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# Do financial development and personal remittances matter in South African economic growth? A bound testing investigation

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**Abstract:** This study explores the relationship amongst financial development, remittances and the economic growth of South Africa using quarterly data spanning the period 1995Q01 to 2015Q04. The study used Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) techniques for the unit root test and the variables were found to be stationary at level and at first difference. Findings from the Autoregressive Distributed Lag (ARDL) bound testing approach to co-integration revealed that a long-run relationship exists amongst these variables. Also, the Error Correction Model (ECM) showed that it required a 36% quarterly speed for maladjustment in the model to return equilibrium. This study concluded that the financial development sector should be improved to engender sufficient and adequate performance that would lead to an effective impact of a long-run GDP growth. An increase in the gross capital formation that could lead to a long-run decrease in GDP growth should be avoided. Policy makers should formulate policies that could improve financial development in order to enhance the country's economy to reap the potential gain of remittance which could enhance economic growth.

**JEL Classifications:** G18, F43, F65, C32, O16

**Keywords:** Financial development, bound-testing, remittances, error correction model, economic growth

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## 1. Introduction

Financial development is broadly defined as an increase in the volume of financial services of banks and other financial intermediaries, as well as of financial transaction in capital markets (Hussain & Chakraborty, 2012). Financial sector historically were considered to play only a minor role in the process of economic growth. However, with the development of sophisticated financial systems in nations across the globe, modern economists conclude that the development of the financial sector of an economy can be an important aid towards economic growth. A growing body of evidence suggests that financial institutions such as banks and insurance companies and financial markets, which include stock markets, bond markets and derivative markets, exert a powerful influence on economic development, poverty alleviation, and economic stability (Levine, 2004). Since the financial sector of a country comprises a variety of financial institutions, markets and products, these measures only serve as a rough estimate and do not fully capture all aspects of financial development. According to Russell & Teitelbaum (1992), workers' remittances constitute an important mechanism for the transfer of resources from developed to developing countries. Globalization is the feature that is liable for increase in remittances inflows to emerging economies. Actually, the term "remittances" can be

defined as financial inflow to the home country from abroad by migrants. Financial inflows have become an important source of foreign exchange earnings for developing economies and are a significant indicator of economic conditions for the respective remittances recipients' economies. Remittance is the second largest source of foreign finance after Foreign Direct Investment (FDI). It is a more stable source of foreign finance in developing economies as compared to FDI, foreign aid and foreign debt (Ratha, 2003). The empirical literature indicates that remittances to developing economies have increased at a vigorous rate and evidence from the World Bank (2012) reported that remittances to developing economies have accounted for 381 billion US dollars with a 11.7% growth rate as well as with a forecast of the flow of remittances to the developing world expected to be 8%, 10% and 10.7% in 2013, 2014 and 2015 respectively. Despite importance of remittances to the growth of a nation, the economic effect of financial development has not been investigated recently, most importantly with a technique that will reveal the short and long-run effects concurrently.

## 2. Problem statement

The South Africa economy is an economy with a stable and improved financial system in Sub-Saharan Africa (SSA). However, the impact of this system on the improvement of economic growth in the country needs in-depth investigation. Despite the fact that the country is characterized by an improved financial system, some hindrances such as political interference and pressure in financial markets are still common. Reserve banks often rely on advances to commercial banks as a major instrument of monetary policy thereby lessening the use of open-market operations. Furthermore, the payment systems of the economy do not ensure rapid settlement of transactions and inter-bank markets are still not performing as they ought to, such that they face greater impediments in identifying and exploiting profitable opportunities in the region. Thus, broadening the financial services provided by the financial sector or institutions (such as commercial banks and the stock exchange market) will assist in increasing the efficiency of financial intermediation; reduce borrowing costs; increase saving incentives; and reduce the risk of bank failure. According to Honohan (2004), MFIs reach less than 2% of the population (especially the poor) in most countries, which denotes the likelihood that private sector borrowers may be unable to obtain finance, even for viable projects.

This has an adverse effect on the economic growth of the nation. It is now high time to concentrate on the remittances of the economy, which can be greatly influenced by the growth of financial development. South Africa as a country with greater prospects of economic stability in SSA has been witnessing decreases in the amount of remittances of approximately US\$ 970 655 337 in 2013, US\$ 913 403 103 in 2014 and US\$ 825 253 479 as at 2015, as well as a corresponding decrease in the economic growth rate (2.3% in 2013; 1.62% in 2014; and 1.26 % in 2015). There is need for an urgent evaluation of financial development because this decreasing rate is a warning signal in the financial development of the country. However, if proper care is taken to stop this decrease, there will be a more rapid accumulation of human capital and faster technological progress, by enabling the identification and funding of better investment projects; mobilization of savings; monitoring of managers; and allowing investors to trade, hedge and diversify risks. Countries with a high level of financial sector performance will perform better in all areas, particularly in terms of regulation, supervision and financial openness (Creane et al., 2003).

Unfortunately, studies on this subject matter have been scanty in South Africa. In fact, no known study has been evident on the financial development, remittances and growth of the South African economy despite a reduction in the economic growth of the country. This needs a quick empirical investigation in order to restore the growth of an economy which is declining gradually. This paper attempts to fill this gap. It is equally important to outline the link between financial development, remittances and economic growth as it has not received systematic attention and none of the current research combines these independent variables (financial development and remittances). A considerable part of the relevant literature argues that remittances are mostly spent on consumption, housing and land, and are not used for productive investment that would contribute to long-run growth. Providing and maintaining an adequate financial service with the use of remittances obtained from the nation's migrants such that the social and economic needs of the country are met must be one of the prime functions of government. Governments must ensure that the necessary infrastructure and skilled labour are available. Furthermore, governments must create and maintain a transparent and efficient regulatory framework and judicial system which safeguards property rights; adequately enforces contracts; fosters healthy competition; and more generally, ensures good governance. All these elements are essential for boosting economic growth.

### 3. Prior literature

Empirical studies have been conducted on the impact of remittances on the economic growth in major remittance recipients such as India, China, the Philippines, Mexico, Nigeria, Egypt, Pakistan, Bangladesh, Vietnam and the Ukraine. Most of the studies generally have found that remittances had a positive impact on economic growth (Pradhan, Upadhyay, & Upadhyaya, 2008; Giuliano & Ruiz-Arranz, 2009; Fayissa & Nsiah, 2010; Nyamongo, Misatib, Kipyegonb, & Ndirangua, 2012; Imai, Gaiha, Ali, & Kaicker, 2014; and Nwaogu & Ryan, 2015). However, relatively few of these studies have found that there was no significant relationship between remittances and economic growth (Barajas, Chami, Fullenkamp, Gapen, & Montiel, 2009; Jouini, 2015; and Lim & Simmons, 2015).

Khalid, Rabi, & Walliullah (2011) examined the remittances and financial development relationship with GDP growth in Pakistan using the annual data from 1973 to 2010. The study adopted the ARDL Bond Testing approach and the results revealed that remittances were pro-cyclical in nature. It was observed that there was an increase in remittances when the home country is progressing and remittances decreases when home countries are experiencing downturns (counter cyclical). The study further revealed that a development in the financial sector was a factor to boost the home country economy.

Remittances and economic growth for Turkey was examined by Karagoz (2009). Annual data collected from 1970 to 2005 was analysed using co-integration and OLS regression techniques. The results showed that remittances inflow to Turkey were significant and negatively linked with economic growth. The study further revealed that the third generation of Turkey that were working in Western Europe were not willing to remit due to strong entrepreneurial skills and, as such, it was very difficult for Turkey to re-gain more remittance inflow as established in the past. Similarly, Qayyum et al. (2008) examined the impact of remittances on economic growth and poverty in Pakistan (1973-2007). An ARDL approach was adopted for the study, which discovered that remittances

have a positive and significant impact on economic growth on one hand and that remittances were accountable for cutbacks in poverty on the other hand.

Akinlo & Egbetunde (2010) investigated the long-run and casual relationship between financial development and economic growth for ten countries in sub-Saharan Africa (Central African Republic, Chad, Congo Republic, Gabon, Kenya, Nigeria, Sierra Leone, South Africa, Swaziland and Zambia) for the period 1980-2005. The result showed a long-run relationship between financial development and economic growth in the ten selected countries in sub-Saharan Africa. Again, the result showed that financial development Granger causes economic growth in Central African Republic, Congo Republic, Gabon and Nigeria while economic growth Granger causes financial development in Zambia.

Inoubli (2011) examined how financial development impacted growth in the MENA (Egypt, Jordan, Morocco, Tunisia and Turkey) region between the period 1981 to 2008. The result revealed that financial development affected economic growth during the period under consideration. Bojanic's (2012) study focused on the relationship of economic growth with financial development and trade openness in Bolivia. The study covered annual time series data from the period 1940 to 2010. The results showed that a long-run relationship amongst the variables. A study by Masoud & Hardaker (2012) provided a theoretical framework for integrating the endogenous growth functions of financial market and institutions theory in order to investigate how the financial market and banking sector develop indicators that affected economic growth in cross countries. The study covered financial development and economic growth for 42 emerging markets over 12 years, using an endogenous growth model. The results suggested that stock market development significantly affected economic growth and also established a stable or long-run equilibrium relationship between the variables.

From the review of empirical studies above, the impact of remittances on economic growth exhibits variability. Despite the fact that most studies advocated the positive impact of remittances in developing countries, critics argue that the growth effect of remittances was either negative or, at best, zero. This piqued the researchers' interest in examining the financial development and personal remittance matter on the economic growth of the Republic of South Africa.

#### 4. Theoretical framework and methodology

This study employed the Cobb-Douglas production function in order to achieve the aim and objective of this paper. The Aggregate Production Function (APF) embedded in the Neo-Classical theory of the Cobb-Douglas production function was employed. APF was considered suitable for this study because APF explained long-run growth as emanating from economic activities that can create new technological knowledge and relationships between the amounts of two or more inputs, particularly physical capital and labour, and the amount of output that can be produced by those inputs. This was in line with the aim of this study to investigate the long-run and short-run relationships amongst financial development, remittances and economic growth in South Africa. Furthermore, APF model affirmed that the long-run growth rate of any economy depends on examination of policy measures as accorded by the policymakers (Felipe, 2001; Frimpong & Oteng-Abayie, 2006; Fayissa & Nsiah, 2010; Kutu & Ngalawa, 2016).

$$Y_t = A_t K_t^\gamma L_t^\alpha \quad (1)$$

Note that  $0 < \gamma < 1$  and  $0 < \alpha < 1$ .

Where  $Y_t$  is the economic growth measured by the real Gross Domestic Product at time  $t$ ,  $A_t$  is the total factor productivity over time;  $K_t$  is the capital input measured by the real value of all machinery, equipment and buildings at a given time  $t$ ,  $L_t$  is the labour input measured by the total number of person-hours worked in a particular time  $t$ ;  $\gamma$  and  $\alpha$  are the output elasticity of capital and labour respectively which are constantly determined by the availability of technology. It was noted that the Cobb-Douglas model showed a constant return to scale when  $\gamma + \alpha = 1$ . This means that doubling the capital ( $K_t$ ) and labour ( $L_t$ ) will also double output ( $Y_t$ ). Alternatively, if  $\gamma + \alpha > 1$ , it implied increasing returns to scale and  $\gamma + \alpha < 1$  implied diminishing returns to scale. However, equation (1) will be transformed using natural logarithm in order to express it in a linear form, as in equation (2)

$$\log(Y_t) = \log(A_t) + \gamma \log(K_t) + \alpha \log(L_t) + U_{it} \quad (2)$$

$Y_t$ ,  $K_t$  and  $L_t$  are output, capital and labour respectively.  $A_t$  is Total Factor Productivity (TFP) or other unconventional input factors not captured by labour and capital. Those factors include the financial development proxies and personal remittances of workers in the South African economy for the purpose of this study.

In this study, it is assumed that TFP is now a function of broad money supply ( $M2$ ); financial sector credit ( $CR$ ) and workers' Remittances ( $REM$ ) over time. Hence,

$$A_t = f(M2_t, CR_t, REM_t) \quad (3)$$

Substituting equation (3) into the original Cobb-Douglas production function (equation 1) generates a newly extended Cobb-Douglas production function in equation (4), which is the financial development and growth model for the South African economy.

$$Y_t = M2_t^{\beta_1} CR_t^{\beta_2} REM_t^{\beta_3} K_t^\gamma L_t^\alpha \quad (4)$$

Equation (4) shows the South African model for the financial development, remittances and economic growth relationship developed by this study. In order to simplify this equation to reflect the input and output relationship, the equation is expressed in a linear form, as follows:

$$Y_t = q_o + \beta_1 M2_t + \beta_2 CR_t + \beta_3 REM_t + \gamma K_t + \alpha L_t + U_t \quad (5)$$

The model for this study is dynamic in nature because the output variable is consistent and it supports the memory effect as posited by Chowdhury (2016) that past period GDP growth predicts the current period GDP growth. Hence, a lagged value of growth is included amongst the independent variables to explain the effect of economic growth at period  $t - 1$  on economic growth at period  $t$  in South Africa.

Therefore, explicitly, the dynamic form of equation (5) is written as:

$$GDP_t = q_0 + \beta_1 GDP_{t-1} + \beta_2 M2_t + \beta_3 CR_t + \beta_4 REM_t + \gamma \log GCF_t + \alpha \log LAB_t + U_t \quad (6)$$

Where  $GDP_t$  and  $GDP_{t-1}$  represent the present and past year gross domestic product growth rate in the South African economy respectively;  $q_0$  is the constant term;  $M2_t$  is the broad money as a percentage of GDP;  $CR_t$  is the financial sector credit as a percentage of GDP;  $REM_t$  captures the total workers' remittances to the government as a percentage of GDP;  $GCF_t$  is the gross capital formation;  $LAB_t$  represents the total ratio of employees ages of between 15-64 as modelled by the International Labour Organisation (ILO);  $U_t$  is the composite random error term and  $t$  denotes the time period (years).

#### 4.1. Data issues

All the data used in this study were secondary in nature and were sourced from the World Bank 2017 World Development Indicators (WDI) for the years 1995 to 2015 but was averaged into quarterly data to increase the frequency as ARDL requires a higher frequency in order to enable sufficient lag selection. The choice of variables in this study were based on past literature by Jayaraman, Choong, & Kumar (2009), Paul & Das (2011), Fayissa & Nsiah (2010), and Lenka (2015).

#### 4.2. Estimating technique

Bound Testing or the Auto Regressive Distributed Lag (ARDL) introduced by Pesaran, Shin, & Smith (2001) was employed to examine the co-integrating relationship amongst

the economic variables and hence, achieve the objective of the study. ARDL was chosen for this study due to its flexibility it places no restriction on having the variables integrated in the same order. It can be applied to variables integrated at both order I (0) and I (1) (Gerni, Kabadayı, Yurttañıkırmaz, & Emsen, 2013). Additionally, Pesaran et al. (2001) averred that ARDL provides consistent and efficient estimates in the long run that are asymptotically normal, regardless of their order of integration. Moreover, ARDL model despite the possibility of endogeneity, provides reliable estimates for both the lags of dependent and explanatory variables (Pesaran et al., 2001) and the pre-testing problems encountered in the conventional co-integration techniques were avoided by using ARDL (Sharifi-Renani, 2007; Akinlo, 2008).

*The Model in ARDL format:*

$$\begin{aligned} \Delta RGDP_t = & c_0 + \sum_{j=1}^n \beta_{1j} \Delta RGDP_{t-j} + \sum_{j=1}^n \beta_{2j} \Delta M2_{t-j} + \\ & + \sum_{j=1}^n \beta_{3j} \Delta CR_{t-j} + \sum_{j=1}^n \beta_{4j} \Delta REM_{t-j} + \sum_{j=1}^n \beta_{5j} \Delta GCF_{t-j} + \\ & + \sum_{j=1}^n \beta_{6j} \Delta LAB_{t-j} + \sigma_1 RGDP_{t-1} + \sigma_2 M2_{t-1} + \sigma_3 CR_{t-1} + \\ & + \sigma_4 REM_{t-1} + \sigma_5 GCF_{t-1} + \sigma_6 LAB_{t-1} + U_t \end{aligned} \quad (7)$$

Where,  $\Delta$  denotes the first difference operator;  $j$  is the chosen number of lags;  $n$  is the optimal or maximum lag length;  $c_0$  is the constant term;  $U_t$  is the stochastic error term;  $\beta_{1j} - \beta_{6j}$  are the short-run coefficient of the independent variables respectively;  $\sigma_1 - \sigma_6$  are the long-run coefficients. The first step in this analysis is to estimate the ARDL model in equation (7) using the ordinary least square from the ARDL environment. The second step is to apply a bound test to examine the long-run relationship using the hypotheses stated below:

$$H_0 : \sigma_1 = \sigma_2 = \sigma_3 = \sigma_4 = \sigma_5 = \sigma_6 = 0$$

$$H_1 : \sigma_1 \neq \sigma_2 \neq \sigma_3 \neq \sigma_4 \neq \sigma_5 \neq \sigma_6 \neq 0.$$

The Bound test uses F-statistics that have a non-standard distribution. Therefore, Pesaran et al. (2001) set up two sets of critical values for given significance levels (1%, 5% and 10%). The first set of values assumes that all variables are stationary at level I(0), and the other set of critical values assumes that all variables are stationary at first differencing I(1). On this note, if the calculated F-statistic is higher than the upper bounds value as stated in the Pesaran critical bounds table, the null hypothesis of no co-integration is rejected. On the other hand, it is accepted if the calculated F-statistic is smaller than the lower bounds value. Whereas, the test become indecisive and unrealistic if the calculated F-statistic lies



between the lower and upper critical values. To check the reliability of the estimate, serial correlation and recursive CUSUM tests were conducted.

## 5. Results and analysis

### 5.1. Unit root testing

The estimation strategy selection depends solely on the nature of the data. To determine the stationarity level of the data used in this study, two different time series unit root test were used, namely the Augmented Dickey-Fuller Test and the Phillips-Perron Test. The results are presented in Table 1.

TABLE 1. UNIT ROOT TEST: ( $H_0$ : There is no unit root)

| VARIABLE     | AUGMENTED DICKEY-FULLER TEST<br>(WITH INTERCEPT) |               |           | PHILLIPS-PERRON TEST<br>(WITH INTERCEPT) |               |           |
|--------------|--|---------------|-----------|--|---------------|-----------|
|              | Order of integration                             | t* Statistics | P Value   | Order of integration                     | t* Statistics | P-Value   |
| <i>RGDP</i>  | I(1)   | 1.641015      | 0.0002*** | I(1)                                     | 1.504968      | 0.0088*** |
| <i>M2</i>    | I(0)   | -2.634044     | 0.0015*** | I(0)                                     | -1.532287     | 0.0024*** |
| <i>CR</i>    | I(1)   | 0.386740      | 0.0084*** | I(1)                                     | 0.727273      | 0.0004*** |
| <i>REM</i>   | I(1)   | -2.126862     | 0.0064*** | I(1)                                     | -1.999766     | 0.0051*** |
| <i>LnGCF</i> | I(0)   | 0.386740      | 0.0084*** | I(0)                                     | 0.727273      | 0.0004*** |
| <i>lnLAB</i> | I(1)   | -2.126862     | 0.0064*** | I(1)                                     | -1.999766     | 0.0051*** |

Note: \*\*\* - indicates statistical significance at 1%.

Source: Authors' estimation.

Using the ADF and PP tests, it was discovered that all the variables are stationary either at I (1) or I (0). All the P-values showed that the null hypothesis of no unit root can be rejected because they are all significant at the 1% level of significance. This is in tandem with the requirements of ARDL and the study conducted by Giles (2013), which clearly stated that ARDL accommodates variables that were stationary at level and at first difference but not at I(2).

### 5.2. Optimal lag selection

According to Giles (2013), ARDL is more advantageous than other conventional co-integrating techniques because it allows a sufficient number of lags of more than two. Based on this fact, the optimal number of lags is the lag with the least AIC and SIC. Thus, the lower the AIC and SIC value, the better the model.

TABLE 2. LAG SELECTION CRITERIA

| NUMBER OF LAG | AIC      | SIC       |
|---------------|----------|-----------|
| 2             | 48.05958 | 48.63365  |
| 3             | 48.15813 | 48.91911  |
| 4             | 47.81313 | 48.7682   |
| 5             | 47.83824 | 47.98153  |
| 6*            | 47.1132* | 47.17003* |

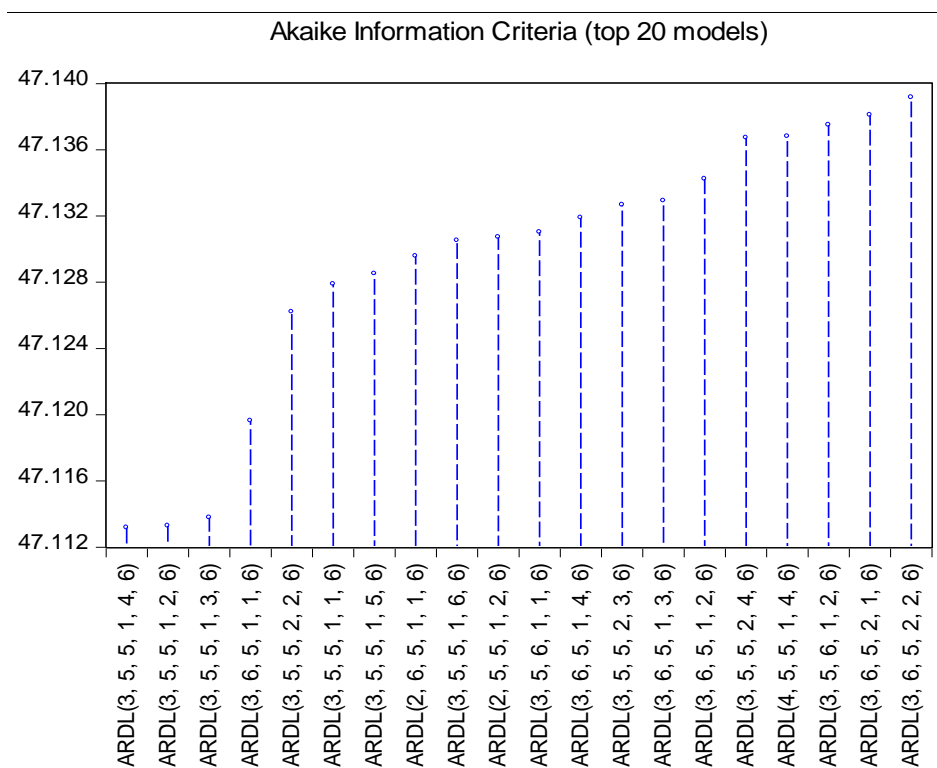
Source: Authors' estimation.

Based on the fact that the least AIC and SIC lag selection criteria is suitable for ARDL estimation, lag six (6) was selected for this study because from the estimation, it was found that lag six (6) gave the least AIC and SIC with values 47.1132 and 47.17003 respectively.

### 5.3. Lag strength measurement

To determine the strength of the chosen AIC model over all other criteria such as SIC and HQ using an automatic lag selection process, this study employs the criteria graph to depict the top twenty (20) ARDL models. Following the rule of thumb which says that the lower the AIC, the better the model, the model (3, 5, 5, 1, 4, 6) is the best model as it gives the lowest positive AIC value of 47.1132; followed by model (3, 5, 5, 1, 2, 6) with an AIC value of 43.113; followed by model (3, 5, 5, 1, 3, 6) with an AIC value of 47.1138. All three models are good but the researchers choose the best model (that is, the model with the least AIC value).

TABLE 3. AIC - TOP 20 MODELS



Source: Authors' estimation.

### 5.4. Bound testing

To test for the long-run relationship amongst the economic variables used in this study, the bound test F-statistic is used as shown below.

TABLE 4. BOUND TEST OF THE SERIES: *RGDP*, *M2*, *REM*, *CR*, *GCF*, *LAB*

| <i>H<sub>0</sub>: There is no long-run relationship</i> |             |             |
|---|-------------|-------------|
| TEST STATISTIC  | VALUE       | K           |
| F-statistic   | 4.652297    | 5           |
| <i>Critical Value Bounds</i>                            |             |             |
| SIGNIFICANCE  | LOWER BOUND | UPPER BOUND |
| 10%   | 2.08        | 3           |
| 5%  | 2.39        | 3.38        |
| 2.5%  | 2.7         | 3.73        |
| 1%  | 3.06        | 4.15        |

Source: Authors' estimation.

Table 4 shows the result of long-run bound test which reveal that the value of F-statistics 4.652297 indicates the existence of a long-run relationship amongst the variables under investigation. Hence, long-run and short-run estimates of the variables using ARDL technique are presented in Table 5.

### 5.5. ARDL estimation

TABLE 5. ARDL ESTIMATION OF THE SERIES: *RGDP*, *M2*, *REM*, *CR*, *GCF* and *LAB*

| Dependent Variable: <i>RGDP</i>                               |             |            |             |           |
|---|-------------|------------|-------------|-----------|
| Method: ARDL  |             |            |             |           |
| Sample: 1995Q01-2015Q04                                       |             |            |             |           |
| Automatic Model selection method: Akaike info criterion (AIC) |             |            |             |           |
| VARIABLE  | COEFFICIENT | STD. ERROR | T-STATISTIC | PROB.*    |
| <i>LONG-RUN ESTIMATE</i>                                      |             |            |             |           |
| <i>M2</i> (-1)  | 2.57E+09    | 5.60E+08   | 4.594194    | 0.0000*** |
| <i>REM</i> (-1)   | -3.57E+11   | 7.33E+10   | -4.865180   | 0.0000*** |
| <i>CR</i> (-1)  | 86796406    | 1.21E+08   | 0.718546    | 0.4762    |
| <i>GCF</i> (-1)   | -4.00E+09   | 1.21E+09   | -3.296547   | 0.0019*** |
| <i>LAB</i> (-1)   | -4.72E+09   | 1.14E+09   | -4.124083   | 0.0002*** |
| <i>RGDP</i> (-1)  | -0.132389   | 0.026746   | -4.949896   | 0.0000*** |
| C   | 2.07E+11    | 5.31E+10   | 3.894100    | 0.0003*** |
| <i>SHORT-RUN ESTIMATES</i>                                    |             |            |             |           |
| <i>D</i> ( <i>RGDP</i> (-1))                                  | 0.481941    | 0.112154   | 4.297119    | 0.0001*** |
| <i>D</i> ( <i>RGDP</i> (-2))                                  | 0.152031    | 0.092708   | 1.639880    | 0.1082    |
| <i>D</i> ( <i>M2</i> )  | 3.40E+09    | 1.37E+09   | 2.484905    | 0.0168*** |
| <i>D</i> ( <i>M2</i> (-1))                                    | -1.85E+09   | 1.32E+09   | -1.401537   | 0.1681    |
| <i>D</i> ( <i>M2</i> (-2))                                    | -2.28E+09   | 1.30E+09   | -1.750577   | 0.0870*   |
| <i>D</i> ( <i>M2</i> (-3))                                    | -1.37E+09   | 1.18E+09   | -1.157345   | 0.2534    |
| <i>D</i> ( <i>M2</i> (-4))                                    | -4.79E+09   | 1.92E+09   | -2.490550   | 0.0166*** |
| <i>D</i> ( <i>REM</i> )                                       | -8.36E+11   | 2.52E+11   | -3.314217   | 0.0018*** |
| <i>D</i> ( <i>REM</i> (-1))                                   | 1.17E+10    | 1.76E+11   | 0.066485    | 0.9473    |
| <i>D</i> ( <i>REM</i> (-2))                                   | 1.89E+11    | 1.65E+11   | 1.141483    | 0.2598    |
| <i>D</i> ( <i>REM</i> (-3))                                   | 1.54E+11    | 1.53E+11   | 1.005294    | 0.3203    |
| <i>D</i> ( <i>REM</i> (-4))                                   | 7.72E+11    | 2.02E+11   | 3.817333    | 0.0004*** |
| <i>D</i> ( <i>CR</i> )  | -6.93E+08   | 2.61E+08   | -2.650579   | 0.0111*** |
| <i>D</i> ( <i>GCF</i> _)                                      | -1.50E+10   | 3.93E+09   | -3.805513   | 0.0004*** |

TABLE 5. ARDL ESTIMATION OF THE SERIES:  $RGDP$ ,  $M2$ ,  $REM$ ,  $CR$ ,  $GCF$  and  $LAB$ 

| Dependent Variable: $RGDP$                                    |             |            |             |           |
|---|-------------|------------|-------------|-----------|
| Method: ARDL  |             |            |             |           |
| Sample: 1995Q01-2015Q04                                       |             |            |             |           |
| Automatic Model selection method: Akaike info criterion (AIC) |             |            |             |           |
| VARIABLE  | COEFFICIENT | STD. ERROR | T-STATISTIC | PROB.*    |
| $D(GCF(-1))$  | 2.84E+09    | 2.19E+09   | 1.294732    | 0.2022    |
| $D(GCF(-2))$  | 2.26E+09    | 2.27E+09   | 0.992827    | 0.3262    |
| $D(GCF(-3))$  | 2.49E+09    | 2.24E+09   | 1.110102    | 0.2730    |
| $D(LAB)$  | -7.61E+09   | 3.67E+09   | -2.071952   | 0.0442**  |
| $D(LAB(-1))$  | 1.36E+10    | 3.72E+09   | 3.659776    | 0.0007*** |
| $D(LAB(-2))$  | 3.92E+09    | 3.20E+09   | 1.226159    | 0.2267    |
| $D(LAB(-3))$  | 1.64E+09    | 3.01E+09   | 0.543676    | 0.5894    |
| $D(LAB(-4))$  | -6.93E+09   | 4.75E+09   | -1.459661   | 0.1515    |
| $D(LAB(-5))$  | 1.31E+10    | 3.54E+09   | 3.707406    | 0.0006*** |

Note: \*\*\* - represents 1% level of significance.

Source: Authors' estimation.

The results of long and short-run ARDL estimates were presented in Table 5. The findings indicate that there is a consistent positive relationship between the current GDP with that of the previous periods. The broad money as a percentage of GDP ( $M2_t$ ) for both short and long-runs are found to be statistically significant and positively related with GDP while its lag from periods one to four were negatively related with GDP growth. Again, remittance ( $REM_t$ ) captured the total workers' remittances to the government as a percentage of GDP and the result revealed a positive and statistically significant relationship for both the short and long runs except for the lags which were insignificant statistically. All lag periods to order four indicated a direct relationship with GDP growth. The implication of this result is that with consideration from the previous periods, an increase in remittances in the past would result in an increase in the current GDP. However, the reverse is the case with the current relationship. This is because evidence shows that remittance will not spur growth if access to banking services was limited.

It was puzzling to note that the financial sector credit as a percentage of GDP ( $CR_t$ ), which was a measure of financial development, does not exhibit short-run significance but became significance in the long run, even though it had a negative relationship with economic growth. The implication of this was that the sector did not perform adequately enough to impact long-run GDP growth positively. Furthermore,  $GCF_t$  and  $LAB_t$  (the gross capital formation and the labour ratio respectively) exhibited mixed relationships with GDP growth.

It was discovered that the previous lags were statistically insignificant while, the reverse was obtained in the case of the immediate lag of  $GCF$  which showed an inverse relationship with GDP growth in the long-run.  $LAB$  also concurred with the  $GCF$  result, except that there is a positive relationship between  $LAB$  and GDP growth in the short run. The clear implication of this result indicated that an increase in the  $GCF$  in the long run and at lag one would further cause a decrease in GDP growth in the South African economy.

## 5.6. ARDL error correction model

TABLE 6. ERROR CORRECTION RESULT OF THE SERIES: *RGDP, M2, REM, CR, GCF, LAB*

| VARIABLE | COEFFICIENT | Std. Error | T-STATISTIC | PROB.    |
|----------|-------------|------------|-------------|----------|
| ECT(-1)  | -0.36423    | 0.157900   | -2.292170   | 0.0306** |

Note: \*\* - represents 5% level of significance.

Source: Authors' estimation.

Since there is evidence of co-integration amongst the variables, the Error Correction Model was used to correct the maladjustment amongst the variables in the long run. The error correction coefficient showed the speed at which the variables return to equilibrium and adjusted to the right direction. Thus, it was discovered that ECM was negatively aligned with coefficient (-0.36423) which indicates that the disequilibrium of the past would take a moderate speed of 36 percent to adjust to long-run equilibrium on quarterly basis. Additionally, the significance of the probability value at 5 percent (0.0306) gives the assurance that long-run equilibrium can be achieved in each quarter. Hence, according to Rabbi (2011), it was asserted that a high significance co-integrating error term (ECT) affirmed the existence of a stable long-run equilibrium relationship amongst the variables under study.

## 5.7. Post estimation tests

### Serial correlation test

TABLE 7. SERIAL CORRELATION TEST OF THE SERIES:  
*RGDP, M2, REM, CR, GCF, LAB*

| <i>H<sub>0</sub>: There is no serial correlation</i> |          |
|--|----------|
| F-statistic  | 1.498970 |
| Prob   | 0.2048   |

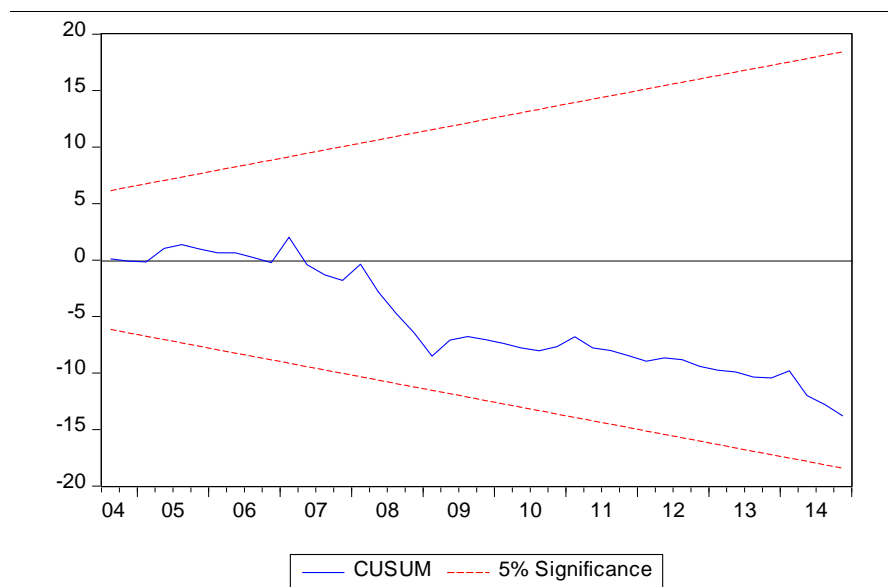
Source: Authors' estimation.

From the Breusch-Godfrey Serial Correlation LM test conducted, the null hypothesis of this study cannot be rejected because the probability is greater than 5 percent. Hence, there is no serial correlation in the model estimated in this study.

### Stability Test of the Model

The result from the CUSUM test (Figure 1) showed the stability nature of all the variables adopted in this study. The CUSUM test from the recursive estimate above further showed the stability of the fitted model. Since the blue line lies between the two red boundaries (lines), this model is very stable and can be relied upon.

FIGURE 1. CUSUM TEST



The CUSUM test from the recursive estimate (Figure 1) further shows the stability of the fitted model since the blue line lies between the two red boundaries (lines). Thus, the stability and the reliability of the model for policy formulation and implementation with regard to the South Africa economy are evident.

## 6. Implication of the findings and conclusions

A thorough examination of the relationship between financial development, remittances and economic growth in South Africa revealed that all the variables were stationary at level and first difference respectively. This is in tandem with the ARDL requirements established by Gerni et al. (2013), which clearly stated that ARDL accommodates variables that were stationary at level and at first difference. The long-run bound test revealed the existence of a long-run relationship amongst the variables under investigation, hence establishing the need for long-run and short-run estimates using the ARDL technique. The result of the long and short-run ARDL estimates indicate a consistent positive relationship between the current GDP with that of previous periods, whereas the broad money supply ( $M2_t$ ) for both the short and long runs are found to be statistically significant and positively related with GDP growth. Its lags from period one to four were negatively related to the GDP growth, thus, affirm the position of Chakraborty (2010). Furthermore, remittance ( $REM_t$ ) revealed a positive and statistically significant relationship for both the short and long runs except for the lags which were insignificant statistically. All the lag period to order four for the remittance indicated a direct relationship with GDP growth, which implies that an increase in remittance in the past resulted in an increase in the current GDP, whereas the reverse is the case with the

current relationship. This finding supported Chowdhury's (2016) study carried out on remittance and GDP but was contrary to the study carried out by Karagoz (2009) that revealed a negative relationship between remittance and economic growth. The financial sector credit ( $CR_t$ ) as observed, does not exhibit short-run significance but became significant in the long run and is negatively related with GDP growth, thereby conforming to the study by Chowdhury (2016) but negating the financial sector credit and economic growth nexus as posited by Inoubli (2011). In addition,  $GCF_t$  and  $LAB_t$  (the gross capital formation and the labour ratio respectively) revealed mixed relationships with GDP growth. It was discovered that the previous lags were statistically insignificant while, the reverse was obtained in the case of immediate lag of  $GCF$  as it showed inverse relationship with the GDP growth in the long run. A positive relationship was discovered between  $LAB$  and GDP growth in the short run.

Also, it was discovered that the disequilibrium of the past would takes a moderate speed of 36 per cent to adjust to long-run equilibrium on quarterly basis and based on Akinlo & Egbetunde (2010) studied. It can be asserted that co-integrating error term (ECT) affirmed the existence of stable and long-run equilibrium relationship among the variables under study, which was also affirmed by the CUSUM test for stability.

Based on these findings, the study concludes that remittance will spur growth if access to banking services can be improved upon. The financial development sector should be improved to engender enough and adequate performance that will leads to the effective impact of long-run GDP growth. An increase in the gross capital formation that can leads to the long-run decrease in GDP growth should be avoided in the South African economy. Policy makers should formulate policy that can improve financial development in order to enhance the country's economy to reaping the potential gains of remittances on economic growth. Above all, prompt attention should be given to re-structure remittance inflows in such a way that both financial sector and the economic growth will not be jeopardized.

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