Impact of monetary policy on stock prices: Evidence from Botswana

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List of Acronyms

- ACF- autocorrelation functions
- ADF- augmented Dickey-Fuller
- BoB- Bank of Botswana
- BoBC- Bank of Botswana Certificate
- BSE- Botswana Stock Exchange
- BSM- Botswana Stock Market
- CSD- Central Securities Depository
- DCI- Domestic Companies Index
- DF- Dickey-Fuller
- MPC- Monetary Policy Committee
- MPS- Monetary Policy Statement
- OECD- Organisation for Economic Cooperation and Development
- OMAC- Open Market Auction Committee
- OLS- Ordinary Least Squares
- PP- Phillips-Perron
- VAR- Vector Auto regression

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CHAPTER 1

(1) Introduction

(1.1) Introduction

Considerable interest has in the recent past been shown on the relationship between monetary policy and stock market performance in both developed and developing countries (see, e.g.; Cassola and Morana, 2004, Bjornland and Lietemo, 2009 and Bernanke and Kuttner, 2005). This has been motivated, in part, by the important role given to monetary policy in macroeconomic management in recent years. The other reasons include advances in econometrics techniques and availability of good quality data.

Most economists believe that monetary policy has a strong influence on the behaviour of households and firms. Specifically, policy-induced changes in current and future real interest rates influence the timing of consumption and investment decisions of households and firms. On the other hand stock prices are assumed to be determined in a forward-looking manner, reflecting the future discounted sum of return on assets (Aje and Daferighe, 2009). This implies that stock prices may change in response to changes in expected future dividends, the expected future interest rate that serves as a discount rate or the stock return premium. From the foregoing, monetary policy may influence stock prices directly through the interest rate channel and indirectly through its effect on the determinants of dividends and the stock return premium by influencing the degree of uncertainty agents face (Ioannidis and Kontonikas, 2008). Indeed much of the recent empirical literature concludes that there is a relationship between monetary policy and asset prices and the strength of relationship depends on structural and institutional features of the economy (see, Sellin, 2001). However, most of these studies were conducted for industrial and to a lesser extent, emerging market economies. The differences in the structural and institutional arrangements between developed and developing countries renders the results from the latter not directly applicably in the former countries. Yet understanding the relationship between monetary policy and asset prices in a developing country context is useful to both monetary authorities and investors alike.

Mishkin (1995) asserted that in order to be successful in conducting monetary policy, the monetary authorities must have an accurate assessment of the timing and effect of their

policies on the economy, thus requiring an understanding of the mechanisms through which monetary policy affects the economy. These transmission mechanisms include interest rate channel, exchange rate channel, other asset price channel and the so-called credit channel (see, Mishkin, 1995). Interest rate channel and the asset price channels are the monetary transmission mechanisms relevant to this study as they link the two main variables of interest; monetary policy and stock prices. The interest rate channel suggests that a shift in monetary policy changes interest rates, which in turn change investment and aggregate demand. Changes in aggregate demand affects the performance of local firms; subsequently affecting stock prices. Asset price channel infers that a shift in monetary policy changes asset prices, consequently the change in value of assets held by household and firms would affect their spending habits (wealth channel) or affect their credit demand for investment consumption (Tobin-q channel). Evidently, monetary authorities need to understand the relationship between monetary policy and stock prices so they can accurately predict the effects that their policy tools have on the aggregate economy. Monetary authorities would then be able to know which policy stance to adopt to achieve set objectives.

Investors on the other hand need to know how monetary policy affects the performance of stock markets to be able to accurately measure the intrinsic value of stock. From a fundamentalist point of view, making profits from stock trading depends on an investor's ability to accurately calculate stock's intrinsic value. This is done by examining the environment of the firm; related economic, financial and other qualitative and quantitative factors. Only then can the investor compare the stock's intrinsic value with its current market price and decide whether the stock in over priced or under priced. An overpriced stock would be the one that the intrinsic value is below the market price, while the reverse is true for the underpriced stock. Rational investors would buy underpriced stock, with the hope that the stock market price will rise to its intrinsic value thus making a profit from the spread. Inversely, rational investors would sell over-priced stock because they would be expected to fall in price towards their intrinsic value.

(1.2) Statement of the Problem

In Botswana, Bank of Botswana (BoB) conducts monetary policy on behalf on the government. The Bank's main policy objective has since 1991 been to maintain monetary stability. Monetary stability is defined as the maintenance of low, predictable and sustainable

level of inflation (see, BoB Annual Report 2010). In order to reach its policy objectives, the Bank uses the bank rate and Open Market Operations as its major policy instruments. The bank rate is the interest rate that the Bank charges commercial banks for borrowing money, while auctioning of the Bank of Botswana certificates (BoBCs) is employed to mop up excess liquidity in the market.

Monetary policy objectives are achieved through the monetary policy transmission mechanisms; this is to say shifts in monetary policy would change the bank rate, which in turn changes market interest rates. This change in interest rates subsequently affects a set of prices and quantities including asset prices, before being propagated through to aggregate demand. Consequently, changes in interest rates may have influence on stock values and hence on the wealth of stock holders. However, the magnitude and direction of this effect has not been examined in Botswana. This is the gap that the present study seeks to fill. As already mentioned, understanding this relationship would be beneficial to both monetary authorities and investors. The monetary authorities will be able to design and implement appropriate policies as well as communicate the possible effects of policy on the stock market performance. On the other hand, investors will be able to accurately calculate the intrinsic value of stock, so as to ascertain whether the stocks are over/under valued at market price, thus helping them identify which stocks to sell/buy to make profit.

(1.3) Objectives

The general objective is to investigate the relationship between monetary policy and stock market performance in Botswana. Specifically this study seeks to:

- Determine the relationship between interest rates and stock prices of companies listed on the Botswana Stock Exchange (BSE).
- Quantify and model the impact of interest rates on stock prices.
- Suggest recommendations for both investors and policy makers.

(1.4) Outline of the paper

The rest of the paper is structured as follows; Chapter 2 is the overview of Botswana's monetary policy as well Botswana stock market. Chapter 3 reviews the literature while Chapter 4 discusses the methodology of the study. Chapter 5 presents the estimation and analysis of results and lastly Chapter 6 outlines the policy suggestions.

CHAPTER 2

(2) Overview of Botswana's monetary policy and stock market

(2.1) Introduction

The chapter seeks to outline the development of both the monetary policy and the stock market in Botswana. Firstly this chapter shall outline the advancement of the monetary policy as carried out by the BoB, and lastly discuss the evolution of the Botswana's stock market.

(2.2) Monetary policy advancement in Botswana

From independence, in 1966, Botswana was part of the Rand Monetary Area (RMA). The RMA also comprised of Lesotho, Swaziland, Namibia (then South West Africa) and South Africa. This arrangement entailed the use of a common currency, the South African rand, as well as monetary policy being conducted from South Africa. The increased revenues from exports increased the need for Botswana to fashion her own monetary policy thus the founding of BoB in 1976 to drive the countries exchange rate and monetary policies to best benefit the economy. The BoB has driven Botswana monetary policy ever since and in 1998 the role was further delegated to the MPC; a committee within the Bank. The committee meets 6 times a year and it publishes an annual Monetary Policy Statement (MPS) which sets out a transparent framework for the conduct of monetary policy (see BoB Annual report 2010).

Monetary policy has gone through a few phases as shown in Table 2.1 below. Before 1991 the financial system particularly the banking sector was characterized by excess liquidity, that is commercial banks held reserves above the minimum legal reserve requirement at the BoB. During this period, the BoB employed direct monetary tools to drive the monetary policy. These direct tools included regulated borrowing and lending interest rates, required reserves and the bank rate. However, the excess liquidity not only made some of the monetary tools (required reserve ratio and bank rate) ineffective, it also translated into very low, sometimes negative, interest rates thus discouraging savings within the economy. However, from 1991 BoB moved towards using indirect monetary policy tools: this marked the beginning of financial liberalisation. These tools are bank rate and open market operations. The latter entails the auctioning of 14-day and 91-day BoBCs on a weekly and monthly basis, respectively. The 2010 BoB Annual Report highlights that implementation of monetary

policy through indirect tools improved the role of interest rates in the monetary transmission process. The bank rate is set to relay the BoB's monetary policy stance while the auctioning of BoBCs is so as to mop up any excess liquidity in the economy. Furthermore, the combination of the two activities benchmark interest rates in the economy: for instance there is a constant spread between the bank rate and the prime lending rate. Since 2006 the purchase of Bank of Botswana Certificates has been restricted to commercial banks only.

At the same time, in contrast to a system of direct controls on interest rates, the structure of banks' lending and deposit interest rates is determined by the market, which then promotes efficient resource allocation. Evidence ascertain that there is effective policy transmission over the long term, shown by the common direction and largely stable margins for the real money market interest rates, because of the progress outlined in the Table 2.1 (see BoB Annual report, 2010).

Table 2.1: Advancement of Monetary policy framework of BoB

Period	Primary objective of monetary policy	Instruments of monetary policy
Pre-1991	to resolve anomalies in the banking system caused by rising excess liquidity, including commercial banks' Unwillingness to take deposits from certain large depositors and a shift out of longer-term interest bearing deposits into shorter-term deposits (current and call deposits).	Direct tools of monetary control: -Regulated interest rates for deposits and lending (Major Instrument). -Bank rate and reserve requirements (were ineffective because of excess liquidity)
1997-1998	To maintain real interest rates in line with those prevailing in major international markets to stabilise capital flows, while price stability was increasingly emphasised.	Commencement of financial liberalisation: -Bank rate (Major Instrument) -BoBCs introduced in 1991 (indirect monetary policy tool)
1998-2001	Promoting and maintaining monetary stability (as reflected in low and stable rate of inflation) and maintaining positive real interest rates as measured by short-term effective yield on three-month BoBCs.	Introduction of the MPS in 1998 but did not numerically specify price stability objective. -Repos and reverse repos introduce to supplement Bank rate(1998) -MPC given Bank rate setting and BoBCs price setting(with help of Open Market Auction Committee OMAC)
2002- present	To achieve a sustainable low and predictable level of inflation	Annual inflation objective set at 4-6% for 2002. Medium term (3 year) objective was introduced in 2006 to run concurrently with the annual objective (3-6%)

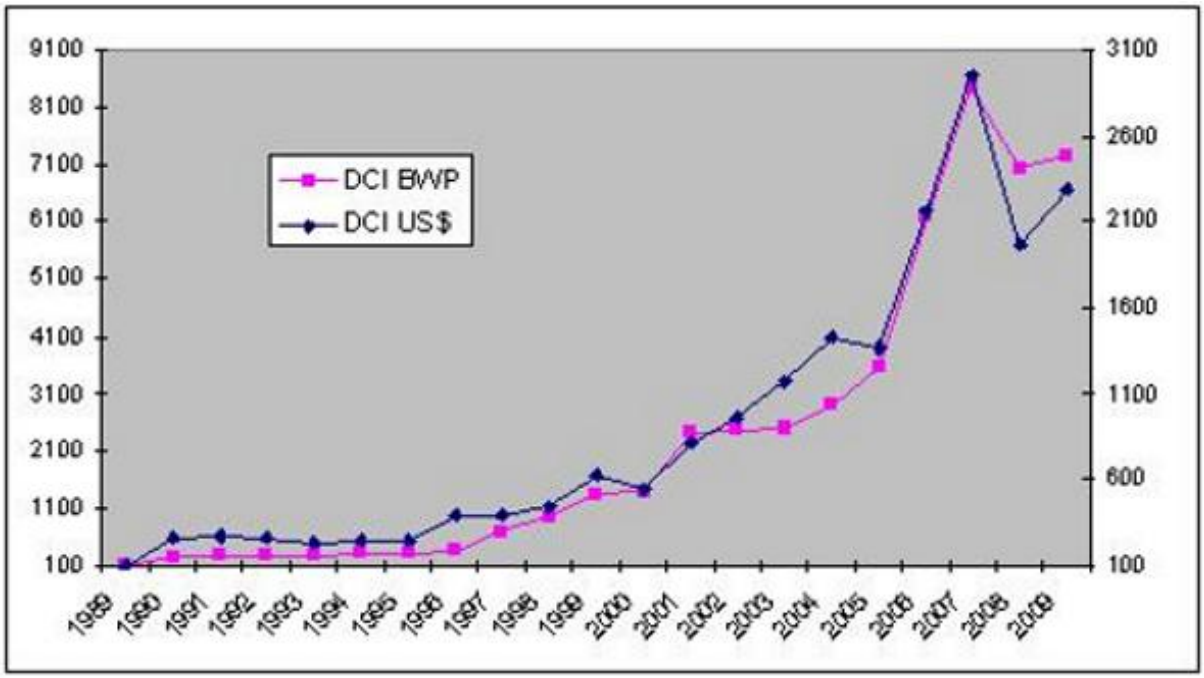
Source: Bank of Botswana 2010 Annual Report (taken as it is in the Annual)

(2.3) Development of Botswana's Stock Market

Botswana stock market is one of the youngest but fast growing exchanges in the world. It was only established in 1989 with only five listed companies. Then it was informally known as the Botswana Share Market (BSM) and it had only one brokerage firm which was assigned dealership; matching sellers and buyers of stocks. Its growth increased the need for a fully fledged exchange hence the inception of BSE in 1995 after the passing of the BSE Act. The number of listed companies has steadily grown over the years, consequently because of the introduction of a Venture Capital Board and a Foreign Board comprising secondary (dual) listings of companies listed in other exchanges. Despite its growth the BSE is among the smallest and most illiquid exchanges in the world. As of 29th September 2011 the Domestic Board boasted a market capitalization of P31 469.61 million.

Jefferis and Kenewendo (2010) noted that Domestic Board is dominated by financial institutions (mainly banks), which accounted for 93.4% of total capitalisation. The Foreign Board comprises mainly of mining & resources companies.

Graph 2.1: Botswana's DCI in both Pula and US$ for period 1989-2009



Source: BSE website: URL: http://www.bse.co.bw/market_n_statistics/market_history.php (retrieved on 13.10.2011 at 1018hrs)

The benchmark index, Domestic Companies Index (DCI), has grown exponentially from 100.00 in June 1989 to 7188.8 in July 2011 (see, Graph 2.1). Jefferis and Kenewendo (2010) asserted that annual returns (in Pulas) on the Domestic Board averaged 24% a year (excluding dividends) from 1990 to 2009. However, common to stock markets around the world, the BSE had a bad year in 2008(explained by the sharp decline of DCI in 2008: Graph 2.1). This was the time of the Global economic recession. However, by the end of 2009 markets had improved and the DCI saw a growth of 2.9% in pula terms and 15% in US dollar terms as the currency strengthened (see, Jefferis and Kenewendo, 2010). Moreover, the BSE also has a miniature and a relatively illiquid Bond Board.

In a bid to develop and improve the exchange's liquidity, the Central Securities Depository (CSD) was introduced in October 2007. As opposed to paper share certificate system the CSD is a computer system that facilitates holding of securities in electronic accounts in contrast to paper certificates. This development will ensure swift transfer of securities hence improving liquidity in the exchange market.

CHAPTER 3

(3) Review of literature

(3.1) Introduction

This section of the study surveys literature on the interaction between monetary policy and stock market. Both monetary and financial economists had been greatly intrigued by this area of study; with the monetary economists mostly concerned with whether money (monetary policy) has any bearing on stock prices and financial economists concerned with whether equity is a good hedge against inflation. A comprehensive review of literature in this particular field was done by Sellin (2001). Sellin (2001) notes that compilation of literature in this area of study proved problematic as it fell in the grey area between the two fields of economics. More often than not researchers in one of the fields were not aware of the relevant papers in the other field, thus references tend to be patchy. However, the above is less true today than years ago because of better access to research papers though online journals.

(3.2) Theoretical Background

The present value or discounted cash flow model offers useful insights on the stock market effects of monetary policy changes. According to this widely used model the stock price (S_t) is the present value of expected future dividends (D_{t+j}). Under the assumption of constant discount rate, it can be shown that:

$$\mathbf{s_t} = \boldsymbol{E_t}\left[\sum_{\mathbf{j=1}}^{\boldsymbol{k}} \left(\frac{\mathbf{1}}{\mathbf{1+R}}\right)^{\mathbf{J}} * \mathbf{D_{t+j}}\right] + \boldsymbol{E_t}\left[\left(\frac{\mathbf{1}}{\mathbf{1+R}}\right)^{\boldsymbol{K}} + \boldsymbol{s_{t+k}}\right] \qquad (1)$$

Where, R is the rate of return used by market participants to discount future dividends, *Et* is the conditional expectations operator based on information available to market participants at time *t* and *K* is the investor's time horizon (stock holding period). The transversality condition implies that that as the horizon *K* increases the second term in the right-hand side of Equation (1) vanishes to zero (assuming no rational stock price bubbles):

$$\mathbf{lim}_{\boldsymbol{k}\to\infty}\, \boldsymbol{E_t}\left[\left(\frac{\mathbf{1}}{\mathbf{1+R}}\right)^{\boldsymbol{K}} \boldsymbol{S_{t+k}}\right] = \mathbf{0} \qquad (2)$$

Thus we the reduce Equation (1) to a more familiar equation:

$$\mathbf{s_t} = \boldsymbol{E_t}\left[\sum_{\mathbf{j=1}}^{k}\left(\frac{\mathbf{1}}{\mathbf{1+R}}\right)^{\mathbf{J}} * \mathbf{D_{t+j}}\right] \qquad \textbf{(3)}$$

From the Equation (3) it follows that a change in monetary policy can affect stock returns in a two ways. First, there is a direct effect on stock returns by altering the discount rate, R, used by market participants. Tighter monetary policy leads to an increase in the rate at which firms' future cash flows are capitalised causing stock prices to decline. Secondly monetary policy changes exert an indirect effect on the firms' stock value by altering expected future cash flows, D_t. Ioannidis and Kontonikas (2008) highlighted that the above model has two underlying assumptions that, first, the discount factors used by market participants are generally linked to market rates of interest and secondly the central bank is able to influence market interest rates.

As argued before monetary policy affects macroeconomic variables, and ultimately inflation, through financial markets. Most literature, including this one, has attributed the link between monetary policy and stock markets to the interest rate channel. Mishkin (1995) outlined that through the interest rate channel a shift in the stance of monetary policy leads to changes in the market interest rates which in turn affects real activity and inflation. The interest rate channel infers that a shift in monetary channel will change the discount rate (R). Lately there has been increased interest by central banks on the 'stock market channel'. The channel resonates that a shift in monetary policy shifts translates into investors changing their expectation of future dividends ($D_{t)}$ and the rate (R) at which the investors discount the expected future dividends, thus revaluing the stock market (see, Patelis, 1997).

(3.3) Empirical Evidence

Sellin (2001) opined that in the late 1990's VAR was applied in the studies of the relationship between monetary policy and stock prices (see, Thorbecke, 1997; Cassola and Morana, 2004). In these studies monetary policy shocks were identified and their effect on the stock returns investigated and they found that stock prices reacted negatively to contractionary monetary policy and positively to expansionary monetary policy.

Patelis (1997) studied whether some portion of the observed changes in US stock returns can be attributed to shifts in the monetary policy stance. He employs the regression methodology, using two sets of explanatory variables: monetary policy variables and financial variables. He finds that monetary policy variables are significant predictors of future returns, although they cannot account fully for the observed stock return predictability. Patelis' explanation for the finding that monetary policy indicators are significant predictors of stock returns relates to the credit channel of monetary policy transmission (Bernanke& Gertler, 1995).

Recent studies confirm results found in earlier studies (outlined in Sellin, 2001) that there is indeed a relationship between monetary policy and stock prices (see, Bernanke and Kuttner, 2005; Ioannidis and Kontonikas, 2008). Ioannidis and Kontonikas (2008) studied the impact of monetary policy on stock prices sampling 13 OECD countries. Despite the differences in monetary policy framework, evidence from all of them concurred that central banks alter stock prices by altering interest rates. However, the strengths of the relationship differed from country to country because of the inherent structural difference between countries.

Recently some interest has since grow on the possible interdependence or reverse causality between monetary policy and asset prices. Bjornland and Lietemo (2009) used VAR methodology to examine the relationship and they found that there is substantial simultaneous interaction between the interest rate setting and shocks to real stock returns in the US. This implies that just as monetary policy is important for the determination of stock prices, the stock market is an important source of information for the conduct of monetary policy. This has since raised much debate on whether monetary authorities should react to asset prices or not.

In as much as most literature on this area of study concurs that monetary policy affects stock price it is also evident that the strength of this relationship differs from country to country. Much of the studies in this area were done in developed countries like USA and other OECD countries and little on emerging markets, particularly African markets. However, Aje and Daferighe (2009) conducted a study in this area on the Nigerian markets and they found results consistent with that of previous studies done elsewhere that monetary policy does have an impact on stock prices. Sellin (2008) recommended that since much research in this area was done using USA data, subsequent studies should be carried using non-US data.

CHAPTER 4

(4) Methodology

(4.1) Conceptual Framework

The empirical analysis is based on the discounted cash flow model. As explained earlier, the model argues that the price of a stock price is the summation of present values of its future dividends (cash flows). Formally this can be represented as:

$$\mathbf{S_t} = \boldsymbol{E_t}\left[\sum_{\mathbf{j=1}}^{k}\left(\frac{1}{1+\mathbf{R}}\right)^{\mathbf{J}} * \mathbf{D_{t+j}}\right] \qquad (4)$$

Where $\mathbf{S_t}$ = Price of stock

$\boldsymbol{R}$ = required rate of return (interest rate)

$\mathbf{D_{t+j}}$ = future dividend pay-out

From Equation 4, interest rates affect stock prices in two ways. Firstly, by affecting economic activity thus altering the amount of dividends paid out (D_{t+j}) and secondly through affecting the investors' required rate of return (R) with which the investors discount the future dividends.

(4.2) Model

The model used to analyze the relationship between monetary policy and stock prices would be an adaptation of that used by Ioannidis and Kontonikas (2008) in a similar study.

$$\mathbf{s_t} = \boldsymbol{\alpha} + \boldsymbol{\beta}\, r_t + \mathbf{u_t} \qquad (5)$$

Equation (5) is taken at log levels where S_t is the stock prices, represented by the log Domestic Companies Index (DCI) of BSE and r_t, interest rate, represented by the 91 day BoBCs rate (the interest rates are already in % so they need not be log transformed).

The DCI is used as to capture the movement of prices of domestic stocks listed on BSE. Although the BoB uses the bank rate as its main policy instrument, this study uses the 91 day BoBCs rate as a proxy for monetary policy stance. This is because the bank rate is relatively static over time and it would be problematic for regression analysis. A lumpy variable in a

regression would fail to explain the variations in stock prices.[1] The 91 day BoBCs rate is expected to have a negative relationship with the log of stock prices. This is because a contractionary monetary policy increases interest rates, which in turn would increase the investor's discount rate. An increased discount rate on the expected future dividends would subsequently lead to decreased stock prices. Furthermore, an increase in the interest rate, through the "wealth channel" or "asset price channel" dampens aggregate demand hence decreasing expected dividends. This would mean stock price tend to decrease when interest rates rise. Inversely, an expansionary monetary policy would reduce interest rates leading to an increase in stock prices.

(4.3) Data sources

The study uses monthly data covering the sample period 2001:1 to 2011:9 (129 observations). The monthly 91 day BoBCs rate data was obtained from the BoB Annual reports and daily DCI data from the BSE archives (DCI). However since there is no trading at the BSE during public holidays and weekends the DCI data had gaps, the data could not be interpolated to generate monthly data, therefore the DCI value of the last available day of a calendar month was used to represent that month.

(4.4)Pre-Testing of the Times series data

It is very important to test the intertemporal properties of times series data before proceeding to examine a possible relationship between the data. Such properties need to be known by the researcher so that he can take appropriate steps to ensure unbiased results.

Stationarity

Stationary time series variables are desirable, but since most financial time series' are unit root nonstationarity, stationary tests are done on times series data. Regression of nonstationary variables yields invalid t and F statistics hence spurious results (see Gujurati, 2003). Stationary time series is one which its mean and covariance are constant over time. If one of the characteristics is not met then the series is said to be nonstationary. Inclusion of nonstationary variables may invalidate tests of statistical significance. The standard test for stationarity is the unit root test and can be expressed as:

[1] See, Bernanke and Blinder 1992 for a discussion of problems associated with the use of lumpy interest rate in monetary policy studies

$$\mathbf{Y_t = Y_{t-1} + U_t} \quad (6)$$

Where: U_t is the stochastic term error. Equation (6) is a first order of AR(1) regression such that Y is regressed at time t or time t-1. If the coefficient of Y_{t-1} is equal to one, then the series is nonstationary. Consider;

$$\mathbf{Y_t = \delta Y_{t-1} + U_t} \quad (-1 \leq \delta \geq +1) \quad (7)$$

If Equation (7) is estimated and $\delta=1$, then the stochastic variable Y_t is considered to contain a unit root. Therefore the time series is known as a random walk.

However, if a time series is differenced once and the series becomes stationary, it is concluded that the random walk series is intergrated of order 1, I(1). Similarly, if a time series has to differenced twice to make it stationary then it is intergrated of order 2, I(2). Generally if it takes for a times series to be differenced n times for it to be stationary then it is said to be integrated of order n or I(n).

Unit root test

The popular way of detecting a unit root is to examine a series' mean and covariance. If the mean is increasing overtime, it suggests that the time series. Another way would be to perform the t-test and F test to find out whether the autocorrelation function (ACFs) for the variable tends to zero as the length of the lag increases. If the ACFs tends to zero quickly then the variable is stationary, if not, then the variable is nonstationary. Another known method for testing for nonstationarity is the Dickey-Fuller (DF) test developed by Dickey and Fuller (1979). The test examines the hypothesis that the variable being tested contains a unit root and therefore should be expressed in first difference form.

In order to run a DF test, the following equations are estimated.

$$\mathbf{\Delta Y_t = \delta Y_{t-1} + U_t} \quad \text{no drift, no intercept} \quad (8.1)$$

$$\mathbf{\Delta Y_t = \beta_0 + \delta Y_{t-1} + U_t} \quad \text{intercept, no drift term} \quad (8.2)$$

$$\Delta Y_t = \beta_0 + \beta_1 t + \delta Y_{t-1} + U_t \quad \text{with intercept and trend} \qquad (8.3)$$

However the Dickey-Fuller test are only valid if the there is no autocorrelation of U_t, white noise. When U_t is auto-correlated then chance of rejecting a correct null hypothesis is high, hence augmenting the test using lags of the dependent variable would be necessary thus the use of the Augmented Dickey-Fuller (ADF) test (see, Said and Dickey, 1984). Just like the DF the ADF test can be specified with no drift and no trend; with trend and no drift; lastly with both trend and drift as follows.

$$\Delta Y_t = \delta Y_{t-1} + \sum \alpha_i \Delta Y_{t-1} + U_t \quad \text{no drift, no intercept} \qquad (9.1)$$

$$\Delta Y_t = \beta_0 + \delta Y_{t-1} + \sum \alpha_i \Delta Y_{t-1} + U_t \quad \text{intercept, no drift term} \qquad (9.2)$$

$$\Delta Y_t = \beta_0 + \beta_1 t + \delta Y_{t-1} + \sum \alpha_i \Delta Y_{t-1} + U_t \quad \text{with intercept and trend} \qquad (9.3)$$

Furthermore, Phillips-Perron unit root tests are used to reinforce the ADF. One advantage that the Phillips-Perron (PP) test has over the ADF test is that it is robust with respect to unspecified autocorrelation and heteroscedasticity in the disturbance process of the test equation. Another advantage is that the user does not have to specify a lag length for the test regression (see, Brooks, 2000). Therefore the PP test works well with financial time series.

The two tests specify the Null hypothesis (H_0) as that the time series has unit root, thus the times series is nonstationary, against the Alternative Hypothesis (H_1) that the time series has no unit root, thus a stationary time series:

H_0: time series has a unit root ($\delta=1$)

$H_{1:}$ time series has no unit root ($\delta\neq1$)

The **decision rule** of whether to reject or not reject the null is as follows;

Reject the Null Hypothesis if the absolute ADF/PP test statistic < critical value

Do not reject the Null Hypothesis if the absolute ADF/PP test statistic > critical value

Table 4.1 ADF summary statistics

	INTERCEPT& NO TREND		INTERCEPT AND TREND	
Variable	Levels	1st difference	Levels	1st difference
Real BoBc	-1.30	-10.07*	-2.50	-10.00*
Log DCI	-1.40	-6.82*	-1.35	-6.85*

(*), (**) (***) indicating Stationarity and significance levels 1%, 5%, 10% respectively.

Table 4.2 PP summary statistics

	INTERCEPT& NO TREND		INTERCEPT AND TREND	
Variable	Levels	1st difference	Levels	1st difference
Real BoBc	-1.71	-10.13*	-3.05	-10.10*
Log DCI	-1.40	-6.92*	-1.56	-6.99*

(*), (**), (***) indicating Stationarity and significance levels 1%, 5%, 10% respectively.

Both the ADF and the PP tests indicate that all the variables are nonstationary at levels, but are all integrated of the first order, I(1). Since the variables are integrated of the same order then there is a possibility of cointegration among them. There are two ways to test for cointegration and one such way is the Engel and Granger (1987) technique. The test requires for the residuals of the linear equation of the variables integrated of the same order to be tested for any unit root. If the residuals are stationary (no unit root) then the variables are said to be co integrated hence a long run relationship exists between the variables. However, this technique has a higher probability of wrongly rejecting the Null hypothesis thus wrongly concluding that there is cointegration between the two variables. The Johansen test of cointegration is superior hence it is the test of choice. The Johansen test for cointegration was

carried out using Eviews 7.1 and it indicated that there is no cointegration among the above variables.

The conclusion is that there is no cointegration amongst the nonstationary variables. Therefore, the nonstationary variables were differenced to make them stationary and the model was estimated by Ordinary Least Squares (OLS) using Eviews 7.1.

CHAPTER 5

(5) Econometric Analysis and Interpretation

(5.1) Econometric analysis

This chapter analysizes the empirical evidence of the impact of monetary policy on the stock prices in Botswana for the period 2001:1 to 2011:9. All the variables were differenced to make them stationary and we got the model below.

$$\Delta S_t = \alpha + \beta \Delta r_t + D_{08} + u_t \qquad (10)$$

Where now ΔS_t is stock returns, and $\Delta \boldsymbol{r_t}$ is a measure of change in real 91 day BoBCs rate (monetary policy). D_{08} is a dummy variable included to control for the effect of the financial crisis (from September 2007 to April 2009) and it takes a value of one for the period and zero otherwise. The real change in interest rate was opted against the nominal measure in order to capture inflation adjusted changes. Moreover, since different investors choose to react to either nominal or real changes in stock returns two regressions will be run using Equation (10), one with nominal stock returns and another with real stock returns.

Table 5.1 Regression results of nominal stock returns against the Real 91 Day BoBC rate

Variable	Coefficient	t-statistic
α	**0.02***	**5.452981**
$\Delta \boldsymbol{r_t}$	**0.01****	**1.951634**
D_{08}	**-0.042***	**-4.634459**

(*), (**), (***) indicating Stationarity and significance levels 1%, 5%, 10% respectively.

F-statistic= 13.30281* R^2=0.175492 Adjusted R^2=0.162300

The estimation results of the OLS estimate of the model specified in Equation (10) are presented in Table 5.1. The F-statistic (at 5% significance level) infers that we reject the Null

hypothesis of joint insignificance, hence the model is significant. The R^2 shows that about 17.5% of the variations in the stock market are explained by changes in monetary policy. This seemingly low R^2 is actually high compared to that of similar studies in other countries. In Germany and Italy monetary policy changes accounted for 1% of the variation of the stock prices, R^2 being 0.01 (see, Ioannidis and Kontonikas, 2008).

In contrast to our *priori* expectation, the coefficient of 91 day BoBCs is positive and significant (at 5% significance level). This is inconsistent with both the theory and evidence from other studies as a negative relation between the 91 day BoBC rates and stock returns was anticipated (see Sellin, 2001). However, the results infer that a 1% increase of the real 91 day BoBC rate will lead to a 0.01% increase in the nominal stock returns of the BSE, hence a positive relationship. This is in conflict with leading studies on the relationship between monetary policy and stock prices (see, Ioannidis and Kontonikas, 2008; Sellin, 2001; Bjornland and Lietemo, 2009)

Table 5.2 Regression results of real stock returns against the Real 91 Day BoBC rate

Variable	Coefficient	t-statistic
α	**0.02***	**5.531315**
Δr_t	**0.017***	**4.115627**
D_{08}	**-0.042***	**-4.626320**

(*), (**), (***) indicating Stationarity and significance levels 1%, 5%, 10% respectively.

F-statistic= 20.52547* R^2=0.247219 Adjusted R^2=0.235174

The estimation results of the OLS estimate of the model specified in Equation (10) are presented in Table 5.1. The F-statistic (at 1% significance level) infers that we reject the Null hypothesis of joint insignificance, hence the model is significant. The R^2 shows that about 24.7% of the variations in the stock market are explained by changes in monetary policy.

Unlike the expected, the coefficient of 91 day BoBCs is positive and significant (at 1% significance level). This is inconsistent with the studies priori and evidence from other studies as a negative relation between the 91 day BoBC rates and stock returns was anticipated (see Sellin, 2001). However, the results infer that a 1% increase of the real 91 day BoBC rate will lead to a 0.017% increase in the real stock returns of the BSE, hence a positive relationship. This is in conflict with leading studies on the relationship between monetary policy and stock prices (see, Ioannidis and Kontonikas, 2008; Sellin, 2001; Bjornland and Lietemo, 2009).

(5.2) Interpretation of results

The results suggest a positive relationship between change in 91 day BoBC rate and stock returns. This is in sharp contrast to the expected hypothesis of a negative relationship between the two variables. This therefore suggests that a monetary policy tightening through increased interest rates, here 91 day BoBC rate, translates into increase in the stock prices: DCI. The hypothesis was that monetary policy tightening would limit aggregate demand and subsequently decreasing stock prices, thus a negative relationship.

This anomaly can be explained by the structure of monetary policy and the composition of the BSE DCI. The monetary policy has since 2006 been such that only commercial banks can trade the BoBCs. This has been important to the BoB as the commercial banks are important media to control money available to the public, thus controlling money supply. However, BoBCs have provided commercials banks with a risk free investment opportunity. Jefferies and Kenewendo (2010) asserted that banks in Botswana have been thought to be overly reliant on the BoBCs for assets and income neglecting some of their duties like financing businesses. On the other hand the BSE domestic board is dominated by the Banking Sector which accounts for 53.3% of the market capitalisation (P 16 765.19 million as on 29th September 2011). The banking sector consists of only four companies (out of 23 of domestic board) namely ABC Holdings, Barclays Bank, First National Bank Botswana and Standard Chartered Bank.

When there is monetary policy tightening through the increase of the 91 BoBC rate commercial banks stock prices increase as the interest rate which the bank is to realise from holding BoBCs increases, thus increased future dividends. The dominance of market capitalization by commercial banks implies that the response of the stock returns to monetary policy changes reflects mainly that of the banks. That is, the positive response of bank stocks overwhelms the negative response of the other companies.

CHAPTER 6

(6) Conclusions and Policy Suggestions

This chapter draws conclusion of the findings of the study and also presents policy suggestions.

(6.1) Conclusions

The purpose of the study was to investigate the impact of monetary policy as conducted by BoB on the stock prices, particularly those of listed on the BSE. Theory and evidence from other country studies showed that there is a negative relationship between interest rates and stock prices. That is, contractionary monetary policy would contract aggregate demand and subsequently leading to fall in stock prices; inversely expansionary monetary policy would lead to an increase in stock prices. This study regressed nominal and real stock returns on using Botswana data for the period January 2001 to September 2011. The empirical results of this study suggest that shifts in monetary policy indeed leads to a change in stock returns, however inconsistent with most studies on the subject matter. The coefficient of the real 91 day BoBC rate is significant and positive which suggested a positive relationship between monetary policy and stock prices in Botswana.

This anomaly is attributed to the structure of the domestic board of the BSE and the conduct of monetary policy by the BoB. The BSE is largely driven and dominated by the banking sector, which accounts for more than half of market capitalisation. On the other hand the BoB prime tool of monetary policy transmission, 91 day BoBCs, is only available for trade to commercial banks. These are the very banks that dominate the DCI, so to the banks an increase in the 91 day BoBC rate is good news as they stand to realise increased interests from holding 91 day BoBCs. This positive reaction to monetary policy tightening offsets the negative reactions of the stock prices of other companies to increase in the 91 day BOBC rate.

(6.2) Policy suggestions

The Bank of Botswana 2010 Annual reports argued that the effectiveness of monetary policy depends on a number of factors, among other the competitiveness and innovation within the banking sector. It is argued that where competition among financial institutions is weak and profit margins are high, monetary policy changes will be transmitted less forcefully than under full competition. Concentration in the banking sector in Botswana in relatively high

and the commercial banks are not somewhat innovative. Commercial banks in Botswana make huge profits despite the market they exist in. This is largely due to their reliance on BoBCs. Monetary policy transmission is marred by over reliance on BoBCs. Policy should be focused on making players in the banking sector less reliant on BoBCs and find other means of sustained income and assets. An analogy would be having a quota of which the commercial banks should finance and invest in businesses.

(6.3) Areas of further Research

Some empirical work that disaggregates the stock prices into bank and non-bank sectors should be done to capture the more accurately the effect monetary policy has on non-bank stock returns.

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