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Efficient markets hypothesis and daily variation in small Pacific-basin stock markets

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Abstract

Purpose – The purpose of this paper is to indicate the existence of certain time series characteristics in daily stock returns of four small Asian (Pacific basin) financial markets. It aims to study efficient capital markets (efficient markets hypothesis (EMH)) as results may infer that there are predictable properties of the time series of prices of traded securities on organized markets in Singapore, Malaysia, Korea and Indonesia.

Design/methodology/approach – The paper analyses daily variations in financial market data obtained from the Sandra Ann Morsilli Pacific-basin Capital Markets Research Center (PACAP).

Findings – The weak form efficiency test example examines the wide range of trading rules available to common investors. Some theorists try to convince everyone that the weak form of EMH is acceptable due to the weight of academic opinion. The paper finds that for short-term (daily) changes, the markets of four of the smaller Pacific-basin stock markets have predictable properties, which leads to the conclusion that the weak-form EMH does not hold for these markets.

Research limitations/implications – The study is limited to those firms and exchanges studied and the time period covered.

Originality/value – There have been all too few studies of these small financial markets up to now and there is no other study utilizing these data on the Pacific basin (Asia). The results are unique and original.

Keywords Capital markets, Pacific region, Stock markets, Time series analysis, Economic returns, South East Asia

Paper type Research paper

Purpose and background

Our purpose is to indicate the existence of certain time series characteristics in daily stock returns of four small Asian (Pacific basin) financial markets. The study does not focus on indexes of prices and returns but rather on the real stock returns of traded securities. The goal is to study whether the efficient markets hypothesis (EMH; weak form) applies in these capital markets. Stock returns refer to both the closing prices of traded securities and dividends associated with those securities. This is important for short-term forecasting of closing returns of listed securities on these and other exchanges.

Random Walk Theory states that a wise investor who throws darts at the stock listings pages of the *New York Times* has as good a chance to outperform the market. The theory first set down by the mathematician Louis Bachelier (1900) received a modern interpretation by the economist Burton Malkiel in his well-known book, *A Random Walk down Wall Street*. Those who adhere to the theory consider it futile to search for shares of firms who are thought to be undervalued or to predict future movements in the prices and/or returns from these same securities. New developments reflect themselves in the prices of securities. Random walk theory followers believe

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The author would like to thank the personnel and officers of the Sandra Ann Morsilli Pacific-basin Capital Markets Research Center at the University of Rhode Island (PACAP) for supplying the data for this study. The purpose of this organization is to promote both research and teaching about the Pacific basin. All data are from the daily price file.

that it is impossible to predict these events and all that investors can do is to accept the hypothesis of "efficient capital markets," often referred to as EMH.

Theorists (Fama, 1970; Fama and French, 1989) define three different levels of efficiency according to the type of information reflected in share prices and/or returns. The three levels of market efficiency entitled "weak-form, semi-strong-form, and strong form" require different levels of information to test their relevance. The weak form efficiency test example examines the wide range of trading rules available to common investors. Some theorists try to convince everyone that the weak form of EMH is acceptable due to the weight of academic opinion. They state that we cannot predict the future of share prices and returns in any abnormally profitable way.

Fama (1970) defined the weak form by focusing on three points:

(1) tests for return predictability;

(2) event studies; and

(3) tests of private (often referred to as insider) information.

In this study, we focus on return predictability. Previously, studies such as those by Lo and MacKinley (1988) found positive autocorrelations for share prices. Conrad and Kaul (1993) after correcting for non-synchronous trading problems corroborated Lo *et al.*'s results for US stock markets. In addition, Lo and MacKinley (1990) found that contrarian profits could result from market overreactions to financial events. Caporale and Gil-Alana (2002), discovered that stock returns possess permanent time series properties by utilizing advanced time series analysis. (To examine the full dimension of these methods see Tsay, 2002, pp. 72-4.) Moreover, there is a rich set of literature of studies for the USA, UK and other developed markets (Balvers *et al.*, 1990; Black and Fraser, 1995; Breen *et al.*, 1990; Campbell, 1987; Clare *et al.*, 1994, 1995; Granger, 1992; Jarrett and Kyper, 2005a, b, 2006, 2008c; Poterba and Summers, 1988; Pesaran and Timmermann, 1995, 2000) which indicate that the weak-form of the EMH may not be plausible in many situations. However, we should note here that the USA, UK and German markets are mature, sophisticated and have a lengthy history. Small Asian financial markets do not have these characteristics.

In another well-known example, John Maynard Keynes showed that the variation in stock returns exists for different sectors of the business cycle. According to Skidelsky (1992) "Keynes initiated what was entitled an *Active Investment Policy*, which coupled investing in real assets (a revolutionary concept at the time) with constant switching between short-dated and long-dated securities, based on predictions of changes in interest". Many studies of these phenomenon's appeared in the financial time series literature after that time and are noted above.

In this study, we focus on daily returns for a huge number of firms listed on four small Asian stock exchanges, (Singapore, Malaysia, Korea and Indonesia). They all contain properties, which one can measure, model and use for prediction. With enough time, patience and understanding of the mathematics of the underlying processes that give rise to a financial time series, forecasters can properly model these time series. The results permit management scientists, financial and economic forecasters to view time series of returns of listed securities as not random and having daily affects. Our results will indicate substantially the existence of time series components in returns of all the firms listed on four small Asian stock exchanges during the time period studied. The results should corroborate results of a number of earlier but less exhaustive studies. When these properties in security returns exist, one may identify and forecast patterns in financial

data, and, in turn, investors may benefit from this information. Furthermore, the results will indicate that the weak form of the efficient markets hypothesis is in question when one must make decisions about investing in these financial markets.

Previous studies indicated that daily variation is neither random nor stochastic. Hence, forecasters have the ability to predict daily patterns with some degree of accuracy. Although the literature on larger Asian stock exchanges is lengthy (Kato, 1990a, b; Kubota and Takahara, 2003; Moorkejee and Yu, 1999; Ray *et al.*, 1997; Rothlein and Jarrett, 2002; Jarrett, 2008a, b), there is not much literature concerning the smaller Asian markets. Chiang and Doong (2001) did study the time-series behavior of stock returns for seven Asian markets. They focused on the relationship between stock returns and unexpected volatility. For daily data, they found some significant results for some but not all of the exchanges. They did not focus on the day of the week effect as will be proposed in this study. In addition, Chiang *et al.* (2005) found an increasing amount of correlation among nine Asian markets indicating that portfolio diversification is not a useful strategy.

The lack of particular studies of the smaller Asian markets is in part due to their emerging status and the notion that index prices for these markets correlate with index prices of the larger Asian markets (see Chang *et al.*, 1999). Recently, a summary of the characteristics and problems faced by the small emerging Pacific-basin stock markets is summarized by Comerton-Forde and Rydge (2006) where they review the market microstructure of the ten Asia-Pacific stock exchanges. They contend that although the objectives of market efficiency and integrity are unanimously sought by exchanges, the path to achieving them is not clear. In this study, we re-examine data to contribute to our knowledge of small Asian financial markets.

Methodology and data collection

The researchers obtained the database for this study from the Sandra Ann Morsilli Pacific-Basin Capital Markets Research Center (PACAP, at the University of Rhode Island), an organization dedicated to promote research about Pacific-basin Financial Markets. We present a summary of the data available for this study in Table I by PACAP.

The predictive model for measuring the effects of changes in the day of the week on closing prices of a security is

$$Y = b_o + b_2W_2 + b_3W_3 + b_4W_4 + b_5W_5 + \varepsilon \qquad \text{(Model 1)}$$

where Y = daily return for the security, W_2 = dummy variable for Tuesday (1 or 0 when not Tuesday), W_3 = dummy variable for Wednesday (1 or 0 when not Wednesday), W_4 = dummy variable for Thursday (1 or 0 when not Thursday), W_5 = dummy variable for Friday (1 or 0 when not Friday), (Note: When X_2, X_3, X_4 and X_5 are zero, we have the regression for Monday.), ε = error term with mean of zero, b_o = intercept of model.

Note that we borrow from the methodology employed by Jarrett and Kyper (2006) in their study of firms listed in US Stock Exchanges and from Jarrett (2008a, 2008b) in his study on the Hong Kong Exchanges and Clearing Limited and Tokyo exchanges. We collected data on firms listed on the Stock Exchange of Singapore (SES) from 1975 to 1998. It was formed in 1973, when the termination of currency interchangeability between Malaysia and Singapore, caused the Stock Exchange of Malaysia and Singapore (SEMS) to separate into the SES and the Kuala Lumpur Stock Exchange

Variables	Year	Characteristics
Jakarta, Indonesia (1985-2000)		
Wkday	1985-2000	Monday-Friday
Trdval	1985-1988	Not available
	1989-2000	Available
Korea (1977-2001)		
Wkday	1977-1998	Monday-Saturday
	1999-2001	Monday-Friday
Trdval	1977-1995	Not available
	1996-2001	Available
Singapore (1975-1998)		
Wkday	1975-1998	Monday-Friday
Trdval	1975-1987	Not available
	1988-1998	Available
Malaysia (1977-2001)		
Wkday	1977-2001	Monday-Friday
Trdval	1977-1983	Not available
	1984-2001	Available

Table I.
Characteristics of data base for stock exchanges studied

Board (KLSEB). It merged with the Singapore International Monetary Exchange (SIMEX) on December 1, 1999, to form the Singapore Exchange (SGX).

The Stock Exchange of Malaysia established in 1964 became known as the SEMS by the secession of Singapore from Malaysia in 1965. In 1973, currency interchangeability between Malaysia and Singapore ceased, and the SEMS was divided into the Kuala Lumpur Stock Exchange Berhad and the SES. The Kuala Lumpur Stock Exchange, which was incorporated on December 14, 1976 as a company limited by guarantee, took over the operations of the Kuala Lumpur Stock Exchange Berhad in the same year. On April 14, 2004, they changed their name to Bursa Malaysia Berhad (BMB), following a demutualization exercise, the purpose of which was to enhance their competitive position and to respond to global trends in the exchange sector by making the exchange more customer-driven, market-oriented and to achieve economies of scale in their operations. There are over 900 firms listed for BMB.

The Korean Stock Exchange (KSE) established in 1956 became the Korea Exchange (KE) in 2005. This occurred after years of merging service to integrate the trading of REITs to create one stock market index. Also, cooperation with KOSDAQ (the Korea NASDAQ trading platform) and other activities created a full market-trading establishment. KE contains over 880 listed firms for trading.

Bursa Efek Jakarta or Jakarta Stock Exchange (JSE) is the stock exchange originally opened in 1912 by the colonial government of the Netherlands. After several closing during the two World Wars, the Indonesians reopened the exchange in 1977. Managed by the Capital Market Supervisory Agency under the Ministry of Finance, Indonesia, the exchange became private in July, 1992, under the ownership of Jakarta Exchange Inc. regulated by the Capital Market Supervisory Agency. In 2008, the JSE will merge with another exchange (the Surabaya Stock Exchange of Indonesia). There are currently over 390 firms listed on the JSE.

Based on the size of these exchanges and the number of trading days in a year, we concluded that there is a sufficiently large enough sample size for extensive year-by-year analysis of the predictability of stock market returns. We concluded that sufficient data

were available for an extensive analysis and no other sources of data were available for these markets in sufficient size. PACAP collects the data from the stock exchanges themselves so their data are the same as if one were to follow the end of day data for each trading day of the year for each exchange. The methodologies for reporting these data are thus the same as if the researchers collected the data themselves on a day-to-day basis. Since the KSE traded on Saturday (until 1999), we added another dummy variable W_6 in the model for years 1975-1999 for the Saturday trading day. The coefficient b_6 would be the regressive coefficient for W_6.

In addition, we considered a second predictive equation based on data available from our source as follows:

$$Y = b_o + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6\,(\text{trdvol}) + b_7\,(\text{trdval}) \qquad \text{(Model 2)}$$

where Y = daily return for the security, X_2 = dummy variable for Tuesday (1 or 0 when not Tuesday), X_3 = dummy variable for Wednesday (1 or 0 when not Wednesday), X_4 = dummy variable for Thursday (1 or 0 when not Thursday), X_5 = dummy variable for Friday (1 or 0 when not Friday), (Note: When X_2, X_3, X_4 and X_5 are zero, we have the regression for Monday), (trdvol) = variable for volume of daily trade in units, (trdval) = variable for value (in currency) of daily trade, ε = error term with mean of zero, b_o = intercept of model.

The second equation permits further explanation of the sources of variation in daily stock market returns. Hence, our research will show if the sources of variation in daily returns are days of the weeks with and without other sources of variations in returns. Again, since the KE traded on Saturday until 2000, the model contained another dummy variable W_6.

Results

Estimations for the ordinary least squares (OLS) models for the Singapore time series data set for 1998 produced results noted in Table II for the response variable daily returns (dretwd). In this table, we note that all of the daily coefficients are significant at levels less than 0.001 for Wednesday, Thursday and Friday but not significant for Tuesday. This would indicate for this year (1998) the regression for Tuesday and Monday would be the same but the regression for Wednesday, Thursday and Friday would produce parallel lines which differ from Monday's regression.

Obviously there are cross-sectional regressions performed for each year studied and for each model of which there are two. (We do not repeat this table for each regression but one may obtain their results for all regression for each model and for all the financial markets studied directly from the author.)

For the entire set of regressions for each financial market, we produce a summary table (Table III) which contains the essential results of this lengthy and exhaustive study.

First not the large number of regressions executed during the analytical portion of this study. The multitude of data pertinent for this study required this large number of regressions if we were to utilize the entire data and conclude the over time changes to the markets occurred. For Singapore the vast majority of daily coefficients are significant at levels of $\alpha = 0.05$ or less and this number was reduced to 18 for Model 2 where other explanatory variables are included in the regression process. If we examine all equations for this financial market, we conclude that F-values for overall regression were significant at very small p-values for all years studied and the Durbin-Watson (DW) statistics were sufficiently large to not reject the notion that no serial autocorrelation is

Model: Model 1
Dependent variable: dretwd
Number of observations read 27,484
Numbers of observations used 27,484

Analysis of variance

Source	DF	Sum of squares	Mean square	*F*-value	Pr > *F*
Model	4	0.65171	0.16293	49.83	<0.0001
Error	27,479	89.83935	0.00327		
Corrected total	27,483	90.49106			

Root MSE	0.05718	*R*-square	0.0072
Dependent mean	0.00123	Adj *R*-square	0.0071
Coefficient variable	4649.63437		

Parameter estimates

Variable	*DF*	*Parameter estimate*	*Standard error*	t-*value*	*Pr* > |*t*|
Intercept	1	−0.00356	0.00077940	−4.57	<0.0001
w2	1	0.00016710	0.00110	0.15	0.8794
w3	1	0.01258	0.00108	11.62	<0.0001
w4	1	0.00302	0.00110	2.75	0.0059
w5	1	0.00763	0.00110	6.93	<0.0001

Durbin-Watson D	2.007
Number of observations	27,484
First order autocorrelation	−0.004

Note: Modified SAS output

Table II.
Singapore stock exchange data in 1998

Financial market	Model	Number of regressions	Number of daily coefficients estimated	Number of daily coefficients not significant at $\alpha = 0.05$ or less
Singapore	1	24	96	19
Singapore	2	24	96	24
Malaysia	1	25	100	15
Malaysia	2	25	150	11
Korea	1	25	144	23
Korea	2	25	197	19
Indonesia	1	16	104	34
Indonesia	2	16	174	34

Note: Summary of data contain in all the regressions. If one wishes to gain access to all the regression results, please contact the author

Table III.
Summary of results

present. The total exceptions were thus small in comparison to the number of tests of significance for the regression coefficients accomplished and by 1983 until the end of the study period there were few exceptions. The conclusion for the DW statistics adds to the validity of the previous significance tests for the regression coefficients and tests for overall regression. These results indicate that for the SSE that each day of the week has a

separate regression resulting in five parallel lines when plotted on a time series graphs. This is the result that we anticipated.

Plots of residuals (not shown here) did not produce evidence of a violation of the usual assumptions concerning the error term (i.e. linearity, homoscedasticity and serial correlation) of the OLS. Regression results are always subject to limitations on the sample study period and the elements (firms) under study. However, the compelling results indicate for the SSE that there is a day of the week effect on the returns of securities. We note further that the hypothesis that closing prices of securities for these firms in the SSE follow random walks is in doubt. We do not dispute that these markets do not function well, and that competitive in which consistent abnormal profits based on public or historical information are rare. Last, there appeared to be no further need to apply an additional test at this time since we observe that the first order autocorrelation is extremely small and would indicate the higher order coefficients would be smaller. This appeared to be true for almost all the regressions.

Table III summarizes the results for the 25 regressions run for each model of the Malaysian data. The results as shown appear similar to that of Singapore with even fewer exceptions. For Korea in Table III, we note the result appear even more compelling since this financial market is larger than the others and we obtained a much larger database.

Table III indicates that only Jakarta, Indonesia, resulted in a higher number (and proportion) of not significant daily coefficients. This indicates that the observations for the other three small financial markets do replicate themselves in the Indonesian markets. This may be due to special characteristics in this financial, the fact that it is only one within this nation and the particular influence of government and perhaps culture in influencing this financial market. Another study may determine if these influence are brought to bear in explaining the nature of the Jakarta financial market but until data are available we cannot do any further investigation.

In addition, Model 2 regressions indicate very similar results to that for Model 1 for all but the Indonesia exchange. Although two additional variables, trdvol and trdval, included in the regressions resulted for the most part in significant (though small) coefficients for the most part, the vast majority of coefficients for the daily dummy variables were significant at very small p-values.

In addition, estimations for the OLS models for the KE time series data sets produced results summarized in Table III for the response variable daily returns (dretwd). For the Korean data, the tests for significance of the dummy variable for day of the week indicated some very important results. Since it is the largest of these exchanges, we consider a few additional notes. The KE market included a Saturday trading day for years thought 1998 and it contained a parameter estimate that was significant except for year 1986. We cannot be certain as to the reasons for the change in 1986, but a brief review of South Korean financial history may explain the large deviation in that year. The Korean government in the mid-1980s began to phase out the policy of tightly controlling the finance industry, banks kept on allocating large chunks of financial resources to *Chaebols*. These firms were conglomerates who started as general trading companies to build the industrial capacity in South Korean. Korean banks deemed the *Chaebols* as "better" or preferred borrowers. By the mid-1980s most *Chaebols* had grown very big and were able to generate substantial amounts of revenue. The sheer size of their assets and revenue generating capacities made most *Chaebols* a relatively safe bet for the banks. On top of this, there existed an implicit understanding that the government would readily bailout a bank or a *Chaebol* whenever any of them got into

trouble. This "perceived" 100 per cent insurance scheme had made the financial institutions negligent and the heavy borrowers irresponsible. There occurred a massive failure of governance of both the lenders and the borrowers. As a result the indebtedness of the corporate sector, especially that of the *Chaebols*, continued to grow and the vulnerability of the financial sector continued to increase in tandem with the former. This significant change in the Korean economy may have affected changes in expectations in the Korean stock markets and hence, resulted in differences in financial activity for that year and explain why the parameter estimates for the stock market did not behave in the way we thought.

With the major exception of 1986, the results we found were anticipated and fit into the pattern existing for other markets in the Pacific basin. Moreover, plots of residuals (not shown here) did not produce evidence of a violation of the usual assumptions concerning the error term (i.e. linearity, homoscedasticity and serial correlation) of the OLS. Regression results are always subject to limitations on the sample study period and the elements (firms) under study. However, the compelling results indicate for the KE and its predecessor is that there is a day of the week effect on the returns of securities. We note further that the hypothesis that closing prices of securities for these firms in the KE follow random walks is in doubt. We do not dispute that these markets do not function well, and that competitive in which consistent abnormal profits based on public or historical information are rare.

In addition, Model 2 regressions indicate very similar results to that for Model 1for the KE. Although two additional variables, trdvol and trdval (starting in 1995), included in the regressions resulted for the most part in significant (though small) coefficients for the most part, the vast majority of coefficients for the daily dummy variables were significant at very small p-values. Only years 1978 and 1986 indicated different results than for all the other years studied. We can explain the deviation for 1986 in the same way that we explained the deviation in the same year for the Model 1 regressions for Korea. Again it is possible that the government financing policies of backing large conglomerates in the mid-1970 to the mid-1980s may have caused some of the difficulties in analyzing financial events during this period. In general, Model 2 regressions for Korea result in an interpretation similar to that determined for Singapore and Malaysia. Coefficients for the dummy variable are predictable in stable times and the notion of the weak-form EMH is in doubt.

The (OLS) Models 1 and 2 regressions for the JSE time series data sets produced results summarized in Table III. For the response variable daily returns (dretwd). For the Jakarta data, the tests for significance of the dummy variable for day of the week indicated some very important results. The computed p-values were for the most part very close to 0 for most of the coefficients of the dummy variables in each regression from 1990 to 2001 (the last year for which PACAP collected data. The exceptions were a small number during that period with Friday have four dummy variable parameter estimates that were not shown to be significant. The period 1985-1989 appeared to be an unstable epoch for the JSE. The models did perform as expected and we have good reason to believe that other forces were affecting this emerging market greatly. The most universally accepted testing criterion for serial correlation is the DW test. This test involves the determination of whether the correlations between successive residuals are zero or not. Based on the calculation of the DW statistics, one will either not reject the hypothesis of no serial correlation or reject that hypothesis and conclude that positive serial correlation is present. In rare instances did this DW statistic indicate the presence of serial correlation. The F-values for overall regression were not

significant at very small p-values for years 1986-1989 also indicating an unstable period at that time. The F-values were significant for all other years except 1998. For most years studied, the DW statistics led to the conclusion that positive serial correlation was not present in the data. Hence, for Model 1, we seem to have two periods of data (195-1989 and 1990-2001). The behavior in the latter period appears to corroborate our results from study of the other three Pacific-basin markets. We cannot conclude anything about the 1985-1989 period except to say that forces affecting the data resulted in n o conclusions on our part. This in part may explain the results summarized in Table III whereby we observed differences in Jakarta financial markets with respect to the others.

When one studies the entire time period as a whole instead of year by year in this study, the results are similar based on an examination (not reported here) by the author. In addition, one could examine the existence of autoregressive conditional heteroskedasticity (the ARCH effect). The LaGrangian multiplier test (LM test, Im *et al.*, 2005) for level shifts could explore the extent to which the data residuals are ARCH. However, an examination of one series did not indicate the existence of an ARCH effect for these residuals from the models.

As an alternative technique we could have produced results from a multivariate time series analysis such as transfer function analysis to include factors not under issue in this study. Since the regressions are cross-sectional studies there is no need to calculate Portmonteau-Q statistics that determine if the errors of prediction are autocorrelated. Ljung and Box (1978) suggest this statistic for determining if the residuals are "white noise" from an ARIMA model. This statistic (Q) is extremely useful when examining a stream of serial or autocorrelation coefficients. However, for each regression, we do not have a stream of coefficients but the first order serial correlation coefficient. Further, calculation this statistic is unnecessary in the applications used in this study since we are neither predicting future values nor are computing the forecast errors. Another suggestion was to produce a global regression for each day of the week over the entire study for each emerging financial market. However, we conclude that such a global regression would produce the same results as the annual regressions produced here and would add little understanding to the phenomena already studied.

Conclusion

We noted that the weak form of the EMH require that one examine and analyze the return predictability. By return, we refer to both the dividend yield and earning/price variables and other variables affecting the return to investments in firms. The great difficulties newly emerging markets have in achieving capital market efficiency are well known. In this study, we show that for short-term changes (daily changes), the markets of four of the smaller Pacific-basin stock markets have predictable properties, which lead to the conclusion that the weak-form EMH does not hold for these markets. This study is unique in that it explores original data from a source that keeps and manages the databases (PACAP). No other such studies of these data are available. However, the results are not consistently different from the results of larger stock markets. We expect that these stock exchanges will continue to grow and become ever more competitive. However, their desire to be efficient in every sense of the word will be difficult. We do not know the influence of insider traders for the four stock markets for the time period covered. We should note that evidence exists for developed markets that these individuals can beat the market. In the future, more about this phenomenon should result when studying the four emerging Pacific-basin stock markets. Our

conclusion may not hold for the Jakarta, Indonesia financial market where our results were not as satisfying. Wu noted above some reasons why Indonesia may be different; however, at this point we do not want to speculate further.

We should comment on the East Asian Financial Crisis. This period of economic unrest started in July 1997 in Thailand (note: Thailand is not part of this study) with the financial collapse of the *Thai Baht*, and affected currencies, stock exchanges and other asset prices in a number of Asian countries. There is consensus on the existence of a crisis and its consequences, with Indonesia and Thailand were the countries most affected by the crisis. Malaysia was also affected but slightly. Singapore was relatively unaffected. In general, this crisis did not affect the analysis of the data analyzed in this study. The PACAP data were of relatively long length and short-term economic effects rarely affect the type of long-term analysis done in this study.

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