Is There a Long Run Relationship Between Stock Prices and Monetary Variables? Evidence from Jamaica.

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Abstract

This paper employed a Vector Error Correction model (VECM) to investigate the inter-relationship between stock prices and monetary indicators for Jamaica. The Johansen co-integration test was used to determine the existence of a long term relationships between stock prices and monetary variables such as money supply, interest rate, inflation rate and the exchange rate. The variables were found to be co-integrated with significant relationships in line with apriori expectations. Coefficients from the co-integrating vector, normalized on the stock price, suggest that the JSE Main Index is positively influenced by the inflation rate and M3 and negatively by the exchange rate, interest rate and M2. Furthermore, the Granger-causality tests show that only M2 is a predictor of stock prices. This suggests that equity investors show greater responsiveness to M2, as changes in this variable are indicative of underlying liquidity conditions and growth in economic activity. As such, regulators have greater impact on the stock market through the money supply channel. Impulse response functions show that shocks to all the variables affect the stock price. Moreover, the short run interactions are similar to the long run relationships for all variables, except the exchange rate and the inflation rate

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[1] The views expressed are those of the author and do not necessarily reflect those of the Bank of Jamaica

Introduction

Understanding the empirical relationships between stock prices and monetary variables such as money supply, interest rate and inflation rate are important to policy makers, investment professionals as well as academics. Most of the studies done on these relationships found that monetary variables are influential factors on stock market returns across a variety of markets. On the other hand, several studies question the existence of any significant relationships between stock prices and monetary variables.[2] The relationships appear to differ from country to country. Consequently, the objective of this paper is to uncover the relationships between stock prices and monetary indicators by examining the dynamics between these variables for Jamaica.

The Jamaica Stock Exchange (JSE), the only securities exchange in Jamaica, has operated since 1968. Trading began in 1969 with 34 companies being listed and since then the JSE has grown in size, depth and liquidity, which has helped diversify portfolio returns of investors. The JSE has also been a viable means for companies to raise capital for investment. Consequently, it is important for central banks to ascertain the impact of monetary variables on stock market performance. In the recent global economic crisis, central banks have used monetary variables, such as the interest rate and money supply, to drive economic activity and curtail high levels of inflation. This underscores the necessity for policy makers to be knowledgeable of the impact of these variables on stock prices in order to influence economic recovery.

This paper will use the Johansen co-integration approach to determine whether there is a long-run relationship between stock prices and monetary variables. In addition, Granger Causality tests will be used to determine whether a causal relationship exists between the variables examined and stock prices. That is, how well do the different variables help in the prediction of the stock price movements? The results provide important information on the short-run and long-term impact of monetary shocks on stock prices.

[2] See Poterba, Culter and Summers (1989)

Literature Review

There exist many published studies that have examined the interaction between stock returns and macroeconomic variables. It is widely theorized that stock prices are influenced by macroeconomic variables such as the interest rate, exchange rate and inflation rate. In particular, some papers show that monetary policy and macroeconomic events have a substantial influence on the volatility of stock prices.[3] The implication of this is that central bank policies, through the use of various monetary variables, can influence investment decisions and, consequently, the overall state of the economy.

Examination of the dynamic inter-relationship between stock prices and monetary indicators is guided primarily by three areas of finance: the efficient capital market (ECM) theory; the arbitrage pricing theory (APT); and general equilibrium (GE) models of the financial sector. The ECM theory states that the stock returns should reflect all available information in the market, while the APT predicts a relationship between the returns of a portfolio and the returns of a single asset through a linear combination of many independent macro-economic variables (see Stephen Ross, 1976). That is, the APT theorem establishes an equilibrium pricing relation between each asset's expected return and all others.[4] Alternatively, GE models emphasize stock returns as an important link between the real and financial sides of the economy (see Tobin, 1969). Using a GE model, Tobin demonstrated how stock returns may respond to changes in the monetary and fiscal policy variables of the model. Tobin's theoretical analysis suggests that both money growth and budget deficits both have a significant impact on stock returns.

Studies testing ECM theory utilize variables such as stock prices, interest rate, inflation, money supply and the foreign exchange rate. For example, Fama (1970), Rogalski and Vinso (1977), Geske and Roll (1983), Pearce and Roley (1985) provide evidence that the efficient capital market hypothesis holds. Vinso and Rogalski (1977) and Geske and Roll (1983) went further to study the nature of causality among the variables examined. These

[3] See Gan, Lee, Yong and Zhang (2006)

[4] Specifically, the theorem shows that an asset's expected returns beyond the risk –free rate will simply be the sum of its exposure to some shared sources of risks, weighted by the prices the market assigns to these risks-the risk premia.

studies differ in terms of the direction of causality. That is, whether the causality goes from the publicly available information to the stock prices or from the stock prices to the publicly available information. Geske and Roll (1983) argue that their empirical phenomenon does not indicate causality, while Rogalski and Vinso (1977) found that causality does not appear to go from money supply to stock prices but rather from stock prices to money supply and possibly back again. Laopodis (1987) and Darrat (1988) in examining the effect of monetary and fiscal policies on the stock market discovered that changes in the stance of fiscal policy play an important role in determining stock prices. Darrat (1988) concluded that the ECM hypothesis does not hold and indicated that stock prices do not reflect all available information in the market.

Many empirical papers used the Ross (1976) model to guide their examination of the validity of APT regarding stock prices. Schor, Bonomo, and Pereira (2000) analyzed monthly returns of 10 share portfolios negotiated at Bovespa between 1987 and 1997 and found evidence in favor of the APT. [5] Cagnetti (2002) focused on testing and comparing the Capital Asset Pricing Model (CAPM) and APT in the Italian stock market. [6] He found that APT, which allows multiple sources of systematic risks to be taken into account, performs better than the CAPM in all the tests considered. Iqbal and Haider (2005) studied the validity of APT using returns from 24 actively trading stocks in Karachi Stock Exchange and found support for APT. Hamida (2006) investigated the Swiss Investment Expenditures using Tobin's q model and found that Tobin's q model is relevant in explaining the Swiss investment movements after controlling for some stock exchange disturbances which begun in 1985.[7]

Consequently, a key dimension of analyzing financial market performance is to investigate the effect of policy actions on the financial markets. Over the past two decades, several studies have been conducted on the efficiency of the stock market and

[5]São Paulo Stock Exchange (Bovespa) is the largest stock market in Latin America.
[6]The CAPM is a model that describes the relationship between risk and expected return and that is used in the pricing of risky securities. It states that the expected return of a security or a portfolio equals the rate on a risk-free security plus a risk premium. If this expected return does not meet or beat the required return, then the investment should not be undertaken.
[7] Such as the availability of information needed to make sound investment decisions.

the relationship between monetary and fiscal variables and stock prices. The bulk of these studies examined stock markets in developed nations, while more recently, a few studies have focused on developing and emerging market economies. In particular, there is limited empirical evidence for the Caribbean on the long term relationship between stock price movements and monetary and fiscal variables. Some analysts account for this by highlighting that emerging markets are usually characterized by market participants as well as quality and availability of information which change rapidly through time.[8] Consequently, stock markets in emerging market countries are generally characterized as unstable and shallow.

Many studies have found long run relationships between stock prices and macroeconomic variables. These papers include Muradoglu, Metin and Argacs (2001), Karamustafa and Kucukkale (2003), Erdoğan and Özlale (2005) and Andreas Humpe (2007). Kwon and Shin (1999) was one of the first papers to examine the long run relationship between economic activity and stock prices using a vector error correction model (VECM) and Granger Causality tests.[9] Also using a VECM, results by Murudoglu et al (2001) revealed that stock price indices were co-integrated with the production index, exchange rate, trade balance and money supply. Even though the proxies used for monetary variables differ across papers, a common trend was seen in the use of money indicators such as money supply, exchange rate and inflation.

However, most of the research on relationships between stock prices and macroeconomic variables have been applied to developed economies. Similar to other emerging market economies, there is a dearth of studies on the impact of monetary variables on stock price movements in Jamaica. Of significance is the study done by Bailey (2000) which found that monetary and fiscal variables affect stock market volatility.

[8] See Muradoglu, Metin and Argas (2001)
[9] The Engle and Granger co-integration technique was used to determine the long term equilibrium relationship among variables in the financial markets while taking into consideration the non- stationarity property of financial time series.

Data and Methodology

The long run equilibrium relationships between the Main JSE Index and selected monetary variables were examined using a VECM framework.[10] Impulse response functions were used to examine the dynamic relations between stock index and the various money indicators. Monetary indicators employed in the analysis include 180- day Government of Jamaica (GOJ) Treasury bill yields, the value of the Jamaica Dollar vis-à-vis the US dollar, inflation rate and the money supply (measured by M2 aggregate which was seasonally adjusted).[11] The monthly lag of each series was utilized and the data employed spanned the period January 1990 to March 2009 (231 observations).

The Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests were used to determine the order of integration for each time series variable. The ADF values for each time series are calculated by estimating regression equations for a random walk model, a random walk with drift and a random walk with drift and trend. For each estimation, apriori expectations according to the literature and past empirical studies in conjunction with the inferences from time series plots of the variables helped in determining the appropriate model to be selected. Visual inspection of the plots indicates no significant structural break points for the sample period. For the VEC model, the minimum lag length required was selected using the Akaike Information Criterion (AIC) as this selects a better model than the Schwartz Bayesian Criterion (SBC) when utilizing relatively small samples.[12]

The Johansen Multivariate Co-integration test

The long run equilibrium relationship between the Main JSE Index and the money variables is estimated as a system of equations, employing the Johansen multivariate co-

[10] The Johansen (1991) procedure is based on a vector error correction model to test at least one long run relationship between the variables, Humpe and Macmillan (2007).

[11] More generally, an impulse response refers to the reaction of any dynamic system in response to some external change.

M2 includes all of M1 (the most liquid assets) and a collection of additional assets that are slightly less liquid. These additional assets include savings account, time deposits, certificates of deposit, foreign currency transferable deposits and repurchase agreements.

[12] See Enders (2004).

integration approach. The relationship among the variables is based on the following model:

$$\Delta X_t = \mu + \theta_1 \Delta X_{t-1} + \ldots\ldots + \theta_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \varepsilon_t \qquad [1]$$

with

$\theta_i = -(I - A_1 - \ldots - A_i)$, $\qquad i = 1,\ldots,k-1$

$\Pi = -(I - A_1 - \ldots - A_k)$

where

- ε_t is a sequence of zero-mean, white noise vectors;

- θ is a vector of parameters which contain information about the short-run adjustment processes;

- Π captures information about the rank of the matrix and, hence, the possible existence of long run equilibrium relationships among the elements of X. This matrix can be decomposed into the product of two $n \times r$ matrices α and β so that $\Pi = \alpha\beta'$ where the **β** matrix contains r co-integrating vectors and α represents the speed of adjustment parameters (Johansen, 1988);

- X represents the vector of variables used in the model and captures the short run dynamics.

Johansen (1988) developed two likelihood ratio tests for testing the number of co-integration vectors (r): the trace test and the maximum eigen-value test. The trace statistic test the null hypothesis of $r = 0$ (no co-integration) against the alternative that $r > 0$ (there is one or more co-integrating vectors). The maximum eigen-value statistic test the null hypothesis that the number of co-integrating vectors is r against the specific alternative of $r+1$ co-integrating vectors.[13]

[13] See Zhang et al (2006).

Granger-Causality Test

In examining whether lagged values of one variable help predict another variable, the Granger-causality test is used. If the time series are non-stationary and co-integrated, the Granger-causality test is based on the following equations:

$$\Delta X_t = \alpha_x + \sum_{i=1}^{k} \beta_{x,i} \Delta X_{t-i} + \sum_{i=1}^{k} \gamma_{x,i} \Delta Y_{t-i} + \Phi_x ECT_{x,t-i} + \varepsilon_{x,t} \qquad [2]$$

$$\Delta Y_t = \alpha_y + \sum_{i=1}^{k} \beta_{y,i} \Delta Y_{t-i} + \sum_{i=1}^{k} \gamma_{y,i} \Delta X_{t-i} + \Phi_y ECT_{y,t-i} + \varepsilon_{y,t} \qquad [3]$$

where;

- Φ_x and Φ_y are the parameters of the *ECT* term, measuring the error correction mechanism that drives X_t and Y_t back to their long run equilibrium relationships;
- ΔX_t and ΔY_t are the first differences of the time series variables.

The null hypothesis for the first equation is $H_o : \sum_{i=1}^{k} \gamma_{x,i} = 0$, which implies that the lagged terms ΔY_{t-i} do not belong in the regression. On the other hand, the null hypothesis for the second equation is $H_o : \sum_{i=1}^{k} \gamma_{y,i} = 0$, that is the lagged terms ΔX_{t-i} do not belong in the regression. If the null hypothesis cannot be rejected using an *F*-test then there is no Granger causality.

Empirical Results

The Augmented Dickey Fuller (ADF) tests show that all variables are non-stationary in levels. The Phillip Perron's (PP) tests, on the other hand, show that all variables are non-stationary in levels, except the inflation rate which was found to be stationary (see Table 1).[14] Also, both tests results show that the variables are stationary in first differences

[14] The ADF and PP test the null hypothesis that the variable has a unit root. If the variable is non-stationary, then the null hypothesis cannot be rejected. Enders (2004) states that the ADF is biased towards the non-rejection of unit root if there are structural breaks. PP can test for unit root when the structural break is unknown.

except for inflation.[15] The ADF test results are preferred because the PP tests are more size distorted than the ADF tests and as such may reject the null of non-stationarity often when it is true.[16] Previous studies done on similar topics show that, most macroeconomic variables are non-stationary series but their first differences are stationary. Therefore, the results of this paper are consistent with prior findings. A lag length of 7 was selected for the VEC as four out of the five criteria selected this length (see Table 2).

Table 1: Unit Root Test Results

Variables	ADF Unit Root Tests		PP Unit Root Tests	
	Level	First Difference	Level	First Difference
JSE Index	-2.35	-14.95***	- 2.25	- 24.87***
Interest Rate	-2.49	-14.43***	- 0.48	- 23.67***
Inflation Rate	-2.00	-16.26***	-14.74***	-
Exchange Rate	-3.22	-10.32***	- 2.99	- 10.74***
M2	-2.05	- 5.17***	- 0.75	- 35.95***
M3	-0.16	- 8.39***	- 0.70	-223.33***

Significance at the 1% level is denoted as ***.

Table 2: Lag Length Selection Criteria

	LR	**FPE**	**AIC**	**SC**	**HQ**
Lag	7 (414.94)	7 (3.14e-11)	7 (-7.18)	2 (-4.31)	7 (-5.59)

*the numbers in the brackets are the coefficients for the tests for the respective lag selection.

where:

- LR is the sequential modified Likelihood Ratio test statistic (each test at the 5% level);
- FPE represents the final prediction error;
- AIC is Akaike Information Criterion;
- SC is the Schwarz Information Criterion;
- HQ is the Hanna-Quinn Information Criterion.

[15] Note that the * beside the results indicate that the null hypotheses of a unit root or non-stationarity were rejected as such, the series are stationary.

[16] See Schwert (1989). He finds that if the change in a variable has an ARMA representation with large and negative MA component, then the ADF and PP tests are severely size distorted but the PP test is more size distorted than the ADF tests.

The Johansen Co-integration Tests Results

The Trace test and the Max Eigen-value test show that the variables are co-integrated with $r = 4$ (see Table 3).[17] The co-integrating vector was normalized using the JSE index (see Table 4).[18] There was a positive and significant coefficient on the money supply aggregate (M3) and the exchange rate variable. In contrast, the interest rate, the inflation rate and M2 have negative and significant coefficients.

The long-term adjustment coefficients identify the fraction of the long-term gap that is closed in each period (see Table 5). The first equation, which is the JSE index, shows that the remaining long-term stock price gap closes by about 31.0 per cent in each period, while the gaps in the exchange rate, inflation rate, interest rate, M2 and M3 close by about 0.3 per cent, 6.0 per cent, 23.0 per cent, 4.0 per cent and 54.0 per cent, respectively. These results indicate that interest rate, the JSE index and M3 take a longer time to achieve equilibrium after a shock when compared to the exchange rate, inflation rate and M2.

Table 3: The Johansen Test Results

	Maximum Eigen-value Statistics	Trace Statistics
R=0	88.35474 (40.95680)	230.5975 (103.8473)
R<=1	54.25059 (34.80587)	142.2428 (76.9277)
R<=2	40.17847 (28.58808)	87.99219 (54.07904)
R<=3	24.84200 (22.29962)	47.81372 (35.19275)
R<=4	17.68730 (15.89210)	22.97172 (20.26184)
R<=5	5.284426 (9.164546)	5.284426 (9.164546)

The values in the bracket denote the 5% critical value from MacKinnon-Haug-Michelis (1999).

[17] The model contains an intercept term but no trend. The results show 5 co-integrating vectors.

[18] Enders (2004) outlined that it is typical for one of the variables to be used to normalize the co-integrating vector by fixing its coefficient to unity. It is irrelevant which variable is used as the vector simply describes a long-term relationship among the variables, but does not necessarily imply causality among the variables. That is, the same conclusion can be drawn from any re-normalization of any of the variables. For example, the same amount of co-integrating relationships was found when the interest rate was normalized.

Table 4: Vector Error Correction Estimates

Co-integrating Equation	CoinEq1
LOGJSEINDEX(-1	1.00
LOGFXRATE(-1)	-0.69 (0.13) [-5.40]
LOGINFLATIONRATE(-1)	0.42 (0.09) [4.52]
LOGINTEREST(-1)	1.65 (0.12) [13.42]
LOGM3_SA(-1)	-0.46 (0.09) [-5.44]
LOGM2_SA(-1)	6.36 (0.6) [10.62]
C	-55.44 (4.55) [-12.18]

Table 5 - Long Term Adjustment Coefficients

Error Correction	D(LOG JSEINDEX)	D(LOG FXRATE)	D(LOG INFLATION)	D(LOG INTEREST)	D(LOG M3)	D(LOG M2)
COINEQ1	-0.309 (0.071) [-4.340]	0.003 (0.009) [-0.308]	0.061 (0.036) [1.710]	-0.229 (0.07) [-3.510]	0.547 (0.298) [1.833]	-0.035 (0.008) [-4.660]

The Impulse Response Functions

Two sets of impulse response functions were computed in this study. One set illustrates a one standard deviation generalized innovation of the monetary variables on the JSE index (see Figure 1) and the other illustrates the impact of a one standard deviation generalized innovation in the interest rate on the other variables (see Figure 2).[19]

Impact on JSE Index:

Response from M2 Shock

The results of the impulse response functions show a negative effect on the Main JSE Index from a shock to M2 over the first 14 months and then the Index remains constant at zero for the remaining 10 months.

[19] Obtaining a one standard deviation confidence band around the mean values of the impulses.

The negative impact of a shock to money supply on the JSE index was expected due to the substitutability effect of assets for the JSE index.[20] This arises from agents belief that the Central Bank will react to unexpected high money growth by quickly moving to more restrictive monetary policy, to counterinfluence higher inflation rates.[21] The anticipation of higher rates in the future causes agents to sell securities immediately, forcing interest rates upward. Higher interest rates then lead to lower stock prices, assuming investors view these assets as substitutes. In addition, investors may have revised upward their expectations of inflation when positive money stock surprises occurred (see Fama, 1981).

Response from M3 Shock

This positive impact of a shock to M3 on the JSE index can be explained by the positive influence of higher M3 on corporate sector profitability in real terms.[22] This growth in profitability may induce stronger investor interest in the equities market, as investors attempt to maintain purchasing power by investing in stocks. In addition, an increase in the money stock results in greater liquidity in the economy which can be used to purchase stocks, causing stock prices to rise.[23]

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[20] See Gan, Lee, Yong, and Zhang (2006). They found a negative impact of a shock to money supply (measured by M1) on the stock index. This was explained by the fact that the money supply in New Zealand is influenced mainly by foreign investors. They argue that if the interest rate is high relative to other countries, the investors are likely to leave their money in the bank rather than to invest in risky stock market. If the interest rate is too low then the investors may want to invest in other markets. In addition, Geske and Roley (1983) stated that the consensus finding among studies such as Grossman (1981), Urich and Wachtel (1981) and Pearce and Roley (1983) is that unexpectedly high money growth is associated with higher interest rates and lower stock prices.

[21] Geske and Roley (1983) stated that the consensus finding among studies such as Grossman (1981), Urich and Wachtel (1981) and Pearce and Roley (1983) is that unexpectedly high money growth is associated with higher interest rates and lower stock prices.

[22] In the opinion of Mukherjee and Naka (1995), the effect of money supply on stock prices is an empirical question and the results may differ for each researcher based on the particular country, the quality of the data set and the measure of monetary aggregate used. This was found to be true in the papers that were examined as some writers found positive relationship while others found negative for the different monetary indicator employed.

[23] On the contrary, Friedman and Schwartz (1963) explained that an increase in M2 growth would indicate excess liquidity available for buying securities, resulting in higher security prices. Maysami and Koh (2000), found a positive relationship between money supply changes and stock returns in Singapore. Bailey (2000), also states that innovation to the monetary variable had a large positive impact on the index. She explained this as the rise in nominal money balances without an instantaneous adjustment in prices results in an increase in real balances. This increase in real balances with a rise in inflationary expectations initially reduces real interest rate, hence increasing the real value of the stock. This stance was supported by Muradoglu and Metin (1996) who found that monetary variables indicate potential monetary expansion and are expected to be positively related to stock returns.

Response from Interest Rate Shock

The negative impact of a shock to interest rate on the Main JSE Index showed a steady decline over the impulse horizon. This result is supported by findings from previous studies, such as Humpe and Macmillan (2007) that found US long term interest rates negatively influenced share price growth.

Response from Inflation Rate Shock

The effect of a shock to the inflation rate on the stock index was positive throughout 24-month horizon. This finding is contrary to previous studies that found a negative relationship between the two variables. The empirical relationship between inflation and stock prices has been a subject of enduring interest to academics, investment professionals and policy makers. Theory suggest that stock prices should be inflation neutral due to the fact that companies can pass on one-for–one cost and that the real interest rate that investors use to discount real cash flows does not rise when inflation rises. However, if inflation is properly anticipated and if companies can in fact pass on costs of doing business, then nominal cash flows should be unaffected by a general increase prices. However, as inflation rises, it tends to become more uncertain and a component of price increases may not be properly anticipated by firms.

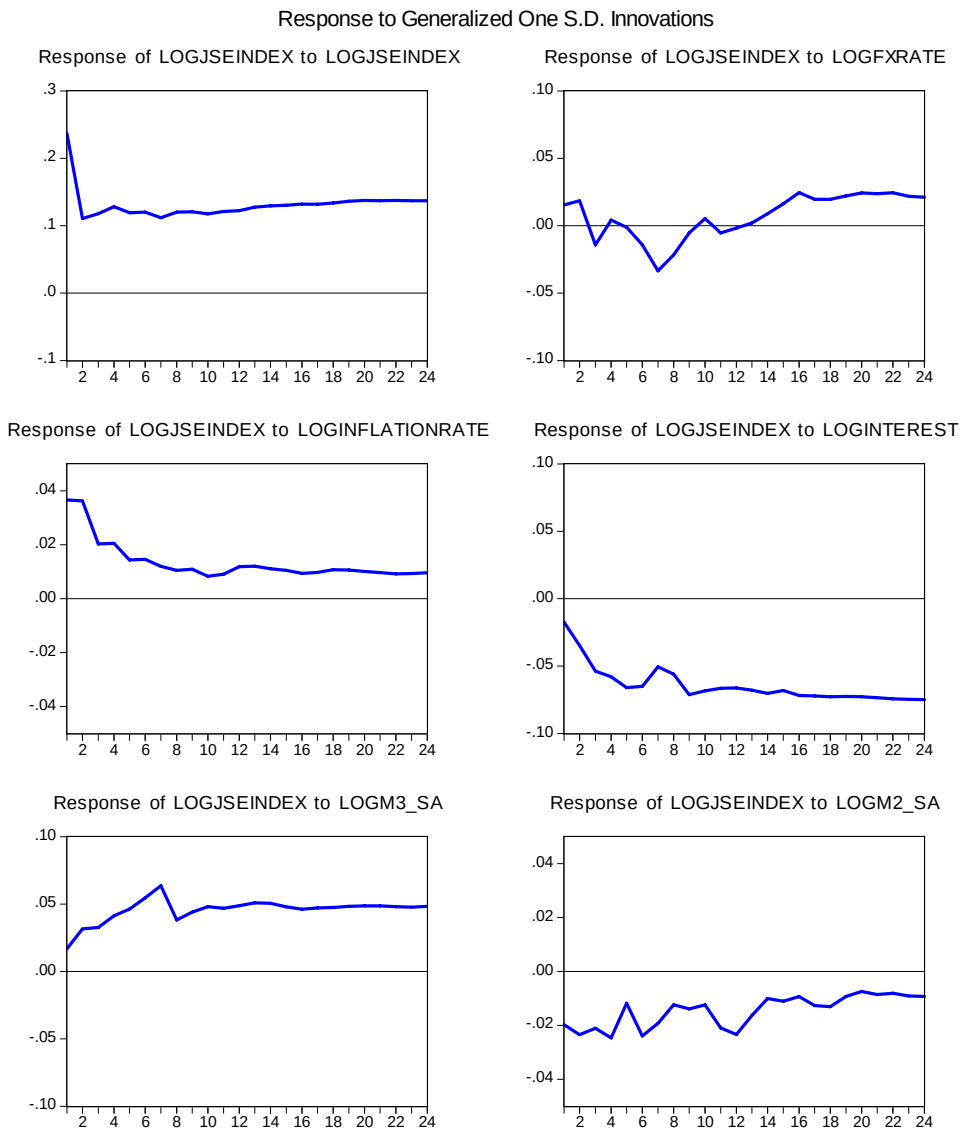
Blanchard (1993) found that an unexpected increase in inflation leads to a sharp decrease in stock prices in that year. The leading practitioners' model of equity valuation, the so-called "Fed model", implies that stock yields are highly positively correlated with inflation, a prediction borne out by the empirical evidence presented by Asness (2000, 2003). One hypothesis underlying this relationship is that inflation or the monetary authority's responses to inflation, damages the real economy and in particular, the profitability of the corporate sector. In this case, the growth rate of real dividends declines in response to inflation, driving up the dividend yield leading to stronger investor interest in the equities market.

Modigliani and Cohn (1979) propose another hypothesis, namely, the inflation illusion hypothesis. According to this hypothesis, stock market investors fail to understand the effect of inflation on nominal dividend growth rates and extrapolate historical nominal growth rates even in periods of changing inflation. The positive relationship between the inflation rate and real stock prices can also be explained by the fact that investors may use the stock market as a means of storing their purchasing power as they try to hedge against increases in prices. However, Fama and Schwert (1977), state that the hypothesis that common stocks are a hedge against the expected monthly inflation rate should be abolished as most empirical evidence goes against this view.

Response from Exchange Rate Shock

A negative impact of a shock to the foreign exchange rate on the JSE Index was evident for the first 12 months, after which the Index increases to zero and then remains positive for the final 10 months. This is the case as significant depreciation of the exchange rate often times result in a switch from local denominated investments to foreign currency denominated investments. Ajayi and Mougoue (1996) and Bailey (2000) showed that the depreciation of the local currency had negative short term and long term effects on the stock market. Importantly, stock prices are expected to react ambiguously to exchange rates. These authors explain that in addition to a substitution effect, this currency changes directly impact institutions' balance sheets. Depreciation could either raise or lower the value of a company, depending on whether the company mainly imports or exports. As such, when the stock market index is considered, the net effect from an exchange shock cannot be predicted.

Figure 1: Impulse Response Function of JSE Index to Shocks in the Macroeconomic Variables



Impact on GOJ 180-day Treasury bill rate:

Response from M3 Shock

There was a positive effect of a shock to M3 on interest rates for the first 8 months, then it turns negative for the next 12 months and then it remains constant at zero for the remaining 4 months (see Figure 2). The impact of a shock to M3 is positive as the increase in the money supply is inflationary and the Central Bank typically absorbs excess liquidity in the economy by increasing interest rates.

Once the Bank achieves its goal of controlling inflation in the long run, then interest rates may be reduced to spur investment.

Response from M2 Shock

In the case of M2, the impulse response function shows a negative shock over the 24 months considered. If an increase in M2 results from higher economic activity, ceteris paribus, the interest rate will decline, further stimulating the economy.

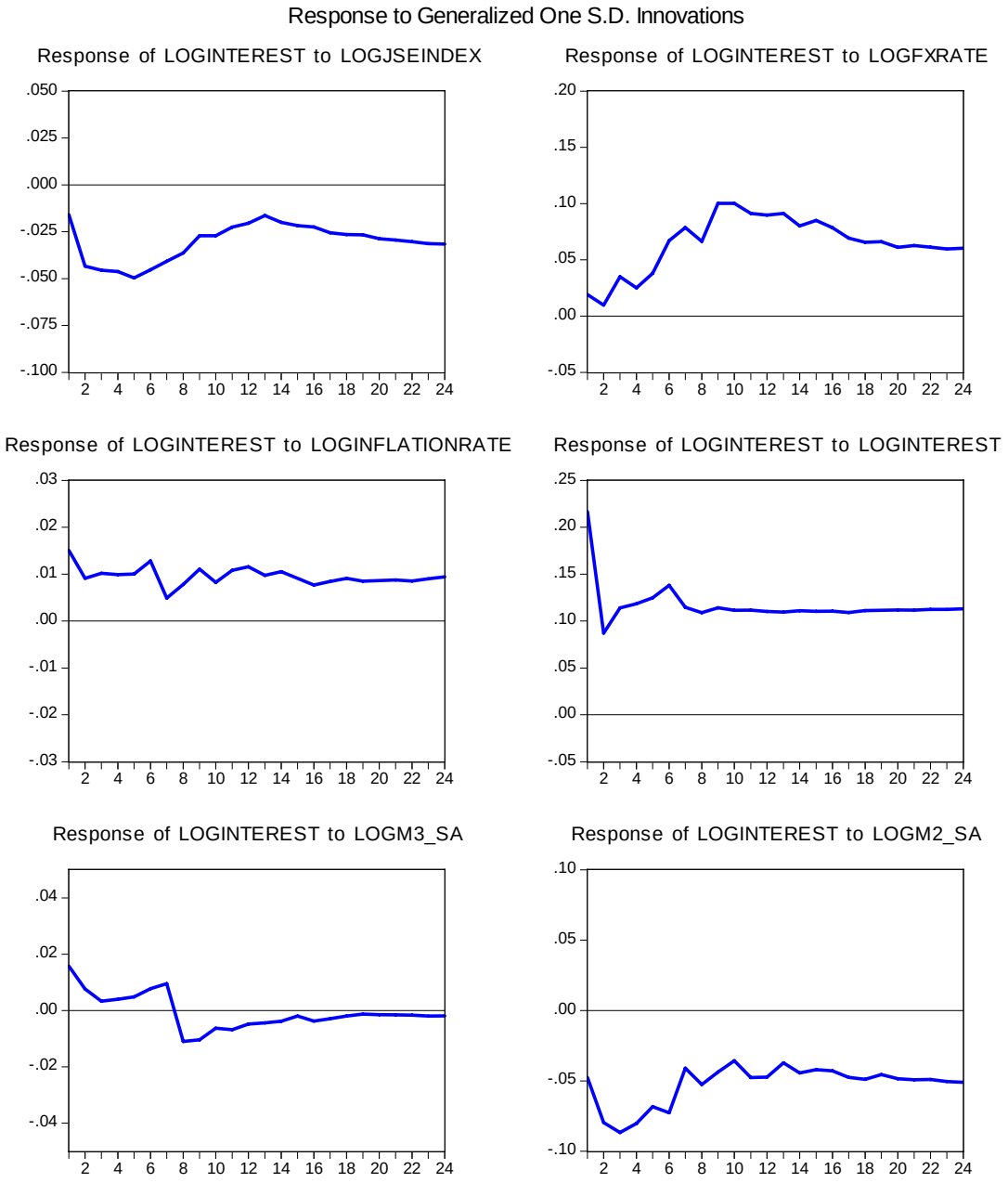
Response from Main JSE Index Shock

Interest rates decline in response to a shock to the JSE index. Interest rate is the earnings paid on bonds which are substitutes for stocks. Growth in stock prices associated with an economic expansion will result in lower interest rates, which further increases stock prices.

Responses from Exchange Rate & Inflation Rate Shocks

The exchange rate and the inflation rate have a positive impact on the interest rate. This result is consistent with the application of contractionary monetary policy to control high levels of inflation and the depreciation of the value of Jamaican Dollar vis-à-vis the US dollar.

Figure 2: Impulse Response Function of the GOJ Treasury Bill Rate to Shocks in the Macroeconomic Variables



Granger-Causality Test Results

Results from the Granger Causality tests indicate that the JSE index helps to predict the exchange rate and M2 but not the inflation rate, interest rate or M3 at the 5.0 per cent level of significance (see Table 5).[24] That is, the JSE Index 'Granger Causes' the exchange rate and M2. The exchange rate only helps to predict M2, while M3 does not aid in predicting any of the six variables. The inflation rate aids in predicting M3 only while the interest rate helps to predict the exchange rate and M2. Finally, M2 is a predictor of all variables but M3.

Table 5-Granger Causality Test (p-values)

Variables	JSE Index	Exchange Rate	Inflation Rate	Interest Rate	M2	M3
JSE Index	-	0.0310	0.6968	0.2059	0.0402	0.0795
Exchange Rate	0.9267	-	0.1218	0.2173	0.0003	0.9893
Inflation Rate	0.8659	0.0638	-	0.8150	0.9533	0.0000
Interest Rate	0.6517	0.0391	0.9162	-	0.0003	0.1016
M2	0.0383	0.0000	0.0361	0.0000	-	0.0638
M3	0.9914	0.8053	0.9788	0.2836	0.4962	-

Conclusion

There exist very limited empirical studies on the relationships between stock market returns and monetary variables for emerging market economies, especially for the Caribbean region. This paper focused on the inter-relationships between stock prices and monetary indicators by examining the dynamics between these variables for Jamaica using monthly data from January 1990 to March 2009.

The Johansen multivariate co-integration tests indicate that there exists a long term relationship between the JSE index and the five monetary variables examined. The coefficient from the co-integrating vector, normalized on the stock price, suggest that, as broadly expected, the JSE index was influenced positively by the inflation rate and M3 and negatively by the exchange rate, interest rate and M2.

[24] Since the JSE index does not Granger causes the interest rate, the negative impact of the impact of the JSE index on the interest rate is reflective of buoyancy in the economy because of the lower rates.

Granger Causality tests show that the JSE Index is a predictor of the exchange rate and M2. This may reflect investors' confidence in the domestic currency when they demand local equities. As such, weak confidence in the equity market is associated with depreciation of the domestic currency. The only variable that was significant predictor of the stock price is M2, which also Granger causes all other variables except for M3.

Impulse response functions, which investigate the short tem dynamic linkages between the stock market returns and the monetary variables, indicate that M2 has a negative impact on stock prices while the impact on M3 was positive. The impact of the exchange rate and the interest rate on the JSE Main Index was negative while inflation rate had a positive effect.

In conclusion, the results show that there are long term relationship between the stock market returns and the monetary variables examined. However, the Granger Causality test shows that only M2 is a consistent predictor of the stock price. The implication of this is that the Central Bank could influence stock market growth by targeting M2, as this is a better predictor of future stock prices, rather than inflation, interest rate and exchange rate.

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