WORKING PAPERS IN ECONOMICS

Testing the Rationality of Exchange Rate and Interest Rate Expectations: An Empirical Study of Australian Survey Based Expectations

by

Suk-Joong Kim

No. 230 **March 1996**

DEPARTMENT OF ECONOMICS

The University of Sydney
Australia 2006

Testing the Rationality of Exchange Rate and Interest Rate Expectations: An Empirical Study of Australian Survey Based Expectations

by

Suk-Joong Kim

No. 230 March 1996

Abstract

This paper examines the rationality and optimality of the survey based expectations of Australian exchange rate and interest rates. One and four week ahead forecast of USD/$A exchange rate and two and four week ahead forecasts of the 190-day bank bill and 10-year bond rates were examined. The actual and expected variables were found to be cointegrated which indicates that the expected future values and the future realisations of the exchange rate and interest rates have long run equilibrium relationships. Estimation techniques that take into account the time-varying nature of the forecast error variance and the linear serial correlation in the form of moving average errors were employed for testing the optimality of the expectations in the cases where the frequency of the expectations data were finer than the forecast horizons. The estimation results show that the rationality of the expectations could not be rejected for all the expectations with the exception of the two week ahead forecast of the 90-day interest rate, which indicates that all available information was used at the time of forming relevant forecasts. The optimality of the expectations as tested through the Unbiased Expectations Hypothesis, is decisively rejected in all cases.

The Author wishes to thank Tony Phipps for helpful comments, and Gary Shilson-Josling for providing the survey data used in this paper.

National Library of Australia Card Number and ISBN 1-86451-215-6

CONTENTS PAGE

I. Introduction

There have been much research on the rationality of expectations in financial markets. Market expectations regarding future values of exchange rates have been well studied especially in the form of testing the joint hypothesis of the unbiasedness and risk neutrality of forward exchange rates as predictors of future spot rates. The general results emerge from these studies show a clear rejection of the joint hypothesis when forward discounts are tested as unbiased predictors of future exchange rate changes, and the source of this failure is argued to be the presence of time varying risk premia in forward rates and hence the violation of the risk neutrality. There have been growing interests in survey based market expectations since there are no risk components in the expectations and they directly reflect economic agents' expectations, and so the unbiasedness test of the expectations is straight forward.

Some of the empirical results surveyed in this paper includes Chinn and Frankel (1991) who pooled the data on the monthly expectations of future US Dollar (USD) exchange rates against 25 currencies for the period February 1988 and February 1991. They conclude that the expectations appear to be biased. MacDonald (1992) examines the optimality of the British survey based monthly forecasts conducted on companies in G7 countries for the three month ahead US Dollar (USD) exchange rates against the British Pound, the Yen and the Deutsche Mark for the period October 1989 to March 1991. He concludes that the unbiasedness hypothesis of the forecast is rejected in all cases, however, disaggregated data show that some individual forecasters are able to generate unbiased forecasts. Liu and Maddala (1992) use weekly survey forecasts on four USD exchange rates for the period 24 October 1984 to 19 May 1989 and examine the market efficiency of the forecasts by testing for cointegration between the actual and expected future rates. They find that the Rational Expectations Hypothesis (REH) is supported but the Market Efficiency Hypothesis is not. Cavaglia, Verschoor and Wolff (1993) examine the monthly survey of 3, 6 and 12 month ahead forecasts of 12 USD exchange rates and 8 DM exchange rates. They find the rationality of the forecasts are rejected in most of the exchange rates considered. Mckenzie and Lim (1992) consider the weekly survey of 1 and 4 week ahead forecasts of USD/$A and Yen/USD exchange rates in Australia for the period 8 January 1987 to 30 September 1991 and conclude that the rationality of the forecasts can not be rejected in all cases except for the 4 week ahead forecast of the USD/$A rate. However, they do not examine the unbiased properties of the forecasts.

The aim of this paper is to ascertain the rationality and the unbiasedness properties of market expectations in Australian financial markets. The rationality of expectations requires that expectations are formed utilising all available information at the time of forecasts, and the testing of unbiasedness is essentially the test of optimality of forecasts. The outline of the paper is as follows: section II explains the nature of data used; section III discusses the methodology involved and examines the estimation results; and some conclusions are offered in section IV.

II. Data Descriptions

The financial prices considered in this paper are the USD/$A exchange rate, short- and long-term interest rates measured as the 90-day bank bill and the 10-year government bond rates, respectively. These were collected from various issues of the *Australian Financial Review*. The market expectations of the future values of these prices were proxied by the market survey by Money Market Services Australia (MMS). They carry out weekly telephone surveys on 1 and 4 week ahead point forecasts of the USD/$A exchange rate ($ER^e(1)$ and $ER^e(4)$, respectively) in the foreign exchange market, and 2 and 4 week ahead point forecasts of the 90-day bank bill rate ($SR^e(2)$ and $SR^e(4)$, respectively) and the 10-year government bond rate ($LR^e(2)$ and $LR^e(4)$, respectively) in the debt market. They survey the expectations of 20 to 25 financial market economists and market participants in various postings and report

the medians of the survey. The first date of the survey was 29 October 1984 for the exchange rate and 2 August 1985 for the interest rates. From February 1993 the respondents were asked to supply minimum and maximum value forecasts rather than point forecasts which makes the usage of survey expectations including post-February 1993 data problematic, and so the observations up until 25 and 21 January 1993 were used for the exchange rate and interest rate expectations, respectively.

Another problem with the survey data is the presence of missing observations which represent missed out surveys due to public holidays and for other reasons. There are 431 and 391 potential survey weeks in the sample and there are 54 and 46 weeks without survey, with the longest block of non-survey periods being 3 and 4 weeks, yielding 377 and 355 useable observations for the exchange rate and interest rate expectations in the whole sample, respectively. One solution to the issue of missing observations is to ignore them and use the data as if there is no missing observations. Another is to generate forecasts for them and use the complete data for the whole sample. The methods available for accomplishing this include linear interpolation, OLS out-of-sample forecasts, forecasts based on the E-M algorithm and Chow and Lin (1976)'s BLUE estimations for the missing observations, among others. The approach adopted in this paper is to follow Harvey and Pierse (1984) who show that the recursive estimations of ARIMA models with the Kalman filter algorithm can produce consistent forecasts for the missing observations. First, each survey series, with the missing observations omitted, was subjected to the usual identification process for the ARIMA models with a view to finding an appropriate structure for each series. This was complemented by the automatic selection method, where up to ARIMA(5,1,5) models were estimated and the model with the smallest Schwarts Information Criterion (SIC) was chosen (see Table A). Both methods produced fundamentally the same results and whenever they differ the model chosen by the automatic selection method took precedence. Next, each series, with the missing observations included, was estimated with the appropriate ARIMA structure as identified above using the recursive updating procedure. SPSS for windows version 6.1 was used to generate the necessary forecasts of the missing observations using the above Kalman filtering procedure. Thus, there are totals of 431 and 391 observations available for 1 and 4 week ahead forecasts of the exchange rate and the two and four week ahead forecasts of the interest rates, respectively.

III. Modeling Expectations and Empirical Results

III.A. Unit Roots and Cointegration

The standard test of the Unbiased Expectations Hypothesis (UEH) is to run the following regression:

$$y_t = a + b \cdot y^e_{t/t-m} + e_t \tag{1}$$

where, y_t is the actual observation of the series at time *t*,
$y^e_{t/t-m}$ is the market expectation of y_t formed at time *t-m*,
that is, it is an *m* period ahead forecast.

and test the joint hypothesis of zero constant and unit slope coefficient assuming serially independent errors. Note that *m* is used to denote the forecast horizon throughout this paper. The test of the REH is usually through testing the significance of the regressors in an auxiliary regression of e_t on the variables included in the available information set at time t-*m*, I_{t-m}. There are numerous problems with this approach, the most serious of which is the danger of producing spurious results. This is because the stationarity assumption for the variables under consideration can be in doubt. This is especially true when they are financial prices which are usually non-stationary. Then the integrity of the hypothesis testing is in doubt. If both the

actual and expected series are I(1), then OLS estimations of (1) will produce spurious results unless the two variables are cointegrated in which case the estimated *a* and *b* will show the nature of the long run relationship between the two. Table 1 shows the results of the unit root tests of the actual and expected variables. The Augmented Dickey-Fuller (ADF) tests show that in no case is the hypothesis of unit root rejected for any series. Thus, (1) can be regarded as a cointegrating regression for the actual and expected variables, and cointegration can be tested formally by testing for a unit root in the estimated errors. Table 2 reports the estimations of (1). The results shows that the errors from the cointegration regressions are clearly I(0) confirming the cointegration of the actual and expected variables with the cointegration factor very close to one in all cases. Thus, they have a long run relationship indicating that market expectations can not wander too far off the actual observations in the long-run.

III.B. Newey-West Estimation

In order to avoid the spurious regression problems, many researchers transformed the variables to yield stationarity and the corresponding regression model is then

$$\Delta_m y_t = a + b \cdot \Delta^e_m y_t + e_t \tag{2}$$

where, $\Delta_m y_t = (y_t - y_{t-m})$
$\Delta^e_m y_t = (y^e_{t/t-m} - y_{t-m})$.

Now the LHS variable is I(0) and the regression is sensible only if the RHS variable is also I(0) which requires that the actual and expected variables be contemporaneously cointegrated.

The last section of Table 1 reports the ADF tests for the $\Delta^{e}_{m}y_{t}$'s. All the expected changes are I(0), and so the required contemporaneous cointegration is observed in all cases. The testing of the UEH is still the joint hypothesis test of a=0 and b=1 with serially uncorrelated errors. However, interesting econometric problems arise when the data observation frequency is finer than the forecast horizons. If the data are collected weekly and the expectations are more than 1 week ahead, the forecast errors will not be serially independent. It can be shown that the realised errors of *m* week ahead forecasts follow a moving average process with *m*-1 lags (MA(*m*-1)). The residuals of (2) represent forecast errors and, assuming rational expectations, their expected value at the time of forecast is zero. Formally, we require $E(e_t | I_{t-m}) = 0$, where I_{t-m} is the set of information available at time *t-m*. This is known as the orthogonality property of the rational expectations and implies that all relevant information available at the time of making the forecasts should be used. As in Lim and McKenzie, it is noted that since the errors are I(0), and so stationary, they have an infinite moving average representation according to the Wold decomposition theorem. That is, $(e_t - \mu) = \sum_{i=0}^{\infty} \delta_i \varepsilon_{t-i}$, where μ is purely deterministic and can be regarded as the mean of e_t which is zero, $\delta_0 = 1$, and ε_t is a white noise process with $(0, \sigma^2)$. Thus, it follows from below that the requirement for the rational expectations can be expressed as $\delta_i = 0$ for $i \geq m$[1].

$$
\begin{aligned}
E(e_t | I_{t-m}) &= E\Big(\sum_{i=0}^{m-1} \delta_i \varepsilon_{t-i} + \sum_{i=m}^{\infty} \delta_i \varepsilon_{t-i} | I_{t-m}\Big) \\
&= \sum_{i=0}^{m-1} \delta_i E(\varepsilon_{t-i} | I_{t-m}) + \sum_{i=m}^{\infty} \delta_i E(\varepsilon_{t-i} | I_{t-m}) \\
&= \sum_{i=m}^{\infty} \delta_i \varepsilon_{t-i} \text{, since } E(\varepsilon_{t-i} | I_{t-m}) = 0 \text{ for all } i < m
\end{aligned}
$$

This implies that δ_i can be non-zero for $i \leq m$-1 and the forecast errors can be at most MA(*m*-1) under the REH[2]. Thus, any hypothesis testing based on OLS estimated standard errors of (2) are invalid since estimated variance-covariance matrix of the estimators will not be unbiased. This makes OLS estimation of (2) inappropriate for testing the optimality of expectations in all cases with the exception of $ER^e(1)$.

Hansen and Hodrick (1980) show a method of calculating a consistent variance-covariance matrix of the OLS estimators by adjusting for the MA(*m*-1) structure of the errors. Hansen (1982)'s General Method of Moments estimators are an improvement over Hansen and Hodrick since they are consistent even in the presence of heteroskedasticity in addition to serial correlation in the form of moving average errors. However, it was shown that the estimated variance-covariance matrix is not guaranteed to be positive definite in small samples. Newey and West (1987) suggest a method to guarantee the positive definiteness of the matrix by applying discounting weights to the (*m*-1)'th order autocovariance structure. The Newey-West correction to the variance-covariance matrix is to apply OLS to (2) and calculate the matrix as below:

$$
\hat{V}(\hat{\beta}) = N(X'X)^{-1}\hat{\Omega}(X'X)^{-1},
$$

$$
\hat{\Omega} = \sum_{j=-(m-1)}^{m-1} \frac{1}{N}\left(1 - \frac{|j|}{m}\right) \sum_{t=1}^{N} \hat{e}_t x_t x'_{t-j} \hat{e}_{t-j},
$$

where, N is the size of the sample and x_t denotes the regressors.

Table 3 reports the OLS estimations of (2) with the Newey-West corrections[3]. The constant is negative and insignificant in all cases and the slope coefficient is positive for $ER^e(1)$, $SR^e(2)$, $LR^e(2)$ and $LR^e(4)$ which indicates that the forecasters correctly expected, on average, the direction of future changes, and they got the direction wrong for $ER^e(4)$ and $LR^e(4)$. However, only the coefficients for $ER^e(1)$, $SR^e(2)$ and $LR^e(2)$ are significant and the size of the coefficient is significantly smaller than 1 in all cases. The optimality of the survey forecasts as tested through testing the UEH can be rejected in all cases. The diagnostics of the estimations reveal that there is a significant serial correlation for regressions where $m>1$, as expected, and heteroskedasticity is significant only for $ER^e(4)$. These pose no problems for hypothesis testing since the estimated standard errors were already corrected for these non-spherical disturbances. However, the highly significant non-linear serial dependence together with the highly significant non-normality of the residuals indicate that the variance of the errors of all the estimations are not time independent. This time varying variance is also evident in the significant ARCH(4) test statistics in all cases. Engel (1982) shows that it is possible to observe unconditional homoskedasticity of the errors associated with conditional heteroskedasticity in which case the unconditional distributions of the errors will be leptokurtic even if they are conditionally normally distributed. Thus, the presence of conditional heteroskedasticity in all cases can explain the observed combination of significant non-linear serial correlation, significant Bera-Jarque statistic and insignificant Breusche-Pagan test.

III.C. EGARCH Estimations

Instead of employing the two step procedure of estimating (2) by OLS and applying the necessary adjustments to the variance-covariance matrix, the moving average structure of the errors can be modeled directly by considering an ARIMAX(0,1,m-1) model as below:

$$\Delta_m y_t = a + b \cdot \Delta^e_m y_t + \varepsilon_t + \sum_{i=1}^{m-1} \delta_i \varepsilon_{t-i} \tag{3}$$

The maximum likelihood estimation of (3) will produce asymptotically efficient estimators, and it is now straight forward to examine the REH by testing the null of an MA(m-1) error process against the alternative of higher MA processes. Once the rationality of the market

expectations is established the optimality of the forecasts can be tested by examining the UEH (i.e. testing the joint hypothesis of a=0 and b=1).

The discussions in III.B suggests the existence of time varying heteroskedasticity of the forecast errors and that Generalised Auto Regressive Conditional Heteroskedasticity models would produce more efficient estimates than OLS with the Newey-West corrections. Model (3) can be rewritten to explicitly account for this time varying nature of the error variance by allowing the conditional distributions of ε_t to be heteroskedastic[4]. Kim (1995) finds that changes in daily \$A exchange rates show time-varying heteroskedasticity and models it by Exponential Generalised Autoregressive Heteroskedasticity (EGARCH(1,1)) with successful results. Two of the dependent variables in (3) are changes in the \$A exchange rate, and so the application of EGARCH may be useful. A parsimonious EGARCH (1,1) model was adopted and is shown below:

$$\Delta_m y_t = a + b \cdot \Delta^e_m y_t + \varepsilon_t + \sum_{i=1}^{m-1} \delta_i \varepsilon_{t-i}\ , \tag{4-a}$$

where $\varepsilon_t \sim (0, h_t)$, $z_t = \frac{\varepsilon_t}{\sqrt{h_t}}$, $z_t \sim iid(0, 1)$.

$$\ln h_t = \beta_c + \beta_{\varepsilon 1} \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \beta_{\varepsilon 2} \left(\frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}}} - \sqrt{\frac{2}{\pi}} \right) + \beta_h \ln h_{t-1}\ . \tag{4-b}$$

(4-a) and (4-b) are the conditional mean and variance equations of the EGARCH(1,1) model, respectively. In addition, the standardised t density is assumed for the conditional distribution of the errors to account for the possible leptokurtosis in the conditional distributions[5]. The log-likelihood of the distribution is as below:

$$\ln L = T \left[\ln \Gamma\left(\frac{d+1}{2}\right) - \ln \Gamma\left(\frac{d}{2}\right) - \frac{1}{2} \ln(d-2) \right]$$

$$-\frac{1}{2}\sum_{t=1}^{T}\left[\ln h_t + (d+1)\ln\left(1+\frac{\varepsilon_t^2}{h_t(d-2)}\right)\right]$$

where $\Gamma(.)$ denotes gamma function, and *d* is the degree of freedom parameter. As *d* approaches infinity (or *1/d* approaches zero) the *t* distribution converges to the standardised normal.

The estimation results for (4) are shown in Table 4. The constant is small in magnitudes but is significant, at least at 10%, in all cases with the exception of ER^e(4) and SR^e(2). The estimated *b* is now positive for ER^e(4) and LR^e(2), and it is smaller in magnitude in the other cases. It is significant only for ER^e(1), ER^e(4) and SR^e(4). The estimated coefficients for the lags of moving average error terms are highly significant and close to one in all models where $m>1$.

The estimated conditional variance equation reveals that there is a significant GARCH effect in the volatility of actual changes of the variables. A large unexpected change is followed by an equally large change in either direction, and the autoregressive term for the conditional variance is very close to one in all cases and the hypothesis of unit root in the conditional variance can not be rejected in all cases with the exception of ER^e(1) where it is rejected at 10%[6]. The size of the estimated *1/d* is significantly different from zero at 1% in all cases except for LR^e(2) and LR^e(4) where it is significant only at 10%. This indicates the conditional distributions of the errors are leptokurtic and provides a justification for using the conditional *t* distributions.

The diagnostics of the estimations show a decrease in the kurtosis of the standardised residuals, z_t, in all cases, and the skewness is reduced in all cases with the exception of ER^e(1) where there is a slight increase. The significant linear and non-linear serial correlation present in the errors of (2) are eliminated in the standardised errors except for SR^e(4) where there is still significant linear correlation at 1%. This shows that including the lagged moving average errors removed the linear serial correlations while the EGARCH aspect of the estimations eliminated the non-linear dependence of the estimated standardised residuals.

The testing of the REH as carried out through testing for higher moving average errors (i.e. H_0: MA(*m*-1) vs. H_1: MA(*m*)) can not be rejected in all cases with the exception of SR^e(2) where the test statistic is significant at 10%. The irrationality of expectations of SR^e(2) turned out to be the cause of the remaining linear serial correlation. In fact, up to MA(3) terms for the errors were significant and correcting for this higher order moving average structure removed the linear serial correlation. The UEH is decisively rejected in all cases. The test results indicate that while the survey forecasters were rational in the sense that they used all available information for forming expectations and they correctly forecast the direction of future changes, their forecasts were not optimal.

III.D. Error Correction Model Estimations

The discussions in sub-section III.A indicate that there is a cointegrating relationship between the actual and expected variables, and so there exists corresponding Error Correction Model (ECM) representation of the variables. Noting that (3)' can be turned into an ECM by adding $\Delta_m y_t^e = (y_t^e - y_{t-m}^e)$ as an additional regressor in the conditional mean equation as below:

$$\Delta_m y_t = a + b\cdot\Delta_m^e y_t + \gamma\cdot\Delta_m y_t^e + \varepsilon_t + \sum_{i=1}^{m-1}\delta_i\varepsilon_{t-i}\,, \tag{4}$$

Table 5 reports the maximum likelihood estimations of (4) by the EGARCH approach. There is no fundamental change in the results compared with the estimation results in sub-section III.C. The γ is significant only for SR^e(2) which confirms that, except for the SR^e(2) equation, EGARCH models estimated in the previous sub-section have no misspecification bias in the form of omitted variables. The REH is supported now in all cases and the linear serial correlation is present only in the standardised errors of both the 90-day rate estimations. The optimality of the forecast is decisively rejected in all cases. The diagnostics of the estimations are also similar.

IV Summary and Conclusion

This paper examined the rationality and optimality of the forecasts of future USD/$A exchange rate and 90-day and 10-year interest rates. It has been found that all the variables considered had unit roots, and that there exists a long run relationship between the expected and actual observations of each of the variables. The frequency of the data observation that is finer than the forecast horizons necessitated that the estimation models be corrected for the moving average error structures. The OLS estimations with the Newey-West correction of the standard errors were adopted, and the maximum likelihood estimations of EGARCH and ECM models incorporating the moving average errors and the time varying nature of the forecast errors were also carried out. The results of the various estimations are fundamentally the same, that is, the forecasts of the exchange rate and the interest rate changes were rational but not optimal. The rationality of the expectations as tested by examining the moving average structure of the estimated models could not be rejected in any forecast with the exception of the 2 week ahead forecast of the 90-day rate which indicates that the forecasts were made taking into account all available information at the time of forecast. However, the optimality of the forecast is rejected in all cases. The expected change of the series could not predict what the actual changes would be.

Endnotes

[1] Note that the orthogonality condition requires that $E(e_{t-m}|I_{t-m}) = 0$, however, $E(\varepsilon_{t-m}|I_{t-m}) \neq 0$ since

$$e_t = \mu + \sum_{i=0}^{\infty} \delta_i \varepsilon_{t-i}$$

$$\varepsilon_t = (1 + \sum_{i=1}^{\infty} \delta_i L^i)^{-1}(e_t - \mu)$$

where L is lag operator.

[2] More formal proof can be found in Pesaran (1987), pp. 184-185.

[3] Estimations were carried out with RATS version 4.2 using the Robusterror option in the Linreg command with lags=(*m*-1) and damp=1.0. Estimates obtained this way is identical to the Newey and West correction for heteroskedasticity with Bartlett weights in MFIT Version 3.1.

[4] Note that this does not destroy the white noise property of ε_t. ε_t is weak white noise if $E(\varepsilon_t \varepsilon_s) = 0$, for all $t \neq s$, and strong white noise if $E(\varepsilon_t \varepsilon_s) = 0$ and $E(\varepsilon_t^2) = \sigma^2$ (see Hendry (1995) pp. 39-40). Thus, even the strong white noise assumption is compatible with the conditional heteroskedasticity of ε_t.

[5] Baillie and Bollerslev (1989) and Bollerslev (1987) report that the daily and weekly changes in the USD exchange rates have leptokurtic conditional distributions and these are explained well by the standardised *t* distributions. Similar results for daily $A changes are reported in Kim(1995).

[6] The usual problems associated with the unit root testing may be present and so the results should be interpreted with caution.

Table A: ARIMA Order Selection Based on SIC for the Expected Variables

$$\text{ARIMA(p,d,q)} = \Delta^d y_t^e = \alpha + \sum_{i=1}^{p} \beta_i \cdot \Delta^d y_{t-i}^e + \varepsilon_t + \sum_{j=1}^{q} \gamma_j \cdot \varepsilon_{t-j}$$

ER^e(1)

		MA					
	Lags	0	1	2	3	4	5
AR	0	$\boxed{-8.5957}$	-8.5811	-8.5661	-8.5503	-8.5363	-8.5224
	1	-8.5833	-8.5678	-8.5530	-8.5374	-8.5225	-8.5129
	2	-8.5668	-8.5511	-8.5565	-8.5215	-8.5294	-8.5119
	3	-8.5485	-8.5328	—	—	—	-8.4850
	4	-8.5313	-8.5167	—	—	—	—
	5	-8.5145	-8.5045	-8.5273	-8.5139	-8.4680	—

Conclusion: ARIMA(0,1,0)

ER^e(4)

		MA					
	Lags	0	1	2	3	4	5
AR	0	$\boxed{-8.6465}$	-8.6308	-8.6150	-8.5993	-8.5869	-8.5712
	1	-8.6381	-8.6264	-8.6108	-8.5960	-8.5817	-8.5663
	2	-8.6242	-8.6085	-8.6145	-8.5786	-8.5640	-8.5482
	3	-8.6058	-8.5930	—	-8.5723	—	—
	4	-8.5910	-8.5751	-8.5592	—	—	—
	5	-8.5723	—	—	—	—	—

Conclusion: ARIMA(0,1,0)

SR^e(2)

		MA					
	Lags	0	1	2	3	4	5
AR	0	—	-2.2556	-2.2403	-2.2312	-2.2400	-2.2281
	1	-2.2553	$\boxed{-2.2636}$	-2.2475	-2.2434	-2.2321	-2.2165
	2	-2.2426	-2.2472	-2.2303	-2.2481	-2.2317	-2.2151
	3	-2.2379	-2.2385	-2.2118	-2.2214	-2.2101	-2.1954
	4	-2.2453	-2.2300	-2.2201	-2.2041	-2.1968	—
	5	-2.2277	-2.2110	-2.2074	-2.1907	—	—

Conclusion: ARIMA(1,1,1)

SR^e(4)

		MA					
	Lags	0	1	2	3	4	5
AR	0	—	—	—	—	-2.1766	-2.1670
	1	—	—	—	-2.1856	-2.1711	-2.1555
	2	—	—	$\boxed{-2.1900}$	—	-2.1614	-2.1471
	3	—	—	—	-2.1636	-2.1470	-2.1303
	4	-2.1815	-2.1660	-2.1588	—	—	—
	5	-2.1652	-2.1485	-2.1464	-2.1298	—	—

Conclusion: ARIMA(2,1,2)

LR^e(2)

		MA					
	Lags	0	1	2	3	4	5
AR	0	—	—	—	—	—	-2.7482
	1	—	—	—	—	-2.7502	-2.7339
	2	—	—	—	—	—	-2.7267
	3	—	—	—	$\boxed{-2.7529}$	-2.7099	-2.7077
	4	—	-2.7521	-2.7357	—	—	—
	5	-2.7464	-2.7338	—	—	—	—

Conclusion: ARIMA(3,1,3)

LR^e(4)

		MA					
	Lags	0	1	2	3	4	5
AR	0	—	—	—	—	—	—
	1	—	—	—	—	—	—
	2	—	—	—	—	-2.8346	-2.8200
	3	—	—	—	—	$\boxed{-2.8802}$	—
	4	—	—	-2.8710	—	—	—
	5	—	—	—	—	—	—

Conclusion: ARIMA(3,1,4)

Notes: d is set to 1 as shown in Table 1.

The selection of ARIMA structure using Schwarz Information Criterion is to select that combination of AR and MA lags that minimises $\text{SIC} = \text{Ln}(\tilde{\sigma}^2_{ML}) + \text{Ln}(N)(p+q)(1/N)$; where $\tilde{\sigma}^2_{ML}$ is the maximum likelihood estimate of error variance, N is the sample size and p and q are lags of AR and MA parts, respectively.

Blank cells in the tables indicate that either the particular combination of p and q failed to converge in 20 iterations or there was a residual serial correlation significant at 5%, which made that model unsuitable.

Cells highlighted indicates the model with the minimum SIC and hence the selected model for the series.

Table 1: ADF Unitroot Tests

With Linear Trend and Constant: $\Delta y_t = \alpha + \gamma \cdot t + \beta \cdot y_{t-1} + \sum_{i=1}^{\text{Lags}} \delta_i \Delta y_{t-i} + u_t$

With Constant: $\Delta y_t = \alpha + \beta \cdot y_{t-1} + \sum_{i=1}^{\text{Lags}} \delta_i \Delta y_{t-i} + u_t$

	ER^e(1)		ER^e(4)		ER		C.V.
	Level	First Diff.	Level	First Diff.	Level	First Diff.	
Trend and Constant	-2.6511		-2.6198		-2.5981		-3.4221
Lags	0		0		0		
Constant	-2.3838	-21.9598	-2.3432	-21.0444	-2.2895	-20.7498	-2.8685
Lags	0	0	0	0	0	0	
Conclusion	I(1)		I(1)		I(1)		

	SR^e(2)		SR^e(4)		SR2		C.V.
	Level	First Diff.	Level	First Diff.	Level	First Diff.	
Trend and Constant	-1.1685		-1.3742		-1.3597		-3.4232
Lags	1		3		2		
Constant	0.0484	-17.4272	-0.43	-9.082	-0.4286	-11.9246	-2.8692
Lags	1	0	3	2	2	1	
Conclusion	I(1)		I(1)		I(1)		

	LR^e(2)		LR^e(4)		LR2		C.V.
	Level	First Diff.	Level	First Diff.	Level	First Diff.	
Trend and Constant	-1.7340		-1.9832		-1.7733		-3.4232
Lags	6		3		0		
Constant	-0.4795	-8.9155	-0.5216	-21.2809	-0.3487	-18.9173	-2.8693
Lags	6	5	1	0	0	0	
Conclusion	I(1)		I(1)		I(1)		

	Δ^eER(1)	Δ^eER(4)	C.V.	Δ^eSR(2)	Δ^eSR(4)	Δ^eLR(2)	Δ^eLR(4)	C.V.
	Level	Level		Level	Level	Level	Level	
Constant	-19.5327	-5.9932	-2.8686	-9.937	-12.1976	-11.1478	-9.5434	-2.8692
Lags	0	3		1	0	1	1	
Conclusion	I(0)	I(0)		I(0)	I(0)	I(0)	I(0)	

Notes: The Augmented Dickey Fuller test statistic is for H_0: $\beta = 0$, and lags of the test was determined by the number of lagged residuals needed to make the residuals of the testing equation white noise using Ljung-Box test.

Critical value for each test was calculated using MacKinnon (1991)'s response surface method.

Table 2: Cointegration Estimations and Tests

$$y_t = a + b \cdot y^e_{t/t-m} + e_t$$

	$ER^e(1)$	$ER^e(4)$	$SR^e(2)$	$SR^e(4)$	$LR^e(2)$	$LR^e(4)$
a	0.0282 **	0.0930 **	-0.1026	-0.0409	0.0847	0.2212
	(0.0073)	(0.0141)	(0.0934)	(0.1387)	(0.1170)	(0.1592)
b	0.9622 **	0.8769 **	1.0112 **	1.0078 **	0.9926 **	0.9825 **
	(0.0098)	(0.0189)	(0.0068)	(0.0101)	(0.0095)	(0.0129)
Q(20) : $\chi^2(20)$⁽¹⁾	17.6644	613.8168 **	252.3111 **	572.6104 **	170.0824 **	550.5152 **
	{0.6095}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}
ADF⁽²⁾	-19.2430 **	-6.1356 **	-9.2930 **	-7.0851 **	-8.3294 **	-5.8115 **
Lags	0	4	0	3	2	4

† means significance at the 10% level
* means significance at the 5% level
** means significance at the 1% level
Numbers in (..)'s and {..}'s are standard errors and asymptotic p-values, respectively.

Notes: (1) Ljung-Box test of residual correlation with the lag length set equal to the square root of the sample size.

(2) Since the residuals of OLS estimations have no linear and non-linear trends, the ADF test is without trend and constant, i.e. $\Delta y_t = \beta \cdot y_{t-1} + \sum_{i=1}^{Lags} \delta_i \Delta y_{t-i} + u_t$.

Table 3: OLS Estimations with Newey-West Corrections

$$\Delta_m y_t = a + b \cdot \Delta^e_m y_t + e_t$$

	$ER^e(1)$	$ER^e(4)$	$SR^e(2)$	$SR^e(4)$	$LR^e(2)$	$LR^e(4)$
a	-0.0004	-0.0023	-0.0134	-0.0269	-0.0265	-0.0495
	(0.0007)	(0.0028)	(0.0370)	(0.0649)	(0.0197)	(0.0368)
b	0.2367 *	-0.0085	0.4262 **	0.5073 **	-0.0245	0.0890
	(0.0987)	(0.1756)	(0.1165)	(0.1237)	(0.1187)	(0.1844)
	Hypothesis Testing⁽ᵃ⁾					
Test for UEH:						
$\chi^2(1)$	59.8286 **	32.9807 **	24.2494 **	15.8706 **	74.5159 **	24.4099 **
H_0: a = 1	{0.0000}	{0.0000}	{0.0000}	{0.0001}	{0.0000}	{0.0000}
$\chi^2(2)$	60.5764 **	38.5940 **	24.3469 **	15.8740 **	75.8886 **	24.4347 **
H_0: a = 0 and b = 1	{0.0000}	{0.0000}	{0.0000}	{0.0004}	{0.0000}	{0.0000}
	Diagnostics					
S. C.⁽ᵇ⁾:						
Linear:	18.9239	515.2113 **	206.6766 **	555.0463 **	165.2681 **	523.4231 **
Q(20):$\chi^2(20)$	{0.5268}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}
Non-Linear:	80.3288 **	290.4696 **	170.0018 **	177.5994 **	132.8415 **	334.3111 **
$Q^2(20)$ $\chi^2(20)$	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}
Heteroskedasticity⁽ᶜ⁾:						
B-P: $\chi^2(1)$	1.8887	6.4421 *	0.0442	0.0510	0.2372	0.0053
	{0.1694}	{0.0111}	{0.8334}	{0.8213}	{0.6262}	{0.9420}
ARCH(4): $\chi^2(4)$	36.6783 **	134.1458 **	146.7396 **	125.2190 **	104.7734 **	186.2636 **
	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}
Functional Form⁽ᵈ⁾:						
RESET: $\chi^2(1)$	0.1846	6.8488 **	0.2633	0.0040	2.4775	2.0805
	{0.6674}	{0.0089}	{0.6079}	{0.9495}	{0.1155}	{0.1492}
Normality⁽ᵉ⁾:						
Bera-Jarque: $\chi^2(2)$	226.0631 **	162.5695 **	953.8406 **	1011.102 **	36.905 **	34.8769 **
	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}
Skewness	-0.8326	-0.8856	1.5073	1.6089	0.5531	0.5311
Excess Kurtosis	3.1916	2.4837	7.1662	7.3278	1.0598	1.0448

Note: (a) Wald test of the Unbiased Expectations Hypothesis.

(b) Ljung-Box test of for linear and non-linear (squared) residual serial correlation with the lag length equal to the square root of the sample size ($\sqrt{N} \approx 20$), H_0: white noise.

(c) Breusche-Pagan test of heteroskedasticity, H_0: unconditional homoskedasticity.
Test of Autoregressive Conditional Heteroskedasticity of up to 4th order,
H_0: conditional homoskedasticity.

(d) Ramsey's RESET test of model misspecification, H_0: correct specification.

(e) Bera-Jarque test of conditional normality of residuals, H_0: normality.

Skewness and kurtosis are those of the residuals.

Table 4: EGARCH Estimations

$$\Delta_m y_t = a + b\cdot\Delta^e_m y_t + \varepsilon_t + \sum_{i=1}^{m-1}\delta_i\varepsilon_{t-i}$$

$$\ln h_t = \beta_c + \beta_{\varepsilon 1}\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \beta_{\varepsilon 2}\left(\frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}}} - \sqrt{\frac{2}{\pi}}\right) + \beta_h \ln h_{t-1}$$

	$ER^e(1)$	$ER^e(4)$	$SR^e(2)$	$SR^e(4)$	$LR^e(2)$	$LR^e(4)$
a	0.0015 **	0.0036	-0.0377	-0.0876 *	-0.0312 †	-0.0638 †
	(0.0006)	(0.0023)	(0.0159)	(0.0385)	(0.0180)	(0.0338)
b	0.19226 *	0.0615 *	0.04401	0.21704 **	0.00223	0.06051 *
	(0.0775)	(0.0259)	(0.0319)	(0.0487)	(0.0356)	(0.0256)
δ_1		0.97612 **	0.9666 **	0.94619 **	0.96497 **	0.99625 **
		(0.0209)	(0.0125)	(0.0268)	(0.0134)	(0.0146)
δ_2		0.97747 **		0.86966 **		0.97324 **
		(0.0197)		(0.0331)		(0.0180)
δ_3		0.87777 **		0.71923 **		0.95298 **
		(0.0205)		(0.0292)		(0.0150)
β_c	-1.2948 †	-0.4707	0.0354	0.0051	-0.1202	-0.7508 †
	(0.6921)	(0.2981)	(0.0277)	(0.0100)	(0.1080)	(0.4377)
$\beta_{\varepsilon 1}$	-0.0110	0.0143	0.0108	-0.0122	0.0083	0.1030
	(0.0781)	(0.0479)	(0.0223)	(0.0169)	(0.0309)	(0.0699)
$\beta_{\varepsilon 2}$	0.3692 *	0.2705 **	0.1588 **	0.0476 †	0.1187 †	0.2265 *
	(0.1525)	(0.0959)	(0.0576)	(0.0255)	(0.0681)	(0.1137)
β_h	0.8356 **	0.9408 **	1.0054 **	1.0029 **	0.9633 **	0.7700 **
	(0.0862)	(0.0362)	(0.0050)	(0.0042)	(0.0324)	(0.1353)
1/d	0.3272 **	0.2293 **	0.3706 **	0.2997 **	0.1020 †	0.1223 †
	(0.0695)	(0.0660)	(0.0555)	(0.0531)	(0.0574)	(0.0631)
Log-Likelihood	1489.7	1446.6	206.6	152.9	320.1	316.4
	Hypothesis Testing$^{(a)}$					
$\chi^2(1)$: Test for IGARCH	3.6350 †	2.6746	1.1396	0.4708	1.2798	2.8880
H_0: $\beta_h = 1$	{0.0566}	{0.1020}	{0.2857}	{0.4926}	{0.2579}	{0.0892}
$\chi^2(1)$: Test for REH	0.2880	1.5588	2.9935 †	0.7761	1.2766	1.4705
H_0: MA(m-1) vs. H_1:MA(m)	{0.5915}	{0.2118}	{0.0836}	{0.3783}	{0.2585}	{0.2253}
$\chi^2(2)$: Test for UEH	121.084 **	1316.114 **	901.701 **	258.674 **	787.513 **	1361.586 **
H_0: a = 0 and b = 1	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}
	Diagnostics of $z_t^{(b)}$					
Linear S. C.:	16.7339	18.0190	39.7039 **	26.6888	22.5474	22.7435
$Q(20) : \chi^2(20)$	{0.6702}	{0.5862}	{0.0054}	{0.1442}	{0.3116}	{0.3016}
Non-Linear S. C.:	15.5863	18.1269	8.9113	27.9226	10.3746	23.9598
$Q^2(20): \chi^2(20)$	{0.7419}	{0.5791}	{0.9839}	{0.1112}	{0.9609}	{0.2442}
Skewness	-1.0137	-0.7242	-0.4852	0.0376	0.5001	0.4466
Excess Kurtosis	2.6002	1.4460	5.9486	4.9510	0.6458	0.8175

Notes: (a) Wald tests of integrated variance (Integrated GARCH), Rational Expectations Hypothesis and Unbiased Expectations Hypothesis, respectively.

(b) See notes for Table 3.

Table 5: ECM Estimations

$$\Delta_m y_t = a + b\cdot\Delta^e_m y_t + \gamma\cdot\Delta_m y^e_t + \varepsilon_t + \sum_{i=1}^{m-1}\delta_i\varepsilon_{t-i}$$

$$\ln h_t = \beta_c + \beta_{\varepsilon 1}\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \beta_{\varepsilon 2}\left(\frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}}} - \sqrt{\frac{2}{\pi}}\right) + \beta_h \ln h_{t-1}$$

	$ER^e(1)$	$ER^e(4)$	$SR^e(2)$	$SR^e(4)$	$LR^e(2)$	$LR^e(4)$
a	0.0015 **	0.0027	-0.0303 †	-0.0815 *	-0.0308 †	-0.0919 **
	(0.0006)	(0.0023)	(0.0159)	(0.0378)	(0.0182)	(0.0326)
b	0.20891 *	0.0631 *	0.0350	0.21238 **	0.00296	0.07871 *
	(0.0829)	(0.0311)	(0.0316)	(0.0536)	(0.0360)	(0.0317)
δ_1		0.96616 **	0.97052 **	0.94707 **	0.96562 **	0.97845 **
		(0.0224)	(0.0121)	(0.0344)	(0.0134)	(0.0190)
δ_2		0.93907 **		0.86958 **		0.9749 **
		(0.0226)		(0.0391)		(0.0178)
δ_3		0.86904 **		0.70702 **		0.93983 **
		(0.0246)		(0.0353)		(0.0178)
γ	-0.0288	-0.0108	0.08796 *	-0.015	0.04415	0.03904
	(0.0428)	(0.0452)	(0.0390)	(0.0431)	(0.0410)	(0.0437)
β_c	-1.3216 †	-0.2517	0.0405	0.0213	-0.1973	-0.7600 †
	(0.7393)	(0.1906)	(0.0329)	(0.0594)	(0.1554)	(0.4337)
$\beta_{\varepsilon 1}$	-0.0107	0.0176	0.0203	0.0189	0.0202	0.0886
	(0.0798)	(0.0370)	(0.0276)	(0.0390)	(0.0385)	(0.0691)
$\beta_{\varepsilon 2}$	0.3701 *	0.1951 *	0.1799 **	0.3095 **	0.1556 †	0.2500 *
	(0.1566)	(0.0763)	(0.0655)	(0.0956)	(0.0837)	(0.1204)
β_h	0.8320 **	0.9687 **	1.0052 **	0.9859 **	0.9396 **	0.7688 **
	(0.0923)	(0.0229)	(0.0055)	(0.0146)	(0.0468)	(0.1331)
1/d	0.3306 **	0.1897 **	0.3743 **	0.3473 **	0.1062 †	0.1271 *
	(0.0696)	(0.0615)	(0.0559)	(0.0632)	(0.0598)	(0.0633)
Log-Likelihood	1489.9	1440.2	209.2	152.5	320.5	318.6
	Hypothesis Testing$^{(a)}$					
$\chi^2(1)$: Test for IGARCH	3.3157 †	1.8656	0.8665	0.9352	1.6625	3.0149 †
H_0: $\beta_h = 1$	{0.0686}	{0.1720}	{0.3519}	{0.3335}	{0.1973}	{0.0825}
$\chi^2(1)$: Test for REH	0.0332	1.4637	2.4994	0.1722	1.0967	1.2419
H_0: MA(m-1) vs. H_1:MA(m)	{0.8554}	{0.2263}	{0.1139}	{0.6782}	{0.2950}	{0.2651}
$\chi^2(2)$: Test for UEH	107.227 **	907.800 **	934.156 **	216.278 **	767.806 **	849.039 **
H_0: a = 0 and b = 1	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}
	Diagnostics of $z_t^{(b)}$					
Linear S. C.:	17.9580	16.6762	30.2794 †	35.0742 *	19.9159	21.6355
$Q(20) : \chi^2(20)$	{0.5902}	{0.6739}	{0.0655}	{0.0197}	{0.4632}	{0.3606}
Non-Linear S. C.:	16.4166	16.5864	8.5610	9.7390	9.7549	17.2904
$Q^2(20): \chi^2(20)$	{0.6905}	{0.6796}	{0.9875}	{0.9727}	{0.9724}	{0.6340}
Skewness	-1.0082	-0.6815	-0.5895	-0.1124	0.4745	0.4927
Excess Kurtosis	2.5574	1.2152	6.2339	5.4462	0.6227	0.8070

Notes: (a), (b) See notes for Table 3.

References

Baillie, Richard T. and Bollerslev, Tim (1989) "The Message in Daily Exchange Rates: A Conditional-Variance Tale", *Journal of Business and Economic Statistics*, July, Vol. 7, No. 3, pp. 297-305.

Barnhart, Scott W. And Szakmary, Andrew C. (1991) "Testing the Unbiased Forward Rate Hypothesis: Evidence on Unit Roots, Co-Integration, and Stochastic Coefficients", Journal of Financial and Quantitative Analysis, Vol. 26, No. 2 June, pp. 245-267.

Bollerslev, Tim (1987) "A Conditionally Heteroskedastic Time Series Model for Speculative Prices and Rates of Return", *Review of Economics and Statistics*, Vol. 69, pp. 542-547.

Chinn, Menzie and Frankel, Jeffrey (1991) "Are Exchange Rate Expectations Biased? Tests for a Cross-Sections of 25 Currencies", *NBER Working Paper*, No. 3807.

Chow, G. C. And Lin, A. (1976) "Best Linear Unbiased Estimation of Missing Observations in an Economic Time Series", *Journal of the American Statistical Association*, Vol. 71, pp. 719-721.

Engle, Robert F. (1982) "Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation", *Econometrica*, July, Vol. 50, No. 4, pp. 987-1007.

Cavaglia, Stefano; Verschoor, Willem F. C. and Wolff, Christian C. P. (1993) "Further Evidence on Exchange Rate Expectations", *Journal of International Money and Finance*, Vol. 12, pp. 78-98.

Hansen, Las P. (1982) "Large Sample Properties of Generalized Method of Moments Estimators", *Econometrica*, Vol. 50, pp. 1029-54.

Hansen, Las P and Hodrick, Robert J. (1980) "Forward Exchange Rates as Optimal Predictors of Future Spot Rates: An Econometric Analysis", *Journal of Political Economy*, Vol. 88, No. 51, pp. 829-853.

Harvey, Andrew C. And Pierse, R. G. (1984) "Estimating Missing Observations in Economic Time Series", *Journal of the American Statistical Association*, Vol. 79, pp. 125-131.

Hendry, David (1995) *Dynamic Econometrics*, Oxford University Press, New York.

Hodrick, Robert J. (1987) *The Empirical Evidence on the Efficiency of Forward and Futures Foreign Exchange Markets*, Harwood academic Publishers, Chur.

Kim, Suk-Joong (1995) "Modeling Changes in Daily $A Exchange Rates: An Application of GARCH", in Forbes, C., Kofman, P. and Fry T. Editors *Proceedings of the 1995 Econometrics Conference at Monash*, 1995, Monash University, Melbourne, pp. 489-526.

Lim, G. C. and Mckenzie, C. R. (1992) "Testing the Rationality of Expectations in the Australian Foreign Exchange Market Using Survey Data with Missing Observations", Research Discussion Paper 360, December 1992, The University of Melbourne,.

Liu, Peter C. And Maddala, G. S. (1992) "Rationality of Survey Data and Tests for Market Efficiency in the Foreign Exchange Markets", *Journal of International Money and Finance*, Vol. 11, pp. 366-381.

MacDonald, Ronald (1992) "Exchange Rate Survey Data: A Disaggregated G-7 Perspective", *The Manchester School*, Vol. LX Supplement, June, pp. 47-62.

Pesaran, M. Hashem (1987) *The Limits to Rational Expectations*, Basil Blackwell, Oxford.

Newey, Whitney K. And West, Kenneth D. (1987) "A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix", *Econometrica*, Vol. 55, No. 3, pp.703-708.

Takagi, Shinji (1991) "Exchange Rate Expectations: A Survey of Survey Studies", *IMF Staff Papers*, March, Vol. 38, No. 1, pp. 156-183.

Working Papers in Economics

187	C. Karfakis & A.J. Phipps	Do Movements in the Forward Discount on the Australian Dollar Predict Movements in Domestic Interest Rates? Evidence from a Time Series Analysis of Covered Interest Parity in Australia in the late 1980s; May 1993
188	J.B. Towe	Citation Analysis of Publications on the Australian Tariff Debate, 1946-1991; August 1993
189	C. Karfakis & S-J Kim	Exchange Rates, Interest Rates and Current Account News: Some Evidence from Australia; September 1993
190	A.J. Phipps & J.R. Sheen	Unionisation, Industrial Relations and Labour Productivity Growth in Australia: A Pooled Time-Series/Cross-Section Analysis of TFP Growth; September 1993
191	W.P. Hogan	Market Value Accounting in the Financial Sector; November 1993
192	Y. Varoufakis & W. Kafouros	The Transferability of Property Rights and the Scope of Industrial Relations' Legislation: Some Lessons from the NSW Road Transport Industry; November 1993
193	P.D. Groenewegen	Jacob Viner and the History of Economic Thought; January 1994
194	D. Dutta & A. Hussain	A Model of Share-Cropping with Interlinked Markets in a Dual Agrarian Economy; March 1994
195	P.E. Korsvold	Hedging Efficiency of Froward and Option Currency Contracts; March 1994
196	J. Yates	Housing and Taxation: An Overview; March 1994
197	P.D. Groenewegen	Keynes and Marshall: Methodology, Society and Politics; March 1994
198	D.J. Wright	Strategic Trade Policy and Signalling with Unobservable Costs; April 1994
199	J. Yates	Private Finance for Social Housing in Australia; April 1994
200	L. Haddad	The Disjunction Between Decision-Making and Information Flows: The Case of the Former Planned Economies; April 1994
201	P.D. Groenewegen & S. King	Women as Producers of Economic Articles: A Statistical Assessment of the Nature and the Extent of Female Participation in Five British and North American Journals 1900-39; June 1994
202	P.D. Groenewegen	The French Connection: Some Case Studies of French Influences on British Economics in the Eighteenth Century; June 1994
203	F. Gill	Inequality and the Wheel of Fortune: Systemic Causes of Economic Deprivation; July 1994
204	M. Smith	The Monetary Thought of Thomas Tooke; July 1994
205	A. Aspromourgos	Keynes on the Australian Wages System; July 1994
206	W. Kafouros & Y. Varoufakis	Bargaining and Strikes: From an Equilibrium to an Evolutionary Framework; July 1994
207	A. Oswald & I. Walker	Rethinking Labor Supply: Contract Theory and Unions; July 1994
208	J.B. Towe & D.J. Wright	The Research Output of Australian Econometrics and Economics Department: 1988-93; July 1994
209	F. Gill & C. Rose	Discontinuous Payoff Functions under Incomplete Information; August 1994

210	S-J Kim	Inflation News in Australia: Its Effects on Exchange Rates and Interest Rates; October 1994
211	Y. Varoufakis	Moral Rhetoric in the Face of Strategic Weakness: Modern Clues for an Ancient Puzzle; November 1994
212	E. Jones	Bureaucratic Politics and Economic Policy: The Evolution of Trade Policy in the 1970s and 1980s; December 1994
213	R. Hataiseree & A.J. Phipps	The Relationship Between Money and Income in Thailand: Some Evidence for the 1980s Using a Cointegration Approach; January 1995
214	G. White	Classical Competition, Keynesian Adjustment and Composite Dynamics: A Critical Perspective; February 1995
215	C. Karfakis & A.J. Phipps	Treasury Note and Bank Bill Rates, the Risk Premium and Australian Monetary Policy; February 1995
216	P.D. Groenewegen	The Post 1945 Internationalization of Economics The Australian Experience; April 1995
217	S-J Kim	Modeling Changes in Daily $A Exchange Rates: An Application of GARCH; June 1995
218	R. Hataiseree & A. Phipps	The Degree of Capital Mobility in Thailand: Some Estimates Using a Cointegration Approach; June 1995
219	I.J. Irvine & W.A. Sims	Measuring Consumer Surplus with Unknown Hicksian Demands; June 1995
220	I.J. Irvine & S. Wang	Saving Behavior in a Pure Life-Cycle Model with Income Uncertainty; June 1995
221	J. Logan	The Self-Destruction of Private Health Insurance; October 1995
222	A. Aspromourgos	Cantillon on Real Wages and Employment: a rational reconstruction of the significance of land utilization; November 1995
223	M. Smith	A Monetary Explanation of Distribution in a Gold Money Economy; December 1995
224	J.B. Towe	The Ranking of University Accounting and Finance Departments in Australia, 1990-94; January 1996
225	W.P. Hogan	Foreign Debt: Perceptions, Experiences and Issues; January 1996
226	N. Barkatullah	OLS and Instrumental Variable Price Elasticity Estimates for Water in Mixed-Effects Model Under Multipart Tariff Structure; January 1996
227	C. Simkin	Three Essays on Problems of Market Economies; January 1996
228	L. Haddad	On the Transition from a Supply to a Demand-Constrained Economic System: The East European Experience; February 1996
229	F. Gill	The Road to Full Employment: Co-ordination in a World of Interdependent Decisions; February 1996
230	S-K Kim	Testing the Rationality of Exchange Rate and Interest Rate Expectations: An Empirical Study of Australian Survey Based Expectations; March 1996

Copies are available upon request from:

Department of Economics
The University of Sydney
N.S.W. 2006, Australia

Working Papers in Economics Published Elsewhere

2	I.G. Sharpe & R.G. Walker	*Journal of Accounting Research*, *13(2)*, Autumn 1975
3	N.V. Lam	*Journal of the Developing Economies*, *17*(1), March 1979
4	V.B. Hall & M.L. King	*New Zealand Economic Papers*, *10*, 1976
5	A.J. Phipps	*Economic Record*, *53(143)*, September 1977
6	N.V. Lam	*Journal of Development Studies*, *14*(1), October 1977
7	I.G. Sharpe	*Australian Journal of Management*, April 1976
9	W.P. Hogan	*Economic Papers*, 55, The Economic Society of Australia and New Zealand, October 1977
12	I.G. Sharpe & P.A. Volker	*Economics Letters*, 2, 1979
13	I.G. Sharpe & P.A. Volker	*Kredit and Kapital*, *12*(1), 1979
14	W.P. Hogan	*Some Calculations in Stability and Inflation*, A.R. Bergström et al (eds.), J. Wiley & Sons, 1978
15	F. Gill	*Australian Economic Papers*, *19*(35), December 1980
18	I.G. Sharpe	*Journal of Banking and Finance*, *3*(1), April 1978
21	R.L. Brown	*Australian Journal of Management*, *3*(1), April 1978
23	I.G. Sharpe & P.A. Volker	*The Australian Monetary System in the 1970s*, M. Porter (ed.), Supplement to Economic Board 1978
24	V.B. Hall	*Economic Record*, *56*(152), March 1980
25	I.G. Sharpe & P.A. Volker	*Australian Journal of Management*, October 1979
27	W.P. Hogan	*Malayan Economic Review*, *24*(1), April 1979
28	P. Saunders	*Australian Economic Papers*, *19*(34), June 1980
29	W.P. Hogan I.G. Sharpe & P.A. Volker	*Economics Letters*, 6 (1980), 7 (1981)
30	W.P. Hogan	*Australian Economic Papers*, 18(33), December 1979
32	R.W. Bailey, V.B. Hall & P.C.B. Phillips	*Keynesian Theory, Planning Models, and Quantitative Economics*, G. Gandolfo and F. Marzano (eds.), 1987
38	U.R. Kohli	*Australian Economic Papers*, *21*(39), December 1982
39	G. Mills	*Journal of the Operational Research Society* (33) 1982
41	U.R. Kohli	*Canadian Journal of Economics*, *15*(2), May 1982
42	W.J. Merrilees	*Applied Economics*, 15, February 1983
43	P. Saunders	*Australian Economic Papers*, *20*(37), December 1981
45	W.J.Merrilees	*Canadian Journal of Economics*, *15*(3), August 1982
46	W.J. Merrilees	*Journal of Industrial Economics*, *31*, March 1983
49	U.R. Kohli	*Review of Economic Studies*, *50*(160), January 1983
50	P. Saunders	*Economic Record*, *57*(159), December 1981
53	J. Yates	AFSI, *Commissioned Studies and Selected Papers*, AGPS, IV 1982
54	J. Yates	*Economic Record*, *58*(161), June 1982
55	G. Mills	*Seventh Australian Transport Research Forum-Papers*, Hobart 1982

56	V.B. Hall & P. Saunders	*Economic Record, 60*(168), March 1984
57	P. Saunders	*Economic Record, 59*(166), September 1983
58	F. Gill	*Économie Appliquée, 37*(3-4), 1984
59	G. Mills & W. Coleman	*Journal of Transport Economics and Policy*, 16(3), September 1982
60	J. Yates	*Economic Papers*, Special Edition, April 1983
61	S.S. Joson	*Australian Economic Papers, 24*(44), June 1985
62	R.T. Ross	*Australian Quarterly, 56*(3), Spring 1984
63	W.J. Merrilees	*Economic Record, 59*(166), September 1983
65	A.J. Phipps	*Australian Economic Papers, 22*(41), December 1983
67	V.B. Hall	*Economics Letters*, 12, 1983
69	V.B. Hall	*Energy Economics, 8*(2), April 1986
70	F. Gill	*Australian Quarterly, 59*(2), Winter 1987
71	W.J. Merrilees	*Australian Economic Papers, 23*(43), December 1984
73	C.G.F. Simkin	*Singapore Economic Review, 29*(1), April 1984
74	J. Yates	*Australian Quarterly, 56*(2), Winter 1984
77	V.B. Hall	*Economics Letters*, 20, 1986
78	S.S. Joson	*Journal of Policy Modeling, 8*(2), Summer 1986
79	R.T. Ross	*Economic Record, 62*(178), September 1986
81	R.T. Ross	*Australian Bulletin of Labour, 11*(4), September 1985
82	P.D. Groenewegen	*History of Political Economy, 20*(4), Winter 1988 and *Scottish Journal of Political Economy, 37*(1) 1990
84	E.M.A. Gross, W.P. Hogan & I.G. Sharpe	*Australian Economic Papers, 27*(50), June 1988
85	F. Gill	*Australian Bulletin of Labour, 16*(4), December 1990
94	W.P. Hogan	*Company and Securities Law Journal, 6*(1), February 1988
95	J. Yates	*Urban Studies, 26*, 1989
96	B.W. Ross	*The Economic and Social Review, 20*(3), April 1989
97	F. Gill	*Australia's Greatest Asset: Human Resources in the Nineteenth and Twentieth Centuries*, D. Pope (ed.), Federation Press, 1988
98	A.J. Phipps	*Australian Economic Papers, 31*(58), June 1992
99	R.T. Ross	*Australian Bulletin of Labour, 15*(1), December 1988
100	L. Haddad	*Hetsa Bulletin*, (11), Winter 1989
101	J. Piggott	*Public Sector Economics - A Reader*, P. Hare (ed.), Basil Blackwell, 1988
102	J. Carlson & D. Findlay	*Journal of Macroeconomics, 13*(1), Winter 1991
102	J. Carlson & D. Findlay	*Journal of Economics and Business, 44*(1), February 1992
104	P.D. Groenewegen	*Decentralization, Local Government and Markets: Towards a Post-Welfare Agenda*, R.J. Bennet (ed.) Oxford University Press, 1990
107	B.W. Ross	*Prometheus, 6*(2), December 1988
108	S.S. Joson	*Rivista di diritto valutario e di economia internazionale, 35*(2), June 1988
112	P. Groenewegen	*NeoClassical Economic Theory 1870 to 1930*, K. Hennings and W. Samuels (eds.), Boston Kluwer-Nighoff, 1990

113	V.B. Hall T.P. Truong V.A. Nguyen	*Energy Economics, 12*(4) October 1990
114	V.B. Hall T.P. Truong & V.A. Nguyen	*Australian Economic Review*, (87) 1989(3)
115	F. Gill	*Australian Journal of Social Issues, 25*(2), May 1990
116	G. Kingston	*Economics Letters*, 15 (1989)
117	V.B. Hall & D.R. Mills	*Pacific and Asian Journal of Energy, 2*(2), December 1988
118	W.P. Hogan	*Abacus, 25*(2), September 1989
120	P. Groenewegen	*Flattening the Tax Rate Scale: Alternative Scenarios & Methodologies*, (eds.) J.G. Head and R. Krever, 1990
122	W.P. Hogan & I.G. Sharpe	*Economic Analysis and Policy, 19*(1), March 1989
123	G. Mills	*Journal of Transport Economics and Policy, 23*, May 1989
126	F. Gill	*The Australian Quarterly, 61*(4), 1989
128	S. Lahiri & J. Sheen	*The Economic Journal, 100*(400), 1990
130	J. Sheen	*Journal of Economic Dynamics and Control*, 16, 1992
135	Y. Varoufakis	Économie Appliquée, *45*(1), 1992
136	L. Ermini	*The Economic Record, 69*(204), March 1993
138	D. Wright	*Journal of International Economics, 35*, (1/2) 1993
139	D. Wright	*Australian Economic Papers, 32*, 1993
141	P. Groenewegen	*Australian Economic Papers, 31*, 1992
143	C. Karfakis	*Applied Economics, 23*, 1991
144	C. Karfakis & D. Moschos	*Journal of Money, Credit and Banking, 22*,(3), 1990
147	J. Yates	*Housing Studies*, 7, (2), April 1992
149	B. Rao	*The Economic Journal, 102*(414), Sept. 1992
150	D. Wright	*Bulletin of Economic Research*, 47(1), Jan. 1995
157	B. Rao	*Applied Economics, 24*(6), June 1992
158	W.P. Hogan	*Economic Papers, 10*(1), March 1991
159	P.Groenewegen	*Local Government and Market Decentralisation: Experiences in Industialised, Developing and Former Eastern Block Countries*, R. J. Bennett (ed.) UN University Press, 1994
160	C. Karfakis	*Applied Financial Economics, 1*(3), September 1991
161	B. Rao	*Southern Economic Journal, 61*(2),Oct. 1994
162	Y. Varoufakis	*Erkenntnis, 38*, 1993
163	Y. Varoufakis	*Science and Society, 56*(4), 1993
164	D. Wright	*The ManchesterSchool of Economics and Social Studies*, 63(4), December 1995
173	C. Rose	*The Rand Journal of Economics, 24*(4), Winter 1993
174	D. Wright	*Canadian Journal of Economics*, 28(4), November 1995
177	P. Groenewegen	*European Journal of the History of Economic Thought, 1*(2) Spring 1994
178	D. J. Wright	*Economic Record, 70*(211), December 1994
187	C. Karfakis & A. J. Phipps	*Australian Economic Papers*, 33(62), June 1994
189	C. Karfakis & S-J Kim	*Jounal of International Money and Finance, 14*(4) August 1995

190	A.J. Phipps & J.R. Sheen	*Labour Economics and Productivity*, *6*(1), March 1994
193	P. Groenewegen	*Contributions to Political Economy*, *13*, 1994
194	D.Dutta & A. Hussain	*Journal of Contemporary Asia*, *25*(4), 1995
199	J. Yates	*Housing Policy Debate*, *5*(2), 1994
202	P. Groenewegen	*Dix-Huitieme Siecle* (26), 1994
203	F. Gill	*Australian Economic Papers*, *33*(62), June 1994
208	J.B. Towe & D.J. Wright	*Economic Record*, *71*(212), March 1995
210	S-J Kim	*Applied Financial Economics*, *6*(2), 1996