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STOCK PRICES, EXCHANGE RATES AND CAUSALITY IN MALAYSIA: A NOTE

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ABSTRACT

This article contributes to the debate on stock prices and exchange rates in Malaysia. It examines causal relations using a new Granger non-causality test proposed by Toda and Yamamoto (*Journal of Econometrics*, **66**, 225-50, 1995). Among the findings of interest, there is a feedback interaction between exchange rates and stock prices for the pre-crisis period. The results also reveal that exchange rates lead stock prices for the crisis period. In a financially liberalized environment, exchange rates stability is important for stock market well-being.

Keywords: Exchange rates, Stock prices, Causality, Malaysia

JEL Classification numbers: G1, C5, F3

I. INTRODUCTION

There is increasing interest in the relationship between stock prices and exchange rates. This is due to the emergence of new capital markets, adoption of more

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flexible exchange rate regimes and the liberalisation of financial markets in many emerging markets. In the case of Asian countries, interest has been reenergised following the Asian currency crisis in 1997. The crisis which started in Thailand had caused a wave of currencies depreciation and stock markets decline in the region. Among the affected countries, Malaysia was the first country confronted by massive movements in exchange rates and stock prices.

Before the crisis, Malaysian economy has been growing at an average of 8.5% per year for more than a decade. Accompanying this tremendous growth was a rapid acceleration of stock prices. For a long time, exchange rate stability has been an important ingredient in the country's macroeconomic policy. Since early 1990s, foreign capital began to play an important role in the economy, indicated by huge amount of foreign capital inflows.[1] But, an excessive amount of short-term capital had led to an overheated stock market and asset prices, leading to the fragility of financial system. The collapse of Thai baht in 1997 had triggered a wave of currencies depreciation in the region. In the second half of the 1997, the ringgit depreciated by 33.6 % against dollar, and reached the historic low of MYR4.88 per dollar on January 7, 1998. From February through June 1998, ringgit was relatively stable, but since then the downward pressure intensified following the depreciation of the Japanese yen, the contraction of economic activities and increased speculative activity. In order to stabilize the ringgit, selective capital

[1] The long-term private capital flows was about MYR9.5 billion a year while the short-term capital was about MYR8 billion a year (Bank Negara Malaysia, 1999).

controls were introduced on the 1 September 1998 which witnessed the ringgit was pegged at MYR3.80 per dollar. This represented 34% depreciation from the pre-crisis peak.

It was obvious that the immediate impact of the ringgit depreciation was on stock market, with the Kuala Lumpur Composite Index (hereafter, KLCI) declined by 44.8% in the second half of 1997. As the contagion spread in the region, investor confidence was further eroded. The reversal of short-term capital pushed down the price further and the KLCI to decline to a low of 286 points on 1 September 1998, the day capital controls were introduced. Since then, the stock market has been recovering gradually.

This study contributes to the debate on the causal relations between exchange rates and stock prices in Malaysia. To this end, it employs a new causality methodology which allows causal inferences to be conducted in a system including time series processes that may be integrated as well as cointegrated. Toda and Yamamoto (1995) provide a simplistic approach for assessing causal relations regardless of order of integration and/or the cointegration rank in a vector autoregressive (VAR) system. Additionally, it considers both bivariate and multivariate frameworks. It should be emphasized that the use of incomplete system which fails to account for other important variables may end up with spurious result. The lack of causal relationship in the past studies could be because of the omission of important variables, which serves as a conduit through which the exchange rates and stock prices are linked.

The rest of the paper is structured as follows. Section II highlights previous findings while Section III discusses the data and methodology. Section IV presents the empirical results. Section V concludes.

II. BRIEF LITERATURE REVIEW

There are two views on the relationship between stock prices and exchange rates. Classical economists argue that currency appreciation may affect product international competitiveness and trade balance position.[1] As a result, firms' profits are affected due to output contraction and this, in turn, affects stock price. This is suggestive that the exchange rates lead stock prices with positive correlation. However, the proponents of portfolio-balance model argue that, being part of wealth, equity may affect the exchange rates through demand for money. Higher stock prices, for example, may lead to a higher demand for money with ensuring higher interest rates. With a relatively higher interest rate, foreign capital inflows will result in an appreciation of domestic currency. This suggests that stock prices lead exchange rates with negative correlation.

[1] For example, flow-oriented model by Dornbusch and Fisher (1980).

A few studies have assessed causal relation between exchange rates and stock prices and largely provided mixed evidence. For example, Bahmani-Oskoee and Sohrabian (1992) conclude that there is a feedback interaction between the U.S. stock prices and exchange rates. Hatemi-J and Irandoust (2002) find that causality is unidirectional running from stock prices to exchange rates in Sweden. Granger *et al.* (2000) find some evidence that the exchange rate lead stock price in Japan and Hong Kong.

In the case of emerging markets, Abdalla and Murinde (1997) investigate the issue in the financial markets of India, South Korea, Pakistan and the Philippines. Employing monthly data in a form of bivariate vector autoregressive (VAR) model, the results shows that exchange rates changes lead stock prices in India, Pakistan and South Korea. In the case of the Philippines, stock prices take the lead. Granger *et al.* (2000) find that there is bi-directional causality in Indonesia and Malaysia. In the case of Taiwan, stock prices contain leading information. Nagayasu (2001) analyzes intra- and inter-market causality in a form of bivariate VAR model and concludes that stock prices seem to have caused upward pressure on exchange rates in Thailand and the Philippines. In addition, Azman-Saini *et. al* (2003) find that there is a feedback interaction in Thailand for the pre-crisis period. However, the exchange rates lead stock prices during the crisis period.

III. DATA AND METHODOLOGY

Daily data for exchange rates and stock prices spanning from January 1993 to August 1998 are utilized. The use of lower frequency data such as weekly or monthly observations may not be adequate to capture fast-moving exchange rates and stock prices. The significant interaction between the two series may be diluted in data of lower frequency. The starting date indicates data availability and the post-August 1998 is avoided due to the imposition of capital controls which almost completely closed the financial market to foreigners. End of day spot bilateral exchange rates vis-à-vis U.S. dollar are utilized.[2] The capitalization-weighted Kuala Lumpur Composite Index is used for Malaysian stock prices. The Standard & Poor's 500 index (hereafter, SP500) represents the U.S. stock market. In order to better understand the issue the sample period is divided into two sub-samples. Pre-crisis period cover from January 1993 to December 1996 and crisis period continues from January 1997 through August 1998, with a total numbers of 1378 observations are available for analysis. The variables are obtained from *Datastream* and transformed into natural logarithm.

It is well known that in the context of integrated series, the conventional application of the F-test (i.e. in a standard VAR model) is unsuitable[3]. Moreover, the *F*-test is not valid unless the variables are cointegrated in levels. Recently an

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[2] The exchange rate is expressed as ringgit per unit of U.S. dollar.
[3] Spurious regression due to non-standard distribution of the test statistics, see Toda and Phillips (1993).

alternative approach which utilizes the Modified WALD (MWALD) test for testing linear restriction on the parameters was proposed by Toda and Yamamoto (1995). This test has an asymptotic χ^2 distribution when a VAR (k + $d_{\max}$) is estimated where $d_{\max}$ is the maximum degree of integration suspected to occur in the system. Toda and Yamamoto point out that, for d=1, the lag selection procedure is always valid since $k \geq 1 = d$. If d=2, then the procedure is valid unless k=1. Moreover, the MWALD statistic is valid regardless of whether a series is $I(0)$, $I(1)$ or $I(2)$, non-cointegrated or cointegrated of an arbitrary order. Zapata and Rambaldi (1997) show that the MWALD test has a comparable performance in size and power to the LR and WALD tests.

Rambaldi and Doran (1996) demonstrate that this procedure can be easily constructed using a seemingly unrelated regression (SUR) form. Following Toda and Yamamoto, stock prices and exchange rates can be causally linked in a system as follows:[4]

$$\begin{bmatrix} SP_t \\ EX_t \end{bmatrix} = \alpha_0 + \alpha_1 \begin{bmatrix} SP_{T-1} \\ EX_{t-1} \end{bmatrix} + \alpha_2 \begin{bmatrix} SP_{t-2} \\ EX_{t-2} \end{bmatrix} + \alpha_3 \begin{bmatrix} SP_{t-3} \\ EX_{t-3} \end{bmatrix} + \alpha_4 \begin{bmatrix} e_{SP} \\ e_{EX} \end{bmatrix} \qquad (1)$$

where α_0 is an identity matrix and $\mathrm{E}(\varepsilon_t) = \lfloor \varepsilon_{SP_t} \varepsilon_{EX_t} \rfloor = 0$ and $\mathrm{E}(\varepsilon_t \varepsilon_t{}') = \Sigma$. For example, if k=2 and $d_{\max}$=1, a causality from EX to SP can be established through rejecting the null of EX_{t-1} and EX_{t-2} are jointly equal to zero in the first

[4] Assuming 3-order VAR, where SP = stock prices and EX= exchange rates

equation of the above system. A similar procedure can be used to test the causality from *SP* to *EX* by establishing a significance of the MWALD statistic for a group of lagged *SP* variables in the second equation of the system.

IV. EMPIRICAL RESULTS

As a first step, it is necessary to determine the degree of integration of stock prices and exchange rates. The augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) tests are two commonly used procedures in the empirical literature. In both tests, the null hypothesis is that a unit root exists in the autoregressive representation of the time series. However, these tests have been criticized for having low power. The tests tend to accept the null too frequently against a stationary alternative (Schwert, 1987; DeJong *et al.*, 1992). Due to the growing controversy surrounding the specific test to employ, this study utilizes mean stationary test proposed by Kwiatkowski *et al.* (1992) (hereafter, KPSS) to complement the ADF and PP tests. The KPSS test is based on the following statistic:

$$\eta(u) = (1/T^2)\sum_{t=1}^{T} S_t^2 / \sigma_k^2, \text{ where } S_t = \sum_{i=1}^{t} \nu_t,\ t=1,\ldots..\text{T}. \quad (2)$$

where ν_t is the residual term from a regression of y_t on an intercept, and σ_t^2 is a consistent long-run estimate of y_t, and T represents the sample size. If the computed value of $\eta(u)$ is larger than the critical value, then the null hypothesis of stationarity is rejected.

The results of unit root tests reported in Table 1 indicate that the level of each series is nonstationary. Using the ADF, PP and KPSS test without trend, the hypothesis of level non-stationarity cannot be rejected for all series. However, results for the first-difference clearly show that the hypothesis of non-stationarity can be rejected. Thus, like most financial time series, the stock price and exchange rates require differencing to achieve stationarity or they are $I(1)$.

------- Insert Table 1 here -------

Having identified that all series are $I(1)$, the nature of causality between exchange rates and stock prices is assessed using methodology outlined in section III. As a preliminary analysis, bivariate relationships are estimated. The results are presented in Table 2.

------ Insert Table 2 here -------

Panels A and B report results for the pre-crisis and crisis periods, respectively. The results suggest that there is a bi-directional causality between exchange rates and stock prices in both periods. These results, however, may be flawed because of possible misspecification bias. The omission of important variables may lead to type 'I' and type 'II' errors, that is, spurious rejection of causal relationship as well as spurious detection of it. From a macroeconomics perspective, it is useful to include other variables in the estimation model (see for example, Hatemi-J and Irandoust, 2002). Therefore, re-examination of causal analysis is carried out by adding the US stock prices to equation (1). This allows the U.S. equity market to exert its potential influence on the Malaysian stock prices and exchange rates. The results of are presented in Table 3.

------ Insert Table 3 here -------

The results for the pre-crisis period suggests that both the nulls of Granger non-causality from stock prices to exchange rates and from exchanges rates to stock prices can be rejected at the 10% level of significance. Apparently, the inclusion of the U.S. stock price does not affect causal structure. This suggests that there is a strong evidence to support bi-directional causality or feedback interaction. However, the result for the crisis period indicates that only the null of Granger non-causality from exchange rates to stock prices can be rejected at the 10% significant level. This is indicative of the one-way causality running from exchange rates to stock prices.

V. CONCLUSION

This study contributes to the debate on causal relation between stock prices and exchange rates in Malaysia. Based on a sample from January 1993 to August 1998, the results show that there is a bi-directional causality for the pre-crisis period. With respect to informational efficient market hypothesis, this finding suggests that both stock and foreign exchange markets are not efficient as information in one market can be used to predict the movement of other market.

The results for the crisis period suggest that there is one-way causality running from exchange rates to stock prices. During the crisis, stock market decline was led by the ringgit depreciation. This finding is inconsistent with the classical economist argument which suggests that exchange rates take the lead with positive correlation. One possible explanation is that, an anticipation of further currency depreciation encouraged international investors to liquidate their share holdings as further delay will cut down their profits. Capital flows reversal intensified the ringgit depreciation and stock market decline. In a financially liberalized environment, exchange rates stability is important for stock market well-being.

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Table 1

Results of Unit Root Test

Period	Variables	ADF*	PP*	KPSS#
			Level	
Pre-crisis	*EX*	-1.53	-1.57	1.47 [a]
	SP	-2.23	-2.13	1.97 [a]
	SP500	0.65	0.76	4.27 [b]
Crisis	*EX*	-2.39	-2.27	1.69 [a]
	SP	-1.88	-1.91	1.68 [a]
	SP500	-1.62	-1.72	1.74 [a]
			First Difference	
Pre-crisis	*EX*	-14.05 [a]	-27.69 [a]	0.05
	SP	-11.91 [a]	-23.61 [a]	0.16
	SP500	-14.93 [a]	-29.10 [a]	0.02
Crisis	*EX*	-16.07 [a]	-32.02 [a]	0.08
	SP	-14.74 [a]	-31.71 [a]	0.22
	SP500	-10.36 [a]	-20.51 [a]	0.15

Notes: [a] and [b] indicate rejection of null hypothesis at the 5% and 10% level, respectively.

* The test statistics were computed with lag not exceeding the floor function $floor(4(T/100)^{2/9})$.

\# Lag lengths were determined based on $[cT]^k$, where c=5 and k=0.25 are adopted.

Table 2
Results of Bivariate Granger non-causality test

	Hypothesis:	MWALD(lag)	Remark
Panel A: Pre-Crisis	SP – /–> EX	318.19 # (14)	Reject null
	EX – /–> SP	25.45 # (14)	Reject null
Panel B: Crisis	SP – /–> EX	566.84 # (4)	Reject null
	EX – /–> SP	119.36 # (4)	Reject null

Notes: # indicate rejection of null hypothesis at the 10 % level of significance.
(– /–>) indicates does not *Granger*-cause.
Lag lengths were determined using Akaike Information Criterion (AIC).

Table 3
Results of Multivariate Granger non-causality test

	Hypothesis:	MWALD (lag)	Remark
Panel A: Pre-Crisis	SP – /–> EX	29.52 # (14)	Reject null
	EX – /–> SP	22.93 # (14)	Reject null
Panel B: Crisis	SP – /–> EX	4.16 (4)	Accept null
	EX – /–> SP	12.66 # (4)	Reject null

Notes: # indicate rejection of null hypothesis at the 10% level of significance.
(– /–>) indicates does not *Granger*-cause.
Lag lengths were determined using Akaike Information Criterion (AIC).