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Keywords

among, hold, interdependence, parity, rate, interest, real, does, nations, g7

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Real Interest Rate Interdependence Among the G7 Nations: Does Real Interest Parity Hold?

Abstract: We evaluate the extent of real interest rate interdependence among three month treasury bill rates of the G7. Monthly data over the period 1970(1) to 2003(12) is subjected to recursive estimation of a cointegrating equation. The evidence suggests a high degree of interdependence between the G7 interest rates with the degree of integration increasing over the sample period. Tests for parameter constancy highlight the disruptive effects of the first oil price shock although the impacts on financial markets of September 11 and the Asian crisis have limited impacts. The evidence for the presence of a leading nation among the G7 is inconclusive. The high degree of interdependence between the G7 financial markets suggests that capital between the G7 is highly mobile.

JEL Classification: G 15: International Financial Markets

Keywords: integration, real interest parity, beta constancy, strong exogeneity

1. The Significance of Real Interest Parity (RIP) Among the G7

The objectives of this study are fourfold: to determine if a long run relationship exists between the G7 real interest rates; to see if the degree of interdependence among the G7 has increased over the sample period 1970(1) to 2003(12); to identify any instability in the real interest rate relationships among the G7 and to determine if a leading series exists among the G7 real rates. The G7 nations are chosen as the basis for this analysis because the financial behaviour of these seven leading economies are of critical importance to the smaller non member G7 nations which rely on the stability of the G7 for their own financial harmony. The more integrated are the G7s capital markets, the less likely it is that international transactors will have opportunities to diversify away systemic risk by trading at different real rates in individual G7 markets. Therefore it seems that an analysis of financial market integration focused on the G7 group is of great interest to policy makers and transactors outside the G7. Real interest parity (RIP) is chosen as an empirical basis for studies of market integration because RIP provides a direct test of the proposition that capital markets are integrated.

The remainder of this paper is organised in the following manner: Section 2 examines the previous literature. Section 3 details the methodological basis and its theoretical underpinnings, Section 4 defines the properties of the data set and discusses the major results of the study and in Section 5 the implications of the study are discussed.

2 Previous Studies

Tests for the presence of the RIP condition between the G7 countries or individual G7 countries with others outside the G7 have been carried out by Cumby and Mishkin

(1986), Cavaglia (1992), Felmingham, Zhang and Healy (2000), Fountas and Wu (1999), Fujii and Chinn (2001), Dreger and Schumaker (2003), Wu and Fountas (2000), Chung and Crowder (2004), Holmes (2005) among others.

Dreger and Schumaker, use monthly data over the sample period (1980:1 to 1998:12) applied to a cross section of G7 3 month term to maturity nominal interest rates. They base their tests for RIP on the differences between equivalent nominal rates in different countries. The US is treated as the foreign country in all of these bivariate studies. Dreger and Schumaker reject RIP between the US and each of the remaining G7 nations basing their analysis on weak form tests for stability and do not take into account the impact of shocks, generally and in particular those generated by the Asian crisis in 1997 or by September 11th 2001. The Dreger and Schumaker data set truncates prior to the occurrence of these two events. Wu and Fountas(WF) (2000) overcome the first of these problems by allowing for structural breaks. The Gregory and Hansen (1996) test is used to test for the bivariate cointegration of G7 short term real interest rates subject to a non predetermined structural break. The Wu and Fountas study is based on a time series covering the period 1974 to 1995 and produces strong evidence in favour of bilateral interest rate convergence between the US and several of the remaining G7 countries particularly at the short end of the capital market. However, Canadian and UK long run rates are not influenced by equivalent US rates so that these countries can expect an independent domestic monetary policy to act as a stabilisation tool in relation to these domestic economies.
Cavaglia (1992) is one noteworthy study which finds evidence in support of the presence of RIP. By applying a Kalman filtering technique Cavaglia finds that ex ante real interest differentials are relatively short lived and mean reverting to zero

suggesting that RIP holds in a long run steady state. Fujii and Chinn (2001) conduct a direct test of the RIP condition among the G7 countries at both the long and short term end of the maturity spectrum. They use quarterly data for the period 1976(1) to 2000(1) for short term maturities and for the long term they consider the period dating from 1973(1) to 2000(1). Fujii and Chinn find evidence for the presence of RIP at the longer end of the maturity spectrum although the evidence is much weaker at the short term end. Chung and Crowder (2004) also reject RIP over the long run (1960-1996) and explain the failure of RIP in terms of the failure of uncovered interest parity. Finally, Holmes (2005) finds strong coherence of real interest rate movements among European Union members.

These previous studies provide a motivation for the present one. We will focus on the short term end of the maturity spectrum, given Fujii and Chinn's lack of support for RIP at that end. Neither Wu and Fountas or Dreger and Schumaker consider capital market events occurring beyond 1995 and 1998 respectively. Therefore we extend the data set to the end of 2003 and accommodate the impacts of some major disturbances on the integration of G7 capital markets. Included here are the two oil price shocks occurring in 1974 and 1979; the effects of policy reactions to the 1981 and 1990 recessions; the Asian currency crisis and September 11, 2001. It is possible that such events distort a long term underlying relationship between equivalent short term real rates of interest among the G7 nations. To capture the extent of these effects and the nature of the long run relationship between G7 real rates, we use cointegration techniques in particular those based on recursive estimation which allows for consideration of increasing degrees of integration and of parameter inconstancy.

3 Research Design

The Johansen (1988) and Johansen and Juselius (1990) model is used to test for the presence of cointegration in both bivariate and multivariate cases and these models form the basis of our tests for RIP among the G7. The Johansen (1988) and Johansen and Juselius (1990) model takes the following form:

$$\Delta r_t = \mu + \sum_{i=1}^{p-1} \Gamma_i \Delta r_{t-i} + \gamma r_{t-1} + e_t \qquad (1)$$

Where r_t is a $(n*1)$ column vector of p real interest rates, i the number of lags, μ is an $(n*1)$ vector of constant terms, Γ is a coefficient matrix, e_t is a vector of Gaussian error terms. The cointegration hypothesis is formulated as follows:

$$H_1(q) : \gamma = \alpha\beta' \qquad (2)$$

where α and β are $p \times q$ matrices of full rank. The Johansen approach requires estimation of the above equation and the residuals are then used to compute two likelihood ratio tests for the determination of the number of cointegration vectors: the trace test and the maximum eigenvalue test.

The maximum eigenvalue statistic is defined in the following:

$$\lambda_{max} = - T \ln (1 - \lambda_{r+1}) \qquad (3)$$

where $\lambda_{r+1}, \ldots \lambda_n$ are the n-r smallest squared canonical correlations among the G7 rates of interest and T= the number of observations. The second test is based on the trace statistic. This statistic is given in the following expression (4).

$$\lambda_{trace} = -T \Sigma \ln (1 - \lambda_i) \qquad (4)$$

The approach adopted here in testing for an increasing degree of interdependence is based on the time path plot of Trace statistics derived from the recursive estimation of the cointegrating equation (1). This process is described by Hansen and Johansen (1999) and involves a base period estimate of the cointegration estimate using some of the sampled observations. Our base period is a monthly time series over the period 1970(1) to 1973(12): thirty six observations in all. Then, holding the short run parameters of the cointegration vectors constant at their full sample values, the recursive estimation proposed by Hansen and Juselius (2002, p.50-64) is conducted. To capture the effects of shocks associated with the instability of the slope coefficients (the constancy of β) is tested by applying the Hansen and Johansen (1999) procedure. A likelihood ratio test is constructed by comparing the likelihood function from each recursive sub sample with the restriction that the cointegration vectors estimated from the full sample fall within the space spanned by the estimated vectors of each individual recession. The test statistic is chi square distributed with $p-r$, r degrees of freedom.

Having found that there is cointegration among G7 short term real rates of interest, it is of interest to pursue the notion that there is among the G7 capital markets a leader. This requires the specification of criteria defining the notion of a leading country, generally, these characteristics of strong exogeneity provide a reasonable set of criteria for leadership. This criteria depends in the first place on the presence of weak exogeneity evidenced by the fact that the loading factor, or speed of adjustment parameter is zero in estimation. Having distinguished the weakly exogenous time series from those which are not, we proceed to determine if the weakly exogenous series are Granger non-causal and therefore strongly exogenous. If we were to find that only 1 of the 7 individual series were strongly exogenous, then we identify this series to be the market leader among the G7.

The general form of the VECM used for this purpose can be expressed as follows:

$$\Delta r_t = \omega_t + \alpha \quad ECT_{t-1} + \sum_{j=1}^{p-1} \phi \ \Delta r_{t-j} + \sum_{j=1}^{p-1} \varphi \quad \Delta r^*_{t-j} + \varepsilon_t$$

The strong exogeneity test involves a weak exogeneity test and Granger non causality. Δr^* does not cause Δr if the null $H_0 = \varphi = \alpha = 0$ is not rejected.

4. Is the G7 Integrated?

4.1 Properties of the Data Set

The data used are three month treasury bill rates for all countries – the US, Japan, UK, Germany, France, Canada and Italy. All data are obtained from *Global Financial Data.* The data is monthly and covers the period 1970.1 to 2003.12. Real interest rates are calculated as $i - \pi$. The stationarity property of the data are examined in order to determine the suitability of the individual series for a contegrative study. Table 1 presents results for unit root tests. The results suggest that all interest rate series are non stationary at the 5 percent level with the exception of the France and US series which are non stationary at the 10% level under the ADF test and is equal to the critical value at the 10% level under the KPSS test. However, all the data series are I(0) in first differences.

[Table 1, about here]

4.2 *Real Interest Parity Holds?*

We address this issue in the process of analysing the results of both bivariate and multivariate cointegration studies. The results for the multivariate tests are shown on Table 2. See the Appendix for results of the bivariate tests. The bivariate studies indicate evidence of cointegration for 18 of 21 pairs of G7 3 month treasury bill rates according to both the trace and eigenvalue statistics or either the trace or eigenvalue statistic. The results of tests for multivariate cointegration confirm these bivariate findings. From Table 2, the eigenvalue and Trace tests each for the multivariate study indicate the presence of four cointegrating vectors at the 95 percent confidence level. However, there are six cointegration vectors among the 3 month treasury bill series for the G7 nations at the 90 percent confidence level. The bivariate and multivariate cointegration tests suggest that the G7 has evolved as a closely integrated capital market.

4.3 Does Interdependence between the G7 Increase Over Time?

Now that we have discovered some evidence for the existence of closely integrated treasury bill rates among the G7, nations it is interesting to examine how the degree of interdependence has changed over time. The time series graph of the Trace statistic derived from the recursive process is shown on Figure 1. Its time path should display an upward slope for $j \leq r$ and is constant for $j > r$, so if there is a downswing in the time path of the trace statistic for any given cointegrating vector, then some instability is indicated. This analysis of the changes in the number of cointegrating vectors present among the G7 treasury bill rates is confined to the multivariate case at the 10 percent significance level. The time path graph of the trace statistic is shown on Figure 1.

[Figure 1, about here]

The vertical axis shows the normalized values of χ^2 at the 10 percent level of significance. All potential χ^2 values are normalized on the critical value at the 10 percent level of significance which has the value 1. If an individual cointegration vector is significant at the 10 percent level it will be above the value 1 shown on the vertical axis. Applying this criterion, the period 1974 to 1980 contains only one significant cointegration vector. By 1990 the number of cointegration vectors has risen to four. Some further instability is in evidence in 1992 in the midst of the great recession dating from 1990-1993. This instability in the relationship between treasury bill rates may be explained by differing monetary policy responses to the 1990 recession. An interesting aspect of our results is the lack of any evidence supporting the view that other shocks apart from the two oil price shocks in 1975 and 1979 have impacted on G7 real interest rate interdependence. The positive slopes of the cointegration vectors resumes following the 1992 recession, so that six significant cointegration vectors are evident for the remainder of the 90s and for the early years of the new century. The integration of the G7 three month treasury bill series is practically complete by the end of the sample period in 2003.

4.4 Parameter Constancy?

The recursive test results are graphed on Figure 2.

[Figure 2 about here]

The χ^2 critical values are plotted on the vertical axis and are normalized at the 10 percent level of significance which appears at the value 1. The null hypothesis for this test requires the constancy of β at the dates shown on the horizontal axis. The inconstancy of β is indicated if the graph on Figure 2 is above the value 1. The inconstancy of β is indicated on Figure 2 over the early part of the sample, during the period from 1974(1) to 1976(12) when the critical value of the test just exceeds one (1.0267). However, parameter constancy does apply to the cointegration vectors from 1977(1) to 2003(12). This evidence about parameter inconstancy in this multivariate case is reported at the foot of Table 5.

[Table 3 , about here]

Periods of inconstancy of the slope parameters (β) of the cointegrating vectors are identified in the second column of Table 5 where it is noted that parameter inconstancy is evident for the period February 1974 to December 1976. The third column indicates that the maximum χ^2 value of the test for inconstancy at the 10 percent level was 2.577 recorded in October 1975 (75:10) while the minimum χ^2 value 1.027 occurring in December 2003 are less in value than 1 indicating that the hypothesis of parameter inconstancy be rejected in favour of parameter constancy.

There are eleven of a potential twenty one bivariate pairings which exhibit parameter inconstancy in the bivariate cointegration studies. However, parameter constancy applies across the entire sample period in ten cases as follows: UK -Germany, US-UK, Germany-Italy, Germany-UK, Germany-Canada, France-Italy, France-UK, Italy-UK, Italy-Canada and UK-Canada. The absence of parameter inconstancy in these countries reinforces the view that real interest rate linkages among the G7 nations remain relatively stable over the period January 1974 to December 2003.

4.5 Leadership

Tables 4 and 5 report the tests for weak exogeneity and Granger non-causality respectively.

[Table 4 – 5 about here]

Evidence for the presence of a leading country or countries may be gleaned from tests for strong exogeneity. If an individual real interest time series is strongly exogenous then we interpret this to mean that none of the other G7 real rate time series influence the behaviour of the one in question. Strong exogeneity requires that the individual time series be both weakly exogenous and that Granger non-causality exists, namely, that lagged values of the 6 remaining real rates have no impact on the one in question.

The results of our tests for weak exogeneity are shown on Table 4 and are based on tests of the significance of the parameter α in the error correction version of the cointegration hypothesis. The null hypothesis for this test of weak exogeneity is that $\hat{\alpha} = 0$. From Table 4 when there are 6 significant (at the 10 percent level) cointegration vectors, the calculated value of χ^2 exceeds its critical value (12.59) for each of the 7 countries. So it is appropriate in each case to reject the null hypothesis and conclude that none of the individual series is weakly exogenous.

The argument alters markedly however, if the test for weak exogeneity is applied at the 95 percent level where 3 cointegration vectors are discovered. Then applying the weak exogeneity test at $r = 3$, we find that we accept $\hat{\alpha}=0$ on four occasions for Canada, the US, the UK and Germany. In each case the critical χ^2 exceeds its estimated value and the hypothesis that $\hat{\alpha}=0$ is not rejected in these cases. The real interest rate series for these 4 nations are weakly exogenous and play no part in the error correction process. This leaves the series for Italy, France and Japan as the three series showing the burden of error correction back towards long run equilibrium.

The results in Table 5 reveals clearly that the Canadian and US series are not strongly exogenous: the variation of the Canadian real rate is caused by the German, UK and US real rates as anticipated. However, the US real rate is caused by the UK and German rates although the US rate Granger causes its Canadian equivalent. The two candidates for strong exogeneity are the UK and German real interest series. Both

Granger cause the equivalent US series but there is some fairly weak evidence (8 and 9 percent probability level) that the German and UK series cause each other. The presence of strong exogeneity for an individual time series suggests an element of independence in the behaviour of the time series possessing this attribute.

5. Conclusions

The outstanding finding from this study is that the financial markets of the G7 are closely integrated at the short term end of the maturity spectrum. This result complements the findings of Fujii and Chinn (2001) who find evidence for the presence of RIP on this occasion at the long term end of the maturity spectrum. At the 10 percent level of significance we find that the G7 real 3 month treasury bill series follow a single trend suggesting that RIP holds at the short end of the maturity spectrum as well while at the 5 percent level there are four cointegration vectors present. We find that the greatest turbulence in the financial system is caused by the first great oil price shock, while the Asian crisis and the 9/11 tragedy had an apparently minor impact. This observation raises the following question: does the source and direction of individual shocks matter for the various manifestations of instability in the financial system? A formal answer is required.

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Table 1: Unit Root Tests for Levels and First Differences of the Series

Variable	ADF	PP	KPSS
Interest Rates:		Levels	
U.S.	-2.88*	-2.54	0.36*
U.K.	-2.50	-2.17	0.81***
Canada	-1.99	-2.35	0.67**
Japan	-1.87	-2.51	0.72**
France	-2.64*	-2.42	0.69**
Italy	-1.98	-2.34	0.72**
Germany	-2.41	-2.69*	0.65**
		First Differences	
U.S.	-4.27***	-13.09***	0.059
U.K.	-13.01***	-19.60***	0.056
Canada	-6.41***	-14.94***	0.102
Japan	-6.94***	-24.30***	0.044
France	-9.19***	-15.77***	0.066
Italy	-7.40***	-16.80***	0.055
Germany	-7.02***	-16.97***	0.057

Note: Significance levels for the ADF and Phillip-Perron test without trend are : 10%, -2.58: 5%, -2.90 and 1%, -3.51
Significance levels for the KPSS test are: 10%, 0.347: 5% 0.463: 1%, 0.739 (null hypothesis: the series is stationary)
*, **, *** significant at the 10%, 5% and 1% levels respectively.

Table 2

Johansen Maximum Likelihood Cointegration Test

Null	Alternative			95% critical value		90% critical value	
		$m\lambda$	Trace	$m\lambda$	Trace	$m\lambda$	Trace
r=0	r=1	60.74	214.19	46.47	132.45	28.36	117.73
r<=1	r=2	46.43	153.45	40.53	102.56	24.63	89.37
r<=2	r=3	37.48	107.02	34.40	75.98	20.90	64.74
r<=3	r=4	35.52	69.54	28.27	53.48	17.14	43.84
r<=4	r=5	18.46	34.01	22.04	34.87	13.39	26.70
r<=5	r=6	12.86	15.55	15.87	20.18	10.60	13.31
r<=6	r=7	2.69	2.69	9.16	9.16	2.71	2.71

Table 3: Periods of β Parameter Inconstancy

Bi-Variate Pairs	β Parameter Constancy	Date of Maximum	Date of Minimum
US-Japan	Jan 74 – July 77	3.369 (75:8)	1.097 (76:12)
US-Canada	Jun 75 – Dec 75	1.120 (75:8)	1.036 (75:12)
US - Germany	July 74 – Dec 75	1.645 (75:11)	1.039 (76:7)
Canada – Japan	Jan 74 – May 90	2.937 (75:2)	0.737 (76:8)
US- Italy	Aug 75	1.036 (75:8)	1.036 (75:8)
Canada - France	Feb 74 – May 74	1.159 (74:4)	1.114 (74:5)
Japan - UK	Jan 74 – Oct 82	3.603 (80:3)	0.838 (76:11)
Japan - Germany	Jan 80 – Dec 93	2.176 (80:4)	1.008 (93:12)
Japan - France	Feb 74 – Mar 76	1.539 (75:5)	1.105 (76:3)
Japan - Italy	Jan 74 – May 75 Jan 80 – Sep 80	3.231 (74:5)	0.526 (75:8)
Germany - France	Jan 74 – July 74	1.492 (74:1)	1.035 (75:8)
Multivariate Analysis	Feb 74 – Dec 76	2.577 (75:10)	1.027 (76:12)

Table 4: Test for Weak Exogeneity $\alpha = 0$

r		ChiSq	Canada	France	Germany	Italy	Japan	UK	US
1	$H_0 : \alpha = 0$	3.84	0.00	2.16	0.00	12.16	8.06	0.23	0.81
2	$H_0 : \alpha = 0$	5.99	3.28	11.07	2.32	17.87	8.74	1.52	4.70
3	$H_0 : \alpha = 0$	7.81	4.98	11.45	2.96	19.30	10.02	1.88	6.63
4	$H_0 : \alpha = 0$	9.49	17.22	18.75	16.67	34.82	20.65	13.17	12.54
5	$H_0 : \alpha = 0$	11.07	17.91	22.81	17.52	38.32	26.18	15.81	16.13
6	$H_0 : \alpha = 0$	12.59	26.82	32.92	19.95	43.71	36.11	15.84	20.00

Table 5: Strong Exogeneity Test: $\alpha = \varphi = 0$

Null Hypothesis:	F-Statistic	Probability
$H_0 : UK \nrightarrow Canada: \ \alpha = \varphi = 0$	11.9223	9.4E-06
$H_0 : Canada \nrightarrow UK: \ \alpha = \varphi = 0$	1.47772	0.22942
$H_0 : US \nrightarrow Canada: \ \alpha = \varphi = 0$	20.7956	2.6E-09
$H_0 : Canada \nrightarrow US: \ \alpha = \varphi = 0$	1.61900	0.19941
$H_0 : Germany \nrightarrow Canada: \ \alpha = \varphi = 0$	8.23108	0.00031
$H_0 : Canada \nrightarrow Germany: \ \alpha = \varphi = 0$	2.83340	0.06001
$H_0 : US \nrightarrow UK: \ \alpha = \varphi = 0$	0.78530	0.45669
$H_0 : UK \nrightarrow US: \ \alpha = \varphi = 0$	7.21208	0.00084
$H_0 : Germany \nrightarrow UK: \ \alpha = \varphi = 0$	2.43435	0.08897
$H_0 : UK \nrightarrow Germany: \ \alpha = \varphi = 0$	2.53623	0.08045
$H_0 : Germany \nrightarrow US: \ \alpha = \varphi = 0$	4.31859	0.01395
$H_0 : US \nrightarrow Germany: \ \alpha = \varphi = 0$	2.59216	0.07613

Figure 1: Trace Statistic Time Path 1970:1 – 2003:12

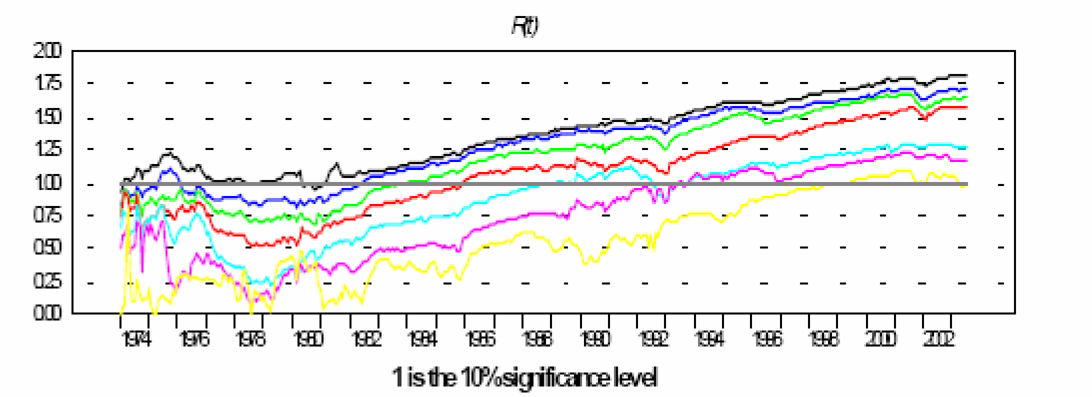
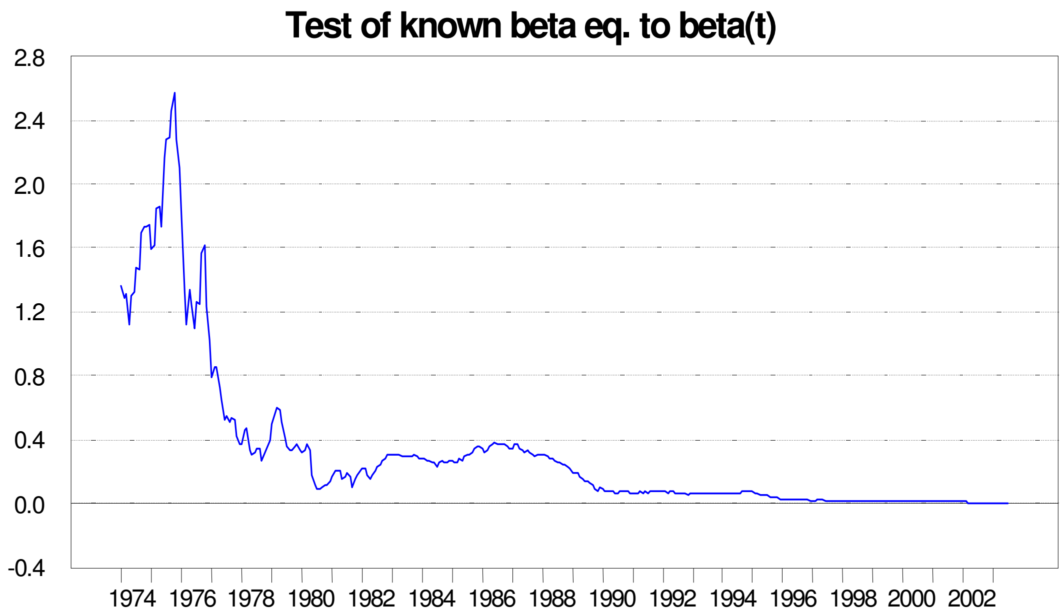


Figure 2: Beta Constancy Test



Appendix
Table A1
Johansen Maximum Likelihood Cointegration Test

Null	Alternative	mλ	Trace	95% critical value mλ	95% critical value Trace	90% critical value mλ	90% critical value Trace
		US-CANADA					
r=0	r=1	15.16	20.23	15.87	20.18	10.60	13.31
r<=1	r=2	5.07	5.07	9.16	9.16	2.71	2.71
		US- JAPAN					
r=0	r=1	14.65	18.24	15.87	20.18	10.60	13.31
r<=1	r=2	3.59	3.59	9.16	9.16	2.71	2.71
		US-UK					
r=0	r=1	18.37	21.45	15.87	20.18	10.60	13.31
r<=1	r=2	3.08	3.08	9.16	9.16	2.71	2.71
		US-GERMANY					
r=0	r=1	13.71	16.56	15.87	20.18	10.60	13.31
r<=1	r=2	2.84	2.84	9.16	9.16	2.71	2.71
		US-FRANCE					
r=0	r=1	16.74	19.54	15.87	20.18	10.60	13.31
r<=1	r=2	2.80	2.80	9.16	9.16	2.71	2.71
		US-ITALY					
r=0	r=1	17.29	19.02	15.87	20.18	10.60	13.31
r<=1	r=2	1.72	1.72	9.16	9.16	2.71	2.71
		CANADA-JAPAN					
r=0	r=1	39.12	42.06	15.87	20.18	10.60	13.31
r<=1	r=2	2.94	2.94	9.16	9.16	2.71	2.71
		CANADA-UK					
r=0	r=1	44.32	46.59	15.87	20.18	10.60	13.31
r<=1	r=2	2.27	2.27	9.16	9.16	2.71	2.71
		CANADA-GERMANY					
r=0	r=1	22.60	25.99	15.87	20.18	10.60	13.31
r<=1	r=2	3.39	3.39	9.16	9.16	2.71	2.71
		CANADA-FRANCE					
r=0	r=1	181.74	185.20	15.87	20.18	10.60	13.31
r<=1	r=2	3.46	3.46	9.16	9.16	2.71	2.71
		CANADA-ITALY					
r=0	r=1	22.99	24.77	15.87	20.18	10.60	13.31
r<=1	r=2	1.79	1.79	9.16	9.16	2.71	2.71
		JAPAN-UK					
r=0	r=1	35.98	44.76	15.87	20.18	10.60	13.31
r<=1	r=2	8.78	8.78	9.16	9.16	2.71	2.71
		JAPAN-GERMANY					
r=0	r=1	39.60	44.39	15.87	20.18	10.60	13.31
r<=1	r=2	4.49	4.49	9.16	9.16	2.71	2.71

				95% critical value		90% critical value	
		mλ	Trace	mλ	Trace	mλ	Trace
		JAPAN-	***FRANCE***				
r=0	r=1	16.06	18.90	15.87	20.18	10.60	13.31
r<=1	r=2	2.84	2.84	9.16	9.16	2.71	2.71
		JAPAN-ITALY					
r=0	r=1	47.21	49.48	15.87	20.18	10.60	13.31
r<=1	r=2	2.27	2.27	9.16	9.16	2.71	2.71
		UK-GERMANY					
r=0	r=1	24.30	9.16	15.87	20.18	10.60	13.31
r<=1	r=2	4.61	4.61	9.16	9.16	2.71	2.71
		UK-FRANCE					
r=0	r=1	20.90	24.51	15.87	20.18	10.60	13.31
r<=1	r=2	3.62	3.62	9.16	9.16	2.71	2.71
		UK-ITALY					
r=0	r=1	14.45	17.38	15.87	20.18	10.60	13.31
r<=1	r=2	2.93	2.93	9.16	9.16	2.71	2.71
		GERMANY-FRANCE					
r=0	r=1	26.78	30.24	15.87	20.18	10.60	13.31
r<=1	r=2	3.46	3.46	9.16	9.16	2.71	2.71
		GERMANY -ITALY					
r=0	r=1	23.32	27.79	15.87	20.18	10.60	13.31
r<=1	r=2	4.47	4.47	9.16	9.16	2.71	2.71
		FRANCE-ITALY					
r=0	r=1	35.37	39.07	15.87	20.18	10.60	13.31
r<=1	r=2	3.71	3.71	9.16	9.16	2.71	2.71