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Journal of
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GRADUATE BUSINESS SCHOOL

The Impossible Trinity and Financial Markets – An Examination of Inflation Volatility Spillovers

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Abstract

According to studies on the impossible trinity, under conditions of high financial integration, the domestic interest rate is closely linked to the foreign one if the possibility of maneuvering interest rates is absent in this transaction. The Fisher effect is brought into this escapade because interest rates generally trend positively with inflation. Botswana has set her inflation target between 3-6% and this study attempts to determine inflation spillover effects from the United Kingdom, United States of America, Canada, Japan, China, Belgium, France, Germany, South Africa, Nigeria, and Ghana using data from 1980-2012. Comparatively, the attempts made by previous studies to examine spillovers generally lacked a long-run focus and channeled much attention to periods of financial crisis. This study deviates from other studies by using the Augmented Dickey Fuller (ADF) test to examine unit roots for the countries under examination. The study further applies the Johansen cointegration procedure, as well as the Granger causality test. The results show that Botswana's inflation dynamics trend positively with all the countries under scrutiny except South Africa in a long-run framework. However, the Granger causality test only proved that Botswana's inflation lead China's inflation dynamics. In conclusion, Botswana's inflation is not driven by other countries' inflation dynamics.

Keywords: Inflation, financial integration, spillovers, financial markets

JEL Classification codes: E31, E43, E44, G15, E52

http://dx.doi.org/10.7835/jcc-berj-2015-0103

Monitoring and controlling inflation is every central bank's principal responsibility. Botswana's central bank (Bank of Botswana) has been in full swing to promote the medium term objective of 3-6% inflation. In 2010, the country's headline inflation, as measured by the Consumer Price Index (CPI), was standing at 7.2% registering mixed and generally minor movements across commodity groups. It has been noted that Botswana is integrated with foreign economies' financial markets and institutions, and this study intends to determine the degree of influence of this aspect of the Mundell-Fleming model. Faia and Iliopoulos (2011) highlighted that, under conditions of high financial integration, the domestic interest rate is closely related to the foreign one, absent however, the possibility of maneuvering the interest rates. The expectation is that, as Botswana's financial integration rises, the country will be more prone to spillover effects from other economies. Such spillovers could be interest rates, inflation, or exchange rate appreciation or depreciations. It has been noted that while monetary authorities can monitor and control domestic inflation, other country's spillovers are quite difficult to control, especially if they are trading partners. It is critical that central banks at least have deterministic procedures informing them about the relationship between the country's inflation and other economies inflation dynamics. Previous studies demonstrated that the persistence of inflation drastically went down after the introduction of inflation targeting (Siklos, 1999; Mishkin & Schmidt-Hebbel, 2001; Kuttner &

Possen, 2001; Corbo, Landarretche, & Schmidt-Hebbel, 2002; Neumann & Von Hagen, 2002; Angeriz & Arestis, 2007). From this premise, economists have argued that inflation uncertainty is generally believed to result from excess inflation or lack of central bank credibility (Ball, 1992; Friedman, 1977). Greenspan (2004) elaborated that inflation uncertainty is both a result and a defining characteristic of the monetary landscape. However, the potential effects of such uncertainties on monetary policy subsequently inflation, are subject to theoretical debates drawing from the extant literature (Cukierman & Meltzev, 1986; Devereux, 1989; Dotsey & Sarte, 2000; Orphanides & Williams, 2005; Taylor, 1994).

While the extant literature examines such spillovers using varying techniques, such as multivariable conditional models, Diebold and Yilmaz models, dynamic correlation, and VAR–MGARCH, there are loopholes with these techniques. Firstly, even though these models have the propensity to provide evidence of such spillovers, the procedures do not provide a relationship assessment of the country's inflation or interest rates in a long-run framework. Central banks and policy makers are highly interested in the long-run affiliations of inflation and interest rate dynamics because this will be assistive in planning and implementing mechanisms that can alleviate robust spillovers from other countries. This study attempts to solve this glitch by using the ADF test to examine unit roots and the Johansen cointegration test to provide a long-run relationship assessment between Botswana's inflation dynamics with those of other countries. This paper also goes further to determine the direction of causality between Botswana's inflation and other economies using the Granger Causality test, since it is critical for an economy to know which countries induce its inflation dynamics. Secondly, it has also been noted that previous studies channeled much attention towards spillovers during financial and economic turbulence, for instance, Yang and Hamori (2014), and Cronin (2014). This paper deviates from this perspective and focuses on how other economies drive Botswana's inflation under conditions of financial and economic stability. Hence, this paper also makes a breakthrough in determining whether or not there has been a change in the drivers of inflation, such as an increase in money supply or monetary shock for example.

This paper is an extension to the extant literature and uses data from 1980–2012 for the United States, United Kingdom, Canada, Germany, France, South Africa, Nigeria, Ghana, Japan, China, Belgium and Botswana to analyze spillover effects. The rest of this paper is structured as follows: Next is the literature review which focuses on different perspectives of inflation dynamics and spillover effects; thereafter follows the research hypotheses and data description; this will be followed by research methodology and hypotheses test results; then a discussion of the research findings follows with a conclusion and practical implications of the study.

Literature Review

Literature on inflation dynamics and spillover effects has been diverse. Some studies generally focused on financial markets and institutions, return spillovers and exchange rate dynamics, for instance, Yang and Hamori (2014), Hoti (2005), Cronin (2014), Alotaibi and Mishra (2015), Claeys and Vašíček (2014), and Bekiros (2014). Conversely, it cannot be overlooked that the impossible trinity has also been proven to have robust inflationary effects drawing from Faia and Iliopulos (2011) and Aizenman, Chinn, and Ito (2010). From this premise, the discussed literature will be structured as follows: spillover effects from the financial markets' standpoint and the impossible trinity viewpoint. Next to be discussed are spillover effects from financial markets and institutions.

Financial Markets: Interest Rates, Exchange Rates and Money Dynamics

According to Yang and Hamori (2014), over the past decades stock markets in the Association of South East Nations (ASEAN) have increasingly matured as they integrated with the world capital markets. However, most of the ASEAN economies are still developing and their stock markets have been noticed to be easily affected by monetary policy changes in the United States of America. Traditional theories on financial markets have earlier suggested a relationship between stock markets performance and information dissemination (Fama, Fisher, Jensen, & Roll, 1969; Mitchell & Mulherin, 1994). Yang and Hamori (2014) by far illustrated that shocks from changes in monetary policy play an important role in stock markets since it is designed to impact the macroeconomy which in the long run, affects the stock markets indirectly. The general assumption is that, as the world economy globalizes and world financial markets and institutions integrate, shocks from developed countries markets like the United States of America should by propensity affect other markets through various transmission mechanisms, such as credit channel, balance sheet channels, and the trade channel.

Empirically, Yang and Hamori (2014) analyzed the impact of the United States of America's interest rates and excess liquidity on the ASEAN stock markets using data from January 1990 to December 2012. The study was a replication of Kim and Nguyen (2009) study, which investigated spillover effects from the United States Federal Reserve systems and the European Central Bank (ECB) target interest rates on market returns and return volatilities of 12 stock markets of the Asia-Pacific region. Yang and Hamori (2014) in consequence revealed that United States interest rates have a negative impact on the ASEAN stock market by applying the Markov-switching models. It was also found out that the federal funds rate had a negative effect on selected ASEAN stock performance during economic expansion periods (Yang & Hamori, 2014). The lagged stock returns, therefore, on their own and played a small role in determining future movement of ASEAN countries stock markets, thus affirming that spillover effects from the United States monetary policies influence the ASEAN stock markets during tranquil periods.

While Yang and Hamori (2014) focused on interest rates, Chang, Hsu, and McAleer (2013) aimed to examine the effects of volatility spillovers from firm performance and exchange rates with asymmetries in the Taiwanese tourism industry. The study used data from July 2008 to June 2010 for 999 firms. Chang et al. (2013) defined spillover effects as the interaction between two series. From this definition, Chang et al. (2013) used two multivariate models, BEKK-A-GARCH and VARMA-AGARCH in volatility specifications. From the empirical results, the study indicated that there were considerable effects in volatility spillovers from exchange rates to firm performance. In addition, the study presented evidence that all return series revealed quick and high volatility spillovers at over 60%, and a negative correlation between exchange rate returns and stock returns. Chang et al. (2013) highlighted that firm size can be important in terms of evaluating performance drawing from previous studies of Carlton and Perloff (2005) and Caves (1992).

Whereas Chang et al. (2013) focused on return variations and exchange rate variations, Hoti (2005) aimed to analyze the degree of economic, financial and political cooperation or interdependence between countries in the Balkan region using a multivariate conditional variance model on monthly risk returns data from October 1985 to April 2005. Hoti (2005) allowed country risk to reflect the ability and willingness of a country to service its foreign financial obligations. Such risks, according to Hoti (2005), may be prompted by specific risk, regional, economic, financial, and political factors. The analysis provided risk ratings using multivariate conditional volatility models for six countries, namely Albania, Greece, Romania, Serbia and Montenegro, and Turkey. Empirical results showed that the six selected Balkan countries were closely related in terms of their economic, financial, political and composite risk returns. Country spillover effects were present almost in every country. An overview showed that the risk return volatility of a particular country was negatively related with the shock to risk returns for countries in the region.

Cronin (2014) employed the Diebold and Yilmaz (2012, 2009) spillover approach to study the relationship between the United States money supply and the financial crisis since 2000. Cronin (2014) held that since the collapse of the Lehman brothers in September 2008, and some ensuing turbulence experienced in financial markets, the Federal Reserve and other central banks chose to pursue what Borio and Disyatat (2010) refer to as balance sheet policies alongside standard monetary policy that basically focuses on setting short term interest rates (Cronin, 2014). Cronin (2014) further reported that price volatilities can also affect money aggregates. From this premise, Cronin (2014) also considered two money aggregates: M2 representing broad money and the monetary base. The empirical evidence presented in consequence suggested that in the evaluation between money and financial assets, returns and volatility measures tend to be much stronger during periods of financial markets turbulence than in calmer times. The analysis also revealed that the relationship between M2 and financial assets tends to be stronger than the monetary base and financial assets relationship. Next to be reviewed are the studies on the impossible trinity.

The Impossible Trinity: Financial Integration and Imported Inflation

According to Aizenman (2013), a major contribution of the Mundell-Fleming framework has been the impossible trinity or the trilemma. The trilemma postulates that a country may simultaneously choose any two but not all three policy goals of monetary independence, exchange rate stability, and financial integration. Most economies generally prefer monetary independence in order to control the supply of money and domestic interest rates. From the impossible trinity, an open economy can regain monetary independence by giving up financial integration and opting for exchange rate stability and monetary sovereignty combination. Under normal circumstances, giving up financial integration prevents arbitrage between domestic and foreign bonds, thus precluding spillover effects from foreign economies (Aizenman, 2013). According to Aizenman (2013), industrialized economies' financial openness heightened after the beginning of the 1990s and the exchange rate stability rose after the end of the 1990s, thus reflecting the introduction of the Euro in 1999. Consequently, monetary independence demonstrated a declining trend as financial integration intensified. Aizenman (2013) further highlighted that greater financial openness, when accompanied by a high level of financial development, can reduce output volatility in consequence. Nonetheless, financial integration has been measured using the Index of Capital Account Openness (KAOPEN) brought forth by Chinn and Ito (2008, 2006).

Drawing from Faia and Iliopulos (2011), increasing financial integration challenges the optimality of inward strategies for an optimal monetary policy. The scholars analyzed open economies and macroeconomic aspects such as foreign net lending and the current account status as determined by collateral constraints. However, the degree of financial exposure was captured by the loan to raise ratio which corresponds to sensitivity of foreign lending to the value of the collateral. Comparatively, according to Faia and Iliopulos (2011), results of the study seem to revert the impossible trinity, which is an argument formulated by the Mundell-Fleming proposition (Mundell, 1963; Fleming, 1962). As a review, the traditional formulation of the impossible trinity states that under free capital flows, pegging the exchange rate undermines the ability of the monetary authority to conduct autonomous policy actions, hence its ability to respond to shocks (Faia & Iliopulos, 2011). The underlying rational for this theory was then formulated as follows: Under high financial integration, the domestic interest rate is closely linked to the foreign one, absent however the possibility of steering the interest rates (Faia & Iliopulos, 2011). Hence, under high financial openness, pegging the exchange rates would reduce the ability of the monetary authority to stabilize the economy. Aizenman, et al. (2010) noted on this backdrop that a country can only achieve two but all three goals of monetary independence, exchange rate stability, and financial integration. From the study, Aizenman et al. (2010) concluded that countries with greater monetary authority tend to experience higher inflation which may reflect each country's objective to monetize debt obligations. It was further found out that countries with higher exchange rate stability tend to experience lower inflation.

From the discussed literature, there is a plethora of evidence suggesting spillover effects from interest rates and exchange rates from other economies, as evidenced by Yang and Hamori (2014), Chang et al. (2013), Hoti (2005), Cronin (2014), Alotaibi and Mishra (2015), and Bekiros (2014). Yang and Hamori (2014) evidenced that the United States of America's interest rates had a direct impact on the ASEAN stock markets. The general implication is that since interest rates trend positively with inflation, by virtue of the Fisher effect, interest rates spillovers should also move together with inflation. Fisher (1930) postulated that nominal interest rates trend positively with inflation. However, from the perspective of the impossible trinity, financial integration tends to be closely related to foreign countries inflation (Faia & Iliopulos, 2011). Thus, imported inflation is affected by spillover effects from financial markets and the impossible trinity theory.

Research Hypotheses

This study has explained inflation spillovers from various angles, as evidenced by Yang and Hamori (2014), Chang et al. (2013), Hoti (2005), Cronin (2014), Alotaibi and Mishra (2015), and Bekiros (2014). Comparatively, there is also much evidence supporting the effects of the impossible trinity on imported inflation drawing from Faia and Iliopulos (2011) and Aizenman et al. (2010). This study examines Botswana's inflation dynamics from 1980–2012 and relates it with the country's major trading economies and other countries such as South Africa, China, Japan, United Kingdom, United States of America, Canada, France, Germany and Belgium. The study goes further to include two robust African economies, namely Ghana and Nigeria. From the extant literature, the following hypotheses were formulated:

- Hypothesis 1: Botswana's inflation trends positively with trading partner's inflation rates and other economies, and
- Hypothesis 2: Botswana's trading partners lead the country's inflation rates.

Data Description

This study uses data from 1980 to 2012 in order to examine inflation spillovers from Botswana's trading economies and selected robust African economies. The research uses inflation records as a percentage change in the Consumer Price Index (CPI) for Botswana, South Africa, China, Japan, United Kingdom, United States of America, Canada, France, Germany, Belgium, Ghana, and Nigeria. The data was obtained from the World Bank Development Indicators issues and Botswana Financial Statistics (BFS) which are monthly central bank (Bank of Botswana) publications on key economic performance indicators. Due to data availability challenges, not all economies examined in this study had readily available data, specifically Germany, South Africa, and

China. Inflation records available for Germany were from 1992 to 2012, hence, a total of 21 observations were provided for the study. This was the same for South Africa; data for the period 1981-2012 was provided, hence giving a total of 32 observations for empirical analysis.

Still, data on China was only from 1987 to 2012, providing a total of 26 observations for the study. The summary statistics of the data set shows that inflation records for all the countries under examination were positively skewed with skewness coefficients greater than zero (United States of America = 2.36; United Kingdom = 1.90; South Africa = 0.13; Nigeria = 1.54; Japan = 1.38; Ghana = 2.43; Germany = 1.45; France = 1.87; China = 1.83; Canada = 1.78; Botswana = 0.60; Belgium = 1.26). Another measure of data distribution, kurtosis shows that data exhibited variations in terms of peakedness. Practically, the United States of America, United Kingdom, Nigeria, Japan, Germany, France, Canada, and Belgium exhibited flat distributions with kurtosis coefficients greater than three. This set of data was therefore platykurtic; however, for Botswana and South Africa the registered kurtosis coefficients were 2.15 and 2.90, thus affirming peakedness (leptokurtic). Given these variations in skewness and kurtosis, it is clear that the data set for all the economies contains outliers and it does not follow normal distributions properties. Noted from the descriptive statistics is that Nigeria and China had rather extremely high inflation records with an average of 20 and 29.50. Tables 1 and 2 show statistical properties of the data set. Japan also showed variations in inflation records with a minimum of –1.99, as compared to other economies under examination. There were no modifications made to the data set.

Table 1
Descriptive Statistics of the Data Set as from 1980 to 2012

Statistic	USA	UK	SA[1]	Nigeria	Japan	Ghana	Germany[2]	France
Mean	3.3900	3.9400	9.4400	20.0000	0.9300	29.5000	1.9000	3.5000
Median	3.0700	2.6800	9.3700	13.0000	0.5500	24.6000	1.7000	2.1000
Max.	12.0000	15.1600	18.4200	72.8000	7.2400	122.9000	5.1000	13.5000
Min.	0.7000	0.8600	0.3300	5.4000	–1.9900	8.7000	0.3000	0.1000
Std.Dev.	2.1200	3.1700	4.7500	18.2300	1.8000	27.0000	1.1300	3.5700
Skewness	2.3600	1.9000	0.1300	1.5400	1.3800	2.4300	1.4500	1.8700
Kurtosis	9.6800	6.7700	2.1500	4.1000	5.8100	8.8000	5.1000	5.2800
Jarque-B.	92.1000	39.4000	1.0500	14.7000	21.4000	78.3000	11.0000	26.3900
Prob.	0.0000	0.0000	0.5900	0.0000	0.0000	0.0000	0.0000	0.0000
Sum	112.0000	130.1000	302.1000	674.3000	30.7000	972.4000	40.0000	115.0000
Observ.	33.0000	33.0000	32.0000	33.0000	33.0000	33.0000	21.0000	33.0000

Note. [1] Data available for SA (South Africa) was from 1981-2012. [2] Data available for Germany was from 1992 to 2012.

Table 2
Descriptive Statistics of the Data Set as from 1980 to 2012

Statistic	China[1]	Canada	Botswana	Belgium
Mean	5.8600	3.4700	9.7900	3.0400
Median	3.6500	2.4000	9.1800	2.4000
Max.	28.0000	12.5000	16.5000	8.7000
Min.	–1.0000	0.2000	5.7500	–0.1000
Std.Dev.	7.5000	2.9000	2.6200	2.1400
Skewness	1.8300	1.7800	0.6000	1.2600
Kurtosis	5.6000	5.7800	2.9000	3.7100
Jarque-B.	21.9000	28.0000	2.0400	9.5000
Prob.	0.0000	0.0000	0.3600	0.0000
Sum	152.0000	115.0000	220.0000	100.0000
Observ.	26.0000	33.0000	33.0000	33.0000

Note. [1]Data available for China was from 1987 to 2012.

Methodology

Drawing from the extant literature, there are a number of alternative frameworks of the ARCH and GARCH models (Bollerslev, 1986; Engle & Kroner, 1995; Engle, 2002). Studies have noted that the most widely used models in the class of multivariate GARCH models are BEKK (Baba, Engle, Kraft, & Kroner, 1985; Engle & Kroner, 1995) and dynamic conditional correlation (Engle, 2002). GARCH models are now commonly used to monitor and analyze changes in the volatility of financial assets returns.

Testing for Unit Roots: Stationarity Analysis

This paper uses the Johansen cointegration test to examine the statistical drifts between different inflation series. Hence, it is imperative to carry out stationarity analysis since cointegration examines the long-run comovement between non-stationary series. Drawing from Phillips and Perron (1988), multifarious methods for detecting the presence of a unit root in parametric series models have attracted a great interest in both statistical theory and application, for instance Fuller (1984). Following Asemota and Bala (2011), ADF test is the most applied stationarity test for determining the order of integration of macroeconomic time series. The testing procedure for the ADF test is based on the generalized model of the form:

$$\Delta y_t = \alpha + \beta_t + \gamma y_{t-1} + \delta \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t. \quad (1)$$

The specific model applied for this study was:

$$\therefore \Delta y_t = \alpha + \beta_t + \gamma y_{t-1} + \sum_{i=1}^{k} \delta \Delta y_{t-1} + \varepsilon_t. \quad (2)$$

The variables were defined as α being the regression constant and β as the coefficient of the time trend. The unit root was then carried out under the null assumption that (H_0): $\gamma = 0$ signifies a unit root against the alternative (H_0): $\gamma \neq 0$. By implication, ε_t was allowed to be the white noise error term and Δy_{t-1} was equivalent to $\Delta y_{t-1} - \Delta y_{t-2}$. Thus, Δy_{t-2} will be equivalent to $y_{t-2} - y_{t-3}$ and so on. Tables 3 to 5 show the results of the ADF test.

Table 3
Stationarity Test Results

Null Hypothesis (H_o): Belgium has a Unit Root (1980-2012)							
ADF Test Results	ADF Test Equation Statistics: Least Squares						
ADF test statistic	Critical level	Critical values	Variable	Coefficient	Std. Error	t-statistic	ρ–values[1]
–2.4400	1% level	–(4.2700)**	BEL(–1)	–0.3400	0.1400	–2.4400	(0.0200)
	5% level	–(3.5600)**	α	1.3700	0.9000	1.5200	(0.1400)
	10% level	–(3.2100)**	β_t	–0.0270	0.0330	–0.8200	(0.4200)
Null Hypothesis (H_o): Botswana has a Unit Root (1980-2012)							
ADF Test Results	ADF Test Equation Statistics: Least Squares						
ADF test statistic	Critical level	Critical values	Variable	Coefficient	Std. Error	t-statistic	ρ–values[1]
4.4300	1% level	–(4.2700)**	BOT(–1)	–0.7700	0.1800	4.4300	(0.0010)
	5% level	–(3.5600)**	α	8.4100	2.1900	3.8400	(0.0060)
	10% level	–(3.2100)**	β_t	–0.0660	0.0490	–1.3500	(0.1890)
Null Hypothesis (H_o): Canada has a Unit Root (1980-2012)							
ADF Test Results	ADF Test Equation Statistics: Least Squares						
ADF test statistic	Critical level	Critical values	Variable	Coefficient	Std. Error	t-statistic	ρ–values[1]
–2.5200	1% level	–(4.2700)**	CAN(–1)	–0.3100	0.1200	–2.5200	(0.0180)
	5% level	–(3.5600)**	α	1.4500	1.0100	1.4400	(0.1600)
	10% level	–(3.2100)**	β_t	–0.0380	0.0380	–1.0100	(0.3200)

Null Hypothesis (H_o): China has a Unit Root (1987-2012)							
ADF Test Results		ADF Test Equation Statistics: Least Squares					
ADF test statistic	Critical level	Critical values	Variable	Coefficient	Std. Error	t-statistic	ρ–values[1]
–3.2800	1% level	–(4.2700)**	CHI(–1)	–0.6600	0.2000	–3.2800	(0.0030)
	5% level	–(3.5600)**	α	10.6300	5.0200	2.1700	(0.0500)
	10% level	–(3.2100)	β_t	–0.3500	0.2100	–1.6800	(0.1100)
Null Hypothesis (H_o): France has a Unit Root (1980-2012)							
ADF Test Results		ADF Test Equation Statistics: Least Squares					
ADF test statistic	Critical level	Critical values	Variable	Coefficient	Std. Error	t-statistic	ρ–values[1]
–2.3000	1% level	–(4.2700)**	FRA(–1)	–0.1600	0.0700	–2.3000	(0.0290)
	5% level	–(3.5600)**	α	0.0900	0.6600	0.1400	(0.8900)
	10% level	–(3.2100)	β_t	0.0060	0.0300	0.2500	(0.8000)

Note. [1] Based on the MacKinnon (1996b) ρ–values. **Represents the presence of a unit root.

Table 4
Stationarity Test Results

Null Hypothesis (H_o): Germany has a Unit Root (1992-2012)							
ADF Test Results		ADF Test Equation Statistics: Least Squares					
ADF test statistic	Critical level	Critical values	Variable	Coefficient	Std. Error	t-statistic	ρ–values[1]
–4.1700	1% level	–(4.2700)**	GER(–1)	–0.7600	0.1800	–4.1700	(0.0080)
	5% level	–(3.5600)	α	1.1100	0.9200	1.2100	(0.2500)
	10% level	–(3.2100)	β_t	0.0040	0.0300	0.1300	(0.9000)
Null Hypothesis (H_o): Ghana has a Unit Root (1980-2012)							
ADF Test Results		ADF Test Equation Statistics: Least Squares					
ADF test statistic	Critical level	Critical values	Variable	Coefficient	Std. Error	t-statistic	ρ–values[1]
–6.2600	1% level	–(4.2700)	GHA(–1)	–1.1500	0.1800	–6.2600	(0.0000)
	5% level	–(3.5600)	α	63.3000	13.2100	4.7900	(0.0000)
	10% level	–(3.2100)	β_t	–1.8100	0.5200	–3.4600	(0.0010)
Null Hypothesis (H_o): Japan has a Unit Root (1980-2012)							
ADF Test Results		ADF Test Equation Statistics: Least Squares					
ADF test statistic	Critical level	Critical values	Variable	Coefficient	Std. Error	t-statistic	ρ–values[1]
–4.8800	1% level	–(4.2700)	JAP(–1)	–0.6400	0.1300	–4.8800	(0.0000)
	5% level	–(3.5600)	α	1.3000	0.5500	2.3800	(0.0200)
	10% level	–(3.2100)	β_t	–0.5600	0.0300	–2.1500	(0.0400)
Null Hypothesis (H_o): Nigeria has a Unit Root (1980-2012)							
ADF Test Results		ADF Test Equation Statistics: Least Squares					
ADF test statistic	Critical level	Critical values	Variable	Coefficient	Std. Error	t-statistic	ρ–values[1]
–3.3100	1% level	–(4.2700)**	NIG(–1)	–0.5500	0.1700	–3.3100	(0.0020)
	5% level	–(3.5600)**	α	16.2100	7.4500	2.1800	(0.0300)
	10% level	–(3.2100)	β_t	–0.2800	0.3100	–0.9200	(0.3600)
Null Hypothesis (H_o): South Africa has a Unit Root (1981-2012)							
ADF Test Results		ADF Test Equation Statistics: Least Squares					
ADF test statistic	Critical level	Critical values	Variable	Coefficient	Std. Error	t-statistic	ρ–values[1]
–4.1500	1% level	–(4.2700)**	SA(–1)	–0.7600	0.1800	–4.1500	(0.0002)
	5% level	–(3.5600)	α	12.0900	3.2300	3.7400	(0.0009)
	10% level	–(3.2100)	β_t	–0.2900	0.1000	–3.0500	(0.0050)

Note. [1] Based on the MacKinnon (1996b) ρ–values. **Represents the presence of a unit root.

Table 5
Stationarity Test Results

Null Hypothesis (H_o): UK has a Unit Root (1980-2012)							
ADF Test Results			ADF Test Equation Statistics: Least Squares				
ADF test statistic	Critical level	Critical values	Variable	Coefficient	Std. Error	t-statistic	ρ–values[1]
–4.1200	1% level	–(4.2700)**	UK(–1)	–0.4600	0.1100	–4.1200	(0.0030)
	5% level	–(3.5600)	α	2.0600	1.0000	2.0600	(0.0500)
	10% level	–(3.2100)	β_t	–0.0400	0.0400	–1.0300	(0.3100)
Null Hypothesis (H_o): USA has a Unit Root (1980-2012)							
ADF Test Results			ADF Test Equation Statistics: Least Squares				
ADF test statistic	Critical level	Critical values	Variable	Coefficient	Std. Error	t-statistic	ρ–values[1]
–5.7100	1% level	–(4.2700)	USA(–1)	–0.6500	0.1100	–5.7100	(0.0000)
	5% level	–(3.5600)	α	2.7100	0.7600	3.5400	(0.0010)
	10% level	–(3.2100)	β_t	–0.0500	0.0300	–1.7600	(0.0900)

Note. [1]Based on the MacKinnon (1996b) ρ–values. **Represents the presence of a unit root.

Drawing from the results of the stationarity test, inflation series which are non-stationary (unit roots) and suitable for further empirical analysis are Botswana, Belgium, China, South Africa, United Kingdom, Canada, France, Germany, and Nigeria.

Cointegration Analysis

The technicalities of Diebold and Yilmaz (2009) models do not provide the long-run examination of affiliations. Hypothesis 1 postulated that Botswana's inflation trends positively with trading partners' inflation rates and other economies. The extant literature is currently prolific in a variety of cointegration tests. Following Johansen (1988), the idea of using cointegrating vectors in the study of non-stationary series comes from Granger (1981), Granger and Weiss (1983), Engle and Granger (1987), and Granger and Engle (1985). By implication, Engle and Granger (1987) suggested estimating cointegration relations using regression analysis. Nonetheless, such estimates have been examined further by Stock (1987), Phillips and Durlauf (1986a), Phillips and Park (1986b), Phillips and Ouilaris (1986c), Stock and Watson (1987), Park (1990, 1992), Phillips and Hansen (1990), Hovarth and Watson (1995), Saikkonen (1992), and Elliot (1998).

This study applies the Johansen cointegration test to examine statistical drifts between the different economies' inflation. Cointegration methods have been popular in applied economic research since their introduction (Österholm & Hjalmarsson, 2007). In the process of testing for cointegration using the Johansen approach, consider m vector X_t of $I(1)$ variables. The underlying principle is that if they are cointegrated, there exist r $(0 \leq r \leq m)$ linear combinations of such variations that are stationary (Mallory & Lence, 2012). The other postulation is that there should be r long-run relationships among the m (X_t) variables following Mallory and Lence (2012). In addition, the VECM of (X_t) with cointegrating rank r $(0 \leq r \leq m)$ will then be represented by:

$$\Delta X_t = \prod X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + e_t. \tag{3}$$

Allowing Π being matrix $m \times m$ that denotes long run implications, Γ will then be $m \times m$ lag parameter matrices and e_t m-vector of residuals (Mallory & Lence, 2012). By implication, allow r $(0 \leq r \leq m)$ matrix Π to be expressed as $\Pi = \alpha\beta^T$. Then, α will be matrix $(m \times r)$ comprising of the speed of adjustment of long run relations. Statistically, β will then be matrix containing r cointegrating vectors. Thus, β and α will then have the rank $r = rank\ (\Pi)$ (Mallory & Lence, 2012). Following Johansen (1988, 1991) and Johansen and Juselius (1990), there are cointegrating relationships among the X_t variables if r $(0 \leq r \leq m)$, whereas there will be no cointegration if $r = 0$. The trace test statistic computed for this study under the null hypothesis is that there are at most r cointegrating vectors and the model applied is the following:

$$\tau_{p-r} = -2\,ln Q\left[\left(\frac{H_0}{H_1}\right)\right] = -T\,ln\left\{\frac{|s_{00}|(1-\lambda_1)(1-\lambda_2)\cdots(1-\lambda_r)}{\left||s_{00}|(1-\lambda_1)(1-\lambda_2)\cdots(1-\lambda_r)\cdots(1-\lambda_p)\right|}\right\},$$
$$= -T\,ln((1-\lambda_{r+1})(1-\lambda_{r+2})\cdots(1-\lambda_p),$$
$$= -T\sum_{i=r+1}^{m} ln(1-\lambda_i^{'}). \tag{4}$$

If we allow T to be the number of dates in the sample, λ's will then be ordered eigenvalues of $S_{11}^{-1}S_{10}S_{00}^{-1}S_{01}$ and $S_{ij} \equiv T^{-1}\Sigma_t R_{it} R_{jt}^T$, and R_{it} and R_{jt} will then represent the results obtained from regressing ΔX_t and ΔX_{t-1} on $\Delta X_{t-1}, \cdots, \Delta X_{t-k+1}$ (Mallory & Lence, 2012). The maximum eigenvalue test will be used to test the null hypothesis that there are r cointegrating vectors against the alternative $r + 1$ cointegrating vectors. Following Mallory & Lence (2012), the model is:

$$-T\,ln(1-\lambda'_{r+1}). \tag{5}$$

Causality Analysis

Hypothesis 2 postulated that Botswana's trading partners lead the country's inflation rates. The Granger causality test will be applied to determine leading or lagging relationships. According to Granger (1969), cross spectral methods provide useful ways of describing the relationship between two or more variables, where one is causing the other. The assumption made in this paper is that the stochastic variables rely on the postulation that the future cannot cause the past. If A_t is allowed to be a stationary stochastic process, then $\overline{A_t}$ will represent the set of past values $\{A_{t-j;}\ j = k, k+1, \ldots, \infty\}$, following Granger (1969). The predicted series, as postulated by Granger (1969), will then be denoted by $\varepsilon_t(A|B) = A_t - P_t(A|B)$.

Still, if I allow $INF(BOT)_t$ to be Botswana's inflation series at time t and $INF(X)_t$ to be any of the countries inflation series at time t, then from Granger (1969) if the variables $(INF(BOT)_t, INF(X)_t)$ are strictly stationary, $INF(BOT)_t$ will Granger cause $INF(X)_t$ if past and current values of $INF(BOT)_t$ contain additional information on the future values of $INF(X)_t$ (Karagianni, Pempetzoglou, & Saraidaris, 2012). Nonetheless, I will designate $F_{INFBOT,t}$ and $F_{INF(X),t}$ to be information sets of observations of $INF(BOT)_t$ and $INF(X)_t$ at time t. Thus, $INF(BOT)_t$ will then Granger cause $INF(X)_t$ if

$$(INFBOT_{t+1}, \ldots, INFBOT_{t+k})|F_{INF(X),t}, F_{INFBOT,t}) \nsim (INFBOT_{t+1}, \ldots, INFBOT_{t+k})|F_{INFBOT,t}),$$

then, for the reverse causality, $INF(X)_t$ will Granger cause $INF(BOT)_t$ if:

$$(INF(X)_{t+1}, \ldots, INF(X)_{t+k})|F_{INFBOT,t}, F_{INF(X),t}) \nsim (INF(X)_{t+1}, \ldots, INF(X)_{t+k})|F_{INF(X),t}).$$

Mathematically, allow $\nsim$ to denote equivalence in the distribution and $k \geq 1$. Failing to reject the null (H_0): $\alpha_{21} = \alpha_{22} \cdots = a_{2k} = 0$ implies that $INF(BOT)_t$ does not Granger cause $INF(X)_t$. Similarly, failing to reject the (H_0): $\beta_{11} = \beta_{12} \cdots \beta_{1k} = 0$ will then signify that $INF(X)_t$ does not Granger cause $INF(BOT)_t$. However, following Granger (1969b), assuming cointegration exits between $INF(BOT)_t$ and $INF(X)_t$ the error correction models for testing causality will then be:

For Botswana and China:

$$\Delta BOT_t = \alpha_1 + \sum_{i=1}^{m}\beta_{1i}\Delta CHI_{t-i} + \sum_{i=1}^{n}\delta_{1i}\Delta BOT_{t-i} + \sum_{i=1}^{r}\varphi_{1i}ECM_{r,t-1} + \varepsilon_{1t} \tag{6}$$

$$\Delta CHI_t = \alpha_2 + \sum_{i=1}^{m}\beta_{2i}\Delta CHI_{t-i} + \sum_{i=1}^{n}\delta_{2i}\Delta BOT_{t-i} + \sum_{i=1}^{r}\varphi_{2i}ECM_{r,t-1} + \varepsilon_{2t}$$

For Botswana and Germany:

$$\Delta BOT_t = \alpha_1 + \sum_{i=1}^{m}\beta_{1i}\Delta GER_{t-i} + \sum_{i=1}^{n}\delta_{1i}\Delta BOT_{t-i} + \sum_{i=1}^{r}\varphi_{1i}ECM_{r,t-1} + \varepsilon_{1t} \tag{7}$$

$$\Delta GER_t = \alpha_2 + \sum_{i=1}^{m}\beta_{2i}\Delta GER_{t-i} + \sum_{i=1}^{n}\delta_{2i}\Delta BOT_{t-i} + \sum_{i=1}^{r}\varphi_{2i}ECM_{r,t-1} + \varepsilon_{2t}$$

For Botswana and the United Kingdom:

$$\Delta BOT_t = \alpha_1 + \sum_{i=1}^{m} \beta_{1i} \Delta UK_{t-i} + \sum_{i=1}^{n} \delta_{1i} \Delta BOT_{t-i} + \sum_{i=1}^{r} \varphi_{1i} ECM_{r,t-1} + \varepsilon_{1t} \tag{8}$$

$$\Delta UK_t = \alpha_2 + \sum_{i=1}^{m} \beta_{2i} \Delta UK_{t-i} + \sum_{i=1}^{n} \delta_{2i} \Delta BOT_{t-i} + \sum_{i=1}^{r} \varphi_{2i} ECM_{r,t-1} + \varepsilon_{2t}$$

For Botswana and Belgium:

$$\Delta BOT_t = \alpha_1 + \sum_{i=1}^{m} \beta_{1i} \Delta BEL_{t-i} + \sum_{i=1}^{n} \delta_{1i} \Delta BOT_{t-i} + \sum_{i=1}^{r} \varphi_{1i} ECM_{r,t-1} + \varepsilon_{1t} \tag{9}$$

$$\Delta BEL_t = \alpha_2 + \sum_{i=1}^{m} \beta_{2i} \Delta BEL_{t-i} + \sum_{i=1}^{n} \delta_{2i} \Delta BOT_{t-i} + \sum_{i=1}^{r} \varphi_{2i} ECM_{r,t-1} + \varepsilon_{2t}$$

For Botswana and Canada:

$$\Delta BOT_t = \alpha_1 + \sum_{i=1}^{m} \beta_{1i} \Delta CAN_{t-i} + \sum_{i=1}^{n} \delta_{1i} \Delta BOT_{t-i} + \sum_{i=1}^{r} \varphi_{1i} ECM_{r,t-1} + \varepsilon_{1t} \tag{10}$$

$$\Delta CAN_t = \alpha_2 + \sum_{i=1}^{m} \beta_{2i} \Delta CAN_{t-i} + \sum_{i=1}^{n} \delta_{2i} \Delta BOT_{t-i} + \sum_{i=1}^{r} \varphi_{2i} ECM_{r,t-1} + \varepsilon_{2t}$$

For Botswana and France:

$$\Delta BOT_t = \alpha_1 + \sum_{i=1}^{m} \beta_{1i} \Delta FRA_{t-i} + \sum_{i=1}^{n} \delta_{1i} \Delta BOT_{t-i} + \sum_{i=1}^{r} \varphi_{1i} ECM_{r,t-1} + \varepsilon_{1t} \tag{11}$$

$$\Delta FRA_t = \alpha_2 + \sum_{i=1}^{m} \beta_{2i} \Delta FRA_{t-i} + \sum_{i=1}^{n} \delta_{2i} \Delta BOT_{t-i} + \sum_{i=1}^{r} \varphi_{2i} ECM_{r,t-1} + \varepsilon_{2t}$$

For Botswana and South Africa:

$$\Delta BOT_t = \alpha_1 + \sum_{i=1}^{m} \beta_{1i} \Delta SA_{t-i} + \sum_{i=1}^{n} \delta_{1i} \Delta BOT_{t-i} + \sum_{i=1}^{r} \varphi_{1i} ECM_{r,t-1} + \varepsilon_{1t} \tag{12}$$

$$\Delta SA_t = \alpha_2 + \sum_{i=1}^{m} \beta_{2i} \Delta SA_{t-i} + \sum_{i=1}^{n} \delta_{2i} \Delta BOT_{t-i} + \sum_{i=1}^{r} \varphi_{2i} ECM_{r,t-1} + \varepsilon_{2t}$$

For Botswana and Nigeria:

$$\Delta BOT_t = \alpha_1 + \sum_{i=1}^{m} \beta_{1i} \Delta NIG_{t-i} + \sum_{i=1}^{n} \delta_{1i} \Delta BOT_{t-i} + \sum_{i=1}^{r} \varphi_{1i} ECM_{r,t-1} + \varepsilon_{1t} \tag{13}$$

$$\Delta NIG_t = \alpha_2 + \sum_{i=1}^{m} \beta_{2i} \Delta NIG_{t-i} + \sum_{i=1}^{n} \delta_{2i} \Delta BOT_{t-i} + \sum_{i=1}^{r} \varphi_{2i} ECM_{r,t-1} + \varepsilon_{2t}$$

Hypothesis Test Results

Trace Test Results

Hypothesis 1 postulated that Botswana's inflation trends positively with other economies. For the trace test computed for China, the registered ρ-values were 0.0005 and 0.0466, which are both less than the critical level of 0.05; the hypothesis was thus affirmed ($\rho = 0.0005 < 0.05$ & $\rho = 0.0466 < 0.05$). Canada also registered two cointegrating equations. This uniformity extended vigorously to European economies, namely the United Kingdom, France, Germany, and Belgium. Nigeria also registered ρ-values less than the critical level of 0.05, thus affirming the hypothesis. While the above mentioned economies registered two cointegrating equations, South Africa was an outlier registering ρ-values of 0.0844 and 0.10 which are both greater than the critical level of 0.05, consequently rejecting the null. Table 6 shows results of the trace test.

Table 6
Trace Test Results

Coint. Vectors	Eigenvalue	Trace Statistic	Critical Value[1]	ρ–values[2]
		China (1987-2012)		
$r = 0$	0.6200	27.3600	15.5000	(0.0005)**
$r \leq 1$	0.1500	3.9600	3.8400	(0.0466)**
		South Africa (1981-2012)		
$r = 0$	0.3100	13.9400	15.5000	(0.0844)
$r \leq 1$	0.0900	2.7100	3.8400	(0.1000)
		UK (1980-2012)		
$r = 0$	0.4500	27.2000	15.5000	(0.0006)**
$r \leq 1$	0.2400	8.8000	3.8400	(0.0030)**
		Belgium (1980-2012)		
$r = 0$	0.2800	19.0000	15.5000	(0.0142)**
$r \leq 1$	0.2400	8.5300	3.8400	(0.0035)**
		Canada (1980-2012)		
$r = 0$	0.4100	25.2500	15.5000	(0.0013)**
$r \leq 1$	0.2500	8.8200	3.8400	(0.0030)**
		France (1980-2012)		
$r = 0$	0.4600	28.7100	15.5000	(0.0003)**
$r \leq 1$	0.2600	9.5100	3.8400	(0.0021)**
		Germany (1992-2012)		
$r = 0$	0.7400	38.5300	15.5000	(0.0000)**
$r \leq 1$	0.4900	12.8600	3.8400	(0.0003)**
		Nigeria (1980-2012)		
$r = 0$	0.4000	22.9200	15.5000	(0.0032)**
$r \leq 1$	0.2000	7.0500	3.8400	(0.0079)**

Note. [1] Critical level of 0.05. [2] Based on the MacKinnon, Haug, & Michelis (1999) ρ–values. **Represents trace test cointegration at 0.05 critical level.

Maximum Eigenvalue Test Results

In extension to the trace test, the maximum eigenvalue test was further carried out to test the hypothesis. For the case of China, the ρ-values reported were both less than the critical level of 0.05, suggesting two cointegrating equations. This was the same for Nigeria and Canada. This uniformity also extended to European economies, with the United Kingdom registering two cointegrating equations. France and Germany also registered two cointegrating equations at a critical level of 0.05. However, Belgium registered one cointegrating equation at a critical level of 0.05. South Africa reported ρ-values of 0.1426 and 0.10 which are greater than the critical level of 0.05, thus rejecting the null hypothesis. Table 7 shows the results of the maximum eigenvalue test.

Table 7
Maximum Eigenvalue Test Results

Coint. Vectors	Eigenvalue	Max-Eigen Statistic	Critical Value[1]	ρ–values[2]
		China (1987-2012)		
$r = 0$	0.6200	23.4000	14.3000	(0.0014)**
$r \leq 1$	0.1500	3.9600	3.8400	(0.0466)**
		South Africa (1981-2012)		
$r = 0$	0.3100	11.2400	14.3000	(0.1426)
$r \leq 1$	0.0900	2.7100	3.8400	(0.1000)

Coint. Vectors	Eigenvalue	Max-Eigen Statistic	Critical Value[1]	ρ–values[2]
		UK (1980-2012)		
$r = 0$	0.4500	18.4000	14.3000	(0.0105)**
$r \leq 1$	0.2400	8.8000	3.8400	(0.0030)**
		Belgium (1980-2012)		
$r = 0$	0.2900	10.4500	14.3000	(0.1838)
$r \leq 1$	0.2400	8.5300	3.8400	(0.0035)**
		Canada (1980-2012)		
$r = 0$	0.4100	16.4300	14.3000	(0.0224)**
$r \leq 1$	0.2500	8.8200	3.8400	(0.0030)**
		France (1980-2012)		
$r = 0$	0.4600	19.2100	14.3000	(0.0076)**
$r \leq 1$	0.2500	9.5000	3.8400	(0.0021)**
		Germany (1992-2012)		
$r = 0$	0.7400	25.7000	14.3000	(0.0005)**
$r \leq 1$	0.4900	12.8900	3.8400	(0.0003)**
		Nigeria (1980-2012)		
$r = 0$	0.4000	16.0000	14.3000	(0.0277)**
$r \leq 1$	0.2000	7.1000	3.8400	(0.0079)**

Note. [1] Critical level of 0.05. [2] Based on the MacKinnon et al. (1999) ρ–values. **Represents cointegration at 0.05 critical level

Granger Causality Test Results

Hypothesis 2 proposed that Botswana's trading partners lead the country's inflation. The Granger causality test results show that Botswana Granger causes China's inflation with a ρ-value of 0.0053. However, for causality running from China to Botswana, the ρ-value registered was 0.7434, implying a statistically insignificant relationship. Even though the majority of economies examined registered cointegration earlier (United Kingdom, Belgium, Canada, France, Germany, and Nigeria), causality test results only proved a leading relationship from Botswana to China. Table 8 shows the results of the Granger causality test between Botswana's inflation and other economies.

Table 8

Pairwise Granger Causality Test Results

Causality	Observations	F-Statistic	ρ–values[1]
	China (1987-2012)		
$INF(BOT)_t \rightarrow INF(CHI)_t$	24	7.0100	(0.0053)**
$INF(CHI)_t \rightarrow INF(BOT)_t$	24	0.6760	(0.7434)
	South Africa (1981-2012)		
$INF(BOT)_t \rightarrow INF(SA)_t$	30	0.2900	(0.7503)
$INF(SA)_t \rightarrow INF(BOT)_t$	30	1.4700	(0.2496)
	UK (1980-2012)		
$INF(BOT)_t \rightarrow INF(UK)_t$	31	0.6500	(0.5294)
$INF(UK)_t \rightarrow INF(BOT)_t$	31	1.3100	(0.2876)
	Belgium (1980-2012)		
$INF(BOT)_t \rightarrow INF(BEL)_t$	31	2.5300	(0.0991)
$INF(BEL)_t \rightarrow INF(BOT)_t$	31	0.3000	(0.7455)
	Canada (1980-2012)		
$INF(BOT)_t \rightarrow INF(CAN)_t$	31	0.1400	(0.8705)
$INF(CAN)_t \rightarrow INF(BOT)_t$	31	0.1900	(0.8242)

Causality	Observations	F-Statistic	ρ–values[1]
	France (1980-2012)		
$INF(BOT)_t \rightarrow INF(FRA)_t$	31	1.6700	(0.2073)
$INF(FRA)_t \rightarrow INF(BOT)_t$	31	0.6100	(0.5486)
	Germany (1992-2012)		
$INF(BOT)_t \rightarrow INF(GER)_t$	19	2.6400	(0.1066)
$INF(GER)_t \rightarrow INF(BOT)_t$	19	3.7200	(0.0508)
	Nigeria (1980-2012)		
$INF(BOT)_t \rightarrow INF(NIG)_t$	31	1.2300	(0.3084)
$INF(NIG)_t \rightarrow INF(BOT)_t$	31	0.0700	(0.9336)

Note. [1] Critical level of 0.05. **Represents a causal relation.

Discussion

Hypothesis 1 proposed that Botswana's inflation trends positively with other economies inflation. The trace test showed cointegration between Botswana's inflation series and all the other economies except South Africa. This was the same with the maximum eigenvalue test with South Africa still showing no long run comovement with Botswana's inflation. Comparatively, Hoti (2005) empirical study seems to be proportionate to the results of this paper. Hoti (2005) aimed to analyze the degree of economic, financial and political integration between economies of the Balkan region using multivariate conditional variance models on monthly risk ratings from 1985 to 2005. The analysis revealed that the Balkan economies were closely related in terms of shocks in their economic and financial systems. Nonetheless, spillover effects were observed in almost every country. It is then plausible that if two economies are trading partners, as Botswana, China, United Kingdom, Belgium, France and Germany, then a statistically significant relation between their inflation series should surface either at a cointegration or causality level. The cointegration tests of this study revealed that only South Africa did not show long run comovement with Botswana's inflation.

On this premise, the claims of Cronin (2014) may hold. Cronin (2014) used econometric techniques to examine the relationship between money and financial assets since 2000 and found out that spillover effects reached their peak after the September 11 terrorist attacks. Drawing from this study, it is credible then that South Africa may reveal stronger ties with Botswana's inflation in periods of financial and economic turbulence. Faia and Iliopulos (2011), however, noted that from the perspective of the impossible trinity, under conditions of high financial integration, the domestic interest rates are supposed to be closely related to the foreign one if the prospect of steering interest rates is not allowed. The second proposition brought forth by hypothesis 2 was that Botswana's trading partners lead the country's inflation rates. The results showed causality running from Botswana to China only despite earlier reported multiple cointegrating equations by the Johansen cointegration test. Thus, Botswana's inflation is not driven by other economies as anticipated.

Conclusion

This study endeavored to determine the relationship between Botswana's inflation and other economies' inflation dynamics. It has been observed that the extant literature on inflation spillovers used conditional models and Diebold and Yilmaz methodology which do not provide the long-run relationship assessment of the inflation series. This study solved this glitch by using the ADF test to examine unit roots and the Johansen cointegration test to examine statistical drifts between the inflation series. The study went further to determine the direction of causal relations between Botswana's inflation and other economies' inflation series using the Granger causality test. This paper is a deviation from the extant literature, as it focused on inflation spillovers under conditions of economic and financial stability. Previous studies generally channeled much attention to periods of financial and economic turmoil, for instance, Yang and Hamori (2014) and Cronin (2014).

The technical approach applied in this study has shown that Botswana's inflation series trends positively with all the countries under examination (China, United Kingdom, Canada, France, Germany, Belgium and Nigeria), except South Africa over the material period (1980-2012). Nonetheless, the Granger causality test results have only shown that Botswana drives China's inflation. The expectation was that the different economies, particularly the United Kingdom, Belgium, Canada, France, Germany and South Africa, should drive Botswana's inflation since they are economically advanced. However, it will not be provident to assume that spillovers are equivalent to cointegration or causality analysis because these models only provide long run relationship assessment of the inflation series over the material period. Thus, robust spillovers may have surfaced any time over the material period, for instance, the 2008 Global Financial Crisis (GFC).

This study did not focus on other factors that can affect Botswana's inflation, such as interest rates, money supply, and exchange rates. For a future study, it will be imperative to investigate if these macroeconomic factors have profound effects on the country's inflation. These three factors could be examined using trivariate models proposed by Kónya (2006). In conclusion, Botswana's inflation is not driven by other countries' inflation series. However, the country's inflation trends positively with majority of economies as anticipated. On this backdrop, it is conceivable that Botswana's inflation may be driven by the country's own macroeconomic factors such as monetary shocks, interest rates or exchange rates.

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