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Mid-Term Review of the 2015 Monetary Policy Statement

Bank of Botswana

1. Introduction

The Mid-Term Review (MTR) of the 2015 Monetary Policy Statement (MPS) examines price developments and the underlying factors in the first half of 2015. It assesses key financial and economic developments that are likely to impact on the inflation outlook; it also assesses financial stability and, in turn, evaluates the likely monetary policy choices for the second half of 2015. This approach assists the Bank in promoting policy credibility and understanding of monetary policy with a view to anchoring public expectations of a low, predictable and sustainable level of inflation within the 3 – 6 percent objective range in the medium term.

As anticipated in February when the 2015 MPS was launched, inflation remained within the Bank's objective range for most of the first six months of 2015; inflation declined from 3.8 percent in December 2014 to 3.1 percent in June 2015; it breached the lower bound of the range in February and March, by decreasing to 2.8 percent. Domestic and external inflationary pressures were subdued in the context of weaker commodity prices, modest growth in global economic activity and restrained growth in personal incomes. On account of the positive medium-term outlook for price developments, the Bank Rate was reduced by 100 basis points to 6.5 percent in February 2015 and maintained at that level until it was reduced by 50 basis points in August 2015. Furthermore, in response to tighter liquidity in the banking system, the Primary Reserve Requirement was reduced from 10 percent to 5 percent effective April 2015.

At the time of the MPS launch, global economic growth for 2015 was forecast at 3.5 percent[1], thus reflecting a pick-up in growth in advanced economies, led by the United States of America (USA), while the pace of economic expansion in emerging market economies was expected to moderate. In the event, lower-than-expected growth in the first quarter, in the USA in particular, resulted in a modest downward revision to the forecast for global economic growth in 2015 to 3.3 percent.[2] Nevertheless, economic activity in advanced countries is expected to expand gradually, with the forecast for global growth in 2016 unchanged at 3.8 percent, buoyed by accommodative monetary policy, easing financial conditions, low commodity prices (particularly oil), and improving confidence and labour market conditions.

1 The International Monetary Fund's World Economic Outlook (WEO) Update, January 2015.

2 The International Monetary Fund's WEO Update, July 2015.

2. Monetary Policy Framework

The primary objective of the Bank's monetary policy is to achieve price stability, which is defined as a sustainable level of inflation that is within the medium-term objective range of 3 – 6 percent. The policy is also formulated with a view to safeguarding the stability of the financial system. In this regard, the Bank recognises that further economic and social development, including balanced economic growth that results in sustained increase in household incomes and a greater degree of financial inclusion (for both households and businesses), contributes to the promotion of financial stability and effective transmission of monetary policy in support of price stability. A low and predictable level of inflation and a conducive financial environment foster savings mobilisation, productive investment and international competitiveness of domestic producers, thus contributing towards the broader national objective of sustainable economic development.

The monetary policy framework is forecast-based, with a medium-term outlook that primarily guides the Bank's response to projected movements in inflation, while taking account of prospects for economic growth and developments in financial soundness indicators for monitoring and addressing risks to financial stability. To this end, in assessing the policy stance, the Bank considers projections of real monetary conditions[3] in the context of other relevant domestic and international considerations, and their impact on the output gap[4] and, ultimately, on inflation. The policy framework recognises the importance of communication to inform stakeholders and influence expectations; as such, there is a Press Release after each of the regular Monetary Policy Committee meetings to announce the policy decision and the rationale for it.

3. Inflation In The First Half Of 2015

In the first half of 2015, global inflation was restrained due largely to low oil prices, a decline in other commodity prices, persistent excess capacity in major economies and weak demand in countries with below-target inflation, notably, the euro area and Japan. However, to an extent, this was offset by rising inflation in some emerging market economies due to the sizeable currency depreciation associated with capital outflows.

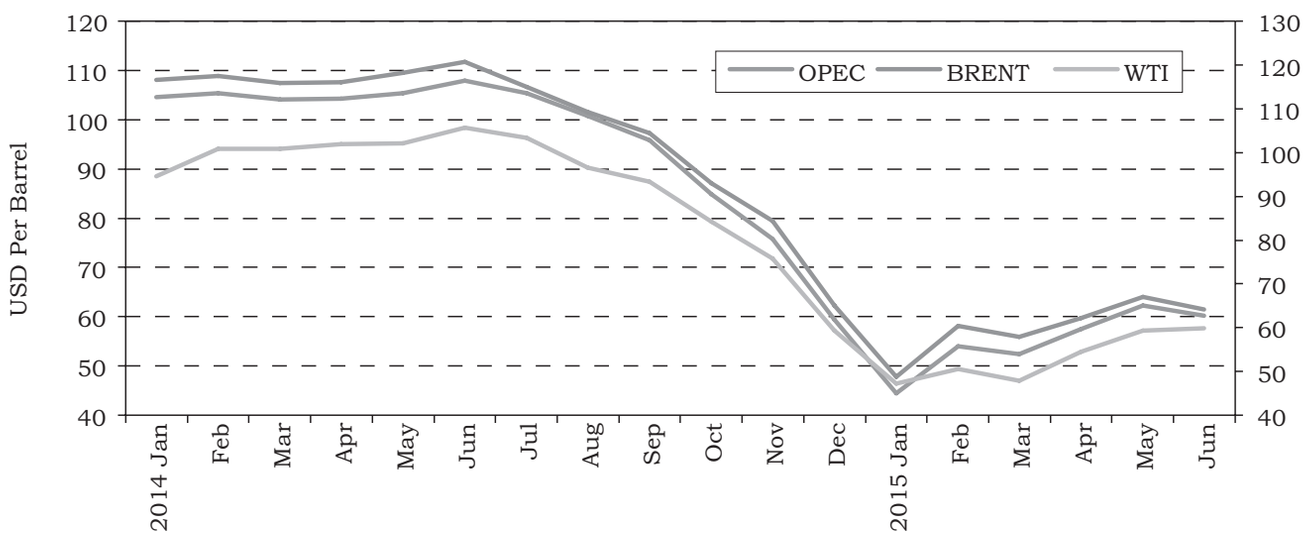
3 The real monetary conditions index (RMCI) measures the relative looseness or tightness of monetary conditions and gauges the likely effect that monetary policy has on the economy through changes in the exchange rate and interest rates. The real monetary conditions are measured by the RMCI that combines, through a weighted average, the deviations of the real exchange rate and real interest rate from their respective trend values.

4 The output gap refers to the difference between actual output and long-term trend output (as an indicator of productive capacity). A negative output gap means the actual level of output for a given period is below the trend level for that period, thus indicating the economy is operating below its estimated potential. A positive output gap is the converse outcome.

For Botswana's trading partner countries[5], average inflation decreased from 3.1 percent in December 2014 to 2.4 percent in June 2015. In particular, for the same period, South African inflation remained within the South African Reserve Bank's target range of 3 – 6 percent (having moved from 5.3 percent to 4.7 percent) while for SDR countries, inflation decreased from 0.5 percent to 0.1 percent.[6]

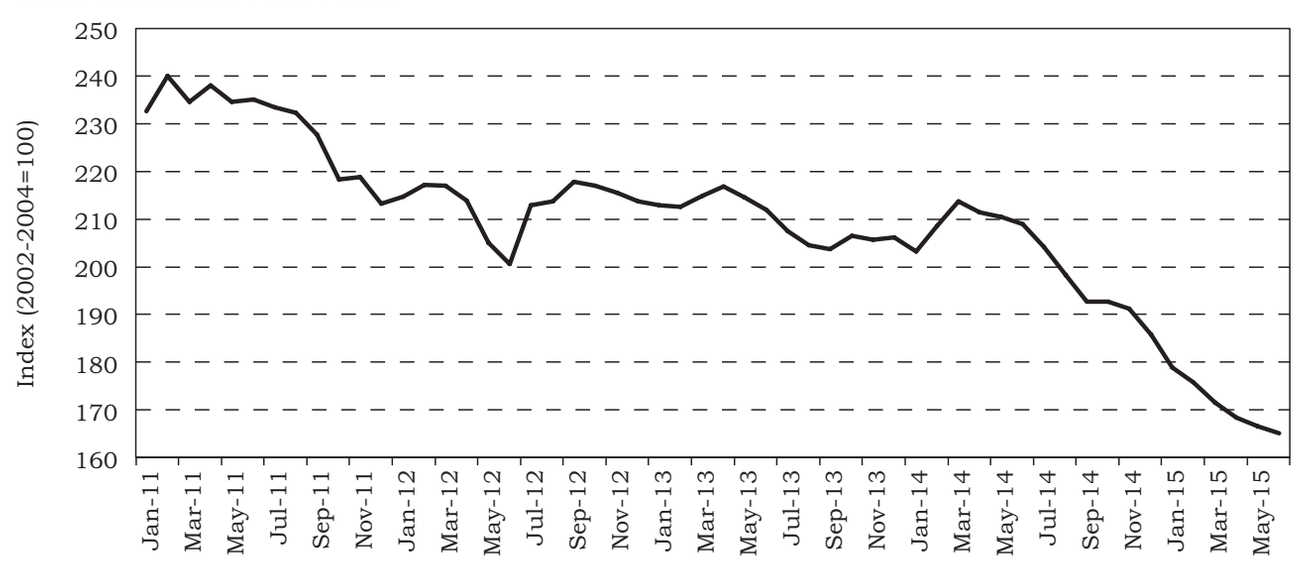
Oil prices recovered from an average low level of USD44 in January to around USD57 per barrel early in the second quarter of 2015 (Chart 1), against the background of a reduction in shale oil production in North America and concerns about a possible disruption to one of the busiest channels for shipping oil due to the conflict in Yemen. Oil prices rose further and stabilised at an average of about USD60 per barrel in June 2015, in this way reflecting a well-supplied market and subdued demand. International food prices declined by 11.2 percent in the first half of 2015 (Chart 2). Prices decreased over the period for all constituent food items (meat, cereals, sugar, oils and dairy products).

CHART 1: OIL PRICES (MONTHLY AVERAGES)



Note: Brent and WTI are international benchmark crude oils, while OPEC is a reference basket consisting of 12 crudes, representing the main export crudes of the member countries weighted according to production and exports to the main markets.
Source: OPEC and U.S Energy Information Administration

CHART 2: MONTHLY FOOD PRICES



Source: Food and Agricultural Organisation

5 South Africa and the SDR countries (euro area, Japan, UK and USA).

6 A notable downward trend in prices remains across constituent economies. Notably, UK, USA and the euro area inflation rates were very low in the first half of 2015, and in some instances negative, thus engendering concerns of deflation, while positive inflation in Japan declined in the same period.

Inflation in Botswana decreased from 3.8 percent in December 2014 to 3.1 percent in June 2015, thus ending the six-month period within the Bank's objective range of 3 – 6 percent. Similarly, inflation excluding administered prices and the 16 percent trimmed mean inflation decreased from 4.9 percent and 3.7 percent to 4.7 percent and 3.6 percent, respectively, in the same period. The decrease in inflation across all the main measures reflected the impact of lower rates of price change for commodities with large weights in the consumer basket (e.g., food), modest wage growth[7], weak demand pressures and the subdued impact of the increase in administered prices[8] and government levies. Inflation breached the lower bound of the medium-term objective range in February and March, given the downward adjustment in fuel prices in February 2015, while the impact of extending the range of staple foods subject to a zero rate of value added tax also began to take effect. In addition, the appreciation of the Pula against the South African rand helped moderate imported inflation.

CHART 3: BOTSWANA INFLATION (JANUARY 2011 - JUNE 2015)

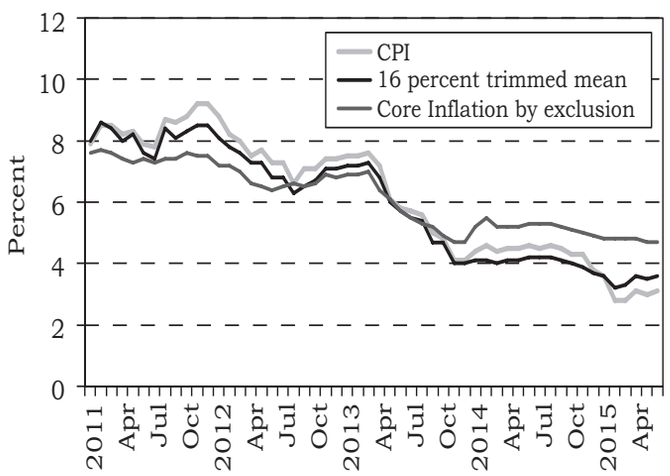


CHART 4: BOTSWANA AND INTERNATIONAL INFLATION (JANUARY 2011 - JUNE 2015)

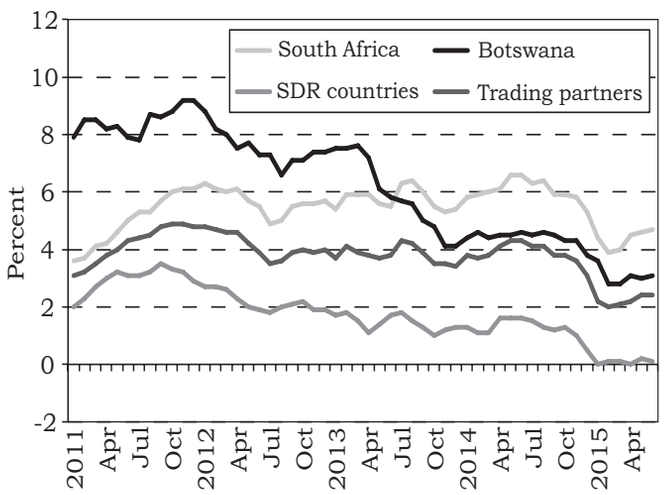


CHART 5: DECOMPOSITION OF THE CPI (JANUARY 2011 - JUNE 2015)

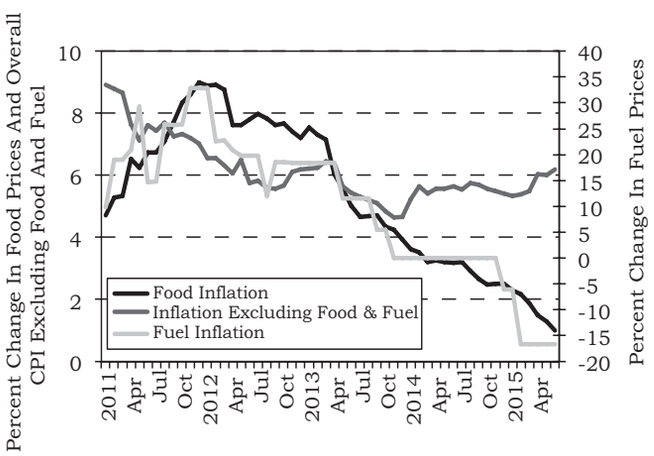
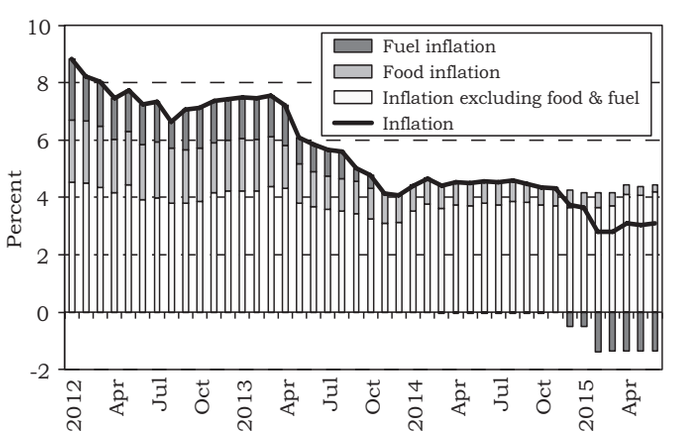


CHART 6: CONTRIBUTION OF FOOD AND FUEL PRICES TO INFLATION IN BOTSWANA (JANUARY 2012 - JUNE 2015)



Source: Statistics Botswana and Bank of Botswana

7 Government increased civil service salaries by 6 percent in April 2015, which is in line with the Bank's upper band of the inflation objective range. This was considered modest due to the accumulated deterioration in the purchasing power over the years when the Government either did not award any salary increase or did so at a lower magnitude than the prevailing inflation.

8 On average, the adjustments in administered prices subtracted approximately 0.45 percentage points from inflation in the first half of 2015 compared to 0.12 percentage points added to inflation in the corresponding period in 2014.

Demand pressures on inflation were modest in the first six months of 2015, in the main, due to restrained growth in personal incomes and lower commercial bank credit. The annual growth in commercial bank credit went down in the first half of the year, from 13.5 percent in December 2014 to 7.4 percent in June 2015. The credit growth occurred in the context of modest growth in incomes and stricter lending conditions applied by commercial banks[9]. Year-on-year growth in lending to the business sector decreased from 17.2 percent in December 2014 to 4.2 percent in June 2015, while that for household credit fell from 10.7 percent to 9.9 percent in the same period.

Growth in lending to households continues to be monitored for its potential impact on demand and financial stability. The current profile of household debt is consistent with maintenance of financial stability as reflected in the annual growth in mortgage loans to households, which declined from 18.4 percent in December 2014 to 6.9 percent in June 2015, while unsecured lending increased from 7.4 percent to 11.2 percent in the same period. The moderation of mortgage credit growth, against the backdrop of some weakening of prices in the property market, reduces potential risks in this area. Currently, banking sector indicators, including low default ratios for household borrowing, also suggest a stable financial environment. The aggregate ratio of non-performing loans to total loans was 2.9 percent in June 2015 (unchanged from December 2014).

Growth of domestic output is estimated at 4.6 percent in the year to March 2015; this is a significant decline from the annual growth of 7.9 percent in the first quarter of 2014. The lower growth is mainly attributed to a sharp deceleration in the expansion of the mining sector, which grew by 2.5 percent in the 12 months to March 2015 compared to 25.4 percent in the corresponding period last year. In the same period, growth in the non-mining sector increased marginally to 5 percent from 4.9 percent. The sectors that led non-mining output growth are trade, hotels and restaurants (7 percent), transport and communications (6.8 percent) and finance and business services (5.5 percent).

4. Monetary Policy Implementation in the First Half of 2015

Globally, monetary policy in the first six months of 2015 was conducted in an environment of uneven growth prospects. Policymakers focused on measures such as liquidity support to the financial sector and structural reforms to nurture competitiveness and sustain growth momentum. In addition, there is continuing fiscal consolidation aimed at achieving sustainable budget deficits and reducing the current high levels of sovereign debt. Global inflation decreased due to lower oil and non-oil commodity prices, spare capacity in major economies, as well as subdued growth in global demand (especially in countries experiencing below-target inflation).

Monetary policy was accommodative in advanced economies, with the US Federal Reserve Bank, Bank of England, Bank of Japan, and European Central Bank (ECB)[10] maintaining policy interest rates at low levels,wwhile the Reserve Bank of Australia reduced the policy rate by a cumulative 50 basis points, in the context of declining commodity prices that negatively impacted on its natural resource-based producers.

In contrast, for emerging market economies, there were divergent policy actions to either support increased economic activity or restrain inflationary pressures stoked by currency depreciation. Policy interest rates were reduced in India and China, with the latter reducing the primary reserve requirements as well in an effort to stimulate growth. Conversely, in Brazil, monetary policy was tightened to restrain inflationary pressures in the first half of the year. Meanwhile, South Africa maintained the repo rate at 5.75 percent in the same period[11].

In Botswana, monetary policy was implemented against the background of moderate growth in nominal personal incomes and weak domestic demand pressures, thus restrained government expenditure and lower credit growth. Furthermore, foreign inflation was low, with benign pressure on domestic prices. These factors contributed to a positive medium-term outlook for inflation and provided scope for easing monetary policy to support economic activity without undermining price stability. Hence, the Bank Rate was reduced by 100 basis points in February 2015[12].

Monetary policy implementation involved the use of Bank of Botswana Certificates (BoBCs)[13] to absorb excess liquidity[14] in order to ensure maintenance of interest rates that are consistent with the monetary policy stance; while reverse repurchase agreements were used to mop up excess liquidity between weekly auctions of BoBCs. Earlier in the year, temporary liquidity shortfalls for individual financial institutions, which to some extent reflected inefficiency of the interbank market, continued to be addressed through

9 Strict lending conditions augur well for financial stability, given the potential for reduced loan losses; however, safeguarding financial stability must be carefully balanced with the need for sufficient credit to support economic growth.

10 The ECB began purchasing government bonds in March 2015, thus expanding its asset purchase programme by 60 billion euros per month until at least September 2016, in the context of the risk of deflation.

11 In late July 2015, the South African Reserve Bank increased the repo rate to 6 percent to influence inflation expectations downwards, given increased risks to the inflation outlook.

12 The Bank Rate was reduced further by 50 basis points to 6 percent on August 6, 2015.

13 The value of outstanding BoBCs exceeded the cap of P5 billion in the first half of 2015, in view of growth in commercial bank liabilities, in particular deposits by the Botswana Public Officers Pension Fund (BPOPF).

14 Excess liquidity is money balances beyond that needed by commercial banks for investment and daily flows, with no credit extension obligation and hence can be invested temporarily. Importantly, each commercial bank holds a specific level of excess liquidity that reflects its management policy.

recourse to the Bank's credit facilities. Furthermore, the Primary Reserve Requirement on Pula-denominated deposits was reduced from 10 percent to 5 percent effective April 1, 2015, thus injecting liquidity into the banking system. As at the end of June 2015, overall excess liquidity in the banking system was P9.3 billion.

As a result of the reduction in the Bank Rate, money market interest rates decreased (Chart 7)[15]. The yield on the 14-day BoBC fell from 3.07 percent at the end of December 2014 to 1.87 percent in June 2015, while for the 3-month BoBC, the yield eased from 3.19 percent to 2.11 percent in the same period. The average prime lending rate of commercial banks also fell from 9 percent to 8 percent, while the 88-day deposit rate fell slightly from 2.67 percent in December 2014 to 2.62 percent in June 2015. Although the prime lending rate fell in response to policy easing, credit growth continued the downward trend as commercial banks adopted a cautious approach to lending in the context of reduced liquidity and increasing costs of raising loanable funds, particularly through customer deposits. Overall, there is a need for banks to review their asset, liability and risk management practices with a view to reflecting the changed situation and also actively consider possible alternative sources of financing in addition to deposits.

Generally, real interest rates decreased in the first half of the year from -0.70 percent in December 2014 to -1.19 percent in June 2015 for the 14-day BoBC and from -0.59 percent to -0.96 percent for the 3-month BoBC. Similarly, the real prime lending rate fell from 5.01 percent in December 2014 to 4.75 percent in June 2015.

In January 2015, the Pula basket weights for the South African rand and SDR were revised from 55 percent and 45 percent, respectively, to 50 percent each. Furthermore, the rate of crawl of the Pula exchange rate was changed from -0.16 percent to zero, to reflect the minimal difference between the projected inflation in Botswana and the major trading partners, as represented by the composition of the Pula. The trade-weighted nominal exchange rate (NEER) was, therefore, stable in the six months to June 2015. Bilaterally, the Pula depreciated by 4 percent and 1.2 percent against the US dollar and the SDR, respectively, while it appreciated by 1.6 percent against the rand. The real effective exchange rate (REER)[16] of the Pula depreciated by 0.1 percent in the six months to June 2015 due to lower Botswana inflation compared to the average inflation of trading partner countries.

CHART 7: INTEREST RATES (JANUARY 2011 - JUNE 2015)

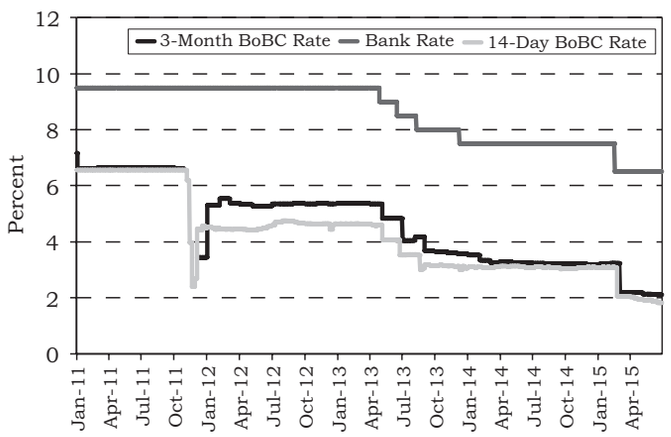


CHART 8: REAL INTEREST RATES: INTERNATIONAL COMPARISONS FOR 3-MONTH MONEY MARKET INSTRUMENTS(JANUARY 2011 - JUNE 2015)

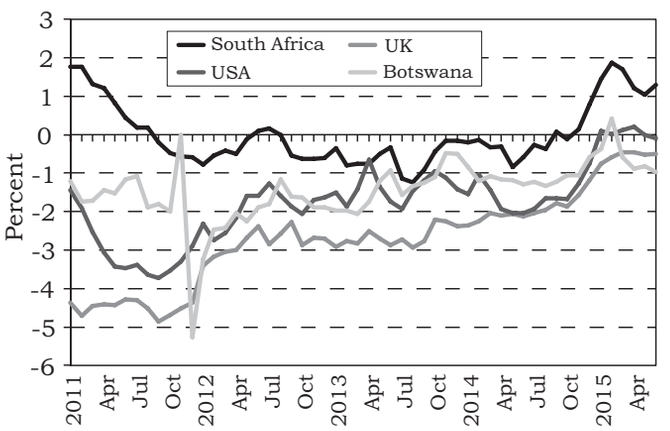
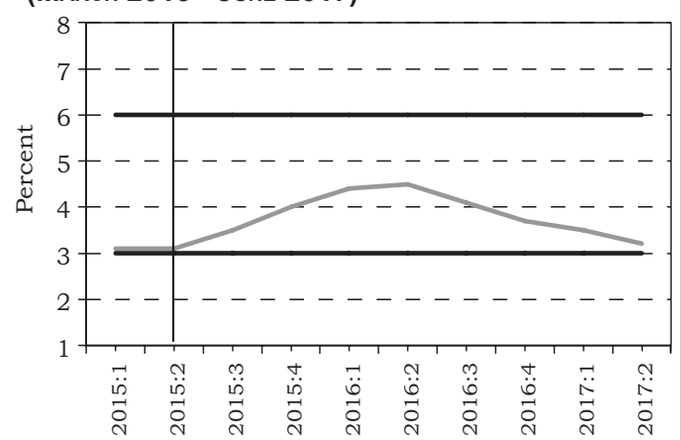
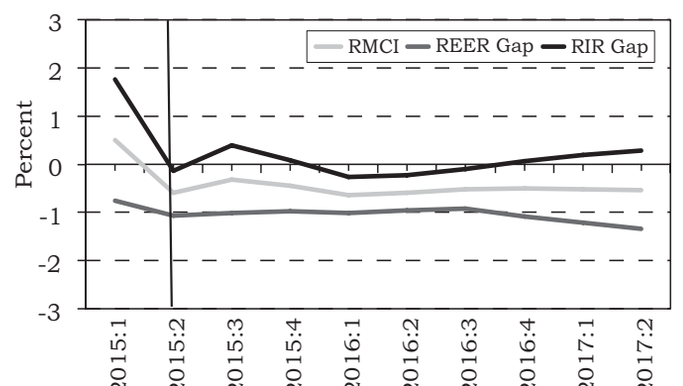


CHART 9: BOTSWANA INFLATION FORECAST (MARCH 2015 - JUNE 2017)



Source: Bank of Botswana.

CHART 10: REAL MONETARY CONDITIONS INDEX (RMCI) (MARCH 2015 - JUNE 2017)



15 Quoted yields are based on the weighted average of the winning bids at auction.

16 The REER is calculated using Botswana's headline inflation, weighted average inflation for SDR countries and South African headline inflation.

Developments with respect to the REER and real interest rates resulted in relatively loose real monetary conditions in the first half of 2015. The moderately loose monetary conditions reflected the dominance of the real exchange rate gap relative to the real interest rate gap.

5. MEDIUM-TERM INFLATION OUTLOOK

The forecasting process for inflation entails an assessment of likely changes in factors that affect domestic price movements; namely, demand and supply interaction, imported inflation and other exogenous factors such as changes in administered prices and government levies. The external influences on domestic prices include economic and financial developments in South Africa and global events such as changes in international commodity prices and demand in major markets.[17]

Global output in 2015 is forecast to increase by 3.3 percent, which is slightly lower than 3.4 percent of 2014. Output growth for major economies is projected at 2.1 percent in 2015, from 1.8 percent in 2014. In emerging market and developing economies, growth is expected to slow from 4.6 percent in 2014 to 4.2 percent in 2015. This would be reflective of tighter external financial conditions as well as weaker economic expansion in China and the decline in commodity prices, which could weigh down on growth momentum in commodity-exporting countries. Furthermore, the expected commencement of a monetary policy tightening cycle in the USA and UK could lead to currency depreciation in emerging market economies, higher borrowing costs and consequently higher inflation. In South Africa, GDP is forecast to grow by 2 percent in 2015 compared to 1.5 percent in 2014, but economic prospects continue to be hindered by the persistent electricity supply shortages.

Globally, inflationary pressures are expected to be dampened by weaker growth in global economic activity, low commodity prices and spare capacity in advanced economies. Therefore, global inflation is projected to decline from 3.5 percent in 2014 to 3.2 percent in 2015. Overall, it is expected that external price developments will have a benign influence on domestic inflation. In particular, inflation for trading partner countries is projected to average 2.3 percent in 2015, mostly reflecting persistently low inflation in SDR countries (0.17 percent). Headline inflation in South Africa is forecast to average 4.5 percent and remain within the 3 – 6 percent target range until the end of 2015. It is expected that the relative strength of the Pula against the South African rand will moderate imported inflation.

Domestic non-mining output expansion is projected to remain above trend in the medium term; however, domestic demand pressures on inflation are expected to be modest, given restrained growth in personal incomes. Slower growth in credit also contributes to modest demand pressure on inflation. Overall, it is expected that inflation will be within the objective range for the remainder of 2015 and into the medium term.[18] Upside risks to the inflation outlook relate to any substantial increase in administered prices and government levies, as well as any increase in international oil and food prices beyond current forecasts. However, inflation could be moderated by any further slowing of growth in global economic activity as well as technological progress, productivity improvements, structural reforms and growing trade and competition.

It is projected that monetary conditions will ease going forward, in view of the dominance of the negative real effective exchange rate gap over the mostly positive real interest rate gap. The unrestrictive real monetary conditions are expected to contribute to growth in economic activity in the medium term.

6. MONETARY POLICY STANCE

The current state of the economy and the projected performance as well as the level of the financial sector development, along with the positive inflation outlook, suggest that maintaining an accommodative monetary policy stance is consistent with keeping inflation within the 3 – 6 percent objective range in the medium term.

The Bank's implementation of the exchange rate policy will entail a zero rate of crawl for the NEER, given that inflation in Botswana is projected to be close to the lower bound of the medium-term objective range of 3 – 6 percent.

7. SUMMARY AND CONCLUSION

Inflation remained within the Bank's objective range of 3 – 6 percent for most of the first six months of 2015 against the background of benign domestic demand pressures, modest wage growth and the subdued impact of the increase in administered prices and government levies, and favourable foreign price developments. The Bank Rate was reduced by a percentage point in the first half of 2015 to bolster economic growth in the context of the positive medium-term outlook for price developments, while the primary reserve requirement was reduced to ameliorate tight liquidity in the banking system.

Looking ahead, it is anticipated that external price pressures on domestic inflation will be benign, given the projected moderate expansion in global economic activity, low commodity prices and the dampening impact of the capacity underutilisation in major economies. In the domestic economy, the slow increase in incomes and credit as well as restrained government expenditure are expected to moderate demand pressures. Consequently, maintaining an

17 Forecasts for external variables are obtained mainly from the IMF's WEO database.

18 As reported in the March 2015 Business Expectations Survey, businesses expect inflation to remain within the objective range for both 2015 and 2016.

accommodative monetary policy stance is consistent with achieving the inflation objective in the medium term and remains appropriate for stimulating stronger economic expansion. The Bank remains committed to monitoring economic and financial developments with a view to responding appropriately to ensure price and financial stability, without undermining growth in economic activity.

The Impact of Exchange Rate Devaluations on Inflation and Output in Botswana

Esther M. Mpete[1]

Abstract

The study assesses the effects of Pula devaluation on inflation and output in Botswana using a reduced-form vector autoregressive approach on quarterly data from 1994 to 2012. Globally, the most common objective of monetary policy is to maintain price stability in the economy. However, because of the openness of most economies, international trade brings about fluctuations and volatility in the exchange rate of currencies. Where they are allowed to fluctuate, exchange rate movements facilitate correction of imbalances in the Balance of Payments. In the case of a fixed exchange rate regime, currency devaluation is the most common approach used to restore external balance and international competitiveness. This approach was common in Botswana prior to the introduction of the crawling band arrangement. However, devaluation is known to bear an inflationary bias and Botswana has in the past experienced higher inflation relative to its trading partners, which accentuated the erosion of competitiveness of local production of tradeable goods and services in both the international and domestic markets. The results of the study indicate that a devaluation of the Pula induces inflationary pressures, but also generates an increase in non-mining economic activity.

1. Introduction

Monetary policy affects the real economy mainly through four channels that operate in market economies; interest rates, credit ceilings, exchange rates and inflation expectations. The choice of which instrument(s) to use depends on the objectives of the monetary policy. The most desirable policy instrument is one that has most influence on the target variable. During the Bretton Woods system era, and indeed for a long time thereafter, the exchange rate was used as a monetary policy instrument in order to facilitate balance of payment adjustments, keep domestic prices stable and preserve the value of a nation's currency (Salvatore, 2001). In the recent past, most economies have adopted inflation targeting regimes and thus have adopted the use of interest rates as their main policy instrument. Even so, the exchange rate is still an important channel of monetary policy transmission mechanism (Williamson, 2003). The exchange rate affects the price of tradeable goods and consequently the demand for goods and services in and outside the economy. Economies which do not have a liberalised exchange rate regime still make use of the exchange rate as a policy tool to control and stabilise inflation. According to Fischer (1996), a country with high inflation problems may use a pegged exchange rate as a nominal anchor to stabilise its inflation, and as long as the peg is adjusted less frequently and is not maintained too long, it can be a powerful tool in bringing down inflation. Several transition economies have managed their inflation scourge this way; among them Brazil and Russia in 1994-1995 (Fischer, 1996).

Relative to its trading partners, Botswana is facing higher inflation, emanating primarily from high dependence on imports; due to inelasticity of imports to price changes since many of them are not available locally (Expenditure Switching Mechanism). As a mineral-dependent economy with a weak manufacturing sector, the country depends highly on imports. In an economy such as Botswana, therefore, the exchange rate has a large impact on inflation and on international competitiveness and consequently on output. A well-informed understanding of the impact of exchange rate movements on prices is vital in assessing the monetary policy stance (Leigh and Rossi, 2002). It is in this context that this study intends to investigate the impact of Pula devaluation on prices and output in Botswana. Section 2 of this paper focuses on the background of Botswana's exchange rate regime; Section 3 reviews the empirical literature; Section 4 specifies the methodology employed; Section 5 presents the results of the estimation from the vector autoregressive model, while Section 6 concludes the paper.

2. Background Of The Exchange Rate Regime

Prior to 1990, policymakers in Botswana used exchange rates as one of the key monetary policy instruments to fight imported inflation and preserve price stability. On the other hand, because the economy relied largely on mineral exports as a source of national income, there was also need to promote and maintain competitiveness in the international market for non-mining exports. There was an obvious conflict between the two goals. A revaluation of the exchange rate in order to curb imported inflation rendered exports less competitive (and some totally uncompetitive), while a devaluation of the Pula made Botswana exports more competitive against the rest of the world, but would lead to higher imported inflation. The direct use of the exchange rate to fight inflation was discontinued in 1990. The management of exchange rates has only remained as a support for the monetary policy – from being a policy instrument to being a policy variable (Setlhare, 2004).

1 Economist, International Finance and Trade Unit, Monetary and Financial Stability Department. The views expressed in this paper are those of the author and do not necessarily reflect those of the Bank of Botswana.

Due to high inflow of diamond mining export revenue, the Pula has a potential to appreciate to economically undesirable levels (Masalila and Motshidisi, 2002) – a scenario which would lead to a problem commonly known as the Dutch Disease[2]. It is, therefore, in the interest of the policymakers not to allow the Pula to appreciate, in real terms, against the currencies of Botswana's major trading partners[3] (Bank of Botswana, 1996). From 1990, the exchange rate was mainly used to promote domestic tradeables' competitiveness in the international market, therefore, a number of currency devaluations (Table 1) had to be carried out whenever the exchange rate appreciated to levels deemed uncompetitive.

TABLE 1: CHRONOLOGY OF THE PULA DEVALUATIONS

DATE	ACTION	COMMENTS
May 6, 1982	10 percent devaluation	Stabilisation measure in response to BoP crisis in 1981/82
June 1984	5 percent devaluation	Competitiveness measure
January 9, 1985	15 percent devaluation	Competitiveness measure
August 1990	5 percent devaluation	Competitiveness measure
August 1991	5 percent devaluation	Competitiveness measure
1992 - 2000	Devaluation (totalling 23 percent) in the form of technical adjustments, adjustment of the Pula basket and band mechanism	Aimed at maintaining competitiveness
February 6, 2004	7.5 percent devaluation	Competitiveness measure
May 30, 2005	12 percent devaluation	Competitiveness measure

Note: *BOP – Balance of Payments*
Source: *Bank of Botswana*

Botswana's exchange rate regime[4] has evolved from an adjustable peg to a crawling band. Whilst the former was characterised by discrete currency devaluations whenever the authorities deemed necessary, the latter enables small and continuous adjustments of the Pula exchange rate. To achieve its objective, the exchange rate policy aims to maintain stability of the Real Effective Exchange Rate (REER) through a crawling peg exchange rate mechanism, where the rate of crawl is aligned with the differential between the expected average rate of inflation of trading partner countries and Botswana's inflation objective. Since the introduction of the crawling peg exchange rate mechanism in May 2005, the Pula has continued to crawl downwards (small continuous devaluations), as domestic inflation has remained higher than average trading partner inflation (Bank of Botswana, 2006 - 2013). A graphical presentation of the nominal effective exchange rate (a trade-weighted exchange rate), as well as the nominal US dollar\Pula exchange rate, in Chart 1a-b, illustrate this downward crawl.

CHART 1A: NOMINAL EFFECTIVE EXCHANGE RATE

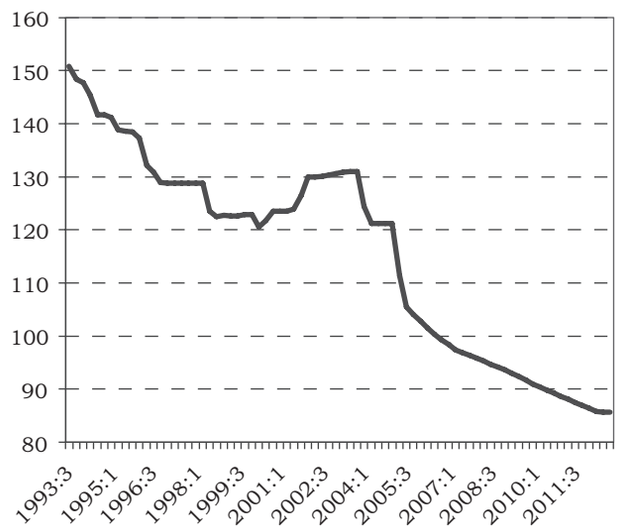
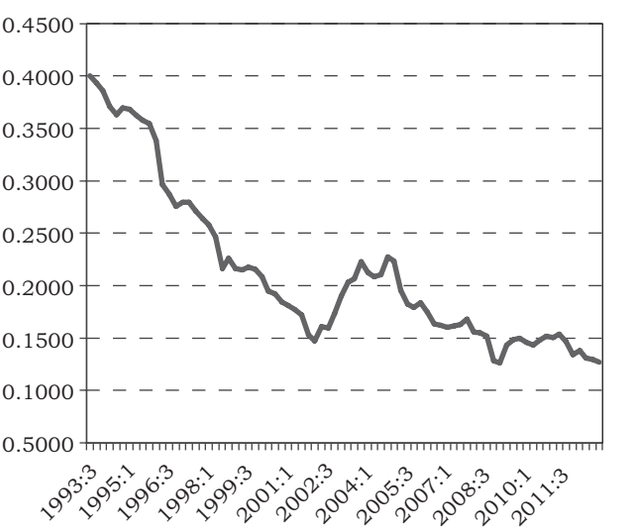


CHART 1B: NOMINAL DOLLAR/PULA EXCHANGE RATE



2 Dutch disease is an affliction that affects relatively small resource-rich countries whereby a massive rise in resource export revenues causes an appreciation of the exchange rate, making non-resource exports uncompetitive in the international export market, e.g., manufacturing, and hindering diversification.

3 The exchange rate of the Pula is pegged to that of its major trading partners' currencies, thus the South Africa rand and the International Monetary Fund's (IMF) Special Drawing Rights (SDR).

4 The exchange rate policy is aimed at achieving competitiveness of local producers of tradeable goods and services in both international and domestic markets.

Theoretically, devaluing the Pula should lower export prices relative to competing goods in foreign markets, increasing foreign demand for domestic goods, and it also should reduce the prices of domestically produced goods relative to competing imports, thus leading to increased overall domestic production. However, in a country not well-endowed with inputs (raw materials), domestic production is largely reliant on imported capital, raw materials and intermediate goods. Currency devaluation makes such imported input goods more costly due to a higher import price via the new rate of exchange, which brings about pressures of imported inflation; escalating the cost of production and, therefore, rendering the final goods expensive and less competitive in the international and domestic markets, thus dampening economic production.

In order to make informed policy decisions, it is essential to investigate the effects of Pula devaluation on domestic prices and on economic activity. Thus, the aim of this study is to assess the impact of nominal Pula devaluation on inflation and output. The assessment will be done by investigating the dynamic interrelationship between the exchange rate, inflation and output in Botswana using a Vector Autoregression (VAR) approach.

3. LITERATURE REVIEW

Several empirical studies have been carried out in a number of countries to estimate the degree of pass-through of exchange rate changes to prices. Similarly, a host of methodologies have been employed by different researchers. Empirical studies based on simple regressions (Agenor, 1991; Athukorala, 1991; Leith, 1991; Roger and Wang, 1993; and Menon, 1995) have been provided in investigating the exchange rate transmission. More recently, McCarthy (1999), Leigh and Rossi (2002), Gueorguiev (2003), Akinlo and Odusola (2003), Cespedes et al. (2005), among others, have provided further empirical refinements using a Vector Autoregressive (VAR) approach.

Menon (1995) has compiled a lengthy survey of various empirical works on exchange rate pass-through[5] prior to 1995; which covered 43 different studies. In his analysis, Menon found that (1) there was a pervasive incidence of incomplete pass-through reported across all studies, (2) the pass-through ranged from a low of about 50 percent to almost full pass-through, (3) the level of pass-through was higher for developed economies and lower for less developed countries, and (4) there were extensive lags (even up to 8 quarters) corresponding to the higher transmission of exchange rate changes to prices. However, Menon observed that most researchers had employed Ordinary Least Squares (OLS) to estimate the pass-through, but had not taken into consideration the time series properties of the data. This had limited their findings because non-stationary data causes a problem of spurious regressions, giving biased results.

Mike Sikwila (2011) estimated the impact of exchange rate adjustment on consumer price inflation in Zimbabwe using quarterly data from 1990-2006. Sikwila employed Ordinary Least Squares to estimate an error correction model, using the consumer price index, the nominal official effective exchange rates, Gross National Product (GNP) and broad money supply (M2). It was found that the first round impact of devaluation on consumer prices was low; with an elasticity of 0.05. However, the long-term elasticity was estimated at 0.51, which means about half of an exchange rate adjustment would be passed on to domestic inflation. The author concluded that his findings did not support the view that following a devaluation prices rise by the same magnitude of devaluation and that policies which favour exchange rate devaluation are advantageous to the economy of Zimbabwe.

The effect of exchange rate changes on general economic activity have been extensively studied, both in industrialised and developing economies. Developing countries with exchange rate management regimes still use exchange rate devaluations as a stabilisation tool in economic adjustments. Traditional economists maintain that the role of exchange rates is not restricted to balance of payments adjustment, but devaluations have a positive effect on economic activity as they promote domestic production of tradeables. The New Structuralists School argues that devaluations (depreciations) have a contractionary impact on output and perverse effects on inflation. Furthermore, an analysis that devaluation is contractionary has also received considerable theoretical attention (see among others; Agenor, 1991; Berument and Pasaogullari, 2003; Akinlo and Odusola, 2003).

Agenor (1991) investigates a causal relationship between output and real exchange rates and also assesses the effects of exchange rate devaluations. He builds a rational expectations macro-model which uses a cross-sectional analysis in a multi-country survey of 23 countries. He finds that an anticipated devaluation of the real exchange rate has a negative effect on economic activity, whilst an unanticipated devaluation has a positive effect – an expansionary effect. According to Agenor, an anticipated devaluation is seen as an adverse supply shock, and therefore, translates into a rise in price levels. Labour will then demand an increase in their nominal wages. As a result, labour demand and imported inputs will go down, and consequently output will fall.

Berument and Pasaogullari (2003) assess the effect of exchange rate depreciation on inflation and output in Turkey. During its financial crisis, Turkey experienced immense nominal domestic currency depreciation episodes from 1994 to 2001, to the extent of 62 percent. The duo highlight that these episodes were followed

5 Different studies have tested the exchange rate changes transmission on different prices; be it export prices, import prices, domestic producer prices or domestic consumer prices.

by significant output losses. They engage a VAR to assess the dynamic interaction between the variables of interest, which are real exchange rates, inflation and seasonally adjusted real output in that order. They also include U.S. nominal interest rates as an exogenous variable because the U.S. interest rate captures the external developments that may have significant effects on the real exchange rate, inflation, and the real GDP in Turkey. They found that the impact of devaluation on output is negative and permanent. Moreover, they find that devaluations are inflationary in the economy of Turkey.

In examining the dynamics among the Naira exchange rate, inflation and output in Nigeria, Akinlo and Odusola (2003) have found that there is a contractionary impact of exchange-rate depreciation on output, whilst inflation innovations are explained mainly by exchange rate fluctuations and real income. According to Akinlo and Odusola it is not impossible that, with favourable internal and external environment (such as stable financial markets, access to international markets and high economic recovery), a real exchange rate shock might produce greater benefits with less inflation than in the past.

Previous Empirical Work on Exchange Rate and Inflation in Botswana

Empirical work on the effect of devaluation on output has not been done in Botswana, however, a number of studies have investigated the effect of exchange rate movements on domestic prices. In 1991, Leith investigated the exchange rate transmission to prices in Botswana. The study estimated a simple log-linear model which incorporated three variables; Botswana CPI, South African producer price index and the rand/pula nominal exchange rate. He found a 100 percent pass-through of changes in exchange rates and foreign price levels onto domestic prices; which transmitted at a lag of five quarters. However, Leith disregarded the time series properties of the data. But, because empirical evidence has shown that the data generation of exchange rate and consumer price indices time series presents a random walk process – and hence non-stationary – findings of this study may be biased due to spurious correlations.

Using quarterly data over the period 1976-1992, Masale (1993) found that Botswana prices, South Africa prices and the rand/pula exchange rate were all integrated of order one, I(1), and therefore, estimated a cointegration analysis to establish the long-run relationship of these variables. However, the study failed to find existence of a long-term cointegrating relationship between exchange rate and relative prices. Furthermore, estimation of a short-term relationship led to a rejection of the hypothesis of Purchasing Power Parity among the variables. The exclusion of other relevant regressors, such as Gross Domestic Product, interest rates and money supply, could explain the poor results. Another factor which could have improved the results was using a better choice of foreign prices which reflected Botswana's trade pattern rather than just South Africa.

In 1999, Atta, Jefferis, Mannathoko and Siwawa-Ndai investigated the exchange rate policy and price determination in Botswana. The study attempted to establish the link between long-run equilibrium prices and short-run inflation by employing a dynamic error correction model. They found that: (1) the exchange rate and South African prices are cointegrated with domestic prices (rather than with money), in support of theoretical literature that there is a dominant long-run equilibrium relationship between prices and the exchange rate in a pegged exchange rate regime; (2) in the short-run both domestic prices and imported inflationary pressures determine growth in the price level; and (3) that changes in the exchange rate and prices will only have short-term price competitiveness effects.

In this chapter, literature has shown that the dynamic interrelationship between exchange rates, prices and output is not only country specific in terms of economic development, but also depends on the level of a nation's technological advancement. In fact, there are a lot of factors that affect the degree of transmission of exchange rate movements on both the real sector and the monetary sector; these include the type of exchange rate regime, monetary policy objectives, level of financial market development, integration of the real and monetary sectors, and microeconomic characteristics of the economy. Ceteris paribus, the most common outcome of the studies reviewed is that exchange rate changes, whether market-determined or policy-oriented, explain a large amount of the movements in consumer (and producer) prices and the pass-through is relatively fast.

4. Methodology And Data

In determining the impact of exchange rate changes on inflation and output in Botswana, the paper employs a VAR approach as it allows for endogeneity, simultaneity and a flexible interaction among economic time series variables, in order to deduce the general dynamic interrelationships among variables. Analysis will be drawn primarily from the innovation accounting techniques; impulse responses and variance decompositions.

Specification of the Model

Following the study by Berument and Pasaogullari (2003), the impact of Pula devaluation on inflation and output is investigated by incorporating seven equations into a VAR model. The model is specified as follows,

$$X_t = A + \sum_{i=1}^{n} \beta_i X_{t-1} + \varepsilon_t \qquad \varepsilon_t \sim (0, \Sigma)$$

where, X_t is a matrix of variables $(\pi_t^{oil}, \pi_t^p, r_t, m_t, e_t, y_t, \pi_t)$, A is a matrix of constants $(\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7)$ β_i, is a matrix of coefficients, ε_t is a matrix of reduced-form disturbances and $\Sigma = E(\varepsilon_t \varepsilon_t')$ is a covariance matrix. Where $(\pi_t^{oil}, \pi_t^p, r_t, m_t, e_t, y_t, \pi_t)$ are the world oil price inflation, trading partner inflation, Bank Rate, first difference of broad money aggregate, exchange rate changes, non-mining output growth, and domestic consumer price inflation, respectively. Σ is a covariance matrix of the VAR disturbances ε_t, and is diagonal; therefore, the disturbances in the ε_t are serially uncorrelated. The orthogonalisation[6] of the VAR residuals is estimated using the standard Choleski decomposition approach. The ε_t are useful when using VAR for forecasting (thus known as the forecast errors). Impulse responses and variance decompositions are deduced only from the orthogonalised shocks.

Choice of Variables

This study chooses to use nominal effective exchange rates (NEER), particularly given the fact that the Pula is pegged to a basket of currencies; therefore, the trade-weighted exchange rate index captures the true extent of the exchange rate fluctuations faced by the economy. Trading partner inflation is included because the current exchange rate regime is a crawling peg mechanism, in which the rate of crawl is based on the differential between the Bank's inflation objective and the forecast inflation of trading partner countries, in order to attain stability of the real effective exchange rate (REER), and thus price competitiveness of domestically produced goods. Stability of the REER is attained through price stability in Botswana which ought to be in line with that of trading partner countries; therefore, trading partner inflation also plays a vital role in explaining price movements in Botswana.

The Consumer Price Index (CPI) is used as a proxy for domestic prices, and appropriately so because the Botswana CPI basket contains about 69 percent of tradeable goods. Therefore, the effect that this study seeks is addressed[7]. The choice of real non-mining gross domestic product (GDP) as a proxy for economic activity or output is motivated by two reasons. First, the ideal proxy would have been industrial production (IP) because it is a better indicator for economic production and activity, but there are no captured statistics on industrial production in Botswana, whilst GDP is consistently recorded. Secondly, and following the practice in most studies (Leigh and Rossi (2002), Gueorguiev (2003), Akinlo and Odusola (2003), Cespedes et al. (2005)) on this research area, GDP is a good and common proxy for economic output.

The Monetary Policy Statements of Bank of Botswana (2005-2012) state that the central bank uses interest rates to moderate inflationary pressures in the economy and that changes in interest rates and other policies, such as fiscal and exchange rate policies, affect the overall level of domestic demand and output. In order to capture the impact of monetary policy in explaining changes in prices and output, the study incorporates the Bank of Botswana policy rate (termed 'Bank Rate') to represent monetary policy shocks in the VAR system.

In order to avoid the bias of an omitted variable, the model also includes the broad money aggregate (M2) which is proxy for money supply. The money supply function explains changes in the level of domestic prices. Furthermore, in order to capture some exogenous demand shocks emanating from global developments, the model includes world oil prices (West Texas Intermediate (WTI) Cushing crude oil spot price)[8].

Data Issues and Data Sources

This study uses quarterly values of real non-mining GDP, Bank Rate, NEER, CPI, M2, trading partner inflation and world oil prices. The sample period runs from January 1994 to December 2012, using quarterly data, which yielded 76 observations.

Quarterly real GDP and monthly CPI data were obtained from the statistical bulletin of the Statistics Botswana website; GDP data were used as they are. The CPI series was transformed into a quarterly series by taking an average of the three months of a quarter. The trading partner inflation series was computed by making a trade weighted (as reflected in the Pula basket) composite of the South African CPI inflation and SDR CPI inflation. SDR CPI was computed by taking CPIs of the four composite currencies that make up the SDR, weighted according to their composition in the SDR. The Bank Rate, M2 and nominal effective exchange rates data were obtained (as monthly series) from the Botswana Financial Statistics tables posted on the Bank of Botswana website; and were then transformed into a quarterly series by taking three-month averages. The Cushing WTI crude oil spot price were sourced from the US Energy Information Administration webpage; prices were stated in US dollars per barrel, but were converted to annualised percentage change (inflation).

Time Series Properties of the Data

Growth of real non-mining GDP showed some seasonality for the period under study; even though the seasonal fluctuations are not particularly regular. To capture the seasonality, the series was seasonally adjusted using the X12 in Eviews. Furthermore, time series graphical representations of the exchange rate,

6 A procedure in which a set of orthogonal vectors is recursively obtained.

7 It would have been ideal to also include producer prices so as to compare the level of exchange rate pass-through with one at consumer levels, but unfortunately such data are not available in Botswana.

8 West Texas Intermediate (WTI) is a grade of crude oil used as an international benchmark in oil pricing (alongside the Brent crude oil). Cushing, Oklahoma, is an important hub where WTI crude oil is priced.

inflation and non-mining GDP growth showed noticeable spikes in;

1. 2002 quarter three – in line with the introduction of Value Added Tax in Botswana,
2. 2004 quarter one – in line with the Pula devaluation of 7.5 percent in February 2004,
3. 2005 quarter two and three – in line with the 12 percent Pula devaluation in May 2005,
4. 2006 quarter two – in line with restricting the purchasing of BoBCs[9] to banks, and
5. 2008 quarter two – in line with the sharp increases in world oil and food prices.

In that respect, five dummies were generated for inclusion into the vector autoregression estimation to capture these structural breaks.

Ordering of the Variables

In order to formulate and analyse impulse response functions and variance decompositions under a VAR, the residuals need to be orthogonalised. The study uses Cholesky decomposition to orthogonalise the residuals; therefore, the variables in the system should have a particular ordering. Ordering of the variables should be consistent with economic theory. This is because movements in one variable are likely to follow, rather than precede, others. For instance, movements in exchange rates may be a leading indicator to changes in inflation and real activity. Generally, the variables are ordered such that earlier variables in the system cause later ones. The ordering starts with variables that are determined outside the system, these being external shocks to the economy which include oil prices and trading partner inflation. The endogenous variables are ordered as follows; the Bank Rate, broad money aggregate, exchange rate changes, non-mining output GDP, and domestic consumer price inflation, respectively.

5. Estimation Results And Findings

Unit root tests

The Augmented Dickey-Fuller (ADF) test seeks to confirm the null hypothesis that a series has a stochastic trend (unit root) against the alternative of either a deterministic linear trend (for trended series) or a constant (for series without trends). The first panel displays test results for the variables in levels, whilst the second panel shows tests for a single root, with critical values shown in the third panel. A trend was added only if the graphical presentation (in Figure 2) showed a trend. The null hypothesis of a unit root is rejected if the computed ADF test statistic is greater in absolute value than the critical value. According to Table 2 below, we fail to reject the null hypothesis that there is a unit root for the Bank Rate, log of real non-mining GDP, log of M2 and log of exchange rate, at their levels. We fail to reject the null hypothesis at all the three significance levels. These variables are non-stationary at their level; which means that the variables have no tendency to return to their mean in the long-run. However, we reject the null hypothesis of a unit root for the oil price inflation, trading partner inflation and CPI inflation; these three variables are I(0).

TABLE 2: AUGMENTED DICKEY-FULLER TEST OF THE VARIABLES USED (1994:1– 2012:4)

Variables	Trend	ADF t-statistic	P-value
Test for levels			
Oil Price inflation	No	-3.8634*	0.0037
Trading partner inflation	No	-3.0229**	0.0376
Bank rate	No	-1.4110	0.5725
Log of real non-mining GDP	Yes	-2.5614	0.2989
Log of M2	Yes	-1.7135	0.7355
Log of nominal effective exchange rate	Yes	-1.7256	0.7300
CPI inflation	No	-5.3267*	0.0000
Test for unit root			
Bank rate	No	-4.2046*	0.0012
Log of real non-mining GDP	Yes	-7.9499	0.0000
Log of M2	Yes	-6.2306*	0.0000
Log of nominal effective exchange rate	Yes	-6.3022*	0.0000
Critical Values* **	**with drift**	**without drift**	
1%	-4.09	-3.52	
5%	-3.47	-2.90	
10%	-3.16	-2.59	

*Notes: 1. * Means significance at the 1 percent level, whilst ** is significance at the 5 percent level.*
*2. *** Mackinnon critical values for rejecting the null hypothesis of a unit root.*

9 Bank of Botswana Certificates

The non-stationary variables were further tested for stationarity in their first differences and were found to be integrated of order one, i.e., I(1). This means the four variables have a stochastic trend, therefore, should be entered in their first differences in the VAR estimation. The VAR must be stationary around the deterministic trend so as to compute and accurately interpret the responses to shocks as short-run dynamics around a stationary long-run state.

Reduced-form Estimation Results

The model estimates a VAR(2); which is the lag structure suggested by the Schwartz Information Criterion (SIC). The SIC was preferred because it tends to select a more parsimonious model as compared to the Akaike Information Criterion (AIC). The AIC suggested a lag structure of three lags, whilst the SIC suggested two lags; the model was estimated using both lag structures. The lag length that gave the smallest value of the SIC was chosen as the optimal lag structure.

Tables 3, shows a summary of the reduced-form model estimation. Five structural break dummies are included as explained in section 4. Evidently, the model has a plausible goodness of fit, which means the model explains a significant proportion of the variability of the variables. In comparison, the adjusted R^2 for the domestic consumer inflation equation shows a much better fit, followed by the foreign inflation equation, the world oil price equation, the monetary policy equation and the exchange rate equation, respectively.

The standard errors of the equations are favourably low; except for the foreign and oil inflation equations. The correlation matrix of the error terms suggests that a positive relationship exists between domestic prices and world oil prices, foreign prices, domestic interest rates, money demand and real non-mining output. Conversely, there is a negative relationship between inflation and exchange rate movements. However, a more definitive analysis of the relationship among these variables will be derived from the impulse responses and variance decompositions.

Diagnostic Model Evaluation

VAR stability

The VAR was tested for stability using the inverse roots of the characteristic AR polynomial. Figure 1 shows that all the roots of the estimated model lie within the unit root circle, which indicates that the VAR is stable. Stability of the VAR is crucial, otherwise the standard errors of the impulse responses will not be valid.

FIGURE 1: VAR STABILITY CONDITION CHECK

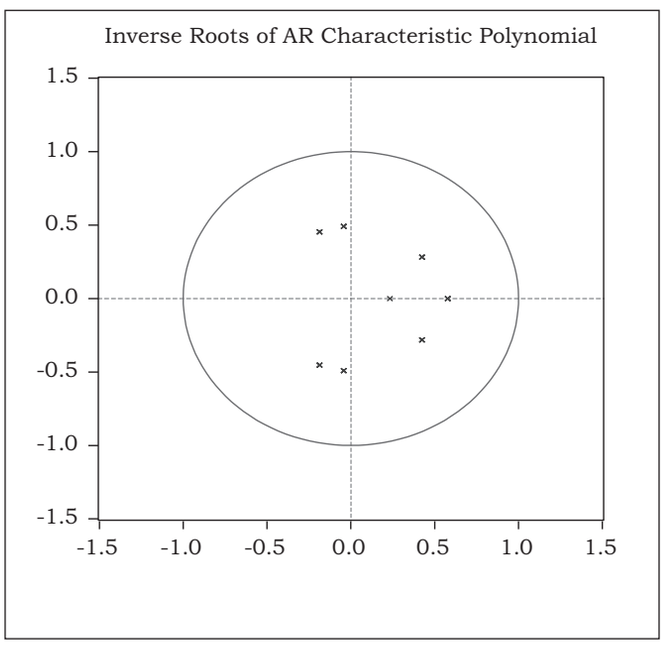


TABLE 3: SUMMARY OF THE VAR FEDUCED-FORM ESTIMATION

Test Statistics	Oil Inflation	Partner Inflation	Bank Rate	Real Output	M2	Exchange Rate	CPI Inflation
Goodness of fit statistics							
Adjusted R^2	0.75	0.86	0.67	0.35	0.37	0.65	0.91
Standard error of equation	0.81	0.80	0.26	0.05	0.26	0.01	0.07
Correlation of errors							
Oil prices	1.0000	0.1423	0.1595	-0.1417	0.0106	0.0538	0.1290
Partner inflation	0.0000	1.0000	0.2763	0.0839	-0.0754	-0.1216	0.1684
Bank Rate	0.0000	0.0000	1.0000	0.1519	0.1177	-0.2356	0.0738
Real output	0.0000	0.0000	0.0000	1.0000	-0.0287	-0.0851	0.2401
M2	0.0000	0.0000	0.0000	0.0000	1.0000	-0.0120	0.1893
Exchange rate	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	-0.2447
Inflation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000

Serial correlation

In order to test and confirm that the error terms of the estimated VAR are not serially correlated, an autocorrelation LM test was performed on the residuals of VAR. The null hypothesis of this test states that there is no serial correlation at lag order h, where h is the specified lag order for the serial correlation regression. The test statistic for lag order h is computed by running an auxiliary regression of the residuals U_t on the original regressors and lagged residual U_{t-u}. The lag order six has been chosen arbitrarily by Eviews and the results show that indeed there is no serial correlation in the residuals of the estimated VAR.

Impulse Responses

As explained in Section 3, the error terms in the model are contemporaneously uncorrelated; therefore, responses of each disturbance can be examined in isolation. On the other hand, the autoregressive roots of the VAR have been tested and the VAR was found to be stable, giving leeway for an analysis of the innovations through impulse responses. A unit shock is applied to the error of each variable, and impulse responses give the responsiveness of the dependent variable to that unit shock, as well as a map out of how the effect dies out over time.

Appendix A1 and A2 present median impulse responses of consumer prices and real output growth to each shock of the other six variables in the system. The responses are mapped out in a horizon of 10 quarters. The solid line in each graph is the estimated response, while the dashed lines denote the two standard error 90 percent confidence band around the estimate. A positive shock to the variables is regarded as an increase in these variables. Similarly, a positive exchange rate shock (i.e. a rise in the foreign currency per domestic currency) is interpreted as an appreciation or revaluation (Berument and Pasaogullari, 2003; Akinlo and Odusola, 2003; Tovar, 2006). To understand this clearly, we recall that devaluation means a fall in the value of domestic currency in terms of foreign currency; therefore, a revaluation is a rise in the value of domestic currency relative to foreign currency.

Impulse responses indicate that in Botswana the relationship among domestic prices, world oil prices, foreign prices, domestic interest rates, money demand, real output and exchange rate is generally statistically insignificant, except for the response of inflation to an exchange rate shock; the error bands in most of the response functions lie on both sides of the zero line, indicating that the responses are statistically not different from zero. However, the responses and expected signs conform to economic theory.

Highlighting on the variables of interest, impulse responses show that a positive shock in the exchange rate induces a negative response of domestic prices, as expected. Inflation declines for the first five quarters and begins to pick up until it stabilises at the eighth quarter. The magnitude is statistically significant in the first five quarters. It is found that a positive exchange rate shock pushes the level of general increase in prices down. This also means devaluation is inflationary in the economy. This result is consistent with economic theory. In fact, in Botswana, subsequent to the discrete devaluations mentioned in Chapter 1, inflation increased significantly (Chart 2).

CHART 2 : EXCHANGE RATE AND DOMESTIC INFLATION (JANUARY 1994 - DECEMBER 2012)

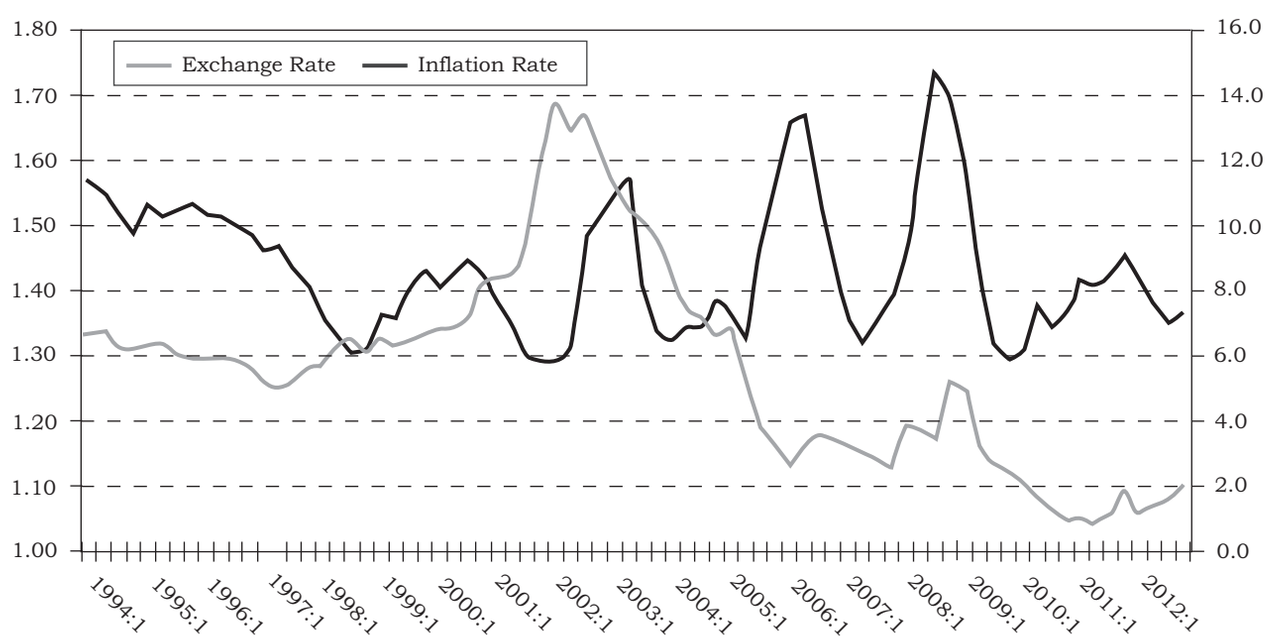


TABLE 4: PERCENTAGE OF THE FORECAST ERROR VARIANCE EXPLAINED BY INNOVATIONS

Variance Decomposition of	LRGDP (y)				ΔCPI (π)			
Horizon (Quarters)	1	2	3	4	1	2	3	4
Standard Errors	0.03	0.04	0.04	0.04	0.01	0.01	0.01	0.01
ε^{oil}	0.0	1.7	2.1	2.3	1.7	10.5	17.9	20.2
$\varepsilon^{\pi p}$	0.6	9.2	10.0	9.9	2.3	6.0	9.6	11.8
ε^{r}	2.0	1.9	1.8	1.9	0.0	0.1	1.0	1.0
ε^{m2}	0.2	2.5	2.9	3.1	6.1	5.1	2.9	2.3
ε^{e}	0.0	1.1	2.3	2.3	5.2	11.4	17.1	20.4
ε^{y}	97.1	83.6	80.7	80.2	4.5	6.0	5.9	5.3
ε^{π}	0.0	0.1	0.1	0.25	80.1	60.9	45.7	39.0

Impulse response functions also indicate that non-mining economic activity responds negatively to an exchange rate shock (which is a revaluation); suggesting that devaluations are expansionary in Botswana. The response of output to an exchange rate shock is, however, not instantaneous, output responds only in the second quarter and remains negative in the first four quarters. The responses are, however, insignificant throughout the forecast horizon.

Variance Decompositions

The variance decompositions give the proportions of how much of the forecast error variance of a given variable is explained by innovations of each explanatory variable. However, most of the variations are due to their 'own' shocks. Variance decompositions are reported in Table 4, where the percentages of forecast error variances in output and domestic prices, explained by innovations of each variable in the VAR system, are reported.

Results show that, apart from shocks emanating from components of the domestic CPI basket, much of the variance in domestic consumer prices is explained by changes in the exchange rate and world oil prices. In the fourth quarter, the forecast error variance is about 20 percent for both variables.

Variance decompositions show that in the fourth quarter, economic activity is more responsive to foreign inflation by 10 percent, followed by money supply at 3 percent, whilst it remains less responsive to prices, at 0.2 percent. Both oil price and exchange rate shocks do not have an instantaneous effect on domestic output, and after a year they explain only 2 percent of its forecast error variance. The most important source of variation in non-mining output forecast error is its own innovations.

The forecasting power of exchange rate innovations is more pronounced on domestic consumer prices than on economic activity. In the second quarter, innovations in the exchange rate explain only 1 percent of the variation in economic output whilst they explain 11 percent of the variation in prices; however, by the fourth quarter the percentage of variation in prices explained by the exchange rate is 20 percent.

Furthermore, on the four-quarter forecast horizon, real activity innovations have a little influence on the variation in prices. Similarly, the predictive power of inflation innovations for real activity is insignificant.

6. CONCLUSION

Recent empirical studies have found a contractionary impact of exchange rate depreciations on output, whilst others have found an expansionary impact of the currency depreciations. In Botswana, authorities have put great effort on keeping the Pula from appreciating to levels which might paralyse other sectors of the economy, due to increasing mineral export earnings. Authorities use the exchange rate as a policy variable to support domestic and international competitiveness of domestic tradeables. To achieve this, the real effective exchange rate is kept stable through the crawling peg exchange rate policy. The nominal effective exchange rate time series illustrates Pula devaluation, over the years, which is more pronounced after the introduction of the crawling band mechanism.

This study has estimated the extent of the effect of Pula devaluation on domestic prices and output. The study employed a vector autoregressive approach which included consumer prices, broad money aggregate, trading partner inflation, world oil prices, non-mining Gross Domestic Product, nominal effective exchange rates and the Bank Rate. A number of dummy variables were also included in the VAR to capture a couple of past discrete devaluations within the scope of study, as well as some structural changes observed. Some forecast error variance decompositions and impulse responses have been performed to analyse the impact of variables within the VAR.

Findings of this study have generally been in line with the established macroeconomic behaviour of these variables in the context of Botswana. Findings show that both prices and output respond negatively to a shock in exchange rates, which means a revaluation[10] of the Pula is anti-inflationary, but it dampens non-mining economic output. In contrast, currency devaluation induces inflationary pressures, but has a positive (expansionary) impact on non-mining economic activity in Botswana because it promotes competitiveness of tradeable goods, both domestically and internationally. This result is also in line with the traditional Keynesian approach, where output is assumed to be demand-determined and that the economy operates below its potential; the view is that currency devaluation will lead to an improvement in the current account and consequently an increase in aggregate demand, which, in turn, will induce an increase in output and employment.

REFERENCES

Agénor, P. (1991) "Output, Devaluation and the Real Exchange Rate in Developing Countries", Weltwirtschaftliches Archiv, 127(1), 18–41.

Akinlo, A. E., and Odusola, A. F. (2003) "Assessing the Impact of Nigeria's Naira Depreciation on Output and Inflation", Applied Economics, 35(6), 691-703.

Atta, J., Jefferis, K.R., Mannathoko, I., and Siwawa-Ndai, P. (1999) "Exchange Rate Policy and Price Determination in Botswana", Africa Economic Research Consortium, Research Paper No. 93.

Athukorala, P. (1991) "Exchange rate pass-through: the case of Korean exports of manufactures", Economics Letters, 35, 79-84.

Bank of Botswana Monetary Policy Statements, various issues (2005 - 2012)

Bank of Botswana Annual Reports, various issues (1994 - 2011)

Berument, H. and Pasaogullari, M. (2003) "Effects of the Real Exchange Rate on Output and Inflation: Evidence from Turkey", The Developing Economies, XLI-4 (December), 401–35.

Black, J. (2002) Dictionary of Economics. Second edition. New York: Oxford University Press.

Choudhri, E. U., and Hakura, D. S. (2006) "Exchange rate pass-through to domestic prices: Does the inflationary environment matter?" Journal of International Money and Finance, 25, 614-639.

Deléchat, C., and Gaertner, M. (2008) "Exchange Rate Assessment in a Resource-Dependent Economy: The Case of Botswana" International Monetary Fund, Working Paper No. 08/83.

Enders, W. (2004) Applied Econometric Time Series. 2nd Edition, New York: John Wiley & Sons Inc.

Fischer, S. (1996) "Maintaining Price Stability". International Monetary Fund. Finance and Development. Central Banking: The Challenges Ahead. 33(4), 11-18.

Gagnon, J. E., and Ihrig, J. (2001) "Monetary Policy and Exchange Rate Pass-Through", Board of Governors of the Federal Reserve System, International Finance Discussion Paper No. 704.

Ghosh, A., Gulde, A., Ostry, J. D., and Wolf, H. (1996) "Does The Exchange Rate Regime Matter for Inflation and Growth", International Monetary Fund, Working Paper No. 95/121.

Ghysels, E., and Osborn, D. R. (2001) Econometric Analysis of Seasonal Time Series. Cambridge: Cambridge University Press.

Gueorguiev, N. (2003) "Exchange Rate Pass-Through in Romania", International Monetary Fund, Working Paper No. 03/130.

Kamin, Steven (1996) "Real Exchange Rates and Inflation in Exchange-Rate Based Stabilisation: An Empirical Examination". Board of Governors of the Federal Reserve System, International Finance Discussion Paper No. 554.

Kganetsano, Alex (2006) "Transmission Mechanism for Monetary Policy of Botswana", PhD Thesis. University of Sheffield.

Leigh, D., and Rossi M. (2002) "Exchange Rate Pass-Through in Turkey". International Monetary Fund, Working Paper No. 02/204.

Leith, C. J. (1991) "The Exchange Rate and the Price Level in a Small Open Economy: Botswana", Journal of Policy Modelling 13(2), 309 – 315.

Marc, K. (1998) "Exchange Rate Regimes, Inflation, and Output and Inflation in Sub-Saharan Countries", Bank for International Settlements, Monetary and Economic Department, Working Paper No. 53.

Majaha-Järtby, J. (1998) "Adoption of Indirect Instruments of Monetary Policy in Less Developed Countries", Bank of Botswana Research Bulletin , 16(12), 24 – 30.

Masale, S. M. (1993) "Inflation and Exchange Rate Policy in Botswana: An exploratory study", University of Sussex.

Masalila, K. (2001) "Financial Liberalisation and Monetary Policy Effectiveness: A Comparison of Botswana, Malawi and Zimbabwe". Bank of Botswana Research Bulletin 19(1), 67 – 70.

Masalila, K., and Phetwe, M. (2001) "Botswana's Monetary Policy Framework", Paper prepared for the Conference on Monetary Policy Frameworks in Africa, Pretoria, South Africa.

10 Increase in the value of domestic currency relative to foreign currency

Masalila, K., and Motshidisi, O. (2003) "Botswana's Exchange Rate Policy", Bank for International Settlements, No 17.

McCarthy, J. (1999) "Pass-Through of Exchange Rates and Import Prices to Domestic Inflation in Some Industrialized Economies", Federal Reserve Bank of New York, Research Department.

Menon, J. (1995) "Exchange Rate Pass-through", Centre of Policy Studies and the IMPACT Project, Journal of Economic Surveys, 9(2), 45 – 49.

Roger, J., and Wang, P. (1993) "Output, Inflation, and Stabilization in a Small Open Economy: Evidence From Mexico", Federal Reserve Bank of Dallas. Research Paper No. 9315.

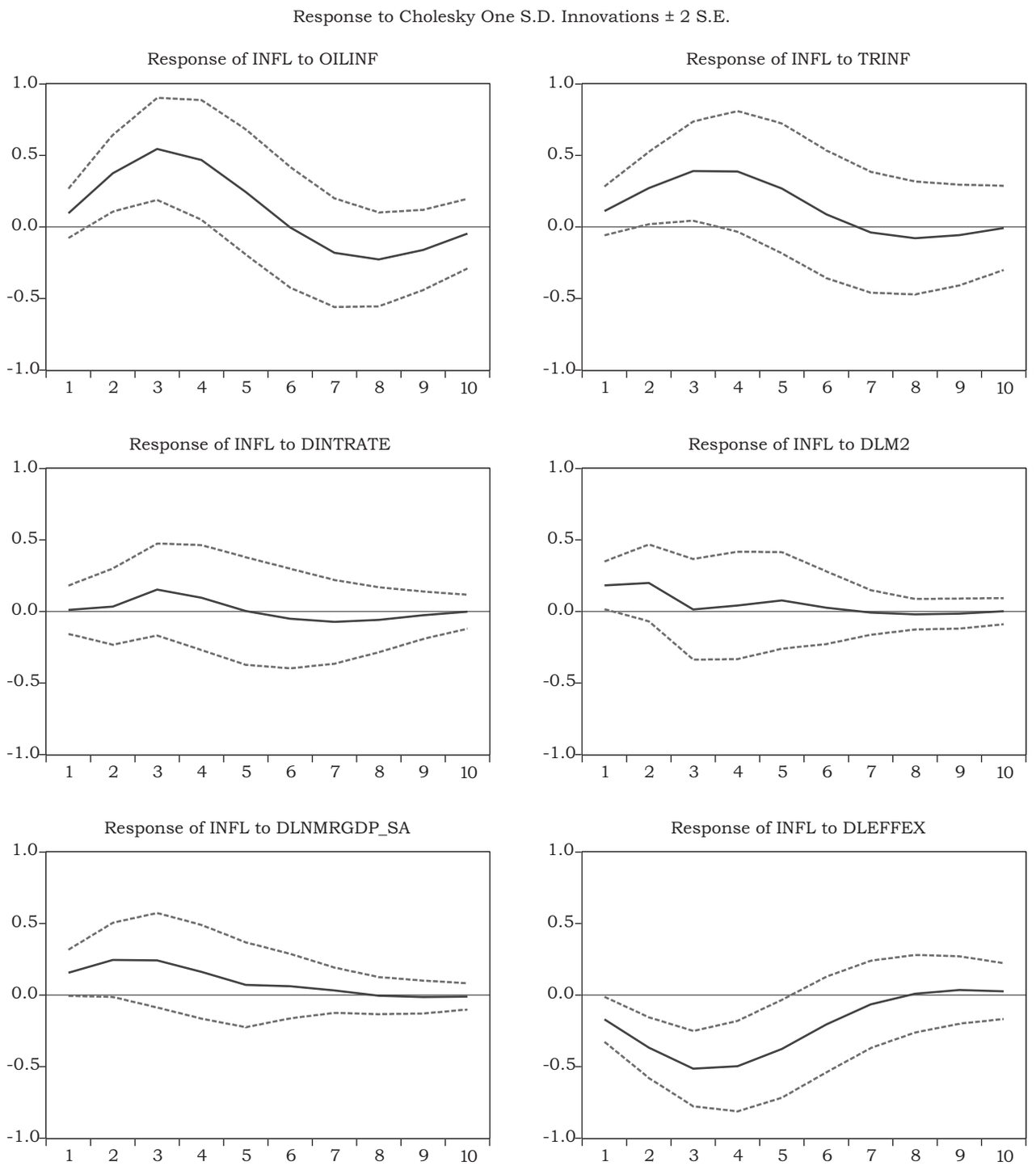
Setlhare, L. (2004) "A Close Look at Botswana's Management of Monetary Policy: The Reaction Function Approach". Journal of Economic Studies.

Sikwila, M. (2011) "Inflation Impact of an Exchange Rate Adjustment: The Case of Zimbabwe". University of North West, Mafikeng, South Africa.

Statistics Botswana, Botswana External Trade Digest, various issues (2008 - 2012)

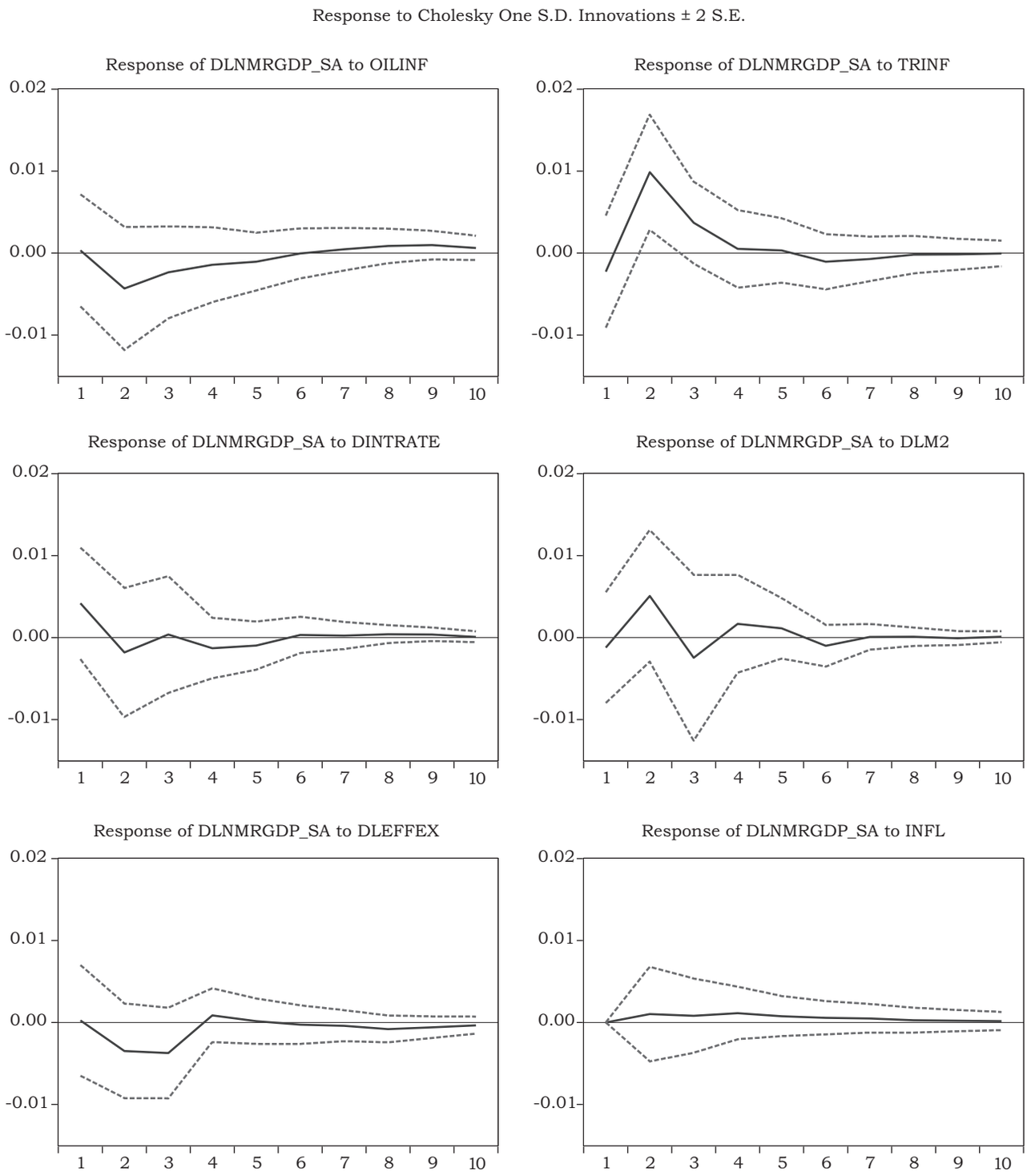
Williamson, J. (2003) "Exchange Rate Policy and Development", Initiative for Policy Dialogue, Institute for International Economics.

FIGURE A1 : IMPULSE RESPONSES OF CPI INFLATION



NB: INFL is Botswana CPI inflation, OILINF is the world oil price inflation, TRINF is the average trading partner inflation, DINTRATE is the change in the Bank Rate, DLM2 is the change in the log of broad money aggregate, M2, DLNMRGDP_SA is the change in log of non-mining real GDP (seasonally adjusted), DLEFFEX is the change in log of nominal effective exchange rate.

FIGURE A2 : IMPULSE RESPONSES OF OF REAL GDP



NB: *INFL is Botswana CPI inflation, OILINF is the world oil price inflation, TRINF is the average trading partner inflation, DINTRATE is the change in the Bank Rate, DLM2 is the change in the log of broad money aggregate, M2, DLNMRGDP_SA is the change in log of non-mining real GDP (seasonally adjusted), DLEFFEX is the change in log of nominal effective exchange rate.*

The Policy Interest Rate Pass-Through In Botswana

Tebogo Munyengwa and Mbakile Seabe[1]

Abstract

This paper examines the way changes in the policy interest rate affect the economy. The approach involves two stages; the first stage is the pass-through of policy interest rates to market interest rates and the second stage traces the transmission of market interest rates to key variables in the economy. The study adopts the error correction model and the recursive VAR methodology, using quarterly time series data from 1995 to 2013. For the first stage, the results suggest a significant degree of pass-through from the policy rate to the prime lending rate. However, the transmission of the prime lending rate to other key economic variables remains inconclusive in the second stage, possibly due to other factors affecting monetary policy, such as the exchange rate regime, the frequent adjustment of administered prices and the dominance of the government sector in the economy.

1. Introduction

Countries with independent monetary policies and inflation targeting (IT), or which are in transition to IT frameworks, have further focused attention on the use of policy interest rates as the main instrument to signal the monetary policy stance. The Bank of Botswana (BoB) has not been an exception in this regard, as the policy interest rate is an important instrument in its monetary operations. In this context, a central bank affects price developments by changing its policy rate, which is transmitted to commercial bank interest rates and, ultimately, output and inflation. This process is known as the transmission mechanism of monetary policy. For the purpose of this paper, this process is examined in two stages. The first stage is the pass-through of policy interest rates to market interest rates, while the second stage relates to the transmission of market interest rates to output and inflation.

The general consensus is that the success of the conduct of monetary policy operations mainly depends on the speed of adjustment of market interest rates and the degree of pass-through, which is the first stage. Pass-through in this context refers to the extent to which changes in policy rates are reflected in changes in market rates, both in the short and long run (Bredin et al., 2001). As Lowe (1995) points out, the ultimate impact that changes in the policy rate have on the business cycle and inflation depends upon how the changes are transmitted to other interest rates in the economy and how those interest rates affect economic activity. Therefore, for Botswana, the first stage of monetary policy transmission is the pass-through of the Bank of Botswana's Bank Rate to market (deposit and lending) interest rates.

A significant number of interest rate pass-through studies have been mainly in developed countries and a few in developing countries. These studies identify a number of factors that determine the pass-through process, including, among others; monetary policy factors, competition in the banking sector, inflation, liquidity and capitalisation levels of banks and ownership structure of the banking system.[2] These factors, in turn, explain the difference in pass-through experiences across countries. For instance, in Sub-Saharan African countries, the monetary policy transmission process, working through the interest rate channel, has proved to be a challenge due to less-developed and shallower financial markets (Mohsin, 2011). This indicates the need to assess this first stage of the monetary policy transmission, given the importance of the interest rate channel in Botswana.

The second stage, dealing with the transmission of market interest rates to the economy, has also generated substantial interest in economic research in many countries. Most studies focused on how a change in the monetary policy stance, usually defined as an exogenous shock in a short-term interest rate, affects the economy. The key variables under investigation were output, inflation and exchange rates.[3] The main issue of discussion relating to the monetary policy transmission mechanism is the potential of short-term interest rates to influence output and inflation.

Evidence has emerged from studies in other countries, contributing to the understanding and correct assessment of what monetary policy can do to an economy. This facilitates formulation of alternative macroeconomic policy frameworks (Chuku, 2009). For example, Ganev et al., (2003) investigated the transmission mechanism in the Euro area. They found that, for most Euro area countries, inflation responded consistently with economic theory to the changes in the short-term interest rates. That is, increases in interest rates dampened inflation.

Analytical work has been conducted in Botswana by Kganetsano (2007) and Setlhare (2013), using the vector autoregression (VAR) and structural VAR approaches, respectively, to explore the transmission mechanism of monetary policy in Botswana. The two authors found a limited transmission of the policy rate to inflation. This was possibly due to the issues relating to the size, structure and developmental aspect of the banking and capital market system in Botswana (Setlhare, 2013). These findings contribute to the design, management

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2 See Cottarelli and Kourelis (1994), Lowe (1995), Bredin et al., (2000), Mizen and Hoffman (2002), Amarasekara (2005), Misati et al., (2011).

3 For example, see the work by Chuku (2009), Hung and Pfau (2008), Cheng (2006), and Amarasekara (2006), among others.

and implementation of monetary policy, as they provide more insight into how monetary policy operates.

This paper seeks to explain the pass-through aspect of the interest rate first, before assessing how it further affects the economy. This study adopts two approaches to examining the transmission path of monetary policy. Firstly, the Error Correction Model (ECM) is used to determine the interest rate pass-through from the Bank Rate to other market interest rates. Secondly, the recursive VAR methodology is employed to assess the effect of interest rate (market interest rate with a higher pass-through) changes on the economy. The remainder of the work is organised as follows: Section 2 provides the evolution of the conduct of monetary policy in Botswana; Section 3 describes the methodologies used; while section 4 reviews the estimated results. Section 5 concludes the discussion.

2. MONETARY POLICY IN BOTSWANA

Monetary Policy Developments

Significant financial reforms have taken place in Botswana, starting with the pre-financial liberalisation period from 1975 to 1990, where the focus was on moderating the cost of credit and maintaining a sound banking system. The conduct of monetary policy during this era was through direct controls. These included pre-set lending and deposit interest rates, credit limits and reserve requirements (BoB, 2010). Due primarily to the booming diamond mining industry, from 1985 to 1994, the economy, as well as the associated economic growth, generated excess reserves in the banking sector; hence there was a need for a shift in the conduct of monetary policy as the existing policies were inadequate in dealing with the liquidity situation. The focus then moved towards mopping up of the excess funds from the banking sector. Hence, during the financial liberalisation era, the Bank's policy objective was achievement of positive real interest rates which would, in turn, contribute to inflation control. This involved the introduction of the Bank of Botswana Certificates (BoBCs) in 1991 to mop up the excess liquidity.

The explicit focus of monetary policy on price stability commenced in 1998, alongside the publication of the Bank's monetary policy statements (Setlhare, 2013). However, the Bank began to publish the goal as an annual numerical inflation objective only in 2002. The inflation objective was set as a range of 4 – 6 percent in the 2002 Monetary Policy Statement (MPS). Furthermore, credit growth was introduced as an intermediate target given that it can be observed on a timely basis and it is an important driver of domestic demand. Credit growth was considered relevant given that it is directly controlled by monetary policy through the changes in interest rates. Other factors considered and monitored in making monetary policy decisions included the growth in government expenditure as well as relevant domestic and international economic information.

The Bank adjusted the annual inflation objective for the year at times (Table 1). This was motivated by, among other things, increases in administered prices, devaluation of the Pula (in 2005) and forecast inflation in trading partner countries (in 2007) (various MPSs). In 2006, the Bank decided to specify an inflation objective for the medium term (3-year horizon) in addition to the annual objective.

TABLE 1: INFLATION OBJECTIVE RANGE

Year	Objective Range
2002 – 2003	4 – 6 percent
2004	4 – 7 percent
2005	1st half 3 – 6 percent
	2nd half 4 – 7 percent
2006	4 – 7 percent
2007	4 – 7 percent
2008 – 2013	3 – 6 percent

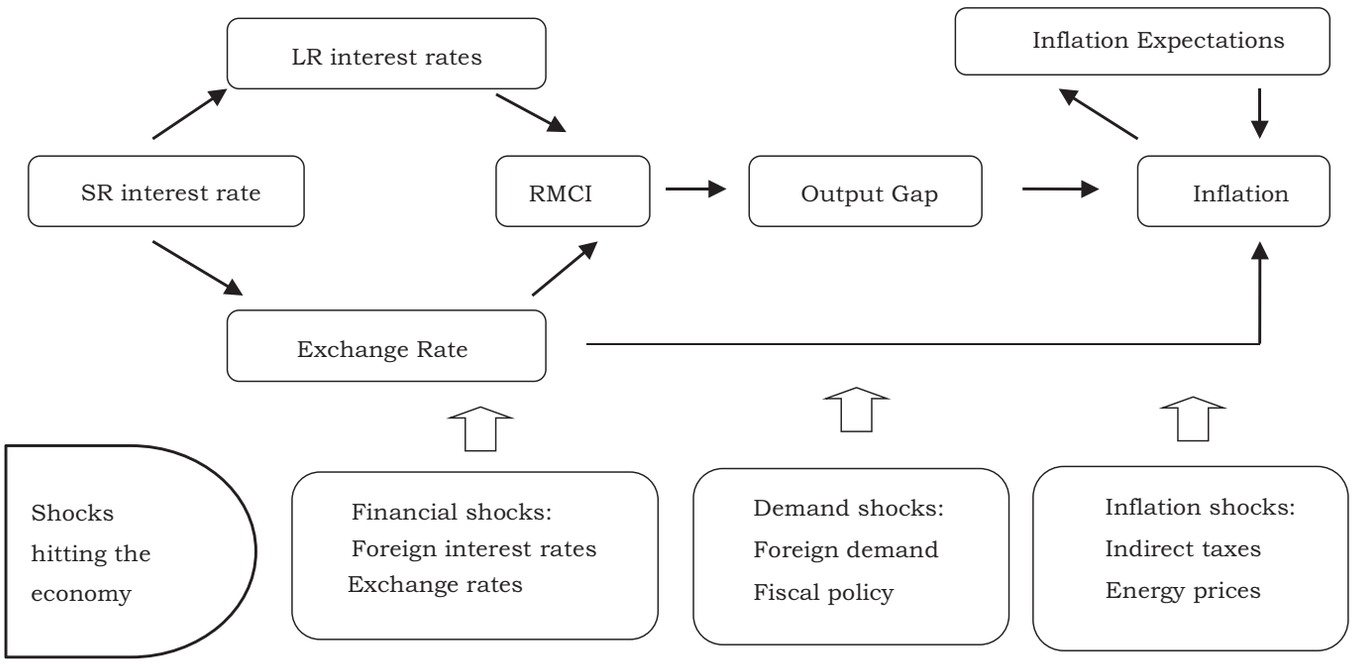
Source: various BoB Annual reports

In 2008, the annual inflation objective and intermediate credit growth target were discontinued and the medium-term inflation objective range of 3 – 6 percent was introduced as a definition of price stability under a formal medium-term forecasting framework (BoB, 2010). In this framework, the inflation forecasts replaced the credit growth as the intermediate target. The inflation forecast incorporates a number of variables that affect inflation, both from the supply and demand side.

Botswana's Monetary Policy Transmission Mechanism

The decisions of the central bank on the Bank Rate affect economic activity and inflation through a number of channels collectively known as the "transmission mechanism" of monetary policy. The channels include: the interest rate channel, which involves the change of interest rates via the market interest rate, to the real monetary conditions and ultimately inflation; the exchange rate channel, which involves changing interest rates to affect exchange rate movements, real monetary conditions and ultimately inflation; the credit channel, which involves the change of interest rate to affect investment demand and ultimately inflation; and the asset price channel, which involves the change of interest rates to affect asset prices, investment demand, and ultimately output and inflation.

FIGURE 1: BOTSWANA'S MONETARY POLICY TRANSMISSION MECHANISM



Notes: (a) SR = Short run
(b) LR = Long run
(c) RMCI = real monetary conditions index
Source: Bank of Botswana

Figure 1 illustrates the key links of Botswana's monetary policy mechanism. First, changes to the Bank Rate affect the long-term interest rates, which, in turn, have an impact on the monetary conditions. Changes in short–term interest rates will also affect the exchange rate, which, in turn, impacts on the monetary conditions and on inflation directly. The monetary conditions, in turn, affect the output gap, which has an influence on the price levels. Meanwhile, periodically the economy experiences shocks, which also have an impact on inflation. These shocks include developments in foreign interest rates, foreign demand, fiscal policy, energy prices, as well as indirect taxes, among others.

3. METHODOLOGY

This section explores the tools used in analysing the two stages of monetary policy transmission in Botswana between 1995 and 2013, using quarterly time series data. The first stage uses Engle-Granger cointegration and error-correction models to examine the short- and long-run dynamic relationships between the Bank Rate and the market interest rates (prime, mortgage, saving and 88–day deposit). This assessment follows the works of Lowe (1995), Tieman (2004) and Charoeseang and Manakit (2007) by specifying the long-run equilibrium relationship between market and policy rate as follows:

$$i_t^m = \alpha + \beta \cdot i_t^p + \varepsilon_t \qquad (1)$$

where i_t^m is the market interest rate at time t, i_t^p is the policy rate (Bank Rate), which is the Bank of Botswana monetary policy indicator, ε_t is the disturbance term, α and β are the model parameters. Parameter α reflects a constant mark-up over the Bank Rate, while β is a long-run pass-through coefficient. In the long-run, if pass-through is instantaneous and complete, β is equal to one and is incomplete when β is less than one.

To examine the short-run dynamics of the market interest rates to changes in the policy rate, the error-correction model is specified as

$$\Delta i_t^m = \gamma_1 + \gamma_2 \Delta i_t^p + \gamma_3 \left(i_{t-1}^m - \beta \cdot i_{t-1}^p - \alpha \right) + \mu_t \qquad (2)$$

Here, Δ is the difference operator; hence, the equation shows that the first difference of the specified market interest rate, Δi_t^m, is a function of the first difference of the policy interest rate Δi_t^p, the deviation from the long-run relationship in the last period, $i_{t-1}^m - \beta \cdot i_t^p - \alpha$, and a constant γ_1. In this equation, the coefficient γ_3 indicates the speed of adjustment of the short–run dynamics to the long-run equilibrium relationship. Hence, the coefficient can be interpreted to signal the effectiveness of the interest rate instrument of monetary policy: a higher value of γ_3 signals a faster market response, implying a more effective first step in the interest rate channel of monetary policy transmission (Tieman, 2004). The mean adjustment lag (MAL) is used to obtain the average number of quarters required to reach the

long-run value. The MAL of a complete pass-through is a measure of the time it takes for market rates to respond to movements in policy rates; it is calculated as $(1-\gamma_2)/\gamma_3$ (Charoenseang and Manakit, 2007; Chong, 2006).

The second stage estimates the impact of the market interest rate with a higher pass-through (as estimated from the first stage) to key economic variables. To achieve this, the study adopts a recursive VAR model specified by Enders (2004) as follows:

$$Y_t = b_{10} + b_{12}X_t + \gamma_{11}Y_{t-1} + \gamma_{12}X_{t-1} + \varepsilon_{1t}$$

$$X_t = b_{20} + \gamma_{21}Y_{t-1} + \gamma_{22}X_{t-1} + \varepsilon_{2t} \quad (3)$$

Where b_{10} and b_{20} are the intercept coefficients and, b_{12} and the γ_s are the auto-regressor coefficients. The model makes three assumptions: (1) both Y_t and X_t are stationary; (2) errors ε_{1t} and ε_{2t} are uncorrelated white noise disturbances with standard deviation σ_y and σ_x, respectively. The interpretation of this system is that X_t has a contemporaneous effect on Y_t , but Y_t affects X_t with a one period lag. Both ε_{1t} and ε_{2t} shocks affect the contemporaneous value of Y_t, but only the ε_{2t} shock affects the contemporaneous value of X_t.

The variables selected include all the variables that are commonly used in estimating VAR models (Amarasekara, 2006). These variables are indicators of aggregate economic activity, inflation and an intermediate market interest rate. In addition, the study considers the exchange rate to reflect trade openness and the dummy variable to capture the structural break in the economy.[4]

An indicator of aggregate economic activity, non-mining real gross domestic product (NMRGDP), is considered because it is assumed that increasing economic activity will have upward pressure on inflation. The expectation is that high interest rates should decrease the level of non-mining real GDP, with declining non-mining real GDP expected to dampen inflation.

The Botswana headline consumer price index (botscpi) is used, while the intermediate market interest rate used is that with the highest pass-through from the Bank Rate, which is only adjusted by Bank of Botswana. An increase in the policy rate is expected to lead to an increase in the intermediate market interest rate, which will lead to a fall in consumption and investment, resulting in lower inflation.

Since Botswana is a small open economy, the nominal effective exchange rate (NEER) is included to reflect the external environment. The NEER (foreign currency/domestic currency) is determined by a weighted average of two different currencies: the South African rand and the SDR (which consists of the US dollar, UK pound, Japanese yen, and the euro). A negative relationship between the exchange rate and inflation is expected (Mishkin, 1995).

Money supply (M2) is considered to reflect how financial depth affects inflation. Liquidity in Botswana is mainly influenced by the mining sector, as revenues from the sales of the diamonds in Botswana are injected back into the economy through government spending (Masalila and Phetwe, 2001). This leads to demand increasing more rapidly than supply, generating inflationary pressures. Therefore, high interest rates are expected to reduce the demand for money, hence a negative relationship is expected between interest rates and the money supply, as well as with inflation.

A dummy variable is included, following the arguments by Mies and Tapia (2003), to reflect the structural break in the economy.[5] The dummy is used to absorb the effects of structural break on inflation. In this regard, the dummy variable (dumrec) is expected to capture the world financial crisis in 2008.[6] Therefore, the recursive VAR model in Botswana will include the following endogenous variables: Botswana consumer price index, non-mining real GDP, money supply, intermediate interest rate and exchange rate, while the dummy variable is the exogenous variable.

Cholesky Ordering

A recursive model using a Cholesky decomposition assumption requires a triangular ordering of an identity matrix; hence, the relationship between the reduced-form errors and the innovative shocks are given by:

$$\begin{pmatrix} \varepsilon_t^{prime} \\ \varepsilon_t^{neer} \\ \varepsilon_t^{m2} \\ \varepsilon_t^{RNMGDP} \\ \varepsilon_t^{botscpi} \end{pmatrix} = \begin{pmatrix} 1_t & 0 & 0 & 0 & 0 \\ b_{21} & 1_t & 0 & 0 & 0 \\ b_{31} & b_{32} & 1_t & 0 & 0 \\ b_{41} & b_{42} & b_{43} & 1_t & 0 \\ b_{51} & b_{52} & b_{53} & b_{54} & 1_t \end{pmatrix} \begin{pmatrix} e_t^{prime} \\ e_t^{neer} \\ e_t^{m2} \\ e_t^{RNMGDP} \\ e_t^{botscpi} \end{pmatrix}$$

This recursive identification scheme implies that the prime lending interest rate reacts only to its own shock. The exchange rate reacts to its own shock and a shock from the prime rate, while money stock reacts to a shock from the exchange rate, prime rate, and from its own shock. Non-mining real GDP, however, reacts to its own shock, as well as the shock from prime rate, exchange rate and money stock. Finally, inflation reacts to its own shock and a shock to all the other variables included in a VAR.

4. EMPIRICAL RESULTS

For the first stage, all variables were found to be non-stationary at levels, but stationary at first differences, indicating that the variables are integrated of order

4 All the variables except for the intermediate market interest rate have been converted into logarithms so that they can be interpreted as percentages.

5 Other dummy variables to capture the introduction of VAT, alcohol levy, school fees and the restriction of BoBCs to primary dealers were dropped as they were insignificant in this model.

6 The 2008 financial crisis suppressed economic activity leading to a significant decline in global inflation.

one, I(1). Given that all the variables are I(1), we first estimate an equation with differenced variables to establish the shortrun relationships between variables, then estimate an equation without differenced variables to establish the long–run equilibrium relationship between variables and finally run the error correction model.

Regression results (Table 2) show a high degree of pass-through from the policy rate to the money market rates. For the deposit rates, the degree of interest rate pass-through from the policy rate was on average 46 percent for 88 day deposit and 49 percent for the savings rate. In the case of lending rates, the pass-through is quite high at 94.8 percent for the prime lending rate. This is expected, as the prime lending rate follows the Bank Rate. Meanwhile, the pass–through to mortgage rates was low at 37.4 percent, indicating interest rates on long–term loans are irresponsive to movements in the policy rate and the level of pass-through is very low, a point also noted by Amarasekara (2005) in the case of Sri Lanka.

The time series cointegration tests were done using the Engle Granger approach (Table 3). The cointegration tests show that for three variables (saving rate, prime rate and mortgage rate), we reject the null hypothesis of no cointegration, while for the rest we fail to reject the null hypothesis. These show that for the former three variables, there is a long-term relationship between the concerned market interest rates and the policy rate. The prime lending rate had a complete pass-through coefficient of 1 (a one percent change in the Bank Rate gives rise to a one percent change in the prime lending rate). This is hardly surprising given that in Botswana, by convention, banks are expected to respond to movements in the Bank Rate with timely adjustments to their prime rates. The mortgage rate had a pass-through coefficient of at 0.95 (95 percent) and lastly the savings rate at 79 percent. The constant mark-up was 1.5 percent. The lack of cointegration between the money markets rates and the Bank Rate could be due to the fall in the BoBCs rates since 2009, as a result of the reduction in the amount of liquidity absorbed through BoBCs.

TABLE 2: SIMPLE LINEAR REGRESSION EQUATIONS WITH DIFFERENCED LOG VARIABLES

Market Interest Rates		α	β	R^2	DW
Money-Market Rates	*14-Day BoBC Rate*	*-0.0539 (0.4027)*	*1.0382 (0.0000)****	*0.73*	*1.92*
	3-Month BoBC Rate	*-0.0565 (0.4109)*	*0.7360 (0.0000)****	*0.25*	*2.90*
Deposit Rates	*88–Day Deposit Rate*	*-0.0578 (0.0998)*	*0.4601 (0.0000)****	*0.34*	*1.97*
	Savings Rate	*-0.0407 (0.4743)*	*0.4977 (0.0001)****	*0.19*	*1.78*
Lending rates	*Prime Lending Rate*	*0.0101 (0.4717)*	*0.9475 (0.0000)****	*0.93*	*1.95*
	Mortgage Rate	*-0.0502 (0.3479)*	*0.3739 (0.0014)****	*0.12*	*2.14*

**** Significant at 1 percent level*
Numbers in parentheses are p-values

TABLE 3: LONG-RUN RELATIONSHIP (VARIABLES NOT DIFFERENCED) AND COINTEGRATION TEST

Market Interest Rates		α	β	ADF test Stat.
Money-Market Rates	14-Day BoBC Rate	-6.7653 (0.0000)	1.3029 (0.0000)	-1.801
	3-Month BoBC Rate	-5.9007 (0.0000)	1.2953 (0.0000)	-3.037
Deposit Rates	88 Day Deposit	-3.2800 (0.0000)	0.8835 (0.0000)	-2.318
	Savings Rate	-3.6392 (0.0000)	0.7900 (0.0000)	-3.184*
Lending rates	Prime Lending Rate	1.5235 (0.0000)	0.9996 (0.0000)	-6.936***
	Mortgage Rate	1.6027 (0.0023)	0.9517 (0.0000)	-3.517***

**** Significant at 1 percent level * Significant at 10 percent level*
Numbers in parentheses are p-values

TABLE 4: ERROR CORRECTION MECHANISM ESTIMATION RESULTS

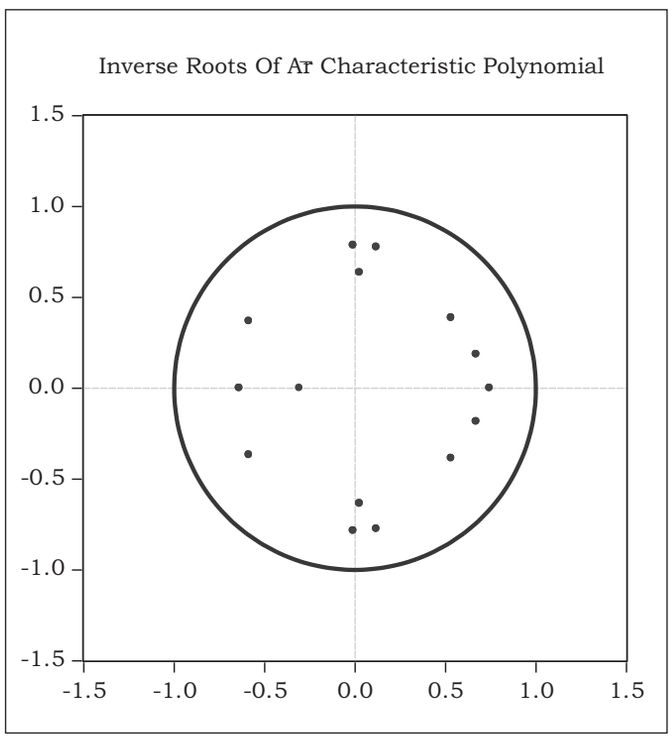
Market Interest Rates		γ_1	γ_2	γ_3	R^2	DW	MAL (quarters)
Deposit Rates	*Savings Rate*	-0.0383 (0.4828)	0.5307 (0.0000)***	-0.1754 (0.0076)***	0.25	1.60	2.7
Lending Rates	*Prime Lending Rate*	0.0115 (0.2849)	0.9644 (0.0000)***	-0.4020 (0.0000)***	0.96	2.30	0.1
	Mortgage Rate	-0.0492 (0.3190)	0.3886 (0.0004)***	-0.2528 (0.0004)***	0.25	1.82	2.4

**** Significant at 1 percent level*
Numbers in parentheses are p-values

For the variables where cointegration was established, the next step was to analyse the behaviour of the variables using the ECM (Table 4). Similar to the findings of the long-run relationship, the ECM equation suggests high (96 percent) pass-through from the Bank Rate to the prime lending rate. However, it is average for the saving rate (53 percent) and sluggish (39 percent) for the mortgage rate. All the γ_3 estimates are negative and statistically significant, which shows that market interest rates are mean-reverting to the long-run equilibrium. In this context, rates will adjust downwards when the rates are above their equilibrium levels and adjust upwards when they are below the equilibrium level. However, the results indicate a lower speed of adjustment for the saving (17.5 percent) and mortgage (25.3 percent) rates, while it is moderate for the prime rate (40.2 percent). The low value of the adjusted R^2 suggests that there are other factors (for example steadily increasing market segments like mortgages) that affect the interest rate pass-through process in Botswana for the saving rate and mortgage rate. According to the MAL formulae, on average it takes between 0 and 3 quarters for the policy rate to completely have effect on the lending and savings interest rates. Notably, the pass-through to the prime lending rate is immediate. For this reason, the prime lending rate will be used as the intermediate market interest rate in the next stage.

In the second stage, all variables were non-stationary at levels, but stationary after the first difference, indicating that the variables are I(1). The stability test indicates that the model is stable given that the unit roots (presented as dots in figure 2) lie within the circle. In this case, the VAR's impulse responses and variance decomposition are valid.

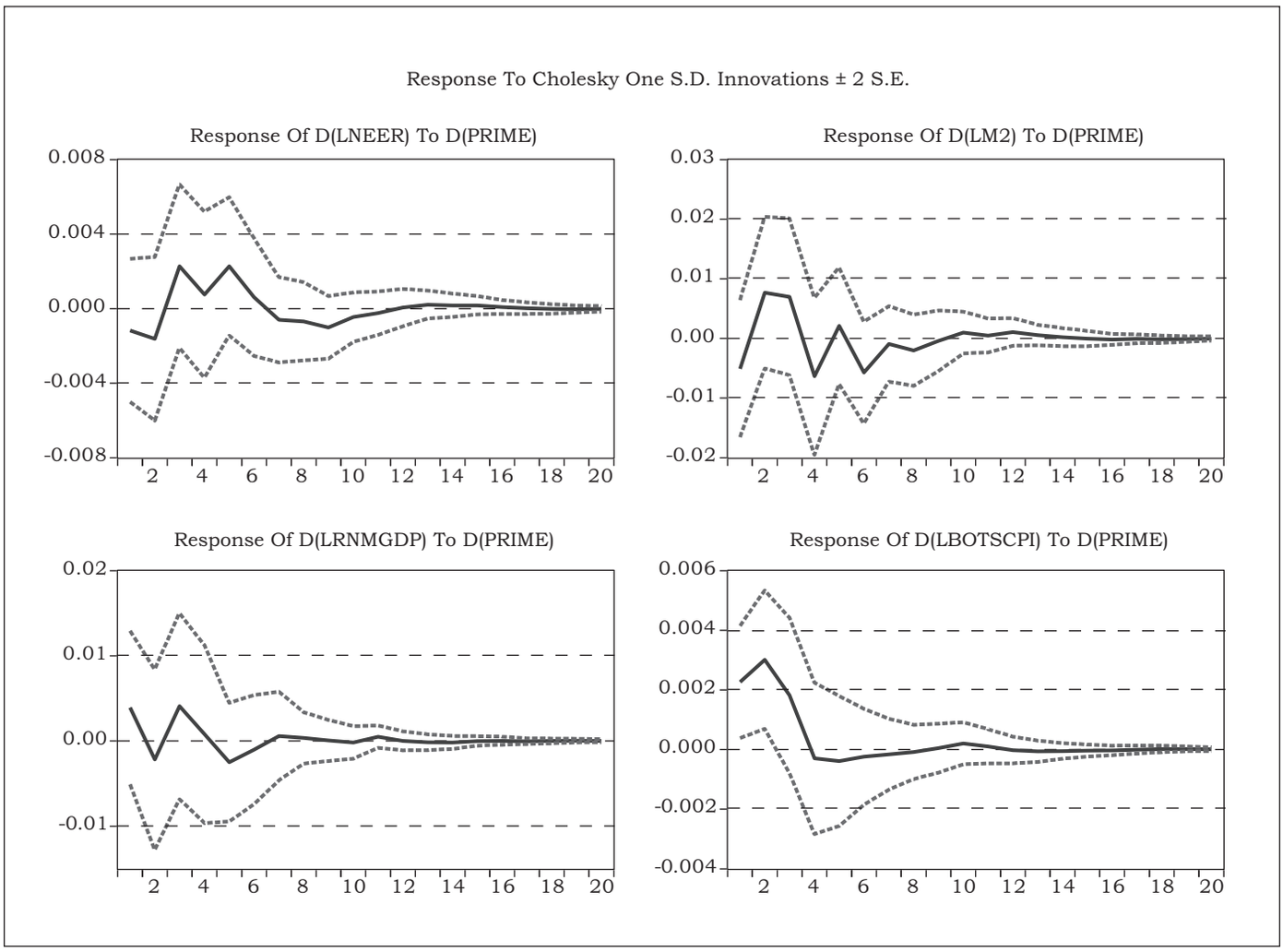
FIGURE 2: STABILITY TEST RESULTS FOR A VAR MODEL



Estimation results from the standard recursive VAR

The lag length used is three (as suggested by the sequential modified LR test statistic at 5 percent level, Akaike information Criteria and final prediction error in e-views) and the model has no serial correlation and is stable. Impulse responses of a change in the prime rate emanating from a monetary policy shock to the endogenous variables are analysed. The variance decomposition is used to determine the degree of variation in inflation as explained by the endogenous variables.

FIGURE 3: IMPULSE RESPONSE RESULTS FOR A STANDARD VAR MODEL



Impulse Responses

The impulse response results are presented in Figure 3. The response horizon is given by the horizontal axis. Periods 1 to 20 represent quarters 1 to 20. The solid lines are the responses of variables to the shock, where the upper and lower dashed lines are the one standard error bands which reflect the statistical significance of the variables. The impulse responses will be statistically significant if the standard errors lie in the same region of the zero line.

Figure 3 shows four panels of the impulse response graphs indicating how the policy interest rate affects economic variables[7]. These findings are not statistically significant, underlining the fact that any interpretation should be treated with caution. In the top left panel, the response of exchange rate to a monetary policy shock does not conform to theory. The results indicate a depreciation of the exchange rate to policy shock, while theory suggests an exchange rate appreciation. The top right panel reflects the expected negative response of money supply to a policy shock. On the bottom left panel, non-mining GDP increased with a policy shock. This response contradicts theory as high interest rates are expected to suppress economic activity. Lastly, inflation also increased with a policy shock. This reaction is called a price puzzle. It implies that the response of inflation to a monetary policy shock is not conforming to economic theory.

One possible explanation for the price puzzle could be the persistence of inflation from previous high levels (Arnostova and Hurnik, 2004). Another possible explanation is suggested by Mokoti (2009), who argues that this response of inflation to monetary policy is not a price puzzle, but an appropriate response of inflation to a contractionary monetary policy. His contention is based on the standard theoretical proposition that tightening monetary policy leads to a rise in other market interest rates, causing the cost of production to increase, which, in turn, results in an increase in inflation. The adjustments of administered prices could also be an explanation as they lead to inflation variation which distorts the conduct of monetary policy (Kganetsano, 2007).

The other explanation to the non-conforming reaction of variables to a policy shock could be due to the nature of the exchange rate regime. Taylor (1995) argues that, in a fixed exchange rate set up, the transmission of interest rates is limited. Also, it takes time for the exchange rate to be re-adjusted to the prevailing

7 The interpretation of the responses are at time t, which is at quarter 1.

economic fundamentals. These factors could also be a reason for the statistically insignificant impulse responses. Other researchers found similar results, for example, Setlhare (2013), Burger et al. (2011), Kganetsano (2007), Mokoti (2009) and Mmopelwa (2003), even though variables and objectives of their studies were different.

The non-responsive non-mining real GDP could be due to the dominance of the general government sector (an important driver to several other sectors) in non-mining output, which may not be related to monetary policy, since, in most cases, government spending is inelastic in its response to interest rate changes. In addition, agricultural output, although small, is mostly influenced by climatic conditions.

Setlhare (2013) points out that the other possible explanation for the unexpected reaction of the endogenous variables to a policy shock could be a change in the policy making environment. Botswana experienced changes in both the exchange rate regimes and monetary policy frameworks over the period.

Variance Decomposition

The variance decomposition points to the contribution of other variables to variations in inflation in the VAR system. It separates the variation in inflation into components according to the contribution by each shock in a VAR system. The results of the variance decomposition are found in Table 5.

lending rate explain about 40 percent of variation in inflation in the medium term.

In this experiment, one should cautiously interpret the exchange rate shocks as the exchange rate used is fixed. Its movements could be explained by resulting changes in fundamentals. That is, changing investment climate could prompt authorities to adjust the exchange rate for international competitiveness and not necessarily for the inflation objective.

5. CONCLUSION

This study investigated the two stages of monetary policy interest rate pass-through in Botswana. The results of the first stage indicate that policy rate has influence on the market interest rates both in the short and long run. Notably, there is a complete pass-through from the Bank Rate to the prime lending rate. Through the mean adjustment lag, it is established that, on average, it takes less than three quarters for commercial banks to completely adjust their lending and deposit interest rates in response to a change in the policy rate.

In the second stage, the impulse responses of the recursive VAR model show that the response of all variables (non-mining output, money supply and the exchange rate), except inflation, are statistically insignificant. The response of non-mining real GDP, inflation and exchange rate contradicts theory, while the responses of money supply conform to theoretical

TABLE 5: VARIANCE DECOMPOSITION OF D(LBOTSCPI)

Period	S.E.	D(PRIME)	D(LNEER)	D(LM2)	D(LRNMGDP)	D(LBOTSCPI)
1	0.398464	14.99055	0.003769	0.725146	2.864790	81.41575
2	0.623043	27.46874	5.668916	2.799023	2.320403	61.74291
3	0.840523	24.35410	4.447936	6.983449	4.785727	59.42878
4	1.006163	24.09772	4.599174	7.381726	4.707772	59.21360
5	1.111691	23.37297	4.457659	7.332824	4.957644	59.87890
6	1.175168	23.32413	4.456245	7.591618	4.957678	59.67032
7	1.217525	23.01127	4.786649	7.539461	4.952785	59.70983
8	1.246434	22.96228	5.016279	7.527139	4.965592	59.52871
9	1.263787	22.80882	5.066129	7.638907	4.953429	59.53272
10	1.273671	22.85345	5.140684	7.702724	4.949343	59.35380

The variance decomposition analysis shows that variations of the endogenous variables have a moderate impact on inflation. However, the prime lending interest rate explains more of the variation in inflation than other variables, with the highest contribution of 27.5 percent in period 2. On the far end, variation in non-mining real GDP contributes the least to changes in inflation, with the highest contribution of 5 percent in period 8. Overall, these findings reflect that changes in the monetary policy rate transmitted through the prime predictions. This could likely be attributed to periodic adjustments in administered prices, which are beyond the influence of the monetary policy. However, the results of the variance decomposition reflect that the prime lending interest rate, together with all other endogenous variables in the model, have a significant influence on inflation, a sign of an effective monetary policy interest rate pass-through in Botswana.

On the other hand, the sluggish pass-through in the short run for the savings and mortgage rates implies that the commercial banks do not adjust these rates timeously in response to monetary policy shocks. Therefore, the monetary authorities should continue intensifying their effort on communicating monetary policy issues, as well as instructing the commercial banks to respond promptly. Analysis of the impulse response of key variables to the policy rate remains inconclusive due to other shocks in the economy. This provides impetus for further inquiry into monetary policy transmission in order to obtain a deeper understanding, with a view to enhance the efficiency of monetary policy.

REFERENCES

Amarasekara, C. (2005), "Interest rate pass-through in Sri Lanka", Staff Studies, Vol. 35 Nos. 1/2, pp. 1-32.

Amarasekara, C. (2006), "The impact of monetary policy on economic growth and inflation in Sri Lanka", Central Bank of Sri Lanka.

Arnostova, K. and Hurnik, J. (2004), "The monetary transmission mechanism in the Czech Republic: Evidence from the VAR analysis", Czech National Bank, Czech Republic.

Bank of Botswana (2010), Monetary Policy Statement. Gaborone: Bank of Botswana.

Bredin, D., Fitzpatrick, T. and O'Reilly, G. (2001), "Retail interest rate pass-through: The Irish Experience", Central Bank of Ireland, Technical Paper 06/RT/01.

Burger, P., Fillipus, H. and Molalapata, I. (2011), "The price puzzle and the role of South African monetary policy in Botswana", Journal of Economic and Financial Sciences, 5(1).

Charoenseang, J. and Manakit, P. (2007), "Thai monetary policy transmission in an inflation targeting era", Journal of Asian Economics, Issue 18, pp. 144 – 157.

Cheng, K.C. (2006), "A VAR analysis of Kenya's monetary policy transmission mechanism: How does the Central Bank's REPO Rate affect the economy?" IMF Working Paper no. 300, Washington DC, USA.

Chong, B.S. (2006), "Monetary transmission via the administered interest rates channel", Journal of Banking and Finance, Issue 30, pp. 1467 – 1484.

Chuku, A.C. (2009), "Measuring the effects of monetary policy innovations in Nigeria: A Structural Vector Autoregressive (SVAR) Approach", African Journal of Accounting, Economics, Finance and Banking Research, 5(5).

Cottarelli, C. and Kourelis, A. (1994), "Financial structure, bank lending rates, and the transmission mechanism of monetary policy", Staff papers-International Monetary Fund, Vol. 41, No. 4, pp. 587-623.

Enders, W. (2004), "Applied econometric time series" John Wiley & Sons, Inc. 111 River Street, Hoboken, NJ 07030, USA.

Ganev, G., Molnar. K. and Prezemyslaw, W. (2002), "Transmission mechanism of monetary policy in Central and Eastern Europe". European Central Bank.

Hung, L.V. and Pfau, W.D. (2008), "VAR analysis of the monetary transmission mechanism in Vietnam". [online]. Available: http://ssrn.com/abstract=1257854. [2010, August 18].

Kganetsano, T.A. (2007), "Transmission of monetary policy in Botswana". Loughborough University, Department of Economics, England.

Lowe, P. (1995), "The link between the cash rate and market interest rates", Reserve Bank of Australia, Research Discussion Paper 9504.

Masalila, K.S. and Phetwe, M. (2001), Botswana's monetary policy framework, paper prepared for the Conference on Monetary Policy Frameworks in Africa, 17-19 September 2001, Pretoria.

Mies, V. and Tapia, M. (2003), Monetary policy transmission mechanism in Chile: has the effect of monetary policy changed in time? Why? [Online]. Available: http://www.cemla.org/org/pdf/redviii/chile_mies_tapia.pdf. [2009, May 10].

Misati, R.N., Nyamongo, E.M. and Kamau, A.W. (2011), "Interest rate pass-through in Kenya", International Journal of Development Issues, Vol. 10 No. 2.

Mishkin, F.S. (1995), "Symposium on the monetary transmission mechanism". Journal of Economic Perspectives, 9(4).

Mizen, P. and Hoffman, B. (2002), "Base rate pass-through: evidence from banks' and building societies' retail rates", Bank of England Working Paper No 170.

Mmopelwa, B.N., (2003), "The operation and transmission mechanism of monetary policy in Botswana: A VAR Approach", University of Stellenbosch, Research Department, South Africa.

Mohsin, K. (2011), "The design and effects of monetary policy in Sub-Saharan African countries", Journal of African Economies, Vol. 20 No. 2, pp. ii16-ii35.

Mokoti, P.T. (2009), "The short trade-off between prices and output: The case of Botswana", Faculty of Humanities, University of Manchester, England.

Setlhare, L. (2013), "The Monetary Transmission Mechanism in Botswana: A Structural Vector Autoregression Approach", Bank of Botswana Research Bulletin, Vol. 26(1), pp. 37-57.

Taylor, J.B. (1995), "The monetary transmission mechanism: An empirical framework", Journal of Economic Perspectives, Vol. 9 No. 4, pp. 11-26.

Tieman, A., (2004), "Interest rate pass-through in Romania and other Central European economies", IMF Working Paper, WP/04/211.

A Search for Measures in Support of Financial Stability in Botswana

Lesedi Says Senatla[1]

Abstract

Policy formulation in Botswana, as is the case in other jurisdictions, involves evaluation and mitigation of threats to financial stability. This paper intends to inform policy choice on macro-prudential instruments to apply in order to moderate credit growth, as necessary. It employs two alternative empirical methods, namely, time series analysis and panel data methods in the econometric search process and finds that interest rates (Bank Rate) have a significant influence on credit developments, as expected. The paper also confirms that changes in real GDP growth are important in driving credit growth in Botswana. The use of more than one method is intended to test the robustness of the findings. It is envisaged that more direct macro-prudential policy instruments could complement the policy rate and strengthen effectiveness of monetary policy and the maintenance of financial stability.

1. Introduction

Research on financial stability risks has gathered pace of late, following the global financial crisis which started in 2007 in developed economies[2]. Hence, there has been increasing interest in macro-prudential (or system-wide) policy instruments as a means of tackling systemic risks in contrast to past emphasis on micro-prudential or institution–specific policy approaches to risk management. The focus on macro-prudential policy instruments arose from the realisation that micro-prudential policy approaches, and the 'light touch' regulatory environment, fell short of dealing comprehensively with the build-up of systemic (economy-wide) risks. It turns out that systemic crisis is intrinsically damaging as it results in economy-wide output losses (Borio, 2003). Hence, macro-prudential measures could at times be necessary to forestall the onset of a financial crisis.

Studies of financial stability, however, make clear that there is no distinctively and commonly agreed definition of financial stability. However, the broad understanding is that financial stability relates to a strong and well-functioning financial system that supports economic activity on a sustained basis and is resilient to shocks.

This paper follows the existing literature in considering whether unsustainable acceleration in credit growth could pose a threat to financial stability going forward[3], and hence examines the prospects for using relevant macro-prudential policy instruments to foster financial stability. Various empirical studies[4] have demonstrated that macro-prudential policy instruments have varying degrees of success in safeguarding financial stability. For example, Lim et al. (2011) used panel regression methods on a set of 49 countries to test for the effectiveness of macro-prudential instruments. The instruments included caps on loan-to-value ratio (LTV) and debt-to-income (DTI) ratios, ceilings on credit growth, reserve requirements, countercyclical capital requirements and time varying/dynamic provisioning. The dependent variable was real credit growth with Gross Domestic Product (GDP) growth and monetary policy (prime lending rate) used as control variables. The macro-prudential instruments were shown to be statistically significant as expected.

Arregui et al. (2013), likewise, test the effectiveness of LTVs, DTIs, risk weights, reserve requirements and provisioning requirements in curtailing credit growth on a panel of 38 countries. The dependent variable was real year-on-year growth in credit-to-GDP and the data period was 2000 to 2011. All the variables, except provisioning, were found to be statistically significant and, hence, effective at restraining credit growth.

Wang and Sun (2013) found reserve requirements and the Bank Rate (monetary policy) to be among important policy variables influencing growth of bank loans in China. The study used panel methods on a cross section of 171 banks.

The latest study by Claessens et al. (2014) generally confirms the findings of earlier authors[5]. However, they also find that monetary policy (changes in interest rate) is an unreliable tool in influencing bank asset growth. In contrast to all the aforementioned studies, Zhang and Zoli (2014) interestingly find that changes in reserve requirements are not effective in suppressing loan growth. They studied a panel of 13 Asian countries and 33 other countries for the period 2000 to 2013.

Following from the literature, this study tests the potential for existing policy instruments, namely, reserve requirements and changes in monetary policy (or the policy rate) in influencing credit growth, and potential impact on financial stability. The study uses both time series and panel regression methods in order to check the robustness of the findings. Quarterly data ranging from 2000 to 2013 for time series analysis and annual panel data from 2008 to 2013 on a cross section of 8 banks was used.

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1 Deputy Director, responsible for Financial Stability, Monetary and Financial Stability Department. The views expressed in the paper are those of the author and do not necessarily reflect those of the Bank of Botswana.

2 Lozano and Guarin (2014) make a similar point.

3 See seminal paper by Minsky (1972), for example.

4 Kiyotaki and Moore (1997) provide a theoretical model about the effect of credit limits or constraints, thus laying a foundation, albeit indirect, for empirical macro-prudential (or system-wide) policy studies.

5 Claessens et al. studied a panel of 2800 banks in 48 countries for the period 2000 to 2010.

It is found that, regardless of the econometric method used, reserve requirements[6] played a statistically minimal part in influencing movements in total credit. Instead, the Bank Rate is found to have a bigger influence on growth of total credit and, by extension, household credit.

For this study, credit refers to loans and advances by commercial banks only. Reasons for this narrow focus on banks' data are three-fold. First, there is paucity of reliable long-dated time series data for most of the non-bank financial institutions. Second, some non-bank financial institutions, including some statutory banks, borrow from commercial banks to on-lend. For this reason, adding credit from other lenders to commercial banks' loan portfolio could result in double counting which, thus, exaggerates the magnitude of economy-wide credit[7]. Third, and following from the second point, commercial banks are the major credit providers in Botswana.

The remainder of the paper is divided into 5 sections. Section 2 provides a synopsis of latent financial stability risks in Botswana; section 3 shows stylised facts on credit developments; section 4 presents the econometric model; section 5 provides empirical test results; and section 6 concludes with policy recommendations.

2. A Synopsis Of Latent Financial Stability Risks In Botswana

Botswana's financial system consists of banks and non-bank financial institutions. Banking institutions are licensed and supervised by the Bank of Botswana, while non-bank financial institutions[8] are regulated by the Non-Bank Financial Institutions Regulatory Authority (NBFIRA).

Crucially, commercial banks play a dominant role in the financial system, as evidenced by their asset size relative to GDP; for example, this ratio was 53 percent compared to 43 percent and 17 percent for pension funds and insurance companies, respectively, in 2013.

In turn, the banking system is dominated by four large banks, namely Barclays Bank of Botswana Limited, First National Bank of Botswana Limited, Stanbic Bank Botswana Limited and Standard Chartered Bank Botswana Limited, whose combined assets were 80 percent of total banking assets as at the end of 2013. Thus, the financial system is vulnerable to adverse financial developments that may arise from any of the four large banks. In broad terms, the vulnerability and risks to financial stability in Botswana reflect both structural and behavioral orientations of the financial system as highlighted below.

Structural factors

Financial institutions in Botswana, e.g., commercial banks and insurance companies, are majority-owned by non-resident transnationally-active financial conglomerates. Inherent in this ownership structure is the likelihood that foreign-based parent companies could use financial resources of subsidiaries, or deposits in Botswana for survival in the event of economic/financial difficulties abroad, thus transmitting externally generated financial/economic distress to the domestic financial system.

As in other jurisdictions, the financial system in Botswana is operationally interlinked, implying the likelihood of transmittal of risks, or vulnerabilities across the different segments of the financial sector. Figure 1 is a schematic structure of the interaction between banks and insurance companies based on the life cover, and credit default risk cover, provided by insurance companies on unsecured loans advanced by commercial banks. In this case, in the event of a sustained increase in loan default rates experienced by a bank, or banks, that has/have default risk cover arrangement with an insurance company, the (likely) solvency problem of the bank in question could be transmitted to the insurance company when claims are made, leading to generalised financial sector disturbances[9].

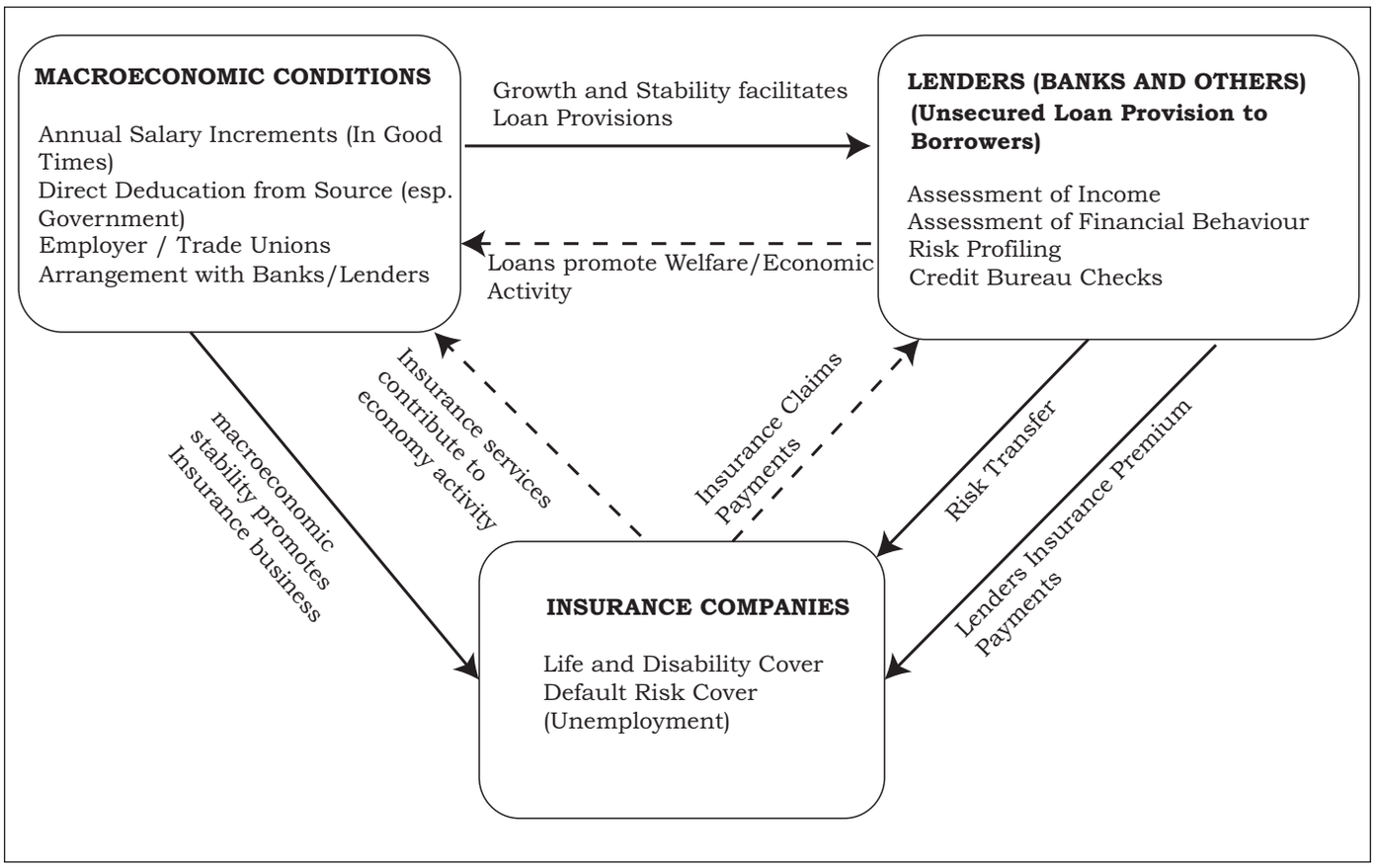
6 Note that the literature views the reserve requirement ratio as both a monetary policy and macro-prudential policy instrument. Seen in a macro-prudential policy context, increases in reserve requirements should lead to a reduction in loanable funds. See the discussion of variables in section 4.

7 Giese et al. (2013) make a similar point regarding intra-financial institutions borrowings in the UK.

8 Non-banking financial institutions include, among others, pension funds, insurance companies and micro-lenders.

9 Note, however, that whether the ensuing financial disruption for the insurance company is pronounced or not depends on the size of the contingent (default risk cover) liability in the balance sheet. If small, then the contingent liability may not harm the financial strength of the insurance company. This is to illustrate the interconnectedness among financial institutions.

Figure 1: Transmittal Linkages Among Banks And Insurance Companies



The other structural issue arises from the funding profile of commercial banks' balance sheets. The majority of banks' deposits belong to resident private businesses, including insurance and asset management companies among others[10], and parastatal organisations. This is reflected in the percentage share of deposits of approximately 61 percent and 11 percent of total deposits for resident private businesses and parastatal organisations, respectively as at December 2013[11]. In turn, most parastatal organisations are reliant on Government's subvention; a situation that makes banks indirectly and, partly, dependent on the Government's financial position; particularly the exogenous factors, such as mineral export receipts and Southern African Customs Union (SACU) payments as these are major sources of Government's revenue. Figure 2 traces out sources and proportions of banks' deposits as at December 2013.

Furthermore, reliance on resident private businesses and parastatal organisations' deposits for funding, as opposed to the more diverse household deposits, predisposes banks to liquidity shocks, in the event of large withdrawals of funds by any of these entities, say, to fund outstanding projects or to invest in alternative high yielding projects.

Algebraically, the banks' funding dependence on parastatals and local authorities (or Government funding) and insurance and asset management companies' deposits, as explained in footnote 12, can be represented as follows:

$$B_t^d = f(\gamma_t;\ \theta_t \mid \gamma_t \in r) \qquad \text{Equation 1}$$

In turn

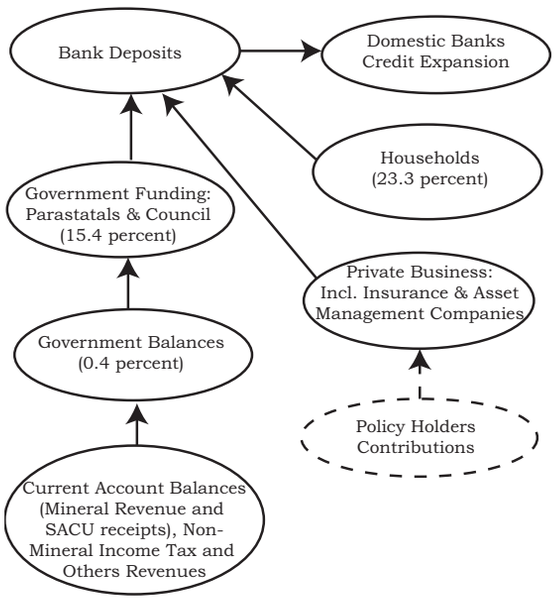
$$\theta_t = \theta(\rho) \qquad \text{Equation 2}$$

where B_t^d represents major banks' deposits at time t; γ_t is parastatals' and local authorities deposits; θ_t captures insurance and asset management companies deposits; r is Government's financial position; while ρ are policyholders' contributions, which are sources of insurance and asset management companies' funding.

10 Asset managers, insurance companies and parastatal organisations individually have the largest individual deposits although in the aggregate they are exceeded by other businesses. Pension funds are included in asset managers and (some) insurance companies' deposits.

11 This proportion has stayed more or less the same throughout the years. Deposits of parastatals and local authorities, which both depend on central government for funding, amount to 15 percent of total deposits is – Figure 2 (See also Botswana Financial Statistics, various issues – Table 3.14).

FIGURE 2: SOURCE OF BANKS, DEPOSITS AND LOAN FUNDING AS AT DECEMBER 2013



Behavioural factors

Even though banks are in the business of maturity transformation, the funding and lending mismatch propensities in which long-dated assets of more than one year are funded by deposits that are up to 6 months in duration[12] (Charts 1 and 2), potentially lead to liquidity challenges. This is because long-term loan obligations cannot be redeemed at short notice by banks (as these are subject to term contracts and repayment scheduels) to satisfy liquidity demands by depositors, as necessary. Moreover, ordinarily, it is not possible for banks to sell off their loan books as there is no active market for loans, nor do banks enter into the loan transactions business in the expectation that they will sell off the loans when it is desired.

The data suggests that the maturity mismatch story above can be represented more aptly as follows:

$$TD = \varphi^{\frac{2}{3}} + \omega^{\frac{1}{3}} \qquad \text{Equation 7}$$

In this case TD is total deposits; is short-term deposits of up to 6 months maturity and captures deposits of up to 12 months and above maturity.

In turn we have:

$$L_t^B = f(TD, \emptyset) \qquad \text{Equation 4}$$

Where L_t^B and $\emptyset$ are, respectively, banks' loans and other bank funding sources, such as subordinated loans.

It is easy to show that

$$dL_t^B = \frac{\partial f}{\partial TD}\, dTD + \frac{\partial f}{\partial \emptyset} d\emptyset \qquad \text{Equation 5}$$

Assuming $d\emptyset = 0$, as it is neither material to the analysis nor sizable in the majority of cases, we are left with:

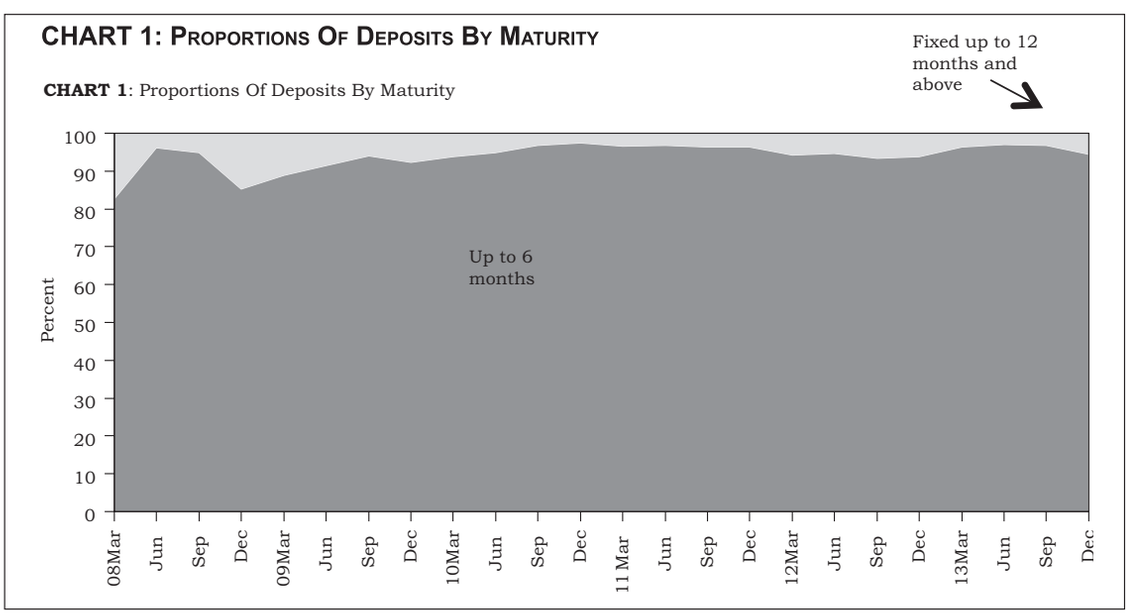
$$dL_t^B = \frac{\partial f}{\partial TD}\, dTD \qquad \text{Equation 6}$$

Crucially, transformation of deposits[13] (TD) into loans from equations 3 and 4, assuming $\emptyset = 0$ and observable in Chart 2, gives the important result that:

$$L_t^B = \left(L_{\varphi,t}^{l\left(\frac{3}{4}\right)+s\left(\frac{1}{4}\right)}\right) + \left(L_{\omega,t}^{l\left(\frac{3}{4}\right)+s\left(\frac{1}{4}\right)}\right) \qquad \text{Equation 7}$$

In this case, L_t^B are loans and advances from banks; L_t^l are loans of one year and above in duration; L_t^s represents loans and advances of up to 12 months duration; and L_φ and L_ω capture the deposits category source of the loan offerings.

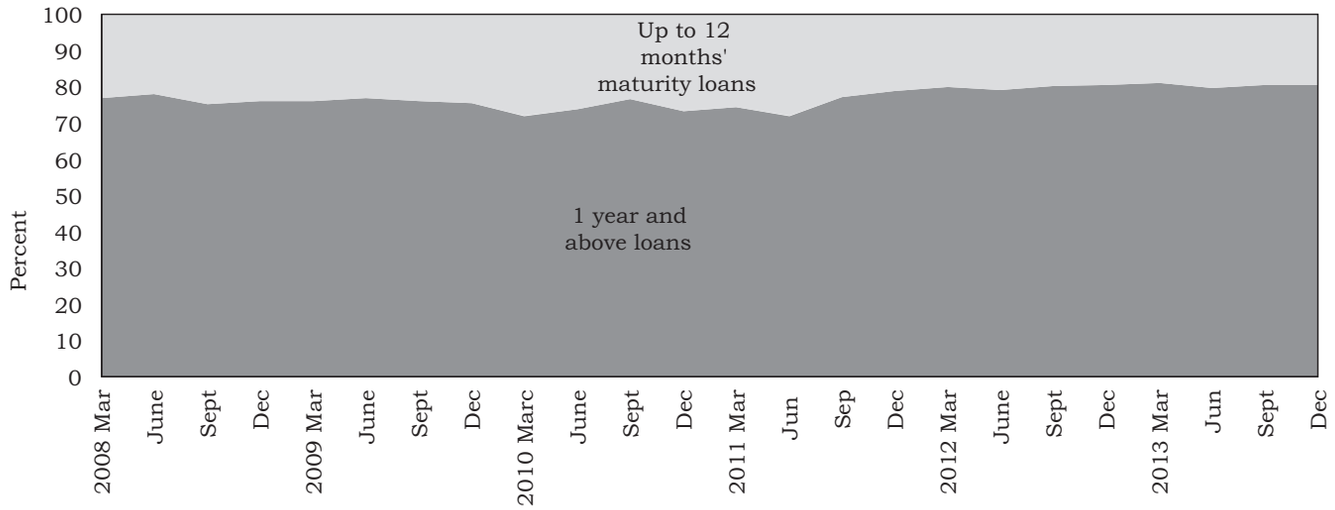
CHART 1: PROPORTIONS OF DEPOSITS BY MATURITY



12 It would appear that banks assume that short term deposits will be rolled over at maturity or witdrawals are matched by cyclical deposit of income that contribute to stable (or growing) average deposit levels; hence, this allows the banks to manage the liquidity risk. The problem arises if the framework for managing the liquidity risk is weak or if exogenous factors lead to large scale withdrawal of deposits

13 Not all deposits are transformed into loans, as some are used to buy non-loan assets or Bank of Botswana Certificates (BoBCs), which are central bank paper introduced in 1991 to absorb excess liquidity. Furthermore, some of the deposits are set aside in compliance with regulatory requirements such as reserve and liquid assets ratios.

CHART 2: Proportions Of Loans And Advances By Maturity



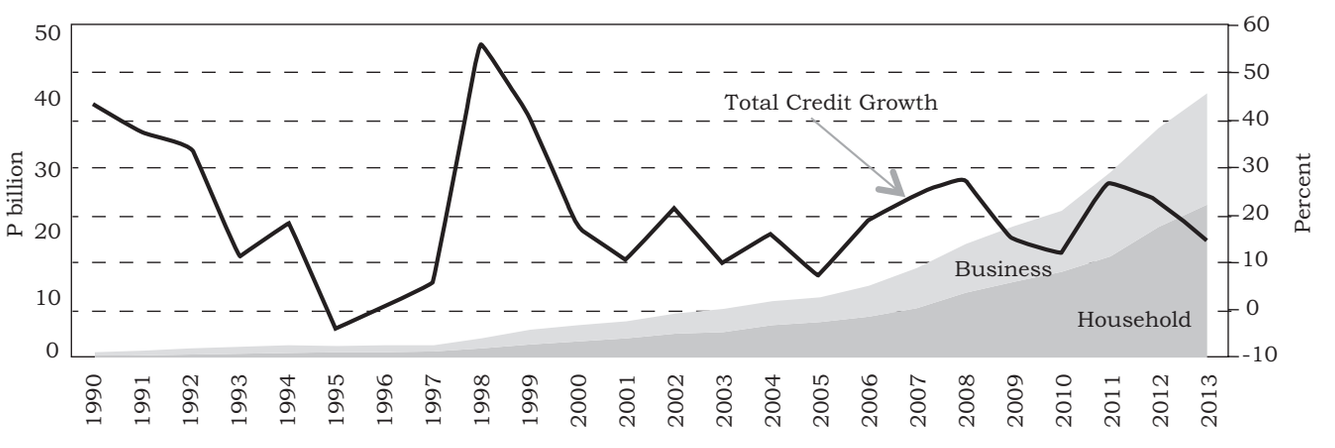
Another behavioural factor, which represents a risk to financial stability going forward, and the empirical focus of this paper, is rapid growth in credit[14]. The deleterious effect of rapid growth of credit on financial stability has received good coverage in the literature. Indeed, Borio and Drehmann (2009) and Drehmann and Juselius (2012) use the noise-to-signal ratio method developed by Kaminsky and Reinhart (1999) to show that rapid private sector credit growth is a predictor of banking crises.

3. Stylised Facts on Credit Developments

Prior to presenting the model and empirically testing the effectiveness of policy instruments[15] on total credit growth, it is useful to show time series movements of this variable along with its components, namely, household and business loans, for completeness. The sources of the data are the Bank of Botswana publications and, in particular, Botswana Financial Statistics (various issues).

Chart 3 shows that total credit increased rapidly in absolute terms from P0.8 billion in 1990 to approximately P40 billion in 2013. On a year-on-year growth basis, total credit growth moderated from a high of 43 percent in December 1990 to 15 percent by December 2013. The largest portion of the banks' loan portfolio in value terms is household loans, which comprised 58 percent of total credit, or P23 billion, as at December 2013. Interestingly, prior to 2001, business loans comprised the largest proportion of the banks' loan portfolio. For example, in 1990, business loans constituted 70 percent of the banks' total loan portfolio.

CHART 3: Level (Lhs) And Annual Growth Rate (Rhs) Of Total Commercial Banks' Credit



14 Appendix Table A1 shows that while the credit/GDP ratio is modest, the growth rate of real credit has been consistently faster than real GDP since 2006, except for 2010. See also the discussion, below, on the credit-to-GDP, gap wherein it is argued that widening gaps signal the financial system's vulnerability to crisis.

15 The macro-prudential policy instruments, as shown in section 4, are reserve requirements and the Bank Rate. Reserve requirements were changed as follows: 3.25 percent to 5 percent in February 2006; increased to 6.5 percent in November 2010 and further to 10 percent in July 2011.

Of particular interest is that the breakdown of household loans shows that the majority of loan obligations are, currently, 'other' or unsecured loans, followed closely by property loans (Table 1). The concentration of loans in the unsecured loans' segment suggests banks' shareholder value maximisation, as these loan types tend to attract relatively high risk-adjusted returns. Nevertheless, Chart 4 indicates that, while unsecured loans constitute the largest proportion of household loan portfolio, banks have since 2011 increasingly shifted towards providing proportionately more property loans. Presumably, this reflects risk diversification motives combined with the recognition that property offers security as it can be repossessed and sold off to recover amounts borrowed in the event of default. On the other hand, commercial banks' business credit has been growing steadily, especially since 2001, and was P17 billion in 2013 (Chart 5).

TABLE 1: HOUSEHOLD LOANS BY PURPOSE AS A PROPORTION OF TOTAL HOUSEHOLD LOANS (PERCENT)

	Property	Motor Vehicle	Credit Cards	Other
2003 Mar	16.2	33.0	…	50.8
2003 Dec	19.6	29.6	…	50.8
2006 Mar	23.8	15.7	…	60.4
2006 Dec	23.6	12.9	…	63.4
2008 Mar	20.6	10.8	…	68.6
2008 Dec	21.2	10.2	…	68.6
2010 Mar	22.6	9.5	…	67.9
2010 Dec	25.1	6.5	…	68.4
2012 Mar	21.9	6.8	3.6	67.7
2012 Dec	23.6	5.9	2.9	67.5
2013Mar	25.3	6.0	3.1	65.5
2013 Dec	28.9	5.6	2.7	62.8

Note: … means data not available.

CHART 4: LEVEL (LHS) AND ANNUAL GROWTH RATE (RHS) OF HOUSEHOLD PROPERTY AND UNSECURED LOANS

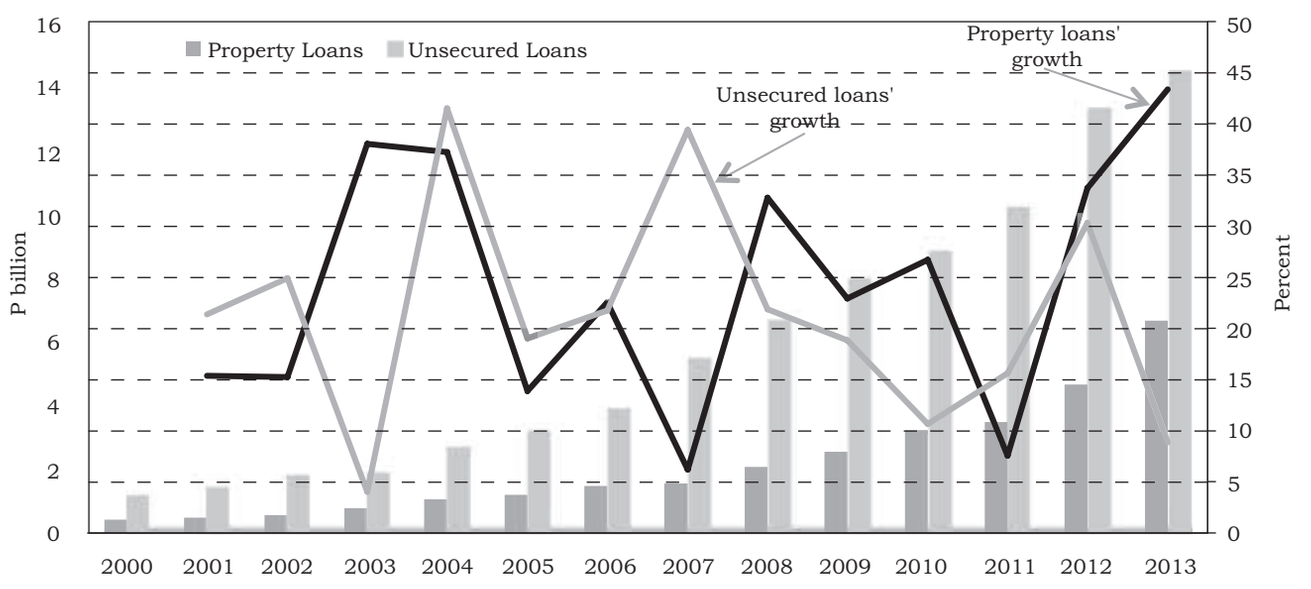
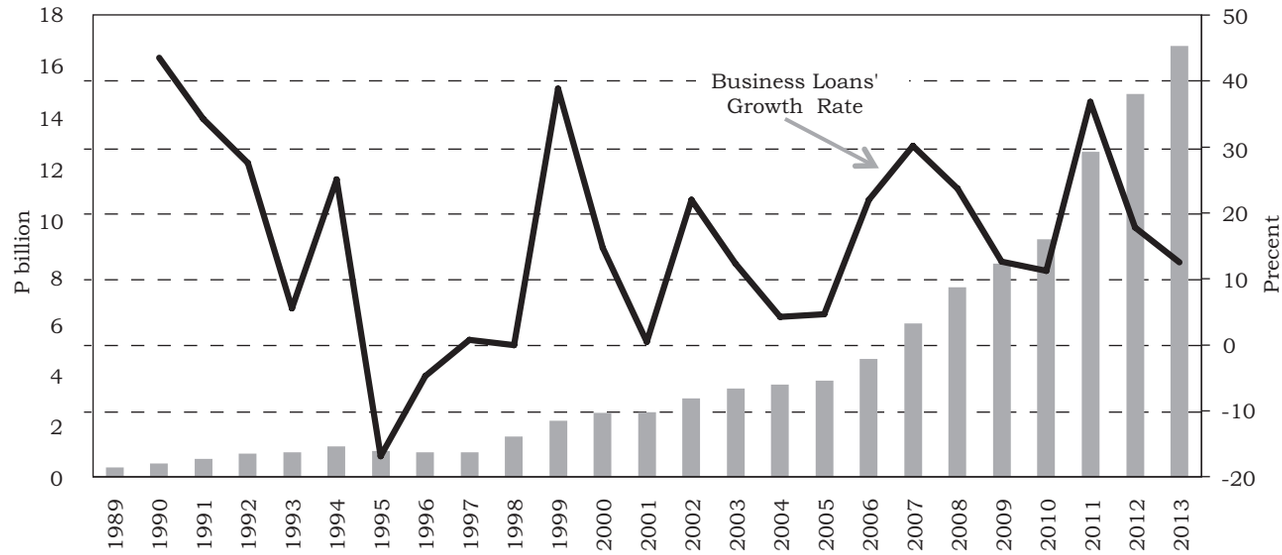
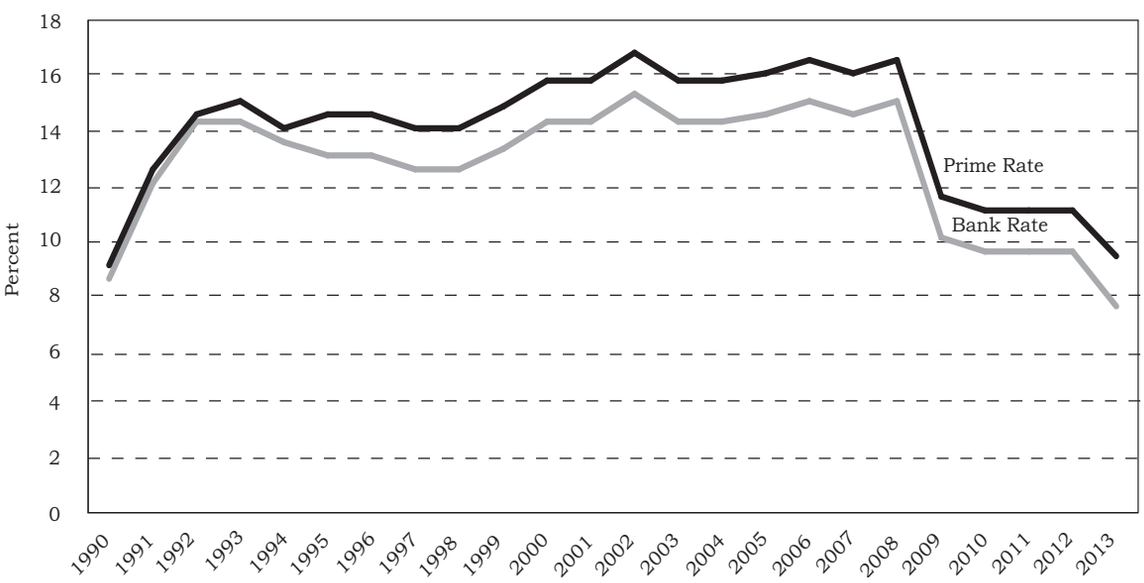


CHART 5: Level (Lhs) And Annual Growth Rate (Rhs) Of Commercial Banks' Business Credit



Coinciding with growth in credit were changes in reserve requirements as described in footnote 15. Similarly, the Bank Rate moved intermittently over the course of time to reach a high of 15.5 percent in September 2008 before falling to 7.5 percent in December 2013. Evidently, and as is to be expected, monetary policy change, i.e., policy rate movements, swayed the prime lending rate in the same direction (Chart 6). In this case, the calculated correlation coefficient between the Bank Rate and the Prime Lending Rate is nearly perfect at approximately 1.00.

CHART 6: Movements In Nominal Bank And Prime Lending Rates



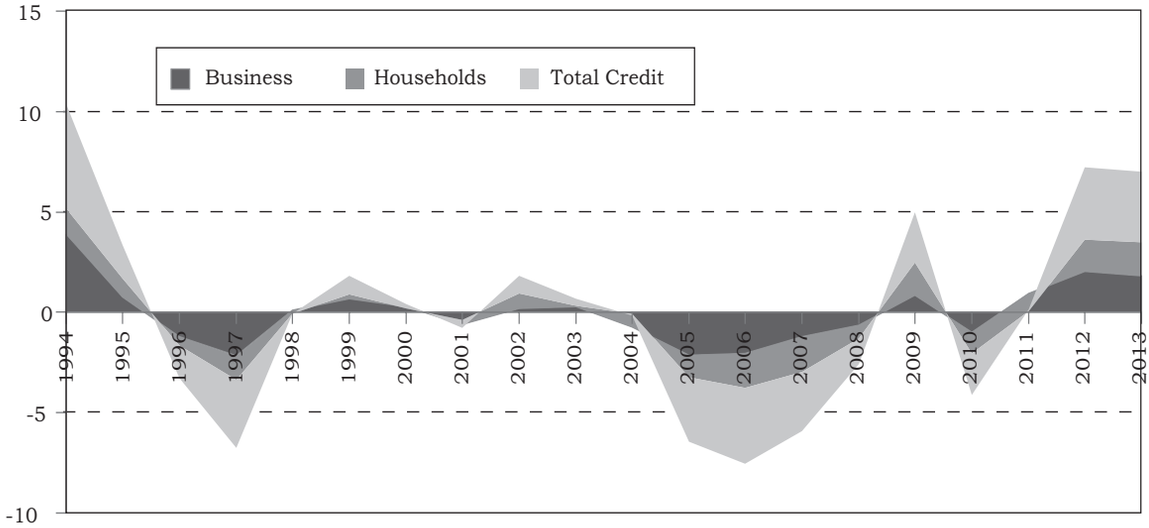
Drehman and Juselius (2013) and Giese et al. (2013) identified elevations in credit-to-GDP gaps[16] as one of the reliable signals of the build-up of vulnerabilities of the financial system to systemic crisis. In Botswana's case, a graph of the credit-to-GDP gap[17] calculated using a one-sided Hodrick-Prescott filter, i.e., a data

16 Credit-to-GDP gap is a Basel Committee's concept defined as the credit-to-GDP ratio minus its long term trend where the trend is calculated using the Hodrick-Prescott filter and a smoothing parameter of 400,000. The Basel Committee recommends a lambda of 400,000, as it has empirically been shown to perform well in picking up long term trends (Basel Committee on Banking Supervision, 2010). In general "…if the credit-to-GDP ratio is significantly above its trend (i.e., there is a large positive gap), then this is an indication that credit may have grown to excessive levels relative to GDP" (Basel Committee on Banking Supervision, 2010, Page 13). The objective of the calculation of credit-to-GDP gaps is to determine the size of countercyclical capital buffers, as appropriate, needed to forestall a system-wide banking crisis.

17 Drehmann and Tsatsaronis (2014) defend the use of the credit-to-GDP gap in emerging market or developing economies, arguing that financial deepening does not invalidate the measure and that, if deepening occurs at a steady pace, this will be reflected in the trend with no effect on the gap.

smoothing method, with a smoothing parameter (λ) of 400,000 shows some signs of accelerating credit pressure build-up after 2011 (Chart 7). Also of interest is that the elevated credit-to-GDP gap in 2009 reflected the slowdown in total output growth[18] during the year.

CHART 7: CREDIT TO GDP GAP (PERCENT)*



Note: The credit-to-GDP gap is calculated as credit-to-GDP ratio minus its long term trend, where the trend is determined using the Hodrick-Prescott filter and a smoothing parameter (λ) of 400,000.

4. ECONOMETRIC MODEL

Consistent with the empirical literature, the study intends to test the efficacy of existing macro-prudential policy instruments, namely, reserve requirements and changes in monetary policy (or the Bank Rate) in influencing credit growth. In that respect, as per the literature, the study controls for changes in tier 1 capital[19], leverage, money supply, bank size, and real GDP growth.

The following reduced form linear function is estimated:

$$\Delta\Lambda = \alpha\iota + \beta 0\ \Delta(B)\Lambda + \beta 1\Delta I + \beta 2\Delta(T\iota\varepsilon\rho 1/\Gamma\Delta\Pi) + \beta 3\Delta(Loan/Dep) + \beta 4\Delta\Gamma\Delta\Pi + \beta 5\Delta 1 + \beta 6\Delta Size + \beta 7\Delta(M2/\Gamma\Delta\Pi) + \varepsilon\tau \quad \text{(Equation 8)}$$

where ΔΛ is real (or CPI adjusted) total credit growth; B is the backward shift operator; I is the Bank Rate; tier1 capital is as in Zhang and Zholi (2014); Loan/Dep is loan-to-deposit ratio, or leverage ratio, as in Claessens et al. (2014) and shows the extent of banks' dependence on deposits for funding; ΔGDP is real GDP growth and GDP growth is expected to have a positive influence on redit growth[20]; D1 are dummy variables[21] capturing policy changes on reserve requirements[22]; Size[23] is total banking assets as a proportion of GDP; and M2/GDP controls for excess liquidity in the financial system following Jahn and Kick (2012). This variable is expected to be positively associated with the dependent variable. ε is the error term.

The expected signs of the coefficients for the 2 variables of interest are as follows:

$$e_{L,I} = \frac{\partial L}{\partial I}.\frac{I}{L} < 0 \quad \text{(Equation 9)}$$

$$e_{L,D1} = \frac{\partial L}{\partial D1}.\frac{D1}{L} < 0 \quad \text{(Equation 10)}$$

Otherwise all other remaining (control) variables are expected to be positively correlated with real total credit growth.

18 The use of total output growth as opposed to just non-mining GDP growth is germane as mining/diamond revenues (indirectly) fuel domestic bank credit. This follows from the hiring of Government's employees and awarding of salary increases. See footnote 23 for a fuller discussion

19 Tier1 capital is the core capital of a bank and includes common equity1 and retained earnings. The Banking Act, Cap 46:04, mandates that the core capital of a bank should constitute a minimum of 50 percent of the total capital of a bank. We define other variables in this list below.

20 Using GDP broadly defined, i.e., both mining and non-mining included, as opposed to a narrow focus on nonmining GDP is ideal for two reasons. First, when mining or the diamonds business, in particular, is flourishing, civil servants, historically at least, borrow more from banks in anticipation of salary increases through the Government's budget allocation. Second, several businesses are dependent on Government expenditure and are likely to borrow more from banks to augment their working capital when mining, and hence, Government's revenues are good or growing.

21 The approach follows Arregui et al. (2013) in using a step function for dummy variables whereby each time there is a tightening in the variable it changes by one. In this case, the dummy variable has the value of 0 prior to any policy change.

22 Equation 10 shows coefficient sign for changes in reserve requirements. The idea is that as the ratio of reserve requirements is increased, loanable funds are reduced.

23 Wang and Sun (2013) and Joyce and Spaltro (2014), among others, argue for the importance of including bank size in bank lending growth formulation/estimations to gauge the contribution of this variable.

In effect, our empirical model is designed in such a way that it generates a dynamic stationary autoregressive moving average (ARMA). The stationary condition results in valid inferences based on t and F tests as the mean is constant and the variance is finite.

5. Regression Results

This section presents empirical test results based on both time series and panel data experimentation.

Time Series Results

Table 2 presents ordinary least squares' regression results based on quarterly time series data[24] from 2000 to 2013 and 2005 to 2013. The reason for the subdivision of the data was because information on tier 1 was only available from 2005 and, hence, the regressions were run with and without tier 1 variable.

The possibility of a problem of spurious relationships arising from non-stationary variables is not an issue as the variables are in first differences[25]. Models run in differenced form tend to attenuate such an issue[26] (Dougherty, 1992). In addition, including both lagged dependent and independent variables, deals with possible autocorrelation. Moreover, the endogeneity problem arising from the real GDP growth variable is addressed through the use of a lagged real GDP growth variable which, therefore, serves as its instrument.

A parsimonious result is reported after eliminating insignificant variables. Table 2 (column 1) shows that the lagged dependent variable has a statistically significant positive coefficient, thus indicating relatively high tenacity. The coefficient of a change in monetary policy (interest rates) variable has the expected negative sign although not statistically significant. However, the monetary policy variable becomes statistically significant at the 10 percent significance level in column 2.

The coefficient of a dummy variable on reserve requirements has the unexpected positive sign in column 1. Repeated experimentation with the reserve requirement variable in column 2 provides further evidence that changes in reserve requirements played no role in credit movements. However, this result is not surprising as increase in reserve requirements from 3.25 percent to 10 percent (currently) was not aimed at restraining credit movements per se and in an environment where banks were not liquidity constrained; rather this was primarily an attempt to mop up excess liquidity so as to reduce the quasi-fiscal costs of sterilisation. The regression results further confirm that changes in credit movements are positively associated with bank capital and real GDP growth, as expected. From column 1, a 1 percentage point growth in real GDP increases credit growth by 0.21 percentage points. Other control variables, namely, money supply to GDP and loan to deposit ratios are statistically significant as expected.

Table 2: Time Series Regression Results

Variables	1	2
Lagged Credit Growth (-1)	0.647***	0.799***
	(0.084)	(0.086)
Bank Rate	-1.324	-1.506*
	(0.864)	(0.840)
Loan/deposit	0.356***	
	(0.120)	
Lagged Real GDP Growth (-2)	0.207*	
	(0.121)	
Real GDP Growth		0.331**
		(0.139)
Lagged M2 to GDP (-1)	0.369**	0.540***
	(0.166)	(0.149)
Dummy on Reserve Requirements	0.767	0.685
	(0.435)	(0.511)
Lagged Tier1 to GDP (-1)		12.471***
		(3.960)
Size	0.296	
	(0.185)	
Observations	54	35
R^2	0.737	0.857
DW	2.225	2.235
AKAIKE info criterion	5.219	4.838

The dependent variable is real total banking credit growth. The estimation period is 2000 Q1 to 2013 Q4 and 2005 Q1 to 2013 Q3 when nominal Tier1/nominal GDP is included. Standard errors are in parenthesis and ***, ** and * indicate significance at 1 percent, 5 percent and 10 percent levels, respectively.

Panel Data Results

Panel data results are based on a cross section of 8 banks in Botswana, namely, Barclays Bank Limited, Stanbic Bank, First National Bank Limited, Standard Chartered Bank Limited, Bank of Baroda Limited, Bank Gaborone Limited, BancABC and Capital Bank Limited. Annual data from 2008 to 2013 are used for estimation purposes; however, the time series dimension of the data is truncated to 2010 to 2013 because of differencing and lags.

As in the case of time series results, a spurious relationship problem arising from non-stationary variables is not an issue for the results as the variables

24 Data sources for time series and panel data are Botswana Financial Statistics and other Bank of Botswana records.

25 This was confirmed by the Augmented Dickey-Fuller test results showing that the variables are I(0).

26 Diagnostic tests results on the residuals, including the Durbin-Watson statistic (Table 2), showed no evidence of serial correlation.

are in first differences. Furthermore, endogeneity problem is not present in the results. This is particularly the case for the Random Effects Model (REM) results as they rely on generalised least squares (GLS) method[27].

The Random Effects Model results are presented in Table 3. To a large extent, the REM results are the most appropriate as they allow for making inferences about the behaviour of banks – or indeed other lenders – that are not in the sample.

Parsimonious results in Table 3 buttress the time series results above in finding no statistical evidence that changes in reserve requirements had a role in credit movements in the context of ample excess liquidity. Likewise, the real GDP growth is as important in panel regression results (with a t-statistic of 2.06) as it was in the time series results. Changes in interest rates have a much better explanatory power than in the time series results with a t-statistic of -2.29. And in this case, a 1 percentage point increase in the Bank Rate leads to a fall in credit growth of 0.34 percentage point. However, in comparative terms, banks are found to be much more responsive to economic performance than they are to monetary policy changes as exemplified by a much higher coefficient for real GDP growth variable.

Control variables, such as bank size and the loan-to-deposit ratio, are also found to be statistically significant as expected.

TABLE 3: PANEL DATA REGRESSION RESULTS

Variables	Random Effects Model
Lagged Real Credit Growth (-1)	0.015
	(0.012)
Bank Rate	-0.338**
	(0.148)
Loan/Deposit	1.091***
	(0.010)
Real GDP Growth	4.105**
	(1.997)
Dummy on Reserve Requirements	-4.160
	(6.776)
Size	1.329***
	(0.111)
Observations	32
Number of Banks	8

*Note: The dependent variable is real total banking credit growth. The estimation period is 2008 to 2013 (annual data). Standard errors are in parenthesis and ***, ** and * indicate significance at 1 percent, 5 percent and 10 percent levels, respectively.*

The Fixed Effects Model results (not shown) were indistinguishable from the Random Effects Model. The experimentation with dividing banks into large and small banks based on their market share and running separate regressions, while leading to a loss of degrees of freedom, shows similar results (not reported) as above.

6. CONCLUSIONS AND POLICY RECOMMENDATIONS

This paper used time series and panel data methods to investigate the role of reserve requirements and the monetary policy instrument (interest rate) changes in influencing growth of total credit. The results indicate that reserve requirements played a statistically minimal part in affecting movements in total credit. Instead, it is found that where the availability of loanable funds is not a constraint, it is more meaningful to use the Bank Rate to restrain growth of total credit, and by extension household credit, of which it is part. However, as the Bank Rate is a general instrument which affects other assets beyond banks' loans and advances and is subject to possible lagged transmission effects to credit variables, it might be important to supplement it – should the need arise and consistent with practices elsewhere– with more direct macro-prudential policy measures, including limits on credit growth for a more targeted restraint of credit growth[28], as more evidence becomes available that the banks' asset quality is under strain[29]. On the other hand, imposing the suggested macro-prudential instruments could inadvertently lead banks to respond by unnecessarily tightening credit underwriting standards and (further) limit their exposures to segments of households or businesses with (presumed) better income or loan repayment ability prospects. This could inhibit growth of potentially profitable/successful small and medium scale enterprises (SMEs), which can contribute to economic diversification and employment creation.

Consistent with the empirical literature, the results also make the case for banks to have strong high quality capital (tier 1) prior to disbursing loans. This is crucial as good quality capital enhances banks' resilience in the event of increasing loan losses arising out of some economic shock incident. Furthermore, there is (strong) evidence that banks take the performance of the economy into account in their lending decisions, as expected. This is important as the strength of the economy serves as mitigation against loan defaults.

Going forward and data permitting, it would be important to conduct similar empirical tests which take into account credit providers other than commercial banks; this should be on condition that meticulous filtering of intra-financial institutions borrowings is done to avoid double counting. That way, a more holistic picture of responsiveness of credit growth to (macro-prudential) policy changes would be obtained.

27 Diagnostic test results (not shown) confirmed that the error terms are independently identically distributed.

28 If the suggested macro-prudential policies are applied solely to banks, borrowers might capitalise on regulatory arbitrage and migrate in large numbers to non-banking lenders, such as micro-lenders, to satisfy their borrowing needs (see also Arregui et al. (2013) on a similar point). But, that discussion is beyond the scope of this paper.

29 Indeed, many other jurisdictions, including Mexico and Thailand, employ a wide variety of macro-prudential policy instruments to manage credit growth. See, for example, Lim et al. (2011) on a list of countries that use a combination of instruments.

References

Arregui, N., J. Benes, I. Krznar, S. Mitra and A.O. Santos (2013), 'Evaluating the Net Benefits of Macroprudential Policy: A Cookbook', IMF Working Paper 13/167 International Monetary Fund, Washington D.C.

Basel Committee on Banking Supervision (2010), "Guidance for National Authorities Operating the Countercyclical Capital Buffer", Bank for International Settlements.

Borio, Claudio (2003), 'Towards a macroprudential framework for financial supervision and regulation?', Bank for International Settlements, BIS Working Paper no. 128.

Borio, C., and M. Drehmann (2009), 'Assessing the risk of banking crises – revisited', BIS Quarterly Review (March).

Claessens, S., S. R. Ghosh, and R. Mihet (2014), 'Macro-Prudential Policies to Mitigate Financial System Vulnerabilities', IMF Working Paper 14/155, International Monetary Fund, Washington D.C.

Dougherty, C. (1992), Introduction to Econometrics, Oxford University Press, New York.

Drehmann, M., and M. Juselius (2012), 'Do debt service costs affect macroeconomic and financial stability?', BIS Quarterly Review (September).

Drehmann, M., and M. Juselius (2013), 'Evaluating Early Warning Indicators of Banking Crises: Satisfying Policy Requirements', BIS Working Papers no. 421.

Drehmann, M., and K. Tsatsaronis (2014), 'The credit-to-GDP gap and countercyclical capital buffers: questions and answers', BIS Quarterly Review, March.

Giese, J., H. Anderson, O. Bush, C. Castro, M. Farag and S. Kapadia (2013), 'The Credit to GDP gap and complementary indicators for macroprudential policy: Evidence from the UK', available at www.Nottingham.ac.UK/cfm/documents/conference.

Hsiao, C. (1996), Analysis of Panel Data, Cambridge University Press, New York.

Hoffman, Boris (2001), 'The determinants of private sector credit in industrialised countries: do property prices matter?' BIS Working paper, no. 108.

Jahn, N., and Thomas Kick (2012), 'Early Warning Indicators for the German Banking System: a Macroprudential Analysis', Deutsche Bundesbank Discussion Paper, no 27/2012.

Joyce, M.A.S. and M. Spaltro (2014), 'Quantitative Easing and Bank Lending: A Panel Data Approach', Working Paper No. 504, Bank of England.

Kaminsky, G. L., and C. M. Reinhart (1999), 'The twin crises: the causes of banking and balance of payments problems', American Economic Review, vol. 89(3) pp. 473-500.

Kiyotaki, N., and John Moore (1997), 'Credit Cycles', Journal of Political Economy, vol. 105, no.2.

Lim, C., F. Columba, A. Costa, P. Kongsamut and A. Otani (2011), 'Macroprudential Policy: What Instruments and How to Use Them', IMF Working Paper 11/238, International Monetary Fund, Washington D.C.

Lozano, I., and A. Guarin (2014), 'Banking Fragility in Columbia: An Empirical Analysis Based on Balance Sheets', Central Bank of Colombia, no. 813.

Magyar Nemzeti Bank (November 2012), "Report on Financial Stability", Budapest, Hungary.

Minsky, H. P. (1972), 'Financial Instability Revisited: The Economics of Disaster', Fundamental Reappraisal of the Discount Mechanism, Federal Reserve Bank of St. Louis.

The Reserve Bank of Malawi (December 2012), "Financial Stability Report".

Wang B., and Tao Sun (2013), 'How Effective are Macroprudential Policies in China', IMF Working Paper 13/75, International Monetary Fund, Washington D.C.

Zhang, L., and E. Zoli (2014), 'Leaning Against the Wind: Macroprudential Policy in Asia', IMF Working Paper 14/22, International Monetary Fund, Washington D.C.

APPENDIX

Table A1 shows that real, or CPI inflation adjusted, total credit has been growing relatively faster than total output, especially since 2006; if sustained, this practice may imply loan repayment difficulties going forward and, hence, threaten banking stability.

TABLE A1: GROWTH RATES OF TOTAL COMMERCIAL BANKS' CREDIT AND GROSS DOMESTIC PRODUCT (GDP)

	Nominal Credit Growth (Percent)	Real Credit Growth (Percent)	Real GDP Growth (Percent)	Credit/Current GDP (Percent)
1995	-3.7	-13.1	7.0	13.6
1996	1.1	-7.8	5.8	11.2
1997	5.6	-2.0	8.0	10.4
1998	56.1	46.7	0.7	14.6
1999	41.3	30.4	9.7	16.5
2000	17.7	8.3	2.0	16.7
2001	10.7	4.7	0.3	17.0
2002	21.3	9.1	6.1	19.3
2003	10.0	3.4	4.6	19.6
2004	16.1	7.7	2.7	20.1
2005	7.3	-3.7	4.6	17.9
2006	18.9	9.6	8.4	18.3
2007	24.4	15.1	8.3	20.0
2008	27.7	12.3	3.9	22.6
2009	15.2	8.9	-7.8	27.3
2010	11.9	4.2	8.6	23.7
2011	26.4	15.8	6.2	26.7
2012	23.6	15.0	4.3	31.2
2013	15.1	10.5	5.9	32.0