

Stock Prices, Foreign Exchange Reserves, and Interest Rates in Emerging and Developing Economies in Asia

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Abstract

This paper examines the relationship between a) stock prices and b) foreign reserves, exchange rates, and interest rates in emerging and developing economies in Asia. Empirical results show that there is no co integration relationship among these four variables. Instead, foreign reserves have significant positive effects on stock prices; however, the opposite is not true. Moreover, exchange rates and interest rates have not influenced stock prices. Accumulation of foreign reserves is important in these countries, as it engenders financial stability and economic growth.

Keywords: exchange rate; foreign exchange reserve; interest rate; stock

1. Introduction

This paper examines the relationship between a) stock prices and b) foreign exchange reserves, exchange rates, and interest rates in emerging and developing economies in Asia. Of these factors, the relationship between foreign exchange reserves and stock prices is the main focus of this study. Foreign reserves have been discussed in the framework of balance of payments in academic fields; however, little study has been done on its influences on the economy. Stock prices are no exception. The relationship between foreign exchange reserves and stock prices has not extensively researched; however, quite recently this relationship has begun to receive much attention. Market participants sometimes watch foreign reserves and conduct financial transactions according to the accumulation of foreign exchange reserves. More concretely, the shortage of foreign exchange reserve is sometimes considered to be a sign of a weak economy. Sometimes countries that have a shortage of foreign exchange reserves become a target of currency speculation or attacks. As a result, foreign exchange reserves are related to financial stability and economic growth. Foreign exchange reserves indicate real or future economic conditions. So, whether or not foreign exchange reserves are an important factor in determining stock prices is an important issue not only for market participants in reality but also for policymakers. However, no economic theories have described the relation between foreign exchange reserves and stock prices and few studies examined the relationship empirically in spite of its importance.

Foreign exchange reserves are assets held by a central bank or other monetary authority. They are accumulated in various reserve currencies, mostly by the US dollar. Reserve positions are held in interbank positions, other transferable deposits, other deposits, loans, equity, investment funds, and financial derivatives, and so on. A central bank that conducts a fixed exchange rate system may encounter a situation in which it must use reserves to maintain the fixed exchange rate or the system. Mixed exchange rate systems that use fixed and floating rate strategies may require the use of foreign exchange operations to maintain the targeted exchange rate within the limits prescribed in each country. In addition, under the floating exchange rate system, official accumulation of foreign exchange reserves may be perceived as an intervention to influence the exchange rate, which may undermine the credibility of floating exchange rates and, recently, inflation targets. Considering these facts, too, it is easily understood that foreign exchange reserves or its ratio to GDP and other factors is strongly related to economic activity or sound economic growth. Foreign exchange reserves are strongly related to the credibility of policy authorities and the economy.

Some emerging and developing economies have introduced measures to boost foreign exchange reserves. This approach seems to obtain high credibility and reputation from market participants and may cause financial stability or stimulate economic growth. In addition, monetary authorities have much interest in enhancing stock prices. Therefore, it is important to examine the relationship between foreign exchange reserves and stock prices. The situation is different from that in developed countries in reality; however, examination of the relationship between a) stock prices and b) foreign reserves, exchange rates, and interest rates in emerging and developing economies seems to be very important.

This paper is structured as follows. Section 2 reviews the literature on the relationship between a) stock prices and b) foreign exchange reserves, exchange rates, and interest rates in emerging and developing economies. Reviews are performed without limitation in Asian economies. Section 3 discusses the theoretical aspects of the empirical analyses. Section 4 shows the empirical analyses and analyses the results. Finally, this paper ends with a brief summary.

2. Literature Review

As mentioned in the previous section, few studies have considered the relationship between a) stock prices and b) foreign exchange reserves, exchange rates, and interest rates in spite of its importance. The only exceptions are balance of payments and stock prices, both of which have been examined theoretically and empirically. However, little study has been conducted on the relationships among stock prices, foreign exchange reserves, and interest rates. In particular, the relationship between foreign exchange reserves and stock prices has not been examined either theoretically or empirically.

However, more studies have been published about the relationship between exchange rates, interest rates and stock prices. Dimitrova (2005) showed that there is a significant relationship between exchange rates and stock prices. Doong et al. (2005) found bidirectional causality between stock prices and exchange rate for Indonesia, Korea, Malaysia, and Thailand. Sohail and Hussain (2009) indicated that real effective exchange rates, industrial production, and money supply have a positive effect on stock prices. Issahaku et al. (2013) showed a causal relationship running from exchange rates and inflation to stock returns. Mazuruse (2014) found that exchange rates, treasury bills, consumer price indexes, and money supply influence stock returns in Zimbabwe. Taguchi (2012) showed positive relationships between stock prices and money supply and between stock prices and interventions in foreign exchange markets by financial authorities.

As globalization has occurred all over the world, the relationship among stock prices of different countries has begun to receive attention. Soydemir (2000) showed that although no single emerging countries 'stock markets affect the US stock market, a combined effect of emerging stock markets on the US stock market exists. The relationship between foreign exchange reserves and stock prices is the main focus of the present study, which, as noted previously, has not received much research attention. Ibrahim (2000) found that foreign exchange reserve policy and exchange rate impact stock market stability in Malaysia. Hassan and Al Refai (2012) indicated that foreign exchange reserves, trade surplus, money supply, and oil prices impact stock prices in Jordan. Bhatia and Kishor (2013) showed bidirectional Granger causality between foreign exchange reserves and institutional investors flows in India. Ray (2013) found that foreign exchange reserves influence stock market capitalization. Akinlo (2015) showed that foreign exchange reserves in Nigeria have a positive effect on stock market growth. In addition to these studies, there are some related studies. Kim and Yang (2009) indicated that capital inflow caused stock prices but not land prices to increase. Chao et al. (2014) found that relative scale of the threshold for foreign exchange reserves influenced the timing of the regime collapse. Osigwe and Uzonwanne (2015) showed the existence of unidirectional causality from exchange rate to foreign reserve. Moreover, the empirical results have not reached definite conclusions. Further studies are needed to clarify these issues.

Few studies have been conducted on the relationship between foreign exchange reserves and stock prices; however, the importance of this area has been growing. In general, the higher the reserves, the higher the ability of the monetary authorities to avoid fluctuations in the balance of payments regardless of foreign exchange rate regimes. It can be concluded that foreign exchange reserves are also related to economic activity and financial stability. Monetary authorities may accumulate foreign exchange reserves to avoid negative evaluations by financial market participants all over the world, especially in emerging and developing economies. There are no strong theoretical reasons for financial authorities to accumulate foreign exchange reserves to avoid turmoil; however, recent financial crises are said to have been related to the shortage of foreign exchange reserves.

Financial authorities are nervous about the accumulation of foreign exchange reserves. However, there is some possibility that this is only an image or illusion. The relationship between foreign exchange reserves and economic activity is becoming more and more important.

Finally, foreign exchange reserve accumulation may correspond to a loan to foreigners to purchase a quantity of tradable goods from the economy. In this case, the real exchange rate depreciates and the growth rate increases. When examining the relationship between a) stock prices and b) foreign reserves, exchange rates, and interest rates, one should consider the relationships between c) foreign exchange reserves and exchange rates and d) foreign exchange reserves and interest rates and so on. Examination of the relationship between foreign exchange reserves and stock prices, however, is sometimes insufficient. The next section presents the empirical research for these issues.

3. Theoretical Aspects for Empirical Studies

To examine the relationship between a) stock prices and b) foreign exchange reserves and other economic variables, namely, exchange rates, and interest rates, equation (1) is regressed using empirical methods.

$$\text{STOCK}_t = \alpha + \beta_1 \text{RESERVE}_t + \beta_2 \text{EXCHANGE}_t + \beta_3 \text{INTEREST}_t + \epsilon_t \quad (1)$$

Where STOCK is stock prices, RESERVES is a foreign exchange reserve, EXCHANGE are foreign exchange rate, and INTEREST is interest rate. t denotes time. Equation (1) is the main target of this study.

However, the formula contains unit roots, so unit root tests need to be performed. If the results showed variables are I (1), co integration should be examined. When the empirical results show a co integration relationship among variables, there must be causality in at least one direction. Finally, error correction causality is used for estimation.

4. Empirical Analyses

4.1 Empirical methods

The data are annual for emerging and developing economies Asia for the period from 1980 to 2015. The reason for the selection of Asia is that there is a data availability problem in emerging and developing economies. Obtaining data from emerging and developing economies in Asia is possible and relatively easy. Exchange rates are each country's exchange rate against the US dollar. Interest rates are money market rates. All of the data are from International Financial Statistics by IMF. The average of the rate for each variable is used for estimation.

First, unit root tests are conducted using Augmented-Dickey Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. Both of these are typical methods to check unit roots. Further, a co integration test is done. Moreover, Granger causality is employed for estimation. To check only one direction can be dangerous. Bidirectional causality relationships should be checked in this study. One reason is that there is no definite theory for this issue. Finally, an error correction model is applied.

4.2 Results and Analyses

The results of unit root tests are as shown in Table 1. Results of both the ADF and KPSS are shown in this table.

Table 1: Unit root tests

	ADF		KPSS	
	Level	1 st Difference	Level	1 st Difference
STOCK	-1.011	-8.737***	0.280	0.706**
RESERVE	-4.389***	-6.291***	0.183	0.580**
EXCHANGE	-1.819	-3.012**	0.585**	0.602**
INTEREST	-1.132	-2.827**	0.335	0.730**

Note: Critical values of ADF tests are -3.632, -2.948, and -2.612 at 1, 5, and 10% level. Asymptotic critical values of KPSS tests are 0.739, 0.463, and 0.347. ***, **, and * are significant at 1, 5, and 10% levels. The results in Table 1 are robust. They show that all of the variables are integrated of order one. Next, regression analyses of equation (1) are conducted. In this case, I(1) is used for regression. Ordinary Least Squares (OLS) is employed as an empirical method; however, two other methods are used here.

However, OLS is usually thought to be a biased estimator when there are co integrations among variables. A fully modified OLS (FMOLS) can solve this problem. When there is a shock to the model (i.e., large change in the underlying X to throw Y out of its long-run equilibrium), OLS is unable to produce a good estimate. The issue becomes even more complicated when the effect of the shock is integrated into the time series and the model does not go back into its long-run equilibrium. FMOLS improves the forecast in this situation.

Robust estimation is unlike maximum likelihood estimation. OLS estimates for regression are sensitive to the observations that do not follow the pattern of the other observations. This is not a problem if the outlier is simply an extreme observation from the tail of a normal distribution; however, if the outlier is from non-normal measurement error or some other violation of standard OLS, it compromises the validity of the regression results if a no robust regression method is employed. The empirical results of OLS, FMOLS, and Robust least squares are shown in Table 2.

Table 2: Regression results

	OLS				FMOLS	Robust Least Squares
C	-1073.134 (-0.834)	6.593** (2.090)	-516.313 (-0.736)	6.045 (0.845)	-411.139 (-0.450)	-1323.860 (-1.014)
RESERVE	0.720** (1.889)	0.732** (2.045)			0.721*** (2.520)	0.639* (1.674)
EXC	21735.34 (0.840)		10468.23 (0.747)		8385.680 (0.455)	26779.47 (1.020)
INT	-1.106 (-0.763)			-0.236 (-0.299)	-0.279 (-0.271)	-1.183 (-0.774)
Adj. R2	0.034	0.071	0.013	0.027	0.023	
F-statistic & probability	1.401 (0.261)	3.627 (0.065)	0.559 (0.459)	0.089 (0.766)		
D.W.	2.743	2.755	2.658	2.635		
Long-run variance					211.506	
Rw-squared						0.121
Rn-squared statistic & probability						3.529 (0.316)

Note: Figures in parentheses are t values for the cases of OLS and FMOLS and z-statistics for the case of robust squared estimation. ***, **, and * denotes significance at 1, 5, and 10% levels.

The empirical results show that accumulation of foreign exchange reserves positively impact stock prices to raise significantly. This result can be expected naturally as explained before. Coefficients of exchange rates and interest rates are expected to be positive (depreciation promotes exports and increases stock prices) and negative. The results are the same as the expectations; however, they are not significant. Interpretation of these findings is difficult but the directions are as expected. Results of the co integration tests are shown in Table 3.

Table 3: Co integration rank test

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	Critical Value (0.05)	Prob.
None	0.999	465.498***	47.856	0.0001
At most 1	0.578	58.326***	29.797	0.000
At most 2	0.450	28.960***	15.494	0.0003
At most 3	0.223	8.605***	3.841	0.003

Note: ***, **, and * denote significance at 1, 5, and 10% levels.

The results in Table 3 are clear. There is no long-run relationship among the four variables, although the relationship between foreign exchange reserves and stock prices is clear. Moreover, causality is checked. This study confirms that foreign exchange reserves have influenced stock prices; however, the reverse relationship should be checked.

In addition, this study found no long-run co integration relationships among the four variables (i.e., stock prices, foreign reserves, exchange rates, and interest rates); however, there may be some possibility of significant relationships among the explanatory variables (i.e., foreign exchange reserves, exchange rates, and interest rates). The Granger causality test is used for estimation. It is the most used method for checking causality and statistical hypothesis method to determine whether one time series is useful in forecasting another variable. For example, a time series X is said to Granger-cause Y if it can be produced by a series of (usually) F-statistics on lagged values of X, that those X values yield significant results about future values of Y. The results are shown in Table 4.

Table 4: Granger causality tests

	F-Statistic	Prob.
RESERVE does not Granger cause STOCK	7.936***	0.008
STOCK does not Granger cause RESERVE	1.938	0.173
INT does not Granger cause STOCK	1.012	0.321
STOCK does not Granger cause INT	1.809	0.188
EXC does not Granger cause STOCK	1.558	0.220
STOCK does not Granger cause EXC	0.058	0.810
INT does not Granger cause RESERVE	1.801	0.188
RESERVE does not Granger cause INT	2.308	0.138
EXC does not Granger cause RESERVE	0.696	0.410
RESERVE does not Granger cause EXC	0.479	0.493
EXC does not Granger cause INT	3.876*	0.059
INT does not Granger cause EXC	3.983*	0.054

The empirical results shown in Table 4 are not robust; however, almost all of the results are as expected. Foreign exchange reserves impact stock prices and the reverse relationship does not exist. Exchange rates have influenced interest rates at the 10% level (however, near the 5% level) and interest rates have influenced exchange rates at the 10% level (also, near the 5% level). However, both of them are rejected at 5% level.

Finally, an error correction model (ECM) is checked. ECM is a multiple time series model that is commonly used for data for which the underlying variables have a long-run trend (i.e., co integration). ECM is useful for estimating both short-term and long-term effects of one time series on another series. The term *error-correction* means that the last period's deviation from a long-run equilibrium influences the short-run dynamics. The result is shown in Table 5.

Table 5: Error correction model

C	9.955
RESERVE	0.079** (2.839)
EXC	-4.307 (-0.664)
INT	-1.430** (-2.839)
Adj.R2	0.762
F-statistic	12.387

Note: Figures in parentheses are t values. ***, **, and * denotes significance at 1, 5, and 10% levels.

Interpretation of Table 5 is quite difficult. The coefficient of RESERVE is positive and significant as expected; however, the coefficient of INTEREST is negative and significant. The result fits well with traditional economic theory; however, this study seems to indicate a small difference. The coefficients are negative but not significant. There may be some possibility that interest rates have played important roles in determining stock prices and movements of financial markets. Market participants should take this fact into account and policymakers should recognize the important roles of interest rates in policy decisions. Interest rates are important measures for economic stabilization in almost all countries.

5. Conclusions

This paper examined the relationship between a) stock prices and b) foreign reserves, exchange rates, and interest rates in emerging and developing economies in Asia. Empirical results show that there are no co integration relationships among these four variables. Instead, foreign reserves have significant positive effects on stock prices; however, the reverse is not true. Moreover, exchange rates and interest rates have not influenced stock prices clearly. Accumulation of foreign reserves is important in these countries, as it may bring economic growth and financial stability.

Finally, annual data sometimes confer difficulties for the analysis of the financial and economic situation. In particular, this paper targets the movements of stock prices that fluctuate so often. In addition, if the sample size were sufficient, the sample period should be divided for future research. Since the 1980s, financial and economic conditions have changed greatly. Other areas and each country should be examined if the lack of data is solved. In Asia, currency crises in 1997-1998 had large and varied effects on each country, for example. There is some room for further study.

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References

- Akinlo, O. O. (2015). Impact of foreign exchange reserves on Nigerian stock market. *International Journal of Business and Finance Research*, 9(2), 69-76.
- Bhatia, A. & Kishor, N. (2013). Impact of FII investments on stock market volatility and foreign exchange reserves: The Indian experience. *Transnational Corporation Review*, 5(3), 26-45.
- Chao, C. C., Chen, L. J., Hu, S. W., Huang, C. Y., & Wang, V. (2014). Stock prices, foreign reserves, and regime collapse, 21(2), 207-225.
- Dimitrova, D. (2005). The relationship between exchange rates and stock prices: Studies in multivariate model. *Issues in Political Economy*, 14, 1-25.
- Doong, S. C., Yang, S. Y., & Wang, A. (2005). The dynamic relationship and pricing of stocks and exchange rates: Empirical evidence from Asian emerging markets. *Journal of American Academy of Business*, 7(1), 118-123.
- Hassan, G. M. & Al Refai, H. M. (2012). Can macroeconomic factors explain equity returns in the long run? The case of Jordan. *Applied Financial Economics*, 22(13), 1029-1041.
- Ibrahim, M. H. (2000). Co integration and Granger causality tests of stock price and exchange rate interactions in Malaysia. *ASEAN Economic Bulletin*, 17(1), 36-47.
- Issahaku, H., Ustarz., Y. & Domanban, P. B. (2013). Macroeconomic variables and stock market returns in Ghana: Any causal link. *Asian Economic and Financial Review*, 3(8), 1044-1062.
- Kim, S. & Yang, D. Y. (2009). Do capital inflows matter to asset prices? The case of Korea. *Asian Economic Journal*, 23(3), 323-348.
- Mazuruse, P. (2014). Canonical correlation analysis: Macroeconomic variables versus stock returns. *Journal of Financial Economics Policy*, 5(2), 179-196.
- Osigwe, A. C. & Uzonwanne, M C. (2015). Causal relationship among foreign reserves, exchange rates and foreign direct investment: Evidence from Nigeria. *International Journal of Economics and Financial Issues*, 5(4), 884-888.
- Ray, S. (2013). Foreign exchange reserves and its impact on stock market capitalization: Evidence from India. *Research on Humanities and Social Science*, 2(2), 46-60.
- Sohail, N., & Hussain, Z. (2009). Long run and short run relationship between macro economic variables and stock prices in Pakistan: The case of Lahore stock exchange. *Pakistan Economic and Social Review*, 47(1), 183-198.
- Soydemir, G. (2000). International transmission mechanism of stock market movements: Evidence from emerging equity markets. *Journal of Forecasting*, 19(2), 149-176.
- Taguchi, H. (2012). Capital inflows and asset prices: The recent evidence of selected East Asian economics. *Asian Economic and Financial Review*, 2(8), 902-920.