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Who Moved Asian-Pacific Stock Markets? A Further Consideration Of The Impact of the US and Japan

by
Robert B. Durand †
Koh Sze Kee †
Iain Watson †

Abstract:

This paper extends prior research by jointly incorporating market indices, interest rates (both short- and long-term) and spot cross exchange rates, to investigate the relationship among seven Pacific-Rim (Australia, Hong Kong, South Korea, Malaysia, Singapore, Taiwan and Thailand) markets, to changes in financial variables in the US and Japan. We find that the US stock market Granger-caused movements in all the markets being considered and that the Japanese stock market had a significant effect in half of the markets included in the study. Other financial variables play no, or little, part in influencing the markets being studied.

Keywords:

INTERNATIONAL FINANCIAL MARKETS; GRANGER CAUSALITY.

† Department of Accounting and Finance, University of Western Australia, 35 Stirling Highway, Crawley WA 6009. Email: iain.watson@uwa.edu.au

The authors would like to thank Dave Allen and Nigel Morkel-Kingsbury for their assistance in accessing data.

Australian Journal of Management, Vol. 26, No. 2, Dec 2001, © The Australian Graduate School of Management

1. Introduction

Relationships between the returns of national stock markets have been an important area of interest for finance academics and investors for over thirty years. Utilising an international, rather than national, set of assets increases the benefits of mean-variance optimisation (Shawky, Kuenzel & Mikhail 1997). Calculating covariation, however, assumes that observations are independent. A growing body of literature suggests that this assumption does not hold. US returns seem to influence the returns of other markets (Eun & Shim 1989; Phylaktis 1997; Ghosh, Saidi & Johnson 1999) and, in Ghosh et al. (1999) and Phylaktis (1999) for example, Japan is found to influence non-Japanese capital markets. The possibility of such a relationship is tantalising as it may suggest market inefficiencies (Becker, Finnerty & Gupta 1990).

This paper is primarily motivated by the fact that prior research in the area of US and Japanese influence over world markets has tended to concentrate on one, or only a few, exogenous variables' potential impact, or only one country's potential influence, or on data from only a limited period. This paper makes a timely contribution by examining these variables simultaneously, thus providing a more accurate picture of the significant drivers of price changes in the Asian-Pacific region.

This paper extends prior research by jointly incorporating the use of more than one market index, interest rates (both short and long-term) and spot cross exchange rates, to investigate the relationship among seven Asian-Pacific (Australia, Hong Kong, South Korea, Malaysia, Singapore, Taiwan and Thailand) markets to changes in financial variables in the US and Japan. In contrast to studies that tend to use daily data over a relatively short period of time, the analysis uses daily data from December 2nd 1985 to December 31st 1996. Data around and after the Asian crash of 1997 are excluded to avoid the inclusion of potentially anomalous observations in the analysis.

We find that the US stock market Granger-caused movements in all the markets being considered and that the Japanese stock market had a significant effect in half of the markets included in the study. Our results indicate that variations in the US market explain over 20% of the daily variance of the Australian and Singapore markets. In contrast to other studies, we find that other financial variables play no, or little, part in influencing the markets being studied. It would appear that variations in the American and Japanese equity markets convey the information previous studies have found for variations in interest and exchange rates. This study suggests that variables such as interest and exchange rates have significant relationships to market indices after excluding foreign stock indices as potential explanatory variables.

2. Prior Research

Previous research in the area of market interrelationships suggests that markets do move together, but there is incomplete evidence as to which market is the most influential and which leads the rest of the world. Eun and Shim (1989) investigate the international transmission mechanism of stock market movements by estimating a vector autoregression for nine markets using daily data from December 31st 1979

to December 20th 1985. They find that variations in the US are rapidly transmitted to other markets in a clearly recognisable fashion, whereas no single foreign market can significantly explain the US market movements. This suggests that the US stock market is the most influential in the world. The Japanese stock market, however, acts like a follower in international stock markets. Variations in the Japanese market fail to explain any substantial part of variations in other markets.

Using weekly data, Theodossiou and Lee (1993) and Theodossiou, Kahya, Koutmos and Christofi (1997) found that weekly market innovations in the US and other major national stock markets have a very low or insignificant impact on weekly stock prices. Moreover, correlations of returns for daily data are consistently lower than those of weekly data. The difference in findings may be attributed to the fact that trading hours in the various national stock markets do not overlap. As a result, a previous day's returns in one market are statistically related to the current returns in markets that close earlier, giving credence to the assertion of mean spillovers. The correlations of daily returns for positively related markets are biased downwards and for negatively related markets are biased upwards. These biases are, however, smaller and insignificant for weekly and monthly data (Kahya 1997).

Ghosh, Saidi and Johnson (1999) investigate the relationship of the US and Japanese markets to Asian-Pacific stock markets.[1] Their results suggest that while some markets are cointegrated with the U.S, some are now cointegrated with Japan, and others are not cointegrated with either. While their study is similar in aim, and title, to the current paper, the methodological differences are worth discussing. Ghosh et al.'s study focuses on the cointegration of two I(1) series (the Pacific-Rim market and the US or the Japanese market) and does not examine if the market in question is cointegrated with both the US and Japanese markets. In order to test the relationship of the seven markets to the US and Japanese markets, this paper employs the log transformations of daily stock price indices in the empirical tests. Using lower frequency data may result in information loss.

Phylaktis (1997) investigates the integration of Pacific-Rim financial markets and the relative influence of the US and Japan. Phylaktis finds that the ex-post real interest rates of Singapore, Malaysia, Hong Kong, Korea and Taiwan have been linked to those of the US and Japan since the 1970's; the capital market integration is greater in the latter period of the study. Examining the impact of shocks in the real rate, Phylaktis' analysis finds that the impact of changes in American real interest rates flows through the system faster than shocks to Japanese rates. This suggests that the US market is more influential than the Japanese market. In contrast, Phylaktis (1999), employing a different methodology from her 1997 paper, argues that the Japanese influence is greater than that of America.

Other empirical studies have also suggested the interest rates, such as the US Federal funds target rate, do have an impact on foreign stock markets. For example, Tan and Shrestha (1996) find that a movement of interest rates in one country conveys information beyond that contained in that variations in that country's stock market alone. Conover, Mitchell, Jensen and Johnson (1999) find that US monetary policy also influences overseas equity markets. In view of the potential impact of variations in the real rate of interest on the cost of capital and potential role of US

1. They analyse Hong Kong, India, Korea, Taiwan, Malaysia, Singapore, Thailand, Indonesia, the Philippines, the US and Japan, employing daily data from March to December 1997.

and Japanese interest rates in influencing returns in the markets being studied, this paper utilises both short and long-term interest rates in the analysis. There are a number of solid reasons for including both short and long run interest rates as exogenous variables. If nothing else, variations in interest rates represent the opportunity cost of holding equity *vis-à-vis* fixed interest investments. Interest rates also proxy for inflationary expectations, monetary policy (Conover, Michell, Jensen & Johnson 1999) and, or, future business conditions (Fama & French 1989; Chen 1991 representing seminal papers). Estrella and Hardouvelis (1991) and Estrella and Mishkin (1998) find that term structure is a leading indicator of future US economic conditions. Bernard and Gerlach (1996) and Kozicki (1997) extend these findings internationally.

Campbell and Hamao (1992) examine the question of the integration of the Japanese and American markets, hypothesising that co-movement between expected returns in these markets would be a sign of common exogenous factors determining equilibrium returns. Using monthly data from January 1970 to March 1990, they find, consistent with the hypothesis of common determinants of equilibrium returns, that similar factors may be used to forecast excess returns in both countries.

Karolyi, Stulz and Stulz (1996) examine four years of daily return data for Japanese ADRs and a matched sample of US stocks with a view to examining the determinants of co-movements between the stocks. They find that co-movements are high when the returns of the respective indices are both high. They find little support for a relationship of co-movements with macroeconomic announcements, interest rates or industry effects.

Studies such as Izan, Jalleh and Ong (1991) and Roll (1992) have suggested that exchange rates are important in explaining the differences in return volatility and return correlations between countries. The analysis in this paper will also include the potential impact of changes in the exchange rate on the indices being studied.

The literature suggests that there are influences by major markets on minor markets, such as those in the Asian-Pacific region. These studies, however tend to focus on a limited number of variables in isolation. This paper makes a timely contribution by examining these variables simultaneously, thus providing a more accurate picture of the significant drivers of price changes in the Asian-Pacific region.

3. Data and Methodology

3.1 Data Sources

Equity data were obtained for the major stock indices for the countries in the study for the period December 2nd 1985 to December 31st 1996[2] and validated against various issues of the Financial Times. The stock market indices used are widely followed and detailed in the appendix, table A. These were chosen after discussions with practitioners. American and Japanese interest rate data were also obtained from Datastream (details may be found in the appendix, table B). Cross rates were

2. Whenever the stock markets are closed on weekdays due to holidays, the price of the previous business day is taken to be the price for the date of the holiday.

calculated from exchange rate data on closing quotes obtained from the Federal Reserve.[3]

3.2. Resolving the Effect of Time Zone Differences

A major complication encountered in any analysis of the international transmission mechanism of stock market movements, is the problem of non-contemporaneous markets. Eun and Shim (1989) suggest that a common approach to overcome this problem has been to carefully examine the structure of the time differences and then explicitly incorporate the implications into the interpretation of the empirical results. This approach is followed in this paper, hence the first step is to examine the structural time differences.

Most of the sample countries we study are, exactly or approximately, in the same time zone, which minimizes the non-contemporaneous markets problem. However, the fact that the US market is in a very different time horizon from its Pacific-Rim counterparts creates complications when assessing the correlation relationships between the two markets. To illustrate this, we may take the Australian market as an example. Assuming that it is 2pm (1400hours),[4] 16th November 1998 in Sydney, then the time for the Pacific-Rim countries in this study will be as follows:

Table 1

Pacific-Rim Time Comparison

Time/Date	11pm (2300 hours) 15th Nov 98	11am (1100 hours) 16th Nov 98	12pm (1200 hours) 16th Nov 98	1pm (1300 hours) 16th Nov 98	2pm (1400 hours) 16th Nov 98
Country/Cities	New York	Bangkok	Hong Kong Kuala Lumpur Singapore	Tokyo Seoul	Sydney

Let us suppose that the Australian stock market (or any other Pacific-Rim market) is influenced by developments in the US stock market. Considering that on November 16th 1998 the Australian stock market is closed before the US stock market opens, it will not be able to respond to a US shock in the same day. Instead, it would respond to the US shock with a one-day lag. In an efficient market, the Australian stock market will respond to a shock in the US markets with a one-day lag. However if the US market is influenced by developments in the Australian market, the former should respond to an Australian shock in the same day. This is because the trading hours of the Australian market precede those of the US, providing the latter with an opportunity to react without delay. Similarly, since Japan and Australia are almost of the same time horizon, if the Australian market is influenced by the developments in the Japanese market, the former should respond

3. http://www.bog.frb.fed.us/rnd.htm.
4. Ignoring adjustments for daylight savings.

to a Japanese shock in the same day. This structure also applies to the Pacific-Rim markets that are influenced by the developments in the Japanese market.

3.3 Statistical Analysis

Autocorrelations of the nature reported in table 2 are problematic for econometricians. To ensure that valid inferences could be made from the regressions, two steps were undertaken to ensure the regression equations reported in the results section (tables 4, 5 & 6) possessed well-behaved (i.i.d.) residuals. Firstly, O.L.S. regressions were estimated using the exogenous variables. Using the analysis with only US variables to illustrate the procedure followed, the following regression was calculated:

$$R_t^C = \alpha + \beta_1 R_{t-1}^{US} + \beta_2 S_{t-1}^{US} + \beta_3 L_{t-1}^{US} + + \beta_4 D_t + \varepsilon_t \qquad (1)$$

where: R^C_t = the log difference of the Pacific-Rim stock market index from the previous night's close in market (country 'c');

R^{US}_{t-1} = the log difference in the S & P index;

S^{US}_{t-1} = the log difference in US short-term interest rates;

L^{US}_{t-1} = the log difference in US long-term interest rates;

D_t = a dichotomous variable that takes the value of 1 if it is Monday in the Pacific-Rim market and zero in all other cases; and

ε_t = an i.i.d. error term.

If the null of uncorrelated error was rejected in equation 1, lagged values of the exogenous variables were included in the regressions until the hypothesis of no autocorrelation could not be rejected. It was found that adding lagged values of exogenous variables, mostly the local market or the US market, dealt with the problem in the most parsimonious fashion. Secondly, once the autocorrelation was removed, the residuals were analysed for conditional heteroskedasticity. If this was present, the regression was then estimated assuming an ARCH(1) (Autoregressive Conditional Heteroskedasticity) process (Engle 1982). Thus, the regressions reported in table 4 will take the form of:

$$\begin{aligned} R_t^C &= \alpha + \sum_{t=-1}^{n} \beta_t R_t^{US} + \sum_{t=-1}^{n} \beta_t R_t^C \; \beta_2 S_{t-1}^{US} + \beta_3 L_{t-1}^{US} + \beta_4 D_t + \varepsilon_t \\ \varepsilon_t \big| \Psi_{t-1} &\sim N(0, h_t) \\ h_t^2 &= \gamma_0 + \gamma_i \varepsilon_{t-1}^2 \end{aligned} \qquad (2)$$

The regressions in table use Japanese, rather than US, variables and those in table 6 use both US and Japanese variables.

While other volatility models might better describe the distribution of the residuals, our experience has been that more elaborate specifications do not materially affect the inferences that may be drawn from the estimated regression coefficients and the associated confidence intervals. Only in the case of Malaysia, where the assumption of a normal distribution for the error terms did not appear to

hold, was this approach modified. In this case, the estimation of the ARCH process was derived under the assumption that the conditional errors were drawn from a *t*–distribution (Bollerslev 1987).

4. Results

Table 2 presents summary statistics for the time series used in the regression analyses reported below. The Box-Ljung (Ljung & Box 1978) test could not reject the null hypothesis of no autocorrelation in all the stock markets being analysed (as dependent variables in the regressions reported below) save Malaysia. While this may be due to the data departing from normality, the hypothesis was also rejected, once again for all markets other than Malaysia, using the non-parametric runs test (Siegel & Castellan 1988). We suggest that this finding may be due to institutional features. Houthakker and Williams (1996), for example, provide a comparable analysis for the US and find less evidence of autocorrelation as it becomes easier to exploit weak form inefficiency (e.g. as derivatives become available that facilitate exploitation of such inefficiency). Autocorrelation in the market indices may also be a function of infrequent trading of their constituents.

For the local independent variables, the analysis of US dollar and Yen exchange rates reported in table 2 for the countries being analysed also tends to reject the null hypothesis of no autocorrelation, save in the case of the dollar/Yen rate. In some cases, the parametric and non-parametric tests for autocorrelation of exchange rates provide mixed results. Parametric and non-parametric tests for autocorrelation of Japanese interest rates also provide conflicting results. The hypothesis that US short-term interest rate changes are autocorrelated cannot be rejected, while the hypothesis concerning long-term rates may be rejected.

The correlations between variables are reported in table 3. Seventy-two of the reported correlations are greater than 10%. Approximately 70% of these correlations are between currencies. Many of the higher correlations are also between equity indices. We find, for example, that all the markets save Korea and Japan have strong positive correlations with the United States. Using the 10% benchmark, we do not find high correlations between the Japanese index and other markets. The correlation matrix would also suggest that currencies have low correlations with movements in the markets being studied.

Table 2
Summary Statistics

	Australia			Hong Kong			Korea			Malaysia			Singapore		
	Share Index	Exchange Rates		Share Index	Exchange Rates		Share Index	Exchange Rates		Share Index	Exchange Rates		Share Index	Exchange Rates	
		Dollar	Yen		Dollar	Yen		Dollar	Yen		Dollar	Yen		Dollar	Yen
Mean	0.00031	–0.00006	0.00014	0.00072	0	0.00019	0.00051	–0.00002	0.00018	0.00054	0.00001	0.00021	0.00044	–0.00015	0.00005
Std. Deviation	0.01047	0.00567	0.00838	0.01637	0.00045	0.00646	0.01358	0.00144	0.00661	0.01401	0.00249	0.00620	0.01344	0.00243	0.00579
Maximum	0.05598	0.04316	0.05072	0.08895	0.00411	0.03392	0.08187	0.01438	0.03674	0.11062	0.02738	0.03076	0.15481	0.01348	0.03170
Minimum	–0.28761	–0.04744	–0.04564	–0.40542	–0.00432	–0.03220	–0.08380	–0.01221	–0.03353	–0.17067	–0.02133	–0.02754	–0.29186	–0.02205	–0.02636
Autocorrelations Lags															
1	0.104**	0.035	0.037*	–0.008	–0.142**	0.033	0.024	–0.012	0.011	0.142	0.032**	0.024	0.191**	–0.099**	–0.001
2	–0.06**	–0.038*	–0.004	–0.002	–0.037**	0.013	0.039*	0.013	0.007	–0.003	–0.001**	0.001	–0.061**	–0.036**	0.012
3	0.073**	–0.05**	–0.022	0.072**	–0.012**	–0.001	0.01*	–0.02	–0.008	–0.009	0.004**	–0.002	0.011**	–0.005**	0.001
4	0.112**	–0.012**	0.011	0.015**	–0.035**	0.001	0.02	0.055*	–0.002	0.019	–0.026**	0.001	0.048**	0.028**	0.004
5	0.063**	0.016**	0.009	0.023**	–0.004**	–0.003	0.009	0.101**	0.003	0.046	–0.011**	–0.009	0.02**	0.044**	–0.013
Runs Test *Z*–Score	–6.028**	0.707	–0.967	–2.53*	3.489**	1.544	–4.675**	–6.603**	2.95**	–6.549	–0.4**	2.085*	–6.028**	2.778**	2.765**

	Taiwan			Thailand			Japan				U.S.A.		
	Share Index	Exchange Rates		Share Index	Exchange Rates		Share Index	Exchange Rates	Interest Rates		Share Index	Interest Rates	
		Dollar	Yen		Dollar	Yen		Dollar	Short	Long		Short	Long
Mean	0.00076	–0.00013	0.00007	0.00061	–0.00001	0.00019	0.00014	–0.00020	–0.00105	–0.00034	0.00046	–0.00015	–0.00015
Std. Deviation	0.02139	0.00204	0.00663	0.01522	0.00282	0.00662	0.01317	0.00649	0.10341	0.01467	0.00977	0.00849	0.00939
Maximum	0.12836	0.03931	0.04832	0.08663	0.07331	0.07541	0.12430	0.03366	1.50408	0.17589	0.08709	0.14660	0.10878
Minimum	–0.10288	–0.02286	–0.03366	–0.09295	–0.07408	–0.06379	–0.16135	–0.03392	–1.44692	–0.27975	–0.22833	–0.14310	–0.13121
Autocorrelations Lags													
1	0.095**	0.032	0.008	0.17**	–0.412**	–0.1**	0.015	0.037*	–0.481**	–0.001	0.033	0.007	0
2	0.072**	0.036*	0.016	0.03**	0.011**	–0.012**	–0.067**	0.012	–0.013**	–0.001	–0.056**	0.009	0
3	0.064**	0.024*	–0.01	0.056**	–0.013**	–0.012**	0.006**	–0.002	0.12**	–0.001	–0.034**	0.003	0
4	0.037**	0.07**	0.003	0.043**	–0.006**	0.001**	0.039**	–0.001	–0.17**	–0.001	–0.039**	0.014	–0.003
5	0.009**	0.083**	–0.003	0.019**	0.014**	0.009**	–0.027**	–0.001	0.103**	0.045	0.054**	0.013	–0.085**
Runs Test *Z*–score	–4.453**	–9.635**	1.265	–6.214**	1.75	4.835**	–0.758	1.927*	1.044	5.932**	–0.298	0.759	5.432**

Note: ** Indicates statistical significance at the 0.01 level; and
* Indicates statistical significance at the 0.05 level.

Table 3
Correlations

This table reports correlations between the markets in the Asian-Pacific markets, lagged overnight changes in the S&P 500 index (US stocks) the overnight change in the local currency value of the Japanese Yen (Yen), the overnight change in the local currency value of the US dollar (USD), the change in Japanese three month rate (middle rate) (Japanese short), the change in Japanese Government long-term bond yields (Japanese Long), the overnight change in US Federal Funds target rate (middle rate) (US short rates) and the overnight change in US 10 year Government bond yields (US Long rates).

	Australia			Hong Kong			Korea			Malaysia			Singapore		
	Local Index	USD	YEN	Local Index	USD	YEN	Local Index	USD	YEN	Local Index	USD	YEN	Local Index	USD	YEN
Australia															
Local Index	1	–0.043	–0.036	0.329	0.001	–0.008	0.089	–0.018	–0.019	0.335	–0.013	–0.016	0.494	–0.019	–0.019
USD		1	0.604	–0.023	0.027	–0.112	–0.044	0.024	–0.052	–0.041	0.129	–0.001	–0.026	0.176	–0.030
YEN			1	–0.038	–0.052	0.723	0.011	0.008	0.455	–0.033	–0.068	0.559	–0.056	–0.226	0.679
Hong Kong															
Local Index				1		0.005	–0.027	0.071	–0.069	–0.071	0.387	–0.055	–0.063	0.465	–0.032	–0.048
USD					1	–0.023	0.010	0.020	–0.039	–0.001	0.046	–0.041	0.000	0.112	–0.037
YEN						1	0.053	–0.009	0.612	–0.006	–0.194	0.698	–0.048	–0.428	0.874
Korea															
Local Index							1	–0.072	–0.025	0.143	–0.024	0.026	0.109	–0.060	0.025
USD								1	0.784	–0.065	0.137	0.091	–0.086	0.035	0.007
YEN									1	–0.055	–0.014	0.505	–0.097	–0.242	0.548
Malaysia															
Local Index										1	–0.053	–0.044	0.647	–0.038	–0.027
USD											1	0.565	–0.095	0.521	0.064
YEN												1	–0.109	0.015	0.782
Singapore															
Local Index													1	–0.044	–0.077
USD														1	0.061
YEN															1

Table 3 Cont.

	Taiwan			Thailand			Japan				USA		
	Local Index	USD	YEN	Local Index	USD	YEN	Local Index	USD	Long Rates	Short Rates	Local Index	Long Rates	Short Rates
Australia													
Local index	0.146	–0.008	–0.011	0.247	–0.005	–0.009	0.039	0.008	–0.060	0.019	0.574	–0.015	0.013
USD	0.009	0.053	–0.087	–0.034	0.082	–0.019	0.002	0.113	–0.009	0.018	0.029	0.016	–0.006
YEN	–0.004	–0.036	0.675	–0.031	–0.044	0.495	–0.016	–0.723	0.005	0.005	–0.020	0.003	–0.026
Hong Kong													
Local index	0.105	–0.042	–0.043	0.288	–0.021	–0.037	0.088	0.027	–0.029	0.021	0.239	0.049	0.021
USD	0.003	0.019	–0.077	0.005	0.043	–0.031	–0.028	0.088	0.019	0.018	0.016	0.007	0.007
YEN	–0.013	–0.089	0.915	–0.009	–0.123	0.635	–0.024	–0.998	0.015	–0.008	–0.050	–0.010	–0.026
Korea													
Local index	0.075	–0.032	0.037	0.155	–0.022	0.021	0.006	–0.052	–0.017	0.024	0.077	–0.033	0.027
USD	–0.012	0.093	0.027	–0.079	0.112	0.079	0.035	0.011	0.022	0.090	–0.015	0.006	0.000
YEN	–0.017	0.017	0.591	–0.069	0.010	0.457	0.014	–0.613	0.026	0.065	–0.043	–0.001	–0.017
Malaysia													
Local index	0.126	–0.113	–0.051	0.346	–0.074	–0.062	0.027	0.006	–0.044	–0.003	0.335	0.009	0.008
USD	–0.014	0.202	–0.106	–0.037	0.378	0.150	0.004	0.197	–0.021	0.085	–0.016	–0.002	0.005
YEN	–0.021	0.072	0.694	–0.035	0.170	0.644	–0.015	–0.698	–0.003	0.054	–0.054	–0.010	–0.019
Singapore													
Local index	0.148	–0.051	–0.066	0.373	–0.049	–0.073	0.012	0.048	0.006	0.012	0.467	0.005	0.026
USD	0.012	0.161	–0.349	–0.023	0.347	–0.048	–0.009	0.434	–0.012	0.044	–0.005	–0.016	0.006
YEN	–0.008	–0.013	0.827	–0.023	0.049	0.677	–0.029	–0.873	0.008	0.013	–0.059	–0.020	–0.026

Table 3 Cont.

	Taiwan			Thailand			Japan				USA		
	Local Index	USD	YEN	Local Index	USD	YEN	Local Index	USD	Long Rates	Short Rates	Local Index	Long Rates	Short Rates
Taiwan													
Local index	1.000	–0.024	–0.022	0.158	–0.007	–0.014	0.006	0.013	–0.013	–0.008	0.127	–0.021	0.018
USD		1.000	0.314	–0.021	0.126	0.032	–0.018	0.090	0.012	0.023	–0.009	–0.027	0.003
YEN			1.000	–0.017	–0.069	0.618	–0.028	–0.917	0.018	0.000	–0.052	–0.021	–0.024
Thailand													
Local index				1.000	0.012	0.002	0.008	0.010	–0.004	0.015	0.236	0.007	–0.002
USD					1.000	0.687	–0.016	0.126	–0.040	0.010	–0.004	–0.013	0.001
YEN						1.000	–0.028	–0.634	–0.022	0.000	–0.040	–0.018	–0.019
Japan													
Local index							1.000	0.022	–0.002	0.005	–0.007	0.013	0.022
USD								1.000	–0.014	0.010	0.051	0.010	0.027
Long rates									1.000	0.007	–0.026	0.026	0.007
Short rates										1.000	0.023	–0.001	–0.001
USA													
Local index											1.000	–0.061	–0.002
Long rates												1.000	0.001
Short rates													1.000

The regression results that analyse the impact of US variables on changes in prices of the Pacific-Rim indices being considered may be found in table 4. In Japan, however, none of the variables was found to be significant. As for the other markets, the null hypothesis that the US market had no positive effect can be rejected at conventional levels. In the case of Australia and Thailand, there is also evidence that it is not just the overnight change that is significant: the previous night's change is also found to be significant (the effect for Australia is negative whilst for Thailand it is positive). The hypothesis that overnight changes in US interest rates have no effect also cannot be rejected, except in the case of long-term interest rates for the Hong Kong market, where a positive relationship is found. The hypothesis that changes in the overnight dollar exchange rate have no effect cannot be rejected except for Thailand (where the impact is negative) and Singapore (where the impact is positive). The analysis controls for a Monday effect[5] and finds that there is a significant negative effect in Hong Kong, Thailand, Malaysia and Singapore and a positive one for Taiwan. It is also noteworthy that several regressions report unusually high values of adjusted R^2: the value for Australia is 0.27, for Singapore 0.23, for Malaysia 0.13 and for Thailand 0.08.

The regression results analysing the impact of Japanese variables on changes in prices of the indices may be found in table 5. The values of the *F*–statistic for the Australian and Korean regressions support the hypothesis that the coefficients for each variable equal to zero cannot be rejected. The other regressions find significant variables. In Hong Kong, Thailand, Malaysia and Singapore, there is a significant negative relationship between variations in the index and changes in the US dollar value of the Yen. In contrast, in Taiwan a positive relationship to the Yen is found. Only in the case of Hong Kong and Thailand do we find a significant, and positive, relationship between the local market index and changes in the Japanese index. In Hong Kong, changes in the Japanese long bond rate are found to have a significant negative relationship to changes in the index. Other variables, such as the Monday effect and lagged changes in the local index, are found to play a similar role in these regressions as they do in the regressions using only US data. In all analyses other than the regression for Hong Kong, the values of adjusted R^2 are lower than those reported for the equations calculated using only US variables.

The regression results analysing the impact of both US and Japanese variables are reported in table 6. Comparing these results with those obtained using only US data (reported in table 4), in three cases (Australia, Hong Kong and Thailand) the values of the adjusted R^2 rise and in three cases (Malaysia, Singapore and Taiwan) its value falls. In the case of Korea, however, the *F*–statistic indicates that none of the variables is statistically significant. Clearly, in the case of Korea, the model derived using only US variables is preferred. Two other popular criteria for model selection—Akaike's Information Criteria (AIC) (Akaike 1974) and Schwarz's Bayesian Criterion (SBC) (Schwarz 1978)[6]—mostly support the choices of models made using the adjusted R^2 criterion. In no case, however, does the inclusion of Japanese variables with the US variables seem to add substantially to the explanatory power of the models.

5. Cross (1973) and French (1980) for seminal contributions to this literature. Wang, Li and Erickson (1997) argue that the effect occurs only on the fourth and fifth Mondays of the month.
6. Both the AIC and SBC are reported in tables 4, 5 and 6 as the maximised likelihood function adjusted by the dimensions of the model.

Table 4
Regressions Using US Variables Only

This table reports regressions analysing the returns of eight Asian-Pacific markets (Australia, Hong Kong, Japan, South Korea (Korea), Malaysia, Singapore, Taiwan and Thailand). The exogenous variables included in the analyses are a dummy variable taking the value 1 if it is Monday in the Pacific-Rim market and zero otherwise (Monday), the overnight change in the local currency value of the US dollar (USD), lagged returns in the local market (Local Stocks), overnight (and lagged overnight) changes in the S&P 500 index (US stocks), the overnight change in US Federal Funds target rate (middle rate) (US short rates) and the overnight change in US 10–year Government bond yields (US Long rates). In those cases where preliminary analysis indicated the presence of heteroskedasticity, the regression reported in the table is the Maximum Likelihood estimate of the returns and the ARCH model (of the form $h^2_t = \gamma_0 + \gamma_1 \varepsilon^2_{t-1}$) is reported underneath. If the error distribution process was assumed to follow a *t*–distribution, rather than a normal distribution, the estimated degrees of freedom of the *t*–distribution and the standard error of that estimate are also reported.

The study period begins on December 2nd 1985 and ends on December 31st 1996. Data was collected from Datastream and the Federal Reserve Board and validated from statistics reported in the Financial Times (London).

	Australia	Hong Kong	Japan	Korea	Malaysia	Singapore	Taiwan	Thailand
Constant	2.80x10^{-04}	0.00166	1.42x10^{-04}	2.65x10^{-04}	6.41x10^{-04}	7.84x10^{-04}	2.09x10^{-04}	1.13x10^{-03}
t–Statistic	*1.8767*	*6.3377***	*0.52165*	*0.96792*	*3.6765***	*4.1226***	*0.50925*	*4.2993***
Monday	–2.14x1000	–0.00250	1.21x10–04	4.99x10–04	–0.00191	–0.00202	0.00270	–0.00316
t–Statistic	*–0.6571*	*–4.5667***	*0.1945*	*0.83993*	*–4.8839***	*–4.8492***	*3.0545***	*–5.403***
USD (–1)	–0.02932	–0.842	0.05331	–0.20223	0.03100	0.15888	–0.24281	–0.17522
t–Statistic	*–1.2608*	*–1.3179*	*1.2817*	*–1.2101*	*0.45826*	*2.2417**	*–1.3444*	*–2.2626**
Local Stocks (–1)	0.25359	–0.01948		0.04670	0.17138	0.2086	0.10977	0.19374
t–Statistic	*11.6146***	*–0.97498*		*2.099**	*8.5756***	*14.2988***	*4.452***	*9.1211***
Local Stocks (–2)	–0.10869					4.40x10^{-04}	0.07250	
t–Statistic	*–9.3597***					*0.02697*	*3.8377***	
US Stocks (–1)	0.36914	0.66491	–0.01891	0.06754	0.28909	0.39936	0.19639	0.23523
t–Statistic	*24.7903***	*27.3527***	*–0.51737*	*2.7802***	*13.3471***	*19.7457***	*3.9499***	*10.1195***
US Stocks (–2)	–0.09894				0.00113		0.05533	0.18711
t–Statistic	*–5.1563***				*0.05263*		*1.4563*	*6.1438***
US Stocks (–3)					0.02621			
t–Statistic					*1.268*			
US Short Rates	0.01065	0.11317	0.03727	0.03057	–0.02602	0.00114	0.02340	0.00179
t–Statistic	*0.66254*	*4.4281***	*0.98919*	*1.0511*	*–1.4171*	*0.05983*	*0.59808*	*0.06756*
US Long Rates	1.55x10^{-03}	0.017806	0.00556	–0.035173	–0.02821	–0.00641	–0.02332	0.01930
t–Statistic	*0.10829*	*0.69271*	*0.09262 W*	*–1.4032*	*–1.3861*	*–0.31433*	*–0.59406*	*0.76278*

Table 4 Cont.

	Australia	Hong Kong	Japan	Korea	Malaysia	Singapore	Taiwan	Thailand
ARCH Model								
Constant	$4.23\text{x}10^{-05}$	$1.22\text{x}10^{-04}$		$1.50\text{x}10^{-04}$	$1.13\text{x}10^{-04}$	$7.04\text{x}10^{-05}$	$3.22\text{x}10^{-04}$	$1.36\text{x}10^{-04}$
t–Statistic	*22.1466***	*36.0947***		*60***	*46.5021***	*34.8515***	*40.1998***	*47.3868***
E–Squared (–1)	0.43886	0.78577		0.18056	0.53397	0.42225	0.28531	0.38673
t–Statistic	*14.0480***	*9.8480***		*6.9768***	*6.2046***	*12.4082***	*9.5040***	*8.6594***
D.F. of *t*–Distrib.					3.0035			
Asymptotic S.E					0.09496			
R–Squared (adj)	0.2705	0.01136	$-2.42\text{x}10^{-04}$	0.00230	0.12452	0.22718	0.02692	0.08174
S.E. of Regression	0.00895	0.01627	0.01318	0.01357	0.01292	0.01182	0.02111	0.01459
F–Statistic	119.945	5.7411	0.8601	1.9512	46.609	107.0814	9.8724	33.1226
p–Value	0	0	0.507	0.058	0	0	0	0
AIC	9920.4	8211.7	8405	8376.5	9089	9207.7	7153.2	8308.5
SBC	9890.6	8352.7	8387.1	8352.7	9056.2	9180.9	7123.4	8281.7

Note: ** = statistical significance at the 0.01 level;
* = statistical significance at the 0.05 level;
AIC = the Akaike information criterion (Akaike (1974));
SBC = for the Schwarz Bayesian Criterion (Schwarz (1978));
W = that the *t*–statistic has been adjusted in accordance with White (1980, 1982);
S.E = 'standard error'; and
D.F = 'degrees of freedom'.

Table 5
Regressions Using Japanese Variables Only

This table reports regressions analysing the returns of seven Asian-Pacific markets (Australia, Hong Kong, South Korea (Korea), Malaysia, Singapore, Taiwan and Thailand). The exogenous variables included in the analyses are a dummy variable taking the value 1 if it is Monday in the Asian-Pacific market and zero otherwise (Monday), the overnight change in the local currency value of the Japanese Yen (Yen), lagged returns in the local market (Local Stocks), the change in the Nikkei 225 index (Japanese Index), the change in Japanese three month rate (middle rate) (Japanese short) and the change in Japanese Government long-term bond yields (Japanese Long). In those cases where preliminary analysis indicated the presence of heteroskedasticity, the regression reported in the table is the Maximum Likelihood estimate of the returns and the ARCH model (of the form $h^2_t = \gamma_0 + \gamma_1 \varepsilon^2_{t-1}$) is reported underneath. If the error distribution process was assumed to follow a *t*–distribution, rather than a normal distribution, the estimated degrees of freedom of the *t*–distribution and the standard error of that estimate are also reported.

The study period begins on December 2nd 1985 and ends on December 31st 1996. Data was collected from Datastream and the Federal Reserve Board and validated from statistics reported in the Financial Times (London).

Table 5 Cont.

	Australia	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand
Constant	$2.90\text{x}10^{-04}$	0.00152	$4.15\text{x}10^{-04}$	$8.13\text{x}10^{-04}$	0.00109	$4.25\text{x}10^{-04}$	0.00141
t–Statistic	*1.7979*	*4.5464***	*1.6543*	*4.562***	*5.4645***	*1.0411*	*5.2655***
Monday	$-5.24\text{x}10^{-04}$	–0.00317	$4.16\text{x}10^{-04}$	–0.00188	–0.00201	0.00250	–0.00317
t–Statistic	*–1.4944*	*–4.4937***	*0.514*	*–4.6966***	*–4.7368***	*2.8228***	*–5.3558***
Yen(–1)	–0.00973	–0.10942	0.01806	–0.06853	–0.10598	–0.08646	–0.16904
t–Statistic	*–0.5651*	*–2.4601**	*0.4329*	*–2.5448**	*–3.5257***	*–1.5739*	*–4.8713***
Local Stocks (–1)	0.22692	0.18833		0.18833	0.20538	0.11099	0.20312
t–Statistic	*11.2816***	*9.6007***		*9.6007***	*11.657***	*4.5084***	*7.3603***
Local Stocks (–2)					–0.05159	0.0718	
t–Statistic					*–3.3402***	*3.806***	
Japanese Index	0.03179	0.16282	0.01552	0.023004	$-1.07\text{x}10^{-04}$	–0.01084	0.07213
t–Statistic	*2.7896***	*6.9995***	*0.7211*	*1.7910*	*–0.0083*	*–0.3311*	*3.8933***
Japanese Short	$5.15\text{x}10^{-04}$	0.00167	–0.0022	–0.00201	$-9.61\text{x}10^{-05}$	–0.00289	$1.60\text{x}10^{-04}$
t–Statistic	*0.40379*	*0.62256*	*–1.2531*	*–0.13005*	*–0.05585*	*–0.92593*	*0.07032*
Japanese Long	–0.02183	–0.04632	–0.0096	–0.01442	$-4.03\text{x}10^{-04}$	–0.02746	0.01106
t–Statistic	*–2.1563**	*–2.4121**	*–0.53098*	*–1.0903*	*–0.03371*	*–1.1418*	*0.68998*
ARCH Model							
Constant	$5.00\text{x}10^{-05}$	$2.27\text{x}10^{-04}$		$1.17\text{x}10^{-04}$	$7.73\text{x}10^{-05}$	$3.22\text{x}10^{-04}$	$1.41\text{x}10^{-04}$
t–Statistic	*45.6621***	*81.6547***		*50.2146***	*37.8922***	*40***	*58.75***
E–Squared (–1)	0.44693	0.16049		0.56582	0.45809	0.29447	0.37746
t–Statistic	*13.6843***	*6.0930***		*6.5900***	*12.9185***	*9.6865***	*10.7784***
D.F. of *t*–Distrib.				3.0104			
Asymptotic S.E				0.09729			
R–Squared (adj.)	$2.00\text{x}10^{-04}$	0.02471	$-9.17\text{x}10^{-04}$	0.02498	0.04648	0.01287	0.03193
S.E. of Regression	0.01047	0.01616	0.01359	0.01383	0.01313	0.02126	0.01498
F–Statistic	1.0825	13.1985	0.47081	11.5695	18.5915	5.7031	14.6069
p–Value	0.372	0	0.798	0	0	0	0
AIC	9678.2	7864.1	8315.7	9010.5	9045.6	7143.1	8274.6
SBC	9654.4	7843.2	8297.8	8983.7	9018.8	7116.2	8250.7

Note: ** = statistical significance at the 0.01 level;
* = statistical significance at the 0.05 level;
AIC = the Akaike information criterion (Akaike (1974));
SBC = the Schwarz Bayesian Criterion (Schwarz (1978));
S.E = 'standard error'; and
D.F = for 'degrees of freedom'.

Table 6
Regressions Using US and Japanese Variables

This table reports regressions analysing the returns of seven Asian-Pacific markets (Australia, Hong Kong, Japan, South Korea (Korea), Malaysia, Singapore, Taiwan and Thailand). The exogenous variables included in the analyses are a dummy variable taking the value 1 if it is Monday in the Asian-Pacific market and zero otherwise (Monday), the overnight change in the local currency value of the Japanese Yen (Yen), the overnight change in the local currency value of the US dollar (USD), lagged returns in the local market (Local Stocks), the change in the Nikkei 225 index (Japanese Index), the change in Japanese three month rate (middle rate) (Japanese short), the change in Japanese Government long-term bond yields (Japanese Long), overnight (and lagged overnight) changes in the S&P 500 index (US stocks), the overnight change in US Federal Funds target rate (middle rate) (US short rates) and the overnight change in US 10 year Government bond yields (US Long rates). In those cases where preliminary analysis indicated the presence of heteroskedasticity, the regression reported in the table is the Maximum Likelihood estimate of the returns and the ARCH model (of the form $h^2_t = \gamma_0 + \gamma_1 \varepsilon^2_{t-1}$) is reported underneath. If the error distribution process was assumed to follow a *t*–distribution, rather than a normal distribution, the estimated degrees of freedom of the *t*–distribution and the standard error of that estimate are also reported.

The study period begins on December 2nd 1985 and ends on December 31st 1996. Data was collected from Datastream and the Federal Reserve Board and validated from statistics reported in the Financial Times (London).

	Australia	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand
Constant	$2.41\text{x}10^{-04}$	0.00202	$2.64\text{x}10^{-04}$	$6.73\text{x}10^{-04}$	$8.13\text{x}10^{-04}$	$1.66\text{x}10^{-04}$	0.00120
t–Statistic	*1.6191*	*6.2143***	*0.96327*	*3.8302***	*4.2812***	*0.40174*	*4.5121***
Monday	$1.95\text{x}10^{-04}$	–0.00292	$5.18\text{x}10^{-04}$	–0.00194	–0.00198	0.00267	–0.00327
t–Statistic	*–0.60371*	*–5.3145***	*0.87194*	*–4.9366***	*–4.792***	*3.0377***	*–5.5931***
Yen(–1)	0.04139	–0.04749	0.00514	–0.05374	–0.06438	–0.05786	–0.13437
t–Statistic	*2.015**	*–1.3183*	*0.14036*	*–2.0193**	*–2.1724**	*–1.0365*	*–3.8284***
Yen(–2)							–0.066621
t–Statistic							*–1.7426*
USD (–1)	–0.06916	0.03203	–0.19476	0.04304	0.15486	–0.17029	–0.14676
t–Statistic	*–2.3291**	*0.04737*	*–1.1448*	*0.63655*	*2.1847**	*–0.92274*	*–1.7806*
Local Stocks (–1)	0.25088	0.02434	0.04510	0.17549	0.20931	0.113	0.17484
t–Statistic	*11.5201***	*0.78104*	*2.0236**	*8.7551***	*14.4716***	*4.5949***	*7.1538***
Local Stocks (–2)	–0.10463				–0.00307	0.06267	
t–Statistic	*–8.8454***				*–0.18678*	*3.3536***	
Local Stocks (–3)						0.06534	
t–Statistic						*3.3948***	
Japanese Index	0.02938	0.04243	0.02782	0.01559	–0.02770	–0.01431	0.06746
t–Statistic	*2.7459***	*2.426**	*1.4251*	*1.2128*	*–2.1738***	*–0.47223*	*3.525***
Japanese Short	$6.23\text{x}10^{-04}$	0.00146	–0.00217	–0.00205	$-3.15\text{x}10^{-04}$	–0.00280	$5.47\text{x}10^{-04}$
t–Statistic	*0.55241*	*0.69066*	*–1.0111*	*–1.3854*	*–0.20284*	*–0.89551*	*0.25099*
Japanese Long	–0.02330	–0.04197	–0.01146	–0.01165	–0.00430	–0.02937	0.01602
t–Statistic	*–2.3446**	*–2.7101***	*–0.71392*	*–0.88643*	*–0.36516*	*–1.2397*	*1.0569*
US Stocks (–1)	0.36966	0.53841	0.06734	0.28563	0.39293	0.18485	0.23838
t–Statistic	*24.8642***	*17.3133***	*2.7634***	*13.1452***	*19.3479***	*3.65***	*10.687***

Table 6 Cont.

	Australia	Hong Kong	Korea	Malaysia	Singapore	Taiwan	Thailand
US Stocks (–2)	–0.09274	–0.18509		-9.20×10^{-04}			0.1549
t–Statistic	*–4.8544***	*–7.1899***		*–0.04279*			*4.1137***
US Stocks (–3)				0.02786			0.08010
t–Statistic				*1.3426*			*2.7061***
US Stocks (–4)				–0.01359			
t–Statistic				*–0.66427*			
US Short Rates	0.00826	0.05860	0.03148	–0.02836	-5.96×10^{-04}	0.02171	-2.06×10^{-04}
t–Statistic	*0.50635*	*2.3069**	*1.0696*	*–1.542*	*–0.03150*	*0.55694*	*–0.00787*
US Long Rates	0.00450	0.00420	–0.03586	–0.02198	–0.00991	–0.02542	0.02467
t–Statistic	*0.31875*	*0.17218*	*–1.4312*	*–1.0807*	*–0.48652*	*–0.64923*	*0.97197*
ARCH Model							
Constant	4.18×10^{-05}	1.27×10^{-04}	1.49×10^{-04}	1.11×10^{-04}	6.97×10^{-05}	3.21×10^{-04}	1.34×10^{-04}
t–Statistic	21.8848**	25.9714**	5.9127**	44.0476**	34.5050**	40.4282**	43.3657**
E–Squared (–1)	0.44347	0.64274	0.18399	0.53449	0.43057	0.28482	0.39325
t–Statistic	14.2275**	5.8431**	6.9588**	6.0156**	12.5494**	9.5577**	8.4226**
D.F. of *t*–distrib.				3.0276			
Asymptotic S.E.				*0.09776*			
R–Squared (adj.)	0.27488	0.01422	0.00138	0.12396	0.22419	0.02651	0.08558
S.E. of Regression	0.00892	0.01625	0.01358	0.01293	0.01184	0.02111	0.01456
F–Statistic	85.1846	4.4709	1.3639	30.1582	70.5246	7.0447	29.292
p–Value	0	0	0.183	0	0	0	0
AIC	9925.2	8246.7	8374.4	9086.3	9208.3	7152.9	8319.6
SBC	9883.4	8207.9	8338.5	9038.5	9169.5	7111.1	8274.8

Note: ** = statistical significance at the 0.01 level;
* = statistical significance at the 0.05 level;
AIC = the Akaike information criterion (Akaike (1974));
SBC = the Schwarz Bayesian Criterion (Schwarz (1978))
S.E = 'standard error'; and
D.F = 'degrees of freedom'.

While the model selection criteria provide no clear criterion for the demarcation of models (save for Korea), the story presented in table 6 is consistent with, and extends, the story provided by the results using only data from either the US or Japan. In each case, overnight changes in the US market have a positive relationship with each local market. Significant lagged effects beyond the previous night's change are once again found for Australia and Thailand and, in these results, for Hong Kong as well. In addition to Hong Kong and Thailand, table 6 also reports that changes in the Japanese index have a statistically significant positive relationship to changes in the Australian index and a negative relationship to changes in the Singaporean index. The four countries found to have a negative relationship to the US dollar value of the Yen (Hong Kong, Thailand, Malaysia and Singapore), when only Japanese data were used in the analysis, still have a negative

relationship to variations in the Yen. Australia, in contrast, is found to have a positive relationship to changes in the Yen whilst in Taiwan a negative relationship is found. On the other hand, only two of the markets, Australia and Singapore, have a significant relationship to the dollar (negative in the case of Australia, positive for Singapore). As was the case when only US data was utilised, the analysis finds a statistically significant relationship between Japanese long-term interest rates and the Hong Kong index. A similar statistically significant negative relationship is also found for the Australian market. Other variables, such as the Monday effect and lagged changes in the local indices, present similar results to those presented in tables 4 and 5. The hypothesis that changes in both short and long-term US interest rates have no effect cannot be rejected, except in the case of Hong Kong. In Hong Kong, US short-term interest rates have a positive effect on the market. This contrasts with the analysis using only US data, where only long rates affected the Hong Kong market.

5. Conclusion

Studies analysing the role that the US and Japanese markets may play in Granger causing variations in Pacific-Rim markets have been motivated by concerns about weak-form efficiency, especially in what are often thought of as less developed markets. Other studies have suggested variations in US financial figures provide new information about macroeconomic or business conditions (such as monetary policy) that are subsequently incorporated into Pacific-Rim markets. Studies have also sought to determine if the US or Japanese market is the dominant force in these markets. Other researchers have concentrated on only one or two of the variables included in the empirical research reported in this paper.

Using daily data from December 1985 to December 1996 this paper has found that the US market has, on average, led Pacific-Rim markets. While it may be suggested that less developed markets are prone to take their lead from the US, the analysis suggests that the effect has been strongest in Australia and Singapore. Yet it is not the US alone that drives Pacific-Rim markets: the Japanese market also had a statistically significant relationship with four of the eight markets analysed. Overnight variations in the US markets which convey information about macroeconomic conditions, US interest rates, both short and long-term, do not seem to play a role in any market, apart from Hong Kong. This may be surprising given arguments that such data convey valuable information to investors. Perhaps such effects are more apparent using lower frequency data or, indeed, perhaps the US equity market conveys more information about how variations in US interest rates should be discounted. In contrast to this, Yen exchange rates and Japanese interest rates seem to be significant in some markets. Exchange rates are found to play a role only in some of the markets studied.

This study has utilised daily data over a relatively long period to analyse and answer broad questions about what happens on average rather than what has happened over particular periods. This paper should be regarded as an exploratory study which, we hope, motivates researchers with access to detailed national data to examine these relationships in more detail than is possible here. In particular, we have excluded data from 1997 and later as data from this period might be highly unusual. The question of whether the relationships uncovered in this paper remain

constant or change dramatically during the Asian financial crisis and its aftermath warrants a separate study.

(Date of receipt of final transcript: April 2001.
Accepted by Stephen Gray, Area Editor.)

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Appendix

Table A

National Stock Market Indices Used in the Analysis

Country	Price Index Used	Datastream Mnemonic
Australia	Australian Stock Exchange All Ordinary	AUSTALL
Hong Kong	Hang Seng	HNGKNGI
Japan	Nikkei 225 Stock Average	JAPDOWA
Malaysia	Kuala Lumpur Composite	KLPCOMP
Singapore	Singapore Straits Times (New)	SNGPORI
South Korea	Korea Stock Exchange Composite Index	KORCOMP
Taiwan	Taiwan Stock Exchange Weighted	TAIWGHT
Thailand	Bangkok S.E.T.	BNGKSET
United States	S&P 500 Composite	S&PCOMP

Table B

Interest Rate Data Used in the Analysis

Country	Interest Rates	Datastream Mnemonic
Japan	Japan Bills 3 Month-Middle Rate	JAP3MBL
	Japan Government Bond Long Term	JAPLONG
United States	US Federal Funds Target Rate-Middle Rate	USFDTRG
	US Bond Yield Government 10 Years (ECON)-Middle Rate	USAGLTB

We have chosen the Japanese 3–month bill rate as the representative short term interest rate (noting that the Japanese did not, during the time of the analysis, have a market comparable to the US T–bill market). While we do not have strictly comparable US data for the entire sample period, we have found that, when three-month data is available, the US federal funds rate is highly correlated with the three month US rate.