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Causal Dynamics among Foreign Portfolio Investment Volatility, Financial Deepening and Capital Markets in Low Income Countries

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Abstract

This study investigated the directional linkages among net foreign portfolio investment volatility, financial deepening and capital market performance in low-income Southern African Development Community (SADC) countries employing a dynamic panel vector error correction model (P-VECM) on unbalanced quarterly panel data for the period spanning from 2000 to 2015. Using cointegration analysis in P-VECM, the study established the existence of a long-run equilibrium relationship among the variables. The pairwise test demonstrated that there is a unidirectional causality relation from net portfolio investment volatility to financial deepening in low income SADC markets. Furthermore, the results indicate a bidirectional causal relationship between real gross domestic product (GDP) and the performance of capital markets, suggesting that as GDP grows, capital markets perform better or vice versa. Additionally, the results reveal that real GDP unilaterally leads both net portfolio investment volatility and financial deepening in these economies. Conversely, the pairwise test distinctively indicates that capital market performance is neither causally related to financial deepening nor to the variability of foreign portfolio investment flows in the selected economies. It is therefore recommended that policy makers in low income economies should embark on programmes that attract more players in the domestic markets to encourage the deepening and performance of financial markets, which will in turn strengthen the long run causality with net foreign portfolio investment flows.

JEL Classification: F21, F32, E44, G15

Keywords: Foreign portfolio investment volatility, financial deepening, Granger causality, capital market performance, P-VECM.

1. Introduction

The recent and unprecedented global financial crisis (GFC), an outcome of large sudden fluctuations in global financial flows, has renewed interest in the macroeconomic and financial

stability of developing countries (Pagliari & Hannan, 2017). Investors and policy makers are concerned about the behaviour, interaction and linkages among foreign portfolio investment variability, deepening of financial markets and the performance of capital markets in developing countries (Claessens, Kose, & Terrones, 2010). The recent financial crisis was exacerbated by the globalisation of financial markets which led to dramatic increases in foreign capital flows, such as portfolio flows, as a proportion of global wealth (Claessens et al., 2010; Bluedorn et al., 2013). Foreign portfolio investment flows are beneficial to developing economies in bridging the savings-investment gap (Malafia, 2005; Karimo and Tobi, 2013; Chaudhry, Frooq & Mushtaq, 2014), but are widely regarded as 'hot money' given their notorious volatility compared to other types of financial flows (Claessens, Dooley & Warner, 1995;De and Chakraborty, 2015). The increase in free mobility of foreign portfolio flows and deepening of domestic markets has occurred almost concurrently with the globalisation of developing financial markets (GDP) (Yeyati and Williams, 2014). Global portfolio flows are considered beneficial to both developed and developing countries; however, large and sudden short-term flows create considerable policy challenges and serious market stability concerns (Hegerty, 2011b). Accordingly, the volatility in foreign financial flows impacts adversely on domestic interest rates, currency volatility, general price level and economic productivity (Waqas, Hashmi & Nazir, 2015).

Despite going through some rapid changes and growth, low-income African markets are still characterised by illiquid markets that can be easily and adversely affected by sudden fluctuations in capital flows (Mihaljek, 2006a; Aye, 2013). Moreover, the challenges confronting the financial stability of low-income markets are compounded by regulatory lapses and external shocks as they integrate. A steady and balanced macroeconomic environment is vital to both domestic and international investors (Waqas et al., 2015). Additionally, a developed financial market should attract substantial capital flows, increase market resilience and absorb the impact of shocks better than undeveloped markets (Forbes and Warnock, 2012; Sahay, Čihák, N'diaye, & Barajas, 2015). Given this, the study was motivated to comprehensively and simultaneously analyse the behaviours of foreign portfolio investment volatility, financial deepening and capital market performance in order to provide quality information to investors and economic policy makers.

The focus on SADC low-income countries is motivated by the need to address the wide range of economic and financial challenges bedevilling the economies and the lack of macro-financial studies in these countries as well as the recent significant growth in the three concepts in developing countries. Low-income economies are confronted by high poverty levels as a result of low per capita income of less than USD1045.00 (World Bank, 2014), shallow and narrow financial markets, high foreign capital fluctuations (Allene and Giovannetti, 2011; Aye, 2013; Otchere et al., 2017), high levels of public debt that rose from 34% of GDP in 2013 to 48% of GDP in 2016 and persistent current account deficits averaging 8% of GDP (IMF Regional Economic Outlook, 2017). Some of the countries in this bloc such as Democratic Republic of Congo, Madagascar, Malawi and Zimbabwe are also classified as fragile countries (IMF Regional Economic Outlook, 2017). Given the fragile condition, they have low capital absorption capacity and low resilience to contain the pro-cyclical behaviour of capital flows and economic shocks (Allen and Giovannetti, 2011). Despite the lack of considerable liquidity and financial growth, the low-income SADC markets managed to escape the adverse effects of the GFC (Otchere, Soumaré, & Yourougou, 2016). However, due to more and more integration with global capital markets, economic policy makers are concerned that another financial crisis might adversely impact on these markets.

The review of empirical literature could not reveal specific studies that have been carried out to investigate simultaneously the short and long-run causal relationship among net foreign portfolio investment volatility, financial deepening and capital market performance, particularly in low-income markets, that is hypothesised in this study to be causal. Additionally, the behaviours of the three concepts have been previously studied by a number of researchers with considerably varying results being obtained. More specifically, much of the focus of the existing studies was aimed at exploring interactions between individual concepts with a range of other financial or economic variables (Levine, 2005; Chakraborty, 2008; Ferreira and Laux, 2009; Knill and Lee, 2014; Rahman and Mustafa, 2017, Sahey et al., 2015; Bakang and Marlyse, 2015; Coşkun, Seven, Ertuğrul, & Ulussever, 2017). This study has attempted to fill this gap.

The study further contributes to the discourse on the directional linkages and dynamic effects among the variables in the following ways:

I. The P-VECM approach utilised in this study is a contemporary panel data analysis method that provides reliable and robust estimates capable of confronting potential biases due to endogeneity and heterogeneity problems that have affected previous studies (Mahadevan and Asafu-Adjaye, 2007).

II. The study utilised a unique data set from low-income SADC economies that are considered narrow and shallow, but transforming fairly rapidly. There is a general dearth of macro-financial empirical literature in these economies.

This paper proceeds as follows: Section 2 is a brief review of empirical literature; Section 3 defines the research methodology utilised for the study, as well as data and data sources; Section 4 presents the empirical results and data analysis. Lastly, Section 5 provides the conclusion and recommendations of the study.

2. Brief Literature Review

2.1 Foreign portfolio investment volatility

Foreign portfolio investment flows are described as cross-border investments in both equity and bond markets (Lo Duca, 2012b). Volatility of foreign portfolio flows is a fairly recent phenomenon that has been analysed and discussed across the majority of major global economies (Ferreira and Laux, 2009). Under stable financial market conditions, emerging markets have significantly benefitted from this type of capital flow. However, strong and volatile foreign portfolio flows result in the need for proper policies to protect macro-financial stability in receiving economies. Foreign portfolio flows have been observed to be very short term in nature and are regarded as hot money (Claessens et al., 1995). It is further pointed out that global portfolio flows are vulnerable to informational problems and rational herding behaviour in financial markets as investors seek for international diversification opportunities (Lo Duca, 2012b; Calvo and Mendoza, 2000). Additionally, the sudden fluctuations also stem from the role of a limited number of mutual fund managers who can enter and exit the market abruptly (Haley, 2001). This behaviour of mutual fund managers is facilitated by the high liquid status of stocks and bonds which enables investors to dispose the assets quickly (Lo Duca, 2012a). Given this, capital controls have been observed not to have a significant effect over the surges and sudden stops in foreign capital flows. According to Broner and Rigobon (2004), developing countries,

especially low-income economies, are more vulnerable to the volatility in foreign portfolio flows due to the illiquid, narrow and shallow financial markets (Aye, 2014).

Although foreign portfolio flows are regarded as an invaluable source of critical external finance for both developed and developing economies (Karimo and Tobi, 2013), the drivers of global portfolio investment volatility remain debatable among scholars and economists. This is compounded by the challenges encountered in the identification and analysis of the drivers of capital flow volatility as the drivers of volatility have been observed to change over time and over cross sections (Lo Duca, 2012a). Mody and Taylor (2003) stressed the role of information asymmetries in preventing markets to clear at a given price causing a disequilibrium where drivers change across time periods depending on whether the financial flows are influenced by supply or demand. Additionally, investors have different allocation strategies and hence the drivers of foreign financial flows change across time, reflecting the varied perceptions, tastes and preferences of domestic or foreign investors (Forbes and Warnock, 2012; Lo Duca, 2012a). During crisis periods, investors change their portfolio mix in order to maintain the desired risk profile (Adrian and Shin, 2010).

Waqas et al. (2015) and Bekaert and Harvey (1998) revealed that the performance of stock markets significantly impacts on the volatility of foreign portfolio flows. Similarly, a positive and significant relationship between foreign portfolio investment flows and stock market returns has been observed in emerging and developing markets (Gordon and Gupta, 2003; Çulha, 2006). Higher stock market returns attract international investors and build confidence of investors, thereby promoting stability of foreign financial flows. Additionally, Easterly, Islam, & Stiglitz (2001) pointed out that the development of domestic financial markets is positively and significantly linked to more stability of foreign portfolio flows. The development of financial markets has been observed to promote risk sharing and increase capacity to absorb foreign financial flows, thereby reducing the variability of foreign capital flows.

2.2 Financial deepening

Financial deepening, on the other hand, was pioneered by Shaw (1973) in order to explain changes in financial systems that facilitate provision of varied financial services targeted at all kinds of societies. Financial deepening is as a multi-dimensional process whereby financial institutions and markets offer a wide range of financial assets and services. Given this, several approaches have been proposed in the measurement of financial deepening. It is regarded as the ratio of broad money supply (M2) to gross domestic product (GDP) by some scholars (Giuliano and Ruiz-Arranz, 2009; Gupta, Pattillo, & Wagh, 2009; Sackey and Nkrumah, 2012 and Rahman and Mustafa, 2017; among others), while other scholars use the ratio of market capitalisation to GDP or the ratio of market liquidity to GDP or private sector credit to GDP (Winkler, 2009; Rahman and Mustafa, 2017). According to the Keynesian school of thought, financial deepening is driven by increased government expenditure which injects money into the economy, thereby pushing outwards the aggregate demand and demand for money. There is a general consensus in the empirical literature that financial deepening promotes economic growth; however, its relationship with mobility of foreign financial flows, particularly of a portfolio nature, is yet to be adequately examined. The indicators of financial deepening may differ in economies and between countries or between financial markets as they are bound to have different levels of financial deepening (Sackey and Nkrumah, 2012). According to the World Economic Forum's Financial Development Index (2010), the breadth and depth of an economy's financial markets are good indicators of financial development.

The relationship between financial deepening and economic growth has resulted in two opposing schools of thought. Firstly, is the *supply leading theory* in which financial development drives economic growth and secondly, the *demand following theory* in which economic growth generates demand for financial products (Mohan, 2006). Although there is considerable empirical literature to support the view that financial development contributes to economic growth (Rajan and Zingales 2003; Levine, 2005), inadequate attention has been given to its relationship with the variability of global financial flows and the performance of capital markets particularly in low-income countries. Developed financial markets have been observed to reduce financial constraints, increase efficiency and in turn promote economic growth (Levine, 2005; Ang, 2011). However, Cornelius (2011) pointed out that while financial systems promote investment accumulation and innovation, for countries to fully benefit from global financial flows some minimum level of stock market development is required. The lack of a certain level of financial market development makes the presence of foreign financial flows ineffective or negatively affect economic growth (Cornelius, 2011). Deep financial markets allow savers to invest in a wide range of financial assets while presenting to borrowers a wide range of financing and risk management instruments (Chami, Fullenkamp, & Sharma, 2010; Goswami and Sharma, 2011). Ali Shah and Bhutta (2014) argued that financial deepening in developing economies promotes smooth adjustment to shocks, but rapid financial deepening causes credit booms and increased vulnerability to crisis. Similarly, early stages of financial market deepening are associated with high market volatility as capital flows can be relatively large compared to absorption capacity of the economy (Cornelius, 2007; Cornelius, 2011). In contrast, Hellmann, Murdock, & Stiglitz (2000) argued that financial deepening leads to increased competition which decreases profit margins but causes bank fragility. Rapid financial deepening and catch-up in developing economies are supported by the sum of bonds and equities held which is estimated at over 200% of GDP (Winkler, 2009; Cornelius, 2011).

3. Data Sources and Research Methodology

3.1 Data and data description

The main variables of interest for this study were net foreign portfolio investment volatility, capital market performance (given by the change in main index of each stock market) and financial deepening. Data was obtained from The World Bank Data bank, International Monetary Fund (IMF)'s International Financial Statistics (IFS), Bloomberg and statistical offices of respective central banks. In line with existing literature, the study employed the change in the main stock market index for each country as the proxy for capital market performance (Kyereboah-Coleman and Agyire-Tettey, 2008; Liu and Sinclair, 2008 and Egly, Johnk, & Liston, 2010). The study utilised quarterly unbalanced panel data spanning a period of 16 years from 2000 to 2015. In cases where data was not available on a quarterly basis, frequency conversion and interpolation of data were used to convert annual data to quarterly data. The frequency conversion and interpolation of annual data to quarterly data (low frequency to high frequency data) is a standard method referred to in the literature that has been employed by Borys, Horváth, & Franta (2009), Ngalawa and Viegi (2011), and Davoodi, Dixit, & Pinter (2013). Additionally, this study employed net foreign portfolio investment flow data to capture the overall position of the economy and the contribution of both foreign and domestic investors. Based on World Development Indicators for July 2014, Table 1 shows the classification of the SADC countries into low-income, middle-income and high-income countries.

Table 1: SADC development indicators

Country	Population in millions	GDP in billion USD	GDP growth	Inflation	Per capita income (USD)	Income level
Zimbabwe	15.2	13.6	3.2%	-0.2%	895.00	Low-income
Zambia	15.7	27.07	6.0%	7.8%	1724.00	Lower middle
Tanzania	51.8	49.1	7%	6.1%	948.00	Low-income
Swaziland	1.2	3.4	2.5%	5.7%	2833.00	Lower middle
South Africa	54	349.8	1.5%	6.4%	6478.00	Upper middle
Seychelles	0.09153	1.4	2.8%	1.4%	15296.00	High income
Namibia	2.4	13.4	4.5%	5.4%	5583.00	Upper middle
Mozambique	27.2	16.3	7.4%	2.6%	599.00	Low-income
Mauritius	1.2	12.6	3.6%	3.2%	10500.00	Upper middle
Malawi	16.7	4.2	5.7%	24.4%	251.00	Low-income
Madagascar	23.5	10.5	3%	6.1%	447.00	Low-income
Lesotho	2.1	2.0	2%	5.3%	952.00	Low-income
DRC	74.8	32.9	9.0%	1.6%	440.00	Low-income
Botswana	2.2	15.8	4.4%	4.4%	7182.00	Upper middle
Angola	24.2	131.4	3.9%	7.3%	5430.00	Upper middle

Source: World Bank Development Indicators (2014)

3.2 Estimation technique

The study built around four basic stages. Firstly, panel unit root tests were conducted to check for stationarity in order to avoid spurious results. Secondly, cointegration analysis was done to determine the existence of long-run relationships among the variables used. The third procedure was to estimate the long-run equilibrium relationship. Lastly, the study used a dynamic panel VECM to test for direction of causality relationships among the variables.

3.2.1 Panel unit root tests

Based on recent econometric studies, unit root tests that are centred on panel data are more robust than tests based on individual time series data (Gurajati 2004; Baltaji, 2008, Hsiao, 2014,). This is a result of information in cross-section data that enhances information contained in time series (Rahman and Mustafa, 2017). In addition, panel unit root tests lead to statistics with a normal distribution in the limit. This study therefore employed the common tests of Levin, Lin and Chu (2002) - LLC; Augmented Dickey Fuller (ADF) and Im, Pesaran and Shin (2003) – IPS. All these tests are applied so that results could be compared and checked for accuracy as well as to maintain consistence. In all three cases of the unit root tests, the null hypothesis for the benchmark model was that the instruments have unit root (i.e. they are non-stationary).

3.2.2 Panel cointegration

After establishing the stationarity (no unit root) of the variables in the panel data, it was necessary to check for the existence of a long-run relationship among net foreign portfolio investment volatility, capital market performance (cmp) and financial deepening (fd) in the selected SADC low-income economies. The study employed the Pedron (2004) and Johansen Fisher-based cointegration test to check for the existence of a long-run relationship between the variables. The two tests were employed so as to ensure robustness and to compare the results.

Following Mahadevan and Asafu-Adjaye (2007), the reduced form empirical model for conducting cointegration tests is as follows:

$$fpi\sigma_{cit} = \alpha_i + \delta it + \beta fd_{cit} + \lambda cmp_{cit} + u_{cit} \quad (2.1)$$

Where;

α_i and δt are country and time fixed effects, respectively.

fd_{cit} is financial deepening in country *ci* at time *t.*

$fpi\sigma_{cit}$ is foreign portfolio investment volatility in country *ci* at time *t.*

cmp_{cit} is capital market performance in country *ci* at time *t.*

Pedron's (1999, 2004) approach allows for heterogeneity across individual members of the panel. In this case, the null hypothesis was that there is no cointegration against an alternative hypothesis of cointegration.

3.2.3 Causality tests

A dynamic panel VECM was employed to investigate the short run and long run dynamic causal linkages among the variables in low-income SADC countries. The adoption of this approach is well supported by empirical studies such as Mahadevan and Asafu-Adjaye (2007), Lee and Chang (2008), Sentürk and Sataf (2015) and Rahman and Mustafa (2017). Accordingly, this study employed the following reduced form trivariate P-VECM equations;

$$\Delta fpi\sigma_{it} = \pi_{it} + \Lambda_{1i} e_{it-1} + \sum_{j=1}^{k} \Lambda_{2ij} \Delta fpi\sigma_{it-j} + \sum_{j=1}^{k} \Lambda_{3ij} fd_{it-j} + \sum_{j=1}^{k} \Lambda_{4ij} \Delta cmp_{it-j} + \varepsilon_{it} \quad (3.1)$$

$$\Delta fd_{it} = \pi_{it} + \Lambda_{1i} e_{it-1} + \sum_{j=1}^{k} \Lambda_{2ij} \Delta fd_{it-j} + \sum_{j=1}^{k} \Lambda_{3ij} fpi\sigma_{it-j} + \sum_{j=1}^{k} \Lambda_{4ij} \Delta cmp_{it-j} + \varepsilon_{it} \quad (3.2)$$

$$\Delta cpm_{it} = \pi_{it} + \Lambda_{1i} e_{it-1} + \sum_{j=1}^{k} \Lambda_{2ij} \Delta cmp_{it-j} + \sum_{j=1}^{k} \Lambda_{3ij} fpi\sigma_{it-j} + \sum_{j=1}^{k} \Lambda_{4ij} \Delta fd_{it-j} + \varepsilon_{it} \quad (3.2)$$

Where;

Δ denotes a change dynamic operator or first differences,

$fpi\sigma, fd\ and\ cmp$ represent; foreign portfolio investment (fpi) volatility, financial deepening (fd) and capital market performance (cmp) respectively.

t represents time period;

π_{it} is a deterministic constant component of the model;

Λ_{1i}…….Λ_4 are coefficients;

j is the optimal lag length determined by Akaike information criteria (AIC), Schwarz information criteria (SIC) , Full Prediction error (FPE) and Hanan and Quinin Criteria (HQIC), and the number of lags that minimise the criteria were used.

e_{it-1} is the error correction term which represents how far the variables are from the equilibrium relationship. The error-correction mechanism estimates how in the event of a disequilibrium, variables adjust towards equilibrium in order to keep the long-run relationship intact. If the set of estimated coefficients (Λ_{2i} to Λ_{4i}) on lagged independent variables are non-zero, then there is short-run causality. If the ECM coefficient Λ_{1i} is negative and significant then there is long-run causality.

4. Empirical Results and Data Analysis

4.1 Introduction

This section presents the results of the P-VECM used and the econometric regression analyses employed in explaining the state and behaviour of the data. It also examines the appropriateness of the methodology used to establish the short-run and long-run relationships among net foreign portfolio investment volatility, financial deepening and capital market performance in low-income SADC economies. Furthermore, it determines the Granger causality (causal relationships) among the variables in the model. The study provides the necessary intellectual platform needed to link net foreign portfolio investment volatility, financial deepening and capital market performance in an economy. Finally, the section is also expected to shed light on the misconceptions that surround the variability in foreign portfolio flows, financial deepening and capital market performance and significant implications for policy formulation and implementation in order to promote development and growth of low-income economies.

In order to appropriately model the data and establish the short-run and long-run relationships, the researchers commenced by conducting panel unit tests.

4.2 Panel unit root test

The panel unit root tests presented in Table 2 show that all the variables were stationary after first differencing I(1). Capital market performance, real GDP, inflation rate, financial deepening, interest rate and capital flow volatility were all stationary at order one I(1) at both individual intercept and individual intercept and trend during the period under investigation. The reason is that the probability of Levin, Lin and Chu, Im, Pesaran and Shin (IPS) and Augmented Dickey

Fuller (ADF) test statistics values: 0.000, 0.000 and 0.000 for each of the variable was less than the probability of the error margin 0.05 (5%), allowed for in the estimate in this study. The stationarity of these variables led to further investigation of the variables in choosing the lag selection criteria and the estimation of cointegration to establish the long-term equilibrium relationship

Table 2: Panel unit root tests

Levin et al. unit root tests

Variables	Levin, Lin, Chu (individual intercept)			Levin, Lin, Chu (individual intercept and trend)		
	Order of integration	t* Statistics	P Value	Order of integration	t* Statistics	P- Value
CPM	I(1)	-6.97204	0.0000***	I(1)	-6.29404	0.0000***
RGDP	I(1)	-9.58031	0.0000***	I(1)	-9.68166	0.0000***
FD	I(1)	0.01807	0.0072***	I(1)	-2.01903	0.0217**
CPI	I(1)	-11.1076	0.0000***	I(1)	-10.5426	0.0000***
INT	I(1)	-1.42506	0.0771*	I(1)	0.65947	0.7452
NFR	I(1)	-14.8314	0.0000***	I(1)	-14.7586	0.0000***
NFPI	I(1)	-16.6544	0.0000***	I(1)	-15.6724	0.0000***

"***", "**" and "*" represent statistical significance at 1%, 5%, and 10%, respectively.

IPS unit root tests

Variables	IPS unit root test (individual intercept)			IPS unit root test (individual intercept and trend)		
	Order of integration	t* Statistics	P Value	Order of integration	t* Statistics	P- Value
CPM	I(1)	-9.18816	0.0000***	I(1)	-7.50122	0.0000***
RGDP	I(1)	-7.95114	0.0000***	I(1)	-6.83203	0.0000***
FD	I(1)	-5.49237	0.0000***	I(1)	-3.48632	0.0002***
CPI	I(1)	-11.1534	0.0000***	I(1)	-9.70885	0.0000***
INT	I(1)	-5.06879	0.0000***	I(1)	-4.57255	0.0000***
NFR	I(1)	-12.6476	0.0000***	I(1)	-11.4039	0.0000***
NFPI	I(1)	-20.5327	0.0000***	I(1)	-20.0243	0.0000***

"***", "**" and "*" represent statistical significance at 1%, 5%, and 10%, respectively.

Augmented ADF unit root tests

Variables	ADF-Fisher chi-square unit root test (individual intercept)			ADF-Fisher chi-square unit root test (individual intercept and trend)		
	Order of integration	t* Statistics	P- Value	Order of integration	t* Statistics	P- Value
CPM	I(1)	118.282	0.0000***	I(1)	85.1439	0.0000***
RGDP	I(1)	98.2837	0.0000***	I(1)	76.2896	0.0000***
FD	I(1)	62.7523	0.0000***	I(1)	38.1736	0.0037***
CPI	I(1)	152.320	0.0000***	I(1)	116.657	0.0000***
INT	I(1)	57.2924	0.0000***	I(1)	49.3323	0.0001***
NFR	I(1)	179.571	0.0000***	I(1)	142.717	0.0000***
NFPI	I(1)	326.436	0.0000***	I(1)	284.537	0.0000***

"***", "**" and "*" represent statistical significance at 1%, 5%, and 10%, respectively.

4.3 Optimal lag selection

The lag length determines when a variable in the system responds to an exogenous shock. From the results, eight different lag lengths were tested to allow for maximum adjustment in the model. The Akaike Information Criterion (AIC) selects lag two (2) while the Schwarz Information Criterion (SIC), Hannan-Quinn Information Criteria (HQIC), Final Prediction Error (FPE) and Sequential modified LR test statistic (LR) choose lag eight (8). All these information criteria are statistically significant at 5%. Overall, it is discovered that the AIC gives the lowest number with a lag value of 71.685. It is based on this evidence that a VECM lag order two (2) was used for this study, conforming to Elboure (2008). The choice of a 2-lag length for this study offered an accurate and robust dynamic model without necessarily widening the estimation sample too much, and eliminates serial correlation in the residuals.

4.4 Panel cointegration test

Table 3 presents the results from the Pedroni Residual ADF test for cointegration where the probability value was statistically significant at 5% with t-statistics value of -14.69502. Therefore, the null hypothesis is rejected and there is established evidence that the variables are co-integrated in the long run.

Table 3: Pedroni ADF residual-based cointegration test

Ho: There is no cointegration $(H_0 : \varpi = 1)$		
Trend assumption: No deterministic trend		
	t-Statistic	Prob
ADF	-14.69502	0.000***

Table 4: Johansen Fisher-based cointegration test of variables

Ho: There is no cointegration				
Cointegration rank tTest using trace statistic				
Eigenvalue	Trace statistic	5% Critical Value	Prob	Hypothesised No. of CE(s)
0.895434	2080.209	95.75366	1.0000	None *
0.452893	860.9211	69.81889	0.0001	At most 1 *
0.353074	535.2411	47.85613	0.0001	At most 2 *
0.233605	300.0586	29.79707	0.0001	At most 3 *
0.175175	156.3872	15.49471	0.0001	At most 4 *
0.092464	52.39211	3.841466	0.0000	At most 5 *
Eigenvalue	Maximum Eigenvalue statistic	5% Critical Value	Prob	Hypothesised No. of CE(s)
0.895434	1219.288	40.07757	1.0000	None *
0.452893	325.6800	33.87687	0.0001	At most 1 *
0.353074	235.1825	27.58434	0.0001	At most 2 *
0.233605	143.6714	21.13162	0.0001	At most 3 *
0.175175	103.9951	14.26460	0.0001	At most 4 *
0.092464	52.39211	3.841466	0.0000	At most 5 *

"***" represents rejection of null hypothesis at 5% level of significance

Furthermore, the study employed the Johansen cointegration test to estimate the cointegrating relationships among the variables using the trace test and the maximum Eigenvalue test. The trace test statistics and the maximum Eigenvalue test confirmed five cointegrating vectors at 5% level of significance (see Table 4 above). This finding is similar to that of Österholm and Hjalmarsson (2007) who carried out a residual-based cointegration test for near unit root variables. The findings imply that a long-run equilibrium relationship exists among the variables under study.

4.5 Panel VECM estimation

A P-VECM with five (5) simultaneous equations was estimated to establish the short-run and long-run relationships among the variables in low-income SADC countries. The estimation produced an error correction term of -0.198614 with a corresponding significant p-value of 0.008993. This means that it will take 19.8% in the speed of adjustment for the instability or disequilibrium in the cointegrating equations to be corrected and attain a long-run equilibrium position. The fitted VECM also indicates that capital market performance at lag one and two, real GDP at lag one and two and interest rates at lag one have an indirect relationship with the capital market performance, thus, it will worsen the performance of capital markets in SADC countries. This implies that instability in real GDP and contraction of the interest rates will negatively impact the capital market performance. However, prices at lag one and two, financial deepening at lag one and two and net foreign portfolio investment at lag one and two have a positive and direct relationship with capital market performance, which will strengthen and improve the capital performances in SADC countries.

4.6 Granger causality estimation

In order to compare and validate the results, the study applied both the Granger causality tests for the block exogeneity Wald test and Pairwise tests in establishing the causal relationship among the variables employed. At 5% (chi-square statistics and the probability values for the VECM block exogeneity Wald test), significant values were obtained that confirmed the existence of a causal relationship when each of the endogenous variables were treated as exogenous and vice versa. Table 5 below shows the results of pairwise Granger causality between the variables in the model, the pairwise Granger causality test was conducted using the F-statistics and respective probability values. From the pairwise test, it is revealed that there is a bidirectional relationship between capital market performance and real GDP where real GDP Granger causes capital market performance and capital market performance also Granger causes real GDP. This finding conforms with the findings generated from the VECM block exogeneity Wald test that in SADC countries, as the GDP is growing, the performance of the capital market also grows. Additionally, the results reveal a one-way causal relationship running from the volatility in foreign portfolio flows (NFPI) to financial deepening (FD). Conversely, the performance of capital markets is neither causally related to financial deepening nor related to the volatility in foreign portfolio flows in the selected economies. Finally, the study revealed a unidirectional causality running from real GDP to financial deepening (FD) as well as a unidirectional causality running from real GDP to net foreign portfolio investment volatility. Economic policy makers are therefore directed to stimulate growth to attain high financial growth and market performance in order to attract stable portfolio flows. From this analysis, it can be logically concluded that capital controls will have little or no adverse effects on economic activity of the countries under this study.

Table 5: Pairwise Granger causality test

Null hypothesis:	Obs	F-Statistic	Prob.	Decision	Type of causality
DRGDP does not Granger cause DCMP	549	5.95145	0.0028	Reject	DRGDP↔DCMP
DCMP does not Granger cause DRGDP		4.42192	0.0124	Reject	DCMP↔DRGDP
DCPI does not Granger cause DCMP	549	137.800	4.E-49	Accept	No causality
DCMP does not Granger cause DCPI		0.64593	0.5246	Accept	No causality
DFD does not Granger cause DCMP	549	124.099	4.E-45	Accept	No causality
DCMP does not Granger cause DFD		1.66738	0.1897	Accept	No causality
DINT does not Granger cause DCMP	549	0.58989	0.5547	Accept	No causality
DCMP does not Granger cause DINT		0.74999	0.4729	Accept	No causality
DNFPI does not Granger cause DCMP	549	10.3466	4.E-05	Accept	No causality
DCMP does not Granger cause DNFPI		82.2020	6.E-32	Accept	No causality
DCPI does not Granger cause DRGDP	549	1.2E-08	1.0000	Accept	No causality
DRGDP does not Granger cause DCPI		5.4E-08	1.0000	Accept	No causality
DFD does not Granger cause DRGDP	549	0.64366	0.5258	Accept	No causality
DRGDP does not Granger cause DFD		2.41608	0.0902	Reject	DRGDP→DFD
DINT does not Granger cause DRGDP	549	2.16032	0.1163	Accept	No causality
DRGDP does not Granger cause DINT		0.74267	0.4763	Accept	No causality
DNFPI does not Granger cause DRGDP	549	89.5912	2.E-34	Accept	No causality
DRGDP does not Granger cause DNFPI		2.36073	0.0953	Reject	DRGDP→DNFPI

DFD does not Granger cause DCPI	549	24.9036	4.E-11	Accept	No causality
DCPI does not Granger cause DFD		34.7407	6.E-15	Accept	No causality
DINT does not Granger cause DCPI	549	1.30393	0.2723	Accept	No causality
DCPI does not Granger cause DINT		0.20548	0.8143	Accept	No causality
DNFPI does not Granger cause DCPI	549	2.21670	0.1100	Accept	No causality
DCPI does not Granger cause DNFPI		11.9022	9.E-06	Accept	No causality
DINT does not Granger cause DFD	549	4.73166	0.0092	Reject	DINT→DFD
DFD does not Granger cause DINT		1.61193	0.2005	Accept	No causality
DNFPI does not Granger cause DFD	549	3.05183	0.0481	Reject	DNFPI→DFD
DFD does not Granger cause DNFPI		11.4391	1.E-05	Accept	No causality
DNFPI does not Granger cause DINT	549	0.00032	0.9997	Accept	No causality
DINT does not Granger cause DNFPI		0.03948	0.9613	Accept	No causality

4.7 Diagnostic tests on the P-VEM Model

This study tested for the PVECM serial correlation, heteroskedasticity and normality in order to ascertain the suitability and robustness of the model. The standard null hypotheses that were tested for the serial correlation, heteroscedasticity and normality tests were:

- $H0: \alpha = 1$, there is no autocorrelation, no heteroskedasticity and the residuals are normally distributed.
- $H1: \alpha \neq 1$, there is serial correlation, heteroskedasticity and non-normality of residuals.

Table 6: Serial correlation LM test

Null hypothesis: No serial correlation at lag order h		
Lags	LM-Stat	Prob
1	33.15473	0.6047
2	52.08980	0.0404
3	83.70179	0.1102

4	333.4940	0.3300
5	74.69271	0.0382
6	13.90087	0.9997

"***" "**" and "*" represent statistical significance at 1%, 5%, and 10%, respectively

Table 7: Heteroscedasticity test

Heteroscedasticity test: Joint test		
Null hypothesis: No heteroscedasticity		
Chi-sq	Df	Prob.
7128.073	1639	0.4916

"***" "**" and "*" represent statistical significance at 1%, 5%, and 10%, Respectively

Table 8: The PVECM normality test

Com	Skewness				Kurtosis				Jarque-Bera		
	Skew	Chi-sq	Df	Prob	Kurtosis	Chi-sq	df	Prob	Jarque	df	Prob
1	1.253864	141.4958	1	0.0000	7.846072	528.3994	1	0.0000	669.8952	2	0.0000
2	-1.081668	105.3006	1	0.0000	9.697257	1009.198	1	0.0000	1114.499	2	0.0000
3	-0.867026	67.65610	1	0.0000	10.97230	1430.045	1	0.0000	1497.701	2	0.0000
4	0.163552	2.407441	1	0.1208	6.342244	251.3383	1	0.0000	253.7458	2	0.0000
5	0.499962	22.49659	1	0.0000	8.866587	774.3789	1	0.0000	796.8755	2	0.0000
6	-0.614986	34.03866	1	0.0000	3.746841	12.54986	1	0.0004	46.58853	2	0.0000
Joint		373.3952	6	0.0000		4005.910	6	0.0000	4379.305	12	0.0000

"***", "**" and "*" represent statistical significance at 1%, 5%, and 10%, respectively

According to the outcomes in Table 6 above, there is no link between observations (no serial correlation) in the equation. Furthermore, Table 7 confirms that the equation is heteroscedasticity (a system whereby the variability of a variable is uneven across the range of values that are estimated) free.

Finally, following Bai and Ng (2005) and Dufour (2003), the normality test was similarly conducted based on skewness, kurtosis and Jarque-Bera. The results based on probability values showed that 98% of the variables in the model passed the normality test, both individually and jointly (see Table 8). Overall, the null hypothesis of no serial correlation, no heteroscedasticity and normality of the residuals cannot be rejected and the P-VECM is well fitted and reliable.

5. Conclusions

This study investigated the short-run and long-run relationships among net foreign portfolio investment volatility, financial deepening and capital market performance in low-income SADC countries. The model was found to be well fitted and statistically significant, and hence adequate and reliable for this investigation in low-income SADC countries.

The study established that there is a long-run equilibrium relationship among the variables and a 19.8% speed of adjustment is needed to attain equilibrium in the long run. This outcome is supportive of Andabai and Igbodika's (2015) causality analysis of financial deepening and the performance of the Nigerian economy between 1990 and 2013 with equilibruim being restored at a rate of 70%. Several studies have demonstrated the significantly positive effect of foreign portfolio investment on economic growth in the long run (Baharumshah and Almasaied, 2009; Choong et al., 2005; Bakang, 2015; Ibrahim, Akinbobola, & Ademola, 2017).

Additionally, a bi-directional association ship between real GDP and capital market performance was revealed, meaning that real GDP can Granger cause capital market performance or capital market performance can cause real GDP growth. Furthermore, a one-way causality relationship running from net foreign portfolio investment volatility to financial deepening was established, meaning that foreign portfolio investment flows have the potential and capacity to increase financial growth and capital market performance. Finally, the study revealed the existence of a one-way causality link running from real GDP to net foreign portfolio investment volatility. These findings are supportive of and consistent with empirical evidence that stipulates that financial market performance and foreign portfolio inflows are crucial for enhancing economic growth (King and Levine, 1993; Chakraborty, 2008; Ahmad, Draz, & Yang, 2015).

The policy implications emanating from this analysis indicate the need for proper policies and programmes to stimulate economic performance in order to attract and stabilise foreign investment flows, which in turn will drive financial market development and performance in low-income economies. It is further recommended that policy makers in low-income economies should also embark on programmes that attract more financial players in the domestic markets to increase the deepening and performance of financial markets, as this will strengthen the long-run causality with net foreign portfolio investment flows. Finally, market confidence in low-income countries can be increased through formulation and implementation of robust risk management frameworks.

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