COMMODITY PRICES AND STOCK MARKET PERFORMANCE IN SOUTH AFRICA

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Abstract

As an export based economy, commodity prices and stock market performances are always a course for concern in the South African economy. This paper investigates the effects of the commodity prices and selected macroeconomic variables on stock market performance. The paper uses quarterly time series data and the estimation covers the period 1994 to 2013. Using Engle-Granger two steps econometric technique, the underlying series are tested for univariate characteristics of the variables unit root by employing the Augmented Dickey-Fuller, Phillips-Perron and Kwiatkowski-Phillips-Schmidt-Shin test statistics. The findings show that an increase in commodity prices is associated with an increase in stock market performance and there is a positive association between stock market and macroeconomic such as money supply and exchange rate in South Africa.

Keywords: Commodity Prices, Stock Market, Macroeconomic Variables, Engle-Granger, South Africa

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1. Introduction

As an export based economy, commodity prices and stock market performances are always a course for concern in the South African economy. According to Hassan and Salim (2011) commodity price is thought to be a significant variable in conducting monetary policy. The premise is that it conveys information about the future movements in general price level. This is based on the fact that they are used as important inputs into production of manufactured goods. Therefore any change in their price directly affects production cost and the general price level. Any movement in commodity price may also signal the probable direction of future price level. As far as stock market is concerned, Nordin et al. (2014) argue that the rise in the stock market index has always been associated with the booming of the market and vice versa. Since a stock market index measures the performance of stock prices, fluctuations in the existing stock prices are indeed being reflected in the stock market index. Eita (2012) points out that the stock markets allow companies to acquire capital easily and efficiently because they create a market for efficient business transactions to take place. They are also important stimulants to economic development because they provide alternatives to debt financing.

Despite the important role played by commodity prices and stock market in the economy, studies on the relationship between these two variables in South Africa are limited. To the best of our knowledge inadequate attention has been given to this aspect in South Africa. Creti et al. (2012) maintains even though commodity markets share several characteristics with stock markets and financial assets, so far literature has analysed this phenomenon mainly by focusing on oil, and looking at the co-movements between stock and oil markets. Most of the literature offers substantial evidence on the impact of oil on stock prices, putting forward the negative relationship between oil price and stock market returns. Another novelty of this study is that according to Rahman *et al.* (2009) prior studies on the determinants of stock return primarily focus on the well developed markets with less attention to the emerging ones. Therefore this study attempts to take advantage of this research gap to investigate the effects of the commodity prices and selected macroeconomic variables on stock market performance in order to extend the existing literature in the South African context. The study uses typical selected macroeconomic variables such as

exchange rate, inflation rate and money supply. Apart from that we employ two variables representing commodity prices (gold price and platinum price) which are considered most important for the South African economy.

Determining such a relationship is not only imperative for academic standpoint but also for policy viewpoint. This sentiment is echoed by Arezki *et al*. (2012) who maintain that given the very high level of volatility in commodity prices, it is important for resource rich countries in general to understand better the relationship between volatility in commodity prices and fluctuations in their macroeconomic variables such as exchange rate. The challenge is more massive in relation to the case of South Africa. The country is reeling from worker strikes and a falling commodity prices. At the same time it is facing fresh challenges in drawing investors to its resource-rich economy. South Africa is regarded is as a trove of precious metals and coal, and is believed to have the world's largest reserves of platinum. But some companies say they are reassessing their business as labour strikes upend production and hurt exports (Maylie and Mcgroarty, 2014). This situation is a cause for concern because according to Hawthorne *et al.* (2005) a substantial proportion of South Africa's export is made up of commodities such as platinum (10.13% of total exports), gold (9.53% of total exports) and coal (6.16% of total exports). They fall amongst top five commodities exported.

Just like many other export based economies, South Africa is also faced with large terms of trade fluctuations which render its real exchange rate volatile. The highly unstable nature of the exchange rate presents a challenge to both policy makers and investors in terms of consumption and investment decision making processes. According to UNCTAD (2012) resource-based economies with floating exchange rates that try to stem inflationary pressure by monetary tightening may face an additional problem in the form of currency appreciation exceeding levels that could be expected on the bases of macroeconomic fundamentals. The objective of this study is to investigate the effects of the commodity prices and selected macroeconomic variables on stock market performance in South Africa using Engle and Granger (1987) approach.

The rest of the paper is organised as follows. Section 2 provides theory and literature review of the study. Section 3 discusses empirical model, estimation techniques and data. Estimation of the results is presented in Section 4 and the study is concluded in Section 5.

2. Theory and Literature Review

The nature of variables used in this study calls for a scrutiny of several theories and empirical literature which are relevant to this investigation. Nordin *et al*. (2014) investigated the role played by the commodity price in influencing the stock market index. They concluded that the price of palm oil is positively significant in influencing the stock market index in Malaysia. Chan and Faff (1998) found out that there has been a widespread sensitivity of the Australian industry returns to gold price returns, over and above market returns. The sensitivity is found to be of positive sign for the resource and mining sector industries, whereas it is of negative sign for the industrials sector.

The theoretical linkage between the macroeconomic factors and the stock mark can be obtained from the present value model or the dividend discount model (DDM) and the arbitrage pricing theory (APT). The present value model focuses on the long run relationship whereas the APT focuses on the short run relationship between the stock market movement and the macroeconomic fundamentals. Any new information about the fundamental macroeconomic factors such as inflation, money supply, real interest rate, etc. may influence the stock price (Naik and Padhi, 2012). The APT theoretical framework developed by Ross (1976) links the stock returns to several variables that characterise several sources of income volatility.The general idea behind this framework is that macroeconomic influences and asset sensitivity to those can explain the expected return on a financial asset.

Dornbusch and Fischer (1980)'s flow orientated model postulates that exchange rate movements cause stock price movements. According Richards *et al*. (2009) this model is built on the macroeconomic view that as the stock prices represent the discounted present value of a firm's expected future cash flow, then any phenomenon that affects a firm's cash flow will be reflected in that firm's stock price if the market is efficient as the Efficient Market Hypothesis suggests. They conducted a study examining the interaction between stock prices and exchange rates in Australia. The empirical analysis provides evidence of a positive cointegrating relationship between these variables, with Granger causality running from stock prices to the exchange rate during the sample period. Although they did not include commodity prices, the significance of the results lends support to the notion that these two key financial variables interacted in a manner consistent with the portfolio balance that is stock price movements cause changes in the exchange rates. Patel (2012) investigated the effects of macroeconomic determinants on the performance of the Indian Stock Market for variables such as money supply, interest rates, inflation, gold price, silver price, oil price, index of industrial production, etc. The study established that there is a long run relationship between macroeconomic variables and the stock market indices. The causality runs from exchange rate to stock market indices to index of industrial production and oil price.

In a related study by Kaehler *et al*. (2013) found out that exchange rate is negatively correlated with Iraqi Stock Market (ISX). The appreciation of the Iraqi dinar against the US dollar by 100 units would, on average lead to a rise of the ISX by 57.9 points. The interest rate also plays a crucial role in explaining the movement of the ISX index because an increase in interest rates is followed by a decrease of the stock market index.

The relationship between money supply and stock price is still ambiguous (Naik and Padhi, 2012). Hosseini *et al*. (2011) indicate that money supply is likely to affect the stock market index through at least three ways: first, innovations in the money supply may be correlated to unexpected increase in inflation and future inflation uncertainty and thus, negatively correlated to stock market index. Second, innovations in the money supply may positively affect the stock market index through its effect on economic activity. Finally, portfolio theory says that a positive relationship exists, since it relates a rise in the money supply to a portfolio change from noninterest bearing money to financial assets including equities. The effects of money supply on stock market is also support by Rozeff (1974)'s monetary portfolio theory which postulate that the volatility of money supply alters the equilibrium position of money, hence altering the composition and assets price in an investor's portfolio.

3. Empirical Method

3.1 Empirical Model

Following an extensive review of the theoretical and empirical literature on the effects of commodity prices and selected macroeconomic variables on stock market performance (returns), the empirical model is specified as follows:

$$SMK_t = f(\overset{-/+}{P_t},\ \overset{-/+}{ER_t},\ \overset{-/+}{M_t},\ \overset{+}{GOLD_t},\ \overset{+}{PLATINUM_t}) \quad (1)$$

where *SMK*, *P*, *ER*, and *M* are stock market performance, inflation, exchange rate and money supply respectively. Variables *GOLD* and *PLATINUM* are two measures of commodity prices. Equation (1) specifies stock market performances as a function commodity prices and other macroeconomic variables such as inflation, exchange rate and money supply. The effect of commodity prices on stock market is expected to be positive. However, the effect of other macroeconomic variables on the stock market is an empirical question.

3.2 Estimation Technique

This study use the Engle-Granger two steps econometric technique Engle and Granger (1987) in order to test the effect of commodity prices and selected macroeconomic variables on the stock market performance. This technique involves determination of the long-run cointegration relationship between the variables. This is done through testing of stationarity of the residuals using unit roots tests such as Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test statistics. Non-stationarity of the variables is taken care of by estimating the error correction model (ECM). The Engle-Granger two steps estimation technique is explained as follows:

$$Y_t = \overset{\wedge}{Y_t} + \mu_t = \overset{\wedge}{\phi}_0 + \overset{\wedge}{\phi}_1 X_t + \mu_t \quad (2)$$

The existence of a long-run cointegrating relationship between *X* and *Y* is important in this estimation technique. It is also important for the properties of the error term to be stationary (Damoense-Azevedo, 2013). The residuals from regressing *Y* on *X* in Equation (2) are derived as expressed in Equation (3):

$$\mu_t = Y_t - \overset{\wedge}{Y_t} \quad (3)$$

Unit root test statistics are used to test if the residuals (μ_t) generated in Equation (3) are stationary. If they are stationary, then it means that the variables are cointegrated. In other words, *X* and *Y* are cointegrated. The existence of cointegration between the variables suggests that it is appropriate to proceed to the second step, which is estimation of the error correction model (ECM). The ECM is specified as follows:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \eta ECM_{t-1} + \varepsilon_t \quad (4)$$

where Δ indicates that the variables are in a differenced form, α_0 represent short run elasticity and η denotes the speed of adjustment to long-run equilibrium. ECM_{t-1} and ε_t are the error correction term and residual term of the short-run equation respectively. ECM_{t-1} is the lagged residuals generated in Equation (3). If there is an adjustment to equilibrium, η is expected to be negative and statistically significant. The ADF, PP and KPSS test statistics are used to test the univariate characteristics of the variables.

3.3 Data

The study uses quarterly data and the estimation covers the period 1994 to 2013. The Johannesburg Stock Exchange (JSE)'s is used as a measure of stock market performance. The data for this variable were obtained from the IMF's International Financial Statistics. Two measures of commodity prices are

used in this study. These are gold (*GOLD*) and platinum (*PLATINUM*) prices. The data for gold prices were obtained from the IMF's International Financial Statistics, while those of platinum prices were obtained from Platinum Today's website (http://www.platinum.matthey.com/prices/price-charts). The data for money supply proxied by M2 (*M*), exchange rate of South African Rand per USA dollar (*ER*) and inflation represented by the consumer price index (*P)* were all obtained from the IMF's International Financial Statistics. The estimations are done with all variables in logarithms.

4. Estimation Results

4.1Unit Root Test

The performance of the unit root test is the first step before estimating Equation (1). This involves univariate characteristics of the variables. The purpose of the test is to determine whether the variables are stationary or nonstationary. The results are presented in Table 1 and they indicate that all the variables are I(1). The implication is that they are nonstationary at levels and stationarity is obtained only after differencing.

Table1. Unit root test results

Variables	Model	ADF		PP		KPSS	
		Levels	Differences	Levels	Differences	Levels	Differences
LnSMK	InterceptTrend & intercept	-1.23 -1.79	-8.03*** -7.98***	-1.34 -2.14	-8.10*** -8.05***	1.02### 0.11	0.07 0.05
LnP	Intercept Trend & intercept	-1.18 -3.14	-5.38*** -5.46***	-1.31 -2.65	-5.39*** -5.48***	1.24### 0.09	0.16 0.07
LnM	Intercept Trend & intercept	-2.35 -0.42	-2.59* -8.08***	-2.27 -0.50	-7.60*** -8.05***	1.24### 0.19##	0.41 0.11
LnER	Intercept Trend & intercept	-1.63 -1.90	-7.88*** -7.84***	-1.71 -2.10	-7.90*** -7.85***	0.75### 0.18##	0.11 0.08
lnGOLD	Intercept Trend & intercept	0.08 -1.92	-6.41*** -6.53***	0.19 -1.89	-6.40*** -6.53***	1.01### 0.28###	0.41 0.20
LnPLATINUM	Intercept Trend & intercept	-0.81 -3.42*	-7.23*** -7.18***	-0.83 -2.60	-6.50*** -6.43***	1.18### 0.14#	0.09 0.10

*Notes: ***/**/* denotes rejection of the null of unit root at 1%/5%/10% significance level.*
###/##/# indicates rejection of o the null of stationary at 1%/5%/10% significance level.

4.2 Estimation Results

Equation (5) presents the long-run results of the effects of the commodity prices and selected macroeconomic variables on stock market performance in South Africa. The t-statistics are squared brackets.

$$\ln SMK_t = -34.05 + 0.16\ln GOLD_t + 0.41\ln PLATINUM_t + 1.92\ln M_t + 0.59\ln ER_t - 4.18\ln P_t$$
$$[-10.4]\ [2.17]\qquad [3.98]\qquad [10.45]\qquad [5.05]\qquad [-10.20]$$
$$R-squared: 0.93$$
$$Adjusted\ R-squared: 0.93 \qquad (5)$$

Equation (5) shows that an increase in commodity prices is associated with an increase in stock performance. An increase of 1% in gold price will results in stock market performance to increase by 0.16%. If platinum prices increase by 1% stock market performance will increase by 0.41%. Macroeconomic variables such as money supply and depreciation of the exchange rate are also associated with an improvement in stock market performance. The residuals from Equation (5) were tested for stationarity using ADF and PP test statistics and the results indicated that they are stationary. This means that there is cointegration between stock market performance and explanatory variables. It is now appropriate to proceed to the next step, which is the ECM. The results of the ECM are presented in Equation (6).

$$\Delta \ln SMK_t = \underset{[-2.76]}{-2.36\Delta \ln P_t} + \underset{[4.54]}{0.43\Delta \ln PLATINUM_t} \underset{[-2.36]}{-0.23\Delta \ln PLATINUM_{t-1}} +$$
$$\underset{[3.29]}{0.34\Delta \ln PLATINUM_{t-2}} \underset{[-1.91]}{-0.19\Delta \ln PLATINUM_{t-3}} \underset{[2.59]}{+0.93\Delta \ln M_t}$$
$$\underset{[2.30]}{+0.84\Delta \ln M_{t-1}} \underset{[2.22]}{+0.27\Delta \ln ER_t} \underset{[-3.04][-3.09]}{-0.09DUM08-0.24ECM_{t-1}}$$

$$R-squared: 0.53$$
$$Adjusted\ \ R-squared: 0.47 \qquad (6)$$

The results of Equation (6) show that all variables are statistically significant. The coefficient of ECM is statistically significant. The ECM coefficient shows that there is adjustment to equilibrium. It suggests a moderate speed of adjustment equal to 24% from short-run disequilibrium to the long-run equilibrium. The results passed all diagnostic statistics (Table 2) and this means that there is no violation of the assumptions of the classical linear regression model.

Table 2. Diagnostic Tests

Tests	Type	Test statistics	Probabilities
Normality	JB	1.08	0.58
Serial correlation	LM	0.31	0.73
Heteroskedasticity	ARCH	0.17	0.67
	White	68.17	0.07
Stability	Ramsey	4.48	0.08

Conclusion

The paper investigated the effects of the commodity prices and the selected macroeconomic variables on stock market performance in South Africa using Engle and Granger (1987) approach. The analysis employed the time series quarterly data and the estimation covers the period 1994 to 2013. The study used the selected macroeconomic variables such as exchange rate, inflation rate and money supply and two variables representing commodity prices (gold prices and platinum prices) as regressors. Whilst the Johannesburg Stock Exchange used as a measure of stock market performance acted as the dependent variable.

Our research contributes to the empirical evidence to the debate of the association between the commodity prices and stock markets performance in developing economies. The study also highlights relationship between the selected macroeconomic variables and the stock market performance in South Africa. The cointegration relationship between stock market performance and explanatory variables was established and the findings show that increase in commodity prices is associated with an increase in stock performance in South Africa. This is in line with Nordin *et al*. (2014) and Chan and Faff (1998).

With regard to relationship between the selected macroeconomic variables and the stock market performance, the results suggest that the positive effect of money supply on the stock market performance proposes that an increase in money supply caused inflation to rise and result in an increase in interest rate. This impacted negatively on stock market performance. A negative effect of prices on stock market performance suggests that equities are not a hedge against inflation and this in line with the postulation of Fama (1980). Our results are also in line with Richards et al. (2009) and Patel 2012 who indicated that there is a positive relationship between exchange rate and the stock prices.

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