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Stock Prices and Exchange Rates Dynamics in South Africa: An application of Asymmetric Co-integration Approach

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Abstract. We applied asymmetric cointegration approachtoinvestigate the impacts of stock prices on exchange rates in South Africa using monthly data from January 1980 to May 2014. The empirical finding shows that the two macroeconomic variables are cointegrated using traditional Engle-Granger approach. While TAR model shows no element of cointegration, MTAR model revealsthat there is long-run relationshipbetween the variables and they are asymmetrically cointegrated as signifies by both F-equality and F-joint respectively. Using Enders & Siklos (2001) table we reject null hypothesis of no cointegration at 5% significance level. This means that stock prices influences exchange rates in South Africa and the speed of adjustment is non-linear, when share price changes exchange rates equally changes but not in the same proportion with that of share prices. The policy implication is that the authorities in this country should focus more on stabilizing their exchange rates in relation to other major global currencies more especially American dollar. When the value of Rand continues to increase the economy will be less competitive internationally at the same time the value of the stocks might be unattractive even to international investors.
Keywords. Stock prices, Exchange rates, Cointegration, Asymmetric, TAR, MTAR.
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1. Introduction

Stability of the capital market is a prerequisite condition for the growth of financial sector which will lead to greater economic growth. Studies on the relationship between stock prices and exchange rates get momentum since early 1990s that brought about changes in the international financial system which came up as a result of rise of new markets, steady ban of capital inflows and foreign exchange limitations, or the implementation of flexible exchange rates system in both transition and emerging markets. These changes broadened numerous investment prospects at the same time increased the volatility of exchange rates which increased significant share of risks to the overall investment

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decision and give hint for the need of portfolio diversification. The present study aimed to investigate the effects of stock prices on exchange rates using asymmetric cointegration approach initiated by Enders &Siklos (2001). Stock prices is one of the determinant factor that influencethe healthiness of the financial sector in every economy, whenever the share prices appreciate both local and international investors are motivated to sale so as to earn maximum returns. Real exchange rates appreciation of local currency induces local firms to be less competitive hence make their export more expensive in the international market, this invariably affect stock prices negatively and therefore shareholders' returns.

2. Review of related literature

2.1. Theoretical Framework

Theoretically, flow-oriented models and stock-oriented are the two models that explain the nexus between stock prices and exchange rates. Flow-oriented model assumes that the main determinant of exchange rate is the country's current account or the performance of its trade balance. This model postulate that variation of exchange rates influence international competitiveness and balance of trade which will affect the real economic variables such as output and real income (Dornbusch&Fisher, 1980). The main argument of flow-oriented model is that

the relationship between stock prices and exchange rates is positive[1]. Stock oriented model on the other hand rely more on the role of financial accounts in the determination of exchange rates.

The two models will however be distinguished into portfolio balance model and monetary model, the latter claimed that the relationship between stock prices and exchange rates is negative and concluded that stock prices have an influence on exchange rates[2]. Increase in the domestics stock prices results to the appreciation of local currency via both direct and indirect networks.

Investors will be encourage to buy more domestic stocks when its prices increase, all thing being equal, they will sale more of foreign assets in order to get domestic currency which is crucial in buying new local stocks. Changes in demand and supply of currencies affect domestic currency positively. Increase in local assets prices leads to more wealth which influenced investors to increase demand for money, this mechanisms increase domestic interest rates. Considering the high interest rates in the economy foreign investors will be motivated to increase their investment and the demand for more domestic currency and consequently the value will appreciate. Monetary approach claim that since exchange rate refers to the price of an asset, the expected future value of exchange rate determined its real value as prices and other assets[3]. The only factors that affect the real exchange rate are those that influence the future value of the exchange rate because stock prices developments might be determined by different aspects the, this approach therefore signify no connection between exchange rates and stock prices. The motivation for this study is related to the influence of South African financial market in African sub-continent that determined the performance of other macroeconomic variables including exchange rates. Secondly, there are limited studies that apply Asymmetric cointegration approach on the share price exchange rates nexus based on the existing empirical literature.

2.2 Empirical Literature Review

However, several empirical studies provided divergent views on the dynamics of stock prices and exchange rates. Earlier studies that apply correlation analysis established divergent results on the interaction between the two financial variables, these include among others Aggarwal (1981), Donnelly & Sheehy (1996) that report a linear relationship between stock prices and real exchange rates for U.S.

and U.K financial markets. Soenen & Hennigar (1988) claimed to establish a negative interaction that is statistically significant among U.S. stock market prices and exchange rates for 15 countries. However, some studies apply cointegration and causality techniques and equally obtained different results. Ajayi et al., (1998) observe nature of causality between stock prices and exchange rates for seven developed markets and eight Asian developing markets. They used Granger causality tests and found that the causality is one-way i.e. stock markets Granger cause exchange rates for all advanced financial markets. While no steady causal relationship established in the emerging markets. Neih & Lee (2001) applied both Engle-Granger and Johansen maximum likelihood cointegration tests to observe whether there is cointegration between stock prices and exchange rates for G7 nations. The result shows no evidence of cointegration between the variables for all the countries under study. Chiang & Yang (2003) in their study for nine Asian economies establish that interaction between exchange rates and rate of stock returns is found to be positive among all countries investigated.

Smyth & Nandha (2003) conducted a study to test the relationship between stock prices and exchange rates for Bangladesh, India, Pakistan, and Sri Lanka. They apply both Engle–Granger and the Johansen cointegration methods and found no cointegration between the variables for all the countries under study. Though, the Granger causality tests shows there is unidirectional causality running from exchange rates to stock prices for India and Sri Lanka, whereas no any causality found for Bangladesh and Pakistan. Plylaktis & Ravazzolo (2005) investigate the short-run and long-run nexus between stock prices and exchange rates using multivariate VAR and Granger causality approaches among five Asia pacific nations; Malaysia, Hong Kong, Philippines, Singapore, and Thailand. Their major finding signifies positive association between stock market and foreign exchange. In the study by Pan et al. (2007) that assess the nexus between stock prices and exchange rates amongseven East Asian countries. Applying both Granger causality tests and multivariate cointegration techniques and found evidence of causality between the variables running from exchange rates to stock prices for all the economies except Malaysia. The result also indicates an absence of cointegration between stock prices and exchange rates.

Analyzing the dynamic interaction between real effective exchange rates and stock prices in China, Zhao (2010) applied both vector Autoregression (VAR) and the multivariate GARCH (MGARCH). The result shows no indication of cointegration between the two variables. The two financial variables also shows time-varying features when apply multivariate GARCH. Investigating the causality between stock and foreign exchange markets in Australia, Canada, Japan, Switzerland, and UK, using granger causality approach, the results shows no cointegration among the variables. There is existence of causality between the variables in Canada, Switzerland, and UK, weak causality however exist in opposite direction in Switzerland. The Hiemstra–Jones test is used to observe the likely non-linear causality and outcome indicate that causality from stock prices to exchange rates in Japan and weak of the exchange rate to stock prices is found in Switzerland (Alagidede, et al., 2011). Study conducted by Ndako (2013) on the connection between stock prices and exchange rates for five Sub-Saharan African financial markets and applied Vector Autoregression and the dynamic conditional correlation models. Based on Vector Autoregression model the finding signifiesan absence of cointegration between the variables in the sample. However, based on the dynamic conditional correlation approach it shows that coefficients are not persistent and the estimate indicate a negative time-changing correlation for all the economies except Ghana that exhibit positive correlation.

3. Overview of South African economy

South Africa [4] was faced with internal and financial sanctions during pre-independence apartheid regime that affected the performance of the economy adversely. However, when the country regained its democratic freedom the economic structures vividly changed. The growth rate of the economyon average reached up to 3.3% between 1994 and 2012 in real terms. The economy is growing at the rate of 5% in real terms during 2004 to 2007 though it fall down to less than 3% between 2008 and 2012 which might not be unconnected withthe last global financial crisis. Johannesburg stock exchange (JSE) was formed in 1887 exactly when the country did its first gold rush, the first law of financial market was passed in 1947 and the stock market joined world federation of exchanges in 1963 and its operations was promoted to electronic trading around 1990s. JSE capital market is well established as it serves both local and African continent. By market capitalization JSE is among the top largest stock market in the world and the largest in Africa as its market capitalization reached a tune of ($1,007 billion) at the end of 2013. JSE offer effective and safe primary and secondary markets through a various variety of instruments sustained by efficient cost services.

4. Data, methodology and empirical results

Monthly data for the period of January, 1980 to May, 2014 ofthis study was obtained from Reserve Bank of South Africa (RBSA) and Data Stream International. Data for stock prices obtained from the Reserve Bank of South Africa and exchange rates from Data Stream International.

4.1. Econometrics model specification

$$LSP_t = \alpha_0 + \alpha_1 LER_t + \mu_t \quad (1)$$

LSP signify log of stock prices and LER log of exchange rates, α_0 is the intercept andα_1 is the slope of the coefficient that describes the connection between the two variables, and μ_t is the error term. Considering the nature of time series data, we need to confirm the stationarity of the data by testing unit root for the variables. Table 1 below shows the result of both ADF and PP unit root tests, it shows that we cannot reject null at level I(0), but it is rejected in first difference I(1) for both variables at 5% level of significance.

Table 1. *Results of the ADF and PP Unit Root Tests for South Africa (1980-2014)*

Variables	ADF	PP
$\boldsymbol{LSP_t}$	-0.849	-0.416
	(0.803)	(0.903)
$\boldsymbol{\Delta LSP_t}$	-6.524	-35.714
	(0.000)***	(0.000)***
$\boldsymbol{LER_t}$	-1.755	-1.784
	(0.402)	(0.405)
$\boldsymbol{\Delta LER_t}$	-19.302	-19.288
	(0.000)***	(0.000)***

Notes: The ADF and PP test equations include both constant and trend terms. The Schwarz information criterion (SIC) is used to select the optimal lag order in the ADF test equation. The values in brackets are corresponding p-values. ***Denote significance level at 1%, **5%, and *10% respectively.

All variables are stationary I (1), this highlight the presence of stationarity therefore we can proceed to test for Engle-Granger cointegration based on the equation below:

$$\Delta\mu_t = \rho\mu_{t-1} \sum_{i=1}^{q} \delta_1 \Delta X_{t-1} + v_t \quad (2)$$

The long-run estimated equation and Engle-Granger estimation is shown below;

Table 2.*Long-run equation and Engle-Granger estimation*

LR Equation	$\boldsymbol{LSP_t = 4.896 + 3.236LER_t + \mu_t}$
	(0.00) (0.00)
E-G Cointegration	$\Delta\mu_t = -1.002\mu_{t-1}$
	(-20.26)

Notes: Figures in parenthesis are standard errors

Based on Engle-Granger cointegration test the t-statistics shows the existence of cointegration for South Africa based on t-statistics (-20.26). To identify whether the cointegrating relationship is asymmetric we employed Enders and Granger (1998) and Enders & Siklos (2001). Equation 2 will be estimated which is based on ρandλ, the equation will be altered below;

$$\Delta\mu_t = I_t\rho_1\mu_{t-1} + (1 - I_t)\rho_2\mu_{t-1} + \sum_{i=1}^{p-1} \gamma_i\Delta\mu_{t-1} + \varepsilon_t \quad (3)$$

Above and below threshold is determine by (τ) as shown by the equation below;

$$T_t = \begin{cases} 1 \; if\mu_{t-1} \geq \tau \\ 0 \; if\mu_{t-1} < \tau \end{cases} \quad (4a)$$

$$M_t = \begin{cases} 1 \; if\Delta\mu_{t-1} \geq \tau \\ 0 \; if\Delta\mu_{t-1} < \tau \end{cases} \quad (4b)$$

Equation 3 and 4a is known as Threshold Auto Regressive (TAR) model, while equation 3 and 4b is Momentum Threshold Auto Regressive (M-TAR) model. This model suggests that when μ_{t-1} is above the threshold the coefficient for the adjustment is $\rho 1\mu_{t-1}$, while if the μ_{t-1} is below the threshold the adjustment coefficient is$\rho 2\mu_{t-1}$. To observe whether the relationship between the variables is asymmetric null hypothesis will be tested (Enders and Siklos, 2011), Ho:$\rho_1 = \rho_2 = 0$. If we reject null hypothesis based on our result, F-equality value will be used to determine asymmetric adjustment by testing the null hypothesis of Ho: $\rho_1 = \rho_2$.

Table 3.*TAR and M-TAR cointegration estimates of share prices and exchange rates*

	TAR	TAR Consistent	M-TAR	M-TAR Consistent
$\rho_1{}^a$	-0.047	-0.042	-0.032	-0.028
	(0.02)	(0.01)	(0.02)	(0.17)
$\rho_2{}^a$	-0.051	-0.064	-0.065	-0.155
	(0.02)	(0.02)	(0.02)	(0.03)
Φ	4.461	4.678	4.99	9.169
	(5.81)	[6.933]	[6.13]	[8.133]*
$\rho_1 = \rho_2$	0.016	0.439	1.057	9.223
	(2.70)	[6.602]	[3.971]	[8.804]*
τ	0	-0.80	0	-0.26

Notes:t-statistics and critical values are given in round and squared brackets respectively. Monte Carlo simulation is used to obtain critical value at 5% significance level.

Table 3 indicate TAR (τ = 0), TAR consistent (-0.80), M-TAR (τ = 0), M-TAR consistent (-0.26) as well as threshold adjustment cointegration. Both ρ_1 and ρ_2 shows element of convergence as indicated by the negative signs and are all significant except ρ_1 for M-TAR consistent which is negative but insignificant.F-statistics Φ is use to reject null hypothesis of no cointegration ($\rho_1 = \rho_2 = 0$) at 1% for M-TAR consistent. Symmetric adjustment hypothesis of the existence of cointegration ($\rho_1 = \rho_2$) as initiated by Enders & Siklos (2001) can be rejected both at 1% as shown in above table 3. Our results based on M-TAR model signify that variables are asymmetrically cointegrated as shown by both F-equality and F-joint.

4.2. Asymmetric error correction model of stock prices and exchange rates

Our result shows asymmetric cointegration for M-TAR consistent, based on the model we will test for asymmetric error correction modelling to examine short-run and long-run dynamics of the variables. ECT_{t-1} is the linear error correction term which determine both short-run and long-run dynamics relationship between stock prices and exchange rates, it explain how variables moves back to equilibrium when deviated, as the speed of adjustment shows asymmetric as indicated by F-joint, we will now move on to test for non-linear error correction model.

$$\Delta SP_t = \underset{(0.18)}{0.018} - \underset{(0.05)}{0.027}Z^{+}_{t-1} + \underset{(0.79)}{0.003}Z^{-}_{t-1} - \underset{(0.00)}{0.403}\Delta SP_{t-1} - \underset{(0.00)}{0.198}\Delta SP_{t-2} - \underset{(0.00)}{0.158}\Delta SP_{t-3} - \underset{(0.66)}{0.038}\Delta ER_t + \varepsilon_t$$

Adj R^2 = 0.14

F-Stat= 9.39 (0.00)

Notes: Numbers in parentheses are *p*-values.

The error correction model (Z^+) shows the degree of convergence and statistically significant, while (Z^-) exhibit element of divergence and statistically insignificant, but since (Z^+) satisfied the above mentioned condition, we will therefore reject null at 10% level of significance. When the variables deviated from the equilibrium above threshold it takes 2.7% times to adjust while only 0.3% to adjust below threshold, this signifies that variables adjust faster above the threshold as hypothesized. The findings propose that 0.3% negative deviation of share prices from the long-run values will be corrected in the subsequent month. However, the positive deviation speed of adjustment is 2.7%. The estimations shown in table above are suitable based on the significance values as shown are all significance. From the policy perspectives, we believed that share prices have significant influence on the exchange rates in South Africa, this become imperative for the decision makers to put more emphasis on the stability of their currency in relation to other currency as failure to check that may result to successive decline of their export because the economy will be less competitive internationally and therefore become less attractive even to foreign investors.

5. Conclusion

The present study investigated the impact of share prices on nominal exchange rates in South Africa for the period of 1980 to 2014. These two financial variables are among the essential determinants of financial market development as well as overall economic growth.Based on the results we found that share prices and

exchange rates are asymmetrically cointegrated based on MTAR model. Impliedly it means share prices influences exchange rates in the long-run this substantiate portfolio balance model and the speed of adjustment tend to be non-linear which is faster when above the threshold.The policy implicationsthat can be drawn from this study include; since the value of stock prices have positive link with exchange rates for a very long period of time. Continuous increase of share prices could influence exchange rate upward which might make the economy less competitive in the international market because their products is much expensive when consider the value of their currency related to others. South African monetary authority should therefore put more effort to control incessant increase of Rand in relation to other major global currencies that might attract more foreign direct investment and stimulate export hence make the economy more competitive.

Notes

[1]According to flow-oriented model it presume that the causality between exchange rate and stocks prices is that depreciation of local currency make local firms more competitive because their export will be less expensive internationally, the higher the export the higher the incomes and this increase firms' stock prices.

[2] For Details on portfolio balance approach see (Frankel, 1983; Branson – Henderson, 1985).

[3]Check (Frenkel, 1976), (Dornbusch, 1976), and (Frankel, 1979) to get more insight on asset market models.

[4]Statistics on South African economy can be accessiblethroughhttp://beta2.statssa.gov.za/?page_id=735&id=1

References

Alagidede, P., Panagiotidis, T., & Zhang, X. (2011). Causal relationship between stock prices and exchange rates. *The Journal of International Trade & Economic Development*, 20(1), 67-86. doi: 10.1080/09638199.2011.538186

Aggarwal, R. (1981). Exchange rates and stock prices: A study of the United States capital markets under floating exchange rates. *Akron Business and Economic Review*, 12, 7–12.

Ajayi, R.A., Friedman, J., & Mehdian, S.M. (1998). On the relationship between stock returns and exchange rates: Test of Granger causality. *Global Finance Journal*, 9(2), 241–251. doi: 10.1016/S1044-0283(98)90006-0

Alagidede, P., Panagiotidis, T., & Zhang, X. (2011). Causal relationship between stock prices and exchange rates. *The Journal of International Trade & Economic Development*, 20(1), 67-86. doi: 10.1080/09638199.2011.538186

Branson, W.H. & Henderson, D.W. (1985). The Specification and Influence of Assets Markets. In: Jones, R. W. – Kenen, P. B. (eds.)' *Handbook of International Economics*. Vol. 2. Amsterdam, Elsevier, 1985, pp. 179–201.

Chiang, T.C.,& Yang, S.Y. (2003). Foreign exchange risk premiums and time-varying equity market risks. *International Journal of Risk Assess. Management*, 4(4), 310–331. doi: 10.1504/IJRAM.2003.003828

Dornbusch, R. (1976). Expectations and Exchange Rate Dynamics. *Journal of Political Economy*, 84, 1161–1176.

Donnelly, R.,& Sheehy, E. (1996). The share price reaction of U.K. exporters to exchange rate movements: An empirical study. *Journal of International of Business Studies*, 27(1), 157–165. doi: 10.1057/palgrave.jibs.8490130

Dornbusch, R.,& Fisher, S. (1980). Exchange Rates and the Current Account. *American Economic Review*, 70, 960–971.

Enders, W.,& Siklos, P., (2001). Cointegration and threshold adjustment. *Journal of Business and Economic Statistics*, 19(2), 166–176. doi: 10.1198/073500101316970395

Engle, R.F.,& Granger, C.W.J. (1987). Cointegration and error-correction: Representation, estimation and testing. *Econometrica*, 55, 251–276.

Frankel, J. (1976). A monetary approach to the exchange rate: Doctrinal aspects and empirical evidence. *Scandinavian Journal of Economics*, 78, 200–224.

Frankel, J. (1979). On the mark: A theory of floating exchange rates based on real interest differentials. *American Economic Review*, 69, 610–622.

Frankel, J. (1983). Monetary and portfolio balance models of exchange rate determination. In: Bhandari, J. – Putnam, B. (eds.): *Economic Interdependence and Flexible Exchange Rates*. Cambridge (MA), MIT Press, pp. 84–114.

Nieh, C.C.,& Lee, C.F. (2001). Dynamic relationship between stock prices and exchange rates for G-7 countries. *The Quarterly Review of Economics and Finance*, 41(4), 477–490. doi: 10.1016/S1062-9769(01)00085-0

Ndako, U. B. (2013). Dynamics of stock prices and exchange rates relationship: evidence from five sub-Saharan African financial markets. *Journal of African Business*, 14(1), 47-57. doi: 10.1080/15228916.2013.765322

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. doi: 10.1016/j.iref.2005.09.003

Phylaktis, K.,& Ravazzolo, F. (2005). Stock prices and exchange rate Dynamics. *Journal of International Money and Finance*, 24, 1031–1053. doi: 10.1016/j.jimonfin.2005.08.001

Rahman, M.L.,& Uddin, J. (2009). Dynamic relationship between stock prices and exchange rates: evidence from three south Asian countries. *International Business Research*, 2(2), 167. doi: 10.5539/ibr.v2n2p167

Smyth, R.,& Nandha, M. (2003). Bivariate causality between exchange rates and stock prices in South Asia. *Applied Economics Letters*, 10(11), 699–704. doi: 10.1080/1350485032000133282

Soenen, L.,& Hennigar, E. (1988). An analysis of exchange rates and stock prices: The US experience between 1980 and 1986. *Akron Business and Economics Review*, 19, 7–16.

Zhao, H. (2010). Dynamic relationship between exchange rate and stock price: Evidence from China. *Research in International Business and Finance*, 24(2), 103-112. doi: 10.1016/j.ribaf.2009.09.001