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Examining the Impact of Fluctuations in Exchange Rates on the Balance of Trade: Does the Marshall-Lerner Condition and J-Curve Theory Hold for Botswana?

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ABSTRACT

The study examined the influence of real exchange rates fluctuations on the trade balance in Botswana. The main objectives were to assess the effects of real exchange rates on the trade balance and determine whether the Marshall-Lerner condition and the J-curve theory hold for Botswana using quarterly time series data from 1995 to 2022. The Johansen Cointegration and Vector Error Correction Model (VECM) were used to assess the impact of real exchange rates on the trade balance. The findings suggest that real exchange rates have a negative impact on the trade balance in the long run, indicating that the Marshall-Lerner condition is not valid. This implies that a weakening of the Botswana Pula does not affect the country's net exports. In the short run, the coefficient of the real exchange rate was negative but statistically insignificant, indicating the absence of the J-curve effect. This indicates that Botswana's net exports performance is not affected by the devaluation of the domestic currency. The study recommends that currency misalignment should be avoided. Furthermore, the study's findings revealed that real exchange rates affect the trade balance in both the short run and long run; therefore, policy makers should maintain the current monetary and managed float exchange rate policies.

Keywords: Marshall-Lerner Condition, J-curve Effect, Real Exchange Rates, Vector Error Correction Model, Botswana
JEL Classifications: F10, F13, F14

1. INTRODUCTION

International trade is vital to the economic development of all nations with open economies because it fosters bilateral ties between them (Bacchetta et al., 2021). Through international trade, a country's exchange rate becomes a crucial indicator of its competitiveness in the global market, which has a significant impact on the nation's economy (Mehtiyev et al., 2021). The exchange rate is a powerful factor that has the potential to influence both an economy's internal and external balance. Studies have found that the real exchange rate significantly affects economic growth (Karahan, 2020; Barguelli et al., 2018). In addition, the exchange rate regime has also been found to play a key role in macroeconomic performance (Ashour and Yong, 2018; Fraj et al., 2020).

Like majority of nations, Botswana is open to foreign trade. As such it depends on imported capital goods and specializes in commodity exports. The essence of international trade to any country cannot be overemphasized, despite its level of development. Zahonongo (2017) and Yakubu and Akanegbu (2015) view international trade as an engine for economic growth and development because it raises living standards, creates jobs, and provides consumers with more choices for products and services.

Botswana is one of the developing countries dealing with the effects of exogenous shocks to their economies. The country implemented reforms and policies aimed at resolving the currency rate crises after the collapse of the Bretton Woods system. Working alongside the IMF, the government created and implemented measures to help resolve the issues related to the exchange rates (Filardo et al., 2022). Various approaches, including fixed and flexible exchange rate systems, were utilized to address these challenges.

1.1. History of Botswana's Exchange Rate Regime

Following its independence, Botswana continued its affiliation in the Rand Monetary Area (RMA), a local economic unification that included the Kingdom of Eswatini (formerly Swaziland), Lesotho, Namibia (previously South West Africa) and South Africa. The RMA adopted the Rand as its joint legal tender, which was subsequently fixed to the US dollar (Bank of Botswana, 2018). The RMA's strategy on the exchange rate was significantly influenced by South Africa, a nation with a bigger economy. The Botswana Pula was then introduced in 1976.

When the Pula was introduced in 1976, Botswana exited the RMA. The Pula was first fixed to the US dollar, and it had one anti-inflationary revaluation before 1980. Albeit South Africa choosing to implement a controlled float in January 1979, the Pula was nonetheless linked to the US dollar until June 1980 (Odhiambo, 2015). However, by June 1980, a shift in strategies was required as a result of the Rand's notable appreciation versus the US dollar owing to the rising gold prices.

In an attempt to alleviate the after-effects of the oil disturbances that sparked the worldwide economic downturn in 1981 and the accompanying fall of the country's external diamond marketplace, the first significant devaluation of the Pula, amounting to 10%, was carried out in May 1982 (Bank of Botswana, 2018). Due to the then-depressed diamond market, Botswana's diamond sales were subject to a quota. This resulted in a sharp deterioration in the country's goods sold abroad and, consequently, a crisis in Botswana' balance of payments.

The Pula was further discounted by 5% in July 1984 and 15% in January 1985 to safeguard the feasibility and effectiveness of domestic manufacturers in the wake of the Rand's decline due to monetary prohibitions in opposition to the apartheid system (Bank of Botswana, 2018). The additional 5% devaluations in 1990 and 1991 were likewise motivated by this objective.

The addition of the Zimbabwean dollar to the Pula basket was made in acknowledgment of the important trading ties with Zimbabwe (Bank of Botswana, 2018). This was only temporary, though, as in 1994 the Zimbabwean currency was removed from the basket because its inclusion was deemed unnecessary owing to altered trade flows. In the end, the local currency had decreased dramatically over time in comparison to the SDR and US dollar since the Rand carried a greater portion in the Pula peg.

It was in 2005 that Botswana adopted and used the crawling peg currency policy regime as displayed on Figure 1 (Bank of Botswana, 2018). Under the crawling band system, the rate of exchange of the Pula is not altered in discrete steps as it was in the past, but rather continuously. The SDR and the Rand are currently included in the currency basket that the Pula is tied to (Motlaleng, 2009). An adequate amount of foreign exchange reserves from diamond export earnings have allowed Botswana to retain both its current and prior currency rate regimes. The current crawling band exchange rate mechanism permits Botswana to reap benefits of two different exchange rate regimes. For instance, enormous influx of diamond revenue would have triggered the Pula to increase in value if it had been permitted to float. The Pula's increase would have made non-mineral export industries less competitive (resulting in the so-called Dutch Disease), making economic diversification extremely difficult to achieve.

Botswana has been praised as a model of economic success and one of the finest performing economies in the world. The economy grew from being one of the poorest at independence to middle-income status by the mid-1990s, owing mostly to diamond revenue spending (Koitsiwe & Adachi, 2015). Ever since the start of Botswana's mineral-led economic growth in the early 1970s, policymakers have been cognizant of the possible limitations and constraints of such a growth route. This is due to the fact that the country's trade balance is linked to diamond exports, hence the country's continuous trade surpluses, as displayed on Figure 2.

In addition, Botswana has used the fixed exchange rate, the flexible exchange rate, and the managed float regimes as part of its exchange rate policy. The fixed exchange rate regime resulted in unending devaluations and revaluations of the Pula, making the currency highly unstable. A fluctuating currency can bring about imported inflation for countries like Botswana, who are substantial importers.

The currencies to which the Pula was pegged was determined by trade patterns and the major currencies used in international trade and payments. Botswana's trade pattern is undiversified, with the majority of conventional exports (diamonds, copper, soda ash, and cattle) denominated in US dollars and the British Pound Sterling, while non-traditional exports and the majority of imports are invoiced in South African Rand (Masalila and Motshidisi, 2003). To ease exchange rate swings among trading partners, the Pula is tied to a trade-weighted basket of currencies, which includes the Rand and Special Drawing Rights (Motlaleng, 2009). The Rand has a larger percentage of the basket, indicating the need to preserve the interests of the bulk of Botswana's domestic enterprises, whose consumption, expenditure, and revenue decisions are heavily influenced by the Rand.

The paper consists of five sections. Section 1 provides background of the study and Section 2 covers a review of related literature. Section 3 outlines the econometric modelling, description of data sources and variables. Section 4 presents empirical findings and analysis of results. Section 5 summaries and concludes the main findings of the study. It further details the recommendations and policy implications.

2. REVIEW OF LITERATURE

2.1. Theoretical Review

2.1.1. The Marshall-Lerner condition

The Marshall- Lerner (Marshall, 1923; and Lerner, 1944) condition states that, all else equal, the need for what the country buys from foreign countries and sells abroad must be sufficiently elastic in order for financial authorities to undervalue the currency to advance the net exports (Wang, 2009). The total price elasticities of merchandise purchased from overseas countries and goods sold abroad in absolute terms, must exceed one if the initial net exports is in equilibrium as illustrated in Figure 2 (Brown and Hogendorn, 2000). In this situation, a currency reduction will boost the trade balance. Conversely, net exports will decline when the total is below one and remain constant when the value is one.

2.1.2. J-curve theory

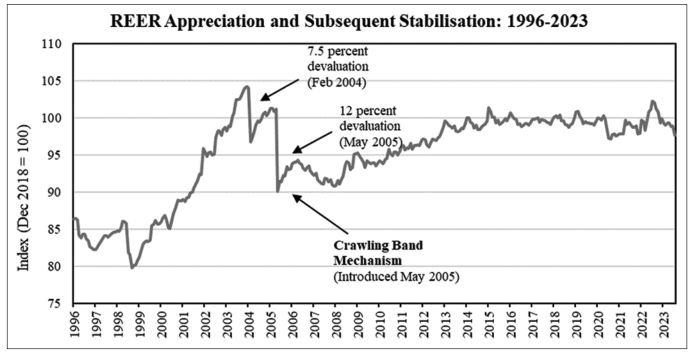
The J-curve effect, as described by Magee (1973), illustrates how a nation's net exports are impacted over time by the downgrading its currency. Shortly after devaluation of the domestic legal tender, local importers pay higher import prices in their own currency, which causes a fall in net exports (Ali et al., 2014). Local exporters in the devaluing country, however, receive lower exporting prices owing to the extremely inelastic temporary need for exports and imports. The slowness of customer behaviour change and the delay in deal renegotiating are the root causes of this inelasticity of demand. Net exports suffer in the short term when prices are mostly stable because prices are sticky and difficult to change (Calvo and Reinhart, 2002). When products are traded at their pre-depreciation prices despite changes in market conditions, it is referred to as price stickiness (Mackintosh et al., 1996). The value of all imports denominated in foreign currencies multiplied by the rate of increase in foreign exchange prices results in a decline in the trade balance because contracts concluded before devaluation fix prices and quantities. For short term periods, they are called exchange rate pass through period.

When local demand moves from imports to local manufacture of replacement products as a result of rising prices of goods bought overseas, the trade balance improves. Additionally, as export prices decline, the volume of shipments to the home countries markets increases. These two long-term impacts, which are collectively dubbed the volume adjustment period, have a favourable effect on net exports (Gartner, 1993). Conversely, the J-curve effect suggests that net exports eventually rise to a point above its pre-devaluation level (Figure 3). This is because a falling currency increases the cost of imports. As time passes, the volume of exported products start to increase since they are less expensive for overseas buyers, while domestic consumers buy fewer imports because they are now more expensive for them. The pre-devaluation net exports level eventually gets replaced by the smaller surplus or deficit attained. A flattened J during a temporary decline and a lasting recovery is the result of the net exports' dynamic reaction, which gives rise to the J-curve phenomena. (Ali et al., 2014). Assume that, at time 0, trade is in perfect balance, as illustrated in Figure 2. A 50 million dollar trade deficit results instantly from a depreciation at time zero. As consumers respond, the trade balance gradually improves, hitting balance in month 3 and reaching an excess of $150 million in month 4.

2.2. Empirical Review

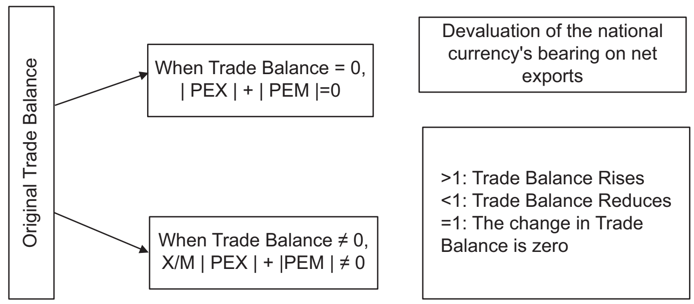
The various existing literature has established that deviations in the foreign exchange rate affects the trade balance in different ways per country, and even the time period under consideration.

Figure 1: Botswana's REER trends



Source: Bank of Botswana (2023)

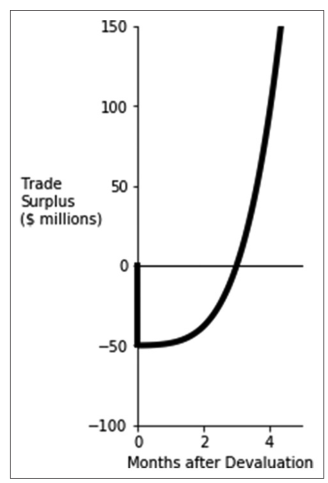
Figure 2: The Marshall-Lerner condition



Source: Appleyard and field (2014)

Where: PEX = Price elasticity for home exports, PEM = Price elasticity for imports, X = Spending on exports, M = Imports expense

Figure 3: J – curve effect



Source: Krugman et al., (2014)

Similarly, variations in the exchange rates movements on the trade balance also varies between bilateral and or multilateral analysis.

Jackson et al. (2021) examined the relationship between exchange rate and trade balance in determining whether the J-Curve phenomenon holds in the short and long-run for Sierra Leone during the period 2002Q2-2019Q4. The data was sourced from the Bank of Sierra Leone. The econometric technique commenced with an assessment of unit root followed by an Unrestricted Vector Autoregressive (VAR) estimation. The procedure leading to using VECM was confirmed through Johansen Cointegration test. The

Marshall-Lerner (ML) condition was also satisfied, with the joint elasticity for export and import summing up to more than one.

Saeed (2020) did a time series analysis of Norway utilizing the ARDL model from 1993Q1 to 2017Q3. It was established that the Marshall-Lerner criterion holds true when it comes to bilateral trade involving non-maritime modes of transportation. Using the PMG method, Ebadi (2020) proved that the Marshall-Lerner condition applied to Asian nations by utilising data between 2000 and 2017. A similar investigation was carried out in China by Guo (2020) to evaluate the applicability of the Marshall-Lerner condition. The theory was found to be valid in the study, which used the ARDL model to explore monthly data between 2008 and 2018.

Sokeng Dongfack and Ouyang (2019) investigated the impact of real exchange rate depreciation on Cameroon's trade balance. Time series data from 1980 to 2016 were analysed to estimate the impact of the local currency, the CFA Franc's devaluation on Cameroon's trade balance. The estimation of short run and long run relationships between the variables using the Johansen cointegration and the vector error correction model (VECM) as a way of examining whether the Marshall-Lerner condition and the J-curve phenomenon hold in the case of Cameroon yielded mixed results. Although the Marshall-Lerner condition was not met for Cameroon, the empirical analysis results provided evidence of correction over the long run of a prior deterioration of the trade balance at an adjustment speed of 81.17%, thus supporting the existence of the J-curve pattern.

Omer et al. (2023) carried out an investigation to determine the validity of the Marshall-Lerner concept in Pakistan. The study used time series data from 1968 to 2019 and applied the GMM and 3 stage least squares estimation in the analysis. It was discovered that depreciation of the RER depressed both imports and exports and the Marshall-Lerner condition was not valid. These findings were comparable to those of Amaral and Breitenbach (2021) and Anning et al. (2015) who looked into the validity of the Marshall-Lerner condition in Ghana and the five economies of Brazil, India, South Africa, Indonesia and Turkey, respectively.

Kallianiotis (2022) tested the effect of a devaluation of a currency on the trade account of a country by using trade between the US and six countries of the Euro-zone (Canada, United Kingdom, Switzerland, Japan, and Australia). The results showed that a depreciation of the US dollar increased the spot exchange rate and increases the price of imports and reduce the price of exports. Then, imports fell while exports increased, resulting in an improvement of the trade account in the long run. In the short run however, the trade account deteriorated, supporting the validity of the J-curve theory. The hypothesis was tested using a regression and a vector autoregressive (VAR) model, where the volatility of the real exchange rate was specified with a GARCH-M process.

Albayrak and Korkmaz (2019) used monthly data on Turkey from 1992 through 2015 to explore the J-curve effect. The study established the J-curve pattern by applying the ARDL method. The explained variable was the net exports while the explanatory variables were domestic income (proxied by GDP) and the rates of exchange. These findings were comparable to those of Akosah and Omane (2017) who looked into the incidence of the J-curve pattern in Ghana.

Sivrikaya and Ongan (2019), Du (2020), and Parray et al. (2022) examined time series data using the NARDL and discovered no proof of the J-curve occurrence in the United Kingdom, China, and India, respectively. Mukisa and Kayongo (2022), Arruda et al. (2019), Panda and Reddy (2016), and Liau and Geetia (2020) all found similar results while studying the J-curve's presence in Uganda, Brazil, India, and Malaysia, in that order.

3. METHODOLOGY

The definition of the trade balance that will be used in the study is similar to that provided by Bahmani-Oskooee and Goswani (2003), who state that the ratio of goods exported to goods imported is used to measure trade between nations. The real GDP of South Africa will represent foreign income and Botswana's real GDP will stand for domestic income. Abel and Bernake (2005)'s approach of calculating the real currency conversion rate will be utilised in this investigation. Testing for stationarity will be done using the Augmented Dickey and Fuller (1981) and the Philips and Perron (1988) tests. Given the limitations of the Engle and Granger (1987) approach, the Johansen and Juselius (1990) cointegration technique will be utilised.

3.1. Model Specification

The trade balance stated as a ratio will be the explanatory variable in this study, which will look at how exchange rates affect Botswana's net exports. Botswana's REER, broad money supply, real GDP (foreign income) of South Africa, and the real GDP (domestic income) of Botswana will all serve as explanatory variables. The variables have been used in previous investigations of the association between net exports and currency conversion rates (Omer et al., 2023; Keho, 2021; Sokeng Dongfack, 2019; Lucy et al., 2015) and money supply (Parray et al., 2022; Jackson et al., 2021; Dao et al., 2020).

The export demand and import demand models employed by Bahmani-Oskooee (1991), Bahmani-Oskooee and Kara (2003) will be used to estimate the trade balance. The import and export models are specified in linear form as:

$$lnEXP_t = \alpha_0 + \alpha_1 lnYFt + \alpha_2 lnRER_t + \varepsilon t \quad (1)$$

$$lnIMP_t = \beta_0 + \beta_1 lnYD_t + \beta_2 lnRER_t + \varepsilon t \quad (2)$$

Where:

$lnEXP_t$ = natural logarithm of the nation's (Botswana) volume of exports

$lnYF_t$ = natural logarithm of trading partner's income, denoted by RSA's real GDP

$lnRER_t$ = natural logarithm of a nation's (Botswana) RER

$lnIMP_t$ = natural logarithm of the nation's (Botswana) volume of imports.

According to Equation 1, α_2 is anticipated to be negative. This is for the reason that a rise in the RER is expected to make Botswana's exports comparatively costly, thus dropping their demand in overseas markets. The coefficient of RER_t in Equation 2, that is, β_2 is anticipated to be positive. The rationale is that a rise in the RER is probably going to make imports comparatively more affordable, which will raise demand for them. Hence, the Marshall-Lerner condition will hold if $| \alpha_2 + \beta_2 | \geq 1$.

According to Equations 1 and 2, imports and exports are not perfect substitute for products made locally. In order to determine the net exports, the proportion of what a country sells abroad to its imported goods is used as the dependent variable rather than the normal trade balance indicator (Gupta-Kapoor and Ramakrishnan, 1999). While the two methods of net exports are in theory relevant for the J-curve investigation, the most appropriate is the trade ratio (Dash, 2013). There are benefits of evaluating the balance of trade as a proportion. The ratio is unresponsive to the export and import measurement units and whether they are in actual or nominal terms (Bahmani-Oskooee, 1991). Finally, the measure also allows for logarithmical transformation of the variables, which precisely gives the Marshall-Lerner condition, not as an approximation (Boyd et al., 2001).

The reduced form empirical model for this study, according to Bahmani-Oskooee (1991) specifies net exports with reference to real domestic income, rate of exchange and foreign income. The reduced form model is obtained from Equations 1 and 2, represented by Equation 3.

$$TB = \alpha + \beta_0 TB_{-1} + \beta_1 XR + \beta_2 YD + \beta_3 YF + \beta_4 MD + \varepsilon t \qquad (3)$$

To obtain the measurements of elasticity, the variables will be transformed to the natural logarithm. Hence the function becomes:

$$lnTB = \alpha + \beta_0 lnTB_{-1} + \beta_1 lnXR + \beta_2 lnYD + \beta_3 lnYF + \beta_4 lnMD + \varepsilon t \qquad (4)$$

Where:

TB = The balance of trade described as the proportion of exports to imports

XR = The real rate of exchange, measured by Pula per US dollar

YD = Domestic income computed as real GDP in Botswana

YF = Foreign income calculated by trading partner's real GDP, which is GDP for RSA

MD = Money supply (M2), measured as a percentage of GDP

εt = Error term

Equation 4 will deduce the long term link between the exchange rate and net exports. The Marshall-Lerner condition requires a positive value β_1. This is because in the long term, a devaluation is likely to boost exports while decreasing imports. The occurrence of the J-curve effect suggests that β_1 tends to be negative in the short term and positive in the long term (that is, deterioration of the net exports followed by its enhancement). Depending on whether the demand factor predominates on the supply side, the parameter β_2 can be either positive or negative (Halicioglu, 2008).

Put another way, an upswing in real domestic income usually follows a growth in imports from the home nation's trading partners, therefore a positive indicator is expected. However, the home nation may reduce its imports owing to economic growth, producing a negative estimate of real domestic income, if higher domestic production of import substitute items is the cause of the rise in domestic income. Similarly, the expected sign of real foreign income, β3, can either be negative or positive. It is anticipated that the parameter β4 will be negative based on the theory of money supply since a rise in the supply of money will worsen net exports.

Similarly, the J-curve effect will also be determined by the ECM, which is the short-run model stated as:

$$\Delta lnTB_t = \alpha + \Delta lnTB_{t-1} + \beta_1 \Delta lnXR_t + \beta_2 \Delta lnYF_t + \beta_3 \Delta lnYF_t + \beta_4 \Delta lnMD_t + ECT_{-1} + \varepsilon t \qquad (5)$$

Where:

Δ = The first difference operator

ECT = The error correction term.

After a shock to the system, the ECT evaluates how quickly the system adjusts to steady state equilibrium. It is anticipated that the parameter will have a significantly negative value (Gujarati and Porter, 2009). Consequently, the J-curve phenomena would be compatible with an initially negative sign on the lag coefficients followed by a positive one, and statistically significant.

4. EMPIRICAL RESULTS AND ANALYSIS

4.1. ADF and Philips-Perron Unit Root Tests

The study utilised the Augmented-Dickey Fuller (Dickey and Fuller, 1979) and Phillips-Perron unit root tests (Phillips and Perron, 1988) to determine the order of integration as recommended by Pesaran et al., (2001). Gujarati and Porter (2009) highlighted that unit root tests are crucial for spurious regression avoidance.

Table 1a presents the findings of the ADF test and Philips-Perron findings are shown in Table 1b. Philips-Perron tests are comparable to ADF tests (Brooks, 2008).

The next stage is to determine the long run relationship.

4.2. Johansen Cointegration Results

The Johansen cointegration test was performed through the Trace and Max-Eigen Value tests. Table 2a provides the outcome of the trace test founded on Johansen cointegration. The null hypothesis

Table 1a: ADF unit test results

Variable	Order of integration	Without intercept and trend				With intercept				With intercept and trend			
		Level		1st difference		Level		1st difference		Level		1st difference	
		t statistic	Prob	t statistic	Prob	t statistic	Prob	t statistic	Prob	t statistic	Prob	t statistic	Prob
LTB	I (1)	−1.1996	0.2096	−3.6333	0.0004***	−1.0428	0.7354	−3.6843	0.0056***	−3.147	0.1010	−3.6785	0.0281**
LRER	I (1)	0.4815	0.8175	−10.4403	0.0000***	−1.2762	0.6387	−10.4161	0.0000***	−2.456	0.34930	−10.3802	0.0000***
LYD	I (1)	0.9966	2.4575	−1.6521	0.0929*	−1.1395	0.6976	−3.0343	0.0352**	−3.3099	0.0706	−3.1246	0.1064
LYF	I (1)	0.9874	1.9473	−1.6263	0.0977*	−1.6292	0.4641	−2.5811	0.1002	−0.9764	0.942	−2.9465	0.1527
LMS	I (1)	0.8113	0.4560	−3.9439	0.0001***	0.0538	−2.8578	−3.9869	0.0021***	−2.2292	0.4684	−4.3691	0.0037***

Values marked with ***, **,* represent stationarity at the 1%, 5% and 10% significance level

Table 1b: Philips-Perron unit root test results

Variable	Order of integration	Without intercept and trend				With Intercept				With intercept and trend			
		Level		1st difference		Level		1st difference		Level		1st difference	
		t statistic	Prob	t statistic	Prob	t statistic	Prob	t statistic	Prob	t statistic	Prob	t statistic	Prob
LTB	I (1)	−1.4953	0.1257	−3.8790	0.0002***	−1.2180	0.6647	−3.9299	0.0026***	−2.0945	0.5427	−3.8755	0.0164**
LRER	I (1)	0.4700	0.8148	−10.4454	0.0000***	−1.3954	0.5822	−10.4206	0.0000***	−2.6848	0.2450	−10.3856	0.0000***
LYD	I (1)	4.4112	1.0000	−3.4631	0.0007***	−1.0799	0.7217	−3.2868	0.0179**	−2.9322	0.1567	−3.2173	0.0866*
LYF	I (1)	4.8946	1.0000	−2.3389	0.0194**	−2.4377	0.1340	−3.2819	0.0182**	−0.1134	0.9941	−3.4403	0.0515*
LMS	I (1)	0.8868	0.8985	−3.5773	0.0005***	−2.5225	0.1130	−3.5709	0.0079***	−1.4235	0.8487	−3.6256	0.0323**

Values marked with ***, **, * represent stationarity at the 1%, 5%, and 10% significance level

Table 2a: Trace cointegration rank test

Hypothesised no. of CE (s)	Eigen value	Trace statistic	0.05 critical value	Prob.**
None*	0.291945	102.0052	76.97277	0.0002
At most 1*	0.203547	66.79135	54.07904	0.0025
At most 2*	0.183047	43.57750	35.19275	0.0050
At most 3*	0.115384	22.95575	20.26184	0.0208
At most 4*	0.097381	10.45034	9.164546	0.0284

Trace test shows 5 cointegrating eqn (s) at the 0.05 level

Table 2b: Maximum Eigen value co-integration rank test

Hypothesised no. of CE (s)	Eigen value	Trace statistic	0.05 critical value	Prob.**
None*	0.291945	35.21380	34.80587	0.0447
At most 1*	0.203547	23.21385	28.58808	0.2089
At most 2*	0.183047	20.62174	22.29962	0.0843
At most 3*	0.115384	12.50541	15.89210	0.1585
At most 4*	0.097381	10.45034	9.164546	0.0284

Max-eigenvalue test shows 5 cointegrating eqn (s) at the 0.05 level

Table 3a: Long run findings

Variable	Coefficient	Standard error	t-statistic
Constant	−22.45147	4.62936	−4.84980
LTB	1.00000	-	-
LRER	3.942595	1.69560	2.3250
LYD	0.202268	1.12279	0.18015
LYF	3.117381	1.39453	2.23544
LMS	−0.938324	1.69560	2.3250

Table 3b: Short run findings

Variable	Coefficient	Standard error	t-statistic
Constant	−0.083997	0.064927	−1.29371
DLRER	−0.319512	0.16178	−1.01591
DLYD	0.189223	0.48191	0.39265
DLYF	−0.259031	1.17213	−0.22099
DLMS	0.018261	0.06521	0.28003
ECT	−0.017944	0.00990	−1.81262

that there are no co-integrating vectors is rejected at 5% level of significance.

The findings of Max-Eigen value-based Johansen cointegration test are displayed on Table 2b. The Max-Eigen value test gives mixed results.

Because the aforementioned tests produce different results, the Trace test takes precedence because it has more power than the Max-Eigen test (Lutkepohl et al., 2000; Habimana et al., 2021). The Trace test leads to the conclusion that there are five co-integrating equations. Since factors can have either impermanent or lasting effects, a VECM will be employed to separate these influences.

4.3. Vector Error Correction Model

A VECM was utilised, as indicated by the cointegration equation in the preceding section and results presented in Table 3a.

The results from Table 3a are analysed using the reverse signs of the supplied coefficients. The real effective exchange rate (RER) of Botswana has negative effects on its trade balance in the long run. This proves that as the RER increases, trade balance deteriorates. This implies that a 1% devaluation of the Botswana Pula will lead to a 3.94% decrease in its trade balance. This is due to the fact that a rise in the domestic currency rate will cause the domestic exports to be expensive and imports to be relatively cheaper, hence a trade deficit. The RER is statistically significant because the t-value in absolute terms exceeds 2. However, the sign of the coefficient of RER is negative, which is in contrast with the a priori expectations of a positive sign. Therefore, the Marshall-Lerner condition was not valid for Botswana for the period 1995-2022. This outcome is consistent with the findings of Omer et al. (2023), Amaral and Breitenbach (2021) and Sokeng Dongfack and Ouyang (2019).

Table 3b shows that the error correction term is negative and statistically insignificant. The value of −0.018 shows that the rate of adjustment is around 1.8%. On the other hand, the model's description of Botswana's trade balance may not account for all of the factors affecting it, which could explain the slow rate of adjustment.

The results show a negative influence of the rate of exchange on the trade balance. Although the RER coefficient is negative, as expected, the J-curve pattern is not present because RER is statistically insignificant.

5. CONCLUSION AND POLICY IMPLICATIONS

This investigation's key objective was to examine the influence of exchange rates fluctuations on Botswana's net exports from 1995Q1 to 2022Q4. The Augmented Dickey Fuller and Philips-Perron stationarity tests were employed to determine the order of integration of the variables. The Johansen cointegration test was carried out through the Trace and Max-Eigen value tests.

The study found that real exchange rates had a negative impact on the trade balance in the long run, indicating that the Marshall-Lerner condition is not valid for Botswana. This implies that a weakening of the Botswana Pula does not affect the country's net exports. In the short run, the coefficient of the real exchange rate was negative but statistically insignificant, indicating the absence of the J-curve effect.

5.1. Implication on Policies and Recommendations

The results of this study have several policy implications, especially the monetary and exchange rate policies.

5.2. Monetary Policy

According to the results of this study, the supply of money influences Botswana's net exports in the short run and long run. In addition, the country has consistently recorded trade surpluses. Trade surpluses indicate increased need for Botswana Pula in the market for exchange of overseas currency, which may cause the Botswana Pula to rise. As an inland country with an undiversified economy, Botswana is mostly import-dependent. Although the country is not inflation targeting, it has been able to maintain the rate of inflation within the acceptable range. Therefore, this study recommends that Botswana maintains its current monetary policy system.

5.3. Exchange Rate Policy

The study revealed that the J-curve phenomenon and Marshall-Lerner condition are inapplicable to Botswana. This means that Botswana's trade balance is unaffected by currency devaluation. This could be attributed to Botswana's implementation of the crawling peg or managed float exchange rate since 2005. In light of the findings, policymakers must preserve the crawling peg exchange rate mechanism, which provides stability to trading partners. It has been observed since May 2005 that the crawling band exchange rate scheme has benefited the country, more especially with regards to diamond export sales. Botswana has been able to maintain her 'buyers' due to the stable currency. A managed float minimises forex volatility hence investors and businesses are able to plan more effectively. In addition, it offers a method for controlling inflation expectations and also contributing to the preservation of foreign exchange reserves by minimising the need for central bank interventions. A managed float permits a controlled devaluation, averting uncontrollably high price rises and unstable economies during times of currency devaluation.

For further study, due to unavailability of Botswana's real exchange rate statistics prior to 1995, it is recommended that monthly data be used in the determination of the validity of the Marshall-Lerner condition and the J-curve effect so as to increase the study's sample size, as well as taking a multi-lateral approach.

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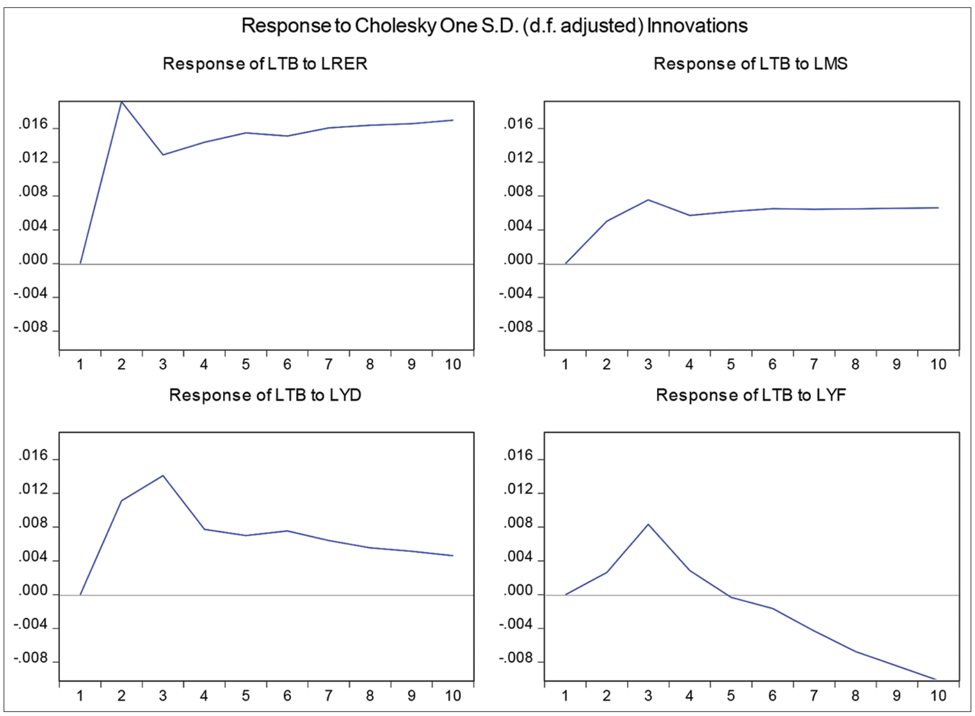
APPENDICES

Annexure 1: Residual test for serial correlation

H_0: No presence of serial connection at lag h						
Lag	**LRE* stat**	**Df**	**Prob.**	**Rao F-stat**	**df**	**Prob.**
1	20.89847	25	0.6983	0.831555	(25, 228.1)	0.6992
2	37.42344	25	0.0526	1.542410	(25, 228.1)	0.0531
3	15.68206	25	0.9240	0.617151	(25, 228.1)	0.9243
4	61.86815	25	0.0001	2.688072	(25, 228.1)	0.0001
5	11.30490	25	0.9913	0.440810	(25, 228.1)	0.9914
6	10.02693	25	0.9966	0.389929	(25, 228.1)	0.9966
7	32.23658	25	0.1513	1.313985	(25, 228.1)	0.1522
H_0: No presence of serial connection from lags 1 to h						
Lag	**LRE* stat**	**df**	**Prob.**	**Rao F-stat**	**df**	**Prob.**
1	20.89847	25	0.6983	0.831555	(25, 228.1)	0.6992
2	57.40707	50	0.2198	1.164947	(50, 258.8)	0.2240
3	97.88329	75	0.0392	1.357815	(75, 248.5)	0.0431
4	138.4787	100	0.0066	1.478476	(100, 229.1)	0.0087
5	149.4640	125	0.0671	1.233465	(125, 206.7)	0.0916
6	169.2534	150	0.1345	1.137106	(150, 183.1)	0.2032
7	220.9087	175	0.0107	1.325776	(175, 159.0)	0.0353

Source: Author compilation using Eviews software

Annexure 2: Impulse response analysis



Annexure 3: Analysis of decomposition of variance

Period	S.E.	LTB	LRER	LMS	LYD	LYF
1	0.091165	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.126879	96.74798	2.287605	0.155888	0.766220	0.042311
3	0.151318	95.56509	2.333591	0.358996	1.408778	0.333550
4	0.167718	95.29755	2.634829	0.407955	1.359432	0.300233
5	0.179512	94.88117	3.044191	0.473630	1.338623	0.262392
6	0.188144	94.40581	3.416621	0.550957	1.380076	0.246534
7	0.194631	93.82408	3.874079	0.624085	1.398471	0.279280
8	0.199561	93.15325	4.360410	0.699189	1.407466	0.379689
9	0.203362	92.40285	4.862608	0.777237	1.418952	0.538354
10	0.206386	91.55029	5.398943	0.857031	1.427708	0.766033