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REMITTANCE INFLOWS AND POVERTY NEXUS IN BOTSWANA: A MULTIVARIATE APPROACH

Mercy T. Musakwa[1] and Nicholas M. Odhiambo

Abstract

This study investigates the causal relationship between remittances (remittance inflows) and poverty in Botswana. Time series data is utilised from 1980-2017. To improve the robustness of the results, two poverty proxies are used, namely: household consumption expenditure and infant mortality rate. The study employs autoregressive distributed lag approach (ARDL) to cointegration and the error correction model (ECM)-based causality test, the findings of the study reveal a short-run and long-run bidirectional causal relationship between poverty and remittances when household consumption expenditure is used as a proxy for poverty. However, when poverty is measured by infant mortality rate, a unidirectional causal relationship from poverty to remittances is confirmed both in the long run and the short run. Using the same poverty proxy, remittances were found to have an indirect causal effect on poverty through real gross domestic product per capita. The study concludes that remittances play an important role in driving poverty reduction in Botswana, irrespective of whether the level of poverty is measured by household consumption expenditure or by infant mortality rate.

Key Words: Remittances; poverty; household consumption expenditure; infant mortality rate; Botswana; ECM-based causality testing

JEL Classification: F24, I31

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1. Introduction

Botswana, like most developing countries, was part of the United Nations (UN) Millennium Development Goals in 2000 (UN, 2000) and subsequent extension of the Sustainable Development Goals (UN, 2018). The overarching objective of these UN-spearheaded conventions is sustainable, inclusive economic development, where no one is left out. This step taken by Botswana exhibits commitment to eradicating poverty through harnessing of resources from domestic and international sources. The surge in remittances in most developing countries has ignited much interest in the ability of remittances to boost economic growth and alleviate poverty. The importance of remittance is confirmed by the inclusion of sections in SDGs that support remittances. Among such section are: section 17.3.2, that focuses on increasing the volume of remittance as a percentage of GDP; section 10.c.1 which emphasises on reducing remittance cost to 3% ; and section 10.7.1 which covers reducing recruitment cost for the migrant workers (World Bank, 2019a). Although the United Nations included remittances as an emerging source of development finance in the SDGs, the paucity of the literature on the relationship between remittances and poverty reduction suggests the importance of another empirical study on Botswana.

This study departs from other studies that have been done the causal relationship between remittances and poverty in the past by using two poverty proxies. This was motivated by the need to capture poverty in income and non-income dimensions. The first proxy is household consumption expenditure, which measures income poverty and the second proxy is the infant mortality rate which captures health poverty. Although there are other indexes that measure poverty in a multidimensional form, such as, the human development index, due to insufficient time series data to carry out a meaningful analysis, the measure could not be used. The selection of two poverty proxies also improves the robustness of the results. Other studies have employed

household consumption expenditure as a poverty proxy (see Ravallion, 2001; Rehman and Shahbaz; 2014) and infant mortality rate as proxies (see Reidpath, and Allotey, 2003; Van Multzahn and Durrheim; 2008; Abosedra *et al.,* 2016). These proxies have been selected in these studies due to a variety of reasons, such as, the need to capture poverty either in income measures or non-income measures and the absence of sufficient data to carry out meaningful analysis with other poverty measures.

After gaining independence in 1966, Botswana was a marginalised country and most Batswana emigrated to work in gold and diamond mines in South Africa (Migration Policy Institute, 2004). This contributed greatly to high remittances in the 1980s averaging 4.2% until the 1990s where the average declined to 1.2% and up to 2017 the share of remittances to GDP remained below 1% (UNCTAD, 2019). After the discovery of diamonds in Orapa, Botswana's fortunes turned, and to date, the economy is highly stable and prosperous in the middle-income category, resulting in most Batswana preferring to work and stay in their own country (Migration Policy Institute, 2004). In the long-term Vision 2036 of Botswana, under Pillar 2 the policy makers envisage outward migration to alleviate high unemployment especially among the youth and internationally competitive Batswana (Ministry of Finance and Economic Development, 2019). Despite the depressed remittances in Botswana, the main objective of this study is to investigate if Botswana can benefit from the remittances in alleviating poverty through establishing the causal relationship between the two variables.

The rest of the study is organised as follows: Section 2 discusses the literature review; section 3 outlines estimation techniques; section 4 presents and discusses the results; and section 5 concludes the study.

2. Literature Review

2.1 Remittances and Poverty Dynamics in Botswana

Botswana entered into a number of conventions that support migration as early as 1945, before independence. Some of the conventions to which Botswana is a signatory which are also part of the United Nations (UN) legal instruments are: 1945 ILO Migration for Employment Convention, 1975 ILO Migrant Workers Convention, 1990 UN Migrant Workers Convention, 2002 Migrant Smuggling Protocol (United Nations Children's Emergency Funds 'UNICEF', 2019). The total number of emigrants as at 2017 was 80.1 thousand and the net migration for the past five years was at 15 thousand (Migration Policy Institute, 2019). The ability of the Botswana government to harness diamond resources and channel it towards development has left most Batswana contented to work and stay in the home country (Migration Policy Institute, 2004). This is contrary to the early years after gaining independence where there was a proliferation of emigrants to South Africa among other destination countries to look for employment (Migration Policy Institute, 2004). Given the increase in remittances in developing countries and the rising debate on whether remittances can reduce poverty, another investigation will shed some light on the nature of this relationship in Botswana.

The highest remittances as a percentage of gross domestic product (GDP) of 8% was recorded in 1980 (UNCTAD, 2019). Thereafter, there was a gradual fall in remittances throughout the 1990s and 2000s (UNCTAD, 2019). The average remittances registered between 1990 and 2000 was 1.4% (UNCTAD, 2019). This is 1% higher than the average of 0.4% recorded from 2000 to 2017 (UNCTAD, 2019). Contrary to the trend in remittances that other developing countries are experiencing, Botswana is receiving thin inflows.

In Botswana, economic development and poverty alleviation policies, among other initiatives are guided by the long-term Vision 2036 (Ministry of Finance and Economic Development, 2019). The long-term vision consists of four pillars, with Pillar 1 – Sustainable development, Pillar 2 – Human and social development, and Pillar 3 – Sustainable Environment, encompassing key aspects in poverty alleviation. In line with the long-term vision, the short-term development plans are rolled out through National Development Plans (NDPs). The current NDP 11 is a successor to NDP 10 that strove to harness the private sector into economic development and reduce dependency on government financial support. NDP 11 reinforces the NDP 10 by providing opportunities for the poor to have sustainable livelihoods (Ministry of Finance and Economic Development, 2019: 28). Government poverty reduction policies can be grouped into three categories. First is economic development, inclusive growth, and economic empowerment; second is social inclusion in education, access to health, housing and economic opportunities; third is social protection and safety nets for those already trapped in poverty (Seleka *et al*., 2007).

In response to government policy initiatives, there has been a gradual reduction in poverty when measured by metrics such as poverty headcount, human development index (HDI), income held by the lowest 20% of the population, infant mortality rate and household consumption expenditure (World Bank, 2019b). Poverty headcount at the $5.50 poverty line was at 82.6%, while poverty headcount at the $1.90 poverty line was at 42.6% in 1985 (World Bank, 2019b). The poverty headcount fell steadily to 60.4% and 16.1% in 2015 for $5.50 and $1.90 poverty lines respectively (World Bank, 2019b). The income held by the bottom 20% improved slightly over the period, with 3.9% income being held by the bottom 20%, a marginal improvement from 3.6% recorded in 1985 (World Bank, 2019b). Thus, Botswana remains a highly unequal country, with the highest 20% taking 58.9% in 1985 and realising a slight fall

of 0.04% in 2015 to register 58.5% (World Bank, 2019b). The human development index (HDI) also reflects a considerable improvement from 0.58 registered in 1990 to 0.72 recorded in 2017 (United Nations Development Programme 'UNDP', 2019).

Infant mortality rate also exhibited an improvement from 53.9% recorded in 1980 to 39.5% registered in 1990 (World Bank, 2019b). The period between 1991 to 1999 was characterized by a surge in infant mortality rate registering an average of 46% (World Bank, 2019b). Botswana registered a consistent decline in infant mortality rate from 2000 to 2017 recording an average of 39.8% (World Bank, 2019b). Household consumption expenditure as a percentage of gross domestic product also improved from 1980 to 2017 (World Bank, 2019b). An average of 63.7% was recorded between 1980 and 2000, while a slight improvement to 64.1% was recorded from 2000 to 2017 (World Bank, 2019b). Thus, household consumption expenditure was characterised by fluctuations from as high as 73% in 1980 to the lowest received between 1980 and 2017 of 50.8% recorded in 1989 (World Bank, 2019b). Although Botswana registered a fall in poverty, poverty levels vary across district, settlement type and sex (Statistics Botswana, 2013).

2.2 A Review of Related Literature

Remittances to developing countries has surged in the recent past and is forecast to reach $528 million by 2018 (Ratha *et al*., 2018). This is a remarkable growth of 10.8% from the previously recorded inflows in 2017 (Ratha *et al*., 2018). Although remittances cannot substitute official development assistance and foreign direct investment, they have grown three-fold compared to the former foreign capital resources in low and middle-income countries when China is excluded (Ratha *et al.,* 2018). Given the steady increase in remittances on the one hand, and

the commitment by Botswana to implement alleviation of poverty another study on the relationship between remittances and poverty will assist policy makers in Botswana to come up with effective poverty alleviation strategies. According to International Organisation for Migration (2018), there are 244 million migrants - migrants comprise 3.3% of the world population in 2015 and is projected to reach 405 million by 2050. Migration within Africa has increased since 1990 and the number of Africans living outside the region has doubled (International Organisation for Migration, 2018). It is projected that in 2015 about 16 million Africans were living in another African country and an additional 16 million were living outside the region (International Organisation for Migration, 2018)

There are a number of reasons, pointed out in the literature, why migrants would like to remit back home. Lucas and Stark (1985) identified altruism, savings and coinsurance as some of the factors that result in remittance inflows. The altruism motive rests on the need by migrants to help their struggling families back home; the savings motive is centred on the need by migrants to build savings back home in case income flow falls or they lose their jobs. The coinsurance motive is driven by a need to invest back home so that if anything happens to them while in the foreign country, they can return home and enjoy a better living standard. Remittances can be in the form of kind or cash that the migrant sends back home (Hagen-Zanker and Himmelstine, 2016).

In addition to altruism, savings and coinsurance, Adam Jr. and Page (2005) identified a positive role played by remittances in stimulating consumption. Ratha (2007) and De Vries (2011) also added investment in real estate, small business growth, improvement in the fiscal position of a country through the balance of payment as additional benefits that are associated with remittances. Besides the direct impact that remittances have on households, there is also a

positive indirect impact of remittances on the economy realised through the multiplier effect, i.e. additional demand that result from increase in consumption and investment. Remittances have a multiplier effect that is felt at a national level. Further, remittances are a stable source of income for households as they have a countercyclical nature that is important during depressions, wars and natural disasters (Kapur, 2004).

Despite the benefits that are given in the theoretical literature, little has been done on empirical front to investigate the causal relationship between remittances and poverty. A considerable body of empirical literature has focused on the impact of remittances on poverty (see Adam Jr. and Page, 2005; Gupta *et al*., 2009; Adam Jr. and Cuecuecha, 2013; Vacaflores, 2018; Wangle and Devkota, 2018). The findings from these studies are divided between those that found a positive impact of remittances on poverty reduction (see Gupta *et al*., 2009; Anyanwu and Erhijakpan, 2010; Tsaurai, 2018). Some studies found the relationship between remittances and poverty to be sensitive to the poverty measure used (Wangle and Devkota, 2018). Among the few studies that investigated the causal relationship between poverty and remittances, the studies are also divided between those that found a unidirectional causality from remittance to poverty namely, Muhammad (2016) and Sanchez-Loor and Zambrano-Monserrate (2015); some studies found bidirectional relationship between poverty and remittances (see Muhammad *et al*., 2016; Sanchez-Loor and Zambrano-Monserrate, 2015; Abdulnasser and Salah, 2014; Gaaliche and Gaaliche, 2014; Hatemi-j and Uddin, 2014); and some found no causal relationship between remittances and poverty (Muhammad *et al*., 2016; Sanchez-Loor and Zambrano-Monserrate, 2015).

Muhammad *et al*. (2016) investigated the causal relationship between remittances and poverty in 39 countries from low-middle, upper-middle and high-income countries employing data

from 1990-2014. In the study, a unidirectional causal relationship was found from remittances to poverty in lower-middle and upper-middle countries.

Gaaliche and Gaaliche (2014) studied the causal relationship between remittances and poverty in 14 emerging and developing countries using data from 1980 to 2012. A bidirectional causal relationship was found between poverty and remittances. Abdulnasser and Salah (2014) also examined the causality between remittances and poverty in Bangladesh using data from 1976-2010. The findings from this study were in line with Gaaliche and Gaaliche (2014), where bidirectional causality was confirmed. In a separate study, Hatemi-j and Uddin (2014) investigated the causal relationship between remittances and poverty in Bangladesh and found the same results as Gaaliche and Gaaliche (2014) and Abdulnasser and Salah (2014). Sanchez-Loor and Zambrano-Monserrate (2015) investigated causality between remittances and poverty in Colombia, Ecuador and Mexico using data from 1980-2012. A bidirectional causal relationship was found in Colombia between remittances and poverty, a unidirectional causality was confirmed in Mexico.

In a study on 39 countries from low-middle, upper-middle and high-income countries, Muhammad *et al*. (2016) found no causal relationship between remittances and poverty in high-income countries. Sanchez-Loor and Zambrano-Monserrate (2015) in a study on Colombia, Ecuador and Mexico found the same results in Ecuador.

Based on the findings of these studies that investigated the causal relationship between remittances and poverty, it can be concluded that the results are mixed. The mixed results can be attributed to different methodologies, time, study countries and poverty proxies employed.

This makes generalisation of the results inappropriate; another empirical investigation will give an insight into the nature of the relationship between remittances and poverty in Botswana.

3. Estimation Techniques and Empirical Results

3.1 Estimation Techniques

In this study, the autoregressive distributed lag (ARDL)-bounds test for cointegration and the error correction model (ECM)-based causality test are used. The ARDL technique was developed by Pesaran and Shin (1999) and extended by Pesaran *et al*. (2001). In both the approaches, the lags of the dependent variable and the independent variables are included the model. The lag length for each variable are determined using the Schwarz Bayesian Criteria(SBC) or the Akaike Information Criteria (AIC). The most parsimonious equation is selected. The ARDL approach has been selected because of numerous advantages that include: (i) the ARDL-bounds test can be used even when series have a different order of integration (Pesaran *et al*., 2001); Solarin and Shahbaz, 2013; Nkoro and Uko, 2016); (ii) the ARDL approach uses a reduced form of single equation, while other conventional cointegration methods employ a system of equations (Pesaran and Shin, 1999); and (iii) the ARDL approach provides unbiased estimates of the long-run model, even in cases where some variables are endogenous (see Odhiambo, 2009).

To proceed with the analysis, a test of cointegration is done on poverty, education, and real gross domestic product per capita functions. Cointegration test establish the presence of a long run relationship between the variables in the function. The presence of cointegration indicates causality in at least one direction (Narayan and Smyth, 2004). The null hypothesis of no cointegration is tested against the alternative hypothesis of cointegration. The calculated F-statistic is compared to the critical values provided by Pesaran *et al*. (2001). If the calculated

F-statistic falls above the critical value, the null hypothesis of no cointegration is rejected. Alternatively, if the F-statistic falls below the lower bound, it is concluded that there is no cointegration. If the F-statistic falls between the upper and the lower bound, the results are inconclusive.

Definition of variables

This study employs household consumption expenditure (Pov1) and infant mortality rate (Pov2) as measures of poverty. Household consumption expenditure is measured as a percentage of gross domestic product (GDP) and captures income poverty. A unidirectional causal relationship from remittances to poverty implies that a high inflow of remittances leads to an increase in household consumption expenditure, resulting in a fall in poverty levels. The reverse causal relationship between the two variables implies that low levels of household consumption expenditure trigger high inflow of remittances. The infant mortality rate is measured as the number of infant deaths per 1000 live births. In this study, the infant mortality rate is used to capture health poverty. A unidirectional causal relationship from poverty to remittances implies high infant mortality rate causes more remittances, while a unidirectional causality from remittances to poverty implies that high remittances are associated with low poverty levels. Remittances are measured as a proportion of gross domestic product.

Other variables included in the multivariate framework are real gross domestic product per capita (GDPC) and education, to fully specify the model and minimise omission-of-variable bias. The GDPC measures the share of national outlay distributed to each individual making up the total population. When GDPC is high, it translate to a general improvement in the income of the poor according to Dollar and Kraay (2001), assuming equal distribution of income, resulting in a fall in poverty levels. Gross primary school enrolment is used as a proxy

for education. Gross primary enrolment is used in this study to measure levels of human capital. Higher enrolment rates mean high human capital and consequently high chances of individuals getting better paying jobs outside the country.

The ARDL-bounds specification for Models 1 and 2 are given in Equations 1-4, where Model 1 consists of household consumption expenditure (Pov1) as a poverty proxy and GDPC and Education (EDU). Model 2 constitutes infant mortality rate (Pov2) as a proxy for poverty, GDPC and EDU.

General Cointegration Model for Model 1 and Model 2 (Pov_m, REM, GDPC and EDU)

$$\Delta Pov_{mt} = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov_{mt-i} + \sum_{t=0}^{n} \alpha_2 \Delta REM_{t-i} + \sum_{t=0}^{n} \alpha_3 \Delta GDPC_{t-i} + \sum_{t=0}^{n} \alpha_4 \Delta EDU_{t-i} + \theta_1 Pov_{mt-1} + \theta_2 REM_{t-1} + \theta_3 EDU_{t-1} + \theta_4 GDPC_{t-1} + \mu_{1t} \ldots\ldots\ldots\ldots (1)$$

$$\Delta REM_t = \alpha_0 + \sum_{i=0}^{n} \alpha_1 \Delta Pov_{mt-i} + \sum_{t=1}^{n} \alpha_2 \Delta REM_{t-i} + \sum_{t=0}^{n} \alpha_3 \Delta GDPC_{t-i} + \sum_{t=0}^{n} \alpha_4 \Delta EDU_{t-i} + \theta_1 Pov_{mt-1} + \theta_2 REM_{t-1} + \theta_3 EDU_{t-1} + \theta_4 GDPC_{t-1} + \mu_{1t} \ldots\ldots\ldots\ldots (2)$$

$$\Delta GDPC_t = \alpha_0 + \sum_{i=0}^{n} \alpha_1 \Delta Pov_{mt-i} + \sum_{t=0}^{n} \alpha_2 \Delta REM_{t-i} + \sum_{t=1}^{n} \alpha_3 \Delta GDPC_{t-i} + \sum_{t=0}^{n} \alpha_4 \Delta EDU_{t-i} + \theta_1 Pov_{mt-1} + \theta_2 REM_{t-1} + \theta_3 EDU_{t-1} + \theta_4 GDPC_{t-1} + \mu_{1t} \ldots\ldots\ldots\ldots (3)$$

$$\Delta EDU_t = \alpha_0 + \sum_{i=0}^{n} \alpha_1 \Delta Pov_{mt-i} + \sum_{t=0}^{n} \alpha_2 \Delta REM_{t-i} + \sum_{t=0}^{n} \alpha_3 \Delta GDPC_{t-i} + \sum_{t=1}^{n} \alpha_4 \Delta EDU_{t-i} + \theta_1 Pov_{mt-1} + \theta_2 REM_{t-1} + \theta_3 EDU + \theta_4 GDPC_{t-1} + \mu_{1t} \ldots\ldots\ldots\ldots (4)$$

Where Pov_m assumes the position of Pov1 – household consumption expenditure in Model 1 when m = 1; and the position Pov2 – infant mortality rate in Model 2 when m = 2; and they enter in the equation one at a time, REM – remittances as a percentage of GDP; EDU –

education, GDPC – real GDP per capita, α_0 is a constant, $\alpha_1 - \alpha_4$ and θ_1 - θ_4 are regression coefficients, and μ_{1t} is an error term.

Granger-Causality Model Specification

The presence of cointegration in any of the functions indicates a long-run relationship among the variables, at least in one direction (Narayan and Smyth, 2004). To establish the direction of causality, the ECM-based causality approach is used in a multivariate framework. A multivariate causality framework – where more than two variables are included in the causality function - has an advantage over bivariate framework, the latter may suffer from omission-of-variable-bias (Odhiambo, 2008). The ECM-based causality models for Model 1 and Model 2 are given in Equations 5-8. The optimal lag length was selected based on either Schwarz Bayesian Criteria or the Akaike Information Criteria. The ECM-based causality allows analysis of causality in the short run and in the long run. The short-run causality is tested using the F-statistic obtained from the variable deletion test, while the long run is obtained from the t-statistic on the lagged error correction term.

The General ECM-based Granger-causality model specifications are given in Equations 5-8.

$$Pov_{mt} = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov_{mt-i} + \sum_{t=1}^{n} \alpha_2 \Delta REM_{t-i} + \sum_{t=1}^{n} \alpha_3 \Delta EDU_{t-i} + \sum_{t=1}^{n} \alpha_4 \Delta GDPC_{t-i} + \theta_1 ECM_{t-1} + \mu_{1t} \quad (5)$$

$$REM_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov_{mt-i} + \sum_{t=1}^{n} \alpha_2 \Delta REM_{t-i} + \sum_{t=1}^{n} \alpha_3 \Delta EDU_{t-i} + \sum_{t=1}^{n} \alpha_4 \Delta GDPC_{t-i} + \theta_1 ECM_{t-1} + \mu_{2t} \quad (6)$$

$$GDPC_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov_{mt-i} + \sum_{t=1}^{n} \alpha_2 \Delta REM_{t-i} + \sum_{t=1}^{n} \alpha_3 \Delta EDU_{t-i} + \sum_{t=1}^{n} \alpha_4 \Delta GDPC_{t-i} + \theta_1 ECM_{t-1} + \mu_{3t} \quad (7)$$

$$EDU_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov_{mt-i} + \sum_{t=1}^{n} \alpha_2 \Delta REM_{t-i} + \sum_{t=1}^{n} \alpha_3 \Delta EDU_{t-i} + \sum_{t=1}^{n} \alpha_4 \Delta GDPC_{t-i} + \theta_1 ECM_{t-1} + \mu_{4t} \dots \dots (8)$$

Where α_0 is a constant, $\alpha_1 - \alpha_4$ and θ_1 are regression coefficients, $\mu_{1t} - \mu_{4t}$ are the error terms and all the other variables are as described in Equations 1-4.

***Data Sources*[2]**

Time series data was employed in this study covering the years from 1980 to 2017 to investigate the causal relationship between remittances and poverty. Remittances data was extracted from the United Nations Conference on Trade and Development (UNCTAD) database. The rest of the data – poverty proxies – household consumption expenditure and infant mortality rate, real gross domestic product per capita (GDPC) and education were extracted from the World Bank Development Indicators. Microfit 5.0 was used to analyse the data.

3.2 Empirical Results

Unit Root Test

Although the ARDL bound test approach does not require pretesting of variables for unit roots, unit roots tests were done on remittances (REM), household consumption expenditure (Pov 1), infant mortality rate (Pov 2), real gross domestic product per capita (GDPC), education (EDU). The tests were done to ascertain if all variables have the highest integration order of one [I (1)], that is acceptable for the utilisation of the ARDL approach (Pesaran *et al.*, 2001). The variables that are stationary at 1%, 5% and 10% are denoted by 3, 2, and 1 asterisks respectively. Gujarati and Porter (2012) define stationarity as when the mean, variance and covariance of variables in a model are constant over time. Non-stationary series results in spurious regression. Table 2

[2] Data is available upon reasonable request

presents unit root results on Dickey-Fuller Generalised Least Square (DF-GLS), Perron unit root test (PP root), and Perron unit root test (PPU root test)

Table 1: Unit Root Test Results

Dickey-Fuller Generalised Least Square (DF-GLS)												
Dickey-Fuller Generalised Least Square (DF-GLS)					**PP (root) Test**				**PPU (root) Test**			
Variable	**Stationarity of all Variables in Levels**		**Stationarity of all variables in First Difference**		**Stationarity of all Variables in Levels**		**Stationarity of all variables in First Difference**		**Stationarity of all Variables in Levels**		**Stationarity of all variables in First Difference**	
	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend
Pov1	-4.7992***	-2.1125	-	-5.4253***	-2.3701	-2.3230	-8.7848***	-5.7903***	-3.0025	-3.9195	-6.6084***	-6.3298***
Pov2	-2.3094	-3.3981*	-8.8734***	-	-2.2318	-3.5114*	-8.7848****	-	-4.0837	-4.0811	-9.5025***	-9.8399***
REM	-0.2259	-1.7454	-1.8385*	-3.5280**	-4.1699***	-3.5174*	-	-	-4.6218	-4.0459	-7.5698***	-9.6037***
GDPC	-0.5747	-2.1439	-6.3333***	-6.2498***	-0.5553	-3.2360**	-7.5580***	-	-3.4699	-3.9018	-7.0933***	-7.1587***
EDU	-0.9543	-1.4020	-3.7208***	5.6913***	-4.0929***	-2.4635	-	-5.9006***	-2.8468	-3.1261	-7.0933***	-7.1587***

Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels, respectively

The results of the unit root test presented in Table 1 confirm that all the variables in the model are stationary either in levels or in first difference. The next step is a test for cointegration among the functions that include Pov1 and Pov2. The variables included in the cointegration function are Pov1, REM, GDPC and EDU for Model 1 and Pov2, REM, GDPC and EDU for Model 2. The cointegration results are presented in Table 2.

Table 2: ARDL Bound Test to Cointegration Results for Model 1 and 2

Dependent Variable	**Function**		**F-Statistic**		**Cointegration Status**	
Panel A: Model 1						
Pov1	F (Pov1|REM, GDPC, EDU)		3.7745*		Cointegrated	
REM	F (REM|Pov1, EDU, GDPC)		5.3461***		Cointegrated	
GDPC	F (GDPC|Pov1, REM, EDU)		0.7397		Not Cointegrated	
EDU	F (EDU|Pov1, REM, GDPC)		1.5134		Not Cointegrated	
Panel B: Model 2						
Pov2	F (Pov2|REM, EDU, GDPC)		1.1505		Not Cointegrated	
REM	F (REM|Pov2, GDPC, EDU)		6.2390***		Cointegrated	
GDPC	F (GDPC|Pov2, REM, EDU)		0.5333		Not Cointegrated	
EDU	F (EDU|Pov2, REM, GDPC)		2.3438		Not Cointegrated	
Asymptotic Critical Values (unrestricted intercept and no trend)						
Pesaran *et al*. (2001:300) critical values (Table CI (iii) Case III	1%		5%		10%	
	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
	4.29	5.61	3.23	4.35	2.72	3.77

Note:*, ** and *** denote stationarity at 10%, 5% and 1 % significance levels, respectively.

The calculated F-statistics are compared to the critical values provided by Pesaran *et al.* (2001); critical values are also provided in Table 2. Cointegration is confirmed if the calculated F-statistics is greater than the upper bound, while no cointegration is confirmed if the calculated F-statistics is below the lower bound. In the case where the F-statistic falls between the lower and the upper bound, the test is inconclusive (Pesaran *et al*., 2001). Results presented in Table 2 confirm

cointegration in Pov1 and REM functions in Model 1, while in Model 2 cointegration is recorded for the REM function. To determine causal relationship among the variables in each function, the ECM-based causality test is employed. For the functions where cointegration is confirmed, a lagged error correction term is added into the functions, and for those functions where no cointegration is confirmed, causality is tested among the variables in the function, without the inclusion of the ECM. The results of the ECM-based causality test are reported in Table 3.

Table 3: ECM-Based Causality Results

	Panel A : Model 1				
Dependent Variable	**F-Statistics [Probability]**				**ECM t-statistics**
	ΔPov1	ΔREM	ΔGDPC	ΔEDU	
ΔPov1	-	6.3474***[0.017]	0.4082[0.528]	4.1294**[0.051]	-0.4298***[-0.024]
ΔREM	3.0804*[0.091]	-	0.5960[0.447)	1.3708[0.253]	- 0.2971***[0.003]
ΔGDPC	0.2137[0.647]	3.7604*[0.062]	-	7.6308***[0.010]	-
ΔEDU	4.9392***[0.034]	6.1434***[0.019]	5.3137***[0.028]	-	-
	Panel B: Mode1 2				
Dependent Variable	**F-Statistics**				**ECM t-statistics**
	ΔPov2	ΔREM	ΔGDPC	ΔEDU	
ΔPov2	-	0.7398[0.397]	3.4818*[0.072]	0.5940[0.449]	-
ΔREM	5.8243***[0.023]	-	0.2591[0.615]	0.4076[0.529]	-0.7160***[0.001]
ΔGDPC	1.4969[0.230]	3.7776*[0.061]	-	5.2103***[0.029]	-
ΔEDU	2.9290*[0.090]	0.1752[0.679]	6.4179***[0.017]	-	-

Note:*, ** and *** denote stationarity at 10%, 5% and 1% significance levels, respectively.

The results presented in Table 3 confirm a bidirectional causal relationship between household consumption expenditure (Pov 1) and remittances in the short run and in the long run. This confirms the altruism motive that people who migrate to other countries feel obliged to help their relatives back home (Depoo, 2014). According to Adam Jr and Page (2005) and Ratha (2013), remittances are used for consumption and investment – human capital, small businesses and other cash assets, confirming the positive impact that remittances has on poverty reduction.

When poverty is measured by infant mortality rate, a unidirectional causal relationship is confirmed, from infant mortality rate (Pov 2) to remittances in the short run and in the long run. This is confirmed by the F-statistics on ΔPov2, which is significant at 5% in the remittances function. This finding suggests that high poverty levels cause emigrants to remit more resources back home. The cause for remitting can range from coinsurance, altruism and savings, according to Lucas and Stark (1985).

There is also an indirect causal flow from remittances to poverty, through real gross domestic product per capita, in the short run. This relationship is supported by a unidirectional causal flow from remittances to real gross domestic product per capita in the short run; and a unidirectional causal flow from real gross domestic product per capita to Pov2 in the short run. Thus, the indirect causality from remittances to infant mortality rate, through real gross domestic product per capita, confirms the indirect causal effect of remittances on poverty that can be realised through the multiplier effect, according to Ratha (2007).

Other empirical results presented in Table 3 Panel A reveal that in Botswana there is: (i) no causal relationship between Pov1 (household consumption expenditure) and remittances both in the short run and in the long run; (ii) there is a unidirectional causality from remittances to real gross domestic product per capita in the short run. This can be realised through the current account where more receipts are recorded; (iii) bidirectional causality between real gross domestic product per capita and education in the short run; (iv) bidirectional causality between Pov1 and education in

the short run and a unidirectional causal relationship from education to Pov1 in the long run; and (v) unidirectional causal relationship from remittances to education in the short run.

Empirical results presented in Table 3, Panel B reveal that in Botswana there is: (i) unidirectional causality from remittances to real gross domestic product per capita in the short run; (ii) unidirectional causality from real gross domestic product per capita to Pov2 in the short run; (iii) a bidirectional causality between real gross domestic product per capita and education in the short run; (iv) no causal relationship is registered between remittances and education in the long run and the short run; and (v) unidirectional causality from Pov2 to education in the short run.

5. Conclusion and Recommendation

In this study, the causal relationship between remittances and poverty in Botswana is investigated using time series data from 1980 to 2017. The study was motivated by the need to find a variable that government can influence to realise poverty reduction. This variable could be remittances that are investigated in this study. The ECM-based Granger-causality model was employed to explore the nature of the relationship obtaining in Botswana. A multivariate framework was adopted in the study to avoid omission of variable bias that may occur in a bivariate framework. Apart from poverty proxies (Pov1 – household consumption expenditure as income poverty and, Pov2 – infant mortality rate as non-income poverty and remittances, gross domestic product per capita and education are included in the model, forming a multivariate Granger-causality model. In addition, the two proxies were also selected to improve the robustness of the results.

The results from the study show that when household consumption expenditure is used as a proxy a bidirectional causal relationship in the short run and in the long run is confirmed. However, when the infant mortality rate is used as a proxy for poverty reduction, poverty is found to Granger-cause remittances in the short run and in the long run. The study found infant mortality rate (Pov2) to indirectly Granger-cause remittances in the short run through real gross domestic product per capita. The study, therefore, concludes that the causal relationship between remittances and poverty in Botswana is sensitive to the poverty proxy used to measure the level of poverty. On the whole, the results confirm a significant role that remittances play in reducing poverty in Botswana, either directly or indirectly. Based on these findings, it is recommended that Botswana may reduce poverty through putting in place policies that support legal migration and establish channels that make remittances easy and less costly.

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