THE RESEARCH BULLETIN

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Contents

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2009 Monetary Policy Statement – Mid-Term Review

1. Introduction

1.1   The Mid-Term Review (MTR) of the 2009 Monetary Policy Statement (MPS) evaluates progress in achieving the 3 – 6 percent inflation objective; it also assesses the medium-term financial and economic conditions and other factors that are likely to influence the inflation outlook and policy formulation in the remainder of the year. Overall, the assessment informs stakeholders of the key economic developments, and consequently the appropriate monetary policy stance, with a view to fostering public expectations of low, sustainable and predictable inflation.

1.2   The medium-term inflation objective of 3 – 6 percent represents the Bank's view of price stability and is considered to be consistent with sustainable long-run growth of the economy. In addition to promoting growth, low inflation that is close to that prevailing in the country's trading partners contributes to attaining stability of the real effective exchange rate (REER).

1.3   As projected at the beginning of the year, inflation fell in the first half of 2009, in the context of weaker output growth and lower fuel prices, and decreased from 13.7 percent in December 2008 to 7 percent in June 2009.[1] Given the outlook for benign price pressures over the medium-term and the risk of a decline in output expansion emanating from the deterioration in global economic performance, the Bank reduced the Bank Rate by a cumulative 400 basis points in the same period (December 2008 – June 2009). Looking ahead, inflation is expected to fall within the objective range in the short term and, subject to the balance between the assessment of expected downward trajectory and the upside risks, it allows scope for monetary policy to remain supportive of the envisaged recovery of GDP.

1.4   While world economic performance continues to be weak, with GDP growth for 2009 projected at −1.4 percent (3.1 percent in 2008), the monetary and fiscal stimuli as well as liquidity and financial support to banks and industry across the world appear to underpin the imminent global economic recovery. The world economy is, therefore, forecast to expand by a faster (albeit low) rate of 2.5 percent in 2010. The improved performance, however, still largely depends on the resumption of normal financial intermediation under enhanced supervisory standards, continuation of open and free international trade and support for vulnerable economies.

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1   Inflation fell further, to 6 percent, in July 2009.

2. Monetary policy framework

2.1   The monetary policy objective is anchored on the attainment of price stability, as defined by the medium-term objective range of 3 – 6 percent. A low and predictable level of inflation contributes to the broader national objectives of sustainable growth and development through promoting savings mobilisation, fostering productive investment and facilitating international competitiveness of the domestic industry.

2.2   The Bank's policy framework entails a forecast-based and forward-looking monetary policy strategy with a medium-term focus. The medium term is defined as a three-year rolling period, which is considered a reasonable time frame over which monetary policy can affect price developments. The policy is guided by the medium-term forecast for inflation, as derived from an assessment of prospective developments for various determinants of inflation. Among the influences on inflation are demand conditions, changes in administered prices and consumption taxes, as well as public expectations with respect to the rate of price changes. The Bank uses interest rates and open market operations to influence demand and, ultimately, price developments in the desired direction. However, the policy response to inflationary pressures is premised on an assessment of the sources of inflation. In particular, there is a distinction between factors with a transitory impact, associated with changes in administered prices and consumption taxes, and those likely to have a lasting influence on inflation, such as changes in demand conditions. Meanwhile, the alternative measures of inflation, including headline, the 16 percent trimmed mean and inflation excluding administered prices, are indicative of the sources of inflation and serve to explain price developments.

2,3   Operationally, the policy framework encompasses regular meetings of the Monetary Policy Committee, which reviews inflation forecasts and the monetary policy stance to take account of ongoing changes in economic circumstances that affect the outlook for the determinants of inflation. Therefore, the Bank is able to respond in a timely manner to prospective developments that would lead to a significant (and lasting) deviation of inflation from the objective range. High and volatile inflation is detrimental to economic growth as it discourages financial saving and generates uncertainty for investment decisions; and it quickly erodes the purchasing power of incomes, hence reducing living standards. On the other hand, sustained periods of low or rapidly falling inflation could be indicative of a decline in economic performance, which could require monetary policy easing to stimulate growth.

2.4   Achieving the Bank's inflation objective also contributes to stabilisation of the real effective exchange rate (REER), which helps to promote international competitiveness of domestic industries. In the

context of the crawling band exchange rate arrangement, and in the event the inflation objective remains higher than inflation in trading partner countries, the Bank implements a continuous adjustment of the nominal effective exchange rate to maintain stability of the REER.

2.5   An integral part of formulating and implementing monetary policy is communicating the Bank's framework to stakeholders, as well as apprising the public on economic developments, inflation outlook and the factors considered in determining the monetary policy stance. Such communication is done through, among others, the Annual Reports, Monetary Policy Statements (and mid-term reviews), economic briefings and press releases following Monetary Policy Committee meetings. In addition to the duty of accountability, transparency enhances public understanding of the policy framework, which promotes policy credibility and the degree to which the Bank could succeed in influencing inflation expectations and maintaining price stability.

3. INFLATION IN THE
FIRST HALF OF 2009

CHART 1: BOTSWANA INFLATION (JANUARY 2004 - JUNE 2009)
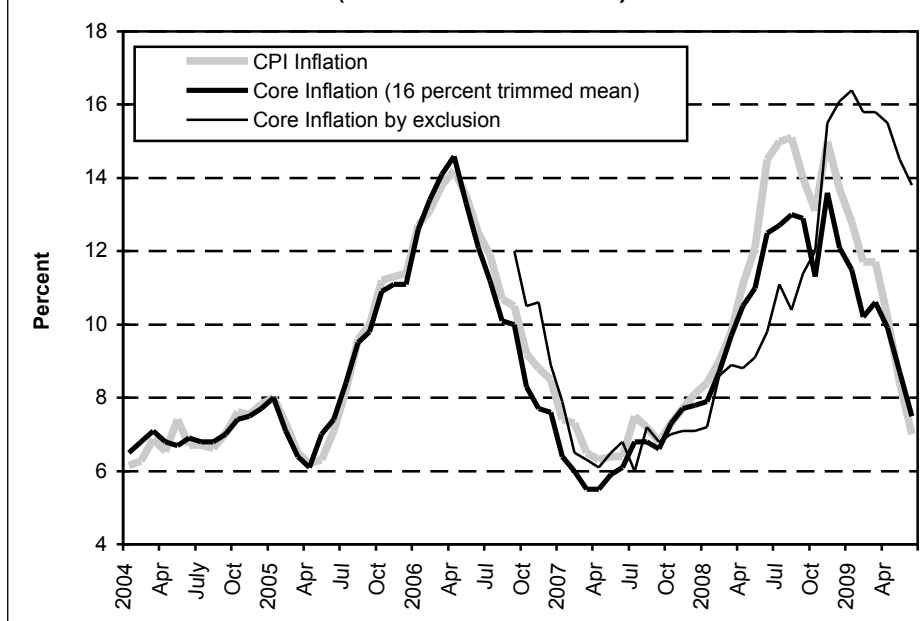
CHART 2: INTERNATIONAL INFLATION (JANUARY 2004 - JUNE 2009)

3.1   Inflation maintained a downward trend in the first half of 2009, largely reflecting the impact of changes in fuel prices. In addition to the decrease in fuel prices, the effect of the large fuel price increases in the first half of 2008 dropped out of the inflation calculation. Overall, inflation declined from 13.7 percent in December 2008 to 7 percent in June 2009, but was above the upper end of the Bank's medium-term inflation objective range of 3 – 6 percent.[2] Both measures of core inflation (16 percent trimmed mean and core inflation excluding administered prices) also decreased from 12.1 percent to 7.5 percent and from 16.1 percent to 13.8 percent, respectively. The higher level for the latter is due to the absence of the impact of the fuel price decrease in this measure.

3.2   Average inflation for the trading partner countries also trended downwards, falling from 6.5 percent in December 2008 to 3.9 percent in June 2009, against the background of weak global economic performance and the substantial decline in international commodity and oil prices in the second half of 2008. In South Africa, headline inflation,[3] which is now the target measure for the South African Reserve Bank (SARB), eased from 9.5 percent in December 2008 to 6.9 percent in

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2   Inflation fell to 6 percent in July and, therefore, is equal to the upper end of the objective range.

3   The SARB replaced the CPIX with the headline inflation as the target measure of inflation at the beginning of the year and also revised the CPIX. Headline inflation is compiled from all the primary and secondary urban areas in which CPI data are collected. The revised CPIX excludes owner's rent which is based on rentals paid for similar residential houses as those found in the owner-occupier market, while the old CPIX excluded interest rates on mortgage bonds from the headline inflation.

June 2009, due to lower rates of increase for energy and food prices. Nevertheless, South African inflation was above the target range of 3 – 6 percent in the first half of 2009. For the SDR countries, which include economies that were in recession in the first half of the year, inflation decelerated from 0.7 percent to –0.8 percent.

3.3   On the domestic front, the previous year's upward influence of fuel and food price increases on inflation was substantially reduced in 2009 (Chart 3). Notably, the annual change in the cost of fuel decelerated from –4.9 percent in December 2008 to –37 percent in June 2009, due to the combination of price reduction in the second half of 2008 and the impact of last year's large increase dropping out of the inflation calculation. Meanwhile, the year-on-year increase in food prices decreased from 24.9 percent in December 2008 to 15.3 percent in the same period.

3.4   Imported tradeables inflation fell significantly from 11.9 percent in December 2008 to 0.4 percent in June 2009, thus reflecting the impact of the decrease in the cost of fuel, as well as lower food price increases. Domestic tradeables inflation also decreased from 26.4 percent in December 2008 to 18 percent in June 2009. The higher level of domestic tradeables inflation reflects the impact of the 30 percent additional tax on alcoholic beverages that was introduced in November 2008. Overall, all tradeables inflation eased significantly from 16.3 percent to 6.5 percent over the same period. Meanwhile, non-tradeables inflation rose from 6.4 percent in December 2008 to 9.8 percent in January 2009, before decelerating to 8 percent in June 2009 as the previous year's increase in electricity tariffs and transport fares dropped out of the inflation calculation.

3.5   Demand pressures on inflation were generally low in the context of the deteriorating world

CHART 3: DECOMPOSITION OF THE CPI (JANUARY 2004 - JUNE 2009)
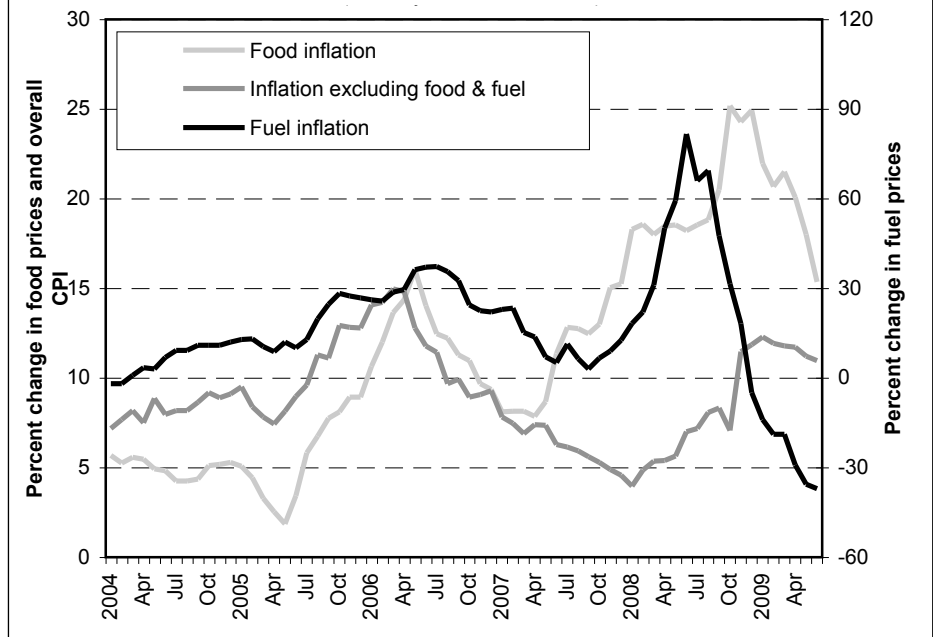
CHART 4: CONTRIBUTION OF FOOD, FUEL AND OTHER ITEMS PRICE CHANGES IN NATIONAL INFLATION (SEPTEMBER 2007 - JUNE 2009)
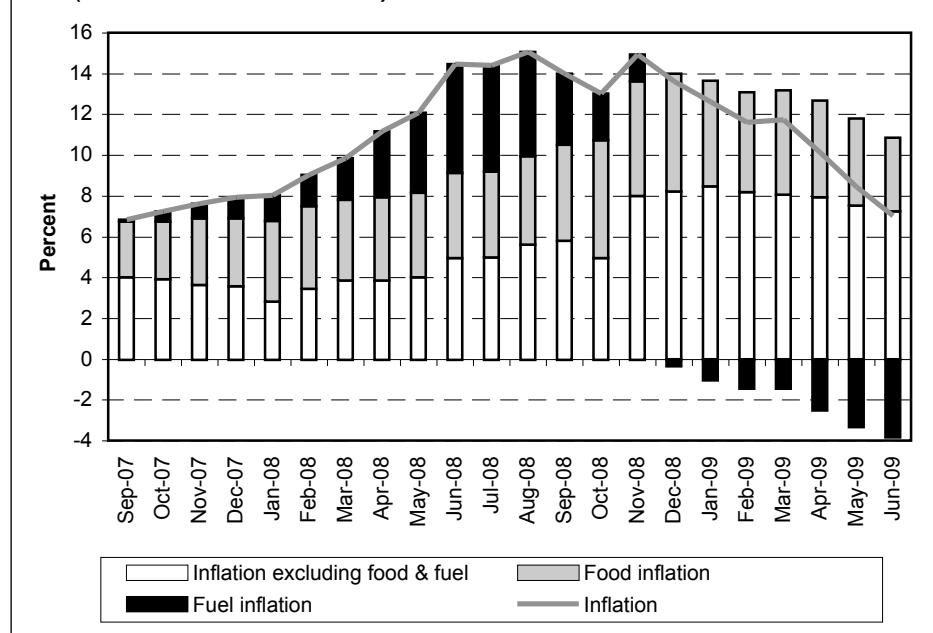
economy that had an adverse impact on domestic economic activity, particularly mining output. In the first quarter of 2009, diamond production was 68.6 percent lower than output for the same period last year and, as a result, the first quarter GDP contracted by 20.3 percent. In contrast, the robust performance of the non-mining sector was maintained, with annualised first quarter growth of 9.3 percent and strong performance of agriculture (14.1 percent), finance and business services (16 percent), and construction and social personal services, which both expanded by 12.9 percent.

3.6   While there was virtually no contagion from the global financial crisis to the domestic banking

system,[4] the private sector credit growth was 4.3 percent in the first six months of 2009, and much slower than the 9.4 percent for the corresponding period in 2008. Indeed, lending to private businesses fell by 4.1 percent (compared to 15.2 percent growth in 2008) while household borrowing increased by 10.6 percent (compared to 5.5 percent in 2008). Credit expansion in the twelve month period to June 2009 was 22.3 percent, lower than the 27 percent for the year to June 2008. Although credit expansion continues to support output expansion, there is evidence of a slowdown in monetary growth and this is reflecting a more cautious lending environment, reduced demand for bank financing associated with slow economic activity, and an increase in loan loss provisions. The upward income effect on household borrowing during this period was limited by the absence of an across-the-board wage increase for civil servants in 2009, which would normally be replicated by other employers.

3.7   The government expenditure programme for 2009/10 was subject to review in the light of lower revenue, and thus potentially reducing the impact of public spending on economic activity and contributing to the lacklustre GDP expansion. Nevertheless, recurrent and development expenditures in the fiscal year to March 2009 were robust and 41.2 percent higher than spending for the corresponding period in 2008; this compares with the original budget estimate of a 14.7 percent increase in expenditure.[5] For the fiscal year 2009/10, the deficit of P13.4 billion announced in the February 2009 Budget Speech, and representing annual expenditure growth of 5.3 percent, is likely to be significantly reduced in the context of the 5 – 7 percent cut in budgeted expenditure and the ongoing review and prioritisation of projects. However, the Government still maintained a countercyclical stance and has secured an external loan to finance

the deficit,[6] while domestic bond proceeds continue to be earmarked for the development of tertiary education infrastructure.

4. MONETARY POLICY IMPLEMENTATION IN THE FIRST HALF OF 2009

4.1   The projections for both inflation and output were largely unchanged from the prognosis made at the beginning of the year. Nevertheless, there were signs in the first half of the year of a quicker global economic recovery than earlier anticipated, which would also imply a shorter period of output contraction in Botswana (Chart 8). There was also a risk of inflation being higher and a delayed return to the medium-term objective range than earlier projected, especially taking account of price developments in South Africa and recovery in international oil prices.[7]

4.2   Overall, with the decline in the rate of price changes expected to continue and inflation expected to fall towards the medium-term objective range of 3-6 percent, monetary policy was eased in the first half of 2009, thus providing stimulus to economic activity in the face of downside growth risks associated with the intensification of the impact of the global economic deterioration. The Bank Rate was

CHART 5: GLOBAL OUTPUT FORECASTS (2008 – 2010)
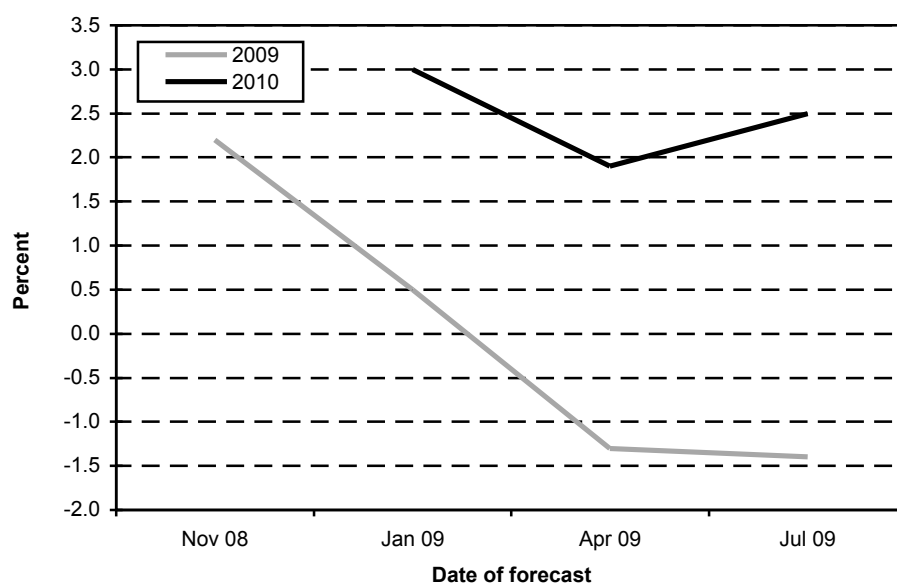
Source: World Economic Outlook, International Monetary Fund.

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4   The first round effect of the global financial crisis on the domestic banking system has been limited due to a low level of foreign exposure and the absence of risky derivatives in their operations. However, there could be a second round impact on the asset quality and profitability of banks emanating from the effect of weak domestic economic activity and income losses.

5   The growth in government spending by 41.2 percent compared to the budgeted 14.7 percent was due to supplementary expenditure authorised by Parliament in December 2008.

6   The Government has negotiated a loan of USD1.5 billion (approximately P10.5 billion) from the African Development Bank to help finance the deficit.

7   It is noted, however, that the forecast for South African inflation includes the impact of the 31.3 percent increase in electricity tariffs by ESKOM, which would have no immediate direct effect on prices in Botswana (to the extent that the Botswana Power Corporation does not replicate the ESKOM tariff increase).

CHART 6: INTEREST RATES (JANUARY 2006 – JUNE 2009)

Chart 6: Interest Rates
(January 2006 - June 2009)
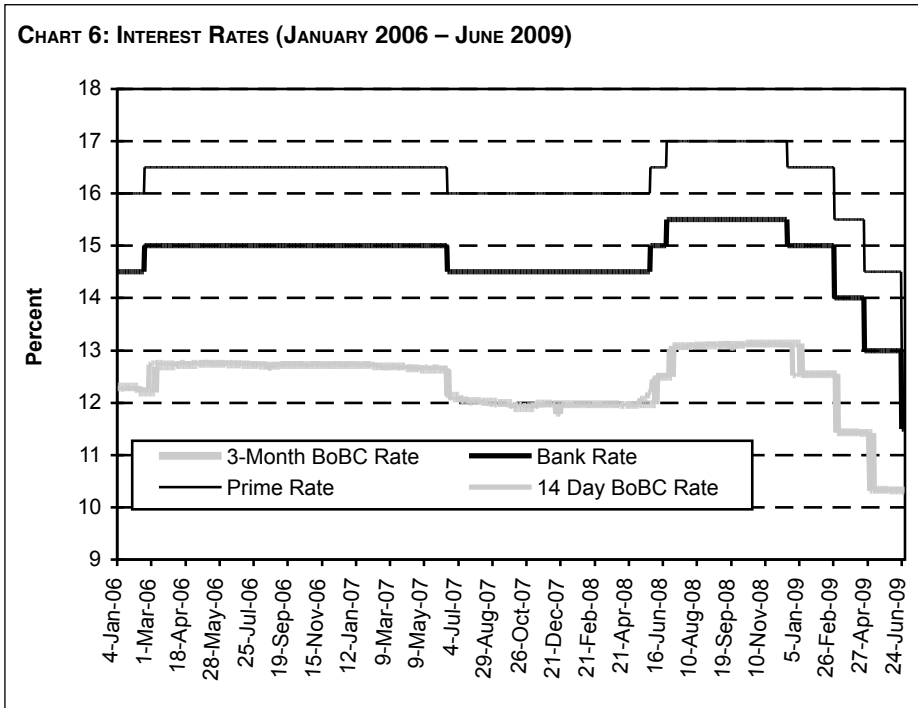
2008 to 1.55 in June 2009, and for the 3-month BoBC the real rate rose from –0.5 percent to 1.6 percent in the same period (see footnote 7). Similarly, the real prime lending rate rose from 2.46 percent in December 2008 to 5.61 percent in June 2009, while the real 91-day deposit rate increased from –4.55 percent to 0.6 percent.

4.4 As domestic inflation remained higher than the average inflation of trading partner countries, the nominal exchange rate of the Pula crawled downwards. Therefore, the nominal effective exchange rate (NEER) depreciated by 1.3 percent in the six month period to June 2009. The Pula appreciated by 9.9 percent against the SDR, mostly reflecting the 10.7 percent strengthening against

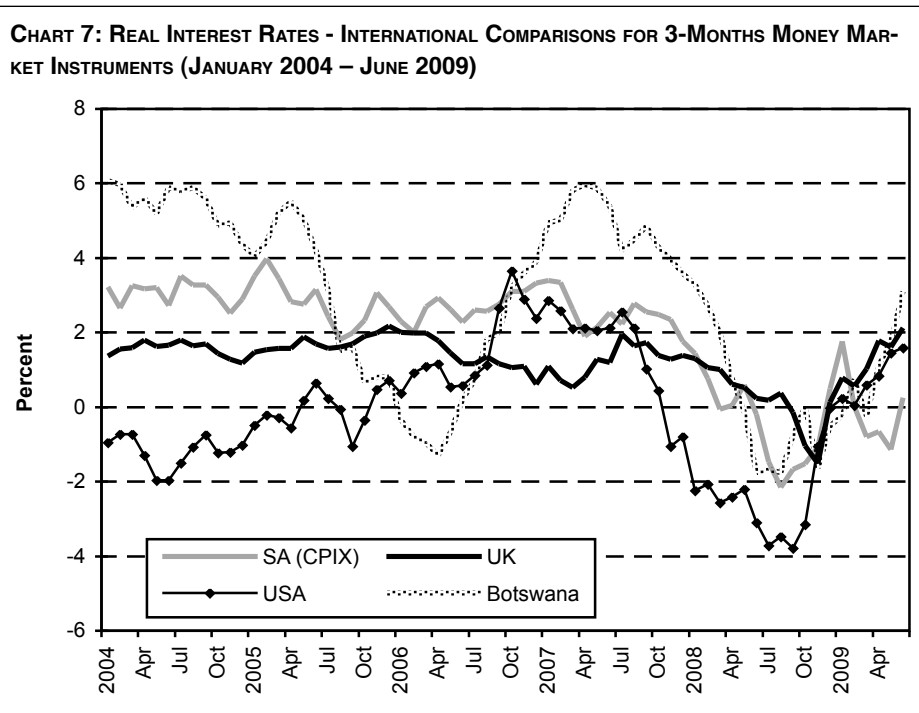reduced by 100 basis points each time in February and April 2009 and by 150 basis points in June 2009 to 11.5 percent. In response, money market interest rates fell (Chart 6). The average prime lending rate of commercial banks decreased from 16.5 percent at the end of December 2008 to 13 percent in June 2009, while the 91-day deposit rate fell from 8.53 percent in December 2008 to 7.64 percent in June 2009.[8] The yield on the 14-day BoBC decreased from 12.55 percent at the end of December 2008 to 8.66 percent in June 2009, while the 3-month BoBC yield fell from 13.13 percent to 8.71 percent.[9]

4.3 Given the faster decrease in inflation, real interest rates rose (Chart 7). The real interest rate for the 14-day BoBC increased from –1.01 percent in December

CHART 7: REAL INTEREST RATES - INTERNATIONAL COMPARISONS FOR 3-MONTHS MONEY MARKET INSTRUMENTS (JANUARY 2004 – JUNE 2009)

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8 In March 2009, the Bank directed commercial banks to maintain an anchor 91-day deposit facility paying Bank Rate minus 4 percent. This was done partly to influence symmetric changes for both deposit and lending interest rates in response to Bank Rate adjustments, with a view to ensuring a more efficient policy transmission process, and in order for policy adjustments to have the desired effect in influencing saving and borrowing decisions.

9 The 8.71 percent for the 3-month BoBC was recorded at the July 2009 auction, which is the earliest auction date for this instrument following the June 2009 reduction in the Bank Rate.

the US dollar. With imminent prospects for global economic recovery, the US dollar (which previously benefited from the flight to quality (safe haven) phenomenon), weakened as investors shifted to higher yielding emerging market portfolios. In turn, the Pula depreciated by 8.1 percent against the rand, which benefited from the same shift in portfolio

holdings. The real effective exchange rate (REER)[10] of the Pula depreciated by 0.6 percent in the six months to June 2009 due to both the narrowing of inflation differentials with trading partner countries and the nominal depreciation against the rand. In effect, the rate of crawl more than offset the inflation differential, thus reversing part of last year's appreciation of the REER.

4.5 Movements in interest rates and the Pula exchange rate are reflected in changes in the real monetary conditions index, which measures the relative tightness and easiness of financing conditions in the economy. As shown in Chart 10, with the progressive reduction in interest rates, the fall in inflation and narrowing of inflation differentials vis-à-vis the average inflation of trading partner countries, real monetary conditions loosened, potentially facilitating domestic demand-led stimulus to economic activity, as well as enhanced international competitiveness of the domestic industry.

5. MEDIUM-TERM INFLATION OUTLOOK

5.1 The forecast inflation path is determined by a combination of, among others, prospective developments with respect to demand-pull pressures resulting from real economic activity, imported inflation and other exogenous factors, such as changes in administered prices. The external influences on domestic prices include economic and financial developments in South Africa, which is Botswana's major trading partner, as well as global events, such as changes in international commodity prices and demand in major markets.[11]

5.2 South Africa's GDP growth is projected to decelerate from 3.3 percent in 2008 to 1.1 percent in 2009, mainly reflecting the decline in manufacturing and mining output, as well as sluggish domestic demand conditions. Despite the forecast output contraction and the associated downward pressures on inflation, there are upside risks to the inflation outlook emanating from a 31.3 percent increase in ESKOM electricity tariffs.

Overall, South Africa's annual headline inflation is projected to remain above the upper end of the 3–6 percent inflation target for the whole of 2009. In the context of sluggish economic activity, the South African Reserve Bank is expected to maintain the current easy monetary policy stance, but with a reduced likelihood of further interest rate cuts in the short term.

5.3 World economic performance remains weak, with output forecast to decline by 1.4 percent in 2009, from an estimated growth of 3.1 percent the previous year, before recovering to 2.5 percent in 2010. The forecast contraction in global economic activity in 2009 is attributed more to weaker performance in advanced economies and the concomitant contraction in trade flows (Chart 8). It is expected that the stimulus packages and financial support to the financial system and other industries, as well as enhanced bilateral and multilateral support for vulnerable economies, would contribute to a quicker economic recovery. It is, however, projected that growth will remain significantly lower than long-term potential. In the circumstances, global inflation remains low and is forecast to average 2.5 percent for 2009. However, there is an upside risk to the inflation outlook due mainly to uncertainties with respect to developments in international oil prices (around USD70 in July from a low of USD44 in December 2008).

CHART 8: EXPORT, IMPORT AND GDP QUARTERLY GROWTH ESTIMATES AND FORECASTS FOR DEVELOPED ECONOMIES
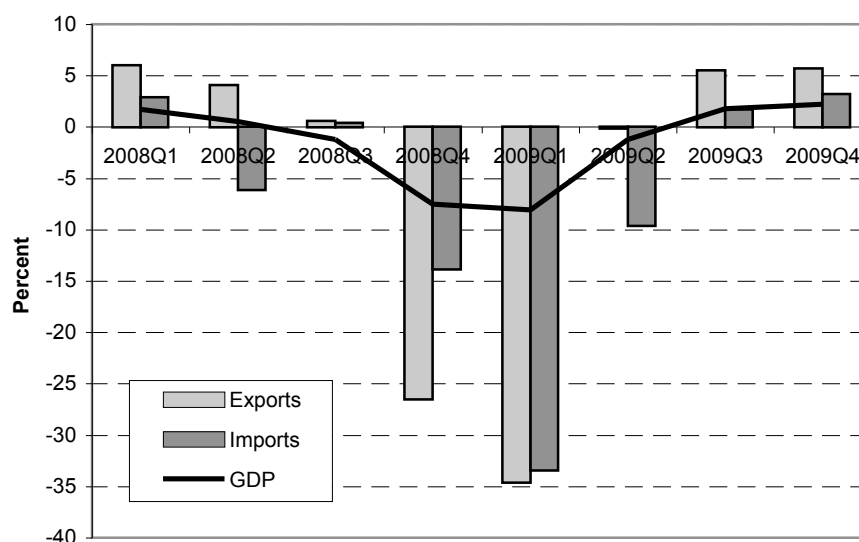
Notes: 1. Developed economies include USA, UK, Euro area, Japan, Norway, Canada, Australia, Sweden, New Zealand and Switzerland
2. Data for 2008Q1 – 2009Q1 are estimates, while those for 2009Q2– 2009Q4 are projections
Source: JP Morgan

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10 The REER is calculated using the weighted average inflation for the SDR countries and South African CPIX inflation.

11 Forecasts for external variables are obtained mainly from the Reuters survey of forecasters.

5.4 The domestic economy, which contracted in the last quarter of 2008 and the first quarter of 2009, is projected to have recovered to positive growth in the second quarter, largely reflecting developments

in the world economy and the consequent beneficial impact on the diamond sector; this trend is expected to be sustained going forward. However, it is expected that output will remain below the long-term trend, with the resultant negative output gap signifying low demand pressures on inflation over the medium term. The March 2009 Business Expectations Survey (BES) revealed widespread pessimism among both the domestic and export-oriented firms. Overall, business confidence had declined from 82 percent in the September 2008 survey to 40 percent in the March 2009 survey. Businesses, nevertheless, anticipated positive output growth in 2009/10, possibly buoyed by government efforts to maintain spending at levels sufficient to support growth outside the mining sector. While the government will incur a large budget deficit to support economic activity, expenditure growth will be at a lower level given the ongoing project review. It is also anticipated that expansion of credit to the private sector will continue to slow in the context of lower growth in economic activity, more cautious lending approach by banks and restrained demand for credit, as well as a moderate increase in personal incomes. In this regard, the March BES indicated much reduced expectations of additional borrowing, from both domestic and external sources.

5.5   The narrowing inflation differentials between Botswana and the trading partner countries suggest continuance of a marginal downward rate of crawl with virtually no upward pressure on inflation. However, market forecasts suggest that the rand will appreciate in the short term and the resultant depreciation of the Pula against the South African rand will exert some modest upward pressure on domestic inflation. Additional upside risks to the inflation outlook include possible large increases in administered prices, notably an increase in electricity tariffs in the context of higher power import costs and to recover the costs of expansion of generation and supply infrastructure. Meanwhile, the March 2009 BES shows expectations of a decline in inflation, with businesses anticipating lower rates of increase for business costs, including raw materials and wages. Overall, the Bank forecasts that inflation will, in the short to medium term, stabilise around the objective range (Chart 9).

Chart 9: Botswana Inflation Forecast (December 2008 - March 2011)
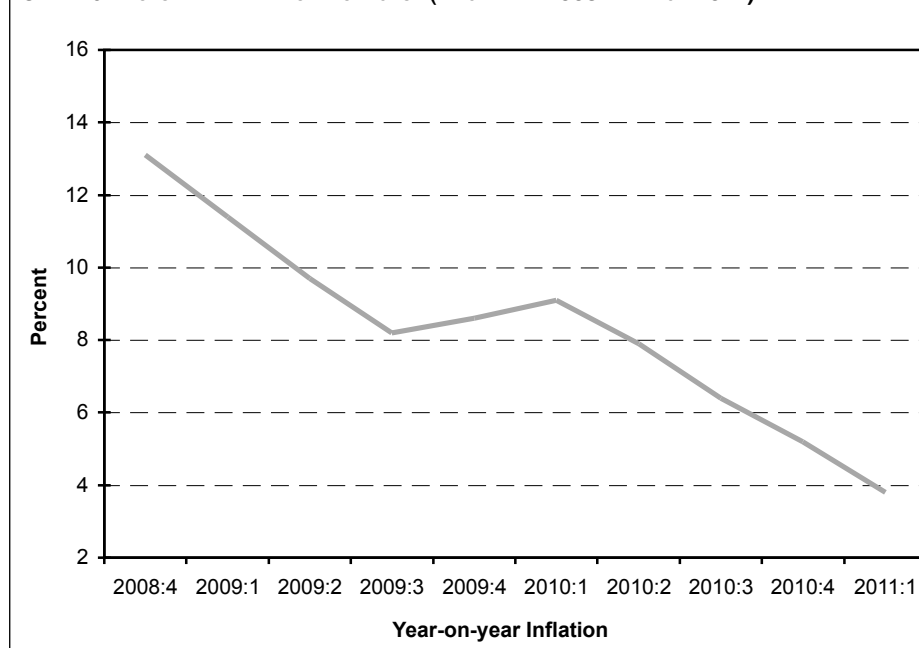
6. Monetary policy stance

6.1   The recent and prospective economic developments indicate a continuation of sluggish economic growth, due to lower external demand, a reduced rate of government expenditure growth and a slower rate of monetary expansion. While it is anticipated that output expansion will resume following negative growth in the last quarter of 2008 and first quarter of 2009, in Botswana and globally, it is forecast that the ensuing rate of increase in output will be lower than the long-term trend. In turn, both the external and domestic demand pressures on inflation will continue to be low. In addition, there are base effects of the large impact of last year's 30 percent alcohol levy dropping out of the inflation calculation; hence the forecast for a further decline in inflation. On the other hand, the projected decrease in inflation provides scope for maintenance of expansionary monetary policy to support domestic economic recovery, particularly in an environment in which fiscal stimulus is constrained by the fall in government revenues.

6.2   However, there are significant threats to the positive inflation outlook, notably the threat of an increase in fuel prices which has potential for wide-ranging second-round effects. In addition, the Botswana Power Corporation faces an increase in costs after the main supplier, ESKOM, was given permission to raise tariffs. Furthermore, in order to help finance expansion of the power supply infrastructure, there could be a large and inflationary increase in local electricity tariffs. In addition, there remains a possibility of an upward adjustment of other administered prices and consumption taxes, as well as government levies, particularly given the strain on fiscal resources. However, such one-off price developments would be transitory and, to the

extent that the second-round impact and expectations are contained, would not result in a continuous rise in inflation.

6.3 Overall, output projections and prospects for monetary expansion indicate benign upward pressures on inflation. Except for a sustained increase in fuel prices, the effect of changes in other administered prices and taxes would be transitory. The important thing, however, is taking appropriate and timely action to contain second-round effects and to manage expectations. As reflected in Chart 10, going forward, the projected movements in real exchange rates and real interest rates, as well as narrowing inflation differentials vis-à-vis trading partner countries suggest less tight monetary conditions.[12]

Rate by 400 basis points between December 2008 and June 2009.

7.2 It is anticipated that external inflationary pressures will continue to be restrained due to weak demand and slack labour market conditions (hence, low wage pressures) and stabilisation of commodity prices at lower levels than in the previous year. Weaker domestic economic activity, a lower rate of increase in business costs and restrained growth in personal incomes will also moderate demand pressures on inflation. There remain upside risks to inflation due to uncertainty on international oil price movements and a possible large increase in administered prices. Overall, it is expected that inflation will stabilise around the medium term objective range in the short to medium term.

Chart 10

CHART 10: REAL MONETARY CONDITIONS INDEX (RMCI) (DECEMBER 2008 – MARCH 2011)
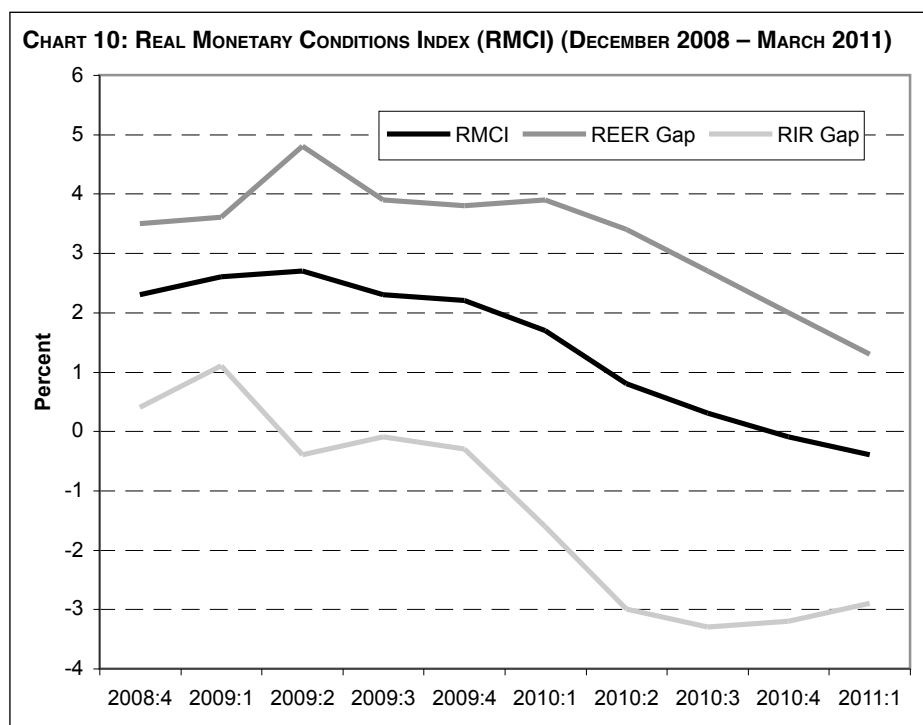
7.3 In the circumstances, the prevailing monetary policy stance that is characterised by a monetary easing bias remains appropriate in the short term and supports a recovery of economic activity, including maintenance of robust performance of the non-mining sectors. The Bank will continue to monitor economic and financial developments with a view to responding appropriately to ensure medium-term price stability without jeopardising the anticipated economic recovery and growth.

7. SUMMARY AND CONCLUSIONS

7.1 Inflation eased in the first six months of 2009, thus continuing a trend that started in the last half of last year, mainly influenced by the decrease in fuel prices and in the context of low domestic demand pressures, as well as a benign external inflationary environment. While inflation remained above the Bank's medium-term objective range of 3 – 6 percent in the period under review, the medium-term outlook of low inflation enabled the Bank to ease monetary policy, reducing the Bank

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

The Importance of Sound Metadata Management for the Production of Quality Statistics – Botswana's Case

Sabata Legwaila[1]

Abstract

The paper outlines Botswana's experience of attaining modern data production standards through metadata management. While the main focus is those statistics that are produced by the Bank of Botswana, the importance of equivalent developments in other areas is acknowledged. The timely availability of quality statistics is important for the formulation of appropriate macroeconomic and financial policies. Throughout modern economies, whether in Government, private businesses or civil society, users require up-to-date and accurate statistics, especially given that credibility is key to policy effectiveness. Like other modern and upcoming economies, Botswana has come to recognise the importance of quality, timely and transparent statistics, the production of which is guided by internationally accepted standards. Metadata must be easy to understand and not only address the content of the data, but also provide avenues for users to make follow-ups with producers. An essential component for any metadata is outlining appropriately prioritised plans for improvement and following up on their implementation. Effective cooperation between statistics producing agencies is essential in order to realize plans to graduate to higher standards of statistics production.

Introduction

The purpose of this paper is to outline Botswana's experience of attaining modern data producer stan-dard through metadata management.[2] In addition, the paper also explains the benefits that the country has achieved regarding improved statistics, and the way forward in utilising modern day data and metadata management systems. The main focus of the paper is on the country's experience with the production of monetary and balance of payments statistics. But the efforts made in statistics in other areas aimed at addressing the many challenges that still exist are also important.

The timely availability of quality statistics is important for the formulation of appropriate macroeconomic and financial policies. Therefore, the importance of good quality statistics cannot be overemphasised. Throughout modern economies, whether in Government, private businesses or civil society, users require up-to-date and accurate statistics, especially given that credibility is key to policy effectiveness. Like other modern and upcoming economies, Botswana has come to recognise the importance of quality, timely and transparent statistics, the production of which is guided by internationally accepted standards.

Due to the demand for high quality statistics by users, producers emphasise producing statistics that are timely, internationally comparable and transparent. For there to be transparency, there is need to document the processes of data production through the use of metadata. Metadata is simply a description of how the data are produced; be it the production processes, description of concepts and terminology, classification and standards, statistical methods and software used, as well as the economic units that generated the data. Metadata are essential in all stages of the production process in order to assist the user understand the data in the context of how it has been produced. Users can utilise sources of information more effectively if they know the definition of concepts and classifications together with the various stages of production. There is, therefore, a wide variety of metadata systems being developed by specialists in various fields, some simple and others more sophisticated in relation to their compilation and management (Lukhwareni *et al*, 2005).

One of Botswana's objectives is to produce high-quality statistics. This has taken the form of the country's active participation in international initiatives of data improvement, mainly based on the standards developed by the International Monetary Fund (IMF). This has been made possible by financial assistance given by the United Kingdom Department for International Development (DFID). Such efforts have helped strengthen capacity to produce a broad range of official statistics in Botswana, compiled by several agencies, through a focus on metadata issues.

The rest of the paper will cover the following: overview of models of data and metadata systems,

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1 Principal Economist (Statistics and Information Services), Research Department. An earlier version of this paper was presented at the conference of the International Statistical Institute (ISI), held in Durban, South Africa in August 2009. The views expressed in this paper are those of the author and do not necessarily represent those of the Bank of Botswana or the ISI.

2 Metadata describes countries' practices with respect to the production and dissemination of statistics.

which gives a basis for national data systems; background information on steps leading to improvements in Botswana's data quality; metadata management efforts and benefits; lessons and challenges and, finally, a conclusion.

AN OVERVIEW OF MODELS OF MODERN DATA AND METADATA SYSTEMS

Data are public goods and, for this reason, their production cannot be limited to use by officials or nationals only. The interconnections of the world's economies require the availability of quality data to inform timely and well-based policy decisions. This is in order, for example, to counter macroeconomic instability, such as the recent global recession and financial turmoil. Ultimately, the value of statistics depends upon their accessibility, quality, timeliness, dissemination, validity and controls (World Bank, 2002), which in turn depend on the credibility of the methods and standards used in the statistics production. Similarly, in a globally competitive environment, business services depend on availability of national, international, and transnational data for policy formulation and evidence-based decision making at national and international levels. In other words, national data enter the international statistical systems, where standardisation is necessary to produce consistent, international data sets. Accordingly, models of national data are, to a large extent, influenced by international data systems and models.

International organisations, including the IMF and World Bank, play an important role in statistical development by promoting and implementing internationally agreed standards, methods and frameworks for statistical activities. These, and other international institutions, have a stake in national statistical systems; hence, they help to ensure that the processes for the compilation of statistics are based on common methods. These enable international comparisons of statistics and enhance coherence of information content and interpretation through the use of standardised concepts and definitions. By providing a common basis for comparison, international guidelines make statistics more useful and offer more transparent reporting of outcomes. The approach also permits the establishment of benchmarks or standards against which national statistical systems can measure their performance, and strive to reach even higher standards. This has led statistics producers to adopt models that meet modern data needs, and put in place metadata systems that not only enhance transparency, but also increase ease of usability.

IMPROVEMENTS OF QUALITY OF STATISTICS IN BOTSWANA

Background to Statistical Developments in Botswana

To be effective, statistical systems must be backed by legislation that provides the safeguards of confidentiality for the providers of raw data and assurances of data integrity and accessibility by users. The nature and organisation of national statistical agencies vary from country to country. In decentralised systems, separate agencies have independent mandates to compile and disseminate statistics in particular areas. But even in highly centralised systems, responsibilities may be divided among different agencies and institutions. Generally, a national statistical system is made up of agencies whose activities are typically coordinated by legislation, administrative practices and professional standards, which is essential for avoiding discrepancies in data. For example, central banks usually collect data on money and banking and other areas such as the balance of payments.

In Botswana, there is enabling legislation governing the collection of data by the various agencies. However, the main agency responsible for producing national statistics is the Central Statistics Office (CSO), which is due to be transformed from a government department into an autonomous agency.[3] The Bank of Botswana produces the balance of payments and monetary statistics, while the Ministry of Finance and Development Planning (MFDP) is the source of government finance statistics. Inter-agency coordination in statistics production is provided through working groups and a high-level Statistics Producers Committee (SPC), comprising representatives from the three institutions. The overall objective is to promote good governance in the production of statistics, including transparency and accountability. In turn, these guide policy formulation and decision making by stakeholders, including government, households and businesses.

Although the CSO has for many years produced relatively reliable statistics, the efforts towards a coordinated approach for an overall framework of good statistical processes started in 2001 following the IMF mission to prepare a Report on the Observance of Standards and Codes (ROSC) on standards of national statistics in Botswana.[4] The report assessed statistics covered by real sector, prices, government finance, monetary and balance of payments, against benchmarks set out in the

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3   At the time of writing, the CSO operates as a government department under the provisions of the Statistics Act (1967). However, in October 2009 a new Statistics Bill was gazetted for discussion by Parliament, which will establish for the new autonomous body, to be called Statistics Botswana.

4   See Appendix 1 for a summary of the mission.

IMF's Data Quality Assessment Framework (DQAF). The report noted that Botswana's statistics were generally of good quality, but needed improvements in both compilation and, more importantly, dissemination frequency and timeliness. Accordingly, since 2001, Botswana has participated in the regional General Data Dissemination System (GDDS) project for Anglophone African countries, for which technical assistance (TA) funded by DFID was provided jointly by the IMF and the World Bank. Initially, the project was intended to last for three years, but was subsequently extended to a second phase up to September 2009, with the possibility of a third phase.

Under the project, the following major recommendations were made under the various statistical areas:

(a) *monetary statistics*: expansion of data coverage to include other depository corporations that were not covered in the then monetary survey and produce a full depository corporations survey; proper application of the concept of residency by banks; banks to submit data electronically; and the need for the development of statistical database software;

(b) *balance of payments statistics*: improving periodicity to quarterly as opposed to annual data as well as improve coverage and/or methodology for various balance of payments items, most importantly trade in services;

(c) *government finance statistics (GFS)*: adopt the 2001 GFS Manual and timely dissemination of central government budgetary accounts as well as compilation of consolidated data of general government (both local and central government); and

(d) *real sector statistics*: acceleration of work programme for implementing *System of National Account (SNA) 1993* with respect to national accounts, production and dissemination of producer price index (PPI) as well as regular 5-yearly updates of the consumer price index weights.

Prior to 2001, except for internal working documents, the Bank of Botswana had no publicly available documentation on how the data were produced. Moreover, while the data were disseminated on a timely and regular basis,[5] there was no publicly available metadata documentation. Thus, apart from relying on past experience, data users had no means of knowing when they could expect to receive data updates, what the policy was regarding revisions; nor did they have confidence that other users did not have more favourable access to data.

Implementing Plans for Improvement

Participation in the Anglophone Africa GDDS Project has led to the development of metadata,

outlining appropriately prioritised plans for improvement, which were first published in the IMF Dissemination Standards Bulletin Board (DSBB) in August 2002.[6] To initiate and assist with the implementation of these plans, the national authorities requested TA from the IMF under both phases of the GDDS Project. A largely ad hoc, country specific approach was used in the first phase; however, in the latter phase a modular approach was adopted under which groups of countries were provided with structured assistance in key areas.

With regard to monetary statistics, the first TA mission took place in 2003. During the follow-up missions in August 2004 and 2005, the range of monetary data was expanded alongside the adoption of the framework recommended by the 2000 *Monetary and Financial Statistics Manual* (MFSM) and data were published using standardised report forms. Other work included the adoption of instrument classification and definitions of institutional units as outlined in the framework recommended by the MFSM and the MFS Compilation Guide.

For balance of payments, the major objective was to compile and publish the quarterly balance of payments accounts; a goal which was achieved in January 2008. However, a remaining challenge is the large errors and omissions which imply significant miss-estimation in one or more of the sub-accounts. This is likely to be due to deficiencies with information collected as part of the quarterly and annual balance of payments survey. Further TA is being sought to help resolve the problem. This commenced with a further IMF TA mission in early 2009, but is also likely to involve other providers of TA.[7]

Efforts over the last few years have focused on ensuring that the monetary and financial and the balance of payments statistics are in conformity with the MFSM and the 1993 *Balance of Payments Manual, fifth edition (*BPM5), which provide practical guidance for compiling statistics in those areas, as well as dissemination issues. Further improvements in this and other areas will continue beyond Phase II of the GDDS project.

Achieving Data Quality through Metadata Management

Besides the need to improve documentation of data production processes, enhancement of metadata quality has to be maintained and managed on an

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5 Principally through two Bank publications: the monthly Botswana Financial Statistics and the Annual Report.

6 Botswana made notable progress in this regard. Prior to the ROSC mission, metadata was a largely unknown concept to compilers of statistics in the country. Nevertheless, Botswana was among the first countries involved in the project to produce and publish metadata on the DSBB.

7 Notably, both the Macroeconomic and Financial Management Institute of Eastern and Southern Africa (MEFMI) and the Commonwealth Secretariat are providing assistance on monitoring private capital flows.

ongoing basis to meet the needs of both users and producers. Following the prompt moves to prepare and post metadata on the DSBB (see footnote 3), this achievement was followed up with deliberate steps to implement the plans for further improvements and these were recorded in the updates of metadata that are undertaken annually. Focusing on metadata issues has helped to highlight what needed to be done to effect improvement, and has also added backbone and discipline to Botswana's statistics production efforts, including improved data quality, dissemination and coordination among agencies and between data sets.

Data Quality Improvements

By implementing plans for improvements with determination, Botswana has made considerable progress in terms of improving the quality of data and its dissemination. For instance, the Bank of Botswana was able to publish the required depository corporations survey within three years of subscribing to the GDDS project. Quarterly balance of payments estimates are also published regularly, although, as noted above, concerns about some aspects of the data remain. Similarly, the CSO has improved quality of key indicators, such as monthly trade statistics.

Improved Dissemination

Similarly, data dissemination has improved. Monetary statistics are submitted on a monthly basis for publication in the IMF International Financial Statistics (IFS), in standardised report formats, and are also published on the Bank of Botswana website[8] each month. Metadata is published on the DSBB and currently updated on an annual basis or when there are new developments to the data. A link to the metadata is provided on the Bank's website, which is currently under review to ensure enhanced data accessibility. These efforts increased data reporting frequency and quality, and has also given rise to closer coordination between the Bank of Botswana, CSO and MFDP, as the key data producing agencies through fora such as the SPC, and a national GDDS committee, comprising representatives from all the three statistics agencies. The close cooperation has resulted in accountability in jointly pursuing agreed goals in terms of data production schedules.

LESSONS AND CHALLENGES

Although the Bank has made significant progress in improving its data, it is evident that, while the country needs to be proactive in taking action where statistics improvements are concerned, the plans and goals need to be so designed as to be achievable in a manageable time frame. Limitations and constraints become clear during regular reviews. For example, the second ROSC mission in 2006

showed how much progress had been and could be expected to be made. In this regard, documenting plans for improvement in the metadata is good for guiding prioritisation for technical assistance. For Botswana, this has promoted clearer prioritisation within and among the three data producing agencies.

This also creates peer pressure for Botswana to benchmark against countries that have achieved higher data quality standards, hence instilling discipline in ensuring perseverance in data improvements efforts. This is facilitated by the regular updates of metadata on the DSBB, which enables users to compare the standards achieved in Botswana with the many other countries, not just in Africa, that participate in GDDS.[9]

Development and improvement of statistics is a continuous process and, therefore, requires careful planning taking into account resource constraints before graduation to the next level, i.e. subscription to the IMF's Special Data Dissemination Standards (SDDS). SDDS is more demanding than GDDS in terms of specific standards that must be both achieved and maintained, and thus requires institutional capacity development and policy review. For example, a wider range of data categories is covered, and countries that persistently fall short of the required standards are identified.[10] Therefore, while Botswana has participated in the module in the second phase of the GDDS project to help her prepare for SDDS, the final decision to subscribe should not be taken lightly.

There can also be a tradeoff among the different dimensions of data standards. For instance, the GDDS emphasises timelines, which could result in an erosion of quality if data is published before it is ready in order to meet the target deadline. There are also practical issues, especially for countries with limited capacity in terms of trained and experienced staff, etc. For such countries in particular, cooperation between data producers and users can make sense, but may risk violating the data dissemination standards relating to equal access for all users. In this context, it can be a challenge for the Bank of Botswana, which is also a major user of statistics, to cooperate effectively with the CSO in the production of statistics (national accounts, for example), without breaching the spirit of this principle.

Capacity constraints also affect suppliers of the raw information that is necessary to compile statistics. These are typically private business that, in a small country such as Botswana tend to be small-scale and limited in number. As such

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8   www.bankofbotswana.bw

9   www.dsbb.imf.org. Currently, 94 coutries participate in GDDS.

10   Additional categories that are covered include foreign exchange reserves (the reserves template), international debt, labour market and production indicators, etc, while requirement in terms of frequency and timeliness of publication are much more stringent than with GDDS.

they may easily suffer from survey fatigue, which contributes to the problem of low response rates that affects surveys conducted by both the CSO and Bank of Botswana.

As noted, subscription to SDDS requires that a high standard is reached simultaneously across a broad range of data categories. For this to be achievable, all the agencies involved need to be supportive of the others, and sensitive to the particular challenges that each may face. An example here, although not strictly relevant to issues of subscription to SDDS, is the cooperation between the Bank of Botswana and the recently-established Non-Bank Financial Institutions Regulatory Authority (NBFIRA) which is important for collecting information about financial institutions outside the banking sector, but which is still in the early stages of developing the necessary capacity.[11]

CONCLUSION

Botswana has gone a long way in improving its statistics, and has done it right the first time, by producing and using metadata to guide the data improvements. The improved coordination among data producing agencies is notable, and the participation of Botswana in the SDDS module of the second phase of the GDDS project, confirms the extent of the progress that has been made. However, subscription to SDDS remains a challenge which will require further time to deal with and should not be rushed. As well as increasing the range of data coverage, further improvements need to be made in terms of accuracy and timeliness, as well as to increase efforts to manage the National Summary Data Page (NSDP) and produce an Advance Release Calendar (ARC), both of which are key requirement of SDDS.[12]

Overall, though there are challenges with respect to graduating to SDDS and capacity constraints, effort are continuing with the assistance of international agencies such as the IMF and the World Bank, in helping with the development of the country's statistics in general through provision of technical assistance and training. In general, there have been marked improvements in the country's statistics. In the period ahead, Botswana will continue to learn from other countries that have succeeded in adopting and utilising modern data models and developing world-class metadata systems to ensure coherence and ease in data production and use.

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11 This is not directly relevant to SDDS, as this does not cover data from banks. However, this could change in the future given the extent to which the recent financial crisis has not been confined to banks.

12 The NSDP is currently published on the Bank of Botswana website, but both access and timeliness of updates could be improved further.

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Appendix 1: Summary on Report on the Observance of Standards and Code Mission

The ROSC Report on Botswana

The IMF ROSC mission commenced in early October 2001 and lasted for two weeks. It focused on the following data categories: national accounts; prices (consumer and producer); government finance; monetary statistics and balance of payments. Neither socio-demographic nor labour market statistics were included at this stage, although the subsequent GDDS project covered some of these areas through the provision of TA.

The final report of the mission was presented to the Government in early December at the same time as the workshop to launch the regional GDDS project, which was held in Gaborone. The report included an assessment of the quality of Botswana statistics together with key short- and longer-term recommendations for improvement. After discussions with the Government and the Bank of Botswana, the report, together with 'The Response of the Authorities', was posted on the IMF website. Overall, the quality of Botswana statistics was generally seen as good, and in some cases very good.

For example, the CPI, on which inflation measures are based, was assessed as being of SDDS quality, and the report emphasised that concerted effort could quickly move Botswana within striking distance of SDDS requirements more generally. The major deficiency in terms of quality was in the area of producer prices, which the CSO candidly admitted was a concern and that assistance would be required to effect necessary improvements.

Another major area where improvements were found to be needed was that of dissemination. This was in terms of both timeliness and availability to all users. Some indication of this can be seen from Table 1, which divides the main ROSC recommendations according to sector. Out of the 31 recommendations, nine (about 30 percent) were in the 'general' category and, of these, eight dealt with dissemination issues ranging from the need to establish advance release calendars to providing more extensive information on methodology, including data limitations. (The ninth was a recommendation regarding the need for training.) Six of these recommendations were identified as achievable in the short term.

Table 1: Botswana ROSC Recommendations

	General	National Accounts	Prices	Government Finance	Monetary Statistics	Balance of Payments	Total
Short term	6 (2)	1 (1)	2 (1)	2 (1)	4 (2)	2	17
Med term	3	2	2	4	1	1 (1)	13
Long term			1				1
Total	9	3	5	6	5	3	31

Note: figures in brackets are the number of recommendations which were given high priority
Source: Botswana ROSC Report

Some of the sector-specific recommendations also dealt with dissemination issues, notably timeliness. The relatively high number of recommendations for government finance was due, in part, to the difficulties associated with incorporating local government finances fully into the framework of regular reporting. A further important conclusion was that, in some areas, production of statistics could be facilitated by improved coordination between agencies. The report noted discrepancies in methodology, delays in communicating necessary information (for instance, the balance of payments relies on various inputs from the CSO such as trade data while in turn, the national accounts require timely balance of payments data), and the potential confusion caused by the various reporting 'years' used across the different sectors.

Source: Bank of Botswana Research Bulletin (2003),

Overview of Initiatives to Promote Convergence in the Context of Regional Integration: An African Perspective[1]

K S Masalila[2]

ABSTRACT

This paper provides an overview of initiatives to promote economic convergence that are geared towards fostering economic integration in Africa. It is found that there is a specific agenda for regional integration in Africa that is supported by the development of institutions, a transition programme and monitoring mechanisms for performance and implementation. Broadly, macroeconomic indicators are converging and are, therefore, less variant across Africa; although their levels generally do not meet the set criteria. In addition, there are frequent slippages in harmonisation efforts and development of institutions, which retard the integration programme. Nevertheless, integration and convergence initiatives incorporate improvements in performance and sustainability of good policies that in the long-term could promote higher levels of investment and durable growth in the continent.

INTRODUCTION

The imperative for regional integration stems from a desire to minimise the cost of trade between nations and facilitate market access that promotes growth of the region's industries, as well as to strengthen the economic power of the combined member states vis-à-vis third parties. For Africa, integration is also a developmental necessity in relation to trade, economic performance, as well as strengthening of policy credibility and effectiveness conducted within a secure and peaceful environment. The organisational and institutional initiatives towards regional integration are expected to ultimately increase intra-regional trade, stimulate regional infrastructure development, improve administrative efficiency of institutions, facilitate higher levels of investment and industrialisation, enhance efficiency of resource allocation, afford cross-country labour/skills mobility and reduce the scope for adverse political influence on macroeconomic policies.

Specific to macroeconomic policy convergence, it is argued that it provides efficiency and growth through the elimination or reduction of exchange rate uncertainty and transaction costs; ensures monetary stability (price stability and lower real long-term interest rates); and helps member countries to cultivate the discipline needed to avoid excessive deficits and unsustainable debts. This paper outlines specific initiatives taken towards regional integration in Africa and efforts being made to attain macroeconomic convergence. The following section outlines the institutional steps towards regional integration for the continent. The next two sections discuss some elements of convergence and the expected benefits, and assess the region's performance with respect to convergence criteria and other expectations arising from regional integration initiatives. The final section covers the concluding observations.

REGIONAL INTEGRATION IN THE AFRICAN CONTEXT

Regional integration initiatives in Africa are undertaken under the auspices of the African Union's (AU) programme of transition to an African Economic Community (AEC) enunciated in the June 1991 Abuja Treaty and the Constitutive Act of the AU adopted in 2000. The African Union has designated regional economic communities (RECs) as the building blocks towards achieving an African Economic Community. In line with the AU integration and transition framework, there are eight recognised RECs, namely, Arab Maghreb Union (UMA); Community of Sahel-Saharan States (CEN-SAD); Common Market for Eastern and Southern Africa (COMESA); East African Community (EAC); Economic Community of West African States (ECOWAS); Economic Community of Central African States (ECCAS); Inter-Governmental Authority on Development (IGAD); and Southern African Development Community (SADC). In addition, there are six other inter-governmental organisations working on the integration agenda: the Central African Monetary and Economic Community (CEMAC); Economic Community of the Great Lakes States (CEPGL); Indian Ocean Commission (IOC); Mano River Union (MRU); Southern African Customs Union (SACU); and West African Economic and Monetary Union (WAEMU). Figure 1 shows the composition of the various RECs and other regional groupings.

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1 This paper was prepared for presentation at the South African Reserve Bank/Irving Fisher Committee Seminar on "Economic and Financial Convergence en route to Regional Economic Integration: Experience, Prospects and Statistical Issues Amidst Global Financial Turmoil". The Seminar was held in Durban, South Africa in August 2009. The views expressed in this paper are those of the author and do not necessarily represent those of the Bank of Botswana, South African Reserve Bank or the Irving Fisher Committee.

2 Deputy Director, Research Department, of the Bank of Botswana. The author is appreciative of useful comments from colleagues in the Bank of Botswana.

As apparent from Appendix Table A1, a feature of these regional inter-governmental organisations, which potentially slows progress towards integration, is their significant overlapping of membership motivated by strategic and political considerations, as well as economic benefits and geographical contiguity. The disadvantages of multiple memberships include difficulties and tardiness in relation to: meeting financial obligations to the RECs; focusing on numerous agendas of each REC; low rates of ratification and implementation of agreed treaties and programmes; incompatibility of some programmes; duplication of effort; and little support for, and/or understanding of RECs in member countries. The other concern with overlapping and uncoordinated membership is with respect to countries belonging to broader regional groupings pursuing economic integration, which also include those that do not belong to the monetary unions, a situation which increases operational problems, as well as complicate the planning for possible future enlargement (Ghosh, Guide and Wolf, 2008). These concerns and impediments to the integration process led the AU Summit held in Banjul in 2006 to put a moratorium on the recognition of new RECs.

The AU programme envisages the gradual integration of African economies through a transition process from establishing free trade areas, customs unions, common markets, monetary unions, culminating in one continental central bank (African Central Bank) and a single currency; initially for the RECs and then for the continent. In a free trade area, the group of countries eliminates tariffs and non-tariff barriers on substantially all trade between them, with each country maintaining its own schedule of tariffs on non-members. For a customs union, the group of countries constitutes a single customs territory in which duties and other restrictive trade regulations are eliminated for substantially all trade between the parties and, in addition, there is a common external tariff applied to trade with non-members. In a common market, in addition to having a customs union, restrictions on the movement of capital and labour are removed, allowing for free movement of goods, services and factors of production. A monetary union augments a common market by establishing a single monetary authority which conducts monetary policy for the union, resulting in introduction of a single currency (SADC FTA Brochure, 2009).

Integration is undertaken based on desirable features of an optimal currency area (OCA)[3] which include the nature and extent of:

(a) price and wage flexibility
(b) financial market integration
(c) factor market integration (capital and labour mobility)

(d) goods market integration
(e) political integration

However, the major drawback of the envisaged economic integration and the adoption of common policies is loss of monetary policy independence for the individual countries. In moving ahead with integration, it is considered that the benefits in terms of trade, optimal policy formulation, enhanced welfare and security, as well as the likely increase in living standards outweigh the loss of policy independence for the individual countries. Moreover, it is argued that over time the desire to work towards economic integration brings its own benefits (Ghosh, Guide and Wolf, 2008, p176). For example, while, initially, weak transaction links and a lack of complementarity in output provide structural reasons for low integration, aggravated by uneven progress in implementing trade liberalisation agreements, targeting a customs union, which would include the elimination of intra-union tariffs and the harmonisation of indirect taxes, leads to progress in economic integration. On process and administrative issues, it has also been noted that a regional approach in key structural areas, such as tariff reduction and harmonisation, legal and regulatory reform, payment systems rationalisation, financial sector reorganisation, investment incentive and tax system harmonisation, and labour market reform enable participating countries to pool their resources and avail themselves of regional institutional and human resources. As a result, the group of countries attains a level of technical and administrative competence that would not be possible on an individual country basis. The regional approach also allows countries to assert their interests from a stronger and more confident position in the international arena (Outtarra, 1999).

In addition, the focus on common and optimal macroeconomic policies ultimately leads to better outcomes with respect to important economic indicators. There is, as well, the desire to foster interregional trade and capital flows, to insulate monetary policy from national politics, and to minimise the adverse impact of global capital flows by pooling reserves. It is noted, for example, that,

> "The European experience suggests two possible benefits, policy credibility and trade and financial integration. Indeed, while the original motivation for European monetary integration in the 1970 Werner Report was fostering greater integration of goods and capital markets in Europe, in the event the impetus for maintaining fixed exchange rates (and eventually adopting a single currency) was to import the Bundesbank's policy credibility to aid disinflation efforts in the early 1980s" (Ghosh, Guide and Wolf, 2008, p186).

Work is, therefore ongoing on the regional integration agenda to develop policies and programmes that would hasten the formation of the AEC; promote intra-African trade; harmonise and coordinate policies and programmes in RECs; as well as

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3 Optimal currency area or region describes a situation whereby a geographical region would maximise economic efficiency by having the entire region share a single currency (Mundell, 1963).

coordinate the development of infrastructure and institutions (Mouyelo-Katoula and Nshimyumuremyi, 2007). In summary, the envisaged phases for transition to AEC are as follows:[4]

(a) creation of regional blocs to be completed by 1999;

(b) strengthening of intra-REC integration and inter-REC harmonisation to be completed in 2007;

(c) establishment of a free trade area and customs union in each regional bloc to be completed by 2017;

(d) establishment of a continent-wide customs union and, therefore, a free trade area to be completed by 2019;

(e) establishment of a continent-wide African Common Market to be completed by 2023;

(f) establishment of a continent-wide economic and monetary union and, thus, also a currency union alongside the pan-African Parliament to be completed by 2028; and

(g) end of all transition arrangements by 2034 at the latest.

Convergence in the Context of Regional Integration in Africa

Convergence in the context of regional integration is essential to establish commonality in an economic region, in particular relating to symmetric economic performance, institutional development, regulation harmonisation, access to infrastructure, as well as policy-making coordination and administrative efficiency. Since economic integration entails a common approach to policy formulation or a central policy-making authority, it is important that this is not constrained by considerations of asymmetry or disparate performance with respect to economic indicators and national institutions. Moreover, in order to have a common effect across the region, centralised policy has to reflect symmetrical developments and need to be transmitted through similar institutions and administrative processes. Symmetry for the region can be assessed in terms of whether: shocks to output are in the same direction; the shocks are of comparable magnitude; and whether aggregate GDP for the region is dominated by movements of one or two members.

In addition to issues of symmetry in economic performance and policy formulation, it is also important to have similar standards and a coordinated approach to the regulation of systemically important institutions such as the financial sector institutions and economic activities; for example, institutions responsible for control of monopolies and competition. Beyond regulation, other considerations relate to harmonisation of legislation, institutions, statistics and administrative processes; especially with respect to tax and trade incentive

structures, tariffs, business and labour laws, as well as payment systems.

The focus on convergence can also improve general governance, adherence to prudent policies, a monitoring framework and, in turn, performance with respect to important economic indicators. Notably, convergence suggests the adoption of the highest standard or optimal policy over which there are monitoring mechanisms and sanctions for non-performance. There is, therefore, self-imposed policy and regulatory discipline that motivates compliance, a factor which engenders policy credibility that, in turn, help to promote investment and market opportunities. In essence, regional surveillance and the dialogue between the various partners reduce the risks of slippages in meeting pre-agreed performance benchmarks, resulting in a more stable, predictable environment, which is an essential condition for the private sector to flourish. Furthermore, the conditions and obligations associated with participation in reform programmes within a regional organisation also facilitate the work of the domestic authorities in implementing politically difficult but important measures that promote fiscal prudence and macroeconomic stability, as well as foster a conducive business environment.

Specific initiatives taken towards the achievement of economic integration in Africa include policies, infrastructure development, trade facilitation and administrative processes, as well as legal reforms.

(a) Macroeconomic Convergence: Policies and Benchmarks

Convergence criteria normally centre on economic indicators that are related to macroeconomic policy formulation and performance. These include the rate of economic growth, level of inflation, interest rates, exchange rate performance, and ratios of the budget deficit, as well as government debt to GDP; alongside ratios of savings and investment to GDP. The African Monetary Cooperation Programme (AMCP) provides a blueprint for macroeconomic convergence for the continent and was formulated with the objective of ensuring the adoption of collective policy measures that foster a harmonised monetary system and commonality in the management of institutions. The programme has a long-term perspective involving (a) the adjustment of member countries exchange rate to equilibrium levels, (b) eventual exchange control-free current and capital account transactions, and (c) the pursuit of market-oriented monetary policy. The ultimate aim is to evolve (through the regional central banks) towards a single monetary zone by 2021, with a common currency and continental central bank (Table 1).

Broadly, macroeconomic convergence is to be promoted through implementation of appropriate monetary policy and fiscal policy. Among the initia-

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4   This programme may, however, become redundant as the AU pushes for the fast tracking of the African financial institutions.

TABLE 1: STAGES FOR IMPLEMENTATION OF THE AFRICAN MONETARY COOPERATION PROGRAMME (AMCP)*

Stage I: 2002 - 2003	Adoption by sub-regions of monetary integration programmes

Stage II: 2004 - 2008

1. Harmonisation and coordination of macroeconomic and monetary policies
2. Gradual interconnection of payments and clearing systems
    - (a) Promotion of African banking networks
    - (b) Promotion of sub-regional and regional stock exchanges
    - (c) Strengthening and harmonisation of banking and financial supervision
3. Observance of the following macroeconomic indicators by 2008
    - (a) Budget deficit/GDP ratio not exceeding 5 percent
    - (b) Central bank credit to government not exceeding 10 percent of previous year's tax revenue
    - (c) Single digit inflation rate
    - (d) External reserves/import cover of at least 3 months

Stage III: 2009 - 2012

Observance of the following macroeconomic indicators by 2012
- (a) Budget deficit/GDP ratio not exceeding 3 percent by 2012
- (b) Elimination of central bank credit to the government
- (c) Inflation rate of less than 5 percent
- (d) External reserves/import cover equal or greater than 6 months

Stage IV: 2013 - 2015

Assessment of macroeconomic performance and negotiation for the establishment of a common central bank (2015); consolidation of third stage achievements
- (a) Inflation rate of less than 3 percent
- (b) Continuous assessment of macroeconomic indicators against convergence criteria; comparative analysis referred to a Convergence Council
- (c) Commissioning of a study on the establishment of an African Exchange Rate Mechanism

Stage V: 2016 - 2020

Finalisation of arrangements for launching the African Monetary Union
- (a) Preparation of institutional, administrative and legal framework for setting up the common central bank and currency of the African Monetary Union
- (b) Review of commissioned study on the African Exchange Rate Mechanism; operationalisation of the mechanism
- (c) Appointment of key officers of the common central bank
- (d) Preparation for the introduction of a common currency
- (e) Recruitment of staff of the Bank
- (f) Mid-term assessment of country performance
- (g) Final assessment of countries' performance against convergence criteria

Stage VI: 2021

1. Introduction and circulation of the common African currency
2. A transitional period during which sub-regional monetary institutions would operate alongside the African Central Bank

Source: Association of African Central Banks

* Note: The AMCP was adopted by the Association of African Central Banks (AACB) in Algiers in September 2002

tives in this respect is the transition towards an African Central Bank. However, this goal is preceded by creation of regional central banks within regional economic communities. Within this framework, there are efforts to ensure effective policy-making and programme implementation to meet the set

Table 2: Main Objectives of REC Monetary Cooperation

REC	Main Objectives of REC Monetary Cooperation
CEMAC	1. To create the conditions for harmonious economic and social development
	2. To create a single currency for all member states
	3. Ensure internal and external stability of the common currency
COMESA	1. Macroeconomic stability
	2. Reduction of transaction costs
	3. Free movement of persons
EAC	1. Attainment of a monetary union
	2. Application of elements of the EAC Treaty that define integration strategies
ECOWAS	1. Creation of monetary union through the observance of a set of macroeconomic convergence criteria and implementation of a set of structural reforms all aimed at ensuring and sustaining macroeconomic stability of member states
SADC	1. Attainment of macroeconomic convergence in the region
	2. Harmonisation of taxation policies and related matters
	3. Harmonisation of monetary policies
	4. Convertibility of the regional currencies and elimination of exchange controls for the establishment of a single currency in the region
	5. Establishment of SADC Monetary Union
WAEMU	1. Manage monetary policy of member States; the policy is aimed at promoting economic growth
	2. Strengthen the monetary union and economic integration of the Union's member States by increasing the competitiveness of their economies
	3. Develop monetary discipline and solidarity
	4. Promote commercial transactions and capital investments
	5. Create macroeconomic stability

Source: United Nations Economic Commission for Africa

goals by these regional institutions.[5] In this regard, central bank legislation is being reviewed to achieve independence and proper allocation of institutional responsibilities. For example, within SADC, a model central bank law has been completed to guide country legislation that would conform to the ideals and policy perspective of a regional central bank. Table 2 outlines the objectives of monetary cooperation in selected RECs and Table 3 shows the macroeconomic convergence criteria.

(b) Trade and Market Integration

In the main, trade and market integration is intended to be achieved through transition to customs union arrangements and the harmonisation of tariffs, such that the flow of goods and services between the REC member countries is on the same terms and conditions as within each country. In pursuit of this goal, market and trade integration within the RECs is being promoted through measures that include the removal of tariff barriers to intra-REC trade, removal of non-tariff barriers and

the development and enactment of common trade policies (United Nations Economic Commission for Africa, 2008). The creation of and/or accession to customs unions would result in a reduction in the number of RECs, as countries belonging to more than one REC have to choose which customs union to join. In terms of progress, the East African Community became a customs union in 2005, while SADC adopted a programme to establish a customs union by 2010; by 2008 twelve (of the 15) SADC countries had established a Free Trade Area, which envisages the absence of tariffs on 85 percent of all trade in intra-community goods for the 12 countries.

(c) Financial Markets and Payments System Integration

The regional cooperation agenda recognises the need for effective financial markets to mobilise resources in support of development objectives, by increasing both the volume and productivity of investment, as well as the importance of enhancing competition in the financial sector and improving its corporate governance. The range of instruments availed by developed financial markets facilitate policy transmission as well as serving as a platform for regional integration and for Africa

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5   There is, nevertheless, a challenge in that some of the RECs' programmes do not conform to that of the AU in the sense that some of the regional central banks are planned to be established after the African Central Bank and so are some of the regional currencies.

TABLE 3: MACROECONOMIC CONVERGENCE CRITERIA

RECs	Primary Criteria	Secondary Criteria
CEMAC	1. Budgetary balance must be non-negative	1. Investment relative to GDP
	2. Annual inflation has to be less than 3 percent	2. Ratio of payroll to total budgetary revenues
	3. Ratio of public debt to GDP has to be no more than 70 percent	3. Current account relative to GDP
	4. Non-accumulation by the state of internal and external debt in the current period	
COMESA	1. Ratio of fiscal deficit to GDP, excluding grants	1. Use of indirect monetary policy instruments
	2. Inflation rate	2. Interest rate policy
	3. Reserve accumulation	3. Achievement of market determined exchange rates
		4. Growth
		5. Savings relative to GDP
		6. Investment relative to GDP
		7. External current account, excluding grants relative to GDP
		8. External debt relative to GDP
EAC	(No difference between primary and secondary criteria)	
	1. GDP growth rate: A high sustainable rate of growth of real GDP, with 7 percent as the minimal annual rate (by the year 2000)	
	2. Inflation: Maintenance of low and stable underlying inflation to single digit rates of less than 5 percent (by the year 2000)	
	3. Current account deficit excluding grants/GDP; reduction of the current account balance as a percentage of GDP to sustainable levels	
	4. Budget deficit (excluding grants)/GDP: Reduction of ratio of budget deficit to GDP to less than 5 percent (by the year 2000)	
	5. National savings/GDP: raising national savings-to-GDP ratio to at least 5 percent (by the year 2000)	
	6. Gross foreign exchange reserves in months of import of goods and services: Build gross foreign reserves to a level equivalent to six months of imports in the medium term	
	7. Maintenance of low and stable market-determined exchange rates	
	8. Maintenance of low market-determined interest rates	
	9. Pursuit of debt reduction initiatives to reduce both domestic and foreign debt, including statutory borrowing limits	
	10. Maintenance of prudential norms of banking regulation, effective supervision, improved corporate governance and transparency of all financial transactions	
ECOWAS	1. Inflation rate = 5 percent	1. Prohibition of all public sector domestic arrears and liquidation of all existing arrears
	2. Ratio of budget deficit (excluding grants) to GDP (commitment basis) 4 percent	2. Tax revenues/GDP ratio ≥ 20 percent
	3. Ceiling on central bank financing of budget deficit to 10 percent of previous year's tax revenue	3. Government salary mass/tax revenue ≤ 35 percent
	4. Gross reserves not less than 6 months of imports	4. Government capital expenditure/tax revenue ≥ 20 percent
		5. Real exchange rate stability
		6. Positive real interest rates
SADC	1. Inflation	1. Economic growth
	2. Budget deficit/GDP	2. External reserves/imports
	3. Debt/GDP	3. Central bank credits/government
	4. Current account/GDP	4. Domestic investment/GDP
		5. Domestic savings/GDP
WAEMU	1. Budget deficit/GDP	1. Wage bill/tax revenue ≤ 35 percent
	2. Average annual inflation rate maintained at a maximum of 3 percent	2. Public investment/tax revenue ≥ 20 percent
	3. Ceiling on total public debt/GDP	3. Tax revenue/GDP ≥ 17 percent
	4. Non-accumulation of public sector internal and external arrears	4. Current account deficit/GDP ≤ 5 percent

Source: United Nations Economic Commission for Africa

to integrate into the global economy. Integrated financial and capital markets also potentially address the problem of the thinness and lack of liquidity in individual country's markets. Moreover, the economies of scale provide scope for reducing costs, enhancing capacity building, maximising resource mobilisation and enhancing the efficiency of resource allocation.

Therefore, efforts are underway towards the establishment of regional institutions, adoption of common policies and regulatory frameworks, in addition to harmonisation of standards. In this regard, it is suggested that the EAC could serve as a model for the integration of financial markets in Africa, since it has established effective cooperation in the areas of policy formulation, regulatory and legal issues, as well as in structural and institutional matters. For example, a Capital Markets Development Committee initiates common policies for the EAC. Its membership comprises representatives of member states from central banks, securities markets regulators, ministries of finance/treasury, stock exchanges, and insurance and pension fund regulators (United Nations Economic Commission for Africa, 2008). In the SADC region, the SADC Committee of Stock Exchanges provides leadership and oversight for the harmonisation of listing requirements and operating systems for stock exchanges in member states, as well as the qualification for the region's stockbrokers. In addition, it encourages cross-listing. The WAEMU countries are served by a regional stock exchange, the Bourse Regionale des Valeurs Mobiliéres/West African Stock Exchange (BRVM), which was established in 1998 with eight regional branches interconnected to the headquarters under the supervision of the Regional Savings and Capital Market Board. For the ECOWAS region, the BRVM also cooperates with the Nigerian Stock Exchange and the Ghana Stock Exchange to achieve convergence of rules, surveillance procedures and training. Other examples are the Central African exchange and cooperation agreements in the AMU region.

The SADC payments system project is also a notable example. Its objective is to assist individual SADC member countries to define a payment system strategy and development plan, and put in place a coordinated regional approach to cross-border payments. A sound and robust domestic payment system within each country is a prerequisite for implementing an effective cross-border payment systems strategy.

(d) Convergence Measurement and Statistical Harmonisation

Yet another important initiative relates to enhancing the comparability of convergence and other economic and social indicators. Its aim is to facilitate the usage of a common platform in the assessment of the indicators of economic and social integration process. Some customs unions and RECs have,

therefore, created statistical units/institutions aimed at strengthening the harmonisation of national statistics and building capacity. This effort is supported by the African Development Bank, which has set up a capacity building programme through the provision of financial and technical support under the framework of the International Comparison Programme for Africa (ICP-Africa), (Mouyelo-Katoula and Nshimyumuremyi, 2007). The ICP is a global statistical initiative established to produce internationally comparable price and expenditure data to facilitate cross-country comparisons of GDP and its sub-aggregates in real terms that are free of price and exchange rate distortions (Mouyelo-Katoula and Nshimyumuremyi, 2007, p10).

Mouyelo-Katoula and Nshimyumuremyi (2007) highlight the fact that GDP and inflation-related indicators require relevant statistical systems to be harmonised at sub-regional and regional levels in terms of: (a) common definitions of indicators to be used to monitor convergence criteria; (b) the scope of the indicators in terms of their main components or the indicators they are derived from, their status, as well as desired frequency; (c) determining the statistical framework which would ensure data comparability; and (d) providing guidelines for future activities in order to set up a harmonised statistical system for Africa.

(e) Overview and Monitoring Mechanism for Convergence

The regional integration effort also incorporates frameworks for monitoring progress on macroeconomic convergence and implementation of the regional integration agenda. The AMCP, for example, requires that periodic (quarterly reports) be submitted to the Association of African Central Banks (AACB) Secretariat and the AEC/AU Secretariat in order to facilitate the monitoring and evaluation of the performance of countries and RECs. The permanent institutional framework for monitoring performance at the level of member states and at the sub-regional level is as follows:

i. Convergence Council, comprising Ministers of Finance and Central Bank Governors, which reports to the Authority of the Heads of State and Government of the AU;

ii. Coordinating Committee, made up of the Bureau of the AACB, i.e., Chairman, Vice Chairman and Chairmen of the Regional Committees. The Committee evaluates proposals of the Technical Committee and makes recommendations for the consideration of the Convergence Council;

iii. Technical Committee, comprising officials of Central Banks and Ministries of Finance, evaluates and analyses information from the various sub-regions and makes proposals to the Coordinating Committee relating to macroeconomic convergence criteria.

Below these structures, there are organs in charge

of carrying out and monitoring the macroeconomic convergence activities within the RECs.

Performance and Assessment of Integration and Convergence Initiatives

The United Nations Economic Commission for Africa (UNECA) report (2008) provides a comprehensive analysis of progress towards economic integration and convergence in monetary and fiscal policies.[6] The report points out that, although the RECs have made some progress, Africa still faces a number of challenges. First, there are no enforcement mechanisms to deal with African States that decide not to adhere to protocols and treaties to which they are signatories. Second, there are no compensating arrangements for the losers of the integration process; and this shortcoming acts as a constraint for the full implementation of integration schemes. Third, compared to world standards, Africa's infrastructure network is generally very weak, constraining the physical integration of the continent. Fourth, the multiple memberships of countries in various RECs, and the resulting overlap and duplication of functions of the RECs also act as stumbling blocks to the integration agenda. Fifth, Africa's macroeconomic and financial environment is very weak. What is observed in most RECs are significant differences (both levels and volatility) in tariffs, inflation, exchange rates, debt-to-GDP ratios, rate of money growth and other vital macroeconomic variables between member countries. In addition, it is suggested that being mostly reliant on agriculture and, for a subset, commodity exports, the intra-block trade shares – the traditional gauge of potential benefits from reduced exchange rate volatility following the establishment of a monetary union – are comparatively small. For the same reason, member states are subject to potentially large asymmetric shocks to their terms of trade, which is the traditional indicator of the potential costs of forming a monetary union (Ghosh, Guide and Wolf, 2008). Nevertheless, there is persistence and endurance of the economic integration effort, possibly reflecting other (potential) benefits, such as progress towards policy credibility and macroeconomic stability, as well as contributing to regional peace and security. A notable example is the endurance of CEMAC and WAEMU, which have lasted for approximately sixty years.

In the UNECA (2008) analysis, the *a priori* assumption is that progress towards meeting macroeconomic convergence criteria could be a sign that policy initiatives and coordination in the RECs are achieving the desired outcome. Inflation is used to analyse convergence in monetary policy with the following results and conclusions:

(a) the variability of inflation among SADC countries has generally declined over time, signify-

ing a tendency among the member countries to have convergence in macroeconomic policy, particularly monetary policy;

(b) a tendency of convergence of inflation levels within COMESA indicating some convergence in monetary policies;

(c) similar to SADC and COMESA, a generally decreasing variation in inflation is observed over time for the ECOWAS region;

(d) in the CEMAC region, the dispersion in inflation is relatively low and stable compared with the other RECs, reflecting a high level of inflation convergence among the member countries and strong convergence in monetary policy;

(e) the variability of inflation within WAEMU has decreased markedly since the late 1990s, showing clear evidence of monetary policy convergence among the member countries

Fiscal balance is used as the key indicator to capture progress made towards harmonising fiscal policies within the RECs. The results show that the overall variability in fiscal balance within each REC was not too wide, an indication that there is much faster convergence in fiscal policy within the regions.

However, there has been only very modest success in stimulating intra-regional trade due to factors that include:

(a) lack of strong industrial capacity in member states to produce diversified goods for trade within the region;

(b) many of the multiple national currencies in Africa lack convertibility;

(c) efforts towards monetary, financial and physical integration have not yielded significant results;

(d) the cost of doing business in Africa is generally high due to infrastructure and service gaps, as well as duplicative and cumbersome trade procedures; and

(e) the free movement of people objective remains largely unrealised.

Ghosh, Guide and Wolf (2008), provide a broader analysis of macroeconomic indicators in three RECs, namely, CEMAC, WAEMU and West African Monetary Zone (WAMZ), with a comparison made with the Gulf Cooperation Council (GCC). It is concluded that, while the average growth performance has been respectable since the turn of the millennium in all the three unions, the difference between the best and worst performers continues to be pronounced. Similar divergences are also apparent for terms of trade shocks. Overall, the differences in changes in the terms of trade and GDP growth are reflected in large divergences in the current account and fiscal balances. With the increase in oil prices in recent years, the CEMAC and WAMZ experienced a doubling of growth rates compared to the 1980s, while GDP growth in WAEMU has increased by a much lower rate (and decreased in per capita terms). Moreover, the rise

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6 The analysis focuses on selected RECs in Africa, namely: SADC, COMESA, ECOWAS, CEMAC and WAEMU.

in growth rates in CEMAC and WAMZ, as in the GCC, was not accompanied by greater volatility in growth, pointing to the increased importance of shared external shocks. It is also indicated that, while there has been improvements in fiscal balances due to the fiscal benefits of increase in oil exports, the improvement in the current account has been muted; in contrast to the GCC, all the three regions continue to run significant deficits as a ratio of GDP.

Overall, it is considered that, while the slow speed of convergence partly reflects exogenous shocks, substantial improvement in adherence to convergence criteria will require significant policy actions, notably on the fiscal side, including continued determined efforts at broadening and diversifying the tax base (Ghosh, Guide and Wolf, 2008, p181). It is also noted that the slow pace of economic convergence results in the pushing back of target dates. For example, the 1987 ECOWAS Monetary Cooperation Programme envisaged the creation of a single monetary zone, but the target date was missed due to macroeconomic divergences. Similarly, the target date for the completion of the WAMZ was pushed back, first to July 2005 and, subsequently, to December 2009, due to slow pace of the attainment of economic convergence criteria. The second stage union is now tentatively scheduled to follow in 2011.

Conclusion

It appears that there is political ambition to achieve regional integration in Africa as evidenced by plans and arrangements to establish economic and governance institutions towards the ultimate goal of a monetary union. In this respect, the plans and implementation monitoring within the RECs afford some reasonable degree of institutional and cross-country cooperation towards the common goals of enhanced intra-regional trade, policy coordination and convergence of important macroeconomic indicators. These developments contribute to strengthening of policy credibility that would support higher levels of investment in the region. It is, nevertheless, clear that both economic/trade performance and the development of regional institutions do not match the aspirations of the AU programmes. In particular, slow progress in enhancing factor mobility and harmonisation of tariff structures and weak administrative performance, as well as infrastructure constraints limit the expansion of intra-regional trade.

Moreover, while there is a tendency for macroeconomic indicators to converge, there is slow progress in meeting the actual set REC convergence criteria in several African countries. In addition, macroeconomic indicators for the continent are particularly vulnerable to external developments, for example, the performance of export markets for major commodities. In the circumstances, the target dates for implementation programmes are often pushed back. It is further observed that inadequate data and differences in important measurements and statistics adversely affect the determination of adherence to convergence criteria and, in the process, slows prospects for harmonisation of statistical series in the various regions. Positively, however, the agenda for integration inherently focuses attention on higher performance standards with respect to both institutions and policy, while there is continuing market expansion and opportunities for collaborative infrastructure development. Over time, these positive attributes are entrenched, helping to sustain the development initiatives. In turn, the collaborative approach fosters international support and technical assistance in enhancing policy development, building institutions and funding infrastructure networks.

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Appendix

Figure 1: Regional Integration Efforts From OAU to AU

Timeline			
Formation: Organisation of African Unity	____	1963	
Established: Economic Community of West African States	____	1975	
Formalised: Southern African Development Coordinating Conference (SADCC)	____	1980	____ Lagos Plan of Action
Established: Preferential Trade Area	____	1981	
		1983	____ Established: Economic Community of Central African States
Western Sahara admitted into the OAU	____	1985	____ Morocco withdraws membership from OAU
Established: Intergovernmental Authority on Drought and Development	____	1986	
Established: Arab Maghreb Union	____	1989	
		1991	____ Abuja Treaty establishes African Economic Community
SADCC transformed into Southern African Development Community	____	1992	
Established: Common Market for Eastern and Southern Africa replaces PTA	____	1994	____ OAU referred to as AU/AEC
Established: Intergovernmental Authority on Development (IGAD) replaces IGADD	____	1996	
		1998	____ Established: Community of Sahel-Saharan States (CEN-SAD)
Call to Establish the African Union	____	1999	____ Established: East African Community (EAC)
		2000	____ Constitutive Act of the AU adopted
Adoption of the New Partnership for Africa's Development (NEPAD)	____	2001	
NEPAD: African Peer Review Mechanism (APRM) approved	____	2002	____ Inaugural Summit and Formation of the AU replaces OAU/AEC
			____ MoU: Conference on Security, Stability, Cooperation and Development in Africa (CSSDA)
Inauguration of Pan African Parliament	____	2004	
		2008	____ Historic: Joint EAC – COMESA – SADC Summit to develop a combined Free Trade Area (FTA)

Source: United Nations Economic Commission for Africa

Table A1: Membership of Regional Economic Communities

Arab Meghrab Union	Common Market for Eastern and Southern Africa	Community of Sahel-Saharan States	East African Community	Economic Community of Central African States	Economic Community of West African States	Intergovernmental Authority on Development	Southern African Development Community
Algeria	Burundi	Benin	Burundi	Angola	Benin	Djibouti	Angola
Libya	Comoros	Burkina Faso	Kenya	Burundi	Burkina Faso	Ethiopia	Botswana
Mauritania	DRC*	Central African Republic	Rwanda	Cameroon	Cape Verde	Kenya	DRC*
Morocco	Djibouti	Chad	Uganda	Central African Republic	Côte D'Ivoire	Somalia	Lesotho
Tunisia	Egypt	Comoros	Tanzania	Chad	Gambia	Sudan	Madagascar
	Eritrea	Côte D'Ivoire		DRC*	Ghana	Uganda	Malawi
	Ethiopia	Djibouti		Equatorial Guinea	Guinea		Mauritius
	Kenya	Egypt		Gabon	Guinea-Bissau		Mozambique
	Libya	Eritrea		Republic of Congo	Liberia		Namibia
	Madagascar	Gambia		Rwanda	Mali		Seychelles
	Malawi	Ghana		São Tomé and Principe	Níger		South Africa
	Mauritius	Guinea			Nigeria		Swaziland
	Rwanda	Guinea-Bissau			Senegal		Zambia
	Seychelles	Kenya			Sierra Leone		Zimbabwe
	Sudan	Liberia			Togo		Tanzania
	Swaziland	Libya					
	Uganda	Mali					
	Zambia	Mauritania					
	Zimbabwe	Morocco					
		Niger					
		Nigeria					
		São Tomé and Principe					
		Senegal					
		Sierra Leone					
		Somalia					
		Sudan					
		Togo					
		Tunisia					

Note: DRC = Democratc Republic of Congo

Bank of Botswana's Short-term Inflation Forecasting Models

James, L.V., Mokoti, T.P., and Molalapata, I.[1]

ABSTRACT

The paper evaluates, compares and documents the forecasting performance of the Bank's short-term forecasting models, namely, the Near-Term Forecasting (NTF) model as well as the Vector Autoregressive (VAR) and the Autoregressive Integrated Moving Average (ARIMA) processes, both of which are used in conjunction with the medium-term macroeconomic model to support monetary policy formulation. While it is generally appreciated that the short-term forecasting models lack explicit policy analysis to fully account for the monetary policy transmission process, they are useful for statistical determination of the near-term path of inflation, an attribute that can be harnessed to estimate data points that are not yet available for use in the medium-term model or in determining the credibility of preliminary data. Most importantly, the near-term evolution of inflation forms part of the initial conditions for the medium-term forecast whose forecast horizon is more relevant for monetary policy formulation and implementation. The paper uses methods including graphical analysis, Mean Absolute Error (MAE), Root Mean Square Error (RMSE) and the Theil U statistic to evaluate and compare the performance of the three short-term models in both the in-sample and out-of-sample forecast horizons. It was found that the NTF generally performed better than the other two models reviewed. The model performed well in both the in-sample and out of sample forecast horizons, emerging first, ahead of the VAR in both the in-sample and out-of-sample forecast horizons. In addition, the NTF outperformed the other two models in terms of capturing the major turning points in inflation in both the in-sample and out-of-sample forecast horizons almost contemporaneously.

1   Respectively, Senior Economist and Economists, Modeling and Forecasting Unit, Research Department. The views expressed in the paper are those of the authors and do not necessarily reflect those of the Bank of Botswana. The paper has benefited from comments by colleagues in the Bank of Botswana.

INTRODUCTION

Empirically, it has been found that monetary policy[2] affects macroeconomic variables, such as inflation and output growth, with a lag. This, therefore, compels monetary policy to be forward-looking in order to influence future price developments. At the beginning of 2008, the Bank of Botswana adopted medium-term inflation forecast as an intermediate target of monetary policy, replacing the annual rate of credit growth which had served as the indicator of domestic demand pressures. However, the Bank still takes account of the rate of credit growth, given that it is one of the contributory factors of demand, by capturing it in the inflation forecast. This technical shift was announced in the 2008 Monetary Policy Statement. It entails the adoption of the inflation forecast as the main information source for the formulation and implementation of monetary policy. It was considered unnecessary to continue to use the rate of growth of credit as the only major and distinct intermediate target of monetary policy (Bank of Botswana's 2008 Monetary Policy Statement). The technical shift followed considerable progress that had been made in building the Bank's system for forecasting and policy analysis that started in 2004 under the auspices of the International Monetary Fund (IMF) Technical Assistance (TA). Through a series of TA missions in which the IMF collaborated with the Czech National Bank (CNB), the Bank was able to build two models; a medium-term structural macro-economic model used for forecasting and policy analysis (i.e., with a forecast horizon of at least two years) and a single-equation model used for short-term inflation forecasting (i.e., with a forecast horizon of one year).

While the two models (built with the assistance of the TA missions) helped to improve the Bank's policy framework, there was need to augment them because the formulation and implementation of a forward-looking monetary policy framework requires a suite of models often with different forecast horizons to generate regular forecasts for incorporation into the work of the Monetary Policy Committee (MPC). As part of the continuous effort to improve the Bank's macroeconomic forecasting capacity, and in recognition of the fact that no single model can be expected to be suitable for all purposes, two additional short-term forecasting models (i.e., with a forecast horizon of one year) based on an autoregressive process have been developed to supplement the NTF and medium-term macroeconomic models. These models include the autoregressive integrated moving average (ARIMA) model and the vector autoregressive (VAR) model.

The short-term forecasting models are crucial in the Bank's forecasting and policy analysis frame-

work for two reasons. First, they complement the medium-term projection model since their output is used as initial or starting conditions for variables in the medium-term model. The use of the output of short-term models as initial conditions in medium-term models emanates from the fact that what happens in the short-term forecast horizon is usually predetermined by past economic developments; hence, the short-term forecasting models are considered more suited to capturing the short-term dynamics of the data. Second, the short-term forecasting models can also be used to forecast components of the consumer price index (CPI) in order to obtain a more detailed insight into the individual sources of future inflationary or disinflationary pressures. However, unlike the medium-term macroeconomic model which has an in-built policy rule, these short-term models do not have any explicit policy analysis capability.

The aim of this paper is to evaluate and document the forecasting performance of the ARIMA and the VAR models against that of the near-term forecasting (NTF) model. The three are simple, robust and parsimonious models that are used to forecast annual inflation on a quarterly basis for a short forecast horizon not exceeding a year, as well as to identify other relevant information that the Bank monitors in pursuit of its inflation objective. The medium-term inflation objective of 3 – 6 percent represents the Bank's view of price stability, which is the level of inflation that is consistent with sustainable long-run economic growth of the economy (2008 Monetary Policy Statement – Midterm Review). This paper is based on a sample period of 1986 quarter one to 2008 quarter two. A deliberate choice of a sample period for which actual outcomes are available was made to enable comparison of actual outcomes with the forecasts from the models. The second section of this paper provides background information on all the three short-term forecasting models, namely; the NTF, VAR and ARIMA. The third section evaluates and compares the forecasting performance of the three models, while section four concludes.

THE SHORT-TERM FORECASTING MODELS

Near-Term Forecasting Model (NTF)
The NTF is a single equation econometric model designed to produce inflation projections over a forecast period of a year. The model was built on the basis of the observed transmission mechanism, which indicates that imported inflation, specifically South African headline inflation, and the nominal rand/Pula (ZAR/BWP) exchange rate are the most direct and fastest of the transmission channels determining inflation in Botswana.[3] As a result,

the NTF model was designed to capture only these channels and effectively reflects the imported components of the domestic inflation, as well as the developments in the ZAR/BWP nominal exchange rate. The model does not systematically capture other important transmission channels, such as domestic demand; and, as such, it is only part of the Bank's broader forecasting and policy analysis system.

The NTF model indicates that domestic inflation is determined by its past level (reflecting inertia), change in the lagged and current values of the nominal exchange rate, lagged and current values of South African inflation as well as the deviation of the real exchange rate from its trend. The deviation of the real exchange rate from its trend reduces to zero in the long run, but it is a non-zero variable in the short term. This term is included to recognise the fact that in the short term, the system may not always be in equilibrium and the coefficient of this term is intended to adjust the system to equilibrium (error correction mechanism). When the real exchange rate is below its trend (i.e., representing the real depreciation of the Pula against the South African rand), the result is an upward pressure on domestic inflation and vice versa.

The NTF model embodies the same design philosophy as the core medium-term model,[4] that dynamic adjustment occurs around a well defined equilibrium path or steady state solution. Therefore, steady state solutions for four critical variables are exogenously imposed on the NTF model. These are, changes in the nominal ZAR/BWP exchange rate, the real ZAR/BWP exchange rate, the South African and domestic inflation rates. The basic principle is to recognise the fact that since there are nominal rigidities in the economy, monetary policy can only affect real variables in the short run, while long-run trends in real variables are largely outside its scope (Handa, 2000:70). This principle is consistent with the vertical long-run Phillips curve theory and it is referred to as the (super) neutrality condition.[5] In addition, the steady state solution paths ensure consistency between the inflation objective, the exchange rate policy and the fundamentals of the economy such as the real exchange rate appreciation trend, which is outside the scope of monetary policy.

The NTF model is also designed in such a way that the impact of other factors outside the model (additional factors and/or expert information), such as the impact of adjustments to regulated prices or consumption taxes on price developments, could be evaluated. Such effects enter the model exogenously. Any other development expected to

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3   Botswana is a small open economy with imported tradeables representing 45.2 percent of the current Consumer Price Index (CPI) basket.

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4   Details about the core medium-term model are discussed in the upcoming paper titled 'Macroeconomic Modelling at the Bank of Botswana.'

5   The super neutrality of money is said to exist if continuous changes in the money supply do not have any real effects on the economy.

impact on inflation, but not directly captured by the model, is dealt with in a similar manner. In short, the NTF forecast is augmented with informed judgement based on other tools, such as spreadsheet forecasting of possible impacts on inflation of changes in particular inflation determinants not directly modelled. Furthermore, given that the NTF model has exogenous variables, it follows that projections of such variables are necessary over the forecast period in order for the model to perform well. The exogenous variables are the nominal ZAR/BWP exchange rate and the South African headline inflation.[6]

The functional specification of the NTF model is as given in equation 1 below where ($\prod_{t-1}$ and $\prod_t$) represents past and current levels of domestic inflation; (E_t and E_{t-1}), changes in the nominal exchange rate, both contemporaneous and lagged; ($\prod^*_t$ and $\prod^*_{t-1}$),South African headline inflation, both contemporaneous and lagged; as well as the past real exchange rate trend (Z^{tnd}_{t-1}). $\alpha_1 - \alpha_{14}$ represents estimated parameters. The parameter (α_1) is essentially an error correction coefficient which reduces to zero in the long run, but assumes a non-zero negative value in the short-term.

$$\prod_t = -\alpha_1(\prod_{t-1} + E_{t-1} - \prod^*_{t-1} - Z^{tnd}_{t-1}) +$$
$$\alpha_2\prod_{t-1} + \alpha_3 E_t + \alpha_4 E_{t-1} + \alpha_5\prod^*_t + \alpha_6\prod^*_{t-1} + \prod^{*ss}_t - \alpha_7\prod^{ss}_t + ((\alpha_8) + (\alpha_9))E^{ss}_t +$$
$$((\alpha_{10}) + (\alpha_{11}))\prod^{*ss}_t + \alpha_{12}D_1 + \alpha_{13}D_2 + \alpha_{14} \quad (1)$$

As highlighted earlier, one other key feature of the NTF model is that it is built around a number of assumptions regarding equilibrium values of certain variables in the model. The assumptions relate to the long-run values of four variables; namely, the changes in the nominal ($\prod^{ss}_t$) and real ZAR/BWP ($\prod^{ss}_t + E^{ss}_t + \prod^{*ss}_t$) exchange rate, as well as South African ($\prod^{*ss}_t$) and domestic ($\prod^{ss}_t$) inflation rates. D_1 and D_2 represent dummies to cater for the structural break in the inflation series created by the introduction of Value Added Tax in 2002.

Autoregressive Integrated Moving Average (ARIMA) Model

ARIMA processes are econometric models used to describe and forecast time series in the short-term. These models are popularly known as the Box-Jenkins models,[7] but technically are known as ARIMA (Gujarati, 2003:837). These models allow the dependent variable to be explained by its past or lagged values and stochastic error terms.

Since they are not based on any economic theory, the models are also referred to as atheoretic models. The ARIMA approach to forecasting is based on the following idea: the forecasts are generated from linear functions of the sample observations; and the aim is to find the simplest model that can replicate the observed data. ARIMA forecasts, like those of the NTF and VAR models, are useful for statistical determination of the near-term evolution of inflation, an attribute that can be harnessed to estimate data points that are not yet available for use in the medium-term model or in determining the credibility of preliminary data.

Each ARIMA process has three parts: the Autoregressive (AR), the Integrated (I), and the Moving Average (MA) parts. The models are often written in shorthand as ARIMA (p,d,q) where p, d and q represents the AR, I and MA components, respectively.

(a) Autoregressive (AR) Stochastic Process

This part of the model describes how each observation is a function of the previous p observations. For example, if p = 1, then each observation is a function of only one previous observation. That is, the model assumes the following structure;

$$Y_t = c + \alpha_1 Y_{t-1} + \mu_t \quad (2)$$

where Y_t is the observed value at time t, Y_{t-1} is the previous observed value at time t-1, μ_t is an uncorrelated random error term, α_1 is the autoregressive coefficient and c is a constant. For such a model, Y_t is said to follow a first-order autoregressive, or AR (1) stochastic process. If p > 1, the model will take the following form;

$$Y_t = c + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \ldots\ldots\ldots\ldots\ldots$$
$$+ \alpha_p Y_{t-p} + \mu_t \quad (3)$$

and Y_t would be said to follow a pth-order autoregressive, or AR (p) process. That is, the value of Y at time t depends on its value in the previous p time periods.

(b) Integrated Stochastic Process (ISP)

Integrated here refers to the number of times a series needs to be differenced to achieve stationarity.[8] This part of the model determines whether to model the observed values directly or use the differences between consecutive observations instead. If a time series is stationary from the onset (i.e., it does not require any differencing), it is said to be integrated of order zero, I(0) and it can be modelled directly. However, if a time series has to be differenced once (i.e., take the first difference) to make it stationary, it is said to be integrated of order one, I(1), and the differences between its consecutive observations are modelled. In other words, if a time series has

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6   Market consensus forecasts for South African headline inflation are obtained from Reuters, while the nominal ZAR/BWP exchange rate is derived from forecasts of the US Dollar cross ratessourced from Bloomberg namely; Euro/USD, JPY/USD, GBP/USD, and ZAR/USD.

7   ARIMA processes are popularly known as Box-Jenkins models because they were popularised by George Box and Gwilym Jenkins in the early 1970s. Box and Jenkins (1970) effectively put together in a comprehensive manner the relevant information required to understand and use ARIMA processes.

8   The important point to note is that in the Box-Jenkins methodology, there must either be a stationary time series or a time series that is stationary after one or more differencing. Stationarity is a random process whereby statistical properties of a given series do not vary overtime.

to be differenced 'd' times to make it stationary, that time series is said to be integrated of order 'd' and it is denotated I(d). In practice, a time series is rarely integrated of order more than two and most economic variables are I(1).

(c) Moving Average (MA) Stochastic Process

This part of the model describes how an observation is a function of the current and past error terms. For example, if q = 1, then each observation is a function of the current and previous error term. That is, the model assumes the following form:

$$Y_t = c + \alpha_o \mu_t + \alpha_1 \mu_{t-1} \qquad (4)$$

where c is a constant (mean of the series, Y_t) and μ is the white noise stochastic error term. Y_t is equal to a constant plus a moving average of the current and past error terms. Thus, Y follows a first-order moving average,[9] or an MA (1), process. If q>1, the model takes the general form:

$$Y_t = c + \alpha_o \mu_t + \alpha_1 \mu_{t-1} + \alpha_2 \mu_{t-2} + \ldots\ldots\ldots$$
$$+ \alpha_q \mu_{t-q} \qquad (5)$$

and Y_t is an MA (q) process. In short, a moving average is simply a linear combination of random error terms.

Combining AR, I and MA parts gives the diverse range of ARIMA models. A model can either follow an AR or an MA or ARMA process. An ARIMA process is simply an ARMA process based on a differenced series.

Data for the selected sample period (i.e., 1986:1 – 2008:2) revealed that the price level followed an ARIMA process in Botswana; hence, an ARIMA model was built as follows:
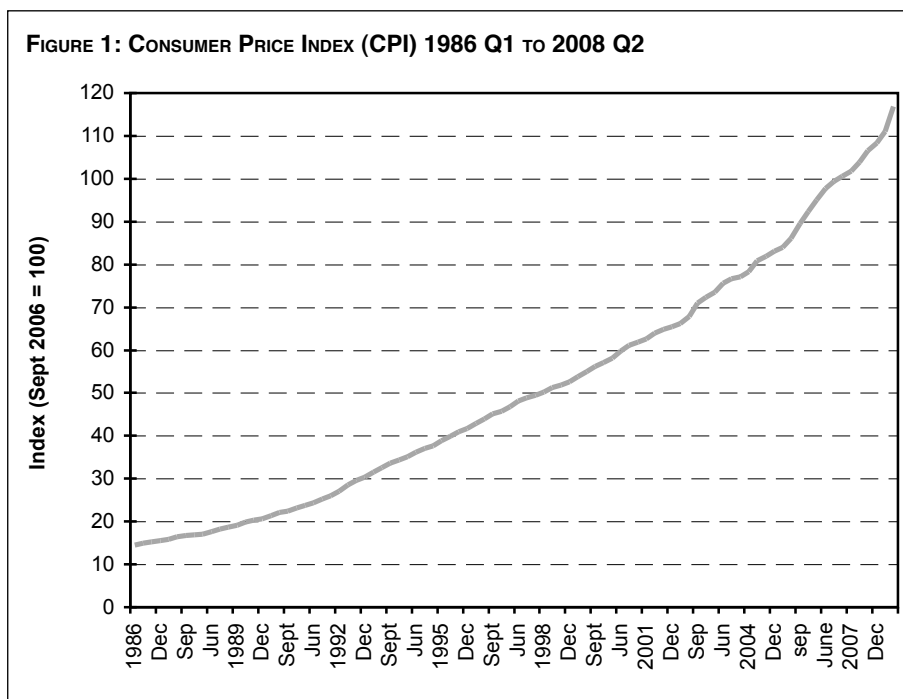
(a) Stationarity test

It is a prerequisite for a time series to be stationary before one can attempt to identify a suitable ARIMA model for it. For the chosen period of study, the CPI shows a steady upward trend (Figure1), suggesting that the CPI series may be non-stationary. However, graphical analysis alone is not enough; hence, an additional stationarity test that has become widely popular over the past three decades; namely, the Unit Root Test, was carried out. Two versions of the unit root test including the Augmented Dickey-Fuller (ADF, 1979) and Phillips-Perron (PP, 1988)

tests were used to get a consensus[10] view on the nature of the CPI series. All the tests showed that the CPI series became stationary only after being differenced twice; hence, it was concluded that the CPI series over the sample period is I(2), meaning it is integrated of order 2. The results were also found to be reliable, since the value of the Durbin-Watson statistic for the differenced CPI data was around two, which, as a rule of thumb, indicates the absence of autocorrelation. Detailed results of the tests are in Table 1 of Appendix 1.

(b) Model Identification

After determining the correct order of integration of the CPI series, the next step was to find an appropriate ARIMA form to model the resultant stationary series. Following the Box and Jenkins methodology, the key identification tools are the autocorrelation function (ACF), the partial auto-correlation function (PACF), and their resultant correlograms, which are simply the plots of ACFs and PACFs against an array of lag lengths. Table 2 of Appendix 1 shows the resultant correlograms of the stationary CPI series. As indicated, autocorrelations and partial autocorrelations at lags 1 are individually statistically significant since they are all outside the 95 percent confidence bounds. The statistically significant correlograms enable determination of the ARIMA pattern of the CPI series. Based on the statistically significant lags, different

FIGURE 1: Cᴏɴsᴜᴍᴇʀ Pʀɪᴄᴇ Iɴᴅᴇx (CPI) 1986 Q1 ᴛᴏ 2008 Q2

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9   In time series analysis, a moving average model is conceptually a linear regression of the current value of a series against previous (unobserved) white noise error terms or random shocks.

10   The use of both the ADF and PP criteria was solely to get a confirmatory outcome on the nature of the CPI series. While both the ADF and PP criteria test the null hypothesis that a variable has a unit root against an alternative that the variable was generated by a stationary process, they use different methods to account for serial correlation. The latter uses Newey-West standard errors whereas the former uses additional lags of the first-difference variable.

ARIMA models were built and statistical model fit measures, such as the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC), were used to identify the best ARIMA model. Table 3 of Appendix 1 gives the AIC and SBC results of the various models, which indicate that an ARIMA (1, 2, 1) model was superior. The best model takes the following form:

$$\text{D (CPI, 2) C AR (1) MA (1)} \qquad (6)$$

and it has the lowest AIC and SBC values, showing that it is the model with the smallest errors. Since CPI is integrated of order 2, it is differenced twice to make it stationary before being estimated [D (CPI, 2)]. The resultant stationary CPI time series can be modelled as an ARIMA (1, 2, 1) process.

(c) Model Diagnosis

It is imperative, according to Gujarati (2003:840), to carry out a diagnostic test to check whether the model provides a reasonable fit to the data. This was done and it was found that none of the autocorrelation and partial autocorrelation functions of the residuals from equation (6) were individually statistically significant. In other words, the correlograms of both the autocorrelation and partial autocorrelation functions showed that the residuals estimated in equation (6) are purely random and small; hence, the model is considered satisfactory and can be used to forecast inflation.

Vector Autoregressive (VAR) Model

A VAR model is one of the most successful, flexible, and easy to use models for analysis of multivariate time series. It is a natural extension of the univariate autoregressive model to dynamic multivariate time series. The VAR model resembles simultaneous equation models in that it considers several endogenous variables together. Each endogenous variable is explained by its lagged values and lagged values of all other endogenous variables in the model.

The VAR model is regarded as providing a credible approach to data description, forecasting, structural inference and policy analysis. Despite the fact that an unrestricted VAR model is not based on any economic theory, the model has proven to be useful in describing the dynamic behaviour of economic and financial time series and for forecasting. It often provides superior forecasts compared to univariate time series models and theory-based simultaneous equation models because it is able to pick up any potential interrelatedness among the variables in the model (MacDonald, R., and Marsh, I., 1999:151). In addition to data description and forecasting ability, the VAR model is also used for structural inference and policy analysis. In structural analysis, certain assumptions about the causal structure of the data under investigation are imposed and the resulting causal impacts of unexpected shocks or innovations to specified variables in the model are summarised.

There are, however, several different types of VARs, namely: reduced form, recursive, structural and vector error correction models. Under a reduced form VAR, each variable is expressed as a linear function of its own past values, the past values of all other variables in the model, and a serially uncorrelated error term. A recursive VAR, on the other hand, constructs the error terms in each regression equation in such a way that they are uncorrelated with the errors in the preceding equations by including some contemporaneous values as regressors. As explained in Watson et al. (2001:3), a structural VAR uses economic theory to sort out contemporaneous links between variables, while a vector error correction model is simply a cointegrated system of a VAR model. However, this paper focuses on the reduced form VAR, which is simply a statistical description of the data and, therefore, suitable for short-term forecasting.

Many variables affect inflation and are, in turn, affected by inflation. However, three economic variables that were found to be highly correlated with inflation in Botswana have been identified and used to build a VAR model for short-term inflation forecasting (see Table 5 of Appendix 2). In the VAR model, inflation is expressed as a function of its past value and the past values of the nominal ZAR/BWP exchange rate and the nominal interest rate, as shown below:

$$CPI_t = \alpha + \sum_{j=1}^{k} \beta_j CPI_{t-j} + \sum_{j=1}^{k} \gamma_j SSAR_{t-j} +$$
$$\sum_{j=1}^{k} \pi_j IS_{t-j} + \mu_t \qquad (7)$$

where CPI represents headline consumer price index in logarithm (logs) form, SSAR the ZAR/BWP nominal exchange rate in logs, IS the nominal interest rate (Bank rate), μ the stochastic error term while, α, β, γ, and π are parameters to be estimated. Some variables such as CPI and SSAR were logged in order to produce a stable VAR system, necessary to produce reliable forecasts (see Table 6 in the Appendix for stability test results).

The method of Ordinary Least Squares (OLS) was used to estimate equation 7, producing independent and identically[11] distributed and, therefore, efficient coefficients. The estimation yielded the following results:

$$\begin{aligned} \log(cpi) = {} & 0.026 + 1.475*\log (cpi(-1)) - 0.478*\log (cpi(-2)) \\ & - 0.055*\log (ssar(-1)) \\ & + 0.054*\log (ssar (-2)) \\ & - 0.001*is(-1) + 0.001*is(-2) \end{aligned} \quad (8)$$

---

11 In probability theory and statistics, a sequence or other collection of random variables is independent and identically distributed (i.i.d.) if each random variable has the same probability distribution as the others and all are mutually independent.

Model Diagnosis

A stability test, t-test and F-test were conducted to check whether the estimated VAR model is a reasonable fit to the data. The estimated VAR system was found to be stable[12] and, therefore, could be used to produce reliable forecasts. The t-test revealed that all but two coefficients were statistically significant. However, the F-test, a measure of the overall significance of the model, indicated that the model is good and can be used for forecasting. This is because the value of the calculated F-statistic far exceeded that of the critical value, an indication that, overall, the estimated coefficients were significantly different from zero (see Table 5 in Appendix 1 for details).

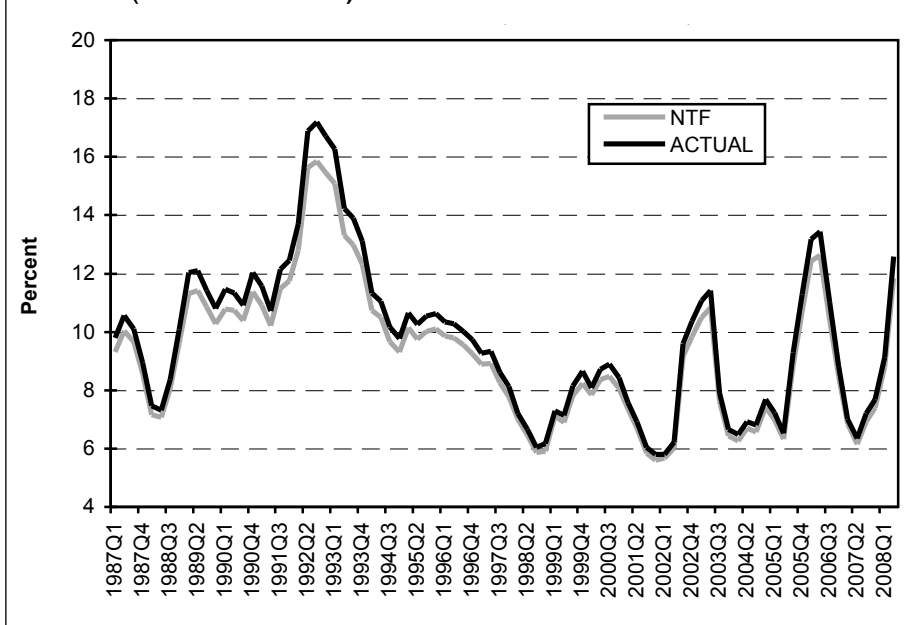## 3. Tʜᴇ Pᴇʀғᴏʀᴍᴀɴᴄᴇ ᴏғ Sʜᴏʀᴛ-ᴛᴇʀᴍ Fᴏʀᴇᴄᴀsᴛ- ɪɴɢ Mᴏᴅᴇʟs

The estimated NTF, VAR and ARIMA models were used to produce both in-sample and out-of-sample inflation forecasts. The in-sample forecast horizon ranges from the first quarter of 1987 to the second quarter of 2008, while the out-of-sample horizon is from the third quarter of 2008 to the second quarter of 2009. The models were then evaluated based on their performance in both the in- and out-of-sample forecast horizons. The evaluation criterion used was the magnitude of the deviation of the forecasts from the actual outcomes.

In-Sample Forecasts

The purpose of in-sample forecasts was to determine how well the models could replicate the observed data. The in-sample forecast provides a test of whether the model adequately captures the data generating process. The graphs below show how the in-sample forecasts of the three models compare to the actual outcomes. The graphs generally indicate that a similar trend exists between the actual inflation outcomes and the predictions of the three models for the entire forecast period. The forecasts and actual values are also highly correlated, with correlation coefficients of 0.99, 0.94 and 0.94 for NTF, VAR and ARIMA, respectively. It is also notable that both the NTF and VAR models outperform the ARIMA model in terms of replica-

tion of the realised outcomes, the NTF being the best among the three models. The NTF model also performs satisfactorily in terms of capturing the major turning points in the inflation cycle, almost contemporaneously, whereas both the ARIMA and VAR models have a tendency to over-predict inflation during peaks. This is due to the fact that forecasts generated by ARIMA and VAR models are projections of the last observed values hence when turning points occur; the extrapolative projection always forecast them with a lag (Fildes, R., and Stekler, H.O., 1999:15).

FIGURE 2: Iɴ-Sᴀᴍᴘʟᴇ Iɴғʟᴀᴛɪᴏɴ Fᴏʀᴇᴄᴀsᴛs ʙʏ ᴛʜᴇ NTF Mᴏᴅᴇʟ ᴄᴏᴍᴘᴀʀᴇᴅ ᴛᴏ Aᴄᴛᴜᴀʟ Oᴜᴛᴄᴏᴍᴇs (1987Q1 ᴛᴏ 2008Q2)

The forecasting accuracy of the three models under consideration was also evaluated using statistical measures, such as the Mean Absolute Error (MAE), the Root Mean Square Error (RMSE) and the Theil U statistics.

(a) Mean Absolute Error (MAE)

The MAE measures the average difference between the forecast and the observed value. It is given as:

$$MAE = \frac{1}{T} \sum_{t-1}^{T} |y_t - f_t| \qquad (9)$$

where f_t is the forecast, y_t the observed value and T is the number of observations.

A weakness of the MAE is that it measures the average magnitude of the errors in a set of forecasts, without considering the direction of the errors.

(b) Root Mean Square Error (RMSE)|

The RMSE is a quadratic scoring rate, which measures the average magnitude of the error. It is given as:
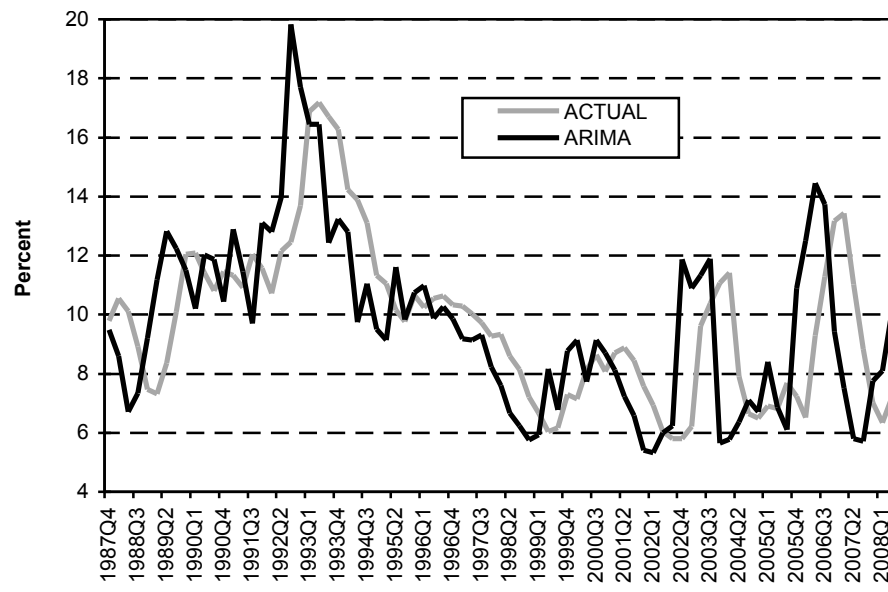
$$RMSE = \sqrt{1/T \sum_{t=1}^{T} (y_t - f_t)^2} \qquad (10)$$

---

12 Stability is the ability of a system to persist and to remain qualitatively unchanged in response either to a disturbance or to fluctuations of the system caused by a disturbance. It can also refer to the capacity of a system to return to equilibrium after having been displaced.

FIGURE 3: IN-SAMPLE INFLATION FORECASTS BY THE **VAR** MODEL COMPARED TO ACTUAL OUTCOMES **(1987Q1 TO 2008Q2)**
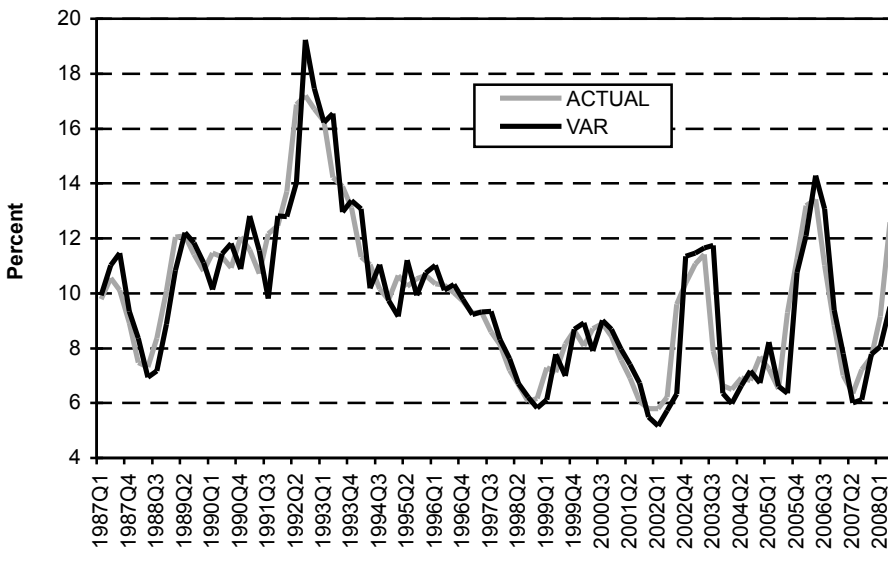
FIGURE 4: IN-SAMPLE INFLATION FORECASTS BY THE **ARIMA** MODEL COMPARED TO ACTUAL OUTCOMES **(1987Q1 TO 2008Q2)**

finity, with values closer to 0 indicating relatively small errors.

(c) Theil U Statistic

The Theil U statistic is a statistical measure that shows the predictive power of the model. The more accurate the forecasts, the lower the value of the Theil U statistic. The Theil U statistic is bounded between 0 and 1, with values closer to 0 indicating greater forecasting accuracy. The Theil U statistic is given as:

$$U_1 = \frac{\sqrt{\frac{1}{T}\sum_{t=1}^{T}(y_t - f_t)^2}}{\sqrt{\frac{1}{T}\sum_{t=1}^{T}y_t^2} + \sqrt{\frac{1}{T}\sum_{t=1}^{T}f_t^2}} \quad (11)$$

where f is the forecast, y is the observed value and T is the number of observations.

Table 4 details the performance of the individual models based on measures of the MAE, RMSE and Theil U statistic. Based on the Theil U statistic, the NTF model has a superior in-sample predictive power. In addition, it also has the lowest MAE and RMSE values. Meanwhile, the VAR model outperforms the ARIMA model in terms of both error minimisation and overall predictive power as indicated by the smaller MAE, RMSE and Theil U Statistic values.

where f_t is the forecast, y_t is the observed value and T is the number of observations.

The difference between the forecasts and corresponding observed values are each squared and averaged over the sample. Since the errors are squared before they are averaged, the RMSE gives a relatively high weight to large errors. This means that the RMSE is most useful when large errors are particularly undesirable. But, like the MAE, it does not capture the direction of the errors.

The MAE and the RMSE can be used together to diagnose the variation in the errors in a set of forecasts. The RMSE will always be larger than or equal to the MAE; the greater the difference between them, the greater the variance in the individual errors in the sample. If the RMSE equals the MAE, then all the errors are of the same magnitude. Both the MAE and RMSE can range from 0 to in-

TABLE 4

Model	MAE	RMSE	Theil U
NTF	0.476	0.542	0.028
VAR	0.825	1.143	0.058
ARIMA	0.930	1.237	0.059

3.3 Out-of-Sample

The superiority of a model should not only be based on its ability to produce accurate in-sample forecasts. The ability of a model to make accurate out-of-sample predictions is also crucial. Therefore, the three models were used to produce inflation forecasts of up to a year out-of-sample, spanning four quarters, from the third quarter of 2007 to the second quarter of 2008.

As in the in-sample forecast horizon, the NTF model outperforms the rest of the models in the out-of-sample forecast horizon, followed by the VAR and ARIMA models, respectively. It has smaller values of the MAE, RMSE and Theil U statistic measures compared to the other models. Table 5 below details the performance of the three models.

TABLE 5

| Model	MAE	RMSE	Theil U
NTF	0.875	0.877	0.028
VAR	1.217	1.373	0.060
ARIMA	2.455	2.785	0.107

Figures 5 to 7 show the out-of-sample forecast trajectory of the three models. The graphs indicate that the forecasts generated by the three models generally remain close to the actual out-turn in the initial period of the forecast horizon. However, as the forecast horizon increases, the spread between the actual out-turn and the forecasts from the VAR and ARIMA models tends to widen, indicating that the models are more suitable for capturing the very short-term dynamics of the data. The spread is narrower and constant over the entire forecast horizon in case of the NTF model. Furthermore, the NTF model performs better in terms of capturing the turning points in the inflation cycle, almost contemporaneously whereas the other models do so with a considerable lag. Overall, the NTF is the best model in terms of the-out-of sample forecast performance, followed by the VAR and ARIMA models, in that order. The statistical measures indicated in Table 5 above confirm the superiority of the NTF over the other two models.

Conclusion

The aim of this paper was to evaluate and document the forecasting performance of the three short-term forecasting models used by the Bank of Botswana. It was found that the NTF is the best short-term

forecasting model of all the three models reviewed. The model performs well in both the in-sample and out-of-sample forecast horizons, emerging first, ahead of the VAR in both forecast horizons. In addition, the NTF outperformed the other models in terms of capturing the major turning points in inflation in both the in-sample and out-of-sample forecast horizons. However, the VAR and ARIMA models remain useful additions to the set of models used in analysing and forecasting inflation in Botswana. Since the two models perform better in a very short forecast horizon, they can be used to forecast only one period (i.e., a month or a quarter) out-of-sample to maximize their effectiveness. Furthermore, the performance of the VAR model could be improved

FIGURE 5: OUT-OF-SAMPLE INFLATION FORECASTS BY THE NTF MODEL COMPARED TO ACTUAL OUTCOMES (2008Q3 TO 2009Q2)
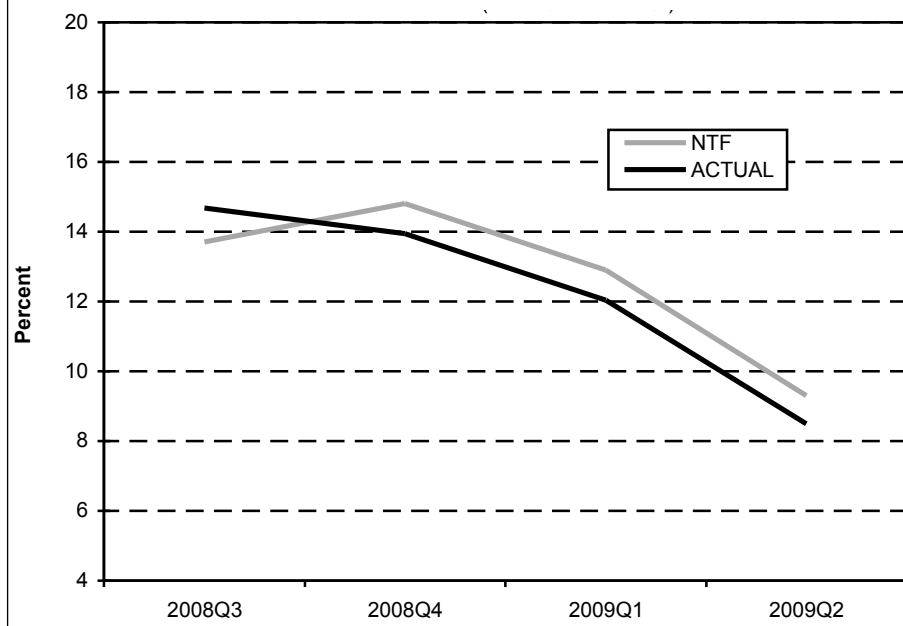
FIGURE 6: OUT-OF-SAMPLE INFLATION FORECASTS BY THE VAR MODEL COMPARED TO ACTUAL OUTCOMES (2008Q3 TO 2009Q2)

FIGURE 7: OUT-OF-SAMPLE INFLATION FORECASTS BY THE ARIMA MODEL COMPARED TO
ACTUAL OUTCOMES (2008Q3 TO 2009Q2)
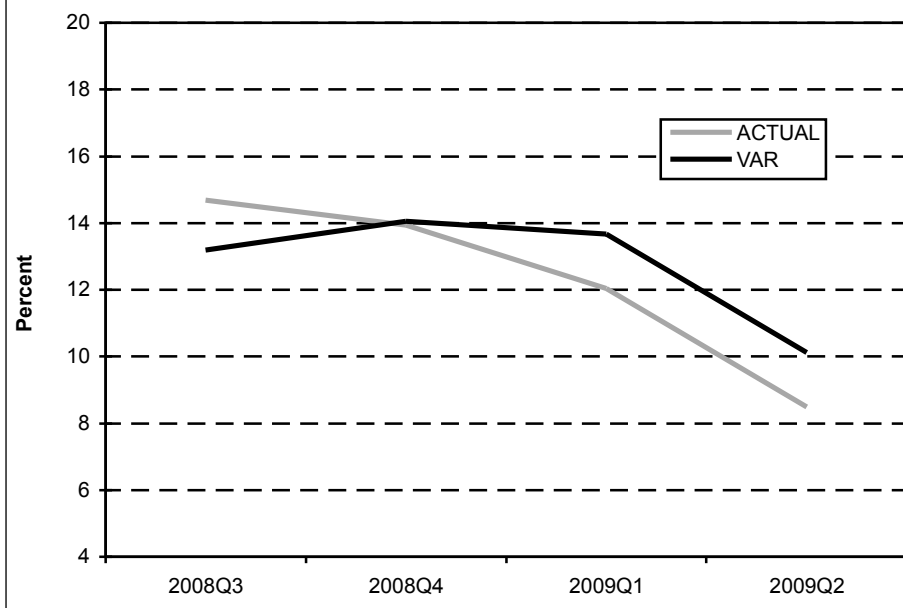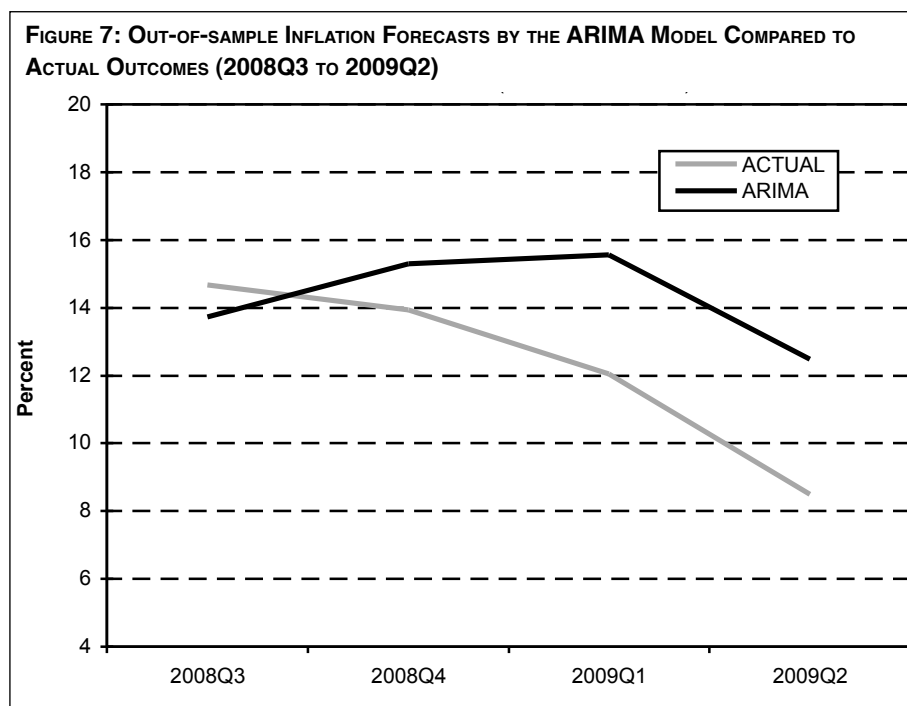
by adding more variables to the VAR system. The superiority of the NTF over the other two models could be attributable to its richer economic theory content and the fact that it captures the direct and fastest transmission channels in Botswana's price developments, namely the ZAR/BWP exchange rate and imported inflation while the other two models mainly rely on the statistical patterns in the data and require fewer assumptions about the structure of the economy.

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APPENDIX 1: ARIMA MODEL

TABLE 1: STATIONARITY TEST

Test	Null Hypothesis	Test Critical Values (5%)	T calculated (level)	T calculated (1st Difference)	T calculated (2nd Difference)	Durbin-Watson
ADF	CPI has unit root	–3.46	2.82	2.016	–6.952	1.9
PP	CPI has unit root	–3.46	2.71	3.158	–9.816	1.8

Table 1 shows that the CPI series is not stationary in both levels and first differences until it is differenced twice. That is, the CPI series is integrated of order two, I(2). In both tests we fail to reject the null hypothesis at levels and first differences because the critical values are greater than the calculated T statistics. All decisions are taken at the 95 percent confidence level.

TABLE 2: CORRELOGRAM

Auto-correlation	Partial Correlation		AC	PAC	Q-Stat	Prob
.*I . I	.*I . I	1	–0.124	–0.124	1.3916	0.238
. I . I	.*I . I	2	–0.047	–0.064	1.5977	0.450
. I*. I	. I*. I	3	0.137	0.125	3.3454	0.341
**I . I	**I . I	4	–0.251	–0.229	9.2847	0.054
.*I . I	.*I . I	5	–0.064	–0.113	9.6765	0.085
. I*. I	. I . I	6	0.088	0.034	10.420	0.108
. I*. I	. I*. I	7	0.092	0.170	11.250	0.128
.*I . I	.*I . I	8	–0.132	–0.155	12.966	0.113
. I . I	.*I . I	9	0.002	–0.091	12.966	0.164
.*I . I	.*I . I	10	–0.064	–0.093	13.382	0.203

Table 2 shows the autocorrelation (AC) and partial autocorrelation (PAC) functions used to identify an appropriate model. An appropriate model is identified on the basis of the patterns of its autocorrelation and partial autocorrelation functions. A correlogram, which is a plot of the AC and PAC functions, is used to show the patterns of the two functions. The different patterns are characteristic of the AR, MA and ARMA processes. For an AR process, the AC function gradually decays to zero as the number of lags increase, whereas the PAC function drops to zero (i.e., falls within the dotted boundary line which represents the 95 percent confidence interval) abruptly after just a few lags, most commonly after one or two lags. For a MA process, the AC function drops to zero abruptly after just a few lags, whereas the PAC function gradually decays to zero as the number of lags increase. In an ARMA process, both the AC and PAC functions gradually decay to zero as the number of lags increase. It

must be noted that although the model specification procedure is mechanical, personal judgement is still required in making a good model choice. Table 2 depicts an ARIMA process as indicated by the wavy decay in both the ACF and PACs.

TABLE 3: MODEL SELECTION USING THE AKAIKE (AIC) AND BAYESIAN (SBC) CRITERIA.

Model	AIC	SBC
ARIMA (1,2,1)	1.44	1.52
ARIMA (1,2,2)	1.48	1.57
ARIMA (2,2,1)	1.51	1.59
ARIMA (2,2,2)	1.49	1.57

APPENDIX 2: VAR MODEL

In identifying a VAR Model for short-term inflation forecasting in Botswana, variables which are considered to have a high correlation with inflation in Botswana were used to build a stable VAR system. These variables are CPI, SSAR and IS.

TABLE 5: RESULTS OF THE VAR MODEL

Variable	Coefficient	Std.Error	t-Statistic
c	0.026	0.046	0.560
log(cpi(-1))	1.475	0.112	13.187
log(cpi(-2))	–0.478	0.111	–1.584
is(-1)	–0.001	0.002	–0.611
is(-2)	0.001	0.002	0.688
log(ssar(-1))	–0.055	0.035	1.585
log(ssar(-2))	0.054	0.035	1.546

Adj. R-squared 0.99

Sum sq.resids 0.004

S.E. equation 0.007

F-Statistic 100742.2

F-Statistic Critical 2.76

Akaike AIC –6.985

Schwartz SIC –6.788

TABLE 6: VAR STABILITY CONDITION CHECK

Endogenous variables: LOG(CPI) LOG(SSAR) IS
Exogenous variables: C
Lag specification: 1 2

Root	Modulus
0.995565	0.995565
0.916215 − 0.054395i	0.917829
0.916215 + 0.054395i	0.917829
0.419688 − 0.179208i	0.456348
0.419688 + 0.179208i	0.456348
0.187710	0.187710

No root lies outside the unit circle.
VAR satisfies the stability condition.

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