FINANCIAL INTEGRATION: EVIDENCE FROM AUSTRALIA

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Abstract

This paper seeks to examine the efficiency of the Australian foreign exchange market by using methods of cointegration and spectral analysis. Uncovered interest rate differentials for five countries namely the US, UK, Japan, Malaysia and Singapore are examined with Australia as the ‘home’ country. The data covers the post-float period, 1984.1-2000.12. In contrast to previous findings, the cointegrating results confirm the presence of financial integration between Australia and the countries under study. However, the empirical results indicate that the restrictions of the hypothesis of uncovered interest parity are rejected. The spectral densities for the interest rate differentials suggest the absence of systematic cyclical fluctuations confirming market efficiency.

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1 Introduction

This paper seeks to examine the implications of interest rate convergence for the Australian economy by testing the empirical validity of the theory of uncovered interest parity. The theory of uncovered interest parity asserts that nominal interest rate differentials of financial assets denominated in different currencies is exactly equal to the expected change in exchange rate. Direct tests of uncovered interest parity involve testing the interest differential as an unbiased predictor of the expected change in exchange rate given the assumptions of rational expectations and risk-neutrality – Cumby and Obstfeld (1981, 1984), MacDonald and Taylor(1989), Flood and Rose (1996, 2002).

Studies for Australia have been undertaken by Tease (1988) – the speculative efficiency condition, Turnovsky and Ball (1983) - covered interest parity and speculative efficiency, Blundell-Wignall, Fahrer and Heath (1993) – uncovered interest parity. While, Turnovsky and Ball find some support for both conditions for the 1974.9 to 1981 period, Tease finds that the speculative hypothesis is rejected for the 30 day market but not the 15 day or 90 day market for the post 1983 period. Blundell-Wignall, Fahrer and Heath fail to find any support for uncovered interest parity for Australia over the 1984.1-1992.12 period.

The present paper contributes to this literature by applying spectral analysis to investigate the properties of interest rate differentials. The advantage of this method is that it permits the examination of interest rates in the frequency domain. If the interest rate differentials exhibit any periodicities or cyclical variations it can be concluded that the Australian financial markets are not efficient. In addition, the study uses the Johansen-Juselius (1990) cointegration method which permits analysis of interest rates in time domain. Monthly data for the period 1984.1 to 2000.12 is employed. With the adoption of a floating exchange rate system in December 1983 and the changing pattern of capital inflows experienced by Australia in the recent past, it would appear reasonable to expect greater interest rate convergence between Australia and its trading partners depending of course on the rate of inflation in each country. An interesting conclusion that emerges from the study is the evidence of financial integration between Australia and the countries under study.

The paper is structured as follows. Section 2 presents the model being tested. Section 3 presents the data. Section 4 describes the methodology used to test the hypothesis and presents the empirical results and Section 5 summarizes the main conclusions.

2 The Model

UIP is the proposition that nominal interest rate differentials of assets denominated in different currencies is exactly equal to the expected rate of change in the exchange rate. Under the assumption of perfect capital mobility and risk neutrality, domestic and foreign rates of return are equalized so that;

$$E_t s_{t+1} - s_t = i_t - i_t^* \qquad (1)$$

where $E_t s_{t+1}$ = nominal exchange rate expectations formed at time t for the period t+1

s_t = nominal exchange rate

i_t = the domestic interest rate and

i_t^* = the foreign interest rate

Rational expectations imply that the nominal rate realized at time $t+1$ will differ from the expected nominal rate by a random error term with zero mean,

$$s_{t+1} = E_t s_{t+1} + v_{t+1} \qquad (2)$$

The expectational error $v_{t+1} = s_{t+1} - E_t s_{t+1}$ is uncorrelated with information known in period t at the time of expectation formation. Replacing $E_t s_{t+1}$ in equation (1) with $s_{t+1} - v_{t+1}$ and shifting v_{t+1} to the right-hand side yields:

$$s_{t+1} - s_t = \Delta s_{t+1} = \alpha + \beta (i - i^*)_t + v_{t+1} \qquad (3)$$

Direct tests of UIP involve testing for $\alpha=0$ and $\beta=1$.[1] If Δs_{t+1} is stationary, then i_t and i_t^* must be cointegrated. Perfect financial integration in this case would imply that $i_t = i_t^*$.

3 Data

The hypothesis presented in Section 2 is tested by using monthly data spanning the 1984.1-2000.12 period. Uncovered interest differentials are examined for five countries, namely the US, UK, Japan, Malaysia and Singapore with Australia as the "home" country. These five countries account for approximately 40% of Australia's total exports and imports. All exchange rates are expressed in terms of Australian dollars per unit of foreign currency.

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[1] Equation (3) has been tested extensively using different econometric techniques. Cumby and Obstfeld (1981), Loopesko (1984)—error orthogonality tests; Taylor (1987b)—vector autoregression analysis; Karfakis and Parikh (1994), Bhatti and Moosa (1995)—cointegration analysis. The majority of findings, however, point to the rejection of UIP. Suggestions as to why it might fail have been put forward by: Frenkel and Levich (1975, 1977) - transactions costs; Fama (1984), Mark (1985), Cumby (1988) – risk premia,; Aliber (1973), Dooley and Isard (1980) - exchange risk and political risk.

The three month treasury bill rate is used for all the foreign countries except Japan. For Japan, the two month private bond yield is used as it is assumed to better reflect market conditions than the government bond yield for the period under study. The three month treasury bill rates are preferred to overnight rates due to greater volatility exhibited by the latter. Short term rates are also assumed to reflect more closely the stance of monetary policy. The thirteen week treasury note rate is used for Australia given the absence of a three month treasury bill rate. Due to limitations in data availability, the assets employed are not strictly comparable.[2] They vary in terms of risk and maturity. All data are obtained from the Reserve Bank of Australia database and the IMF's International Financial Statistics CD-ROM.

Unit Root Tests

The data are first tested for non-stationarity using both the Augmented Dickey Fuller (ADF -1979) and Phillips (1987) tests for unit roots.

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[2] See Chinn and Frankel (1994), Glick and Hutchison (1990) for use of similar data series.

Table 1

ADF and Phillips Tests for the Levels of the Series

	No Trend		**Trend**	
Variable	**ADF**	**Z(t)**	**ADF**	**Z(t)**
Exchange Rates:				
US	-2.57	-2.08	-2.80	-3.10
UK	-2.71*	-1.64	-2.80	-1.97
Japan	-3.18**	-2.36	-2.88	-2.19
Malaysia	-2.57	-2.91	-2.93	-3.26*
Singapore	-2.34	-2.53	-3.46*	-3.86**
Interest Rates				
Australia	-1.20	-0.71	-2.48	--1.91
US	-1.89	-1.25	-1.10	-0.90
UK	-1.88	-1.27	-2.94	-1.40
Japan	-0.53	-0.35	-1.30	-0.75
Malaysia	-2.86*	-2.85*	-2.96	-2.83
Singapore	-2.27	-3.22**	-3.09*	-3.72**
Interest Rate Differential:				
Australia–U.S	-1.84	-1.26	-3.46*	-2.76
Australia – U.K	-3.04**	-2.20	-3.85**	-2.14
Australia–Japan	-1.67	-1.38	-2.01	-1.85
Australia–Malaysia	-1.93	-2.13	-2.54	-2.53
Australia-Singapore	-1.51	-1.56	-3.02	-3.02

Note: The lag length for the ADF and Phillip (1987) regressions has been selected to ensure white noise residuals. A fourth order autoregressive model is used for the ADF test on the basis of the AIC[3] and ten lags on the Bartlett window are used for the Phillip test.

Significance levels with trend: 1%, -4.07 : 5%, -3.46 : 10% -3.16; without trend: 1%, -3.51 : 5%, -2.90, 10% -2.58 (Davidson and MacKinnon 1993).

*, **, *** significant at the 10%, 5% and 1% levels respectively.

The ADF test results reported in Table 1 suggest that the Japanese exchange rate and Australia-UK interest rate differential are stationary at the 5 per cent level of significance, while the Phillips test suggests that the Singaporean exchange rate and interest rate are stationary at the 5 per cent level. The null hypothesis of non-stationarity cannot be rejected for the rest of the data series. As both tests do not yield the same results for the series that appear to be stationary, it is reasonable to conclude that all series are I(1) in levels and I(0) in first differences. See Table 2 for the unit root test results for the first differences of the series.

Table 2

ADF and Phillips Tests for First Differences of the Series

	No Trend		Trend	
Variable	**ADF**	**Z(t)**	**ADF**	**Z(t)**
Exchange Rates:				
US	-13.67***	-13.63***	-13.63***	-13.67***
UK	-12.35***	-6.28***	-12.34***	-6.42***
Japan	-13.23***	-9.61***	-8.35***	-11.29***
Malaysia	-14.11***	-12.07***	-14.08***	-12.13***
Singapore	-9.55***	-9.39***	-9.63***	-9.49***
Interest Rates:				
Australia	-9.79***	-8.57***	-10.67***	-8.46***
US	-10.61***	-6.16***	-10.09***	-6.40***
UK	-17.65***	-6.17***	-17.62***	-6.17***
Japan	-10.53***	-9.39***	-10.50***	-9.28***
Malaysia	-18.66***	-8.34***	-18.62***	-8.30***
Singapore	-14.49***	-13.12***	-14.46***	-13.08***
Interest Rate Differential:				
Australia –U.S	-10.08***	-8.78***	-10.09***	-9.17***
Australia –U.K	-11.88***	-5.76***	-16.16***	-15.57***
Australia –Japan	-8.05***	-9.80***	-8.53***	-9.69***
Australia–Malaysia	-15.01***	-7.51***	-14.97***	-7.48***
Australia-Singapore	-12.06***	-9.68***	-12.04***	-9.62***

Note: The lag length for the ADF and Phillip (1987) regressions has been selected to ensure white noise residuals. A fourth order autoregressive model is used for the ADF test and ten lags on the Bartlett window are used for the Phillip test. Significance levels with trend: 1%, -4.07 : 5%, -3.46 : 10% -3.16; without trend: 1%, -3.51 : 5%, -2.90, 10% -2.58 (Davidson and MacKinnon 1993).
*, **, *** significant at the 10%, 5% and 1% levels respectively.

All the data series appear to be stationary in the first differences. The unit root tests reported in Tables 1 and 2 suggest that Ds_{t+1} is I(0) while $(i - i^*)_t$ is I(1). Therefore the paper goes on to test for cointegration between i_t and i^*_t. If a data series is non-stationary, then its spectral density becomes dominated by the value of the spectrum at the zero

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[3] The AIC is computed as: AIC(k) = $\ln|\Sigma_k| + (2p^2k)/n$, where Σ is the residual covariance matrix; p, the number of variables in the system; n, the number of observations and k the order of lag in the VAR.

frequency hiding possible peaks at higher frequencies. In order to avoid this problem a Hodrick-Prescott filter is used to detrend the data for the spectral analysis.

4 Methodology and Empirical Results

Cointegration

The Johansen (1988) and Johansen and Juselius (1990) procedure is employed to test for a long-run relationship between the variables. This approach is preferred to the Engle-Granger (1987) technique because it has better asymptotic properties than the latter and therefore yield more robust estimates.[4] More important perhaps is that this approach permits identification of all cointegrating vectors within a given set of variables. An additional advantage of this technique is that it permits direct hypothesis tests on the variables entering the cointegrating regression. Johansen and Juselius propose a maximum likelihood estimation approach for the estimation and evaluation of multiple cointegrated vectors. Johansen and Juselius (1990) consider the following model:

Let X_t be an nx1 vector of I(1) variables, with a vector autoregressive (VAR) representation of order k,

$$X_t = \Pi_1 X_{t-1} + \ldots. + \Pi_k X_{t-k} + \upsilon + e_t \qquad (4)$$

t= 1, 2,…….T

where υ is an intercept vector and e_t is a vector of Gaussian error terms.

In first difference form equation (4) takes the following form,

$$\Delta X_t = \Gamma_{k-1} \Delta X_{t-k+1} + \ldots. + \Pi X_{t-k} + \upsilon + e_t \qquad (5)$$

where

$\Gamma_i = - (I - \Pi_1 - \ldots \Pi_i)$, for i= 1, ….. , k-1

and

$\Pi = - (I - \Pi_1 - \ldots\ldots - \Pi_k)$

Π is an nxn matrix whose rank determines the number of cointegrating vectors among the variables in X. If matrix Π is of zero rank, the variables in X_t are integrated of order one or a higher order, implying the absence of a cointegrating relationship between the variables in X_t. If Π is full rank, that is, r=n, the variables in X_t are stationary; and if Π is of reduced rank, $0 < r < n$, Π can be expressed as $\Pi=\alpha\beta'$ where α and β are nxr matrices, with r the number of cointegrating vectors. Hence, although X_t itself is not stationary, the linear combination given by $\beta'X$ is stationary.

Johansen and Juselius propose two likelihood ratio tests for the determination of the number of cointegrated vectors. One is the maximal eigenvalue test which evaluates the null hypothesis that there are at most r cointegrating vectors against the alternative of r+1 cointegrating vectors. The maximum eigenvalue statistic is given by,

$$\lambda_{max} = - T \ln (1 - \lambda r+1) \qquad (6)$$

where λ r+1,….λn are the n-r smallest squared canonical correlations and T= the number of observations. The second test is based on the trace statistic which tests the null hypothesis of r cointegrating vectors against the alternative of r or more cointegrating vectors. This statistic is given by

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[4] See Phillip and Ouliaris (1990).

$$\lambda_{\text{trace}} = -T \sum \ln (1 - \lambda i) \qquad (7)$$

Table 3 presents results of the cointegration tests for i_t and i_t^*.

Table 3

Johansen-Juselius Maximum Likelihood Cointegration Test

A.	Null	Alternative	m
			15.87
			9.16
	r=0		15.87
			9.16
			9.16
	r=0		15.87
			9.16
	r=0		15.87
			9.16

B. Test of Parameter Restrictions	LR
US	14.54
UK	12.15
Singapore	20.11
Malaysia	15.23

[illegible]

and testing for the restriction that $i_t^* = 1$ yields the results reported in Panel B of Table 3. The χ^2 statistics are above the 95 per cent critical value of 3.84. These results raise questions as to whether the Australian financial markets are efficient. In order to address this spectral analysis is used.

Spectral Analysis

Spectral analysis is the study of time series in the frequency domain. The purpose of this analysis is to determine if the interest rate differentials exhibit any systematic cyclical variation. The sample spectrum is the Fourier Cosine transformation of the estimate of the autocovarience function. The Fourier series is a representation of a function as a sum of harmonic terms such that;

$$f(x) = \sum_{a=1}^{\infty} a_a \sin ax + 1/2\, a_0 + \sum_{a=1}^{\infty} b_a \cos ax$$

$$\text{or} \quad a_0/2 + \sum_{a=1}^{\infty} c_a \sin(ax + d),$$

where δ = time lag and a = amplitude of interest rate changes.

If d is measured in radians per unit of time, sin ax repeats itself with period $2p/a$ and therefore the number of cycles per unit or frequency is $a/2p$ The period $2p/a$ is a dimension of t. Spectral analysis permits the identification of any cyclical components in a data series. The angular frequency measured in radians per unit is represented by $2p/a$. If the filtered $(i\text{-}i^*)_t$ contains a periodic element of period k and therefore the frequency, $2p/k$, the spectral densities will have a sharp spike at $a = a_k$. If the filtered $(i\text{-}i^*)_t$ does not contain any periodicities, the spectral densities will be smooth.

The spectral densities of the filtered interest rate differentials are estimated for 150 lags. The spectral densities are estimated as follows:

$$F(\varpi_j) = 1/2\pi\ [\lambda_0 C_0 + 2 \sum_{K=0}^{\infty} l_k C_k \cos \varpi_j k\ ]$$

$\varpi_j = \pi j/m$ = j = 0, 1, 2, ….m, where m = 150 lags.

The estimated autocovariance is given by,

$$C_k = 1/n\text{-}k\ [\sum_{t=1}^{n-k} (i - i^*)_t (i - i^*)_{t+k} - 1/n\text{-}k \sum_{t=1+k}^{n} (i - i^*)_t \sum_{t=1}^{n-k} (i - i^*)_t\ ]$$

With data, $(i - i^*)_t$, t=1, …n and the weights, λ_k are dependent upon m. Microfit computes the Bartlett, Tukey and Parzen estimates. The results are reported in Table 1A in the Appendix.

Figures 1 to 5 plot the spectral densities for the Hodrick-Prescott filtered interest rate differentials using the Bartlett, Tukey and Parzen lag windows. A significant feature of all the figures is the sharp peak that corresponds to the .11 frequency (See Table 1A in Appexdix). The Figures suggest the absence of systematic short cyclical fluctuations. The spectrum is relatively flat after j=1 over the entire period. As the frequency increases the spectrum decreases rapidly. Hence the spectrum confirms the randomness of the series and the absence of systematic cyclical variation.

Figure 1

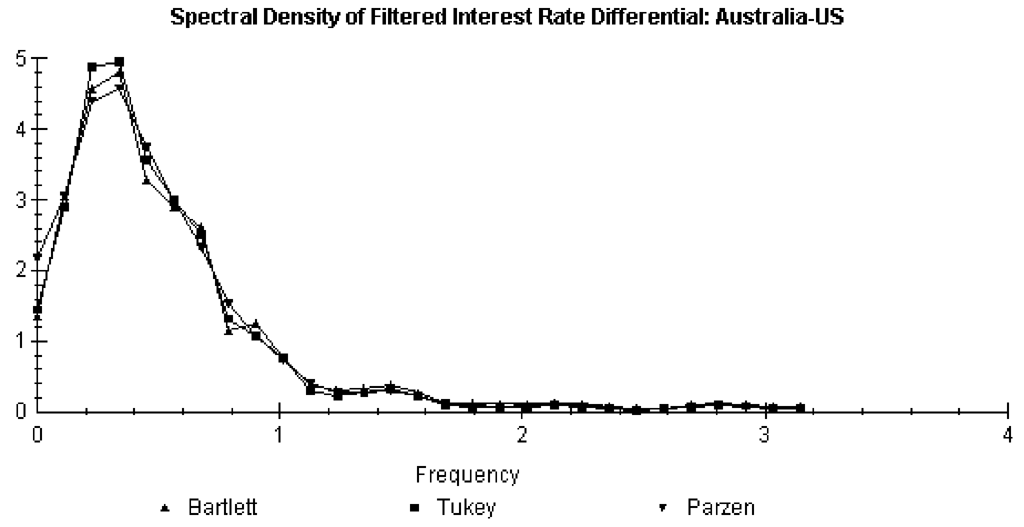


Figure 2

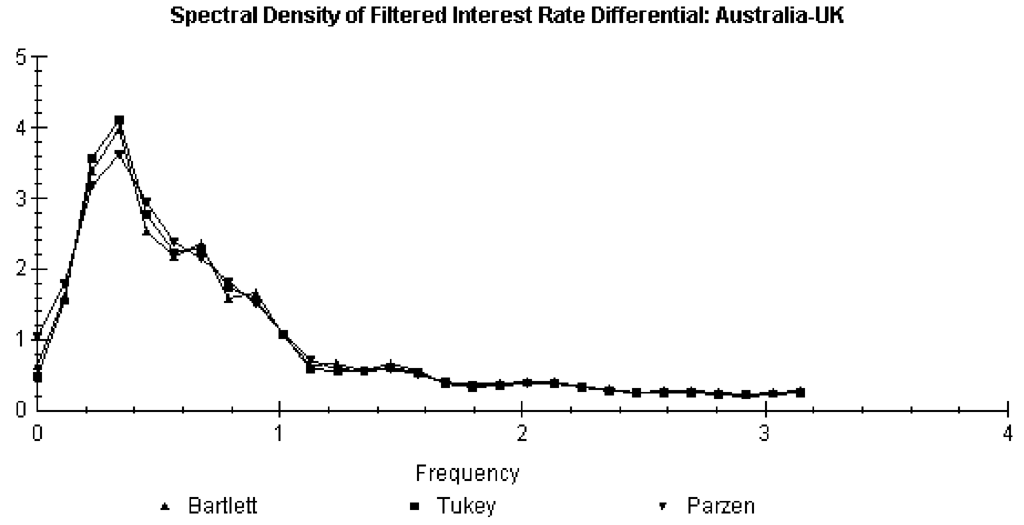


Figure 3

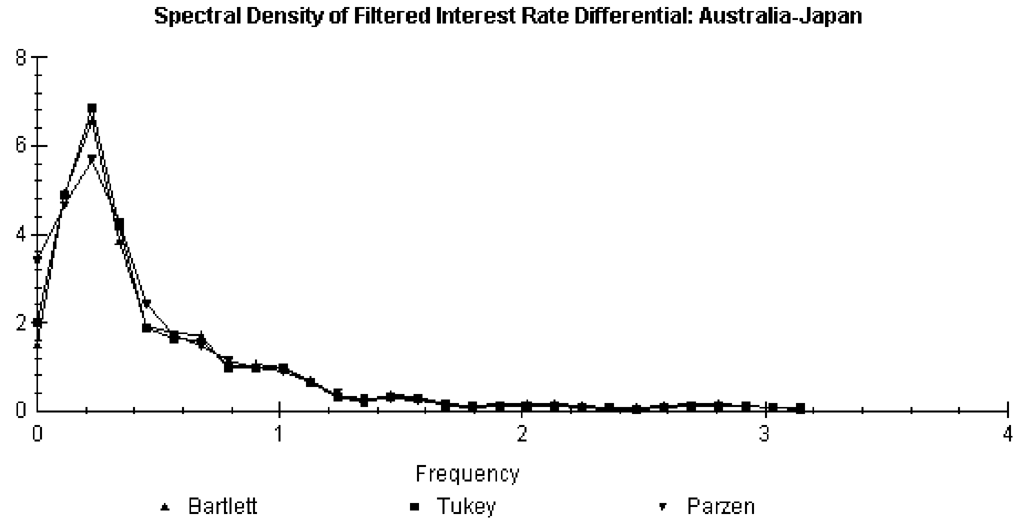

Spectral Density of Filtered Interest Rate Differential: Australia-Japan

Figure 4

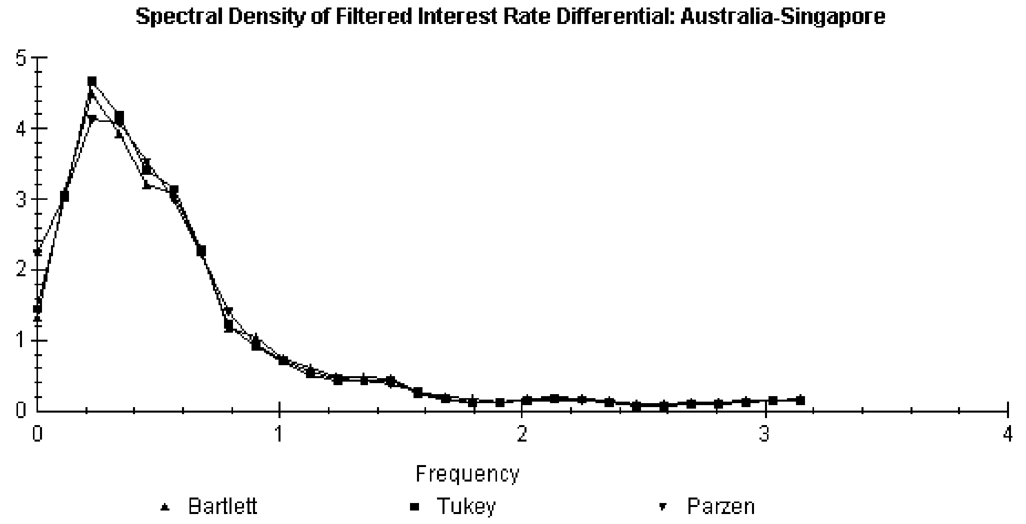
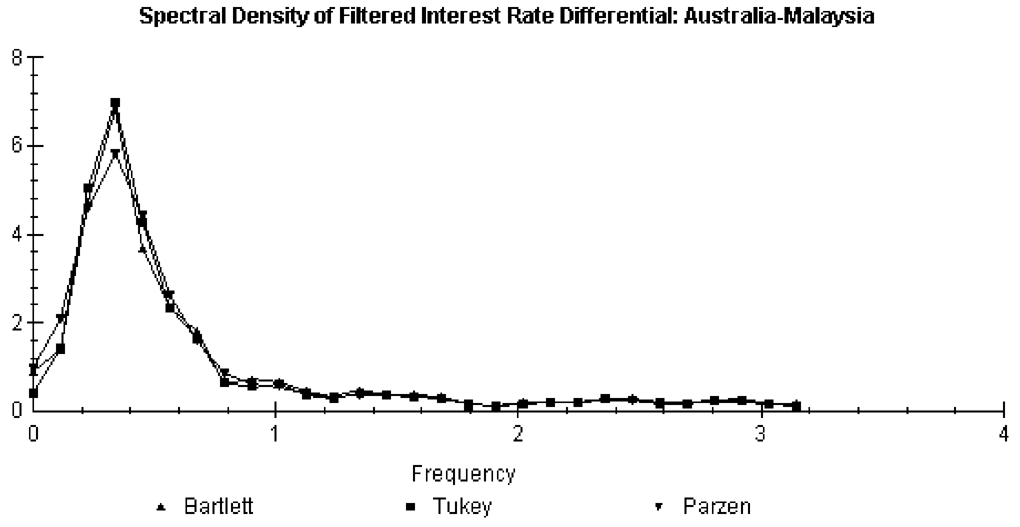

Spectral Density of Filtered Interest Rate Differential: Australia-Singapore

Figure 5



5 Conclusion

The purpose of this study was to examine the efficiency of the Australian foreign exchange market by cointegration and spectral densities. An important finding that emerges from this study is the evidence of an unique cointegrating vector between the domestic and uncovered interest rates confirming financial integration between Australia and its trading partners. However, the restrictions imposed by the theory of uncovered interest parity are rejected. Evidence of financial integration suggests that exchange rate variability would have greater impacts upon inflation targets. The rejection of the restrictions of uncovered interest parity need not necessarily imply the absence of perfect integration. Even with perfect integration, the theory could fail due to the existence of time varying risk premia or the rejection of the assumption of rational expectations. The rejection of the restrictions imposed by uncovered interest parity could also stem from other factors among them restrictions on capital flows and from varying taxation procedures in addition to irrationality and/or unexploited profit opportunities in international financial markets. Given that the spectral densities estimated for the interest rate differentials confirm the randomness of the series and absence of systematic cyclical components, suggesting efficiency of the Australian foreign exchange market, the rejection of the restrictions of the theory could be attributed to one or some of the above mentioned factors.

Appendix

Table 1A

Standardized Spectral Density Functions of the Hodrick-Prescott Filtered Interest Rate Differentials

Frequency	Period	US			UK			Japan		
		Bartlett	Tukey	Parzen	Bartlett	Tukey	Parzen	Bartlett	Tukey	Parzen
0.00	none	1.35	1.44	2.18	.624	.481	1.03	1.51	2.00	3.40
		(.577)	(.656)	(.840)	(.267)	(.218)	(.398)	(.650)	(.911)	(1.30)
.112	56.0	3.04	2.90	3.04	1.61	1.54	1.79	4.92	4.87	4.65
		(.920)	(.932)	(.827)	(.489)	(.496)	(.487)	(1.48)	(1.56)	(1.26)
.224	28.0	4.57	4.88	4.39	3.39	3.57	3.18	6.57	6.85	5.68
		(1.38)	(1.56)	(1.19)	(1.02)	(1.14)	(.867)	(1.98)	(2.19)	(1.54)
.336	18.6	4.80	4.96	4.58	3.98	4.09	3.62	3.84	4.20	4.25
		(1.45)	(1.59)	(1.24)	(1.20)	(1.31)	(.986)	(1.16)	(1.34)	(1.15)
.448	14.0	3.27	3.56	3.74	2.53	2.77	2.95	1.90	1.89	2.41
		(.990)	(1.14)	(1.01)	(.766)	(.888)	(.802)	(.576)	(.068)	(.657)
.561	11.2	2.88	2.98	3.00	2.17	2.24	2.38	1.73	1.65	1.71
		(.873)	(.958)	(.818)	(.658)	(.720)	(.647)	(.525)	(.529)	(.465)
.673	9.33	2.61	2.50	2.33	2.35	2.27	2.14	1.71	1.57	1.45
		(.791)	(.804)	(.636)	(.711)	(.729)	(.582)	(.517)	(.505)	(.396)
.785	8.00	1.15	1.31	1.54	1.57	1.74	1.82	.955	1.00	1.13
		(.350)	(.421)	(.419)	(.477)	(.559)	(.495)	(.289)	(.322)	(.309)
.897	7.00	1.25	1.07	1.06	1.66	1.57	1.50	1.06	.966	.984
		(.380)	(.344)	(.290)	(.503)	(.505)	(.408)	(.322)	(.310)	(.267)
1.00	6.22	.775	.759	.733	1.07	1.08	1.08	.967	.964	.892
		(.234)	(.243)	(.199)	(.324)	(.347)	(.295)	(.292)	(.309)	(.242)
1.12	5.6	.385	.302	.400	.630	.591	.708	.704	.658	.649
		(.116)	(.097)	(.108)	(.190)	(.189)	(.192)	(.213)	(.211)	(.176)
1.23	5.09	.312	.233	.269	.657	.565	.577	.372	.321	.380
		(.094)	(.074)	(.073)	(.198)	(.181)	(.156)	(.112)	(.103)	(.103)
1.34	4.66	.317	.272	.279	.552	.549	.570	.249	.205	.265
		(.096)	(.087)	(.076)	(.167)	(.176)	(.155)	(.075)	(.065)	(.072)
1.45	4.30	.370	.331	.291	.653	.611	.577	.373	.319	.281
		(.112)	(.106)	(.079)	(.197)	(.196)	(.157)	(.113)	(.102)	(.076)
1.57	4.00	.263	.226	.221	.548	.531	.511	.297	.267	.243
		(.079)	(.072)	(.060)	(.166)	(.170)	(.139)	(.089)	(.085)	(.066)
1.68	3.73	.121	.093	.123	.391	.365	.399	.147	.115	.145
		(.036)	(.029)	(.033)	(.118)	(.117)	(.108)	(.044)	(.037)	(.039)
1.79	3.50	.125	.076	.083	.368	.334	.351	.119	.078	.096
		(.037)	(.024)	(.022)	(.111)	(.107)	(.095)	(.036)	(.025)	(.026)
1.90	3.29	.108	.079	.080	.390	.364	.364	.137	.103	.101
		(.032)	(.025)	(.021)	(.032)	(.116)	(.099)	(.041)	(.033)	(.027)

Table 1A continued

Frequency	Period	US			UK			Japan		
		Barlett	Tukey	Parzen	Barlett	Tukey	Parzen	Barlett	Tukey	Parzen
2.01	3.11	.109	.080	.084	.400	.390	.382	.139	.117	.114
		(.033)	(.025)	(.023)	(.121)	(.125)	(.104)	(.043)	(.037)	(.031)
2.13	2.94	.119	.098	.090	.406	.386	.372	.145	.121	.113
		(.036)	(.031)	(.024)	(.122)	(.124)	(.101)	(.044)	(.039)	(.030)
2.24	2.80	.108	.082	.077	.334	.324	.325	.114	.091	.089
		(.032)	(.026)	(.020)	(.101)	(.104)	(.088)	(.034)	(.029)	(.024)
2.35	2.66	.064	.043	.048	.292	.267	.275	.075	.049	.058
		(.019)	(.013)	(.013)	(.088)	(.085)	(.074)	(.022)	(.015)	(.015)
2.46	2.54	.051	.021	.013	.260	.240	.250	.065	.039	.051
		(.015)	(.006)	(.008)	(.078)	(.077)	(.068)	(.019)	(.012)	(.013)
2.58	2.43	.055	.037	.043	.270	.250	.251	.094	.073	.077
		(.016)	(.012)	(.011)	(.081)	(.080)	(.068)	(.028)	(.023)	(.020)
2.69	2.33	.100	.077	.072	.280	.262	.252	.136	.120	.111
		(.030)	(.024)	(.019)	(.084)	(.084)	(.068)	(.041)	(.038)	(.030)
2.80	2.24	.107	.097	.089	.252	.233	.253	.143	.131	.121
		(.032)	(.031)	(.024)	(.076)	(.074)	(.064)	(.043)	(.042)	(.033)
2.91	2.15	.106	.085	.080	.228	.211	.233	.120	.104	.101
		(.032)	(.027)	(.021)	(.069)	(.067)	(.060)	(.036)	(.033)	(.027)
3.02	2.07	.069	.054	.057	.276	.237	.237	.084	.064	.070
		(.021)	(.017)	(.015)	(.119)	(.076)	(.064)	(.025)	(.020)	(.019)
3.14	2.00	.059	.035	.044	.278	.262	.250	.068	.045	.055
		(.025)	(.015)	(.017)	(.119)	(.119)	(.096)	(.029)	(.020)	(.021)

Asymptotic standard errors in parenthesis

Table 1A continued

Frequency	Period	Singapore			Malaysia		
		Bartlett	Tukey	Parzen	Bartlett	Tukey	Parzen
0.00	none	1.31	1.44	2.22	.910	.401	.971
		(.562)	(.655)	(.857)	(.389)	(.182)	(.373)
.112	56.0	3.10	3.02	3.04	1.38	1.42	2.07
		(.939)	(.970)	(.829)	(.418)	(.455)	(.563)
.224	28.0	4.49	4.66	4.13	4.71	5.06	4.60
		(1.35)	(1.49)	(1.12)	(1.42)	(1.62)	(1.25)
.336	18.6	3.93	4.18	4.08	6.81	6.98	5.81
		(1.18)	(1.34)	(1.11)	(2.06)	(2.23)	(1.58)
.448	14.0	3.21	3.42	3.52	3.69	4.26	4.41
		(.972)	(1.09)	(.959)	(1.11)	(1.37)	(1.20)
.561	11.2	3.08	3.14	2.99	2.32	2.32	2.63
		(.931)	(1.00)	(.814)	(.7020	(.745)	(.716)
.673	9.33	2.26	2.27	2.22	1.81	1.63	1.58
		(.685)	(.729)	(.605)	(.548)	(.526)	(.431)
.785	8.00	1.18	1.21	1.04	.627	.639	.862
		(.357)	(.390)	(.381)	(.189)	(.205)	(.234)
.897	7.00	1.04	.908	.946	.711	.544	.596
		(.316)	(.291)	(.257)	(.215)	(.174)	(.162)
1.00	6.22	.730	.700	.713	.658	.602	.541
		(.220)	(.224)	(.194)	(.199)	(.193)	(.147)
1.12	5.6	.599	.519	.548	.423	.361	.405
		(.181)	(.1660	(.149)	(.130)	(.116)	(.112)
1.23	5.09	.478	.439	.463	.320	.291	.336
		(.144)	(.140)	(.126)	(.097)	(.093)	(.091)
1.34	4.66	.474	.439	.437	.462	.390	.360
		(.143)	(.141)	(.118)	(.139)	(.125)	(.098)
1.45	4.30	.465	.425	.389	.359	.353	.355
		(.140)	(.136)	(.105)	(.108)	(.113)	(.966)
1.57	4.00	.281	.257	.274	.354	.326	.324
		(.085)	(.082)	(.074)	(.107)	(.104)	(.088)
1.68	3.73	.197	.157	.177	.330	.294	.264
		(.059)	(.050)	(.048)	(.099)	(.094)	(.071)
1.79	3.50	.175	.129	.133	.162	.133	.164
		(.053)	(.041)	(.036)	(.049)	(.042)	(.044)
1.90	3.29	.134	.107	.122	.127	.095	.124
		(.040)	(.034)	(.033)	(.038)	(.030)	(.033)

Table 1A Continued

Frequency	Period	Singapore			Malaysia		
		Bartlett	Tukey	Parzen	Bartlett	Tukey	Parzen
2.01	3.11	.172	.140	.140	.210	.168	.154
		(.052)	(.045)	(.038)	(.063)	(.054)	(.041)
2.13	2.94	.187	.168	.159	.194	.175	.180
		(.056)	(.054)	(.043)	(.058)	(.056)	(.049)
2.24	2.80	.176	.158	.153	.213	.199	.211
		(.053)	(.050)	(.041)	(.064)	(.063)	(.057)
2.35	2.66	.150	.127	.122	.288	.274	.250
		(.045)	(.040)	(.033)	(.087)	(.088)	(.068)
2.46	2.54	.097	.073	.085	.267	.251	.234
		(.029)	(.023)	(.023)	(.080)	(.080)	(.063)
2.58	2.43	.087	.064	.074	.175	.161	.181
		(.026)	(.020)	(.020)	(.053)	(.051)	(.049)
2.69	2.33	.118	.091	.089	.174	.152	.174
		(.035)	(.029)	(.024)	(.052)	(.049)	(.047)
2.80	2.24	.121	.106	.105	.239	.229	.213
		(.036)	(.034)	(.028)	(.072)	(.073)	(.057)
2.91	2.15	.138	.118	.120	.261	.239	.216
		(.041)	(.037)	(.032)	(.079)	(.076)	(.058)
3.02	2.07	.148	.038	.137	.162	.156	.167
		(.045)	(.044)	(.037)	(.049)	(.050)	(.045)
3.14	2.00	.171	.153	.145	.150	.116	.137
		(.073)	(.069)	(.056)	(.064)	(.052)	(.052)

Asymptotic standard errors in parenthesis

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