JAPTWI	JAPRATE	FOREIGN
AUSTWI	-	.0003	.4545	.2913	.3854	.9112	.9891	.1991	.4829
AUSTRATE	.0761	-	.2045	.5343	.2715	.7864	.9268	.2142	.1512
USTWI	.3798	.9779	-	.4115	.0975	.3109	.3281	.1268	-
USRATE	.3853	.4838	.0394	-	.7306	.7641	.2878	.2529	-
DMTWI	.0448	.0404	.5940	.9736	-	.1022	.9856	.0595	-
DMRATE	.0372	.6824	.1923	.1512	.0220	-	.1088	.6048	-
JAPTWI	.8548	.9147	.1143	.2582	.6842	.3562	-	.4832	-
JAPRATE	.8274	.2066	.4032	.2862	.9272	.0141	.5577	-	-

Table C2
Granger-Causality Test Results: Post-Float
(Marginal Significance Levels)

Equation	Explanatory Variable								
	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	JAPTWI	JAPRATE	FOREIGN
AUSTWI	-	.4475	.0001	.2851	.0102	.1171	.0638	.6729	.0006
AUSRATE	.6303	-	.6474	.4540	.8884	.2486	.9650	.2355	.4338
USTWI	.0744	.4043	-	.2378	.6077	.5418	.7565	.7378	-
USRATE	.9808	.8647	.6652	-	.4852	.1573	.8322	.8566	-
DMTWI	.0713	.1005	.0001	.2362	-	.1186	.0003	.5523	-
DMRATE	.7059	.7406	.0631	.0155	.1132	-	.8564	.0001	-
JAPTWI	.8041	.3148	.0354	.4969	.3715	.6780	-	.8584	-
JAPRATE	.8309	.9295	.0190	.3149	.0334	.2885	.1880	-	-

* The data were pre-filtered by the $(1-1.5L+.5625L^2)$ transformation. All results refer to these pre-filtered data. The pre-float VAR has seven lags and a linear time trend; the post-float VAR has eight lags and a linear trend.

Table C3
Correlation Matrix: Pre-Float

	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	JAPTWI	JAPRATE
AUSTWI	1	.4722	-.0343	.0338	-.0409	.1448	.0188	.0231
AUSRATE		1	-.0067	.0772	.0108	.0061	-.0061	-.0048
USTWI			1	.4197	-.5140	.0134	-.5184	.0073
USRATE				1	-.3247	-.0045	-.2577	-.0143
DMTWI					1	-.0183	.2944	.0156
DMRATE						1	.0083	-.0925
JAPTWI							1	-.0454
JAPRATE								1

Table C4
Correlation Matrix: Post-Float

	AUSTWI	AUSRATE	USTWI	USRATE	DMTWI	DMRATE	JAPTWI	JAPRATE
AUSTWI	1	-.1787	-.1910	-.0285	.1460	-.0110	.0532	.0225
AUSRATE		1	.0458	-.0173	-.0127	-.0278	-.0058	.0018
USTWI			1	.2517	-.7937	-.0219	-.2673	-.0496
USRATE				1	-.2019	.0283	-.1382	-.1176
DMTWI					1	-.0298	.0414	.0342
DMRATE						1	.0582	.0620
JAPTWI							1	-.0137
JAPRATE								1

Table C5
Variance Decomposition for AUSTWI: Pre-Float

Days Ahead	Forecast Variance	Per cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSTWI / ROWTWI
0	.22	3.0	97.0	-	1.20
1	.22	6.1	93.9	.0	1.18
2	.23	6.4	91.6	2.0	1.19
3	.23	6.7	91.3	2.0	1.18
4	.24	8.1	88.9	3.0	1.19
5	.25	8.4	87.2	4.4	1.22
6	.25	8.6	86.9	4.5	1.22
7	.25	8.7	86.7	4.6	1.22
8	.25	8.8	86.6	4.6	1.22
9	.25	8.9	86.5	4.6	1.21
10	.25	8.9	86.5	4.6	1.21
15	.25	8.9	86.5	4.6	1.21
20	.25	8.9	86.5	4.6	1.21
30	.25	8.9	86.5	4.6	1.20

Table C6
Variance Decomposition for AUSTWI: Post-Float

Days Ahead	Forecast Variance	Per cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSTWI / ROWTWI
0	.74	3.8	96.2	-	2.44
1	.79	8.9	90.8	.3	2.55
2	.82	12.1	87.4	.5	2.62
3	.83	12.9	86.6	.5	2.59
4	.84	13.3	86.2	.5	2.60
5	.84	13.4	86.1	.5	2.60
6	.84	13.4	86.1	.5	2.60
7	.84	13.4	86.1	.5	2.57
8	.84	13.4	86.1	.5	2.56
9	.84	13.4	86.1	.5	2.55
10	.84	13.4	86.1	.5	2.56
15	.84	13.4	86.1	.5	2.54
20	.84	13.4	86.1	.5	2.53
30	.84	13.4	86.1	.5	2.51

Table C7
Variance Decomposition for AUSRATE: Pre-Float

Days Ahead	Forecast Variance	Per cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSRATE / ROWRATE
0	.085	.9	22.5	76.6	2.43
1	.094	4.5	20.3	76.2	2.23
2	.097	6.6	19.8	73.6	2.24
3	.104	7.0	20.0	73.0	2.26
4	.104	7.8	20.5	71.7	2.23
5	.104	8.1	20.5	71.4	2.23
6	.104	8.4	20.4	71.2	2.23
7	.105	8.6	20.4	71.0	2.24
8	.105	8.6	20.4	71.0	2.24
9	.105	8.6	20.4	71.0	2.24
10	.105	8.6	20.4	71.0	2.25
15	.105	8.6	20.4	71.0	2.23
20	.105	8.6	20.4	71.0	2.23
30	.105	8.6	20.4	71.0	2.23

Table C8
Variance Decomposition for AUSRATE: Post-Float

Days Ahead	Forecast Variance	Per cent Due to Innovations in Foreign	AUSTWI	AUSRATE	AUSRATE / ROWRATE
0	.029	.5	3.0	96.5	2.88
1	.030	2.8	2.9	94.3	2.57
2	.030	3.6	3.1	93.3	2.51
3	.031	4.8	3.2	92.0	2.55
4	.031	4.9	3.2	91.9	2.54
5	.031	4.9	3.2	91.9	2.54
6	.031	4.9	3.2	91.9	2.58
7	.031	5.0	3.2	91.8	2.58
8	.031	5.0	3.2	91.8	2.61
9	.031	5.0	3.2	91.8	2.61
10	.031	5.0	3.2	91.8	2.61
15	.031	5.0	3.2	91.8	2.60
20	.031	5.0	3.2	91.8	2.63
30	.031	5.0	3.2	91.8	2.63

APPENDIX D

DATA DEFINITIONS AND SOURCES

AUSTWI	=	Trade-weighted index of value of Australian dollar set by RBA and used to determine A/US rate prior to 12/12/83. Set at 9.00 a.m. on current day, based on previous days rates - largely overnight rates in New York. Source, Reserve Bank.
AUSRATE	=	The Australian 90 day bank accepted bill rate. Calculated as mid-point of midday quotes in Sydney. Source, Reserve Bank.
USTWI	=	Morgan Guaranty's trade-weighted index of value of US dollar. Calculated using rates quoted in New York and miscellaneous markets. Source, Reuter.
USRATE	=	The US 90 day prime bank acceptances rate. Daily average of trading in New York. Source, Reuter.
DMTWI	=	The Bank of England's trade-weighted index of value of West German deutschemark. Calculated using closing rates in London. Source, Reuter.
DMRATE	=	The West German 3 month interbank deposits rate. Mid-point of closing quotes in Frankfurt. Source, Reuter.
JAPTWI	=	The Bank of England's trade-weighted index of value of Japan's yen. Calculated using closing quotes in London. Source, Reuter.
JAPRATE (Pre-float)	=	The Japanese unconditional call money rate. Daily average of trading in Tokyo. Source, Reuter.
JAPRATE (Post-float)	=	The Japanese 3-month Gensaki rate. Daily average of trading in Tokyo. Source, Reuter.

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