Revisiting the Nexus of FDI-Led Growth Hypothesis and Economic Development in Rwanda: a Johansen-ARDL Approach to Cointegration

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Abstract

Poverty reduction and economic progress and development accentuate sustainability and growth. This study explores a new model that specifies the FDI-led growth theory for the Rwandan economy. An annual time series data from 1970 to 2018 was obtained from the World Bank. The Johansen cointegration and ARDL approaches were used after realizing a varied order of integration from the stationarity test by adopting unit root tests. All variables were established to wield a positive impact on economic development except financial development from the financial sector which was significant in the short run but insignificant in the long run. Financial development from the private sector, exchange rate, consumer price index, gross domestic product, and population wield significant influence on FDI inflow for economic development, which implies that an improvement in these factors will equitably support economic growth. In principle, 1% improvement in the financial development from the private sector and exchange rate will produce a corresponding 397% and 78% increase advancement in FDI inflows in the long run. Averagely, financial development from the private sector, exchange rate, consumer price index, gross domestic product, and population are valuable to the economy of Rwanda. Therefore, we recommend that the relevant authority expand regional and global bilateral and partnership to enhance the economy to fully reap the benefits of engaging in globalization.

Keywords Rwanda · Johansen cointegration · ARDL · Macroeconomic · FDI-led growth · Economic development

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Introduction

Labor and capital are main factors of economic growth in the neoclassical trade theories. Neoclassical trade theories unanimously encouraged trading between nations even where a country possesses absolute advantage in all factors of economic growth. Therefore, it suffices to conclude that, neoclassical economists propounded and laid the ground for globalization which is the sources of foreign direct investment (FDI)-led economic growth hypothesis. There abound studies on FDI-led hypothesis, albeit, their results are inconclusive. A chunk of research has praised FDI as an agent of economic development; however, others criticized its adeptness. For instance, Prebisch (1960) dependency theory disagreed with globalization-cum-modernization concept. It argues that globalization is an economic detriment to the developing world. Modern researchers such as Morrissey and Mold (2006), Ogujiuba and Omoju (2013), and Maune (2019) have in a way or the other concur with this theory. However, modern blueprint of internationalization and globalization through FDI is evident in transferring technology and human capital to accompany or support the local firms to produce the intended economic development (see Rahman & Mamun, 2016; Rani & Kumar, 2019). Specifically, Rahman and Mamun (2016) and Rani and Kumar (2019) found openness to trade induce economic expansion in the area of high productivity which led to economic progress in the Australian and BRICS economies, respectively. Likewise, the globalization theory confirms that modernization of developing nations benefits from open trade with the developed nations.

Previous studies that argue in favor of globalization based on its benefits such as Schmitt and Alexiou (2016) opined that free movement of capital comes with numerous advantages for the host nation. These benefits include creation of job opportunities, knowledge transfer, and economic development among others. This further strengthens the nexus of FDI-led growth argument which is arguably one of the reasons nations across the globe strive to develop and implement investment oriented economic and political policies in order to entice FDI inflow. Africa nations are not exempted from this and specifically Rwanda after the 1993 genocide which is evident in its annual growth reports (see The World Bank, 2020). Thus, Papageorgiadis et al. (2020) established an important relationship between institutional authorities and characters of their execution agents. Among other vital elements of FDI attractions are abundance of natural resources, modern infrastructure, standardized system, adequate availability of cheap, and competent labor (see Papageorgiadis et al., 2020). In the case of Rwanda, a relative political stability after the genocide, reliable economic policies, stable exchange rate, and increase in population are key attractive of FDI inflows. Recently, researchers such as Akinboade et al. (2006), Asamoah et al. (2016), Anarfo et al. (2017), Sunde (2017), Joshua (2019), Olorogun et al. (2020) and Olorogun (2021) explored the connectedness between FDI and economic expansion in South Africa, Nigeria, and Ghana respectively. Their results affirmed FDI as a driving force for economic development particularly Joshua (2019) found a long-run relationship between FDI and economic expansion. Likewise, Joshua et al. (2020a, b) operationalized the T & Y causality

test to investigate whether FDI-led economic growth in South Africa. Their results showed that FDI inflow is vital to economic expansion for South Africa.

Nonetheless, a number of previous researches have demonstrated a lack of connectedness between FDI inflows and economic development. Studies of Acaya et al. (2013); Khobaiet al. (2017); Borensztein et al. (1998); Joshua et al. (2020); Sarkodie and Adams (2018); Musso et al. (2006); Udi et al. (2020); Yalta (2013), as well as Zandile and Phiri (2019) found no relationship between FDI inflows and economic development on studies across African nations. This raises question as to the efficacy of FDI inflow led growth in Rwanda? Developing economies are well known to rely on external borrowings to support local savings have been perceived conventionally as an important tool for economic advancement. Others view the effective use of local resources to challenge economic distress. For example, Sulaiman and Azeez (2012) revealed the link between external debt and economic development in Nigeria; they discovered that external debt aids the race to economic expansion. This supported Fosu's (1996) finding that external debt inhibits economic growth in Sub-Saharan Africa. Other studies such as Umaru et al. (2013) examined the link between external debt and economic growth in Nigeria. The results showed that external debt impedes economic expansion in Nigeria.

Thus, the uncertainty effect of external influences on economic development accurately characterized the case of Rwandan economy (see No et al., 2008; The World Bank, 2020; Acaya et al., 2013). Add to this, Byukusenge (2016) investigated the effect of trade openness in amplifying inflation in Rwanda. The results showed a strong link between trade openness and inflation. This justified Zakaria's (2010), Tang et al. (2019) established positive relationship between inflation and trade openness. In Rwanda case, according to Byukusenge (2016), overreliance on importation was the main problem, as argued in Evans (2013). This was similar to Jonsson and Subramanian (2001) and Matlanyane and Harmse (2002) earlier conclusion that trade openness has a positive impact on South African economic expansion. On the contrary, Thurlow (2007) explored the effect of globalization in South Africa. The results indicate that trade openness is detrimental to economic growth by expanding the variation gap across the nation. This conclusion is similar to Udoh and Egwaikhide (2008), Varghese (2017), Zakaria (2010) and Byukusenge (2016) through inflation. Moreover, effective use of local resources, however, have been praised by researchers such as Havi and Enu (2014) found that financial sector development is a key to foreign direct investment inflow into Ghana. Thus, for real development to be realized from foreign direct investment, the financial sector is one of the vital economic sectors. This was in line with previous studies such as Olorogun et al. (2020) that accurate measurement of gross domestic product (GDP) should involve all sectors of economy in a country.

Despite enough studies on FDI-led growth hypothesis on African countries, nevertheless, study on this hypothesis on Rwanda is insignificant. Thus, this study focuses on Rwanda as one of the fast growing economies in Africa. Specifically, within the East Africa region, Rwanda's consistent 10% annual economic growth rate before the COVID-19 is well documented and mainly driven by key sectors (see The World Bank, 2020; Behuria & Goodfellow, 2016). There is no argument as to the existence of literature on Rwanda economic growth, nevertheless, available academic literature is scanty, period is less covered, etc. In fact, few existing empirical

studies on Rwanda have not investigated financial development such as the private sector in FDI led growth hypothesis. Exchange rates have been studied but limited period before 2015. Finally, consumer price index, population after the genocide have not been captured in previous literature. The World Bank (2020) asserts that the growth rate is expected to continue in 2020. Thus, the purpose of the study is to reinvestigate the nexus of FDI led growth theory in Rwanda.

Base on the above-stated research gaps on Rwanda, this study endeavors to accomplish these research gaps through exploring the nexus of FDI-led growth in Rwanda including variables such as financial development in the private sector, population as a proxy for labor, as well as consumer price index (CPI). Our results confirm FDI-led economic growth in the case of Rwanda. Specifically, our finding from ARDL model establishes a long-term coexistence between FDI and economic growth and expansion in Rwanda which uphold our initial assumption as to vital role of FDI inflows on economic expansion in Rwanda. Furthermore, our findings found positive and long-run relationship between FDI inflows and population. Similar positive coexistence was observed between FDI inflows and financial development in the private sector. However, we observed short-run connectedness between FDI inflows and financial development in the financial sector. It implies that most of the FDI inflows are not financial assets rather a solid and grounded long-term investments which is a priority for resilient economic development. Other variables such as exchange rate, CPI displayed a positive long-run and short-run significant relationships with FDI in the case of Rwanda. Overall, our Johansen cointegration results affirmed relevance and usefulness of our long-run analysis of FDI inflows led economic growth in Rwanda.

The rest of the study is arranged as follows: the next section is literature review and hypothesis, followed by methods and data, preliminary results, empirical results, and discussion, finally, conclusion and recommendations.

Literature Review and Hypothesis

Internationalization or liberalization of business is seen as a tool of conveying growth from a country to another. This assumption has been supported by some researchers such as Corden(1990), Faeth (2009), Batuo et al. (2018) and Joshua et al. (2020a, b) on the one hand. On the other hand, globalization has been viewed as hindrance to economic expansion particularly when trade is between developed and developing countries. Proponents of trade openness theory such as Parsons (1965) and Gouldner (1979) opined that international trade openness benefits the developing nations since it is a way of transferring development from highly focused regions to lower concentrated. Theoretically, the comparative cost theorist, i.e., Ricardo (1817) was in support of trade openness. Specifically, Ricardo (1817) opined that a nation should specialize in production of a commodity where it has opportunity cost advantage, i.e., lower opportunity cost over other production lines. This would allow for competitiveness in exportation at the global level and importation of commodities with comparatively high opportunity cost. In the same vein, Heckscher et al. (1991) trade theory focused on natural factors endowment discrepancies among the global economies as elements

that enforce globalization. Thus, production and exportation should be based on level factors endowment such as those endowed with capital-intensive products as applied to labor-intensive economies. Like pointed out in the previous sections, there is no consensus on positivity of trade openness on economic expansion.

Numerous theoretical based studies have coherently displayed several means in which trade openness or FDI inflows add to the growth of economies across the world. Alguacil et al. (2011) theoretically pinpoint avenues of optimizing long-term FDI inflows through local channels such as standardization of political and economic structure. Therefore, the extent to which FDI inflows is sustained depends on the reliability of political and economic structure of the host economy. According to Akinlo (2004) savings' rate, degree of trade openness, and level of technological advancement are as vital for FDI inflows as much as the political and economic structure. Furthermore, Gusarova (2019) opined that FDI among the BRICs nations is the main strength of their financial resilience against continuous uncertainty in the wake of trade war between the USA and China. Among these conditions for positive impacts of FDI inflow is that it must not lead to foreign remittances of profits by multinational corporations otherwise it would be a negative impact. Other studies such as Canh et al.'s (2020) study on 21 countries concluded that for FDI inflows to have a positive significant impact on a country, such a country must uphold a stable economic policy. Thus, economic policy instability renders FDI inflows ineffective. However, global economic policy instability could result in FDI inflows in a country.

Macroeconomic Indices and FDI

FDI led growth theory, similarly has been praised by one quarter and criticized by others. For instance, Joshua (2019) confirmed FDI led-growth theory in Nigeria which is confirmatory research to existing findings of Gungor and Katircioglu (2010), Gungor et al. (2014), Khobai et al. (2017), and Gungor and Ringim (2017). These researches contend that FDI serves as a mechanism for economic development across the areas of investigations. Add to this, researchers such as Sokhanvar (2019) and Kalai and Zghidi (2019) showed that inflow of FDI stimulates the process of economic expansion through enhancement of local investment, thus supporting FDI led-growth theory. Similarly, Ito et al. (2012), Pradhan et al. (2019), Hassouneh (2019), and Sarkodie and Strezov (2019) conclude that FDI inflow accelerates economic growth through its spillover effect such as technological transfer globally. Likewise, Tshepo (2014) and Sunde (2017) from their individual study on the subject-matter of discussion found that inflow of FDI is a stimulating force for economic development. Others previous studies such as Shahbaz and Rahman (2012), Omri and Kahoulb (2013), Almfraji and Almsafir (2014), Pandya and Sisombat (2017), and Abdouli and Hammami (2017) were of the same view. In the case of Rwanda, Tekin (2012) found that export from the service sector induced FDI inflow which is far strange from other studies that established a link between real gross domestic products and FDI inflow. In the same way, No et al. (2008) in their study on Rwanda using time series data from 1971–2003 asserted the nexus of FDI led-growth theory in Rwanda. Nonetheless, Kohler (2010), Zakaria (2010) and Byukusenge (2016) found that inflow from trade openness led to high inflation. Acaya et al. (2013) found a

neutral relationship between GDP and FDI. This inconclusive research output necessitates further probe on the subject-matter of investigation.

H1: FDI inflow induce economic development and expansion in Rwanda

Furthermore, exchange rate has been found to be relevant in FDI theory discussion. It has been found effective by some literature while others found its negative impact on economic development. For example, No et al. (2008) on the determinants of FDI inflows into Rwanda found that real exchange rate impacts FDI inflows in the short run but fade away in the long run. Similarly, Joshua et al. (2020a, b, c) in their study found exchange rate to assert a significant influence on economic expansion in South Africa. However, Zhang and Zhang (2018) exploration of exchange rate impact on the energy sector FDI inflow into China found a negative connection between FDI inflow and exchange rate. Population unlike exchange rate has been praised as an FDI inflow attractive mechanism. For example, Joshua et al. (2020a, b) has established a significant relationship between population and FDI inflows. Theoretically, population is a powerful tool in driving economic development. Population serves as a pool where both labor and consumer consumption are found. This was the basic idea of Ricardo (1817) on comparative advantage and Heckscher et al. (1991) on factor endowment international trade theories.

H2: Exchange rate has a significant impact in FDI led-growth in Rwanda

H3: Population has a significant impact in FDI led-growth in Rwanda

Microeconomic Indices and FDI

One of the common characteristics of developing economies specifically, African nations, is the impact of inflation. Inflation which is an excessive money supply through the central bank which impact could only be felt through continued increases in prices of goods and services. CPI is the relative measure of inflation (see Valli & Masih, 2014) which has not been among popular variables used to measure FDI-led growth models in previous literature. Most literature uses inflation as a variable. Thus, Valli and Masih (2014) found connectedness between FDI inflow and level of inflation in South Africa. Furthermore, earlier literature such as Friedman (1977), Grier and Perry (2000) Fountas et al. (2002), and Prah (2019) suggested that inflation causes uncertainty in macroeconomics and impedes economic growth. Thus, inflation targeting policy was found to be effective in the South Africa case. Sayek (2009) showed that inflation erode the purchasing power of household which means inflation has direct impact on CPI as much as it affects foreign investors, i.e., FDI. Thus, balance risk of inflation and growth is imperative for central banks whenever there is monetary surplus in an economy. In this study, we use CPI as a variable to replace popular inflation to capture whether the effect of inflation has a significant relationship on FDI inflow to Rwanda.

There has been a call on reformation of determinants of GDP. In order words, there is a consensus among contemporary economists as to accuracy of determinant of real gross domestic product. They found that current estimation of GDP is faulty as it does not account for all sectors in an economy. Thus, each sector has to be seen as an entity capable of contributing to economic development. For example, the financial sector should be calculated as a variable in determining real gross domestic

product. It justifies the use of financial development variables as a measure of FDI-led growth theory. Unlike CPI, finance development factors have been operationalized in establishing relationships between FDI and economic expansion. Havi and Enu (2014) studied financial development financial sector impact on FDI attraction into Ghana. They found a significant impact of the financial sector inducing FDI inflow into Ghana. Likewise, Prah (2019) explored sectoral contributions in FDI-led growth in Ghana. The results showed individual sectors have positive significance in FDI inflow and economic expansion. Moreover, financial development private sectors were found vital in FDI-led growth theory discussed (see Prah 2019). In the case of Rwanda, to the best knowledge of the researcher, there is few or no study which included population, CPI, financial development variables in their empirical or theoretical study. Therefore, in order to further investigate rapid economic expansion arising in the Eastern African region led by Rwanda.

H4: CPI is one the significant factors in continuous FDI-driven growth in Rwanda

H5: Financial development sectors or factors have a significant impact in FDI-led growth hypothesis in Rwanda

Previous studies such as Rani and Kumar (2019) implemented the ARDL procedure for panel data to investigate the FDI-led growth hypothesis. The study affirmed the indication of a long-run relationship among the variables. The study established a unidirectional causal impact from trade openness to economic development was observed for India and Brazil. Similarly, bidirectional relationship between trade openness and economic expansion in China. For the sake of brevity, all research findings validate the trade induce growth hypothesis. Financial development variables have been found to influence FDI inflows specifically, in Africa. For instance, Havi and Enu (2014) found a significant causality between financial development particularly financial sector and FDI inflow in Ghana. King and Levine (1992, 1993) used (m1 and m2) of GDP, domestic credit to the private sector and liquid liabilities as a measure of financial complexity. Likewise, Pesaran and Smith (1995), Pesaran et al. (2001), Manni and Afzal (2012), Olubiyi (2014), Jadoon et al. (2015), Kalu et al. (2016), Keho (2017), Kripfganz and Daniel (2018), and Maturure (2019) have adopted ARDL and cointegration models (e.g., Johansen 1988) to establish the nexus between FDI and economic expansion in different aspects of economies across the globe.

Data, Model Specification, and Methods

Data and Sources

Current study explores the long-run and short-run cointegration and causality connections between GDP, financial development, consumer price index, and macro-economic variables such as exchange rates and population in the case of Rwanda as the rising of the East-African nations' economies. We obtained an annual time series form the World Bank (www.data.worldbank.org) covering from 1970 to 2018. Pursuant to the objectives of this study, real GDP (constant 2010\$), CPI (2010 = 100) which is changes in the cost of average consumer acquiring basket of goods and services defined which can be at fixed or dynamic as the case may be, exchange

rate, financial development from financial sector (FD_FS) (%GDP), FDI (%GDP), financial development from private sector (FD_PS) (%GDP), and population (POP) (see Lipsey and Chrystal 2006; Li et al. 2019) in terms of total residents regardless of residency status. Qamruzzaman and Jianguo (2018), Papageorgiadis et al. (2020), and Joshua et al. (2020a, b, c) have adopted GDP as a representation for assessing economic growth in several nations across the globe.

Model Specification

Opposite to the previous model advanced in Joshua et al. (2020a, b, c), the specification of model adopted in this paper has FDI as the dependent variable. Our regressors consist of financial development from the private sector, financial (see development from the financial sector Narayan 2005), exchange rate, consumer price index, gross domestic product and population as depicted above. Therefore, our linear model is stated as:

$$FDI = f(FD_PS, FD_FS, EXCHR, CPI, GDP, POP) \quad (1)$$

$$\ln FDI_t = \beta_0 + \beta_1 \ln FD_PS_t + \beta_2 \ln FD_FS_t + \beta_3 \ln EXCHR_t + \beta_4 \ln CPI_t + \beta_5 \ln GDP_t + \beta_6 \ln POP_t + \varepsilon_t \quad (2)$$

wherein β 's are the coefficient of estimated parameter, $\ln FDI$, $\ln FD_PS$, $\ln FD_FS$, $\ln EXCHR$, $\ln CPI$, $\ln GDP$, and $\ln POP$ are the logarithmic rate of the series, ε_t is the error term.

Empirical Investigation Arrangements

The current investigation charts four paths: firstly, exploration of basic central tendency statistics and correlation enquiry. Secondly, we follow this by stationarity test for characters of all defined series with a sequence of test methods such as orthodox augmented Dickey–Fuller (ADF) and Philips–Perron (PP) in order to establish robustness that explicates structural break in its simplest form. Thirdly, novel ARDL model would be use to explore the long- and short-run connectedness among the series. With conjecture and evidence of endogeneity between some of the variables, Johansen cointegration would be adopted to establish the model's overall long-run cointegration. Finally, traditional granger causality would be adopted to explore causation and direction among the group under investigation.

Traditional Unit Root Tests

Existing literature has shown that time series data and as well as macroeconomic variables such as GDP and FDI exhibit trending behavior in mean (Gujarati, 2009). One of the key values of econometric procedures is to determine the nature of such trending characteristics Table 4. This is in order to eliminate such a trend before putting them to analysis.

Thus, stationarity test Table 4 is vital because it enhances the capacity of selecting methods of analysis, ultimately eliminating chances of specious and erroneous estimation. Therefore, we adopted the ADF, PP, and KPSS unit root tests developed by (see Dickey & Fuller, 1981; Phillips & Perron, 1988).

The equation is stated as follows:

$$\Delta X_t = \beta_1 + \beta_2 + \delta X_{t-1} + \sum_{i=1}^k \alpha_i \Delta X_{t-i} + \varepsilon_t \quad (3)$$

In Eq. 3, ε_t is the error term catering for the Gaussians white noise which value is assumed to be zero and probably with autocorrelation that represent the series to be regress by period t .

Cointegration Test

Since our variables are found to nonstationary at level and as well the same in the same integration order at $I(1)$; thus, we adopt in Table 5 the Johansen and Juselius cointegration (see Johansen 1988; Johansen & Juselius, 1990) and used by Chontanawat (2020). We begin our estimation by computing the unrestricted vector autoregressive (VAR) model wherein the vector of the variables ($X - 1$) at t are associated to the vectors of previous variables. Granger specification theorem state that X_t has a vector auto-regressive error correction representation in the following equation.

$$\Delta X_t = \beta_1 + \beta_2 + \Pi X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \emptyset D_t + \varepsilon_t \quad (4)$$

wherein $\Pi = \sum_{i=1}^q A_i - I$ and $\Gamma_i = -\sum_{j=i+1}^q A_j$

X_t is $(X - 1)$ dimension vector in relation to the total number of variables in the series wherein all variables are $\sim I(1)$. Similarly, Π , Γ , $\emptyset$ are parameters to be estimated. Furthermore, D_t is the vector with deterministic element (constant and trend) and ε_t is the error term that follows Gaussian white noise with zero mean and constant variance. Specifically, our interest is on Π which has a long-run effect and a speed of adjustment. If $\Pi = 1$ it means there is one single cointegration vector. In other words, one linear combination which is stationary in a way that the integration of Π can be decomposed into $\Pi = \alpha \beta'$ where α represents the vector speed of adjustment and β denotes vector of long-run equilibrium. Therefore, X_t denotes $I(1)$; however, the specification $\beta' X_{t-1}$ represents $I(0)$. The Johansen procedure in Table 5 is to determine the matrix of Π based on an unrestricted vector auto-regressive and as well test whether we reject the implied restriction through the reduced Π rank. Generally, the trace test and maximum eigenvalue are two popular procedures of estimating the reduced Π rank.

$$\lambda_{trace} = -T \sum_{i=r+1}^k \ln(1 - \lambda_i^2) \quad (5)$$

$$\lambda_{\max}(r, r+1) = -T \ln(1 - \lambda_{r+1}) \quad (6)$$

λ_i is the ordered eigenvalue acquired from estimated matrix; T is the number of observations after lag adjustment. The null hypothesis for the trace test is that the number of distinct cointegrating vectors is less or equal to r as opposite to all alternatives. However, the maximal eigenvalue test's hypothesis states that the number of cointegrating vectors is r against the alternative of $r+1$.

Previous literature such as Engle and Granger (1987) indicated that if a cointegration is established among the variables in the model, an error correction model (ECM) Table 6 is imperative to be estimated. The vector error correction model which allows for long-run equilibrium and short-run dynamic is expressed as follows:

$$\begin{aligned} \Delta \ln FDI_t = & \beta_0 + \sum_{i=1}^p \beta_1 \Delta \ln FD_PS_{t-i} + \sum_{i=1}^p \beta_2 \Delta \ln FD_FS_{t-i} \\ & + \sum_{i=1}^p \beta_3 \Delta \ln FDI_{t-i} + \sum_{i=1}^p \beta_4 \Delta \ln EXCHR_{t-i} \\ & + \sum_{i=1}^p \beta_5 \Delta \ln CPI_{t-i} + \sum_{i=1}^p \beta_6 \Delta \ln GDP_{t-i} \\ & + \sum_{i=1}^p \beta_7 \Delta \ln POP_{t-i} + \lambda_i ECT_{t-1} + \varepsilon_t \end{aligned} \quad (7)$$

where ECT_{t-1} is the cointegration equation. The ECT_{t-1} is the long-run equilibrium association. However, the coefficients of the lagged difference are the short-run dynamics. The ECT_{t-1} coefficient shows the speed of adjustment which leads the variable to a long-run equilibrium.

Results and Discussion

Figure 1 displays the trends of the series under study showing the real behavior of macroeconomics. Similarly, it is noteworthy that the rate of dispersion of the variables as shown in Table 1 from their respective means are observed. Variables such as FDI, FD_PS, FD_FS, CPI, and POP are negatively skewed. Concerning the relevance of each variable in the model, Jarque–Bera test (p value > 0.05) among the series except FDI where (p value < 0.05) indicates that the series is moderately normally distributed. Accordingly, the correlation matrix Table 2 points to a nearly perfect connection among the variables. For example, FDI and GDP were correlated which affirms previous findings by Emir and Bekum (2019) and Joshua (2019). Conclusively, FDI could be a potential stimulus of economic growth in the same way GDP has a significant impact on FDI (Table 3).

The computed results depict that the variables significantly correlate to FDI pointing to the fact that the series can be adopted to forecast the economic progression in Rwanda. Likewise, our findings reveal that the exchange rate has a link to FDI as

Fig. 1 Movement of residual trend among the series under study: (i) LNFDI, (ii) LNFD_PS, (iii) LNFD_FS, (iv) LNEXCHR, (v) LNCPI, (vi) LNGDP, (vii) LNPOP. GDP is the real gross domestic product (constant 2010\$), FDI is foreign direct investment net inflow (%GDP), FD_PS is financial development from private sector, FD_FS is the financial development from financial sector, CPI is consumer price index (2010 = 100), EXCHR is the official exchange rate, and POP is the total population

earlier anticipated. The consequence is that Rwanda’s FDI inflows were from abroad in foreign currencies (US dollars). Thus, it is easy to predict against any future economic growth. Our ADF and PP results in Table 4 indicate that FDI is stable at level while all series are stationary at first-difference at a 5% significance level. Therefore, the overall result shows a mixed cointegration as evident in Table 4. This condition necessitates the performance of Johansen cointegration test to establish whether there is long-run cointegration and the speed of adjustment among the series.

Table 1 Descriptive statistics

	LNFDI	LNFD_PS	LNFD_FS	LNEXCHR	LNCPI	LNGDP	LNPOP
Mean	−.522643	2.113501	2.376822	5.247135	3.110377	21.84045	15.76495
Median	−.271161	2.130002	2.481127	4.863504	2.897223	21.72439	15.76472
Maximum	1.454475	3.076726	3.348252	6.471784	4.987988	23.06909	16.35134
Minimum	−8.927495	0.711264	1.170422	4.336607	0.883730	20.99266	15.13923
Std. dev	1.660205	0.582238	0.452647	0.820218	1.315603	0.588047	0.342111
Skewness	−2.737667	−.289202	−.625372	0.348496	−.158670	0.519255	−.063839
Kurtosis	14.56774	2.729554	3.565425	1.339586	1.732306	2.332064	1.989928
Jarque–Bera	334.4087	0.832373	3.846639	5.945084	3.486662	3.112809	2.159474
Probability	0.000000	0.659557	0.146121	0.051173	0.174937	0.210893	0.339685
Observations	49	49	49	44	49	49	50

Table 2 Correlation matrix

	LNFDI	LNFD_PS	LNFD_FS	LNEXCHR	LNCPI	LNGDP	LNPOP
LNFDI	1.000000						
LNFD_PS	0.188350	1.000000					
	1.242891						
	0.2208						
LNFD_FS	-0.474928	0.140900	1.000000				
	-3.497496	0.922341					
	0.0011**	0.3616					
LNEXCHR	0.133718	0.758586	0.055666	1.000000			
	0.874445	7.545135	0.361320				
	0.3868	0.0000***	0.7197				
LNCPI	0.153046	0.903950	0.083500	0.920912	1.000000		
	1.003677	13.69915	0.543035	15.31204			
	0.3213	0.0000***	0.5900	0.0000***			
LNGDP	0.505704	0.836868	-0.090969	0.745235	0.847436	1.000000	
	3.798894	9.907720	-0.591998	7.243049	10.34478		
	0.0005***	0.0000***	0.5570	0.0000***	0.0000***		
LNPOP	0.259533	0.921010	0.122018	0.812405	0.938951	0.935123	1.000000
	1.741647	15.32277	0.796722	9.029392	17.68656	17.10390	
	0.0889*	0.0000***	0.4301	0.0000***	0.0000***	0.0000***	

FDI signifies foreign direct investment net inflow (% of GDP), FDPS is financial development private sector, FDFINS is financial development financial sector, GDP is the real domestic product (constant 2010, US\$), official exchange rate, consumer price index, GDP population

***, **, and * denote 1%, 5%, and 10% significance level

Table 5 presents the results of Johansen cointegration test, and the trace and maximum eigenvalue tests uniformly indicate the rejection of the null hypothesis that there is no cointegration among the series. However, both trace and maximum eigenvalue tests unanimously show the same conclusion that there are two cointegration relationships at a 5% significance level. Shown in Table 3 is the lag selection criteria for the ARDL estimation. We selected optimal lag according to Akaike information criteria for the ARDL. As evident in Table 5, the regressors account for above 300% of the target variable. Tables 6 and 7 depict the short-run and long-run relationship among the series from the ARDL estimation, respectively, as a result of mixed order integration in the unit root tests. The result shows that FDI inflow is a

Table 3 Lag selection model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-62.68454	NA	7.06e-08	3.399246	3.691807	3.505781
1	260.0492	519.5226	1.16e-13	-9.953618	-7.613130	-9.101342
2	372.3308	142.4060	6.57e-15	-13.04053	-8.652112	-11.44251
3	495.5697	114.2214*	3.30e-16*	-16.66194*	-10.22559*	-14.31818*

LR sequential modified LR test statistic (each test at 5% level), FPE Final prediction error, AIC Akaike information criterion, SC Schwarz information criterion, HQ Hannan-Quinn information criterion

* indicates lag order selected by the criterion

Table 4 Traditional unit root test

	Level		First difference	
	ADF	PP	ADF	PP
lnFDI	−4.4715***	−4.7059***	−8.0598***	−15.2473***
lnFD_PS	−1.7119	−1.5044	−9.7882***	−18.8744***
lnFD_FS	−1.8186	−1.8186	−6.2036***	−6.1765***
lnEXCHR	0.3413	0.2274	−5.2088***	−5.2057***
lnCPI	−1.0513	−.9919	−5.5892***	−5.6195***
lnGDP	0.1215	0.1877	−7.2136***	−7.2136***
lnPOP	−.4873	−.7213	−3.1421**	−2.7060*

FDI signifies foreign direct investment net inflow (% of GDP), FDPS is financial development private sector, FDFINS is financial development financial sector, GDP is the real domestic product (constant 2010, US\$), official Exchange rate, Consumer price index, GDP population

***, **, and * denote 1%, 5%, and 10% significance level

fundamental to economic expansion in Rwanda. This is in line with previous studies such as Khobai et al. (2017) and Sunde (2017) and Goh et al. (2017) findings on South Africa and Asian economies, respectively. The similarities could be as a result of level economic dispositions. In other words, they are all emerging economies. Particularly, a 1% FDI inflow will cause a significant renovation of GDP in the short run and long run in the case of Rwanda. This shows that FDI to Rwanda is a key and vital agent of economic development.

Despite the Johansen cointegration results in Table 5 display of a long-run and speed of adjustment among the series. Specifically, Table 7 indicates that financial development of the private sector exhibits a significant relationship with FDI confirming the FDI led-growth hypothesis. This result indicates that 1% FDI inflow will generate about 397% expansion in the private sector thereby inducing economic expansion. On the contrary, financial development of the financial sector depicts an insignificant transformation of economic development in the long run. This was in contrast with Havi and Enu (2014) findings on the significant role of financial development variables such as financial sector in induced economic growth theory in

Table 5 Johansen cointegration trace and max-eigen test results

Hypothesized no. of CE(s)	Eigenvalue	Trace statistic	Max-eigen statistic	Prob.**
None *	0.940598	301.1697	115.7607	0.0000
At most 1 *	0.846540	185.4090	76.84694	0.0000
At most 2 *	0.778623	108.5621	61.82338	0.0000
At most 3	0.380777	46.73869	19.65091	0.0634
At most 4	0.344435	27.08777	17.31260	0.0995
At most 5	0.212127	9.775176	9.775176	0.2984
At most 6	3.12E-10	1.28E-08	1.28E-08	0.9998

Trace and max-eigen test statistics indicate 3 cointegrating eqn(s) at the 0.05 level

* Rejection of the hypothesis at the 0.05 level, and *p* value is MacKinnon et al. (1999)

Table 6 ARDL short-run results

Cointegrating form variable	Dependent variable: ΔLNFDI		
	Coefficient	Standard error	t-Statistics
$\Delta \text{LNFDI}(-1)$	1.535778	0.225290	6.816886***
$\Delta \text{LNFDI}(-2)$	0.678556	0.126775	5.352445***
$\Delta \text{LNFDI}(-3)$	0.368805	0.062616	5.889902***
$\Delta \text{LNFD_PS}$	-3.055121	0.516168	-5.918846***
$\Delta \text{LNFD_PS}(-1)$	7.496884	0.816829	9.178039***
$\Delta \text{LNFD_PS}(-2)$	3.576218	0.628113	5.693589***
$\Delta \text{LNFD_PS}(-3)$	0.932456	0.406778	2.292299**
$\Delta \text{LNEXCHR}$	1.900330	0.718137	2.646194*
ΔLNCPI	9.328410	1.467475	6.356774***
$\Delta \text{LNCPI}(-1)$	5.949225	1.169730	5.085983***
$\Delta \text{LNCPI}(-2)$	7.579764	1.308788	5.791436***
ΔLNGDP	8.679683	0.649761	13.35827***
ΔLNPOP	142.9918	23.28333	6.141381***
$\Delta \text{LNPOP}(-1)$	-202.5017	36.26376	-5.584134***
$\Delta \text{LNPOP}(-2)$	160.2371	23.95592	6.688828***
$\text{ECT}(-1)^*$	-3.137229	0.317133	-9.892468***

FDI signifies foreign direct investment net inflow (% of GDP), FDPS is financial development private sector, FDFINS is financial development financial sector, GDP is the real domestic product (constant 2010, US\$), official exchange rate, consumer price index, GDP population

***, **, and * denote 1%, 5%, and 10% significance level

Ghana. It suffices to conclude that majority of FDI inflows into Rwanda are mostly infrastructural and physical investment not concentrated financial assets as the case may be.

Table 7 ARDL long-run results

Dependent variable: ΔFDI			
Variable	Coefficient	Std. error	t-Statistic
LNFD_PS	-3.979620	0.838833	-4.744235***
LNFD_FS	0.120598	0.098793	1.220711
LNEXCHR	-.786322	0.178653	-4.401398***
LNCPI	-.367530	0.202689	-1.813266*
LNGDP	5.095309	0.264452	19.26743***
LNPOP	3.250163	1.707926	1.902989*
C	-151.1690	20.99062	-7.201740***

FDI signifies foreign direct investment net inflow (% of GDP), FDPS is financial development private sector, FDFINS is financial development financial sector, GDP is the real domestic product (constant 2010, US\$), official exchange rate, consumer price index, GDP population

***, **, and * denote 1%, 5%, and 10% significance level

Table 8 ARDL bounds test

Test statistic	Value	Signif	I(0)	I(1)
F-statistic	8.664770***	10%	1.99	2.94
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

Likewise, exchange rate attests to impact FDI inflow and economic expansion positively. The findings show that exchange rate imposes a strong and positive influence on FDI inflow and speed of economic expansion of Rwanda in the long run. This result validates the studies of Katusiime et al. (2016) in the case of Uganda and Sunde (2012) in the case of South Africa. In the long run, a 1% improvement in the exchange rate would translate into a significant increase in economic development through FDI inflow by 78% in the case of Rawanda. This outcome is in consonant with Payne and Merva (2010) findings on Croatia. In general, our estimation reveals a long-run cointegration among the series showing an imminent co-movement which is attained by a speed of adjustment of 313%. The ARDL bound test in Table 8 shows that the F-statistic is more exciting than the critical values of the upper-bound I(1). The result led to the rejection of the null hypothesis of no cointegration among the series. This confirms our research objective of a strong relationship between the response variable and the predictors in the model, establishing a cointegration which led to conduction of a more parsimonious ARDL model as discussed in previous sections.

Our model was validated using several diagnostic tests (Table 9, Figs. 2 and 3). Table 9 comprises Lagrange multiplier Jarque–Bera for normality test, Breusch–Pagan–Godfrey for heteroskedasticity test, the CUSUM and CUSUMSQ plots for stability test, and Q-statistic for serial correlation. The results show that JB statistic for normality test ($p - value > 0.05$), heteroscedasticity error ($pvalue > 0.05$), the serial correlation, i.e., Q-statistics ($pvalue > 0.05$) as shown in the Appendix. Figures 2 and 3, i.e., the CUSUM and CUSUMSQ plots, are within the 95% confidence interval showing a stability of the model under estimation. Conclusively, the model is sufficient for an unbiased decision making and policy endorsement. We further conduct the granger causality test among the variables. Table 10 shows the results of the causations among the series. The results indicate a noncausal connection between foreign direct investment (FDI) and financial development in the private sector (FD_PS).

Table 9 Diagnostic tests

Diagnostic test	Coefficient	$p > 0.05$
Normality (J-B)	0.8751	0.6456
Breusch–Pagan–Godfrey	1.1090	0.4194
ARCH	2.300257	0.1379
CUSUM	Stable	
CUSUM of sq	Stable	
Serial correlation: Q-statistic	Appendix

Fig. 2 CUSUM plot

However, we found unidirectional causal effect between FDI and financial development at financial sector, i.e., FDI Granger causal financial development from the financial sector. A similar unidirectional causal relationship is observed between FDI and exchange rate, FDI Granger causal exchange rate but not vice versa. Likewise, unidirectional causal connection between FDI and CPI. Furthermore, a surprising noncausation was observed between FDI and GDP. Finally, we found a bidirectional

Fig. 3 CUSUMSQ plot

Table 10 Granger causality test results

Null hypothesis	Obs	F-statistic	Prob
LNFD_PS does not Granger cause LNFDI	47	0.87308	0.4251
LNFDI does not Granger cause LNFD_PS		1.09395	0.3442
LNFDI does not Granger cause LNFD_FS		4.04611	0.0247**
LNEXCHR does not Granger cause LNFDI	42	0.58479	0.5623
LNFDI does not Granger cause LNEXCHR		19.3093	0.0000***
LNCPi does not Granger cause LNFDI	47	1.64524'	0.2052
LNFDI does not Granger cause LNCPi		35.4746	0.0000***
LNGDP does not Granger cause LNFDI	47	0.84992	0.4347
LNFDI does not Granger cause LNGDP		0.96398	0.3896
LNPOP does not Granger cause LNFDI	47	4.12280	0.0232**
LNFDI does not Granger cause LNPOP		3.17600	0.0519**

FDI signifies foreign direct investment net inflow (% of GDP), FDPS is financial development private sector, FDFINS is financial development financial sector, GDP is the real domestic product (constant 2010, US\$), official exchange rate, consumer price index, GDP population

***, **, and * denote 1%, 5%, and 10% significance level

causal relationship or granger causality between population and FDI inflow. This suggests that FDI inflows to some extent, determine the rate of economic development and growth in Rwanda. Ceteris paribus, for Rwanda, attracting more foreign investments deserve serious attention for sustainable economic expansion.

Conclusion and Recommendations

It is debatable to reach a conclusion as to whether globalization induced global transformation. FDI which is the main agent of globalization has not received a consensus among researchers as evident in previous literature. Thus, we examined the connection between FDI inflow and economic development to establish whether FDI inflows aid Rwanda. Findings from our results indicate a significant relationship which is enough to ascertain the FDI-led growth hypothesis supporting the globalization theory. Our findings indicate that FDI has a strong and long-run association on the economic development in Rwanda which is informative for policy adjustments in the economic structure. Add to this, our results show that financial development from the private sector, exchange rate, consumer price index, gross domestic product, and population has a positive effect on economic expansion. It implies that external capital inflows to support domestic economic activities in meeting up with the investment demand would result in a positive outcome. As a result, globalization by ways of gains from international economic integration through technological transfer, etc. will definitely enhance the local economy. By and large, overall results indicate that FDI inflows are vital in Rwandan’s quest for economic development and expansion.

Therefore, we recommend that there is a need for Rwanda to open its economy by engaging in more regional and global bilateral agreements with other economies for interaction and reciprocal benefits. This would accelerate the domestic economy's transformation by link of foreign development into a matured and competent economy. Absolutely, FDI inflows majorly for an economic reason would enhance the Rwandan economy to be fully integrated without the need of taking foreign loans. If the FDI inflows were properly directed to productive sectors of the economy would bring the anticipated development.

Lastly, the authorities should prioritize exchange rate stability policy for the economy. Currency devaluation should never be an option. Export-oriented economic policy should be preferred above import-oriented economy. This is because export-oriented would be sufficient to control foreign exchange volatility. Therefore, we encourage the authorities to implement policies that would encourage exports such as elimination of export tariffs, subsidies for domestic exporters, easy licensing procedures, and increase of tariffs on imports of products that are produced locally. Akinboade et al. (2006), Anarfo et al. (2017) and Asamoah et al. (2016) are on the FDI impact across sub-Saharan Africa; Tang et al. (2019) on trade openness and economic development using Mauritius as a case study; Corden (1990), and Faeth (2009) are on the theory of international trade and determinants of FDI respectively.; Hassouneh (2019) and Ito et al. (2012), Kohler (2010) are on the spillover benefits or a lack of benefits from the international trade through FDI.; Johansen (1988) under Johansen cointegration; Pesaran and Smith (1995), Pesaran et al. (2001) and Kripfganz and Daniel (2018) are on the long-run covariance among the series using ARDL procedures.; Li et al., (2019) and Lipsey and Chrystal (2006) on population as a driver of FDI inflows and economic development.; Narayan (2005) on justification of financial development variables particularly in the financial sector.; Sarkodie and Adams (2018) institutional issues inhibiting FDI inflows and economic development in Africa using South Africa as an example.; Oxelheim and Ghauri (2008) contention on FDI attraction and Udoh and Egwaikhide (2008) and Varghese (2017) on impacts of exchange rate, inflation on FDI inflows.

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