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How far does the stock market performance influence Malaysia's consumers purchasing power?

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Abstract

This study examined the asymmetric effect of stock market index performance on the external competitiveness of purchasing power for Malaysia covering the period of 1996–2019 utilizing the Ender and Siklos (2001) and the threshold vector error correction model (TVECM) approaches. The empirical findings confirmed an existing of asymmetric effect between stock market index and the external competitiveness purchasing power in Malaysia cases. There is evidence of negative relationship between both series with a bidirectional asymmetric causality relationship. Therefore, policymakers should give more attention of stock market performance to strengthen the current and future monetary policies related to consumer's purchasing power agenda in Malaysia and consider the current global economic uncertainty caused by the COVID-19 pandemic worldwide.

Introduction

Globalization has resulted in significant changes to many countries through trade openness and borderless economic activities. Like many other developing countries, Malaysia's economic growth, education system, health system, employment opportunity and technology development have significantly improved due to globalization (Amavilah et al., 2017). However, there is a price to pay for globalization as domestic economy has been affected by financial crises, including the 1997 Asian Financial Crisis, the 2008 global financial crisis and recently the economic crises due to the COVID-19 pandemic that started at the end of 2019. During the Asian financial crisis, Malaysian exports dropped by almost 20 percent, commercial non-performing loans increased by 18 percent, the Kuala Lumpur Stock Exchange (KLSE) reported a huge loss, and the currency depreciated badly (Liew et al., 2018). As the COVID-19 pandemic is still unfolding, many countries are facing purchasing power deterioration due to high inflation and unemployment.

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Currently, with the index value of 56.1, Malaysia is ranked 36th in the world in terms of purchasing power index (NUMBEO, 2021). Although Malaysia is surviving the current global COVID-19 pandemic, economic uncertainty is still looming even though the country has been ranked among the fastest financial crises recovering countries (Burkett & Hart-Landsberg, 1998). The following Figure 1 and Figure 2 show Malaysian consumers purchasing power and stock market sustainability for the period of 1994 until 2020. In general, the figures indicate that the purchasing power in the country was quite unstable for the last three decades due to several regional and global economic crises.

Comparing the trends of purchasing power and the stock market performance show that there is a convergence effect between both measures. A number of researcher's investors and stakeholders are still examining and debating on the relationship between the stock market and exchange especially considering economic uncertainties amid the COVID-19 pandemic.

Literature Review

Based on the theoretical perspective illustrated from previous literature, the export-oriented industries benefit from currency depreciation due to lower price of products in the international market compared to competitor product prices. Caporale et al. (2014), Dornbusch and Fischer (1980) , and Pan et al. (2007) revealed that the real stock prices will increase during the exchange rate depreciation period and will decrease during the appreciation of the currency. Leung et al. (2017), and Mahapatra and Badhuri (2019) investigated the relationship between exchange rate and the stock market and produced mixed results. Recent empirical studies by Amado and Choon (2020), Dahir et al. (2018), and Ibrahim and Aziz (2003) proved the existence of a long-run equilibrium relationship between those two variables. This is supported by significant short-run relationship findings from Bahmani-Oskooee and Sohrabian (1992). Moreover, Mroua and Trabelsi (2020) recognized a long and short-term relationship between exchange rate and stock market of BRICS countries based on monthly data covering the period of 2008 until 2018.

Frankel (1983) and Branson (1981) proposed the portfolio balance theory to deliver a much more comprehensive result. Moreover, Wong (2018) found that there is a significant relationship between competitiveness exchange rate and stock market in Malaysia by examining the spillover permanent component volatility and transitory component volatility between real exchange rate return and real stock prices, which in turn leads to stronger permanent component volatility spillover rather than

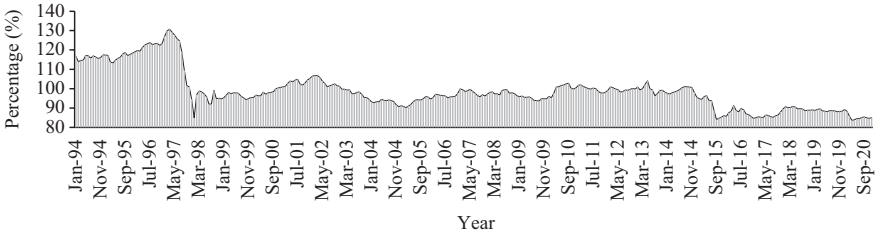

Figure 1 External competitiveness purchasing power trends from 1994–2020
Source: World Bank (2021)

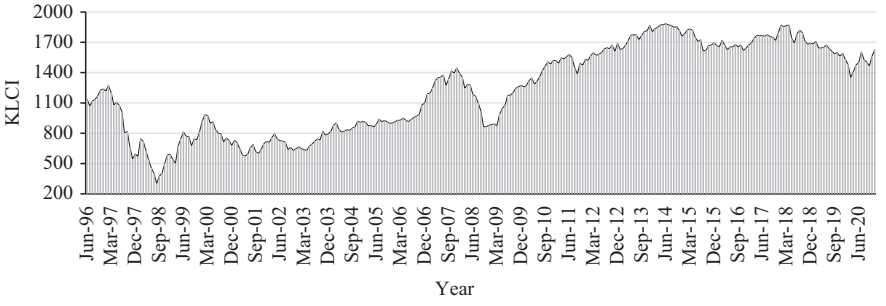

Figure 2 KLSE trends from 1994 to 2020
Source: World Bank (2021)

spillover of transitory component volatility. Wong (2017) found a negative relationship between exchange rate and stock market for Malaysia, Singapore, South Korea, and United Kingdom. Furthermore, Liang et al. (2013) also found the negative relationship while examining the sample of stock market index and nominal exchange rate in Indonesia, Malaysia, Philippines, Singapore, and Thailand.

In contrast, Bahmani-Oskooee and Saha (2016) demonstrated a significant positive correlation between exchange rate and the stock market, concentrating on export-oriented firms in Brazil, Canada, Chile, Indonesia, Japan, Korea, Malaysia, and Mexico by applying the NARDL estimates. In addition, recent study by Vadivel (2021) found a negative relationship between exchange rate and stock market price for India and South Africa. Naresh et al. (2018) also found a negative relationship, while studying the influence of the US dollar fluctuation on the stock market sustainability for BRICS countries. Also, Bashir et al. (2016) found a mixed relationship between exchange rate and stock market for Latin countries. The following Table 1 highlights several selected studies concentrating on stock market and real external consumer purchasing power for Malaysia with the varying empirical findings. This paper is organized as follows: Section 2 discusses the literature review; Section 3 explains the data and the empirical strategies; Section 4 reports the estimated results, and the final section summarizes the findings.

Data and Model Specification

This study used REER for the exchange rate as proxy to Malaysian real external competitiveness purchasing power, following the approach used by Bahramian and Saliminezhad (2020), Ibrahim (2000), and Wong (2017). Meanwhile, the FTSE Bursa Malaysia Kuala Lumpur Composite Index was used as the proxy for Malaysian stock market index. This index is the major index for KLSE and is used in various studies as a proxy for the stock market in Malaysia. The monthly data cover from January 1996 to December 2019, and several financial crises. Purchasing power parity concept is imperative in the determination of exchange rate equilibrium. It is also related to the assumption of foreign exchange stakeholder behavior in response to the variation costs in national market baskets. Thus, this concept is essential in investments and stock market activities as foreign investors can participate in any exchange market. Generally, there are two theoretical perspectives of relationship between exchange rate and stock market, namely, stock-oriented model and flow-oriented model as shown in Table 2.

Based on the classical approach, the relationship between REER and KLSE the following linear function model shown in Equation (1):

$$REER_t = \beta_0 + \alpha_1 KLSE_t + \mu_t \quad (1)$$

where, REER is the real effective exchange rate, KLSE represents the Kuala Lumpur Stock Exchange and both variables are expressed in logarithm formation. This study performs the unit root test by utilizing the Augmented Dickey and Fuller (ADF) (1981), Kwiatkowski et al. (KPSS) (1982), and the Zivot and Andrew (ZA) (1992) unit root tests to determine the endogenous unknown single structural break.

Table 1 Selected empirical studies on the topic for Malaysia cases

Authors	Time Span	Method	Relationship
Aftab et al. (2021)	2005–2018	DCC-GARCH	Negative
Xie at al. (2020)	1998–2019	LA-VAR	Weak
Wong (2018)	2000–2017	C-GARCH	Cointegrated
Bahmani-Oskooee and Saha (2016)	1980–2014	NARDL	Positive relationship
Ali et al. (2015)	1999–2014	TVECM	Not cointegrated
Tsai (2012)	1992–2009	Quantile estimation	Negative
Ibrahim (2000)	1979–1996	Granger causality	No causality impact

Table 2 Theoretical model perspectives between exchange rate and stock market

Theoretical	Approach	Theoretical forecast
Stock oriented model	Monetary Approach	Positive relationship from stock price to exchange rate (Gavin, 1989)
	Portfolio Balance Approach	Negative relationship from stock price to exchange rate (Frankel, 1983)
Flow oriented model	Good Market Approach	Positive relationship from exchange rate to stock prices (Dornbusch and Fischer, 1980)

Next, the Bai and Perron (2003) test was employed, which is appropriate for this study in order to test sequentially multiple structure breaks between REER and the stock market in Malaysia. It also statistically identifies the appropriate number of breaks and the exact data points that occur based on the model with breaks, indicated as (m+1) regime. This approach has ability to allow for autocorrelation and heteroskedasticity especially in the time series as compared to other breaks selection procedures (Anthoshin et al., 2008). Next, the combined cointegration approach developed by Bayer and Hanck (2013) was performed. This approach is combined with the Banerjee et al. (1998), Boswijk (1994), Engle and Granger (1987), and Johansen (1991) providing a precise and reliable cointegration result by eliminating multiple testing procedures of cointegration methodologies as shown in Equation (2) and (3). The Fisher F-statistics value is compared to the critical value to determine cointegration decisions.

$$\text{REER-KLSE} = 2\,[1n\,(P_{EG})+1n(P_{JOH})] \quad (2)$$

$$\text{REER-KLSE} = 2\,[1n\,(P_{EG})+(P_{BO})+(P_{BDM})] \quad (3)$$

where, $P_{EG,}$ $P_{JOH,}$ P_{BO} and P_{EDM} are the probabilities of Banerjee et al. (1998); Boswijk (1994); Engle and Granger (1987); and Johansen (1991), respectively.

To explore an asymmetric relationship, the Ender and Siklos (2001) approach, which allows for the multivariate asymmetric analysis context in time series data, was utilized. This approach proposed two types of tests (TAR and MTAR) to test an asymmetric relationship and long-run cointegration. TAR model is capable of capturing the deep process cycles while MTAR can capture sharp sequential movement. The F-joint statistics test refers to the hypothesis of H_0: $P_1 = P_2 = 0$ (an asymmetric test) and the F-equal statistic test is based on the hypothesis of H_0: $P_1 = P_2$ (long-run test). Meanwhile, the T-max statistic determines the long-run relationship between the tested variables. Moreover, the asymmetric adjustment and the long-run relationship arise when the F-joints and F-equal statistics reject the null hypothesis. Therefore, the Enders and Siklos (2001) model will incorporate the asymmetric adjustment, and is defined as follows (Equation (4)):

$$\Delta\varepsilon_t = p^{+}M_t\varepsilon_{t-1} + p^{-}(1-M_t)\varepsilon_{t-1} + \sum_{i=1}^{k}\delta_i\ \Delta\varepsilon_{t-1} + u_t \quad (4)$$

where, p^{+}, p^{-} and δi represent the coefficient value, u_t is the white noise disturbance, k is the length, i is the indicators function and et-1 are the changes in the previous period. For a more precise asymmetric adjustment, Enders and Siklos (2001) suggested an alternative test using the MTAR model, which depended on the changes of ε_t–1 from the previous time framework, whereby the MTAR formulation can written as shown in Equation (5):

$$\Delta\varepsilon_t = p^{+}M_t\varepsilon_{t-1} + p^{-}(1-M_t)\varepsilon_{t-1} + \sum_{i=1}^{k}\delta_i\ \Delta\varepsilon_{t-1} + u_t$$
$$M_t = 1 \text{ if } \Delta\varepsilon_{t-1} \geq \tau$$
$$M_t = 0 \text{ if } \Delta\varepsilon_{t-1} < \tau \quad (5)$$

Once the H_0: $p^{+} = p^{-} = 0$ hypothesis is tested and the null hypothesis is rejected, we proceed with testing for the asymmetric adjustment effect based on the hypothesis of H_0: $p^{+} = p^{-}$. If the symmetric null hypothesis is rejected, it shows the existence of asymmetric adjustment, which indicates a long-run equilibrium significant difference within the negative and positive estimators as shown clearly in Equation (6) and (7). This can be written as follow:

$$\Delta q_t = \delta_1^{+} M_t\,\varepsilon_{t-1} + \delta_1^{-}(1-M_t)\,\varepsilon_{t-1} + \sum_{i=1}^{k}\varphi i\Delta\ e_{t-1} + \sum_{i=1}^{k}\gamma i\Delta\ q_{t-1} + u_t \quad (6)$$

$$\Delta REER_t = \mu + \delta_1 W_{t-1}^{+} + \delta_2 W_{t-1}^{-} + \sum_{i=1}^{k}\alpha_i\,\Delta KLSE_{t-i} + v_t \quad (7)$$

where, the first difference and indication of the difference operator and the optimum lag order are represented from the previous equations, and v_t is the error correction term that measures the speed of adjustment from short-run towards long-run equilibrium condition. The Wald test estimation is used to examine the long and short-run causality between the estimated series. Finally, the δ_1 and δ_2 coefficient adjustment parameters are used to determine the long-run causality between the tested variables.

Results and Discussion

All variables are confirmed non-stationarity whether using a traditional unit root test or endogenous structure break test. Based on these unit root test statistical results, we proceed to test for the long-run cointegration.

This study found three structural breaks due to the internet bubble bursting crisis in stock markets across the US, Canada, Asia, and Europe in 1999, 2002 and 2015; in addition to 1997 AFC effects and 2003 SARS disease (see Table 4). Fong et al. (2008), and Ofek and Richardson (2003) proved that the types of investors as well as irrationality attitude of investors created the internet boom and crash to the local and international stock markets.

Table 3 Unit root estimation results

Variable	At level			At first difference		
	ADF	KPSS	ZA	ADF	KPSS	ZA
REER	-2.462	0.682**	-3.390	-14.402**	0.063	-8.358** (T_B: M10, 2001)
KLSE	-1.389	1.706**	-3.658	-13.586**	0.090	-9.998** (T_B: M12, 1999)

Note: T_B represent the time breaks and **$p < .05$.

Table 4 Bai and Perron estimation results

Break test	*F*-stat.	Scaled *F*-stat.	Critical value
0 vs. 1 *	231.399	462.799	11.47
1 vs. 2 *	107.848	215.697	12.95
2 vs. 3 *	56.611	113.222	14.03

Note: *$p < .10$. based on the Bai and Perron (1998; 2003) critical value. The breaks dates as determined by repartition represent 1999 M05, 2003 M10 and 2015 M03.

To reaffirm the long run relationship between REER and KLSE, the Bayer and Hanck (2013) combine cointegration test was utilized, and the statistical results are presented in Table 5. Although the EG-JOH statistics value is lower than the critical value at 5 percent and 10 percent significant level, the combined cointegration statistics value exceeds the critical value at 10 percent significant level, which leads to the rejection of the null hypothesis of no cointegration between the series. Thus, it proves the existence of long run cointegration relationship between REER and KLSE.

Table 5 Combined cointegration estimation results

Estimated Model	Fisher Statistics	
	EG-JOH	EG-JOH-BO-BDM
f(REER, KLSE, T_B)	7.142	18.172*
	Critical value	Critical value
At 5%	10.576	20.143
At 10%	8.301	15.938

Note: T_B represent the time breaks.
*$p < .10$.

This study used the MTAR model since it is more effective in the adjustment process by capturing the spiky adjustments in the equilibrium relationship (Table 6), and at the same time, exhibits more momentum in one direction than the other. Based on the result, we found an asymmetric and cointegration relationship between KLSE and REER, due to null hypothesis of symmetric relationship being rejected for both series. These estimation results are similar with Anjum et al. (2017) and Bahmani-Oskooee and Saha (2015) previous empirical fundings. Similarly, Cuestas and Tang (2015) also verified an asymmetric result when examining the China market, while El-Bejaoui (2013) also stated evidence of asymmetric cointegration between the exchange rate and import and export prices and direct relationship with stock prices of related firms.

The TVECM are based on the general to specific approach based on the optimal lag's selection as reported in Table 7. The result suggests that the negative deviation speed of adjustment appears to be stronger than positive deviation speed of adjustment. This implies that the Malaysian stock market has an inverse relationship with the real external competitiveness purchasing power. Specifically, a '*Bull Stock Market Index*' leads to decreasing value of competitiveness purchasing power of Ringgit Malaysia. On average, a 1 percent change in KLSE index causes the REER to change by -6.42 percent. The Wald test result also highlighted a unidirectional causality between REER and KLSE, which contradicted the results in Naresh at el. (2018) and Leung et al. (2017).

Table 6 Ender and Siklos cointegration estimation results

	TAR Model				MTAR Model			
	Without break		With break effect		Without break		With break effect	
	Coef.	*SE*	Coef.	*SE*	Coef.	*SE*	Coef.	*SE*
ρ+	-0.029	0.017	-0.049	0.029	-0.000	0.018	-0.013	0.026
ρ−	-0.052	0.023	-0.061	0.024	-0.082	0.020	-0.105	0.027
F	0.635	1.980	0.101	1.572	8.900*	2.631	6.683*	2.706
Ø*u*	3.744	4.820	4.197	6.050	7.973*	5.022	7.581*	6.450
T-max	-1.690	-1.878	-1.692	-2.238	-0.046	-1.727	-0.503	-2.062

Note:$p < .10$ based on the Monte Carlo simulations with 10,000 repetitions.

Table 7 TVECM estimation results

Variable	Coefficient	*t*-stat.
$\Delta KLSE_t$	0.049*** (0.019)	2.626
$\Delta KLSE_{t-2}$	0.095*** (0.019)	4.817
$\Delta KLSE_{t-5}$	0.035* (0.020)	1.742
TB	-0.015* 0.008	-1.707
δ^+	-0.009 (0.023)	-0.429
δ^-	-0.064*** (0.024)	-2.657

Wald test estimations	Chi-square	*p*
$H_0 = R^{-1} = R^{-2} = R^{-3} = R^{-4} = R^{-5} = R^{-6} = R^{-7} = 0$	4.007	.543
$H_0 = S^{-1} = S^{-2} = S^{-3} = S^{-4} = S^{-5} = S^{-6} = S^{-7} = 0$	37.563***	.000
$H_0 = TB^{-1} = TB^{-2} = TB^{-3} = TB^{-4} = TB^{-5} = TB^{-6} = TB^{-7} = 0$	5.440	.490

Note: R represent the REER, *S* is KLSE, and T_B referring to the time breaks.
*$p < .01$, **$p < .05$, ***$p < .10$.

Conclusion and Recommendation

The overall results of the study contribute and reinforce the findings in existing literature on the asymmetric relationship between the real external competitiveness purchasing power and stock market index, particularly for Malaysia. This study has proven that Malaysian stock market volatility negatively influences Malaysian real external competitiveness purchasing power. Although Malaysia is relatively resilient after recovering from 1997 AFC, the authorities must acknowledge that the current account surplus as well as trade surplus are offset by the budget deficit. Changes in stock market or external competitiveness exchange rate indirectly influences other macroeconomic variables that can affect the stability of current account, especially on trade volume. However, the surplus has been shrinking for the past few years. Therefore, the Malaysian authorities need to strengthen an integration between these two variables as one of the policy tools in drafting the national monetary policies and at the same time signaling the country's economic growth and development. In addition, this study also provides valuable information which would be beneficial for institutions, investors and hedgers about the investment and real external competitiveness purchasing power. A noncausality relationship from real external competitiveness purchasing power to stock market indicates that the Malaysia stock market is attractive, secured, and a diversified market for the foreigner investor. Nonetheless, the stakeholder needs to be vigilant of the unexpected spillover effect of external competitiveness purchasing power to stock market.

Conflict of Interest

The authors declare that there is no conflict of interest.

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References

Aftab, M., Ali, A. & Hegerty, S. W. (2021). Foreign exchange market pressure and stock market dynamics in emerging Asia. *International Economics and Economic policy*, *18*, 699–719. https://doi.org/10.1007/s10368-021-00501-w

Ali, H. S., Mukhtar, U., & Maniam, G. S. (2015). Dynamic links between exchange rates and stock prices in Malaysia: An asymmetric cointegration analysis. *Journal of Economics and Political Economy*, *2*(3), 1–7. http://dx.doi.org/10.1453/jepe.v2i3.357

Amado, A., & Choon, L. M. (2020). Impact of changes in exchange rate on stock market: An empirical evidence from Indonesia. *International Journal of Applied Economics, Finance and Accounting*, *7*(1), 24–31. https://doi.org/10.33094/8.2017.2020.71.24.31

Amavilah, V., Asongu, S. A., & Andrés, A. R. (2017). Effects of globalization on peace and stability: Implications for governance and the knowledge economy of African countries. *Technological Forecasting and Social Change*, *122*, 91–103. https://doi.org/10.1016/j.techfore.2017.04.013

Anjum, N., Ghumro, N. H., & Husain, B. (2017). Asymmetric impact of exchange rate changes on stock prices: Empirical evidence from Germany. *International Journal of Economics and Financial Research*, *3*(11), 240–245.

Anthoshin, S., Berg, A., & Souto, M. (2008). Testing for structures breaks in small samples. *IMF Working Papers*, *WP/08/75*, 1–27.

Bahmani-Oskooee, M., & Sohrabian, A. (1992). Stock prices and the effective exchange rate of the dollar. *Applied Economy*, *24*(4), 459–464. https://doi.org/10.1080/00036849200000020

Bahmani-Oskooee, M., & Saha, S. (2016). Do exchange rate changes have symmetric or asymmetric effects on stock prices? *Global Finance Journal*, *31*, 57–72. https://doi.org/10.1016/j.gfj.2016.06.005

Bahmani-Oskooe. M., & Saha, S. (2015). On the relationship between stock prices and exchange rate: A review article. *Journal of Economic Studies*, *42*, 701–732. https://doi.org/10.1108/JES-03-2015-0043

Bahramian, P., & Saliminezhad, A. (2020). Revisiting purchasing power parity in the Asean-5 countries: Evidence from the Fourier quantile unit root test. *Applied Economics Letters*, 1–6. https://doi.org/10.1080/13504851.2020.1803473

Bai, J., & Perron, P. (2003). Computation and analysis of multiple structural change models. *Journal of Applied Econometrics*, *18*(1), 1–22. https://doi.org/10.1002/jae.659

Banerjee, A., Dolado, J., & Mestre, R. (1998). Error-correction mechanism tests for cointegration in a single-equation framework. *Journal of Time Series Analysis*, *19*(3), 267–283. https://doi.org/10.1111/1467-9892.00091

Bashir, U., Yu, Y., Hussain, M., & Zebende, G. F. (2016). Do foreign exchange and equity markets co-move in Latin American region? Detrended cross-correlation approach. *Physica A: Statistical Mechanics and Its Applications*, *462*(C), 889–897. https://doi.org/10.1016/j.physa.2016.06.090

Bayer, C., & Hanck, C. (2013). Combining non-cointegration tests. *Journal of Time series Analysis*, *34*(1), 83–95. https://doi.org/10.1111/j.1467-9892.2012.00814.x

Boswijk, H. P. (1994). Testing for an unstable root in conditional and unconditional error correction models. *Journal of Econometrics*, *63*, 37–60. https://doi.org/10.1016/0304-4076(93)01560-9

Branson, W.H. (1981). *Macroeconomic determinants of real exchange risk* (pp.1–57). WP 0801, National Bureau of Economic Research, Inc.

Burkett, P., & Hart-Landsberg, M. (1998). East Asia and the crisis of development theory. *Journal of Contemporary Asia*, *28*(4), 435–456. https://doi.org/10.1080/00472339880000241

Caporale, G. M., Hunter, J., & Ali, F. M. (2014). On the linkages between stock prices and exchange rates: Evidence from the banking crisis of 2007–2010. *International Review of Financial Analysis*, *33*, 87–103. https://doi.org/10.1016/j.irfa.2013.12.005

Cuestas, J.C., & Tang, B. (2015). Asymmetric exchange rate exposure of stock returns: Empirical evidence from Chinese industries. *Sheffield Economic Research Paper Series*, *21*(4), 1–21. https://doi.org/10.1515/snde-2016-0042

Dahir, A. M., Mahat, F., Ab Razak, N. H., & Noordin, A. B. A. (2018). Revisiting the dynamic relationship between exchange rates and stock prices in BRICS countries: A Wavelet Analysis. *Borsa Istanbul Review*, *18*(2), 101–113. https://doi.org/10.1016/j.bir.2017.10.001

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, *49*(4), 1057–1072. https://doi.org/10.2307/1912517

Dornbusch, R., & Fischer, S. (1980). Exchange rates and current account. *American Economic Review*, *70*, 960–971. https://www.jstor.org/stable/1805775

El-Bejaoui, H.J. (2013). Asymmetric effects of exchange rate variations: An empirical analysis for four advanced countries. *International Economics*, *135–136*, 29–46. https://doi.org/10.1016/j.inteco.2013.10.001

Enders, W., & Siklos, P.L. (2001). Cointegration and threshold adjustment. *Journal of Business and Economic Statistics*, *19*(2), 166–176. https://www.jstor.org/stable/1392161

Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation and testing. *Econometrica*, *55*(2), 251–276. https://doi.org/10.2307/1913236

Fong, W. M., Lean, H. H., & Wong, W. K. (2008). Stochastic dominance and behavior Towards risk: The market for internet stocks. *Journal of Economic Behavior & Organization*, *68*(1), 194–208.

Frankel, J. A. (1983). Monetary and portfolio-balance models of exchange rate determination. In J. S. Bhandari, & B. H. Putnam (Eds.), *Economic interdependence and flexible exchange rates* (pp. 84–115). The MIT Press.

Gavin, M. (1989). The stock market and exchange rate dynamics. *Journal of International Money and Finance*, *8*(2), 181–200. https://doi.org/10.1016/0261-5606(89)90022-3

Ibrahim, H. M., & Aziz, H. (2003). Macroeconomic variables and the Malaysian equity market: A view through rolling subsamples. *Journal Economic Studies*, *30*(1), 6–27. https://doi.org/10.1108/01443580310455241

Ibrahim, M. H. (2000). Cointegration and granger causality tests of stock price and exchange rate interactions in Malaysia. *ASEAN Economic Bulletin*, *17*(1), 36–47. https://www.jstor.org/stable/25773607

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian Vector Autoregressive Models. *Econometrica*, *58*, 165–188. https://doi.org/10.2307/2938278

Kwiatkowski, D., Phillips, P. C. B., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics*, *54*(1–3), 159–178. https://doi.org/10.1016/0304-4076(92)90104-Y

Leung, H., Schiereck, D., & Schroeder, F. (2017). Volatility spillovers and determinants of contagion: Exchange rate and equity markets during crises. *Economic Modelling*, *61*, 169–180. https://doi.org/10.1016/j.econmod.2016.12.011

Liang, C.C., Lin, J.B., & Hsu, H.C. (2013). Reexamining the relationships between stock prices and exchange rates in ASEAN-5 using panel granger causality approach. *Journal of Economic Modelling*, *32*, 560–563. https://doi.org/10.1016/j.econmod.2013.03.001

Liew, V. K. S., Rowland, R. A., Puah, C. H., Huil, J. K. S., Rahim, A. R., & Wong, S. S. L. (2018). Macroeconomic instability index and Malaysia economic performance. *International Business Research*, *11*(3), 179–185. htts://doi.org/10.5539/ibr.v11n3p17

Mahapatra, S., & Bhaduri, S. N. (2019). Dynamics of the impact of currency fluctuations on stock markets in India: Assessing the pricing of exchange rate risks. *Borsa Istanbul Review*, *19*(1), 15–23. https://doi.org/10.1016/j.bir.2018.04.004

Mroua, M., & Trabelsi, L. (2020). Causality and dynamic relationships between exchange rate and stock market indices in BRICS countries: Panel/GMM and ARDL analyses. *Journal of Economics, Finance and Administrative Science*, *25*(50), 395–412. https://doi.org/10.1108/JEFAS-04-2019-0054

Naresh, G., Vasudevan, G., Mahalakshmi, S., & Thiyagarajan, S. (2018). Spillover effect of US dollar on the stock indices of BRICS. *Research in International Business and Finance*, *44*, 359–368. https://doi.org/10.1016/j.ribaf.2017.07.105

NUMBEO. (2021). *Purchasing power index by country 2021*. https://www.numbeo.com/

Ofek, E., & Richardson, M. (2003). Dotcom mania: A survey of market efficiency in the internet sector. *Journal of Finance*, *58*, 1113–1138. https://doi.org/10.1111/1540-6261.00560

Pan, M. S., Fok, R. C. W., & Liu, Y. A. (2007). Dynamic linkages between exchange rates and stock prices: Evidence from East Asian markets. *International Review of Economics & Finance*, *16* (4), 503–520. https://doi.org/10.1016/j.iref.2005.09.003

Tsai, I. C. (2012). The relationship between stock price index and exchange rate in Asian markets: A quantile regression approach. *Journal of International Financial Markets, Institutions and Money*, *22*(3), 609–621. https://doi.org/10.1016/j.intfin.2012.04.005

Vadivel, A. (2021). Dynamics of exchange rate and stock market price volatility: Evidence from India. *Journal of Public Affairs*, *21*, e2144. https://doi.org/10.1002/pa.2144

Wong, H.T. (2017). Real exchange rate returns and real stock price returns. *International Review of Economics & Finance*, *49*, 340–352. https://doi.org/10.1016/j.iref.2017.02.004

Wong, H.T. (2018). Volatility spillovers between real exchange rate returns and real stock price returns in Malaysia. *International Journal of Finance & Economics*, *24*(1), 131–149. https://doi.org/10.1002/ijfe.1653

World Bank. (2021, June 30). *World development indicators*. https://databank.worldbank.org/source/world-development-indicators

Xie, Z., Chen, S., & Wu, A. (2020). The foreign exchange and stock market nexus: New international evidence. *International Review of Economics & Finance*, *67*(C), 240–266. https://doi.org/10.1016/j.iref.2020.01.001

Zivot, E., & Andrews, D. W. K. (1992). Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis. *Journal of Business and Economic Statistics*, *10*, 251–270. https://doi.org/10.2307/1391541