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Contents

Inflation and Inflation Uncertainty Nexus: Empirical Evidence for Botswana

Daniel Balondi and Innocent Molalapata[1]

ABSTRACT

This paper examines the relationship between inflation and inflation uncertainty in Botswana by analysing monthly data over the period January 1986 to April 2018. The study estimates an autoregressive moving average – generalised autoregressive conditional heteroskedasticity (ARMA-GARCH) model to derive the inflation uncertainty series and then employs the Granger causality test to determine the direction of causality between inflation and inflation uncertainty. The results confirm a positive causal relationship from inflation to inflation uncertainty. This supports the Friedman-Ball Hypothesis which postulates that there is a positive relationship between inflation and inflation uncertainty, with causality running from the former to the latter. The finding is further supported by the Bank of Botswana business expectations surveys (BESs). The surveys indicate that businesses place greater weight on inflation trends than the inflation objective when forming expectations about inflation, suggesting that inflation expectations are more adaptive. This paper concludes that for the Bank to reduce inflation uncertainty and be able to anchor inflation expectations and improve transparency and accountability, the Bank should intensify sharing of information on all major drivers of domestic inflation with the public to help rationalise inflation expectations as well as provide more frequent explanations of current inflation developments and the medium-term forecast.

1. INTRODUCTION

Inflation uncertainty[2] is an important factor in decision making by economic agents. Uncertainty about future levels of inflation can distort saving and investment decisions of economic agents as a result of the unknown future nominal payments (Barimah and Amuakwa-Mensah, 2014). As a result, the relationship between inflation and inflation uncertainty has received substantial attention in economic literature.

Literature reveals conflicting views about causality between inflation and inflation uncertainty. According to Friedman (1976) and Ball (1992), there is a positive relationship between the two, with causality running from inflation to inflation uncertainty. In other words, a higher current inflation rate creates more uncertainty about the level of future inflation. Conversely, Cukierman and Meltzer (1986) postulate that there is a positive causal effect from inflation uncertainty to inflation resulting from opportunistic central bank behaviour[3].

Meanwhile, other researchers suggest a negative relationship. For example, according to Pourgerami and Maskus (1987) and Hollard (1995), higher inflation reduces inflation uncertainty as a result of stabilisation policy pursued by policy makers during the times of high inflation.

With a view to influence inflation expectations and reduce inflation uncertainty to achieve a low and sustainable rate of inflation, Botswana's monetary policy framework underwent an important transformation from 2008. The Bank of Botswana adopted a forward-looking monetary policy framework, with an inflation objective range set at 3 - 6 percent, achievable in the medium term[4]. A forward-looking framework helps to reduce uncertainty about the future course of inflation and to influence and guide expectations, since (a) it provides monetary policy with a nominal anchor and (b) the announcement of an inflation target/objective range communicates the central bank's intentions to the public and to the financial markets (Montes, 2010).

1 Economist and Principal Economist, Modelling and Forecasting Unit, Research and Financial Stability Department. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Botswana.

2 Inflation uncertainty is the state of not knowing the future direction of inflation.

3 This is whereby agents face uncertainty about the rate of monetary growth and, hence, inflation; and in the presence of such uncertainty, the policymaker uses the opportunity and implements an expansionary monetary policy in order to surprise the agents and enjoy output gains.

4 See Monetary Policy Statement (2008).

Following the adoption of a forward-looking monetary policy framework in 2008 by the Bank of Botswana, year-on-year headline inflation trended downwards, from a peak of 15.1 percent in August 2008 to a lower rate of 5 percent in November 2009. Subsequently, inflation averaged 6.9 percent, 8.5 percent and 7.5 percent in 2010, 2011 and 2012, respectively, before falling within the 3 - 6 percent objective range in June 2013. Inflation has become less volatile and remained within the objective range and closer to the lower bound of the objective range for most of the time between June 2013 and December 2017[5] (see Appendix Figure I). This is one of the most remarkable macroeconomic achievements in Botswana. The objective of this paper is to establish the impact of inflation uncertainty during this period by investigating the relationship between inflation and inflation uncertainty. This study extends Hegerty (2012) by using an autoregressive moving average – generalised autoregressive conditional heteroskedasticity (ARMA-GARCH) model and also extending the period of the study to cover the period post the adoption of a forward-looking monetary policy framework by the Bank. Hegerty (2012) investigated the inflation and inflation uncertainty nexus for Botswana and eight other Sub-Saharan countries through the use of an exponential GARCH (EGARCH) model for the period 1976 to 2011.

Following recent empirical studies, we first derive a measure of inflation uncertainty using an ARMA-GARCH model. Thereafter, we investigate the link between inflation and inflation uncertainty using the Granger Causality test. The layout of the rest of the paper is as follows: Section 2 covers the literature review, while the data and descriptive statistics are covered in section 3. Section 4 specifies the methodology and the results are presented in section 5, while section 6 concludes.

2. LITERATURE REVIEW

Okun (1971) established a positive association between inflation and inflation uncertainty using panel data on 17 Organisation for Economic Co-operation and Development (OECD) countries for the period spanning 1951-1968. Okun used standard deviation as a measure for inflation variability and found that countries which, on average, experienced high inflation tended to display higher variability in inflation. Following Okun's study, Friedman (1976) presented an informal argument in support of this relationship. According to Friedman (1976), an increase in inflation may induce an erratic policy response by the monetary authority and, therefore, lead to more uncertainty about the future rate of inflation. This intuitive idea was subsequently validated with the use of sophisticated theoretical models. Demetriades (1988) argues that, in the presence of asymmetric information between the policymaker, the public and asymmetric stabilisation policies, a positive association between inflation and its variance applies. Furthermore, Ball (1992) formally validated the intuition in an asymmetric information game theoretic model, where the public faces uncertainty about the type of the policy maker. According to Ball (1992), when inflation is low, the public is almost certain about the future policy because the policy makers - both the hawkish and dovish - will try to keep it low, and hence uncertainty concerning future inflation will also be low. However, when inflation is high, policy makers respond differently to counter high inflationary pressures; and consequently uncertainty about the future monetary policy stance and the future path of inflation grows. The contributions by Friedman (1976) and Ball (1992) has come to be known as the *Friedman-Ball Hypothesis*. The hypothesis posits that there is a positive relationship between inflation and inflation uncertainty, with causality running from the former to the latter.

However, according to Pourgerami and Maskus (1987), higher inflation reduces inflation uncertainty as agents invest resources in order to improve the anticipated inflation outlook and shelter themselves from its adverse effects. In support of this negative relationship, Hollard (1995) argues that, as inflation uncertainty rises due to increasing inflation, the monetary authority responds by reducing money supply growth, in order to eliminate inflation uncertainty and its associated negative welfare effects, thus, the so-called *Hollard Hypothesis*.

There are other arguments to the effect that the direction of causality runs from inflation uncertainty to inflation. Cukierman and Meltzer (1986) employ a Barro-Gordon model, where agents face uncertainty about the rate of monetary growth and, therefore, inflation. In the presence of this uncertainty, the policy maker uses the opportunity and employs an expansionary monetary policy in order to surprise the agents and enjoy output gains. This scenario, where inflation uncertainty causes inflation, is known as the *Cukierman-Meltzer Hypothesis.*

5 Inflation breached the lower bound of the objective range in 2015 (February, March, September and November), 2016 (January and April to November) and 2017 (November).

The inflation and inflation uncertainty nexus has been empirically analysed mainly using GARCH models. These models are popular in empirical investigations of inflation uncertainty since the estimated conditional volatility can serve as a good proxy for uncertainty (Karahan, 2012). Mixed results are reported in the empirical literature. Grier and Perry (1998) set out to investigate the relationship between inflation and inflation uncertainty in the G7 countries from 1948 to 1993. They used GARCH models to generate a measure of inflation uncertainty and then employed Granger causality methods to test for causality between average inflation and inflation uncertainty. In all G7 countries, inflation was found to significantly increase inflation uncertainty as postulated by the Friedman-Ball hypothesis.

Tashkini (2007) established that higher inflation led to more inflation uncertainty in the Iranian economy for the period January 1969 to March 1985, using an autoregressive moving average-GARCH (ARMA-GARCH) model and Granger causality tests. Using a similar approach, Karahan (2012) established the Friedman-Ball Hypothesis for Turkey for the period 2002 to 2011.

Caporale et al. (2012) estimated a time varying AR-GARCH model of inflation to derive inflation uncertainty and applied a Granger causality test to examine the causal relationship between inflation and inflation uncertainty in the Euro Area from January 1980 to February 2009. The results confirmed a uni-directional causality running from inflation to inflation uncertainty, consistent with the Friedman-Ball Hypothesis. Bamanga et al. (2016) also confirmed the Friedman-Ball Hypothesis for Nigeria using a GARCH model and Granger causality test from January 1960 to July 2014.

Sharaf (2015) examined the causal relationship between inflation uncertainty and inflation in Egypt from 1974 to 2015, using GARCH and Granger causality approaches. The results supported both the Friedman-Ball and the Cukierman-Meltzer Hypotheses, suggesting a bi-directional effect between inflation and inflation uncertainty. Similarly, Oteng-Abayie and Doe (2013) found a similar bi-directional effect between inflation and inflation uncertainty in Ghana for the period 1984 to 2011. The study used the Full Information Maximum Likelihood approach.

Hegerty (2012) investigated the inflation and inflation uncertainty nexus for Botswana and eight other Sub-Saharan countries (Burkina Faso, Côte d'Ivoire, Ethiopia, Gambia, Kenya, Niger, Nigeria and South Africa) through the use of an exponential GARCH (EGARCH) model, for the period 1976 to 2011 using monthly data. High inflation was found to fuel uncertainty in all the nine countries, while the reverse relationship was established only for Burkina Faso, Gambia, Kenya and Nigeria. This study extends Hegerty (2012)'s work by using a GARCH model and also extending the period of the study to cover the period post the adoption of a forward-looking monetary policy framework by the Bank.

3. DATA AND DESCRIPTIVE STATISTICS

The study uses monthly data on Botswana Consumer Price Index (CPI) for the period January 1986 to April 2018, sourced from Statistics Botswana. The CPI series is converted into a logarithm (log) form and inflation (π) is derived as the first difference of the seasonally adjusted[6] log of CPI, where $\pi_t = (lnCPIt_t - lnCPI_{t-1}) * 100$.

FIGURE 1: THE BOTSWANA SEASONALLY ADJUSTED MONTHLY INFLATION RATE OVER THE PERIOD

JANUARY 1986 – APRIL 2018

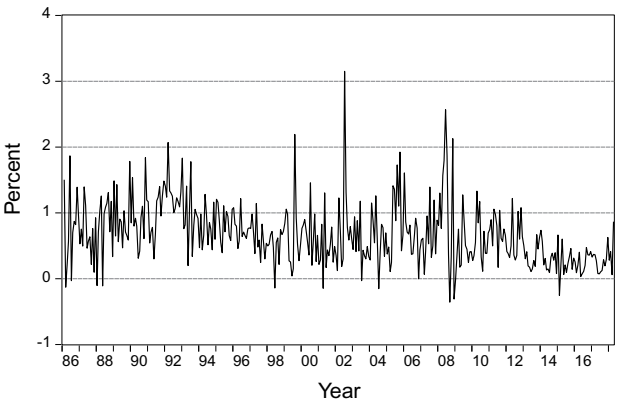


Figure 1 shows the Botswana seasonally adjusted monthly inflation rate. The summary statistics of the inflation rate in Table 1 below indicate that the inflation distribution is not normally distributed, but positively skewed as confirmed by the Jarque-Bera statistic, which is highly statistically significant[7].

6 The moving average method is used to seasonally adjust the CPI series.

7 A positively skewed inflation series indicates that the average inflation rate is greater than the median inflation rate.

TABLE 1: SUMMARY STATISTICS OF THE MONTHLY INFLATION RATE (JANUARY 1986 TO APRIL 2018)

Mean	Median	Std.Dev	Skewness	Kurtosis	Jarque-Bera
0.68	0.61	0.47	1.03	5.26	151.05 (0.00) ***

*** Indicates rejection of the null hypothesis of zero skewness and zero excess Kurtosis at 1% significance level.

4. METHODOLOGY

In examining the relationship between inflation and inflation uncertainty in Botswana, this paper follows the two-step approach used by Sharaf (2015). The first step relates to estimation of inflation uncertainty as a conditional variance in an ARMA-GARCH model[8], while the second step relates to conducting a Granger-causality test to examine the causal relationship between inflation and the generated inflation uncertainty series.

In the first step, the mean-based inflation equation (π) is modelled using an autoregressive, moving average (ARMA) (p,q) model of the form:

$$\pi_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \, \pi_{t-i} + \sum_{j=1}^{q} \beta_j \, \varepsilon_{t-j} \; + \; \varepsilon_t \qquad (1)$$

Where, $E\,(\varepsilon_t|\alpha_{t-1}) = 0; var(\varepsilon_t|\alpha_{t-1}) = \sigma_t^2$

Equation 1 is a standard time-series model of inflation, where the conditional mean of inflation is assumed to follow an ARMA process. α_0, α_i and β_j are parameters, and ε_t is the error term. Inflation at time t is simply a function of past values of inflation (AR terms) and past values of the error term (MA terms). In other words, an ARMA process is a stationary autoregressive, moving average process with (p) autoregressive lags and (q) moving average lags. The optimal lag lengths (p,q) are selected based on the Box-Jenkins procedure and information criteria such as the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC).

Before modelling inflation uncertainty, it was confirmed that the conditional variance of the error terms $\hat{\sigma}_t^2$, in Equation 1, have ARCH effects, and that the residuals are serially uncorrelated[9]. Engle's (1982) Lagrange Multiplier (LM) test was used to diagnose the presence of ARCH effects, while the Ljung-Box Q-test was used to detect serial correlation in the residuals.

In order to construct a measure of inflation uncertainty, the mean inflation equation is augmented to incorporate the presence of the time-varying variances in the residuals using the following ARMA-GARCH model in Equations (2) and (3).

$$\pi_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \, \pi_{t-i} + \sum_{j=1}^{q} \beta_j \, \varepsilon_{t-j} \; + \; \varepsilon_t \qquad (2)$$

$$\sigma_t^2 = \gamma_0 + \sum_{i=1}^{p} \gamma_i \, \sigma_{t-1}^2 + \sum_{j=1}^{q} \eta_j \, \varepsilon_{t-j}^2 \qquad (3)$$

where, $E\,(\varepsilon_t|\alpha_{t-1}) = 0; var(\varepsilon_t|\alpha_{t-1}) = \sigma_t^2$

From this model, the estimated conditional variance σ_t^2 is used as a measure for inflation uncertainty. The sum of the coefficients of the ARCH (γ) and GARCH (η) terms in the conditional variance equation determines the persistence of inflation volatility due to inflationary shocks.

In the second step, after constructing a measure of inflation uncertainty, a bivariate vector autoregressive (VAR) model is used to test whether inflation Granger causes inflation uncertainty or vice versa, as in Equations 4 and 5:

$$\pi_t = \alpha_0 + \sum_{i=1}^{n} \alpha_i \, \pi_{t-1} + \sum_{j=1}^{n} \beta_j \, \sigma_t^2 \; + \; \varepsilon_t \qquad (4)$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{n} \alpha_i \, \sigma_{t-1}^2 + \sum_{j=1}^{n} \beta_j \, \pi_{t-j} \; + \; \mu_t \qquad (5)$$

where α_0, α_i and β_j are parameters, and ε_t and μ_t are error terms. The n represents the lag length chosen for the causality analysis. The null hypothesis in equation 4 is that

8 This paper estimates a pure GARCH model as opposed to an exponential GARCH (EGARCH) model estimated by Hegerty in his investigation on the inflation and inflation uncertainty nexus for Botswana and eight other Sub-Saharan countries due to the absence of EGARCH effects, which is a precondition for EGARCH models.

9 A time series exhibiting conditional heteroscedasticity or autocorrelation in the squared series is said to have autoregressive conditional heteroscedastic (ARCH) effects.

inflation uncertainty does not Granger cause inflation, while the null hypothesis in equation 5 is that inflation does not Granger cause inflation uncertainty. The rejection of the latter hypothesis implies an acceptance of the Friedman-Ball Hypothesis, while a rejection of the former hypothesis implies acceptance of the Cukierman-Meltzer Hypothesis.

5. RESULTS

5.1 STATIONARITY TESTS

The Augmented Dickey-Fuller (ADF) test, the Dickey-Fuller Generalised Least Squares (DF-GLS) test, which is a modified Dickey-Fuller test that has improved power in small samples, the Phillips-Peron (PP) test, and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test were used to determine the time-series properties of the inflation series. The ADF, DF-GLS and PP tests are of the null hypothesis of a unit root against the alternative of stationarity, while KPSS test is based on the null hypothesis of stationarity. However, the ADF, DF-GLS and PP unit root tests have a limitation of not being able to control for structural breaks in a time series, thus the risk of considering structural breaks in the series as evidence of non-stationarity (Sharaf, 2015). Therefore, to allow for a possibility of a structural break in the inflation series, we use the Zivot-Andrews (ZA) test in addition to the aforementioned tests. The ZA test allows for one structural break in the series and considers the null hypothesis of a unit root with no break against the alternative of a stationary process with a break. The results from these tests are reported in Table 2 below.

TABLE 2: UNIT ROOT TEST STATISTICS

ADF	-16.50***	
DF-GLS	-5.54***	
PP	-17.44***	
KPSS	0.13***	
ZA	-17.35***	Break date: 2008:07

*** denote statistical significance at 1% level of significance.

The ADF, DF-GLS, PP and KPSS tests show that the inflation series is stationary. Similarly, the ZA test shows that the null hypothesis of a unit root with no break against the alternative of a stationary process with a break is rejected. The break is identified in July 2008 and coincides with the period when inflation reached a peak of 14 percent in 15 years, due to the sharp global increase in food and energy prices. Therefore, results from these tests indicate that the inflation series is stationary at levels, that is, it is integrated of order zero, I (0).

5.2 ESTIMATES OF INFLATION UNCERTAINTY

Table 3 presents the result of the estimated mean equation of inflation (Equation (1)) used to test for ARCH effects. The AIC and SBIC were used to select the best mean equation of inflation as an ARMA (1,1) process. The Ljung-Box Q test shows no serial correlation in the residuals at different lag lengths. Similarly, the Durbin-Watson test statistic confirms that there is no serial correlation in the residuals. Regarding the ARCH effects, the LM test rejects the null hypothesis of homoscedasticity in the conditional variance of the inflation error terms, implying the existence of ARCH effects.

TABLE 3: ARMA (1,1)

	Coefficient	Std. Error	Probability
α_0	0.654	0.116	0.000***
π_{t-i}	0.980	0.017	0.000***
ε_{t-j}	-0.887	0.036	0.000***
Q Test	Q(1)	Q(3)	Q(5)
	1.909 [0.167]	2.103 [0.551]	7.562 [0.182]
Durbin-Watson Statistic = 1.985			
LM Test	ARCH(1)	ARCH(3)	ARCH(5)
	4.259 [0.04]**	9.780 [0.02]**	11.893 [0.036]**

*** and ** indicate statistical significance at 1% and 5% level of significance, respectively.

The existence of ARCH effects in the inflation series justified the estimation of the ARMA-GARCH model. The AIC and SBC, therefore, selected ARMA (1,1) – GARCH (1,1) as the best model. The generated conditional variance (inflation uncertainty) is depicted in Figure 2 and the results of the estimated model, along with several diagnostic tests, are presented in Table 4. The conditional variance exhibits instability over time; and in some periods, its surge varies directly with the inflation rate. The coefficients of both the ARCH and GARCH terms are statistically significant at the 1 percent level. These results strongly support the presence of a positive relationship between the level of inflation and its uncertainty. Furthermore, the sum of ARCH and GARCH terms is close to one (0.98), exhibiting a high degree of volatility persistence in response to inflationary shocks. Moreover, the GARCH (1,1) is found to adequately capture ARCH effects as depicted by the Q statistic and the LM tests (Table 4). The Q statistic of the squared residuals fails to reject the null hypothesis of no serial correlation and the LM test shows no ARCH effects in the

residuals (see Figures II and III in the Appendix). Therefore, the ARMA-GARCH model of inflation is considered a good fit; and the conditional variance from this estimate can be used as a measure of inflation uncertainty.

FIGURE 2: CONDITIONAL VARIANCE FROM THE ARMA (1,1) – GARCH (1,1) MODEL

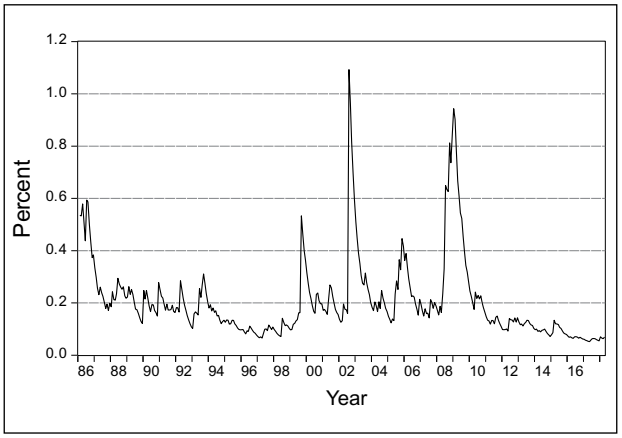


TABLE 4: ARMA (1,1) – GARCH (1,1) MODEL FOR INFLATION AND INFLATION UNCERTAINTY

Panel A: Mean Equation (ARMA (1,1))

	Coefficient	Std. Error	Probability
α_0	0.587	0.220	0.008***
π_{t-i}	0.989	0.012	0.000***
ε_{t-j}	-0.886	0.034	0.000***

Panel B: Variance Equation (GARCH (1,1))

γ_0	0.001	0.003	0.061*
γ_i (ARCH(1))	0.136	0.032	0.000***
η_j (GARCH(1))	0.840	0.035	0.000***
			Persistence (0.98)
Q Test[1]	Q(1)	Q(3)	Q(5)
	0.249[0.618]	0.438[0.932]	1.575 [0.904]
Durbin-Watson Statistic = 1.90			
LM Test	ARCH(1)	ARCH(3)	ARCH(5)
	0.248[0.619]	0.422[0.936]	1.452[0.919]

*** and * indicate statistical significance at 1% and 10% level of significance, respectively.

Note 1: Q Test on the squared residuals

5.3 GRANGER CAUSALITY TEST

The results of Granger-causality tests for inflation and inflation uncertainty indicate that inflation Granger causes inflation uncertainty (Table 5)[10]. The null hypotheses that inflation does not Granger-cause inflation uncertainty are rejected at 1 percent level of significance across lags of 4 to 12. Furthermore, the positive signs in the sum of the coefficients indicate that an increase in inflation rate "Granger-causes" greater inflation uncertainty, while lower inflation out-turns lead to lower uncertainty. The null hypothesis that inflation uncertainty does not Granger-cause inflation is only rejected at the fourth lag at the 5 percent level of significance, while at lags 8 and 12 we find no statistically significant relationship between inflation uncertainty and inflation. Though the sum of the coefficients is negative, the statistical support that increased inflation uncertainty leads to lower future inflation is weak.

TABLE 5: GRANGER-CAUSALITY TESTS BETWEEN INFLATION AND INFLATION UNCERTAINTY OVER THE PERIOD 1986:01 – 2018:04

Null Hypothesis: Inflation does not Granger-cause inflation uncertainty		
4 lags	8 lags	12 lags
94.767 (+)	91.243 (+)	94.102 (+)
[0.000]***	[0.000]***	[0.000]***
Null Hypothesis: Inflation uncertainty does not Granger-cause inflation		
4 lags	8 lags	12 lags
11.456 (-) [0.0219]**	12.113 (-) [0.146]	18.919 (-) [0.102]

*, ** and *** indicate statistical significance at 10%, 5% and 1% level of significance, respectively.

(+) and (-) indicate the sign of the sum of the relevant coefficients in the Granger equation.

Therefore, higher inflation increases inflation uncertainty, which creates real economic costs, but evidence of monetary tightening and stabilisation to lower subsequent inflation is weak. Therefore, there is strong evidence of a uni-directional causality between inflation and inflation uncertainty, which supports the Friedman-Ball Hypothesis. This also supports the findings by Hegerty (2012) for the period 1976 to 2011.

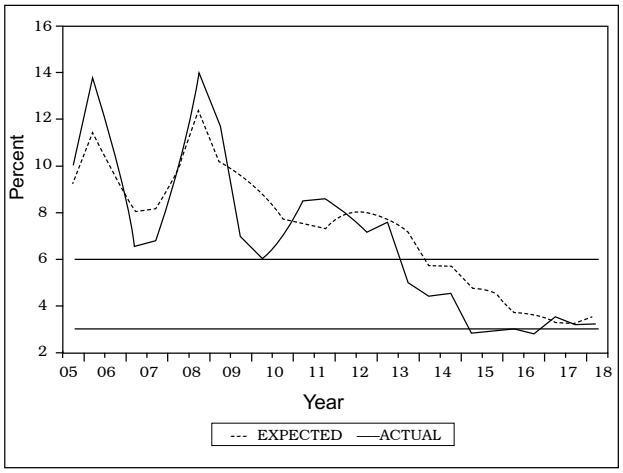
5.4 EXPECTED INFLATION AND ACTUAL INFLATION

Evidence of a positive association between inflation and inflation uncertainty is further supported by the results from the Bank of Botswana's BESs conducted since 2005. The Bank's biannual BES collects information on the local business community's perceptions about the prevailing state of the economy and economic prospects.[11] Figure 3 shows actual inflation against expected inflation.

10 The inflation uncertainty is stationary; and since the inflation series is also stationary, it is permissible to use a Vector Autoregressive approach to test for Granger causality.

11 In the survey, businesses respond to a range of questions relating to, among others, the business climate and the outlook for economic growth, inflation and business performance over the survey horizon, which is one and half years ahead. The survey responses mainly focus on the anticipated direction of change; i.e., whether conditions will improve, worsen or stay the same. The results are then consolidated on the basis of an overall 'net balance', obtained by summing up the positive and negative responses for each question/element.

FIGURE 3: EXPECTED AND ACTUAL INFLATION 2005-2018



Source: Statistics Botswana and Bank of Botswana

The surveys suggest that inflation expectations are more adaptive than rational. That is, the businesses place greater weight on past inflation outcomes than the inflation objective when forming expectations about inflation. In other words, during times of high inflation, businesses expect inflation to remain high and during times of low inflation businesses expect inflation to remain low and within the objective range of 3 - 6 percent. This, therefore, reflects that the Bank's inflation forecasts only anchor expectations of future inflation during the times when inflation hovers around the objective range. Other factors identified to be influencing business expectations are administered prices and international commodity prices. When administered prices and international commodity prices are expected to increase, businesses are likely to revise their expectations about inflation upwards.

Inflation expectations influence current and future pricing decisions. Therefore, anchoring inflation expectations is a critical precondition for price stability. It is, therefore, imperative for the Bank to do more in sharing information on all major drivers of domestic inflation with the public to help rationalise inflation expectations. This should be achieved through strengthening communications by the Bank and publication of the Monetary Policy Reports (MPRs) effective August 2018. Four full MPRs will be published for the February, April, August and October Monetary Policy Committee (MPC) meetings and within seven days following the MPC meetings. There will also be two interim reports for the June and December MPC meetings, which would essentially be updates of relevant previous MPRs and comments on recent macroeconomic developments. Monetary policy decisions will still be communicated to the public through a press release following each of the six MPC meetings. The MPRs are also expected to provide more frequent explanations of current inflation developments and the medium-term forecast to the public; and this would help to communicate the monetary policy stance, anchor inflation expectations and improve the Bank of Botswana's transparency and accountability. Hitherto, the Bank promotes an understanding of the conduct of monetary policy in order to anchor public expectations through the Monetary Policy Statement (MPS) launched at the beginning of each year and a Mid-Term Review in August each year. Furthermore, there are press releases issued after each of the six MPC meetings, which briefly explain the decision of the MPC and the reasons supporting such decisions.

6. CONCLUSION AND POLICY IMPLICATIONS

The study investigated the relationship between inflation and inflation uncertainty in Botswana by testing for the Friedman-Ball Hypothesis, Cukierman-Meltzer Hypothesis and Hollard Hypothesis. The Friedman-Ball Hypothesis postulates that there is a positive relation between inflation and inflation uncertainty, while the Hollard Hypothesis suggests a negative relationship. Using an ARMA-GARCH model and Granger-causality test, the study confirms a positive causal relationship from inflation to inflation uncertainty, which supports the Friedman-Ball Hypothesis. This finding is further supported by the Bank's BESs. The surveys indicate that inflation expectations are more adaptive in that businesses place greater weight on inflation trends than on the inflation objective in their formation of inflation expectations.

Although the results are not conclusive in whether the inflation uncertainty channel has contributed to the recent lower and sustainable rates of inflation, they do have some important policy implications. For example, they point to the benefits of keeping inflation low and stable, in which case it will become more predictable. Therefore, the Bank should minimise the marginal effect of inflation on inflation uncertainty, which can be achieved through: quick implementation of policy responses to forecast inflation movements, thereby reducing inflation uncertainty both in the short and long run; and implementation of the already planned publication of MPRs, which is expected to provide more frequent explanations of current inflation developments and the medium-term forecast to the public and, thus, help anchor inflation expectations and improve the Bank of Botswana's transparency and accountability.

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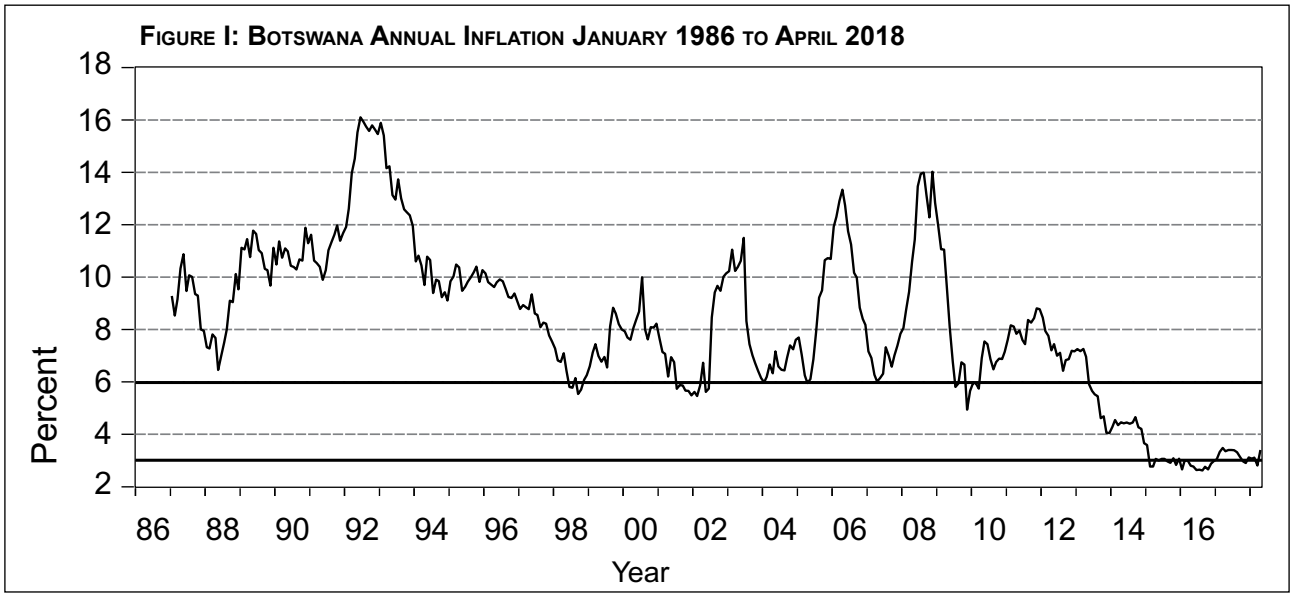
Appendix

Figure I: Botswana Annual Inflation January 1986 to April 2018



Source: Statistics Botswana

Figure II: Serial Correlation Test Results on the Squared Residuals

Date: 05/21/18 Time: 13:23
Sample: 1986M01 2018M04
Included observations: 387

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.|. |	.|. |	1	-0.025	-0.025	0.2489	0.618
.|. |	.|. |	2	0.006	0.005	0.2611	0.878
.|. |	.|. |	3	-0.021	-0.021	0.4375	0.932
.|. |	.|. |	4	0.048	0.047	1.3287	0.856
.|. |	.|. |	5	-0.025	-0.023	1.5749	0.904
.|. |	.|. |	6	-0.030	-0.032	1.9254	0.926
.|. |	.|. |	7	-0.044	-0.043	2.6889	0.912
.|. |	.|. |	8	-0.037	-0.043	3.2401	0.918
.|. |	.|. |	9	-0.044	-0.045	4.0267	0.910
.|. |	.|. |	10	-0.005	-0.007	4.0369	0.946
.|. |	.|. |	11	0.027	0.028	4.3258	0.959
.|. |	.|. |	12	-0.003	-0.003	4.3297	0.977
.|. |	.|. |	13	-0.020	-0.021	4.4867	0.985
.|. |	.|. |	14	0.060	0.055	5.9637	0.967
.|. |	.|. |	15	0.021	0.015	6.1361	0.977
.|. |	.|. |	16	-0.030	-0.035	6.5059	0.982
.|. |	.|. |	17	-0.024	-0.025	6.7455	0.987
.|. |	.|. |	18	-0.026	-0.034	7.0294	0.990
.|. |	.|. |	19	-0.005	-0.007	7.0408	0.994
.|. |	.|. |	20	-0.006	0.001	7.0537	0.997
.|. |	.|. |	21	-0.012	-0.008	7.1109	0.998
.|. |	.|. |	22	0.011	0.014	7.1636	0.999
.|. |	.|. |	23	-0.016	-0.014	7.2645	0.999
.|* |	.|* |	24	0.102	0.100	11.614	0.984
.|. |	.|. |	25	-0.023	-0.027	11.835	0.988

*Probabilities may not be valid for this equation specification.

FIGURE III: ARCH EFFECTS TEST

Heteroskedasticity Test: ARCH

F-statistic	0.286861	Prob. F(5,376)	0.9202
Obs*R-squared	1.451655	Prob. Chi-Square(5)	0.9186

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 05/21/18 Time: 13:25
Sample (adjusted): 1986M07 2018M04
Included observations: 382 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.008698	0.180839	5.577888	0.0000
WGT_RESID^2(-1)	-0.022299	0.051613	-0.432036	0.6660
WGT_RESID^2(-2)	0.004736	0.051567	0.091833	0.9269
WGT_RESID^2(-3)	-0.020377	0.051560	-0.395215	0.6929
WGT_RESID^2(-4)	0.046235	0.051572	0.896504	0.3706
WGT_RESID^2(-5)	-0.022714	0.051626	-0.439965	0.6602

R-squared	0.003800	Mean dependent var	0.994553
Adjusted R-squared	-0.009447	S.D. dependent var	2.698809
S.E. of regression	2.711527	Akaike info criterion	4.848483
Sum squared resid	2764.495	Schwarz criterion	4.910453
Log likelihood	-920.0603	Hannan-Quinn criter.	4.873068
F-statistic	0.286861	Durbin-Watson stat	1.996832
Prob(F-statistic)	0.920193		

Measurements of the Real Effective Exchange Rate (REER)

Kaelo Ntwaepelo and Gaone A Motsumi[1]

ABSTRACT

This paper discusses advantages and disadvantages of methods used in the computation of real effective exchange rate indices. The paper also reviews measures of the real effective exchange rate in Botswana. It focuses on methodological issues concerning the measurements of real effective exchange rates, including choosing price and cost indices, such as consumer price index and producer price index. Each index has advantages and disadvantages. The real effective exchange rate measures differ depending on the price index used and both empirical studies, as well as official and market measures utilise different price indices, weighting schemes and baskets of currencies. It is, therefore, necessary to determine which price index is the most appropriate for given circumstances, in analysing changes in international competitiveness of a country's products. In the case of Botswana, due to unavailability of data for other indices, the Bank of Botswana currently generates one type of index, an effective exchange rate (nominal and real) based on the consumer price index (CPI). The choice of a price index is regarded as a critical factor when considering the different measures of the real effective exchange rate.

1. INTRODUCTION

The exchange rate, which is a price for which the currency of one country is exchanged for another currency is an important determinant of international competitiveness and, therefore, growth of cross-border trade. An exchange rate can be presented as a nominal or real measure, and either as a bilateral or multilateral exchange rate (further discussion in Section 2). A nominal exchange rate is the domestic (foreign) currency price of a unit of foreign (domestic) currency or, simply, the rate at which one currency exchanges for another, while a real exchange rate (RER) is the nominal exchange rate adjusted for inflation differentials between the two countries concerned. The real effective exchange rate (REER) is the measure of nominal exchange rates adjusted for price differentials between the home country and its trading partners (Edwards, 1989). In other words, it is a trade-weighted measure of the average exchange rate of a currency against a basket of trading partner country currencies after adjusting for inflation differentials. It is often expressed as an index number in relation to a chosen base year. This is also referred to as the multilateral real exchange rate and it is used as an indicator of changes in a country's overall international competitiveness.

Inputs into the computation of the REER include nominal exchange rates for trading partner countries, the relative trade weights and the respective price indices. The same measure of price index has to be used for all the countries. A depreciation (increase) in the REER would normally lead, ceteris paribus, to an improvement (deterioration) in the country's real trade balance over time.[2] This paper discusses alternative approaches to measuring REER indices and the related merits and shortcomings.

The rest of the paper is structured as follows: Section 2 presents the conceptual framework of the exchange rate; Section 3 reviews measurements of REER; an estimation of the real effective exchange rate is discussed in Section 4; Section 5 examines the measurement of the REER in Botswana; and the conclusion is in Sections 6.

2. THE CONCEPTUAL FRAMEWORK OF THE EXCHANGE RATE

Figure 1 summarises the general framework of the exchange rate. The spot exchange rate measures the current exchange rate at which a transaction is made, and a forward exchange rate is quoted and agreed on a particular date, but for delivery and payment on a specific future date. The spot exchange rate could be specified either as a nominal or a real bilateral or multilateral exchange rate. A bilateral exchange rate involves only two currencies, whereas a multilateral (or an effective) exchange rate is where at least three currencies for trading partners are considered. The nominal effective exchange rate (NEER) is a weighted average of bilateral exchange rates with currencies of trading partners. The REER is the NEER adjusted for inflation.

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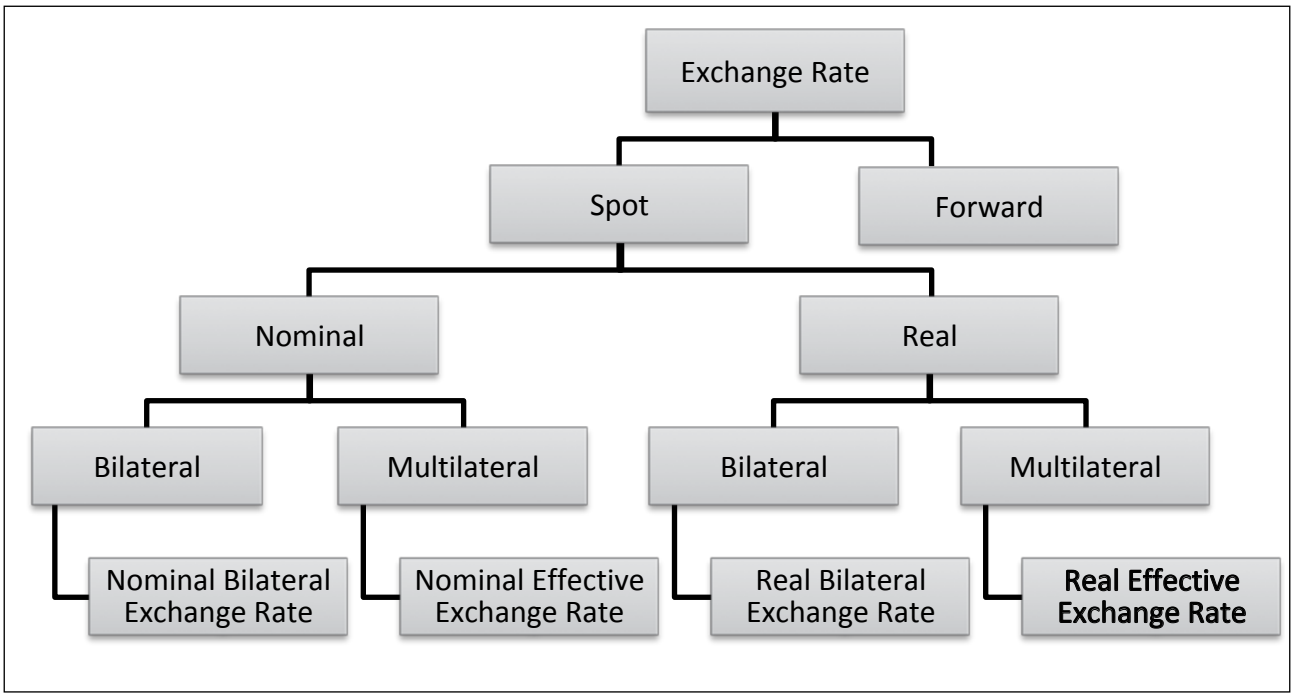
2 Depending on how the bilateral exchange rate is quoted, where if defined as foreign currency per domestic currency an increase/decrease is an appreciation/deprecation and if domestic currency per foreign currency an increase/decrease is deprecation/appreciation.

FIGURE 1: A CONCEPTUAL FRAMEWORK OF THE EXCHANGE RATE



Source: MacDonald (2007)

3. MEASURING THE REER

The REER index is used for, among others, assessing an economy's international trade competitiveness. An increase/decrease in the REER index, *ceteris paribus*, means that the domestic currency is appreciating/depreciating, which can translate into a worsening/improving a country's trade balance. The REER can be expressed in two different ways as indicated below (Opoku-Afari and Lloyd, 2004):

(a) As a ratio between the NEER index and the index of relative prices

$$REER_t = \frac{\text{NEER}_t * \text{CPI}_t}{\text{CPI}_t^{\text{foreign}}} \quad (1)$$

where, REER_t = real effective exchange rate of the domestic economy against a basket of currencies of trading partners at time t

CPI_t = consumer price index of domestic country in period t

$\text{CPI}_t^{\text{foreign}}$ = consumer price index of trading partner countries at time t

$\text{NEER}_t = \prod_{i=1}^{N} S(i)_t^{w(i)}$ = nominal effective exchange rate of domestic economy in period t, which is the weighted average of $S(i)_t$

$S(i)_t$ = nominal bilateral exchange rate between the domestic economy and its trading partner i at time t

w(i) = weight of trading partner i ($\sum_{i=1}^{N} w(i) = 1$)

N = the number of trading partners considered; or

(b) As a weighted average of bilateral real exchange rates with trading partners of a country

$$\text{REER}_{\text{country i}} = \sum_{j=1}^{N} \text{trade weight (j) x RER (j)} \quad (2)$$

where, j = 1, 2,... N are country i's trading partners

The use of the REER facilitates analysis of sources of shifts in competitiveness among which are changes in nominal exchange rates and relative prices. For example, if one country's currency is

depreciating and its price level is increasing at a faster pace relative to those of its trading partners, then the exchange rate depreciation does not result in improved competitiveness. This is because the gain in competitiveness from a depreciating currency is offset by higher costs resulting from the increase in prices. For this reason, when evaluating the effect of exchange rate movements on the economy, it is necessary to focus on the real variable. Indeed, over shorter horizons, and in times of low and stable inflation, movements in the NEER can generally provide a reasonable guide to what is happening to the REER.

The two common methods for computing the REER are described below.

(i) Arithmetic Mean (average) (AM)

The arithmetic mean is computed as a sum of the weighted ratio of the index of the price of the domestic currency relative to the price indices. The AM is influenced greatly by the choice of base year in the computation of the index and has to be rebased when trend analysis needs to be done. The major strength of the AM is its ease of computation, making it more appealing to researchers and practitioners. It, however, gives an asymmetrical treatment to depreciating and appreciating currencies and can result in distortions, due to an upward bias. In other words, the arithmetic average gives a larger weight to those currencies that change more than other currencies in the index. In addition to being sensitive to how the exchange rate is expressed, currency weights drift over time in the arithmetic average computation of the REER.

The arithmetic mean is computed as follows:

$$\text{REER}_t = \sum_{i=1}^{N} w_i \, (S_{it} / P_{it}) \qquad (3)$$

where, S_{it} = an index of the price of the domestic currency in terms of the i^{th} trading partner's currency at time t

P_{it} = ratio of the price index of the i^{th} trading partner in period t to the price index of the domestic economy

w_i = weight of the i^{th} trading partner's currency

N = the number of competitor countries in the reference group of trading partners

(ii) Geometric Mean (average) (GM)

The geometric mean is computed as a product of the nominal effective exchange rate and the effective relative price indices, following Hinkle and Montiel (2000). It has certain properties of symmetry and consistency that an arithmetic mean index lacks. The method gives REER indices for which the percentage change between two dates is not influenced by the choice of the base year period. It is calculated as:

$$REER_d = \frac{\text{NEER}_{\text{jit}} * \text{EP}_{\text{gdt}}}{\text{EP}_{\text{gft}}} \qquad (4)$$

where, $NEER_{jit} = \prod_{i=1}^{\mathcal{N}} E_{di}^{wit}$, with E_{di} representing the index of nominal bilateral exchange rate (period average rates) in units of domestic currency per unit of foreign currency for the home country j, while P_{gft} and P_{gdt} are the foreign and the domestic prices, respectively.

While the AM gives larger weights to currencies which have appreciated or depreciated to a significant extent alongside the domestic currency, the GM treats depreciation and appreciation symmetrically, and thus, this makes the GM more efficient in capturing trends in REER (Hinkle and Montiel, 2000).

4. CHOICE OF VARIABLES IN ESTIMATING THE REAL EFFECTIVE EXCHANGE RATE

These different approaches emphasise diverse aspects of the effect of the exchange rate on the economy, and it is generally necessary to consider a range of measures to obtain an overall view.

Calculating the REER also involves choices regarding the exchange rates (trading partners) and their weighting and measures of inflation. The choices reflect the desired use of the index including measurement and policy intensions. Broadly, the REER can be derived from theoretically implied data outcomes or influenced by policy framework and desired policy outcomes as well as by data availability.

(a) WEIGHTING SCHEMES

The weighting scheme relates to determination of the currencies used in the estimation of the REER which will depend on the estimated share of weights assigned to the trading partner countries in total trade. There are various considerations in the choice of the appropriate weights for the

REER index, depending on the intended use of the measure. For example, a weighting scheme might be chosen to assess the effect of exchange rate movements on the volume and prices of imports and exports, separately or combined. However, in practice, the complexity of the exercise, and to some extent, data availability and quality tend to restrict the number of countries that can be considered.

In computing country weights, the nature of goods and services should also be considered. Ideally, data on all goods and services traded (tradeables) is preferred, there is invariably a constraint with respect to unavailability and/or unreliability of data on services for some countries. In most economies, policymakers are interested in the international competitiveness position of their countries, in terms of both imports and exports of goods and services. In this case, appropriate REER measures should include both import and export weights. Even then, when countries have different patterns of trade for imports and exports, it is preferable to calculate separate REER indices for imports and exports rather than averaging them together (Lafrance, 2008).

An import competitiveness indicator measures a country's competitiveness against imports, while export competitiveness is the ability of the country to produce and sell goods and services in foreign markets at prices and quality that are sustainable in the long term. Import-weighted indices are generally the most appropriate when assessing the effect of exchange rate movements on imports, while export-weighted indices are typically used in order to characterise competitiveness of a country in foreign markets (Betliy, 2002).

Computing import weights is fairly straightforward and is based on bilateral imports, while there are various ways to compute export weights, including bilateral, multilateral and double export weighting schemes. In the bilateral export-weighting system, weights are derived based on bilateral trade patterns. However, this method only takes into account the competitiveness between the domestic economy and its direct trade partners and does not consider the possible indirect competition from the third markets. An alternative approach is the calculation of the multilateral export weights, which measures the country's share in the world trade. These weighting methods captures the importance of other countries in determining the competitive pressure faced by the domestic economy, but ignores the competitive effects of the importing country's domestic producers (Ellis, 2001). Therefore, the double export weighting system helps address this deficiency, with export weights derived as a combination of two elements: a bilateral export weight and a third-market export weight, which capture competition between exporters from two different countries in a third market.

(b) PRICE INDICES

A price index tracks the extent to which a price has changed over a period compared with the price(s) in a chosen base year. In principle, price indices should cover a representative basket of traded goods and services that are comparable across countries. Moreover, it is important that price measures reflect underlying trends, rather than temporary movements associated with short-term influences. Thus, a major problem in designing a relevant real effective exchange rate index is the choice of domestic and foreign price indices.

There are five major indices that are used to estimate the REER. These are; the consumer price index, producer price index, wholesale price index, gross domestic product deflator and unit labour costs. In constructing the REER, comparable and similarly measured price indices should be used for both the domestic country and the trading partners. The index should also be representative of price conditions in those countries as well as relatively free from any measurement error. Each of the indices has advantages and disadvantages (Opoku-Afari and Lloyd, 2004).

(i) Consumer Price Index

Most commonly, REERs are calculated using relativities between consumer price index (CPI) measures, where CPI is a measure of the average of prices of a basket of consumer goods and services at a given period of time. Ideally, a price index should reflect the costs of domestic inputs used in the production process, so that the real effective exchange rate measures the relative costs faced by both domestic and international producers. The strong point in favour of the CPI approach to computing REER is that the CPI is readily available and easily computable since it is calculated on the basis of a basket of goods that is fairly comparable across countries and is available over a long time period. This index, however, is often a poor proxy for tradeable items as it includes prices of nontraded services. Moreover, the calculation of CPI in different countries is not based on the same baskets of goods and services, the weightings often reflect patterns of consumer spending that differ from one country to another (Nilsson, 2000).

(ii) Wholesale Price Index

The wholesale price index (WPI) is the price of a representative basket of wholesale goods and it focuses on the price of goods traded between corporations, rather than goods bought by consumers. It is heavily weighted with tradeable goods and, therefore, is more representative of traded goods.

The main advantage of the WPI is that it covers exports and imports and is closely linked to industry selling prices. Hence it is a good approximation to the price of tradeable goods. However, the WPI might distort prices of raw commodities and semi-manufactured goods, for which price competitiveness is of limited importance and may include a large component of imported intermediate goods, resulting in the true direction of competitiveness not being reflected. Furthermore, the WPI is not available for many countries (Freedman, 2005).

(iii) Producer Price Index

The producer price index (PPI) measures the rate at which the prices of producer goods and services are changing overtime. It includes industrial products and intermediate goods that can be traded internationally, and excludes retail sales. Consequently, a PPI is viewed as a reasonable proxy for tradable goods prices (Clark, 2007).

There are two disadvantages of this approach and these are: First, the PPI uses relative weightings for different industries that may not accurately represent their proportion to real gross domestic product; the weightings are adjusted every few years, but small differences occur. Second, PPI calculations involve an explicit quality adjustment method to account for changes that occur in the quality and usefulness of products over time. These adjustments may not effectively separate quality adjustments from price level changes as intended.

(iv) Gross Domestic Product (GDP) deflator

The GDP deflator measures the impact of inflation on the gross domestic product during a specified period, usually a year. The GDP deflator focuses on production in an economy. It is commonly used to convert nominal GDP to real GDP; thus:

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \qquad (5)$$

The main advantage of using the GDP deflator is that it includes exports and is not limited to consumer goods. Its main disadvantage is that it covers sectors that are not involved in international trade (such as construction, household services and the government sector) and suffers from distortions arising from taxes and subsidies. Furthermore, the GDP deflator is published with a long time lag (due to time lag in GDP figures) and less frequently than the CPI and producer price indices (PPI).

Although GDP deflators have long time lags, the GDP deflator-based method is deemed to be more appropriate as the index reflects more closely a country's domestic price competitiveness because imports are subtracted from expenditure in the process of estimating GDP. In addition, when a country experiences high imported inflation, a GDP deflator-based REER tends to fluctuate less than the wholesale price index (WPI) and CPI-based REERs. The CPI, WPI and GDP deflator-based REERs are often interpreted as the ratio of the relative prices of non-tradeable goods to tradeable goods in a country; thus, an increase in these indicators would imply either a loss in competitiveness in a country's tradeable sector or a greater incentive to relocate resources to the non-tradeable goods sector (Krugman, 2002).

(v) Unit Labour Costs

A unit labour cost index (ULC) is based on the ratio of an index of hourly compensation per worker to an index of output per worker. The ULC in the manufacturing sector (a key part of the tradeable goods sector) is often used as a proxy for unit labour costs in the tradeable goods sector. The cost of labour usually represents the largest share in the total cost of production and the shares of different factors change slowly over time. A ULC is, thus, a useful indicator of competitiveness because it directly reflects production costs. Countries with a low level of ULC relative to other countries are regarded as competitive (Sackey, 2005).

$$ULC_n = W_n / (\text{Q} / \text{H}) \qquad (6)$$

where W_n represents the nominal wage rate, Q is domestic production, H denotes the number of hours worked and, thus, (Q / H) is labour productivity.

The ULC in the manufacturing sector is highly sensitive to cyclical movements in labour productivity over the course of the business cycle and does not take into account non-labour costs

of production. Its main advantage however, is that it captures cost developments in an important sector exposed to international competition. Its disadvantages, however, are that it only focuses on one sector of the economy which undermines its accuracy. Furthermore, sometimes the ULC is subject to significant data revisions as its indices are published less frequently than CPI and PPIs and are likely to differ across countries.

5. THE EXCHANGE RATE POLICY IN BOTSWANA

Botswana's exchange rate policy aims to support competitiveness of domestic industries in the international and domestic markets, thus contributing to the national objectives of economic diversification and employment creation. This is achieved through maintaining a stable REER of the Pula against a basket of currencies of major trading partner countries, i.e., the IMF Special Drawing Rights (SDR) and the South African rand (ZAR).

Over the years, since the Pula was introduced in 1976, the exchange rate policy has evolved in response to changing circumstances (see Table 1). From 1980 to 2005, a managed peg to a basket of currencies was implemented, constituted by the SDR and the ZAR[3] with occasional adjustments of weights, as well as revaluations and devaluations to address estimated misalignments, competitiveness and inflation developments. However, effective May 2005, a crawling band exchange rate system was introduced. The crawling band exchange rate regime is implemented through continuous adjustment of the trade-weighted NEER of the Pula at a rate of crawl based on the differential between the Bank's inflation objective and the forecast inflation of trading partner countries. The rate of crawl is thus determined using a forward-looking approach and is revised on a regular basis. In this forward-looking scheme, the authorities periodically determine the rate of crawl for the subsequent period, such as the next twelve months.

The Botswana economy has over time experienced significant structural changes (from a small poor economy at independence to a middle upper income country) as well as changes in the trade pattern, and this has necessitated commensurate changes in the exchange rate policy.

TABLE 1: CHRONOLOGY OF EXCHANGE RATE DEVELOPMENTS: 1976 - TO DATE

Date	Action	Comments
1966–1976	Member of the Rand Monetary Area (RMA)	No independent exchange rate or monetary policy.
August 1976	Pula introduced and is pegged to the USD, at P1=USD1.	The rand is also pegged to the US dollar at the same rate; hence P1=R1.
April 1977	5 percent revaluation of the Pula; P1=USD1.2075=R1.05	Anti-inflationary measure in response to imported inflation.
January 1979	Introduction of a floating rand exchange rate in South Africa.	The rand appreciates against the US dollar as gold price rises; this led to an appreciation of the rand against the Pula.
June 1980	The Pula basket is introduced, consisting of the SDR and rand in equal weights.	This was aimed at reducing the volatility of the Pula/rand exchange rate.
November 1980	5 percent revaluation of the Pula	Anti-inflation measure.
January 1981	Gold price in the world market drops.	There is a rapid depreciation of the rand as South Africa's export earnings collapse.
May 1982	10 percent devaluation of the Pula.	Stabilisation measures in response to balance of payments crisis.
February 1984	Foreign debt standstill for South Africa and run on the rand.	There is a rapid depreciation of the Pula against the dollar as the rand continues to deteriorate, and similarly rapid appreciation of the pula against the rand.
July 1984	5 percent devaluation of Pula	Competitiveness measures due to the continued appreciation of the Pula against the rand.

3 The Zimbabwean dollar was part of the basket currencies from 1991 and later removed in 1994.

August 1984	Rand weight is restored at 50 percent; after it had fallen to 37 percent by the end of July 1984.	To reduce the drift of the Pula from the rand.
January 1985	15 percent Pula devaluation	Competitiveness measure.
January 1986	New Pula basket is introduced with the rand weight increased to 65 percent.	This was due to the continued depreciation of the rand against the dollar, which in turn meant that Pula was appreciating against the rand.
June 1989	5 percent Pula revaluation	Anti-inflation measure.
August 1990	5 percent Pula devaluation	Competitiveness measure.
August 1991	5 percent Pula devaluation	Competitiveness measure.
September 1991	Inclusion of the Zimbabwe dollar in the basket	Recognition of significant trade relationship with Zimbabwe.
June 1994	Technical adjustment and removal of Zimbabwe dollar from the basket.	To reflect changes in trade patterns, and aimed at maintaining competitiveness through real exchange rate stability
February 2004	7.5 percent Pula devaluation	Competitiveness measure.
May 2005	12 percent Pula devaluation	Competitiveness measure.
May 2005	Adoption of the crawling band mechanism	To avoid discrete adjustments of the exchange rate while maintaining stability in the real effective exchange rate.
May 2005	Increase of the Bank of Botswana's trading margins from +/-0.125 percent around the centre rate to +/-0.5 percent.	Increase inter-bank trading in the foreign exchange market.
July 2007	Pula basket weights changed to 60 percent ZAR and 40 percent SDR	Aligning the policy with the trade patterns
March 2009	Reduce the margins from +/-0.5 percent around the centre rate to +/-0.125 percent.	To reduce the cost of foreign exchange transactions to customers.
July 2012	Pula basket weights changed to 55 percent ZAR and 45 percent SDR	A gradual move towards aligning to the country's trade data (imports and exports)
January 2015	Pula basket weights changed to 50 percent ZAR and 50 percent SDR	A gradual approach to change in basket weights towards trade pattern proportions
January 2017	Pula basket weights changed to 45 percent ZAR and 55 percent SDR	Aligning the policy with the trade patterns

Source: Bank of Botswana

6. CHOICE OF CURRENCIES IN THE PULA BASKET

The choice of currencies in the Pula basket is guided by Botswana's trade in goods and services as well as currencies used in international trade and payments, with weights reflecting the relative importance of the various trade and financial flows vis-à-vis trading partner countries. Table 2 gives the composition of the Pula basket weights for the years 1980-2016.

Prior to 2001, the ZAR and SDR weights in the Pula basket reflected the pattern of merchandise trade, excluding traditional exports such as beef, diamonds and copper/nickel. The exclusion of traditional exports was based on the assumption that the production and amount of resources employed in those economic activities were not affected to any great extent by movements in the exchange rate; they have a very low to zero elasticity with respect to changes in the exchange rate. In essence, it was deemed that competitiveness of the Pula as indicated by movements in the real effective exchange rate of the currency, which is a key objective of the exchange rate policy, did not have much influence on production and supply of traditional exports. Furthermore, the emphasis of the exchange rate policy objective at the time was exclusively to promote international competitiveness of non-traditional exports (Bank of Botswana, 1994).

TABLE 2: PULA BASKET WEIGHTS

Year	ZAR (Percent)	SDR (Percent)
1980 – 1984	50	50
January 1985 – December 1985	75	25
January 1986 – August 1991	65	35
September 1991 – June 1994	60 (ZAR)	30
	10 (Zimbabwe Dollar)	
July 1994 – June 1997	70	30
July 1997 - June 2007	65	35
July 2007 – May 2012	60	40
June 2012 – December 2014	55	45
January 2015 – December 2016	50	50
January 2017 – to date	45	55

Source: Bank of Botswana

The choice of currencies and their respective weights[4] in the Pula basket has evolved given changes in the SDR basket and Botswana's trade pattern. The most recent review of the Pula basket using sales and purchases of foreign currency for the period 2012 – 2016 yields estimates (5-year average) of 29.3 percent trade (and other transactions) in the rand and 67.2 percent for the SDR (Table 3).

TABLE 3: PURCHASES AND SALES BY CURRENCY (EXCLUDING NON-TRADE DATA), 2012 - 2016 (PERCENT)

Year	**ZAR**	**USD**	**GBP**	**EUR**	**JPY**	**SDR**	**Other currencies**	**Total**
2012	44.9	46.3	2.6	2.1	0.2	51.3	3.9	100
2013	32.9	59.2	1.6	2.0	0.1	62.9	4.2	100
2014	23.8	69.1	1.2	2.2	0.1	72.6	3.6	100
2015	23.3	70.4	0.9	1.9	0.1	73.3	3.4	100
2016	21.8	73.4	0.8	1.6	0.1	75.9	2.3	100
5-year average	**29.3**	**63.7**	**1.4**	**2.0**	**0.1**	**67.2**	**3.5**	**100**

Source: Bank of Botswana

7. COMPUTATION OF THE REER

The Bank of Botswana currently generates one type of exchange rate index, an effective exchange rate (nominal and real) based on the CPI, mainly due to unavailability of data for other indices such as PPI, WPI and ULC. The CPI index is computed relative to a base year, which is reviewed on a regular basis (the base year is currently 2016).

The REER takes into account the inflation differentials between Botswana and its trading partner countries as well as the nominal exchange rates. A real appreciation/depreciation in the real exchange rate suggests deterioration/improvement in competitiveness. It is calculated as a ratio of the NEER index adjusted for movements of Botswana and trading partners' relative prices. The relative price is a ratio of the domestic price index to the weighted index of foreign prices of the trading partner countries.

$$\text{REER} = \text{NEER}\left[\frac{CPI_{ZAR}}{CPI_{BW}}\right]^{\propto} * \left[\frac{CPI_{SDR}}{CPI_{BW}}\right]^{1-\propto} \qquad (7)$$

Prior to 1998, an arithmetic average was used to calculate the NEER. Due to the sensitivity of the arithmetic average to extreme values, the weighted geometric average measure of monthly exchange rates of the trading partner currencies was adopted from late 2003.

Alternatively, the REER of the Pula is calculated as a geometric mean of the bilateral real exchange rates (RER) of the domestic currencies with each of its main trading partners.

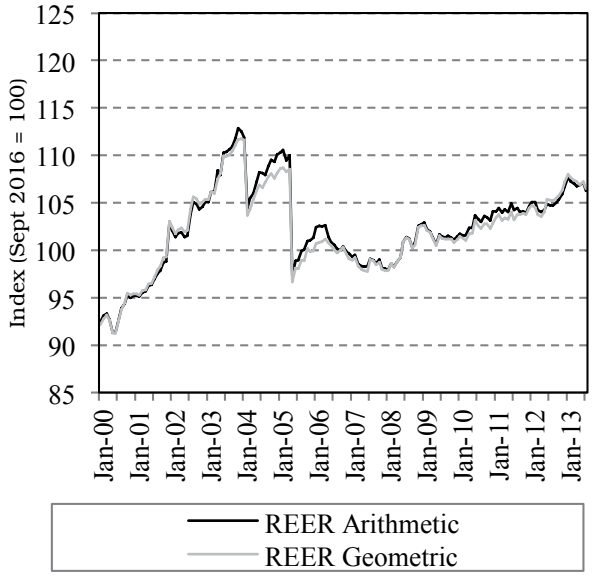
4 The choice of weighting scheme for Botswana is fundamentally based on shares of total trade (exports and imports) but also covers other international transactions given the current measure that uses purchases and sales of foreign currencies.

$$\text{REER} = [RER_{ZAR}]^{\propto} * [RER_{SDR}]^{1-\propto} \quad (8)$$

where NEER is nominal effective exchange rate, CPI_{ZAR} is consumer price index for South Africa, CPI_{SDR} is consumer price index for the SDR countries, the bilateral real exchange rates for South Africa and the SDR are quoted as RER_{ZAR} and RER_{SDR}, respectively, and α is the trade weight.

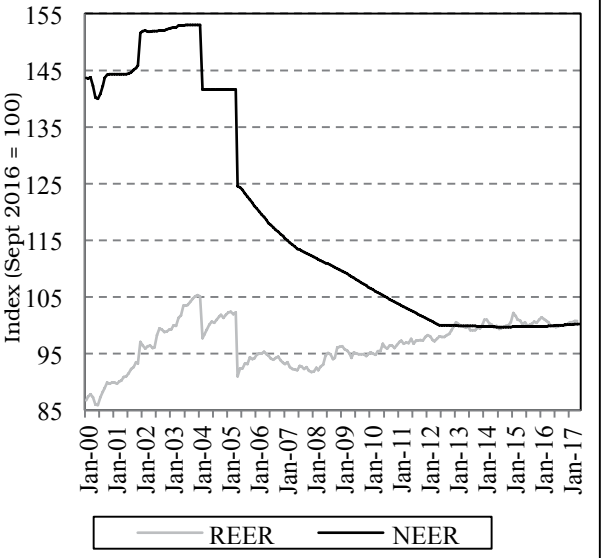
Chart 1 shows the REER for the period 2000 to 2015, calculated using the arithmetic average (previous method) and the geometric average (current method). The chart shows that there was co-movement of the calculated REERs except during periods of devaluation (2004 and 2005), and June 2010 and October 2011, signifying an upward bias towards the South African rand which had changed more than the SDR. Chart 2 shows that between 2000 and early 2004[5], the NEER trended upwards due to a depreciation in bilateral exchange rates in the Pula basket, and this, combined with rising relative prices, caused the REER to appreciate. Subsequently, the NEER depreciated markedly due to devaluation in February 2004 and in May 2005, followed by a cumulative downward annual rates of crawl up to 2014. Due to gains in controlling inflation, the modest (downward and upwards) crawl has resulted in stable NEER. The REER has generally appreciated (following the depreciation in 2004-2005 occasioned by devaluation) up to mid-2012 as inflation remained relatively high in Botswana compared to the trading partner countries. Since then, with inflation falling within the 3 - 6 percent objective range, the REER has been virtually stable and, therefore contributing to maintenance of competitiveness of the domestic industry.

CHART 1: REAL EFFECTIVE EXCHANGE RATE USING ARITHMETIC AND GEOMETRIC CALCULATIONS



Source: Bank of Botswana

CHART 2: REAL AND NOMINAL EFFECTIVE EXCHANGE RATES

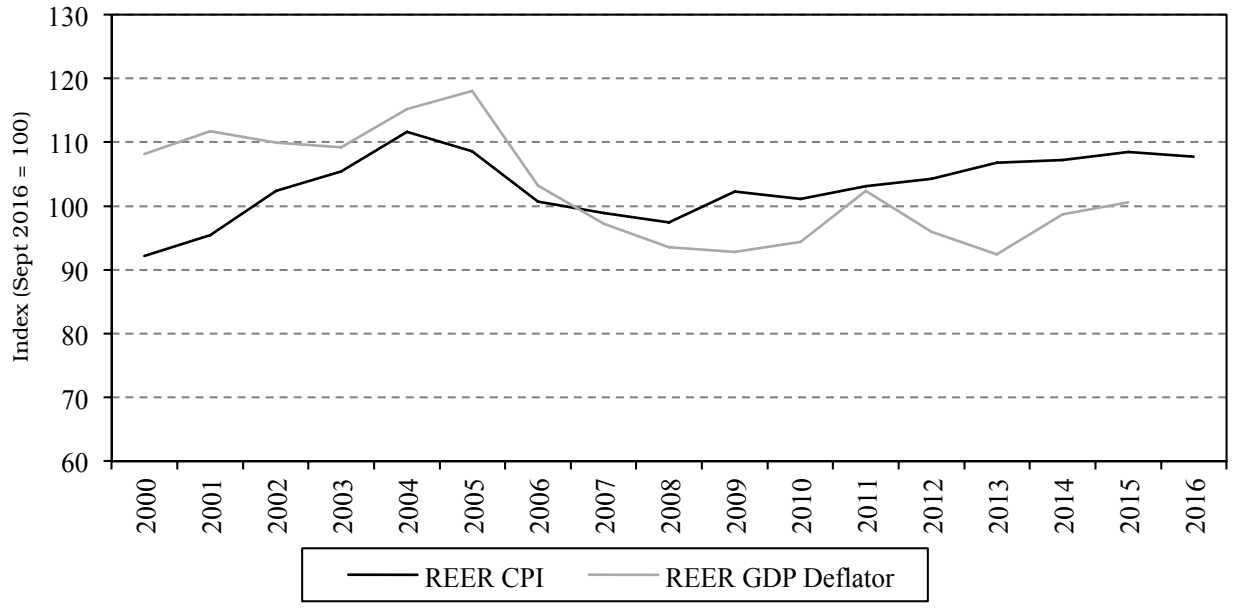


Source: Bank of Botswana

For comparative purposes, a series of REER using the GDP deflator was generated. Chart 3 shows that, using the GDP deflator index, between 2008 and 2016, Botswana seems to have maintained the same level of competitiveness, although much less so compared to the measure of REER based on the CPI. Nonetheless, the GDP deflator-based REER can underestimate the extent of the depreciation of the real exchange rate from the impact of certain fundamentals (including capital inflows and government consumption of tradeable and non-tradeable goods). Unlike the CPI, the GDP deflator is used to measure price inflation or deflation for a specific base year. The GDP deflator differs from the CPI because it is not based on a fixed basket of goods and services but on a flexible basket that changes from year to year depending on consumption and investment patterns. Despite the GDP being more flexible, the CPI is a more accurate reflection of the changes in the cost of living.

5 There was a sharp depreciation of the rand in November 2001 from 1.5488 to 1.7188 in December 2001, hence a jump in the NEER during the same period as seen in Chart 2.

CHART 3: REER CPI AND REER GDP DEFLATOR



8. CONCLUSION

In calculating REERs, it is desirable to use currency basket weights that reasonably reflect the trade pattern, relative price developments and the relevant currencies for trade. In addition, there is need to update currency weights periodically in line with an evolving structure of international trade. However, this is not always possible, as in the case of Botswana, because most of the time, the choice of the indicator is a compromise between an ideal measure and what is practical, given data availability.

Maintaining REER stability was a challenge over the years as the exchange rate (policy) had a dual role of competitiveness and anti-inflation measure. Since the introduction of a more focused monetary policy framework, with single focus on price stability and exchange rate policy framework (crawling band arrangement), the stability of the REER has gained traction due to success in controlling inflation and forward-looking adjustment of the NEER, premised on anticipated changes in price relativities. The REER should however, not be used as the only indicator for variations in competitiveness, as it does not adequately capture the impact of other factors, such as the changes in macroeconomic policies and the exchange rate system. Policymakers, therefore, need to focus on the underlying factors of productivity and wage growth, as well as social and administrative costs that can stifle productivity.

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Exchange Rate Pass-Through to Domestic Prices in Botswana

Esther Mpete[1]

ABSTRACT

This paper uses an unrestricted vector autoregressive model to investigate the degree of exchange rate pass-through on domestic prices in Botswana for the period 1994 to 2016. It is important to investigate the extent to which changes in the exchange rate are reflected in the prices of imported goods, as a contribution to macroeconomic and trade policy formulation. This is more so for countries that seek to promote international competitiveness through exchange rate adjustments within a fixed exchange rate regime. Where there is no pass-through, attempts to improve competitiveness by influencing the direction of exchange rate, may prove futile. This study finds that the impact of exchange rate changes on prices is mostly felt in the first 6 months, and that the pass-through to import prices is more pronounced than the pass-through to consumer prices. The estimated pass-through to domestic prices is about 43 percent in a period of 12 months.

1. INTRODUCTION

Exchange-rate pass-through (ERPT) is defined as the degree of sensitivity or responsiveness of domestic prices (including consumer prices, producer prices and import prices) to exchange rate movements or changes (McCarthy, 2000). As such ERPT can be referred to as the rate at which prices of imports in local currency respond to the movements between the domestic currency and the currency of the source country for imports. With full pass-through, a domestic currency depreciation, which increases the price of foreign currency, would increase the price of imported goods by the same amount. With no pass-through, currency movements would not affect the prices of imports (Taylor, 2000). Theory suggests that, exchange rate movements influence the domestic price movements in most economies, and hence affect inflation. ERPT is thought to be higher where the exchange rate is also a nominal anchor for the domestic economy and inflation expectations. ERPT, therefore, has implications for the design of monetary policy. For a small open economy, such as Botswana, issues of exchange rate pass-through are, therefore, central to the design of appropriate monetary policy and the implementation of the appropriate exchange rate regime.

More broadly, the degree of ERPT has important implications for economic policy. For example, if ERPT is low, then any exchange rate adjustments aimed at improving the trade balance may be less effective because, in such cases, nominal exchange rate changes would not translate into real exchange rate changes (Hahn, 2003). It is necessary, therefore, to quantify the magnitude of the pass-through.

Inevitably, changes in import prices affect domestic prices through prices of imported intermediate and final goods. Therefore, the extent to which an exchange rate change is reflected in the prices of imported goods also has implications for the level of domestic inflation. It is particularly important for a small, open, mineral-dependent economy using a fixed exchange rate regime, such as Botswana, to consider the effects of exchange rate policy on domestic inflation comprehensively. Currency devaluation is effective in preserving competitiveness when there is exchange rate pass-through. However, empirical studies have shown that movements in the exchange rate and prices show varying speed of adjustment from the short to medium term; thus, there is partial or incomplete ERPT. Extensive theoretical literature identifies various explanations for incomplete exchange rate pass-through to import and consumer prices. Empirical analyses also provides evidence of considerable cross-country differences in the ERPT. A major factor in this respect was suggested by Taylor (2000), who put forward the hypothesis that the responsiveness of prices to exchange rate changes corresponds to the inflation environment. He argues that economies with low inflation tend to have low exchange rate pass-through. Campa and Goldberg (2005) argued that the three key factors which drive the extent of exchange rate pass-through are the pricing behaviour of exporters in the producer countries (pricing to market), the sensitivity of mark-up margins to competitive conditions, and the existence of distribution costs that tend to widen the difference between import and final retail prices.

Against this background, it is opportune to study factors that are relevant for Botswana, given the role and objective of the exchange rate policy. This

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paper, therefore, estimates the exchange rate pass-through to domestic prices in Botswana using an unrestricted vector autoregressive (VAR) model. The rest of the paper is organised as follows: Section 2 evaluates the exchange rate policy in Botswana and developments in consumer price inflation. Section 3 reviews literature on the exchange rate pass-through. In Section 4, the methodology and empirical model are defined, followed by the findings in Section 5 and the conclusion in Section 6.

2. BOTSWANA EXCHANGE RATE POLICY AND INFLATION DEVELOPMENTS

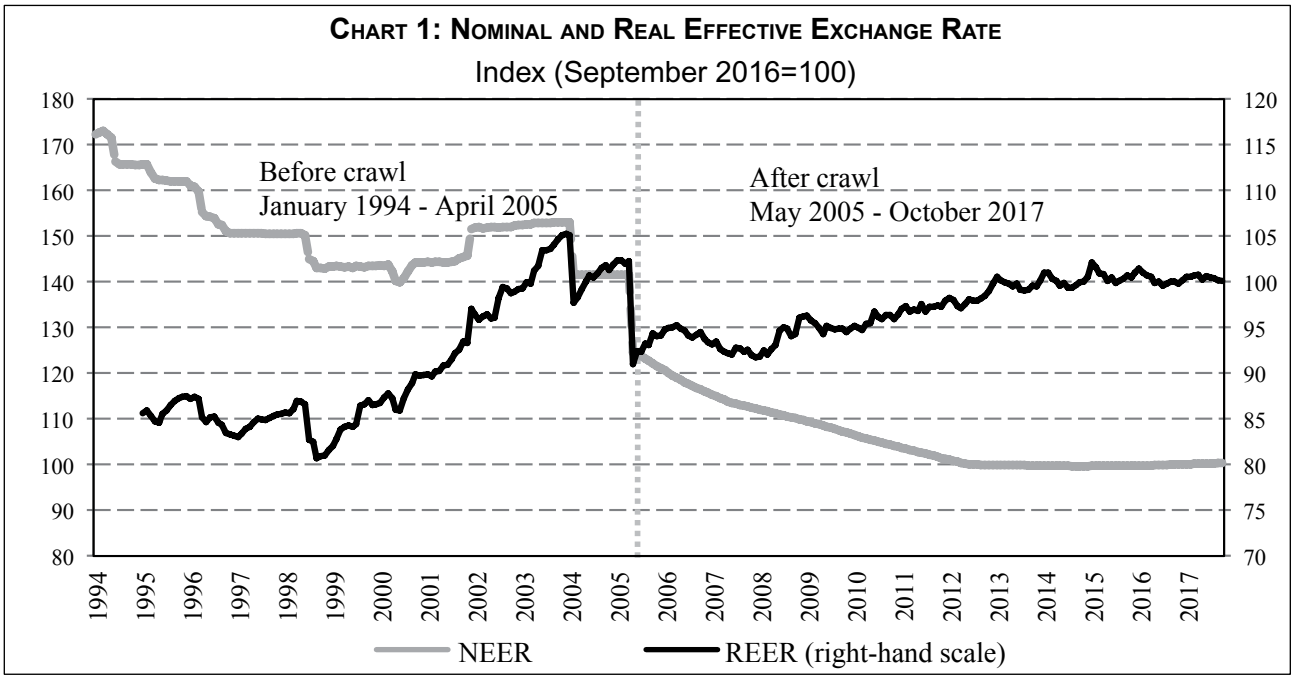
The primary objective of Botswana's monetary policy is to achieve price stability, which is defined as a sustainable level of inflation that is within the medium-term objective range of 3-6 percent. The exchange rate policy gives emphasis to the strategy of economic diversification, the need to promote the competitiveness of Botswana's non-traditional exports and import substitutes.

2.1 Exchange Rate Developments in Botswana

The Government of Botswana, through the Bank of Botswana, pursues a policy best described as that of exchange rate protection[2] , which occurs when the traded goods sector is protected relative to the non-traded goods sector by avoiding a strong Pula (Masalila and Motshidisi, 2003). Prior to 2005, this was achieved through an adjustable peg characterised by devaluations and revaluations of the Pula in order to avoid an overvaluation of the Pula against Botswana's trading partner countries, preserve export competitiveness or restrain imported inflation pressures. To avoid discrete and large interventions, authorities adopted a crawling peg exchange rate mechanism in 2005. With this mechanism, the nominal exchange rate of the Pula is adjusted on a regular basis according to a predetermined formula that takes into account the differential between Botswana's inflation objective and the forecast inflation of its trading partners, viz. South Africa and the Special Drawing Rights countries comprising the United States of America, United Kingdom, the Euro area, Japan and China.

Adjustments of the rate of crawl are primarily intended to support international competitiveness of domestic producers by stabilising the real effective exchange rate (REER). If Botswana's inflation is expected to be higher than the forecast inflation of trading partner countries, a downward crawl of the nominal effective exchange rate (NEER) would be implemented to stabilise the REER and the opposite holds.

CHART 1: NOMINAL AND REAL EFFECTIVE EXCHANGE RATE



Source: Bank of Botswana

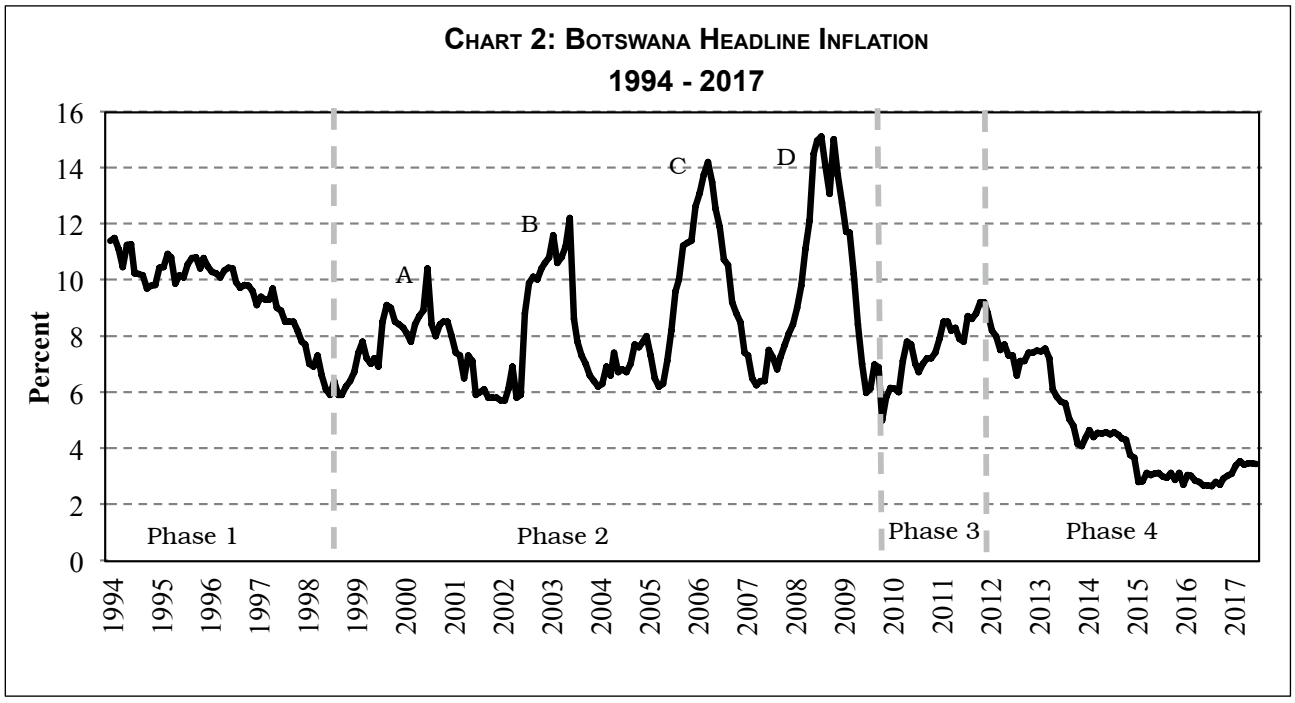
2 Exchange rate protection occurs when a country protects its traded goods sector (export and import-competing activities) relative to the non-traded goods sector by depreciating the exchange rate or preventing an exchange rate appreciation.

Chart 1 illustrates the performance of the trade-weighted NEER for the period 1994 to 2017. Apart from the appreciation of the NEER between 2001 and 2003, which was driven by the appreciation of the Pula against the rand, there has been a general downward trend in the NEER since 1994. The two Pula devaluations in February 2004 and May 2005 were aimed at restoring competitiveness of the Pula, thus returning the NEER to its original downward trending path. However, there appears to be marked differences in the degree of variability between the period before and after the introduction of the crawl, where the latter is characterised by relatively stable variation in the exchange rate due to the crawl[3]. The stability of the NEER is evident subsequent to the introduction of the crawling peg mechanism; however, changes in the exchange rate policy variable, the REER, is the ultimate of export competitiveness in this instance. The REER has tended to appreciate between 2005 and 2013, even with continuous downward annual rates of crawl, due to persistently higher domestic inflation occasioned by exogenous factors. Subsequently, the REER has been largely stable alongside a stable NEER and given successful control of inflation.

2.2 Developments in Botswana's Inflation

Inflation developments in Botswana can be categorised into four phases according to inflation trends (Chart 2). Phase one span the period from 1994 to 1998 where inflation was on a steady decline. The steady decline was attributed to falling imported inflation; technical adjustments on the Pula basket in 1994 to reflect trade patterns; a slowdown in both government spending and Public Debt Service Fund (PDSF) lending growth as well as supportive monetary policy[4] (Bank of Botswana, 1994).

The second phase covers the period between 1998 and 2010, which was characterised by high variability of price changes of between 6 percent and 15 percent due to several factors, both domestic and external. For example, in this period, inflation was exposed to several shocks (labelled A to D in Chart 2), including: the emerging markets financial crises between 1998 and 2001 (A); the introduction of the 10 percent value added tax (VAT) in July 2002, which raised inflation from 5.9 percent at the end of June to 10.1 percent at the end of September the same year (B); Pula exchange rate devaluations of 7.5 percent and 12 percent in 2004 and 2005, respectively (C); the global economic crisis in 2008 to 2009 (D). In addition, large variations in food and administered prices also contributed to inflation volatility.



Source: Bank of Botswana

3 Gradual, small and continuous automatic nominal adjustments of the Pula exchange rate based on the difference in inflation between Botswana and trading partner countries, aimed at maintaining REER stability

4 The Bank maintained positive real interest rates directed towards mobilization of savings and curbing unproductive expenditures, thus reducing credit growth to rates in tandem with growth of nominal GDP.

The third phase, which starts in 2010, is characterised by an increase in inflation, albeit with lower variations than in the previous phase. This was attributed to higher global food and oil prices. For example, the World Bank's food price index increased by 15 percent between October 2010 and January 2011. The surge in food prices was caused by high oil prices, which had increased from US$39/barrel in February 2009 to more than US$100/barrel in March 2011. As countries had just emerged from the global financial and economic crisis, those with high inflation, limited foreign currency reserves and depreciating currencies against the US dollar were more vulnerable to high food prices (Ministry of Finance and Economic Development, 2011).

Likewise, Botswana, which imports crude oil and most food products, is vulnerable to the external food and oil price shocks. Hence the food component of the consumer price index (CPI) increased by 4.7 percent between January 2010 and January 2011. Headline inflation also continued to rise in 2011, reaching a high of 9.2 percent in December 2011. Specifically, this increase in inflation could be linked to the rise in retail petrol and diesel pump prices, which were effected in February 2011. This caused the transport price index component of the CPI to rise over the same period (transport and food price indices account for the biggest shares in the national CPI basket, at 20.65 percent and 16.51 percent, respectively). Moreover, changes in the transport price index also affect other groups in the CPI basket through the transport services. Thus, a change in price of these commodities has a bigger impact on headline CPI.

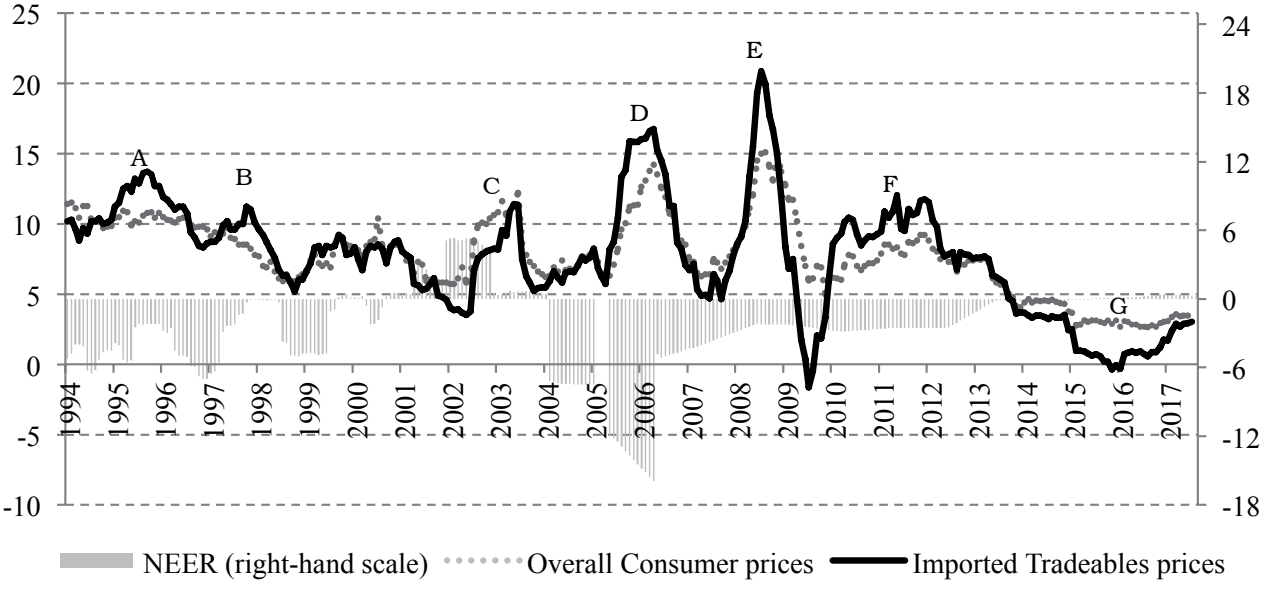
The fourth phase, which starts in 2012, is characterised by a steady decline in inflation into the Bank of Botswana's objective range of 3-6 percent, with instances of a breach of the lower bound of the objective range to as low as 2.6 percent in August 2016. The downward trend in inflation was attributable to slower pace of global economic activity, a sharp fall in commodity prices, including international oil prices, modest domestic economic growth, restrained wage growth, and thus low private consumption, as well as moderating price technological improvements and global production and trade arrangements.

2.3 Exchange Rate Movements and Inflation along the Pricing Chain

Chart 3 indicates that there is an inverse correlation between changes in the Pula exchange rate and changes in domestic prices in Botswana. There is also a high correlation between imported tradeables[5] prices and domestic consumer prices, which may suggest that exchange rate changes are passed on directly to the general domestic price level through imported inputs and final goods. However, changes in the Pula exchange rate against its trading partners, as measured by the NEER, are reflected more quickly and appreciably on import

CHART 3: PRICES AND THE PULA EXCHANGE RATE

Annual Percentage Changes (1994 - 2017)



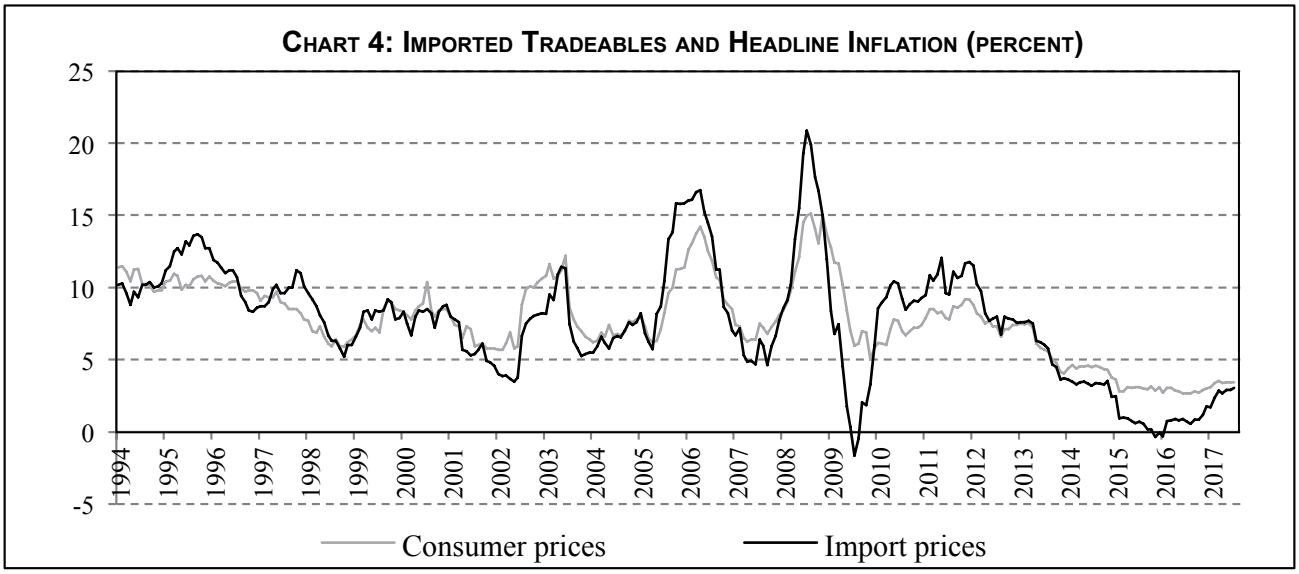
Source: Bank of Botswana

5 Imported tradeables are goods and services which Botswana imports from other countries (trading partners).

prices than on the overall domestic consumer prices (Points A – G on Chart 3), due to indirect (via producer price) effects that take time to materialise.

The composition of the consumer basket is important in understanding the strong correlation between imported tradeables and CPI inflation. The CPI basket has a wide range of items which have different shares of final imported goods and final goods. Imported tradeables items have a weight of 43.77 percent in the domestic CPI basket[6], which mostly fall in the food and transport (fuel) categories. Given total dependence on oil imports, there is also a high correlation between imported tradeables price inflation and international oil[7] price inflation (Chart 5), and a strong positive correlation between changes in domestic transport prices and changes in international oil prices (Chart 6).

CHART 4: IMPORTED TRADEABLES AND HEADLINE INFLATION (PERCENT)



Source: Statistics Botswana

CHART 5: IMPORT PRICE AND OIL PRICE (WTI) INFLATION

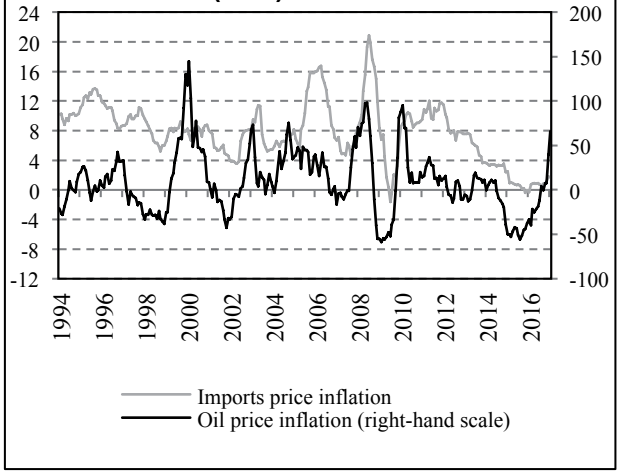
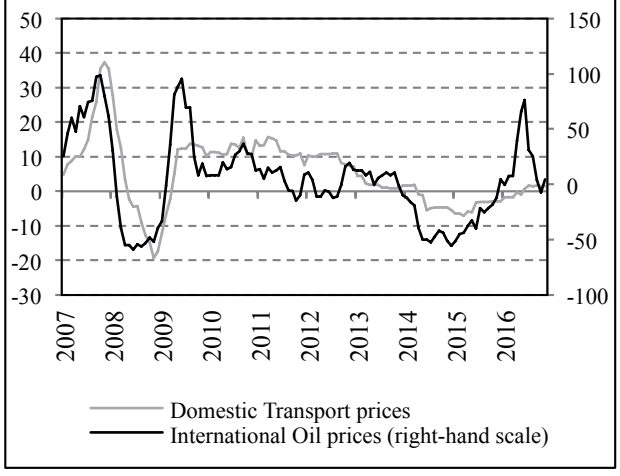


CHART 6: DOMESTIC TRANSPORT PRICE INFLATION VS OIL PRICE INFLATION



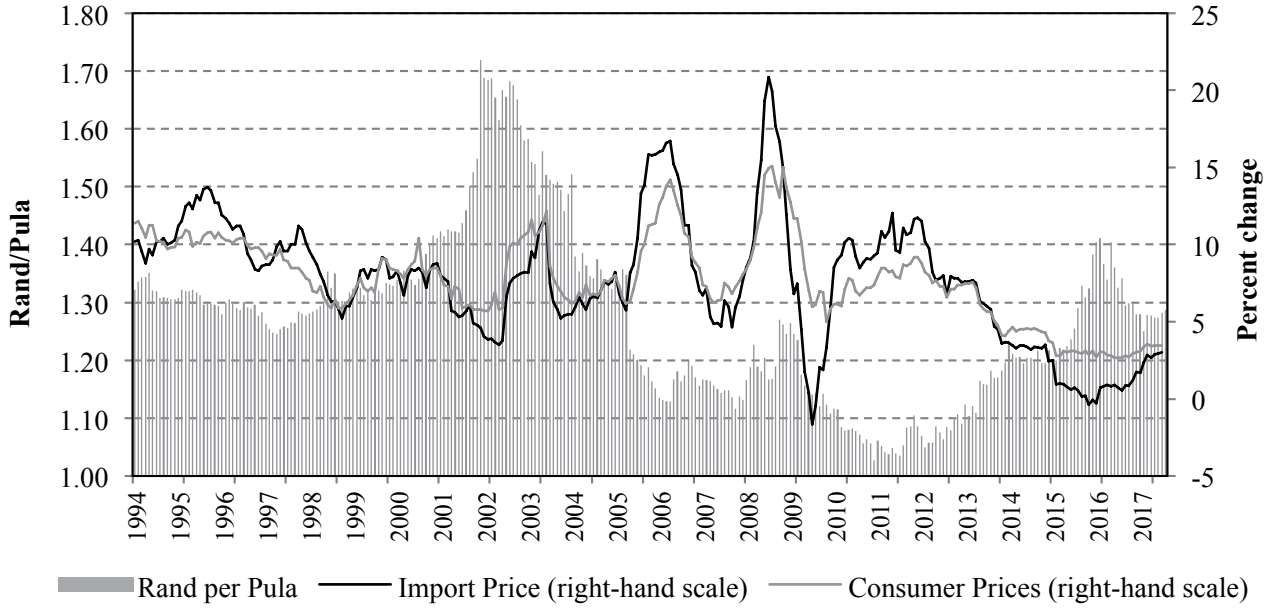
Source: Statistics Botswana and the U.S. Energy Information Administration (EIA)

6 In the old CPI basket (2006-2016) the weight of imported tradeables was 45.17 percent, while in the 1996-2006 basket it was 47 percent.

7 International oil prices are proxied by the West Texas Intermediate (WTI) Cushing spot crude oil price.

The quicker response of consumer prices to exchange rate changes may be due to the larger share of imported goods directly consumed as compared to intermediate goods. Botswana imports about 75 percent of its tradeable goods and services from South Africa, as such, shocks on the rand will be transmitted faster to Botswana inflation compared to shocks from other trading partner countries' currencies. Furthermore, the pass-through of import prices to domestic prices is determined by shocks to the exchange rate as this is one of the factors that affect how economic agents react and adjust their prices. For much of the review period, changes in the Pula exchange rate are largely driven by changes in the South African rand, i.e., the currency with the highest weight in the Pula basket. Thus, movements in the rand exchange rate have a higher impact on the Pula exchange rate compared to the trade-weighted exchange rate; large swings in the rand/Pula exchange rate correlate more with volatility in import prices and, thus with the overall inflation in Botswana. Chart 7 shows the stronger influence of the movements in the rand on import and domestic prices.

CHART 7: RAND/PULA EXCHANGE RATE VS PRICES



Source: Bank of Botswana

3. LITERATURE REVIEW

3.1 Theoretical Literature Review

The impact of exchange rate fluctuations on domestic prices can be transmitted through direct and/or indirect channels. The direct channel of transmission is when exchange rate movements affect domestic prices through changes in the price of imported finished goods and imported inputs (Hyder and Shah, 2004). Thus, when a currency depreciates, import prices will rise in the domestic currency, while a currency appreciation results in lower import prices in the domestic currency. Consequently, in the case of currency depreciation, higher costs of imported raw materials and capital goods will increase marginal production costs and lead to higher prices of domestically produced goods (Turkcan, 2005). Conversely, importing finished goods may simply increase the price in local currency in response to the increased purchasing cost of the imported commodity. Thus, these two alternative transmission channels can be identified under the direct channel of ERPT.

In the case of the indirect channel of ERPT, currency depreciation would affect net exports as locally produced goods become cheaper in the export markets (Taylor, 2000). The increase in foreign demand for local goods would exert upward pressure on domestic prices and lead to two alternative transmission channels of pass-through. First, if the locally produced goods are primary inputs of production, then local producer price levels are expected to rise, resulting in an increase in local consumer prices. Second, if the locally produced goods are finished products, local producers and retailers may increase their prices in response to increased demand in order to maximise profit margins (Hahn and Sanchez, 2007).

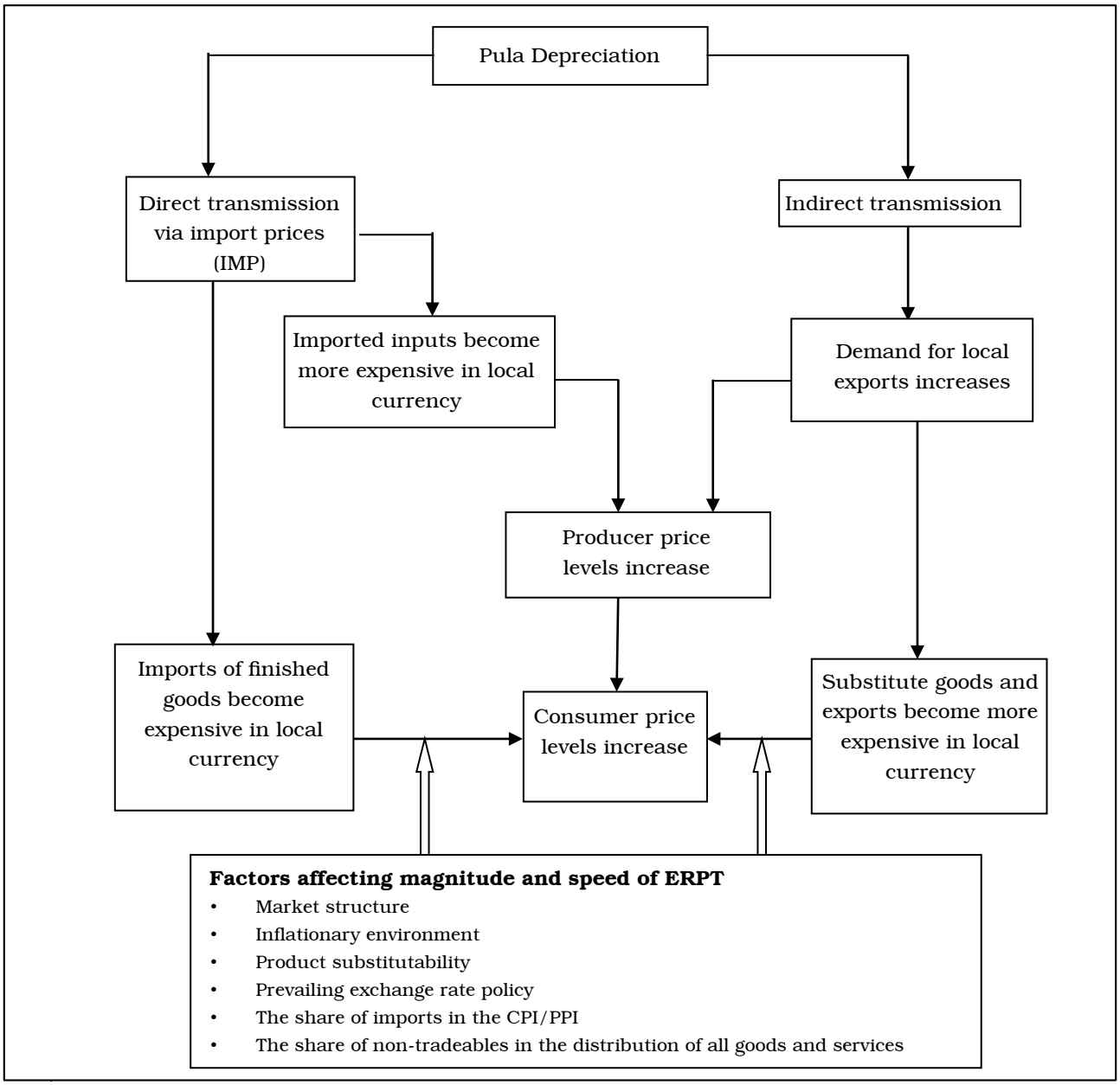
Consequently, prices of local substitute goods will also increase as their demand rises.

However, the magnitude, speed and asymmetry of ERPT through these channels will differ depending on several factors such as the market structure; the inflationary environment; the prevailing exchange rate policy; the share of non-tradeables in the distribution of all goods and services; the relative share of imports in the consumer price index (CPI) basket and producer price index (PPI); and product substitutability, among other factors (Hyder and Shah, 2004). The direct and indirect transmission channels of ERPT discussed are illustrated in Figure 1.

3.2 Empirical Literature

The econometric tools used in the estimation of ERPT have evolved over time from single equations to simultaneous equations, according to different motivations. Various types of VARs have also been used such as vector error correction models (VECM), structural VARs and reduced-form VARs. The literature can also be looked at in terms of two main strands regarding characteristics of the nature of modelling. The first part examines the relationship between the exchange rate and import prices, while the second considers the pass-through from import prices to domestic prices. Nonetheless, there are a few papers that attempt to examine these stages separately without regard

FIGURE 1: THE TRANSMISSION OF ERPT TO DOMESTIC PRICES



Source: Chicooree and Tandrayen-Ragoobur (2012)

to the other. Research on the first stage separately include Campa and Goldberg (2005) and Marazzi et al. (2007), while Taylor stage (2000), Gagnon and Ihrig (2004), Choudhri and Hakura (2005), Ca'Zorzi, Hahn and Sanchez (2007), among others, focused on the second stage.

The VAR approach has a marked advantage over the single equation framework; this explains the popularity of the framework in the literature (among others, McCarthy, 2000; Hahn, 2003; Faruqee, 2006; Ito and Sato, 2006; Ca'Zorzi, Hahn and Sanchez, 2007; Winkelried, 2011). Among the key advantages of the VAR framework is the opportunity to identify structural shocks via Cholesky decomposition of innovations. Moreover, while a single equation framework allows for just one domestic price index, the VAR framework provides room for a set of domestic prices, thus making it possible for an evaluation of ERPT considering a set of domestic prices within the pricing chain from the importers to producers and to consumers. The single-equation framework, on the other hand, is based on the assumption of causality from the exchange rate to inflation, thus ignoring the possibility of reverse causality from inflation to exchange rate, whereas a VAR allows for simultaneous and endogenous interaction of variables.

McCarthy (2000) investigated the pass-through of exchange rate changes and import prices to domestic inflation in some industrialised economies[8] by building a recursive[9] vector autoregression framework. The VAR system was presented by a distribution chain model, including exchange rates, import prices, producer and consumer prices, exogenous supply shock (proxied by oil prices), and an exogenous demand shock (proxied by an output gap). The model also incorporates a central bank reaction function[10] as well as a money demand function. Results indicate that the pass-through was modest in advanced countries, but relatively higher for countries with high import share. The observation was, however, that exchange rates and import prices had a disinflationary effect for these advanced economies, especially in the 1990s.

In quantifying the size and speed of pass-through of exchange rate changes to prices in Romania, Gueorguiev (2003) also employed the recursive VAR approach, segregating prices into consumer and producer prices to compare the degree of transmission of exchange rate changes between the two. The VAR system contained the nominal exchange rate against the US dollar, producer prices, consumer prices (which exclude administered prices), output gap (to capture demand shocks), an index of all commodities (as a proxy for exogenous supply shocks), and total labour costs (as a proxy for domestic supply shocks). The finding was that (a) pass-through was relatively fast and accounted for a significant proportion of domestic inflation, (b) pass-through reached a maximum of 72 percent for producer prices and 43 percent for consumer prices, (c) most of the impact of the exchange rate changes passed through within 12 months, and (d) exchange rate changes explained 40 - 60 percent of observed consumer price inflation. Leigh and Ross (2002) undertook a similar study to that of Gueorguiev (2003), on Turkey[11]. Just like the Romania study they also drew from the McCarthy (2000) distribution chain model.

Most studies focusing on developed countries conclude that ERPT has fallen over the years, particularly in an environment of low inflation (Taylor, 2000; McCarthy, 2000; Choudhri and Hakura, 2005). Consequently, the bulk of the recent literature on ERPT has been aimed at explaining the reasons underlying the seemingly low ERPT (Taylor, 2000; Gagnon and Ihrig, 2004; Marazzi et al., 2007). Reyes (2007), Ca'Zorzi, Hahn and Sanchez (2007), and Ito and Sato (2008) focused on pass-through in emerging market economies. While many of these have focused on individual countries, a number of them have dealt with cross-country samples (Hahn, 2003; Choudhri and Hakura, 2005; Reyes, 2007, Razafimahefa, 2012). However, in Botswana not much has been accomplished by way of research in this area. Hence, this study attempts to contribute to the empirical literature by focusing on Botswana.

4. METHODOLOGY

This section discusses the analytical framework, intuition and assumptions underlying the empirical model. This study adopts the VAR approach as the

8 Nine developed countries—United States, Japan, Germany, France, United Kingdom, Belgium, the Netherlands, Sweden, and Switzerland.

9 The ordering of the VAR variables starts with the most exogenous variable ending with the consumer prices on which all shocks are expected to have an effect.

10 Essentially because monetary policy reacts to exchange rate fluctuations, and also affects exchange rates and domestic inflation.

11 The study excludes both the central bank reaction function and the money demand function – stating that the inclusion of the two variables compromised the degrees of freedom and invalidated their results.

analytical framework for estimation. Also discussed here are the relevant data issues.

4.1 Model Specification

Following McCarthy (2000), the model includes the various prices along the distribution chain, which constitute a distribution chain in the ERPT. The assertion here is that inflation, at each stage of the chain, has several components. The expected inflation at a given stage is based on the available information at the close of time, $E_{t-1}(\pi_t)$. The second and third stages are the effects of period t domestic "*supply*" and "*demand*" shocks on inflation at that phase, i.e. ε_t^s and ε_t^d. The effect of exchange rate shocks (ε_t^e) on inflation at a particular stage constitutes the fourth component. The subsequent component is a shock of the previous stage of the pricing distribution chain (ε_t^m or ε_t^c). The last component is that stage's own shock. The points along the distribution chain, namely; import and consumer prices may be formally presented[12] as follows:

$$\pi_t^m = E_{t-1}(\pi_t^m) + \alpha_1\varepsilon_t^s + \alpha_2\varepsilon_t^d + \alpha_3\varepsilon_t^e + \varepsilon_t^m \quad (1)$$

$$\pi_t^c = E_{t-1}(\pi_t^c) + \beta_1\varepsilon_t^s + \beta_2\varepsilon_t^d + \beta_3\varepsilon_t^e + \beta_4\varepsilon_t^m + \varepsilon_t^c \quad (2)$$

Where, π_t^m and π_t^c denote import price and consumer price inflation, respectively, and their residuals (ε_t^m and ε_t^c). One important assumption at this point is that the shocks at each stage are part of that stage's inflation that cannot be accounted for by drawing expectation on information from period *t-1*, ($E_{t-1}(\pi_t)$). The model also includes contemporaneous information on domestic demand (ε_t^d) and supply (ε_t^s) variables, exchange rate shocks (ε_t^e) and inflation at the preceding stages of the distribution chain. These shocks may be seen as having resulted from pricing power and mark-up by firms at various stages. The other assumptions are as follows: "*Supply shocks*" are identified from the dynamics of oil price inflation. "*Demand shocks*" are identified from the changes in output gap after taking into account the contemporaneous effect of the supply shocks. The "*external shocks*" are estimated from the dynamics of nominal exchange rate movements after taking into account the contemporaneous effect of the supply shocks and demand shocks. These additional set of assumptions give rise to equations (3) - (5).

$$\pi_{it}^* = E_{t-1}(\pi_{it}^*) + \varepsilon_{it}^s \quad (3)$$

$$\bar{y}_{it} = E_{t-1}(\bar{y}_{it}) + \beta_{1i}\varepsilon_{it}^s + \varepsilon_{it}^d \quad (4)$$

$$\Delta e_{it} = E_{t-1}(\Delta e_{it}) + \beta_{1i}\varepsilon_{it}^s + \beta_{2i}\varepsilon_{it}^d + \varepsilon_{it}^e \quad (5)$$

Where π_{it}^*, $\bar{y}_{it}$ and Δe_{it} are oil price inflation, output gap and exchange rate changes, respectively. Shocks are assumed to be serially uncorrelated and also uncorrelated with one another in the system.

As in McCarthy (2000), two more equations are introduced in the form of a central bank reaction function and a money demand equation along the lines of Christiano *et al*. (1996). This is done to avoid the omitted-variable bias. The reaction function establishes the relationship between short-term interest rates and prices since the monetary authority uses short-term interest rates as a pre-eminent monetary policy instrument. The money demand function ties the changes in money supply to the other variables in the model. These last two assumptions give rise to equations (6) and (7).

$$i_t = E_{t-1}(i_t) + \delta_1\varepsilon_t^s + \delta_2\varepsilon_t^d + \delta_3\varepsilon_t^e + \delta_4\varepsilon_t^m + \delta_5\varepsilon_t^c + \varepsilon_t^{MP} \quad (6)$$

$$\Delta m_t = E_{t-1}(\Delta m) + \lambda_1\varepsilon_t^s + \lambda_2\varepsilon_t^d + \lambda_3\varepsilon_t^e + \lambda_4\varepsilon_t^m + \delta_5\varepsilon_t^c + \lambda_6\varepsilon_t^{MP} + \varepsilon_t^{MD} \quad (7)$$

Where, i_t and Δm_t are interest rates and change in money supply, respectively, and their contemporaneous shocks ($\varepsilon_{it}^{MP}$and ε_{it}^{MD}). Finally, the conditional expectations inherited in equations (1) to (7) can be substituted by a linear projection of lags of the seven variables represented in the system of equations. Drawing on the above set of assumptions, a model in the form of a reduced-form VAR is constructed in order to test, analyse and understand the long-term properties of the forecast errors. Consequently, the study uses Cholesky decomposition to deduce both the forecast error variance decomposition as well as the impulse responses of CPI inflation to the orthogonalised shocks of the other six variables included in the model.

Whilst impulse responses will provide the degree of pass-through of exchange rates to consumer prices by providing estimates of the effect of other variables on domestic inflation, the variance decompositions will help determine how important these shocks have been in the domestic price fluctuations over the sample period. A unit shock is applied to the error of each variable from each equation separately, and the effects on the VAR system over time are recorded as impulse responses. Variance decompositions determine how much of the forecast error variance of a given variable is explained by innovations of each

12 Even though Botswana does not produce the PPI, there is an underlying assumption in the model that imported inflation shocks affect local consumer inflation directly and indirectly via their impact on producer price inflation.

explanatory variable, thus they are used to assess how much of the variance in domestic prices can be attributed to the other variables included in the model. Particular focus, however, is on the importance of exchange rates on domestic prices.

The ordering of the VAR is based on the assumptions regarding the distribution chain argument in terms of the pricing structure. Hence, the equations enter the VAR in the following order: oil price; output gap; interest rate; change in money supply; change in exchange rate; import price and consumer price inflation. This may be represented as:

$$\pi^{oil} \longrightarrow gap \longrightarrow i \longrightarrow \Delta m \longrightarrow \Delta e \longrightarrow \pi^{m} \longrightarrow \pi^{c}$$

The oil price inflation and output gap control for supply and demand shocks respectively, while the modelling assumes that causality runs from the exchange rate to prices and that the extent of endogeneity increases from top to bottom of the order.

4.2 Data

The paper uses quarterly data from 1994 quarter 1 to 2016 quarter 4. The nominal effective exchange rate (NEER) index is used to account for the exchange rate variable and it is obtained from Bank of Botswana. The consumer and imported tradeable price indices are obtained from Statistics Botswana. The output gap series (defined as the difference between actual output and potential output) was derived using the standard Hodrick-Prescott filter on the real gross domestic product figures produced by Statistics Botswana. The seasonally adjusted broad money supply (M2) series and the 91-day Bank of Botswana Certificate[13] (BoBC) rates were obtained from the Bank of Botswana. The choice of the 91-day BoBC rate is based on the fact that it closely reflects the money market developments and fundamentals. The Cushing WTI spot price crude oil was used as a proxy for the world price of crude oil, sourced from the US Energy Information Administration (EIA) website. The US dollar/Pula exchange rate was used to convert the crude oil price in US dollar into the Pula price.

4.3 Unit Root Test

The unit root test analysis was carried out using the Augmented Dickey-Fuller test and the results are reported in Table 1. The oil price inflation, output gap, import inflation and consumer inflation are integrated of order zero [I(0)], whereas interest rates, money supply and NEER are I(1). The non-stationary variables were differenced to remove the random walk and drift terms.

TABLE 1: UNIT ROOT TEST RESULTS

Variables	At Levels		At First Difference	
	ADF test-statistic	P-Value	ADF test-statistic	P-Value
Oil price inflation	-3.30*	0.02	-	-
Output gap	-5.89**	0.00	-	-
Interest rates	-0.90	0.95	-6.52**	0.00
Money supply	-0.94	0.95	-7.67**	0.00
Nominal effective exchange rate	-1.76	0.72	-5.82**	0.00
Imported tradeables price inflation	-6.29**	0.00	-	-
Consumer price inflation	-4.96**	0.00	-	-

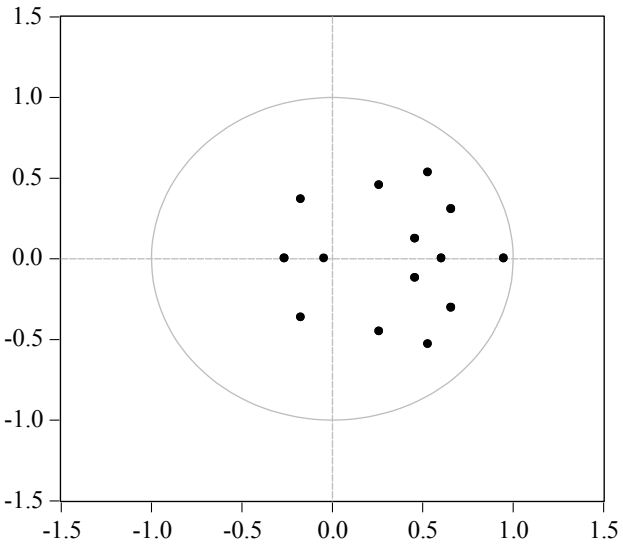
NB: ** denotes 1 percent level of significance whereas * denotes 5 percent level of significance

4.4 Diagnostic Model Evaluation: VAR stability

The VAR was tested for stability using the inverse roots of the characteristic autoregressive polynomial. Figure 2 shows that all the roots of the estimated model lie within the unit root circle, which indicates that the VAR is stable. Stability of the VAR is crucial because otherwise the standard errors of the impulse responses will not be valid.

13 BoBCs are open market operations instruments used to absorb liquidity in the economy, thus used to effect monetary policy.

FIGURE 2: VAR STABILITY CHECK - INVERSE ROOTS OF AR CHARACTERISTIC POLYNOMIAL



4.5 Serial Correlation Test

An autocorrelation LM test was performed on the residuals of the VAR to test for serial correlation. The lag order of six was chosen arbitrarily by Eviews and the results show that there is no serial correlation in the residuals of the estimated VAR.

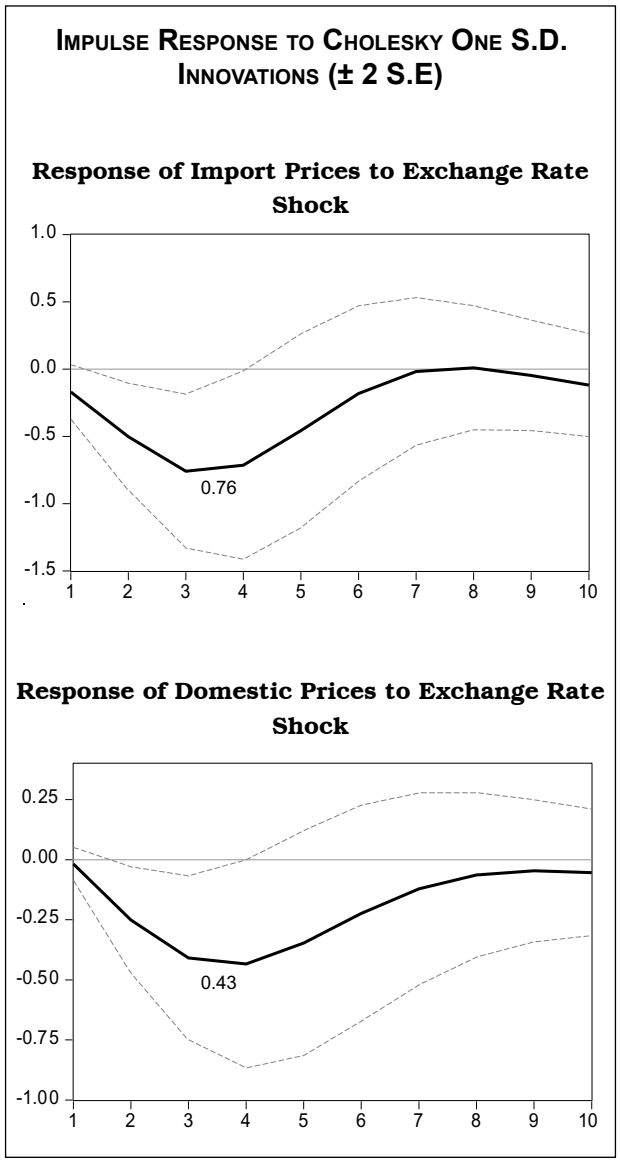
5. FINDINGS

As indicated in Section 4, the model is estimated as an unrestricted VAR consisting of seven variables. The optimal lag length selected for the VAR by the Lag Order Selection Criteria was two. The reduced-form residuals from the VAR are orthogonalised using a Cholesky decomposition to identify the structural shocks of the variables as per the ordering given in Section 4. The degree and speed of pass-through from exchange rates fluctuations to domestic inflation is derived through the use of innovation accounting techniques; impulse response functions and variance decompositions.

5.1 Impulse Response Functions

The impulse responses in Figure 3 indicate the responsiveness of both the import price and consumer price, respectively, to a unit (positive) shock of the exchange rate. The forecast horizon is mapped over a period of 10 quarters. The solid line in each graph indicates the estimated response while the dotted lines are the 2-standard error confidence bands around the estimate.

FIGURE 3: RESPONSE OF IMPORT AND DOMESTIC PRICES TO 1 PERCENT CHANGE IN EXCHANGE RATE



In line with economic literature, the initial impact of an exchange rate appreciation, on both prices, is negative, and remains negative for the entire forecast horizon. The price of imported tradeables responds more rapidly to exchange rate shocks compared to the overall domestic consumer price. A one percent depreciation of the Pula against trading partner countries results in a 0.2 percent increase (initial response) in import prices, the response peaks at 0.76 percent after three quarters (cumulative response). For domestic consumer prices, there is no contemporaneous effect of a one percent exchange rate shock. The estimated pass-through of 1 percent shock in the Pula exchange rate to domestic prices is about 0.43 percent after four quarters. This level of pass-through compares to other sub-Saharan African countries where an average of 0.4 percent has been reported for economies with a fixed exchange rate regime, and about 0.3 percent for flexible exchange rate regimes, in a study done by the International

Monetary Fund (IMF)[14]. This could be attributable to pricing behaviour by economic agents, where exchange rate changes may be considered permanent in fixed exchange rate economies, whereas changes in the exchange rate may be considered temporary and self-corrective in flexible regimes. The level of exchange rate pass-through to domestic prices in developed countries is lower, about 0.1 percent[15], due to effective monetary policy supported by favourable macroeconomic environment as well as institutional frameworks that allow central banks to pursue independent monetary policy; inflation expectations anchored around targets and real shocks, including the exchange rate, that have a small impact on trend inflation.

5.2 Estimation of the Pass-Through Elasticity

Using impulse responses, the cumulative pass-through elasticities are derived by normalising the accumulated responses of one variable to shocks of the other variable by the accumulated response of that variable to its own shock; this offers more precise estimates of the elasticities. ERPT elasticities are done by dividing the accumulated responses of each price index to an exchange rate shock after *m* months by the accumulated response of the exchange rate to its own shock after *m* months. The exchange rate pass-through elasticity at time *t* is, therefore, defined as:

$$ERPT_t = \sum_{m=1}^{T} P_{t,t+m} \Big/ \sum_{m=1}^{T} E_{t,t+m}$$

where, *P* and *E* are the cumulative changes in the price level and exchange rate after *m* periods, respectively. The numerator represents the percentage change in the price index between period *zero*, when the initial exchange rate shock occurs, and time *t*. The denominator is the percentage change in the NEER between time *zero*, where the initial exchange rate shock occurs, and time *t*. Table 2 shows the comparative time profile of the exchange rate pass-through elasticities in both import and consumer prices over 12 months.

TABLE 2: TIME PROFILE FOR ERPT ELASTICITIES

Period	Import Price	Consumer Price
After 3 months	-0.18	-0.06
After 6 months	-0.49	-0.37
After 9 months	-0.67	-0.60
After 12 months	-0.90	-0.79

The estimates of the elasticities corresponding to a year following a shock to the exchange rate indicate that exchange rate shocks pass through to consumer prices fairly quickly; about 80 percent of the impact of exchange rate change is transmitted through to consumer prices within 12 months.

5.3 Variance Decomposition

The error forecast variance decomposition shows the proportion of the changes in one variable due to other variables in the system and those due to its own shock. The variance decomposition indicates the amount of change each variable contributes to the other variables in the VAR. Thus, the variance decompositions are employed as an additional effort to explore the importance of exchange rate shocks in explaining changes in import and domestic prices.

TABLE 3: VARIANCE DECOMPOSITION OF IMPORT PRICE INFLATION

Period	Oil Price	Output gap	Interest rate	Money supply	Exchange rate	Import price	Consumer price	
Q1	**6.7**	2.2	**44.7**	0.2	1.5	**44.8**	0.0	100
Q2	**22.1**	0.7	**37.6**	0.1	4.4	**35.0**	0.2	100
Q3	**34.3**	2.0	**29.7**	0.1	7.8	**26.0**	0.2	100
Q4	**39.5**	5.5	**25.1**	0.1	9.3	**20.3**	0.2	100

TABLE 4: VARIANCE DECOMPOSITION OF CONSUMER PRICE INFLATION

Period	Oil Price	Output gap	Interest rate	Money supply	Exchange rate	Import price	Consumer price	
Q1	**3.2**	0.0	**82.3**	0.7	0.0	2.4	**11.4**	100
Q2	**12.2**	0.4	**67.6**	0.3	2.8	4.6	**12.1**	100
Q3	**21.8**	1.5	**55.6**	0.9	5.5	4.3	**10.4**	100
Q4	**28.5**	3.7	**47.3**	1.3	7.1	3.6	**8.7**	100

14 Exchange Rate Pass-Through in Sub-Saharan African Economies and its Determinants, IMF Working Paper, June 2012, WP/12/141.

15 McCarthy (2000), Choudhri and Hakura (2005); Reyes (2007).

Tables 3 and 4 show the importance of each variable in the VAR in explaining changes in import and domestic prices: the importance of a supply shock (international oil prices) on import prices as stated in Section 2; the importance of import prices in explaining its own shocks (which means there exists other external shocks not included in the VAR system, which account for variations in import prices); and the influence of short-term interest rates and external shocks on consumer prices as expected.

Much interest, however, is in the impact of exchange rates on both import and domestic prices. Exchange rate changes are more influential on import prices than on overall consumer prices as expected. This is because the CPI basket includes non-tradeable goods and services that are less responsive to exchange rate changes. Furthermore, the impact of exchange rate changes on the consumer prices is not direct but through import prices (Table 4); about 10 percent of the change in consumer prices is attributable to changes in the import prices. This could be an indication that more permanent factors and central bank action may be more successful in anchoring domestic inflation expectations.

The contribution of exchange rates to variance in import prices (Table 3) is about 9 percent after a year. The Pricing-to-Market (PTM) rigidities may be playing a role in dampening the ERPT. The PTM phenomenon establishes the pricing behaviour of firms exporting their products to a destination market following changes in the exchange rate. When firms adopt PTM, prices of trading goods do not change with the exchange rate. In some cases, export firms set price of trading goods in destination currency instead of adjusting the price according to the exchange rate changes.

The responsiveness of import prices to exchange rate changes is central to the objective of any exchange rate policy, because correctional adjustments (whether automatic or by intervention) to the trade balance depend on the sensitivity of import/export prices to exchange rate movements.

6. CONCLUSION

In choosing monetary policy framework, the issue of inflation is not only with respect to the suitable exchange rate regime, but also consideration of other factors affecting an open, small and mineral-dependent economy such as Botswana. A mineral-dependent economy tends to rely more on its trading partners for non-traditional commodities. Under a fixed exchange rate regime, any attempts to improve international competitiveness through currency adjustments may be ineffective if the exchange rate pass-through is very low. This is because a low pass-through means that other factors are at play in dampening the effects of exchange rate changes, thus the latter would not have a significant impact on prices. In this case, prices of imports remain rigid, domestic consumers continue purchasing the imported goods at the same rate, thus further worsening the trade imbalance.

Empirical work presented in this study informs the following conclusions: (a) the exchange rate pass-through is relatively fast and accounts for a significant proportion of domestic inflation; (b) ERPT accounts for 76 percent of changes in import prices and 43 percent of change in consumer prices; and (c) that most of the pass-through transmits within 12 months. The ERPT is consistent with that of other Sub-Saharan African countries. On policy implications, this degree of ERPT confirms the extent to which exchange rate changes, through import prices, influence domestic prices and, therefore, its key importance for both monetary policy and trade competitiveness.

It is worth acknowledging that import (and thus domestic) prices are likely to be highly responsive to changes in the bilateral rand/Pula exchange rate than the multilateral NEER, due to the high import volumes with South Africa. There could be scope to explore and quantify the degree (size and speed) of ERPT of the rand/Pula exchange rate on import and domestic prices, however, data limitations (segregating South African consumer goods from total imported tradeable goods) impede such an analysis.

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Regional Economic Integration and Capital Flows in the SADC Region

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EXECUTIVE SUMMARY

This paper investigates the level of intra-SADC cross border capital flows and their determinants following the signing of various protocols intended to aid the flow of capital and promote investment within the economic bloc. The study uses a descriptive analysis based on limited data on foreign direct investment and portfolio investment sourced from the International Monetary Fund (IMF) surveys to investigate the level of capital flows within the SADC countries between 2009 and 2016.

Using panel data for the period 2005-2017, the paper employs the generalised method of moments (GMM) approach to analyse the determinants of intra-SADC capital flows. The results indicate that intra-SADC capital flows remain low, but with scope and potential for expansion. Furthermore, the findings indicate that both economic size and distance matter for intra-SADC capital flows. In terms of control variables, natural resource availability, agglomeration effect, level of infrastructure development and use of common language are found to be important determinants of capital flows within the region, with the latter three variables having a positive effect, while the variable capturing natural resource availability has an unexpected negative sign.

Regarding recommendations, overall, SADC should pursue its industrialisation strategy and roadmap (2015-2063) in order to achieve its strategic goals and targets, including the attainment of higher levels of intra-SADC capital flows. There is also need to ensure that member states have harmonised capital account liberalisation policies. Furthermore, institutional reforms are needed to enhance the level of governance as the descriptive analysis has shown that there is a positive relationship between capital flows, good governance and quality of institutions. SADC countries also need to minimise the negative impact of geographical barriers and close the infrastructure gap through appropriate investments. The study further highlights the need for the regional bloc to ensure that it pursues policies that would improve the investment environment on a sustainable basis.

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2 SADC Member States include the following 15 countries: Angola, Botswana, Democratic Republic of Congo, Kingdom of Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Namibia, Seychelles, South Africa, Tanzania, Zambia and Zimbabwe. Republic of Comoros was not included in the study.

3 CCBG is an organ of SADC, which deals with the development of financial institutions and markets, cooperation regarding international and regional financial relations, as well as monetary, investment and foreign exchange policies.

I. INTRODUCTION

It is argued that free movement of capital stimulates cross-border trade and investment, which can lead to an increase in economic growth. Apart from adding to a country's financial resources, capital flows yield other benefits, such as technology and skills transfer, employment creation and improved standards of living, as well as access to foreign markets and capital from a wider range of investors and associated risk appetites. As such, capital flows, especially foreign direct investment (FDI) flows, are more likely to result in a durable and transformative impact through sustainable economic growth and development in the host countries. In some regions, for instance, the European Union (EU), free movement of capital has encouraged formation of companies with subsidiaries and branches in other member states and has lowered the cost of investment for financial asset providers in those states (Baber, 2014).

Most economists believe that the surge in cross border capital flows since the early 1990s has created unprecedented opportunities for developing countries to achieve accelerated economic growth. The argument is that, in developed countries, savings are abundant, but the return on investment is low because capital per worker is already high. In most developing countries, on the other hand, the return on investment is high as capital per worker is low, but with low levels of savings. Hence, if capital were allowed to move freely across national frontiers, a part of the savings of the developed countries could be productively employed in developing countries. International capital mobility, therefore, is expected to help poorer nations to achieve faster growth and, thus, promote economic convergence among nations (Lucas, 1990). Consequently, a large majority of the developing countries have substantially reduced restrictions on capital inflows, while some have proceeded to offer multiple incentives in the form of tax concessions or subsidies to international investors (Hanson (2001) and UNCTAD (1999)).

While cross border capital flows can support long-term growth, erratic capital movements pose short-term policy challenges, including undesirable consequences on exchange rates, financial markets and asset prices. However, countries have dealt with such challenges through appropriate macroeconomic policies and, in some cases, sought to dampen capital inflows by means of macro- and micro-prudential measures, tax instruments and direct capital controls (Report from the OECD to the G20 Sub-Group on Capital Flow Management, June 2011). While some restrictive measures may be effective in the short run, there are risks, including those related to retaliatory measures by other countries and a progressive fragmentation of international capital markets.

II. STATEMENT OF THE PROBLEM

The classical Heckscher-Ohlin-Mundell paradigm states that trade and capital mobility are substitutes in the sense that trade integration reduces the incentives for capital to flow to capital-scarce countries. However, for countries with fragmented financial markets, especially in less financially developed economies, trade and capital mobility are complementary, i.e., trade integration increases the return on capital and, thus, creates incentives for the flow of capital. To this end, given the level of financial sector development in Southern African Development Community (SADC) countries, integration in the form of launching a free trade area (FTA), as well as the Finance and Investment Protocol (FIP), should have resulted in an increase in intra-SADC capital flows, which are important in gauging the level, nature and depth of economic integration. Hence, this paper seeks to assess the impact of regional integration in fostering capital flows in the SADC region. The paper, therefore, investigates the level of intra-SADC cross border capital flows following the signing of various protocols, in particular, the FIP, which was intended to aid the flow of capital and promote investment within the economic bloc. Furthermore, the study aims to examine the determinants of intra-SADC capital flows, in particular, whether economic size and distance between SADC countries matter for intra-SADC capital flows.

The remainder part of this paper is organised as follows: Section 3 reviews the relevant literature. Section 4 investigates the level of intra-SADC cross border capital flows. The methodology used in determining factors influencing intra-SADC capital flows is explained in Section 5, while Section 6 presents the empirical results from the model. Section 7 concludes and makes policy recommendations while highlighting areas for potential reform.

III. LITERATURE ON INTERNATIONAL CAPITAL FLOWS AND REGIONAL ECONOMIC INTEGRATION

Types of capital flows

The most common types of capital flows are FDI, foreign portfolio investments (FPI) and debt. The components of FDI are equity capital, reinvested earnings and other capital (mainly intra-company loans). FDI yields more benefits than other types of financial flows because it comes with more direct control of management and operating strategy of firms. Furthermore, by comparison, FDI flows have shown some degree of stability, even during economic crises and are less associated with output volatility (Ito et al., 2009), which confirms that they are driven by aspirations towards long-term economic prospects of destination countries rather than speculative forces. On the other hand, portfolio flows include both bond and equity investments. Portfolio investors can sell their shares or bonds without much difficulty and more quickly than FDI; these flows are usually regarded as the hottest of capital flow types. Portfolio flows are also more prone to informational problems and hedging behaviour. Meanwhile, debt flows, consisting of bank loans and bonds, are usually period contracts and, therefore, less volatile once availed. However, debt flows can be difficult to get when the country faces performance and governance challenges.

Benefits and Costs of Capital Flows

Cross border capital flows allow greater portfolio diversification and better management of risk on the part of investors. For example, in the event of adverse exogenous shocks, the availability of international capital presents an economy with the ability to smoothen expenditure, thus reducing consumption growth volatility, which can be disruptive to the economy. Furthermore, capital flows enable the channeling of resources to areas where they can be used productively. The ability to source funds from an international pool of resources affects domestic investment and growth as it allows countries to expand investment and production beyond the constraints imposed by domestic savings. Moreover, as capital flows bring along foreign investors, this results in skills and knowledge transfer, leading to an increase in the level of productivity for the host nation. Capital flows can also have a beneficial impact on the efficiency of the domestic financial sector by increasing the depth and breadth of domestic financial markets and lowering costs associated with lack of competition. Since foreign investors prefer to invest in countries with sound institutions and stable macroeconomic track records; and given that domestic authorities would want to reap the benefits of capital flows, this may have a disciplining impact on domestic policymakers by encouraging them to maintain their focus on macroeconomic stability. As a result, greater focus on macroeconomic stability itself leads to faster economic growth.

The literature indicates that emerging market economies have benefited from capital flows, which have helped ease the domestic savings constraint and subsequently increased investment, thereby boosting economic growth. According to Devlin et al., (1995), to the extent that real returns on marginal investment are lower in capital-rich countries than those in capital-scarce countries, the movement of capital from developed economies to emerging market economies improved the efficiency of global resource allocation.

However, there are potential disadvantages of free capital mobility. One criticism is that capital flowing across borders is not necessarily in response to a real, tangible economic opportunity, but rather a perceived opportunity. Thus, capital may flow into a country because of asset price speculation due to an over-hyped view of economic prospects. This inflates asset prices and the domestic currency, attracting more foreign capital in a self-perpetuating process. Some of the funds may be used for productive investment, but equally some funds may be misallocated on bubble-type property speculation or credit-based consumption, including consumption of foreign goods made cheap by an over-valued currency. Also, depending on the type of flows, especially where FDI is concerned, there is the tendency to use foreign expertise, hence undermining prospects for skills transfer.

Furthermore, foreign capital flows may cause imbalances that threaten macroeconomic stability. This situation becomes likely if the rate of capital inflows is faster than can be productively absorbed by the economy. Such a disparity arises because of policy arbitrage, where capital flows are attracted by sound fundamentals of an economy causing financial markets to allocate too much or too little capital to some recipients at a given moment (Guitian, 1998). In a flexible exchange rate regime, capital inflows will lead to an appreciation of the nominal and real exchange rates, hence adversely affecting competitiveness of exports and import-substituting industries; this would cause a deterioration of the current account balance. If an economy pursues a fixed exchange rate regime, capital inflows will lead to a real exchange rate appreciation via inflationary pressure brought about by the increase in money supply and

domestic credit. In this regard, the Asian financial crisis presents a harsh reminder of the risks associated with more open capital accounts in the context of fixed exchange rate regimes (pegged exchange rates).

Drivers of and Impediments to Capital Flows

Capital flows can occur because of cyclical factors, which describe events that take place on a recurring basis, but are subject to periodical changes. The flows can also occur because of structural factors; factors that do not change with the economic cycle. However, the major debate in the literature is whether capital flows are driven by external ("push") factors or domestic ("pull") factors. According to Kaufman (2017), the push factors are external conditions that incentivise investors to increase exposure in a particular country, while the pull factors are the domestic country characteristics that are favourable for foreign capital. Push factors include variables, such as world GDP growth, stock prices and interest rates in major industrialised countries, global risk aversion, commodity prices and global liquidity. On the other hand, pull factors include structural variables of the target country, such as financial sector development, trade openness, exchange rate regime, institutional quality and capital openness. Therefore, given the benefits that accrue from capital flows, it is important to understand the determinants of and impediments to such flows. This knowledge could help in designing an effective policy intervention framework to manage volatile capital flows and their disruptive potential.

Several studies have been undertaken across the world to determine factors influencing cross border capital flows. Using a sample of thirty-four emerging markets and developing economies (EMDEs) over the period 2009 to 2015, Hannan (2017) employed a panel framework to study the determinants of capital flows, both net and gross flows, across a wide range of instruments. The variables used comprised the generally used push and pull factors considered in the literature, with pull variables including structural variables. For push factors, the study used global risk aversion, commodity prices, global liquidity growth, the US corporate spread and US yield gap. For pull variables, the study used growth and interest rate differential vis-à-vis the US, trade openness, foreign exchange reserves, exchange rate regime, income per capita, capital openness and financial development. The results suggest that capital flows are driven by both push and pull factors. However, there was considerable variation across instruments and types of flows considered. For example, the growth differential appears very important for non-residents' portfolio investment, while search for yield influenced residents' choice to invest abroad.

Alvarez (2015) analysed the role of institutional factors in shaping the dynamics of gross capital flows using a panel regression model for fifty-six countries[3] for the period 1996 to 2012. The study used both the pull and push factors, as well as institutional factors in the analysis. Pull factor variables used were GDP growth, the spread of long-term interest rates, ratio of public debt to GDP, credit to GDP ratio and the ratio of international reserves to GDP, while push factor variables comprised a volatility index, world GDP growth and US long-term interest rates. For institutional factors, the study used a set of variables[4] from the World Governance Indicators. The study found that institutional quality is a significant factor affecting the behaviour of foreign investors.

Kim and Ryou (2009) explored the determinants of financial capital flows in Korea over the period 1981 to 2007 using pull and push factors as well as institutional factors as suggested by theory. The pull factors included the Korean economic growth rate, domestic interest rate, expected depreciation of the Korean won against the US dollar, credit rating, current account balance as a ratio of GDP and trade openness. Push factors included the growth rate of industrial production in developed countries, the US Treasury bill rate and the S&P500 Index, while capital account liberalisation was used to capture the institutional factors. The study found that both the pull and push factors appear to have significantly affected capital inflows in Korea. However, the relative importance of pull and push factors seemed to be different depending on the sample period and the type of financial capital under consideration.

Hattari and Rajan (2006) examined the determinants of intra-bilateral FDI between fifteen developing Asian countries using panel regression covering the period from 1990 to 2004. The variables considered were real GDP, bilateral exchange rates, common border and language, distance and the KOF[5] index of globalisation. The study found that economic factors, such as market size, economic openness, close distance

3 These included 34 high-income countries and 22 low and middle-income countries.

4 These are voice of accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption.

and language similarity are among the reasons that promoted intra-Asian FDI flows.

Portes and Rey (2000) applied a panel model on bilateral gross cross-border equity flows for fourteen countries between 1989 and 1996 in order to establish whether the geography of information is important as a determinant of gross equity flows. The model integrated elements of the finance literature on portfolio composition, international macroeconomics and asset trade. The variables included the financial size and trading costs in the source and destination country, cyclical conditions and informational variables. The study found that indeed information is the main determinant of the pattern of international transactions.

Unlike in developed and other developing countries, there is limited literature on capital flows in the SADC region; the available literature is mostly descriptive, at best. For example, Nkuna (2017) examined intra-SADC FDI flows focusing on Mauritius and South Africa for the period 1999 to 2010. The study employed a descriptive approach to analyse intra-SADC FDI flows. Based on various reports highlighting potential determinants of FDI flows, the study found that for Mauritius and South Africa, hence intra-SADC flows, potential drivers of outward investment are geographical proximity, market access, liberalised markets, a stable macroeconomic and political environment, natural resource availability and institutional framework.

AfDB (2013) also used descriptive analysis to evaluate barriers to, and enablers of cross-border investment in SADC between 2000 and 2010. The identified barriers to cross border investment from the study include the business climate (e.g., unclear and arbitrary administrative requirements), undeveloped financial markets and the lack of a specific tailor-made national investment strategy to tap on the regional investment potential. Factors that enable cross border investment in SADC were geographical proximity and market size, SADC's Protocol on Finance and Investment, diversified sectors and opportunities, existence of special economic zones and regional stock markets.

Kapingura et al., (2018) examined the determinants of three forms of foreign capital; namely cross-border bank flows, FDI and oversees development assistance in the SADC region from 1980 to 2012. The study utilised the 3SLS technique and the generalised method of moments (GMM). The empirical results reveal that both domestic and foreign factors are important determinants of private external financial flows to the SADC region. In all the regressions estimated in the study, foreign variables emerged to be significant in influencing the flow of finance to the region.

Bezuidenhout and Naude (2008) used a gravity model (panel GMM) to estimate the relationship between trade and foreign investment in the SADC region between 1989 and 2004. The variables used in the model included total FDI inflows to SADC, total exports of SADC to the developed countries, total trade of major developed countries to the world and Africa and a distance variable. The study found that there is indeed a significant causal and positive relationship between FDI inflows to SADC and SADC exports. It also found that distance and political instability are also significant determinants, with a negative relationship to FDI.

However, the most relevant empirical work on what influences intra-SADC capital flows was by Nkuna (2016), which investigated the drivers of intra-SADC FDI inflows using a panel regression model based on the gravity framework and focusing on South Africa's outward FDI into the SADC region for the period 1999 to 2010. The model variables were trade openness, market size, bilateral investment treaties, institutional factors, capital account liberalisation, natural resource availability, level of infrastructure development, distance between countries, macroeconomic indicators and availability of labour force. It was concluded that capital account openness, investment treaties and labour availability are key in promoting intra-SADC FDI flows. Agglomeration effects were also found to be important for South African investors into SADC.

Regional Integration: Country/Regional Experiences

The Southern African Development Co-ordination Conference (SADCC) was established in 1980 in Lusaka, Zambia, and was later transformed into the Southern African Development Community (SADC) in 1992 through the signing of the SADC Treaty. The mandate of SADC was to achieve broader economic integration in the region, through the following specific objectives: market integration; macro-economic convergence; strengthening of financial and capital markets; attainment of deeper monetary cooperation; increasing levels of investment; and enhancement of SADC competitiveness.

A number of protocols were also signed, focussing on specific areas to drive the SADC agenda,

5 The KOF Globalisation Index measures the economic, social and political dimensions of globalisation.

including those intended to aid the flow of capital and promote investment across the economic bloc. For example, in 1996, SADC countries signed the SADC Protocol on Trade, which was brought into effect in 2000 and intended to liberalise intra-regional trade in goods and services and contribute towards the improvement of the climate for domestic, cross-border and foreign investment, among others. Member states were in agreement to gradually remove tariffs over a 12-year period with the ultimate aim of establishing a free trade area (FTA). By 2008, 85 percent of intra-SADC trade amongst participating countries attained duty-free status and by 2012, the tariff phase-down was nearly complete. On the other hand, non-tariff barriers proliferated, hindering trade in the region and delaying business processes by discouraging the private sector in their creation of value chains in the region. With the realisation that non-trade barriers were working against the good intentions of establishing the FTA, SADC members agreed to reduce such barriers, among them, quantitative import barriers. Another hindrance to achieving regional integration was that most countries were implementing import-substitution strategies, a developmental model focused on promoting domestic businesses and protecting infant industries from outside competition. However, over time, most of these countries opened up their economies by adopting more market-oriented economic policies, such as privatisation, financial liberalisation, structural adjustment programmes and FDI regulatory reviews.

For regional integration to be a success, countries must be able and willing to strive for the benefits of integration and accept the short-term costs that such a commitment imposes. This suggests that the prospects of success vary widely and have to be analysed on a case-by-case basis. As such, while regional integration might be working for some countries, others might prefer other arrangements or different routes for inclusion in the world economy, such as bilateral agreements. According to Sapir (2004), there are five main considerations to ensure the success of a process of integration. These comprise putting in place clear and shared objectives; appropriate sequencing of initiatives; having clear and feasible deliverables; being mindful of exemptions granted to members as they are not free from costs; and having a framework that allows parties to cope with shocks.

Based on these elements, there is need to clearly map out an orderly integration process, which follows implementation of a set of progressive steps; starting with choosing the level of integration to be pursued, with clear ultimate objectives and a well-defined starting point. There are five different degrees of integration (Balassa, 1961) to choose from, ranging from a free trade area (the least ambitious objective) to full integration (the arrangement that imposes the most stringent requirements on members). The second step of integration requires the selection of the partners to be part of the arrangements based, among others, on their size and degree of homogeneity. The third and final step consists of selecting the degree of convergence of the process. With the European Community (EC) experience, trade integration moved along with social cohesion (i.e., EU Structural and Cohesion Funds),[6] whereas monetary integration moved alongside nominal economic convergence.[7] However, it is not clear whether convergence is a precondition for integration or rather a consequence of the process of integration. Ultimately, parties need to define the degree of flexibility characterising the process. Options available for integration include integration "à la carte",[8] multi-speed models, core/periphery models and full flexibility. The EC experience draws on the multi-speed framework, under which successive enlargements have been accommodated on a flexible setup, as reflected in open partnerships. However, it should be acknowledged that countries have different characteristics in terms of geographical size and population, resource endowments, political and economic systems, as well as stages of development. It is these peculiarities that can have an effect on the integration process across regions as reflected in some worldwide country experiences.

The Common Market for Eastern and Southern Africa (COMESA) has 19 members and a total population of 400 million. It is the largest of the regional economic communities (RECs) in Africa. Resource endowments vary greatly among COMESA member countries, where most of the members are commodity exporters of either agricultural or mineral products (Burundi, DRC, Malawi, Rwanda, Zambia, and Zimbabwe). Some of them rely, to a great extent, on tourism (Kenya, Mauritius,

6 A cohesive society is the one which "works towards the well-being of all its members, fights exclusion and marginalisation, creates a sense of belonging, promotes trust, and offers its members the opportunity of upward social mobility."

7 Nominal convergence criteria regarding inflation, public deficit, public debt, exchange rate volatility and long-term interest rates.

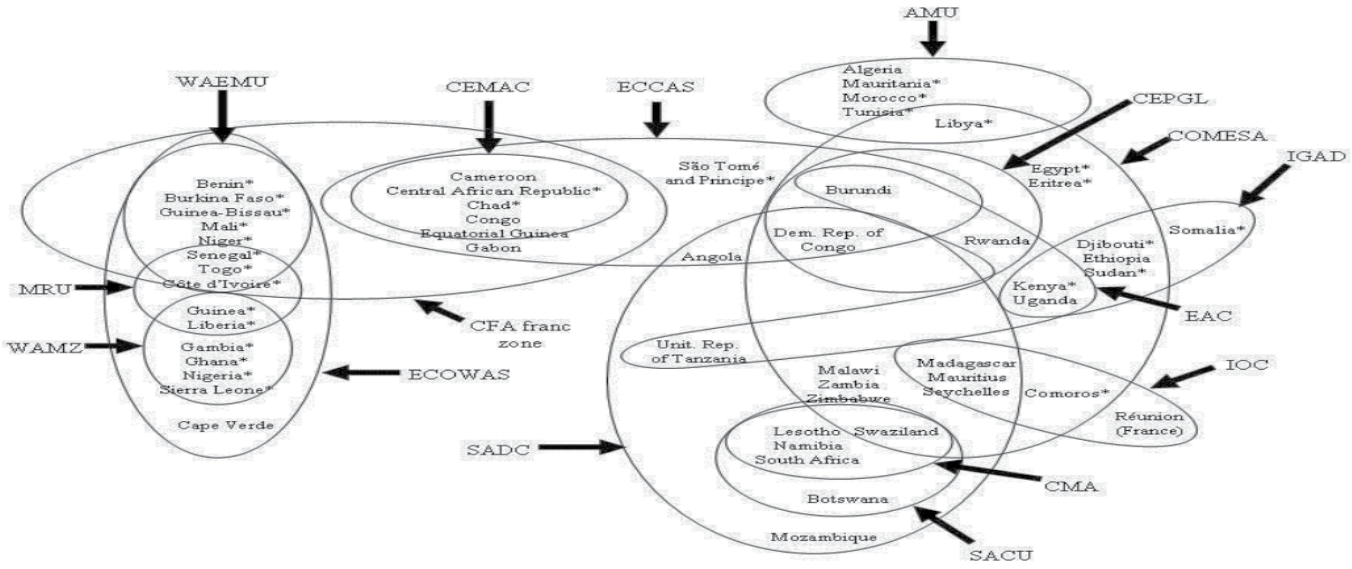
8 This refers to the idea of a non-uniform method of European integration, which allows EU countries to select policies, as if from a menu, and involve themselves fully in those policies. The EU would still have a minimum number of common objectives. However, different countries would integrate at different levels (variable geometry) or at different speeds (multi-speed). Europe 'à la carte' is already a reality, with some countries being part of the Eurozone and others not.

Seychelles and Uganda), while one is a hydrocarbon exporter (Libya). On the other hand, one relies on provision of harbour services (Djibouti). Kenya also acts as a hub for development in the East African region. Most members of COMESA have liberal market-oriented economies, although a few are still tightly controlled or just at the beginning of the liberalisation process. Members of COMESA have made commendable strides towards the formation of an FTA since 2000, albeit members effectively joining at different times. Most countries undertook reform measures focusing on the gradual transformation of isolated national markets into a single regional market. Satisfactory progress has been achieved in trade liberalisation and facilitation by reduction and elimination of trade and non-trade barriers between member states. Between 2000 and 2016, real GDP in COMESA has grown on average by 6 percent per annum. However, the wide divergence among COMESA member states is a major obstacle to full regional financial integration (RFI) for all the members in the medium term. Some countries (e.g., Burundi and Ethiopia) have less sophisticated financial systems and less developed regulatory and supervisory frameworks. Therefore, these countries have a long way to catch up with others, and at the same time, have inadequate resources to implement the requisite actions. Furthermore, the economic environment in fragile member countries need to be addressed. For example, Zimbabwe has experienced negative GDP growth over a number of years. Hence, continued reform efforts, including a further strengthening and integration of financial systems, could help in this regard.

Algeria, Libya, Mauritania, Morocco and Tunisia established the Arab Maghreb Union after signing a treaty in 1989. These five countries share a common heritage and are endowed with large natural resources, despite the differences in their economic structures. Algeria and Libya are naturally endowed with large oil resources, while Mauritania has a large mineral sector. These three countries have small and relatively less developed financial and manufacturing sectors. Morocco and Tunisia, on the other hand, have less developed mineral and oil sectors, but much more developed and sophisticated financial and manufacturing sectors. The five countries have made notable progress in implementing financial sector reforms. All of them have improved their legal and regulatory framework, recapitalised banks and enhanced financial sector soundness and efficiency. Taking advantage of these reforms, the authorities in the five countries in recent years have taken steps to resuscitate the Maghreb integration, a plan that was launched almost 20 years ago.

Progress in most regional blocs, especially in Africa, has been very limited due to the overlapping of regional structures (Figure 1), which tend to have similar, competing, overlapping or mutually excluding objectives. Apart from delaying progress with the integration process, these overlaps result in raised costs for member countries.

FIGURE 1: INTERCONNECTEDNESS OF AFRICA'S REGIONAL ECONOMIC BLOCKS



Source: Figure updated from UNCTAD (2009), Economic Development in Africa 2009: Strengthening Regional Economic Integration for Development. United Nations publication. Sales No. E.09.II.D.7. New York and Geneva.
Abbreviations: AMU, Arab Maghreb Union; CEMAC, Central African Economic and Monetary Community; CMA, Common Monetary Area; CEN-SAD, Community of Sahelo-Saharan States; CEPGL, Economic Community of the Great Lakes Countries; IOC, Indian Ocean Commission; IGAD = Intergovernmental Authority on Development; MRU, Mano River Union; SACU, Southern African Customs Union; WAEMU, West African Economic and Monetary Union; WAMZ, West African Monetary Zone.
* Members of CEN-SAD

IV. INTRA-SADC CAPITAL FLOWS

Trends in the Intra-SADC Cross-Border Capital Flows

FDI Outflows

Despite efforts intended to facilitate investment flows within the SADC region, such as the signing of the FIP in 2006, intra-regional FDI remains largely limited. Although data on intra-SADC capital flows is scant, available data indicates that South Africa remains the most important source of FDI in the SADC region in terms of volume (see Table 4.1). Following the 1994 democratic elections, South African companies have engaged in a sustained outward FDI thrust with substantial impact on the SADC countries.[9] Table 4.1 indicates that intra-SADC FDI flows have generally been increasing overtime, with Mauritius also becoming an important source of FDI in the SADC region. Mauritian investment reflects the appetite of Mauritian companies for intra-regional investment. The prominent sectors being targeted by Mauritian investments relate mainly to distribution of petroleum products, financial services and telecommunications. However, among the SADC countries, Botswana allocates the highest proportion of FDI resources to the region than to the rest of the world (Table 4.2). For example, in 2016, 85.2 percent of Botswana's FDI outflows went to the SADC region, while only 11.5 percent of South Africa's FDI went to the SADC region. This is not surprising as Botswana has a liberalised capital account and there is a search for market beyond the small domestic market. Most of the outflows are for mining, wholesale and retail trade and financial and insurance activities.

FDI Inflows

In terms of volumes of inflows, Mauritius receives the most FDI from other SADC countries (mostly from South Africa and for real estate investment), which averaged USD10.1 billion per year between 2009 and 2016 (Table 4.3). However, relative to proportions, Seychelles received the highest, averaging 39.7 percent of its total FDI from the SADC countries (Table 4.4).

TABLE 4.1: OUTWARD FDI POSITIONS TO OTHER SADC COUNTRIES (USD MILLIONS)

	2009	2010	2011	2012	2013	2014	2015	2016
Botswana	673	412	245	301	347	429	558	895
Mauritius	150	188	5172	7413	9148	8845	9346	16040
Mozambique	0.7	1	0.7	...	...	...	...	...
South Africa	10498	13439	18641	18130	16215	20225	17379	20139
Zambia	9	80	44	63	...	559	447	759

Source: International Monetary Fund (Coordinated Direct Investment Survey)

TABLE 4.2: PROPORTION[10] OF OUTWARD FDI POSITIONS TO SADC COUNTRIES (PERCENT)

	2009	2010	2011	2012	2013	2014	2015	2016
Botswana	80.5	71.7	53.8	41.2	31.9	85.0	90.7	85.2
Mauritius	0.1	0.1	1.9	2.5	3.9	3.8	4.2	6.8
Mozambique	35.0	50.0	17.5	...	...	...	...	...
South Africa	14.9	16.1	19.2	16.2	12.6	13.9	11.2	11.5
Zambia	9.5	21.3	24.2	28.4	...	47.6	38.6	23.8

Source: International Monetary Fund (Coordinated Direct Investment Survey)

9 South African corporates generally have skills and resources to exploit investment opportunities than peers in other countries.

10 This is derived as a country's outflows to other SADC countries divided by the total outflows of that particular country.

TABLE 4.3: INWARD FDI POSITIONS FROM OTHER SADC COUNTRIES (USD MILLIONS)

	2009	2010	2011	2012	2013	2014	2015	2016
Botswana	753	522	570	641	1008	1348	1376	1656
Mauritius	385	477	10055	6510	11222	12295	17766	22006
Mozambique	1655	2392	2892	3978	4520	5134	6402	9986
Seychelles	6	581	565	683	448	347	367	330
RSA	2838	3453	3605	3343	3267	3114	2869	3302
Tanzania	2760	2858	3321	3109	2849	3029	3006	0
Zambia	739	938	906	1407	1217	1623	1747	2418

Source: International Monetary Fund (Coordinated Direct Investment Survey)

TABLE 4.4: PROPORTION OF SADC COUNTRIES' INWARD FDI POSITIONS (PERCENT)

	2009	2010	2011	2012	2013	2014	2015	2016
Botswana	40.7	22.8	16.7	21.6	20.5	45.9	40.7	32.3
Mauritius	0.2	0.3	3.4	2.1	4.2	4.1	6.6	7.8
Mozambique	44.2	51.9	35.4	28.7	22.4	20.5	23.7	28.0
Seychelles	0.6	53.7	54.9	54.2	41.5	37.2	37.7	37.8
RSA	2.0	1.9	2.3	2.0	2.1	2.2	2.3	2.4
Tanzania	34.9	33.0	36.1	31.2	26.3	25.5	23.9	0.0
Zambia	11.8	10.4	10.1	12.5	10.0	10.1	11.1	14.7

Source: International Monetary Fund (Coordinated Direct Investment Survey)

Portfolio Outflows

With regard to portfolio investment outflows, available data indicates that Mauritius is a major source of such investment within the SADC region, averaging USD2.1 billion per annum between 2001 and 2016 (Table 4.5). Mauritian investment reflects the high return for portfolio investment in the region, mostly in South Africa. However, for the period under review, portfolio outflows from Mauritius to the region accounted for about 3 percent of the country's total portfolio outflows, an indication of limited intra-SADC portfolio flows as a result low level of capital market activity in the SADC region, among others.

TABLE 4.5: OUTWARD PORTFOLIO INVESTMENT (PI) POSITIONS TO OTHER SADC COUNTRIES (USD MILLION) AND PROPORTION OF MAURITIUS' AND SOUTH AFRICA'S OUTWARD PI POSITIONS (PERCENT)

	Outward PI Positions to other SADC Countries (USD Million)		Proportion of Outward PI Positions (Percent)	
	Mauritius	South Africa	Mauritius	South Africa
2001	11	60	1.8	0.2
2002	2069	88	12.1	0.3
2003	672	65	2.5	0.2
2004	1210	64	3.1	0.1
2005	420	120	0.8	0.2
2006	1091	192	1.3	0.3
2007	3952	447	2.6	0.6
2008	2247	700	1.7	1.1
2009	5091	760	2.8	0.8
2010	1826	880	1.0	0.7
2011	1276	1379	1.0	1.0
2012	3328	1700	3.3	1.1
2013	2313	1560	2.3	0.9
2014	4091	1494	3.2	1.0
2015	2093	1353	1.7	0.9
2016	1912	1966	1.7	1.3

Source: International Monetary Fund (Coordinated Portfolio Investment Survey)

The capital openness index, as calculated by the IMF, indicates that the SADC region is largely open to capital inflows as opposed to outflows, with only a few countries in the region fully open to both directions of capital flows (Table 4.6). Hence, this partly explains the low levels of intra-SADC capital flows.

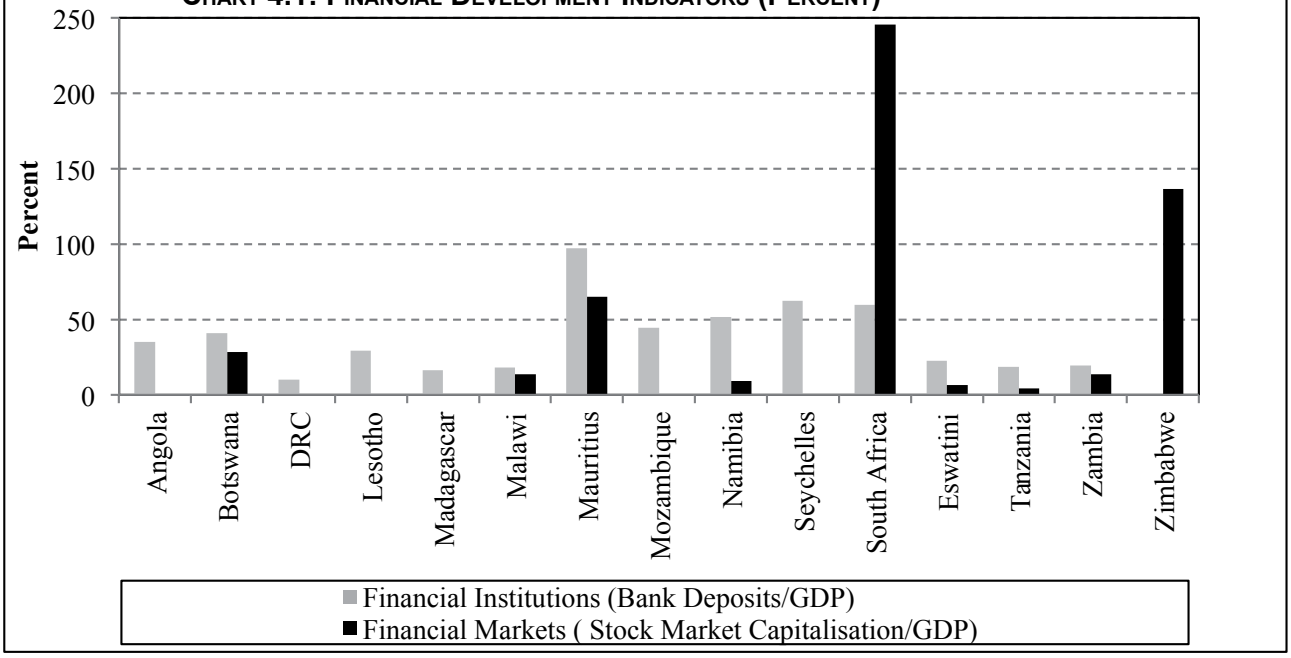
Furthermore, the low level of intra-SADC capital flows is reflective of under-developed financial institutions and financial markets as depicted in Chart 4.1. The low level of financial sector development in the SADC region is partly a result of lack of full liberalisation of the financial sector. In addition, low market capitalisation and inadequate liquidity in capital markets, as well as limited number of financial instruments issued through the financial markets, are hindrances to capital flows in the region.

TABLE 4.6: SELECTED CAPITAL ACCOUNT OPENNESS MEASURES IN 2013

	Financial Markets Openness	Openness of Capital Inflows	Openness of Capital Outflows	FDI Openness Index
Seychelles	1.00	1.00	1.00	1.00
Zambia	1.00	1.00	1.00	1.00
Mauritius	0.75	0.86	0.71	0.50
Botswana	0.65	0.86	0.57	1.00
Namibia	0.55	0.50	0.36	0.50
Eswatini	0.30	0.36	0.14	0.50
RSA	0.25	0.57	0.00	0.50
Malawi	0.20	0.14	0.14	0.00
Zimbabwe	0.10	0.07	0.07	0.00
Angola	0.00	0.07	0.07	0.00
DRC	0.00	0.00	0.00	0.00
Madagascar	0.00	0.70	0.00	0.50
Mozambique	0.00	0.00	0.00	0.00
Tanzania	0.00	0.07	0.00	0.00
Lesotho	no data	no data	no data	no data

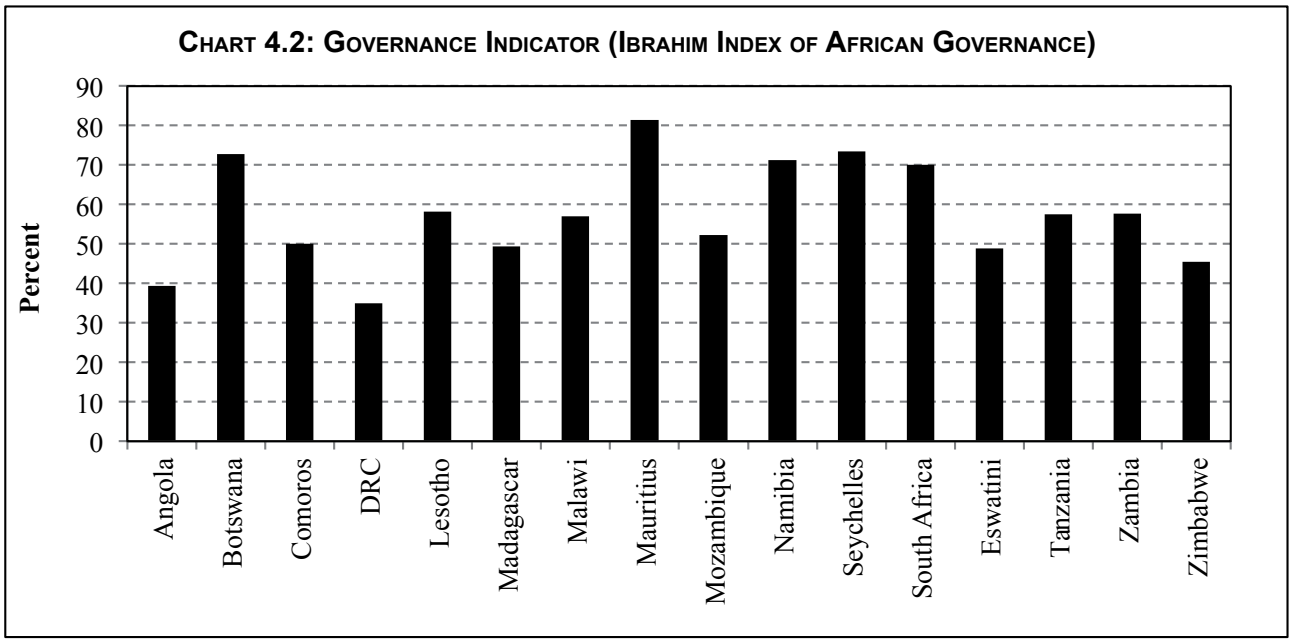
Source: IMF
Note: 1 = fully liberalised

CHART 4.1: FINANCIAL DEVELOPMENT INDICATORS (PERCENT)



Source: IMF

CHART 4.2: GOVERNANCE INDICATOR (IBRAHIM INDEX OF AFRICAN GOVERNANCE)



Source: Mo Ibrahim Foundation

Chart 4.2 indicates that countries that receive more capital inflows within the SADC region are those ranked highly in terms of governance, as measured by the Ibrahim Index of African Governance. For example, Mauritius ranks highly in terms of volume of FDI inflows, while Seychelles received the highest proportion of FDI resources from the region compared to other SADC countries.

In addition, the limited capital flows within the SADC region partly emanates from slow progress of macroeconomic convergence towards a stable environment. Table 4.7 indicates that there is divergence in terms of indicators of macroeconomic stability within SADC countries. It is worth noting that a stable macroeconomic environment is usually an important precondition for attraction of capital flows.

TABLE 4.7: KEY INDICATORS OF MACROECONOMIC STABILITY IN THE SADC REGION FOR 2017

	Inflation	Budget Balance (% of GDP)	Public Debt (% of GDP)	Months of Import Cover	Real Growth	Current Account Balance(% of GDP)
Angola	26.3	-5.3	62.0	7.7	-2.5	-0.6
Botswana	3.3	0.6	15.4	18.1	2.4	22.2
DRC	35.7	0.1	12.2	0.9	3.7	-2.9
Lesotho	5.2	-6.2	35.6	4.1	2.3	-6.2
Madagascar	8.3	-2.3	36.0	4.0	4.2	-0.3
Malawi	11.5	-3.2	56.3	3.6	5.1	-16.1
Mauritius	3.7	-3.2	57.0	9.7	3.6	-5.8
Mozambique	15.1	-6.1	122.2	5.8	3.7	-19.4
Namibia	6.2	-5.3	42.3	4.6	-0.8	-2.3
Seychelles	2.9	-0.04	67.2	4.2	5.3	-19.9
South Africa	5.3	-3.9	50.6	4.9	1.3	-2.5
Eswatini	6.2	-8.3	21.7	3.5	1.9	14.7
Tanzania	5.0	-1.5	41.7	5.9	7.1	-3.3
Zambia	6.6	6.1	51.8	2.9	4.1	-4.5
Zimbabwe	0.9	-9.4	82.3	0.6	3.7	-1.8

Source: SADC central banks

The limited amount of intra-SADC capital flows can also be attributed to the administrative bottlenecks related to the ease of doing business. Countries that are ranked high in terms of doing business tend to attract more capital flows than lowly ranked countries (Table 4.8). Barriers to doing business in the region still exist and these are mainly in the form of complexities and onerous application of administrative requirements, company registration and foreign investors and workers' permit approvals. This indicates that, although countries are willing to open up to others, there is still some self-protectionist attitude, especially perceptions about safeguarding employment for citizens against foreign workers.

TABLE 4.8: DOING BUSINESS 2018 RANKINGS FOR SADC COUNTRIES

	Ease of Doing Business Rank	Starting a Business	Paying Taxes	Trading Across Borders	Getting Credit	Protecting Investors
Angola	175	134	103	180	183	81
Botswana	81	153	47	50	77	76
Congo, DR	182	62	181	188	142	164
Lesotho	104	119	111	40	77	108
Madagascar	162	76	131	134	133	96
Malawi	110	152	134	117	6	96
Mauritius	25	40	10	70	55	33
Mozambique	138	137	117	109	159	138
Namibia	106	172	79	132	68	89
Seychelles	95	141	29	88	133	108
South Africa	82	136	46	147	68	24
Eswatini	112	158	63	32	77	138
Tanzania	137	162	154	182	55	129
Zambia	85	101	15	150	155	89
Zimbabwe	159	180	143	153	105	89

Source: World Bank

There is also slow implementation of a strategy on intra-SADC capital flows focused at attracting regional investors to the extent that they would not face the same kind of constraints as other international investors, hence limited intra-SADC capital flows. Furthermore, regional integration should ideally lead to the removal of tariffs and other trade restrictions (for example, the liberalisation of investment in particular industries) or reducing transaction costs (for example, due to the elimination of trade barriers among member states or converging policy regimes), generally leading to an increase in capital flows within the region. This may also lead to an increase in extra-regional FDI as a result of creating a post-integration larger market, which is especially important for regional groups of smaller economies, or because of import-substitution effects where regional economic integration implies external barriers to trade (i.e., tariff-jumping FDI). Due to limitations of the relevant data (intra-SADC capital movements before 2009) needed for thorough analysis of developments in the SADC bloc, the extent to which regional integration affected capital flows becomes difficult to assess. However, the available data (Tables 4.9 and 4.10), indicate that countries that are more integrated, e.g., West African Economic and Monetary Union (WAEMU), tend to experience more intra-regional trade and FDI flows compared to less integrated regional blocs, such as SADC, which is still working towards a full Customs Union. This is explained by, among others, the free movement of goods and services and the use of a common currency in the WAEMU region.

TABLE 4.9: PROPORTION OF OUTWARD FDI POSITIONS TO WAEMU COUNTRIES' (PERCENT)

	2011	2012	2013	2014	2015	2016
Benin	70.3	60.9	...	...	12.6	21.6
Burkina Faso	...	87.9	99.1	86.3	63.6	85.3
Cote d'Ivoire	...	...	...	...	...	45.6
Mali	100	95	88.7	63.5	96.7	76.6
Senegal	36.4	34.7	...	107.1	...	...
Togo	8.5	...	47.9	22.4	21.3	9.3

Source: International Monetary Fund (Coordinated Direct Investment Survey)

TABLE 4.10: PROPORTION OF WAEMU COUNTRIES' INWARD FDI POSITIONS (PERCENT)

	2011	2012	2013	2014	2015	2016
Benin	27	25.3	11.5	14	18.8	20.5
Burkina Faso	...	17.4	13.8	14.2	11.4	13.4
Cote d'Ivoire	...	...	...	...	...	5.1
Guinea Bissau	36.2	39.3	34.3	36.4	32.9	38.6
Mali	16.1	11.7	11.3	9.8	7.9	7.9
Niger	...	9.2	8.9	15.6	5.9	6.7
Senegal	5.3	7.2	...	3.8	...	...
Togo	8.6	...	8.3	5.5	8.8	5.8

Source: International Monetary Fund (Coordinated Direct Investment Survey)

V. METHODOLOGY FOR DETERMINING FACTORS INFLUENCING INTRA-SADC CAPITAL FLOWS

In determining factors influencing intra-SADC capital flows, particularly whether economic size and distance between SADC countries influence intra-SADC capital flows[11], the study closely follows Nkuna (2016) and employs the GMM approach with the specification derived from the gravity[12] framework (Equation 1). The estimation of Equation 1 in a panel setting, poses some well-known issues, such as the presence of unobserved country-specific effects, potential endogeneity and autocorrelation problems. Therefore, the GMM approach for dynamic panel data is used to address these issues. In particular, a system-GMM estimation is applied as it has a further advantage of increasing the efficiency of GMM estimators. Meanwhile, if the panel (N) is smaller than the time dimension (T), the Arellano-Bond autocorrelation test may become unreliable. Furthermore, too many instruments can overfit endogenous variables and fail to expunge their endogenous components (Roodman, 2006). Hence, to address these shortcomings, the study ensures that N is greater than T and the number of instruments do not exceed N. Given the importance of South Africa as a source of capital flows in the SADC region, and also taking into account data limitations on capital flows between SADC countries, intra-SADC capital flows are proxied by focusing on South Africa's outward flows to other SADC countries. Based on several control variables that have been found in the literature, the equation to be estimated is, thus, specified as follows:

$$capf_{ijt} = \beta_1 capf_{ijt-1} + \beta_2 gdpsa_{it} + \beta_3 gdp_{jt} + \beta_4 dis_{ijt} + \beta_5 tra_{jt} + \beta_6 inst_{jt} + \beta_7 cap_{jt} + \beta_8 nra_{jt} + \beta_9 infd_{jt} + \beta_{10} lf_{jt} + \beta_{11} ln_{ijt} + \beta_{12} fip_{jt} + \beta_{13} lr_{jt} + u_{ijt} \quad (1)$$

Where;

$capf_{ijt}$ denotes the level of capital flows from South Africa to the host country; $capf_{ijt-1}$ is the agglomeration effect; gdpsa_it is nominal GDP of South Africa; gdp_{jt} is nominal GDP of destination countries; dis_{ijt} is the distance between South Africa and the recipient countries; tra_{jt} is the trade openness of SADC countries; $inst_{jt}$ represents institutional factor; cap_{jt} is capital account liberalisation; nra_{jt} depicts natural resource availability; $infd_{jt}$ is infrastructure development; lf_{jt} indicates availability of labour force; ln_{ijt} denotes common language; fip_{jt} is the level of commitment to FIP; and lr_{jt} represents domestic lending rate. $ß_s$ are parameters and u_{ijt} is the error term, which

11 Due to lack of data on portfolio investment and other investment, capital flows are proxied using FDI.

12 The gravity model is derived from the Newton's gravity equation, which holds that the gravitational pull between two objects is directly and positively related to their mass and the distance between the objects acting as a restraint. The application in economics implies that an economic flow between two economic entities will depend on their respective economic sizes and the distance between them.

consists of the unobserved country-specific effects and the observation specific errors.

The study uses panel data for fifteen SADC[13] countries for the period 2005-2017. The choice of the sample size is influenced by lack of a longer series of panel data for some variables and the approach used in the study.[14] FDI stock (capf) is used to represent capital flows from South Africa to other SADC countries. Numerous studies have shown that agglomeration effect ($capf_{ijt-1}$) has a positive impact on FDI. In general, the existing FDI stock signals the foreign direct investors the extent of a country's experience with foreign investors and, hence, guides new investors in choosing a location for investment.

The study also uses nominal GDP in South Africa ($gdpsa_{it}$) to capture the market size of the South African economy and nominal GDP in host country (gdp_{jt}) to give an indication of a country's economic size. SADC integration acted as an incentive for the firms in the region to exploit the enlarged market. Therefore, it is important to investigate the importance of SADC countries' market in attracting South Africa's outward FDI. The expected sign of the coefficient is positive.

To capture the distance factor, the study uses the geographical distance between South Africa and other SADC countries ($dist_{ijt}$), proxied using the distance between Johannesburg and other major cities in SADC. Distance increases the cost of doing business and, therefore, has the potential to deter FDI. The ratio of trade to nominal GDP of a host country (tra_{jt}) is used to capture the level of trade. Theorists like Mundell (1957) regarded trade and FDI as substitutes, while researchers like Bezuidenhout and Naudé (2008) found a positive relationship between exports and FDI. It is, therefore, important to investigate this relationship in the context of South Africa's outward investment to the SADC region. The expected sign of the coefficient is ambiguous.

Furthermore, the rule of law index ($inst_{jt}$) is included to capture the institutional environment. Usually government policy and good governance facilitate free cross-border capital flows. Hence, it is important to empirically examine it with regard to South Africa's outward FDI into SADC. The direct investment openness index (cap_{jt}) measures the level of capital account liberalisation. It is generally argued that the regulatory framework both of the source and host countries has a significant impact on FDI. Most SADC member states, though open to foreign investment in several sectors, still have limits on foreign investment in certain strategic sectors. As such, it is important to empirically ascertain the significance of this variable in the study.

The ratio of natural resource rent to GDP (nra_{jt}) indicates the level of a country's natural resources. The region's rich natural resources continue to be a critical factor in attracting FDI from other regions. Therefore, FDI is expected to be positively related with natural resources. In addition, the percentage of the population using internet ($infd_{jt}$) is used to depict the level of infrastructure development. Infrastructure development is said to be a magnet for FDI as it reduces the cost of doing business. SADC is facing a lot of infrastructural challenges. In this regard it is important to empirically examine the significance of this variable, which is expected to have a positive effect on FDI.

Population of age 15-64 as a share of total population (lf_{jt}) captures the size of the labour force. Cheap and readily available labour force is a significant attraction to foreign investors as this directly reduces the cost of production. A dummy for common language with South Africa (ln_{ijt}), taking one if it is an English-speaking country and zero otherwise, is used. Language similarity is expected to promote intra-regional FDI flows. Also, a dummy to take into account the level of commitment to FIP (fip_{jt}) is included in the model. The FIP is intended to aid the flow of capital and promote investment within the SADC region. The lending rate (lr_{jt}) is used to capture the cost of borrowing in SADC countries. Investors usually are attracted by lower cost of borrowing in destination countries.

Owing to the large variation across the sample of countries, all variables except language, level of commitment to FIP and infrastructure development have been converted into logarithms.[15] Data on FDI stock is obtained from the South African Reserve Bank (SARB). Data on nominal GDP for all SADC countries, natural resources, infrastructure development, labour force and lending rates are sourced from World Bank Development Indicators. Data on the rule of law is obtained from the World Bank Worldwide Governance Indicators database. Trade data and data on capital account liberalisation are obtained from the IMF, while

13 The study excludes Comoros, which is a new member.

14 The approach used in the study is suitable for panel data with small time dimension.

15 Logging also helps to linearise the data and allows for coefficients to be interpreted as elasticities.

information on the FIP is drawn from different SADC publications.

VI. EMPIRICAL RESULTS ON THE DETERMINANTS OF INTRA-SADC CROSS-BORDER CAPITAL FLOWS

Table 5.1 presents the system-GMM results. However, unit root test results are not presented in the analysis as there are no potential problems of unit root given that T is fairly short (T=13). The results indicate that both the size of the economy and distance matter for intra-SADC capital flows. The size of the economy has a positive and significant effect, while distance has a negative and statistically significant effect on capital flows within the SADC region. Therefore, the results indicate that both economic size and distance drive intra-SADC capital flows. In terms of other variables used in the model, natural resource availability, agglomeration effect, the level of infrastructure development and the use of a common language are found to be important determinants of capital flows within the region, with the latter three variables having a positive effect, while the variable capturing natural resource availability has an unexpected negative sign. However, the negative sign could be explained by the fact that natural resources generate macroeconomic uncertainty and, therefore, crowd out investment, consistent with the literature on the natural resource curse (Sachs and Warner, 1995).

TABLE 5.1: SYSTEM-GMM RESULTS

Dependent Variable (capf)	**System-GMM**	
capf(-1)	0.401***	(5.34)
gdpsa	-0.346	(-0.59)
gdp	0.630**	(2.58)
dis	-0.576**	(-3.07)
tra	0.529	(0.93)
inst	-0.229	(-0.40)
cap	-0.078	(-0.31)
nra	-0.273**	(-2.56)
infd	0.334**	(2.22)
lf	-0.002	(-0.00)
ln	0.736*	(1.72)
fip	1.032	(1.60)
lr	0.001	(0.47)
Arellano-Bond test for AR(2)	0.206	
Sargan test	0.160	

Note: Values in parenthesis are t-statistics, while *,** and *** denote that a variable is significant at 10 percent, 5 percent and 1 percent level, respectively.

To test for the robustness of the results, both the serial correlation test and the test for validity of the instruments used were applied. The null hypothesis of no autocorrelation based on the Arellano-Bond test for AR(2) cannot be rejected, as indicated in Table 5.1. Furthermore, the Sargan test indicates that the instruments used as a group are exogenous, hence valid. Therefore, the results from system-GMM estimation are robust.

VII. CONCLUSION AND RECOMMENDATIONS

It has emerged from this research that intra-SADC capital flows are very limited. The descriptive section that relies on the CDIS data has revealed that South Africa and Mauritius are the dominant member states in terms of flows pertaining to both FDI and portfolio investment. However, Botswana far exceeds other SADC countries in terms of the proportion of FDI going regionally as opposed to the rest of the world. There are, however, a number of reasons explaining the low level of activity in capital flows in the SADC region, including restrictions on capital flows, the low level of financial and capital market development, relatively weak governance structures, macroeconomic impediments, administrative bottlenecks, slow implementation of strategy on intra-SADC capital flows focused on attracting regional investors and low level of economic integration. In addition to the descriptive analysis, the empirical results indicate that both economic size and distance matter for intra-SADC capital flows. In terms of control variables used in the model, natural resource availability, agglomeration effect, level of infrastructure development and use of common language are found to be important determinants of capital flows within the region.

With a liberalised capital account, investors may be more willing to invest as they have the freedom to exit when desired. Therefore, there is need to ensure that member states have harmonised capital account liberalisation policies. This condition would also need to hold for the member states to maintain fixed convertible exchange rates and for monetary policy to be coordinated across the SADC region. Harmonisation and opening up of financial and capital markets in the SADC region would also benefit the region in a big way in terms of deepening regional markets. Other potential positive externalities arising from open capital markets include the benefits from increased competition and technology improvements.
Furthermore, institutional reforms are needed

to enhance the level of governance as the descriptive analysis has shown that there is a positive relationship between capital flows, good governance and quality of institutions. This can be achieved through elimination of corruption, preserving political stability, ensuring rule of law and protection of property rights, among others. As indicated earlier, a stable macroeconomic environment is usually an important precondition for attraction of capital flows. With most countries in the SADC region diverging in terms of indicators of macroeconomic stability, there is need to ensure that SADC countries abide by the set macroeconomic convergence targets. SADC countries also need to adopt tailor-made investment strategies in order to fully tap the regional investment potential, as there is also less likelihood that regional cross-border investors can largely be deterred by temporary setbacks in politics and uncertainty in investment conditions, compared to non-regional foreign investors. The regional bloc also needs to speed up the pace of economic integration in order to reap the rewards in terms of increased intra-SADC trade and capital flows.

Overall, sustained capital flows should be supported by industrialisation and economic diversification strategies, such creation of Special Economic Zones (SEZs) in the region. Potential growth sectors for SEZs include tourism, agriculture and finance and business services. Industrialisation and economic diversification also require investment in research and development and innovation. SADC countries also need to minimise the negative impact of geographical barriers and close the infrastructure gap through appropriate investments. The study further highlights the need for the regional bloc to ensure that it pursues policies that would improve the investment environment on a sustainable basis. The use of a common language in the region can also be beneficial to intra-SADC capital flows. The results also underscore the need for SADC countries to guard against the natural resource curse, which has the potential to undermine investment, productivity and competitiveness for other sectors. Furthermore, given the challenge of data limitation, there is need for the SADC Secretariat to invest in a statistical data system similar to the EuroStat. Overall, SADC should pursue its industrialisation strategy and roadmap (2015-2063) in order to achieve its strategic goals and targets including attainment of higher levels of intra-SADC capital flows.

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