Dynamic Causality between Stock Return and Exchange Rate across Global Financial Crisis: Does Stock-Oriented Hypothesis Valid in an Emerging Market?

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INTRODUCTION

- During the period of 2008 global financial crisis, the collapse of financial services firm Lehman Brothers in the United States had an overwhelming impact on the world economy.
- The effect from implementing the quantitative easing policy swiftly permeates the emerging stock markets, causing substantial fluctuation in currency value of different countries (Koulakiotis et al., 2015).
- Given these tremendous changes in foreign exchange markets, domestic stock returns which were expressed in foreign currencies responded asymmetrically (Walid et al., 2011). This asymmetric response has re-ignited the need to delve deep in how stock prices cause exchange rates and vice versa.

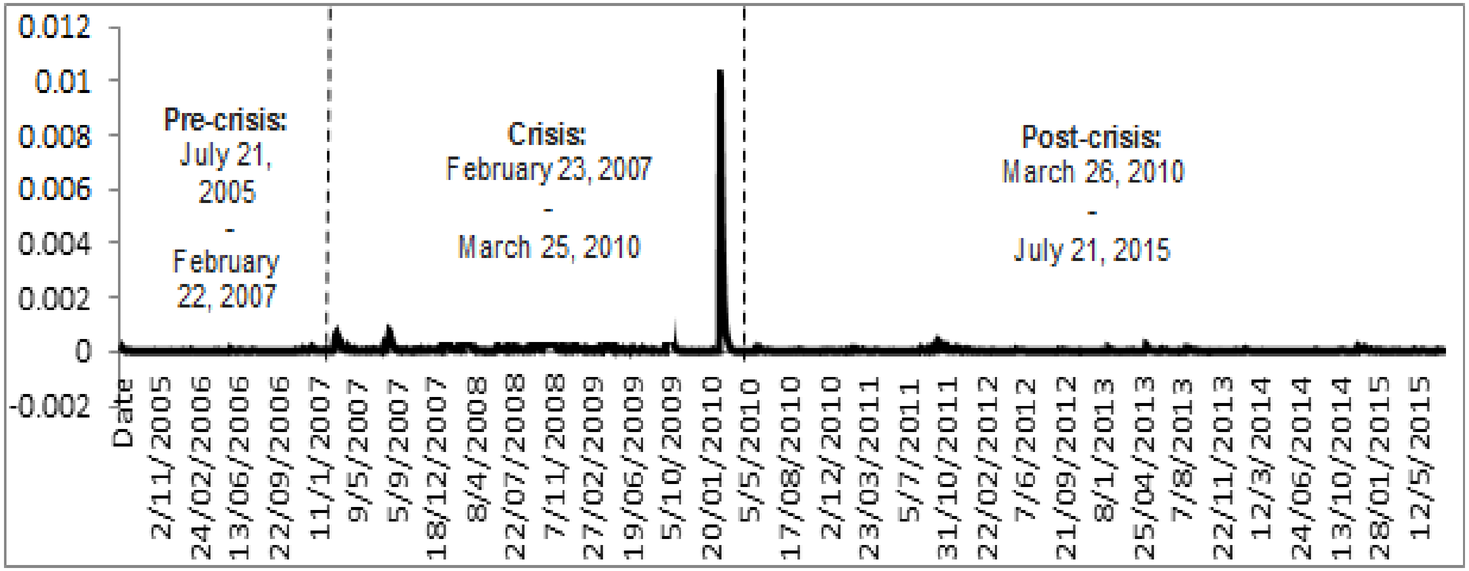


Figure 1: Univariate conditional variance of FBM KLCI return, 2005-2015

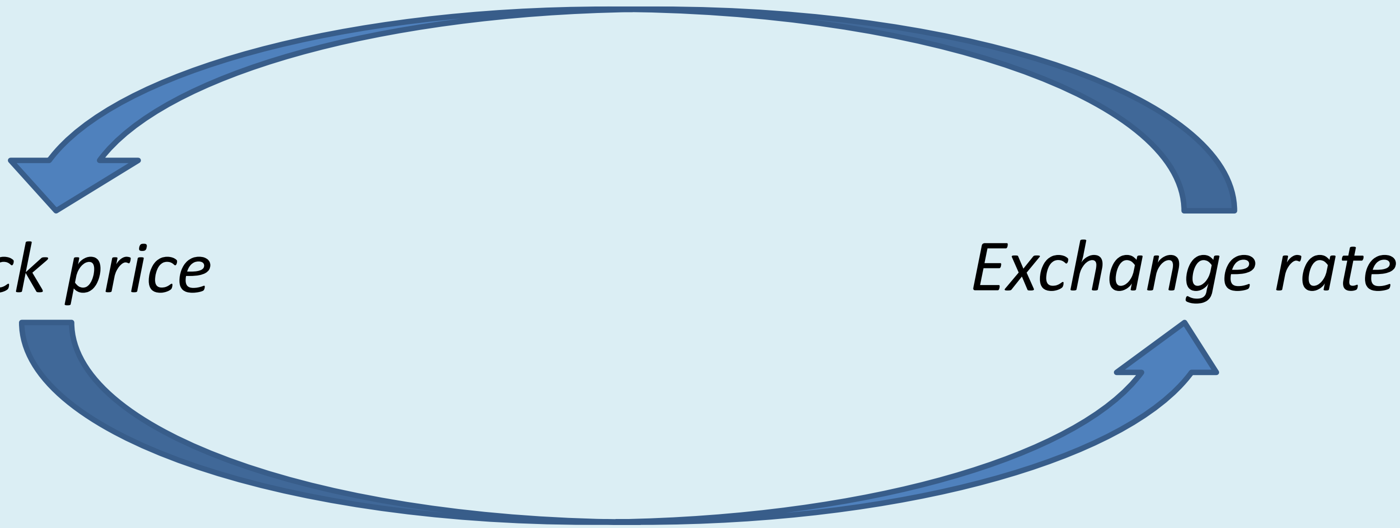
Source: Author's estimation based on MA(1)-GARCH(1,1) model of FBM KLCI return.

- Malaysian stock return (measured by the returns of FBM KLCI) is found to exhibit several spikes in its volatility during the crisis period.
- In order to balance the demand and supply of domestic and foreign financial assets in the high volatile period, market participants amplify their portfolio hedging in order to engage in cross-border transactions and reduce the risk in foreign exchange.

Stock Prices and Exchange Rates Nexus: Theoretical Models

Flow-oriented model

(Dornbusch & Fischer, 1980, Pan et al., 2007; Chen et al. 2009; Walid et al., 2011; Boako et al., 2015; Fowowe, 2015; Sui & Sun, 2016)



Stock-oriented model

(Branson, 1983; Frankel, 1983; Kanas, 2000; Yang & Doong, 2004; Mozumder et al., 2015)

<u>Flow-oriented model :</u>

Local currency depreciation→ Cheaper exports of domestic firms → Greater competitiveness in the international transaction→ Increase the domestic income → Firms' stock price appreciation

<u>Stock-oriented model:</u>

An increased stock price → High demand for local currencies → Local currency appreciation

DATA

Variables: - Daily data of KLCI index

- Daily MYR relative to USD

- Daily MYR relative to CNY

Sample period: July 21, 2005 - July 21, 2015

Source: Bloomberg

- These series are transformed to the first difference of stock price (a daily stock return, SR) and first difference of exchange rate (a daily change of exchange rate, EX) in logarithmic form.
- The sample period is separated into the pre-crisis (July 21, 2005 - February 22, 2007), crisis (February 23, 2007 - March 25, 2010) and post-crisis (March 26, 2010 - July 21, 2015) periods.

METHODOLOGY

Cross-Correlation Function of Standardized Residuals and Squared Standardized Residuals (CCFs)

- This approach is developed by Cheung and Ng (1996).
- There are four reasons for using this approach.
  - It can detect nonlinear causal relationship in mean (first moment) and variance (second moment) of both stationary series (Henry et al., 2007: 123).
  - It has the ability to specify correctly the first moment dynamic (mean) and second moment dynamic (variance).
  - It can detect significant causality of both series for a large number of observations at longer lags.
  - It can reveal useful information on the causality pattern (Cheung & Ng, 1996: 36).

- Limitations of CCFs based on Cheung and Ng (1996):
  – When cross-correlation decays as the lag order increases, the test allocates equal weighting to each lag. This can subject to severe size distortions in the presence of causality-in-mean.
  – The pattern of causality-in-variance in the nonlinear form cannot be detect with zero cross-correlation between innovations.
- Improvement of CCFs by Hong (2001):
  – Hong (2001) develops the non-uniform weighting cross-correlations in a simulation study by providing flexible weighting scheme for cross-correlation at each lag. For example, larger weights are permitted for cross-correlations at lower order lags and otherwise.
  – This non-uniform weighting is expected to give better power against the alternative whose cross-correlations decay to zero as the lag order increases (Hong, 2001: 185).
  – Overall, the advantage of this approach is the flexibility to specify the innovation process and provide robustness to asymmetric and leptokurtosis errors.

- Testing causality-in-mean

$$SR_t = \mu_{SR,t} + \sqrt{h_{SR,t}}\varepsilon_t \qquad EX_t = \mu_{EX,t} + \sqrt{h_{EX,t}}\xi_t$$

$$\varepsilon_t = \frac{SR_t - \mu_{SR,t}}{\sqrt{h_{SR,t}}} \qquad \xi_t = \frac{EX_t - \mu_{EX,t}}{\sqrt{h_{EX,t}}}$$

$$\hat{r}_{\varepsilon\xi}(k) = \frac{C_{\varepsilon\xi}(k)}{\sqrt{C_{\varepsilon\varepsilon}(0)C_{\xi\xi}(0)}}$$

$$S_1 = T\left[\sum_{i=1}^{k}\left(\hat{r}_{\varepsilon\xi}(k)\right)^2\right] \xrightarrow{L} \chi^2(k)$$

$$M_1 = \frac{S_1 - k}{\sqrt{2k}} \xrightarrow{L} N(0,1)$$

If M1 is larger than the critical value of normal distribution, the null hypothesis of no causality-in-mean is rejected.

• Testing causality-in-variance

$$SR_t = \mu_{SR,t} + \sqrt{h_{SR,t}\varepsilon_t}$$

$$EX_t = \mu_{EX,t} + \sqrt{h_{EX,t}\xi_t}$$

$$u_t = \frac{(SR_t - \mu_{SR,t})^2}{\sqrt{h_{SR,t}}}$$

$$v_t = \frac{(EX_t - \mu_{EX,t})^2}{\sqrt{h_{EX,t}}}$$

$$\hat{r}_{uv}(k) = \frac{C_{uv}(k)}{\sqrt{C_{uv}(0)C_{uv}(0)}}$$

$$S_2 = T\left[\sum_{i=1}^{k}\left(\hat{r}_{uv}(k)\right)^2\right] \xrightarrow{L} \chi^2(k)$$

$$M_2 = \frac{S_2 - k}{\sqrt{2k}} \xrightarrow{L} N(0,1)$$

If M2 is larger than the critical value of normal distribution, the null hypothesis of no causality-in-variance is rejected.

RESULTS

- Test of causality-in-mean based on Hong's (2001) approach

	k	5	10	15	20	25	30	35	40
Full sample period									
FBMKLCI → MYRCNY	M_1	24.3010***	17.0449***	13.8235***	11.5152***	9.7008***	9.2353***	-0.6503	8.5343***
MYRCNY → FBMKLCI	M_1	-0.2988	-0.9346	-1.3863	-0.6318	-0.4707	-0.9189	-1.3807	-0.3384
FBMKLCI → MYRUSD	M_1	29.5005***	20.5731***	16.5052***	13.8921***	11.8440***	10.7796***	-1.3453	9.8097***
MYRUSD → FBMKLCI	M_1	-0.3550	-0.4377	-1.1016	-0.6222	-0.3026	-0.6409	-0.8732	-0.1045
Pre-crisis									
FBMKLCI → MYRCNY	M_1	2.3205**	3.0216***	2.1218**	1.2304	1.1503	1.4360*	2.6257***	3.1416***
MYRCNY → FBMKLCI	M_1	0.2862	0.1499	0.1184	0.3499	0.2543	0.3553	-0.7588	0.0529
FBMKLCI → MYRUSD	M_1	3.4205***	4.1857***	3.0320***	2.0238**	1.8849**	2.0588**	2.2486**	2.6169***
MYRUSD → FBMKLCI	M_1	0.3008	-0.2221	-0.3018	-0.2190	-0.4434	-0.3804	-1.4163	-0.3811
Crisis									
FBMKLCI → MYRCNY	M_1	10.73***	7.1188***	5.3536***	4.1947***	3.3537***	3.0875***	-1.5011	2.5791***
MYRCNY → FBMKLCI	M_1	-0.4601	-0.9947	-0.8976	-1.2484	-0.9450	-1.1237	-1.4397	-1.3335
FBMKLCI → MYRUSD	M_1	10.7204***	7.4335***	5.5774***	4.4026***	3.4298***	3.2352***	-1.4344	2.8015***
MYRUSD → FBMKLCI	M_1	-0.9219	-1.5518	-1.9330	-2.2497	-2.3499	-2.5886	-2.8843	-3.0349
Post-crisis									
FBMKLCI → MYRCNY	M_1	0.1998	-0.4104	-0.9731	-1.2074	-1.4737	-1.4932	-2.0872	-1.9996
MYRCNY → FBMKLCI	M_1	-0.9388	-0.8663	-0.7974	-1.2074	-0.7529	0.2142	-0.2663	-0.2229
FBMKLCI → MYRUSD	M_1	29.1670***	20.6298***	17.9734***	15.4261***	13.1280***	11.6610***	-0.0826	9.8807***
MYRUSD → FBMKLCI	M_1	-0.5731	-0.0365	-0.1450	1.4099*	1.3338*	1.3994*	1.7701**	2.5791***

Notes: This table shows the causality test statistic, M_1 calculated from Equation (12). SR denotes as FBMKLCI, while EX denotes as MYRCNY and MYRUSD. "SR → EX" stands for a FBMKLCI return Granger-cause a change of exchange rate in mean respect to $I_{SR,EX,t-1}$. "EX → SR" stands for a change of exchange rates Granger-cause a FBMKLCI return in mean respect to $I_{SR,EX,t-1}$. k indicates a truncated lag number. The null hypothesis of no causality-in-mean is rejected if the test statistic greater than the upper-tailed critical value of standard normal distribution. ***, ** and * indicate statistical significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively.

- Test of causality-in-variance based on Hong's (2001) approach

	k	5	10	15	20	25	30	35	40
Full sample period									
FBMKLCI → MYRCNY	M_2	-0.0546	-1.0804	-1.1591	-1.6942	-2.1082	-1.8734	0.3091	0.3025
MYRCNY → FBMKLCI	M_2	-1.3955	-1.9422	-2.1959	-2.5392	-2.3235	-2.0881	-2.4404	-2.6138
FBMKLCI → MYRUSD	M_2	-0.1582	-1.1517	-1.2778	-1.8118	-2.2025	-2.0077	0.7805	0.7103
MYRUSD → FBMKLCI	M_2	-1.3975	-1.9604	-2.1875	-2.5174	-2.0936	-1.9573	-2.2943	-2.4525
Pre-crisis									
FBMKLCI → MYRCNY	M_2	-1.3138	8.3433***	6.7597***	5.2458***	4.3339***	3.5219***	4.1924***	4.5489***
MYRCNY → FBMKLCI	M_2	0.5110	1.8050**	1.0693	1.0144	0.7536	0.9957	0.6853	0.5781
FBMKLCI → MYRUSD	M_2	-1.4217	11.0015***	9.3220***	7.5434***	6.3567***	5.3689***	5.7517***	6.3012***
MYRUSD → FBMKLCI	M_2	1.0454	2.5318***	1.5062*	0.9825	0.2870	1.2087	0.6507	0.4539
Crisis									
FBMKLCI → MYRCNY	M_2	-0.2638	-1.0924	-1.1029	-1.5873	-2.0416	-2.4665	-3.2708	-2.9523
MYRCNY → FBMKLCI	M_2	-1.3262	-1.9249	-2.0222	-2.1741	-1.9594	-1.7803	-2.1760	-2.4049
FBMKLCI → MYRUSD	M_2	-0.4102	-1.2172	-1.4401	-1.8725	-2.2621	-2.6780	-3.4139	-3.1248
MYRUSD → FBMKLCI	M_2	-1.2916	-1.8957	-2.0301	-2.1561	-1.9948	-1.9504	-2.3202	-2.5291
Post-crisis									
FBMKLCI → MYRCNY	M_2	61.1972***	42.3331***	33.7232***	28.5931***	25.2524***	22.7685***	-2.6058	19.4371
MYRCNY → FBMKLCI	M_2	-1.0642	-1.6468	-1.7241	-1.3525	-1.5699	0.3022	-0.2320	-0.4994
FBMKLCI → MYRUSD	M_2	17.3285***	11.6717***	8.9030***	7.4190***	6.2099***	5.2094***	-1.6438	4.1916***
MYRUSD → FBMKLCI	M_2	-0.9060	-1.6360	-1.6488	-1.0478	-0.6152	-0.8685	-1.3090	-1.6332

Notes: This table shows the causality test statistic, M_2 calculated from Equation (19). SR denotes as FBMKLCI, while EX denotes as MYRCNY and MYRUSD. "*SR* → *EX*" stands for a FBMKLCI return Granger-cause a change of exchange rates in variance respect to $I_{SR,EX\ t-1}$. "*EX* → *SR*" stands for a change of exchange rates Granger-cause a FBMKLCI return in variance respect to $I_{SR,EX\ t-1}$. k indicates a truncated lag number. The null hypothesis of no causality-in-variance is rejected if the test statistic greater than the upper-tailed critical value of standard normal distribution. ***, ** and * indicate statistical significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively.

- **Finding of causality-in-mean:**
  - Causality from FBMKLCI to MYRCNY happens in most of the sub-periods. In the post-crisis period, such causality is found to be not in existence.
  - Such causality from FBMKLCI to MYRUSD happens in all sub-periods at lower- and higher-order lags. → There exists sustainable influence of FBMKLCI on MYRUSD across the crisis.

- **Finding of causality-in-variance:**
  - During the pre-crisis period, causality runs from FBMKLCI to MYRCNY and from FBMKLCI to MYRUSD.
  - During the crisis period, there is no significant causality between FBMKLCI and MYRCNY as well as between FBMKLCI and MYRUSD.

  → Prolonged period of crisis as bad news of the US Subprime Mortgage started to flow in the market in late 2007, followed by one and another events, and finally culminated in the collapse of Lehman Brothers. Hence, investors became used to the new normal and formed an expectation for the worst outcome as more and more bad news unfolded themselves.

CONCLUSION

- The impact of stock return on MYRUSD appears to be significant throughout all the sub-periods.
- Most of the spillovers in mean during the sample period can be attributable to **the channel running from stock return to exchange rates.** This means that the **"stock-oriented model" of exchange rates is tenable in Malaysia.**
- Improved portfolio balances can help to stimulate the performance of the foreign exchange markets.
- Apart from that, this study suggests that stability of MYR especially against USD is being determined by a short-term flow of portfolio balance into the stock market rather than trade balance.

Terima kasih

Thank You

Kindly email wylau@um.edu.my if you have further enquiry