

Re- Examining Linkages between Financial Development, Openness and Vulnerability of Economic Growth in Rwanda using ARDL Application

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Abstract

Investigating the link between the real economy and its factors is vital, as financial development can play a critical role in economic growth and economic vulnerability. This study examines the role of stock financial development and country risk (economic vulnerability) on economic growth, and the moderating influence of country risk in the stock market and economic growth nexus in Rwanda economy over the period of 1995 to 2017. The study employed an econometric technique, including auto-distributive lag (ARDL) for examining long-run and short run relationship, among the variables. The study explored that the economic vulnerability (EVI) is negatively associated with economic growth. Also, the study highlighted the positive impact of openness and financial development on economic growth. The study also suggests that the financial development is solution to solve the negative impact of economic vulnerability on economic growth. Finally, the study suggests some policy recommendations based on the empirical results.

Keywords: *Economic growth, economic vulnerability, financial development, ARDL.*

1. Introduction

The predatory connections that global capitalism has in times of crisis has, through commerce, finance, investment, and labor migration with Africa have grown more precarious since the last crisis in 2008.

Africa is now far more susceptible to the "land grabbing" issue linked to the growth of biofuels. The middle class in Africa has grown somewhat concurrently, but this is deceptive since national financial liberalization has improved credit availability, which has contributed to increase spending but also excessive debt.

Africa's status has not altered, and although development assistance has increased for about fifteen "fragile states," Africans have not profited from North-South flows. African economies are both robust and sensitive to local and global economic and environmental crises due to a number of factors. Among these include a world economy that is unstable and excessive financial and trade integration.

However, Africa has become interested in the notions of "state of development" and "development mentality" due to its recent rapid economic expansion. Even if the favorable prices of primary goods, particularly oil, are mostly to blame for the expansion, certain less resource-dependent nations have also seen significant growth. Some nations, including Tanzania, Rwanda, and Kenya, have even gone so far as to resist financial and commercial pressures.

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Following the early 1990s genocide and civil conflict, Rwanda's economy continued to thrive. Since 2000, Rwanda's government has grown quickly, and as part of its 2020 strategy, the services sector will receive more attention in an effort to accelerate economic growth. The goal of having 90% of Rwandan inhabitants financially included by 2020 is established in this direction.

Rwanda has implemented a number of policies aimed at increasing economic growth and lowering economic vulnerability. These tactics include the creation of SACCOs for each of Rwanda's 416 sectors and the licensing of different foreign commercial banks. Finding out if the Rwandan government's efforts have been successful is crucial information for scholars.

We carried out this analysis on Rwanda's economic growth, trade openness, financial development, and vulnerability in this setting. Considering that, the global policy goal for sustainable economic development now includes financial development, (Park & Mercado, 2015).

Providing a theoretical and empirical evaluation of the relationship between financial development, trade openness, economic vulnerability, and economic growth for the Rwandan economy is the goal of this paper. Then, we make an effort to demonstrate how financial development can lessen the detrimental effects of economic fragility on this nation's economic growth.

We will divide our work into two portions in order to tackle this difficulty. A summary of the research on the connections between financial development, trade openness, vulnerability, and economic growth is presented in the first section. The impact of financial development, openness, and economic vulnerability on economic growth is empirically analyzed in the second section.

2. Literature review

The economic literature, which ranges from King and Levine to the groundbreaking works of Goldsmith (1969), McKinnon (1973), and Shaw (1973), discusses the relationship between the growth of the financial system and economic progress. (1993). One of the key areas of ongoing discussion among scholars and decision-makers is the correlation between financial development and economic growth. (Guidotti and De Gregorio, 1995).

The link between finance and economic growth has received enough attention, with the ideas of financial repression and financial deepening receiving the most attention. According to Agnello et al. (2012), financial reform helped to improve income disparities for the sake of economic growth. According to Asteriou and Spanos (2019), financial development prior to a crisis may help the economy flourish, while financial development following a crisis may have the opposite effect. According to Wong et al. (2021), the quality of urban economic growth is positively impacted by the geographical agglomeration of financial services.

According to Godwin M. et al. (2020), Samson E. (2020), and Standley (2010), one characteristic of Africa is its undeveloped capital markets. Despite the recent expansion of financial markets, the financial sector in African nations is not supporting economic growth to the required extent. The high degree of the region's economic growth's susceptibility to external shocks might be partially explained by the deceleration in the financial system's development in Africa.

Indeed, a lot of research has been done on how vulnerable African nations are economically. According to Guillaumont (2014), vulnerability is "the chance that a nation will be impeded by exogenous shocks, whether they are external (such as a decline in trade) or natural (like droughts)." General vulnerability also includes the impact of

current and future strategies and changes more quickly than structural vulnerability, which only contains factors that are totally influenced by external and enduring forces and are not dependent on a nation's current policies.

Due to their susceptibility to outside shocks, low-income nations are largely unintentionally vulnerable (Danielsson et al., 2018). Its political character is further enhanced by the fact that it is subject to national will. Ultimately, the emergence of exogenous "shocks" stems from the instability of economic situations.

Africa's increasing vulnerability means that it has to be considered a significant barrier to economic expansion. The effect of economic volatility on growth has been the subject of numerous research (Cariolle et al., 2015). The economy of African nations are, in fact, more erratic than those of other developing nations. However, the expansion of Africa has slowed down because of this instability.

We think that the main factor elucidating the impact of vulnerability on economic growth is financial liberalization.

Considering the shortcomings of the financial systems in African nations and their uneven development, the majority of research studies only concur that financial development has a marginally favorable impact on growth in the continent. Growth is positively impacted by the financial sector's development, according to a number of studies (Pradhan, Arvin, Hall, & Nair, 2016; Durusu-Ciftci, Ispir, & Yetkiner, 2017; Christopoulos & Tsionas, 2000; Beck, Levine, & Loayza, 2000).

Moreover, financial development can serve as an armor against economic vulnerabilities in addition to acting as a mediator for economic growth. It lessens the effect of outside shocks on a nation's economy.

This research stands out from others because it examines how the financial sector contributes to economic growth in vulnerable African nations while also taking trade openness into consideration.

We make many contributions to the body of current literature. Our empirical approach first looks at how important the consequences of economic vulnerability are in relation to economic growth. Our work discovers characteristics that might assist economies achieve economic stability by lowering economic vulnerability by determining the relative relevance of various variables.

3. Data and Methodology

3.1 Data

The main objective of this research is to investigate how Rwanda's economic growth is impacted by financial development within the framework of trade openness and economic vulnerability. The application of observations from 1995 to 2017 will serve as the foundation for the empirical implementation.

The econometric analysis's description of the model is displayed in Eq. (1):

$$\ln \text{GDP} = C_0 + \alpha_1 \ln \text{EVI}_t + \alpha_2 \ln \text{FD} * \text{EVI}_t + \ln \text{OPEN}_t + \varepsilon_t \quad (1)$$

Where:

- $\ln \text{GDP}$ is the log of real gross domestic product (GDP) (dependent variable) (data from the World Bank).
- $\ln \text{EVI}$ is the log of economic vulnerability, which is the likelihood that unanticipated external shocks may hinder a nation's economic growth. (Guillaumont, 2008; 2009). Ferdi has validated as the definition of the Economic Vulnerability Index (EVI).

- $\ln \text{EVI} * \text{FD}$ is the log of two indicators financial development and economic vulnerability
- $\ln \text{OPEN}$ is the log of Openness (data : trade openness from world bank)
- \ln is natural logarithm and the FD , EVI , OPEN and are the explanatory variables.

3.2 Methodology

The estimate process is built upon multiple phases. First, the stationarity of the variables is examined. The unit root test, or the test of the variables' stationarity, is the second step. The estimating approach selection will be made based on the test results (Gujarati and Porter, 2009). Then, we can define a variety of econometric methods, including FMOLS and the newly created Autoregressive Distributed-lag process (ARDL). Pesaran et al. (2001) created the ARDL co-integration approach. The ARDL approach has a number of benefits, one of which is that co-integration between variables can be tested regardless of the various integration orders (Pesaran et al., 2001).

Furthermore, if the sample time is short, this technique can also be used to examine long-term connections between series and can be adjusted for likely endogeneity (Pesaran et al., 2001). Consequently, the ARDL method was applied in this research to estimate analysis and long-term co-integration of non-stable variables.

The ensuing outcomes will address this.

Co-integration Analysis (ARDL)

The bound F-test for co-integration is within the ARDL methodology.

The ARDL method is a two-step technique: to examine the presence of long run co-integration, Eq. (1) is re-arranged as an unrestricted error correction model (UECM) in the ARDL framework as Eq. (2):

$$\begin{aligned} \Delta \ln \text{GDP}_t = & C_0 + \alpha_1 (\ln \text{GDP})_{t-1} + \alpha_2 (\ln \text{EVI})_{t-1} + \alpha_3 (\ln \text{FD. EVI})_{t-1} \\ & + \alpha_4 (\ln \text{OPEN})_{t-1} + \sum_{i=1}^n \alpha_5 \Delta (\ln \text{GDP})_{t-1} + \sum_{i=1}^n \alpha_6 \Delta (\ln \text{EVI})_{t-1} \\ & + \sum_{i=1}^n \alpha_7 \Delta (\ln \text{FD. EVI})_{t-1} + \sum_{i=1}^n \alpha_8 \Delta (\ln \text{OPEN})_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

The difference operator, represented by the symbol Δ , denotes short-term dynamics. Long-term associations are measured using the parameters that are attached and one period's lag factors. The long-term co-integration connection is proven to exist if the null hypothesis of zero co-integration is rejected.

The Wald coefficient restrictions check is used to impose constraints on long run parameters, and the Wald F-statistics are obtained as part of the bound F-test procedure. The lower and upper band critical values determined by Pesaran et al. (2001) are compared to this F-statistic. Three possible outcomes concerning the co-integration of the variables could arise. The alternative hypothesis can be accepted in place of the null hypothesis when the estimated F-statistic exceeds the upper band critical value.

If the expected F-statistic is less than the lower band critical value, then the null proposition cannot be discarded. When the estimated F-statistic is in between the lower and upper band critical values, then the outcome is inconclusive. Narayan (2004) argued that a critical value of Pesaran and al. (2001) is for large sample studies and using it for small sample studies may give misleading results. Narayan (2004) calculated a new set of

critical values based on small samples. Since our sample size was not very large, we used Narayan's (2004) critical values. Thus, estimated F-statistics were evaluated against the critical values that calculated by Narayan (2004) to ascertain the long-term relation between the series. The succeeding step examined the ARDL model to obtain long run estimates. The long term parameters can be computed based on the ARDL unrestricted regression estimates by dividing the coefficients of individual explanatory variables with lag one coefficient of the response variable and multiplying it by minus one (Fahmida & Mazbahul, 2012).

The short run error correction model is used to identify short run dynamics and to verify the robustness of the estimated coefficient of long run with respect to Eq. (2). It is specified as shown in Eq. (3):

$$\Delta \ln \text{GDP}_t = C_0 + \sum_{i=1}^n \alpha_5 \Delta(\ln \text{GDP})_{t-1} + \sum_{i=1}^n \alpha_6 \Delta(\ln \text{EVI})_{t-1} + \sum_{i=1}^n \alpha_7 \Delta(\ln \text{FD.EVI})_{t-1} + \sum_{i=1}^n \alpha_8 \Delta(\ln \text{OPEN})_{t-1} + (\text{ECM})_{t-1} + \varepsilon_t \tag{3}$$

With: ECM represent the error correction item. The ECM was computed from the long-term estimated parameters in Eq. (2). The error correction term was expected to be significant and negatively associated with the dependent variable.

4. Results

4.1 Unit-Root Test Result

As a first step, the likely non-stationary concern was addressed using a Standard Augmented Dickey-Fuller (ADF) test. Even though the Autoregressive Distributed-lag (ARDL) technique does not necessitate prior checking of the unit root issue. In the empirical analysis, it is essential to undertake this test to ascertain that variables do not have a unit root problem and their integration order is not more than one.

The ADF unit-root test, showed in Table 1 was realized on two groups, being constant and constant with trend. The results indicated that the variables in the levels were stationary with the exception of OPEN and FD.EVI which were stationary the first difference. The order of integration was not greater than one, which is important for long-term co-integration analysis.

Table 1: Unit root Test

Augmented Dikey-Fuller test					
In level			In first difference		
Variables	Constant	Constant with trend	Constant	Constant with trend	Conclusion
In GDP _t	0.6872	0.1888	0.0000	0.0001	I(1)
In EVI	0.8907	0.6293	0.0067	0.0746	I(1)
In FD.EVI _t	0.0215	0.0747	0.0000	0.0024	I(0)
In OPEN _t	0.0053	0.0016	0.0000	0.000	I(0)

Note: * and ** represent significance level at five and one percent, respectively. The lag length based on shwarz information criterion is 2.

To ensure the existence of long-term relationship between the variables, we rely on Table 2. The results of this table shows that the F-statistic of 15.07 was higher than the upper band critical value of 4.66 at the 1% significance level. Hence, the null hypothesis of zero co-integration was rejected. This mean that there is a long-term relationship between variables studied.

Table 2: Bounds co-integration test

Significance level	Critical value		Calculated F statistic
	Lower band	Upper band	
1%	3.65	4.66	15.07463
5%	2.79	3.67	
10%	2.37	3.2	

4.2 ARDL Estimates

In the previous section, we examined co-integration and found that the series were co-integrated in the long term. The following step will verify the ARDL model and the associated long-term relationship between economic growth, Openness, financial development, and vulnerability.

Table 3: ARDL Model: long run estimation

Variable	Coefficient	T ratio	P
Panel (A)			
LN(EVI)	-1.078089	-14.96521	0.0000
LN(FD.EVI)	-0.655122	-8.375618	0.0002
LN(OPEN)	1.279682	32.63286	0.0000
C	6.033150	16.45077	0.0000
Panel (B)			
R-squared		0.998274	
DW statistic		2.735819	
Serial correlation		0.377120 (0.8151)	
Normality		0.884549	
Heteroscedasticity		1.090978 (0.4931)	

Note: In panel (B), figures in the parentheses are the p values

The following Table 3 shows several results in terms of normality and heterosandasticity. Indeed this autoregressive-distributed model appears reliable because the tests, according to the results, are significant.

After examining the significance of the parameters of the model, we analyze the estimation of the model in the long term. This will be the subject of the next paragraph

The model can be writed with the following equation

$$EC = LNGDP - (-1.0781 * LNEVI - 0.6551 * LNFD_EVI + 1.2797 * LNOPEN + 6.0332$$

The research results, which are based on Table 3, indicate long-term correlations between GDP, financial development, openness, and economic vulnerability. In fact, the effects of the explanatory variables differ:

The findings contradict earlier research (Sakyi et al., 2012; Königer and Busse, 2012; Nowbutsing, 2014) insofar as they indicate that market opening promotes economic growth. Instead, the data demonstrate that trade openness has a contradictory effect on Rwanda's economic growth.

Our research, however, demonstrates that economic vulnerability has a significant detrimental long-term impact on Rwandan growth. (precise=-1.0781)

In fact, it can be argued that the nation becomes more dependent on foreign demand and experiences fluctuations in international markets the more open its economy is to the risk of macroeconomic stability. In this instance, trade liberalization may cause macroeconomic instability by raising.

A better result was obtained when we multiplied financial development by economic vulnerability, indicating a decrease in the detrimental effects of financial vulnerability (coefficient = -0,6551). The impact of financial development on lowering economic vulnerability is explained by this. In fact, financial development has been successful in reducing the negative impact of vulnerability on growth to a well-defined extent through trade openness. The Rwandan modernization initiatives barely begin to explain this. The development of financial and capital markets, infrastructure and natural resources, manufacturing, agro-business and services, and the reform of the investment climate are, in fact, the four focuses of the International Finance Corporation (IFC) program in Rwanda.

These are all long-term consequences. Now let's examine how the short-term factors relate to one another. We will look at Table 5 to investigate these short-term correlations.

Table 5: Short run error correction model

Variable	Coefficient	T ratio	P
Panel (A)			
D(LNGDP(-1))	1.242441	12.70242	0.0000
D(LNGDP(-2))	0.889534	8.700557	0.0001
D(LNGDP(-3))	0.743044	9.391476	0.0001
D(LNEVI)	-0.598309	-2.946334	0.0257
D(LNFD_EVI)	-0.173887	-3.725593	0.0098
D(LNOPEN)	0.386126	3.804369	0.0089
CointEq(-1)*	-2.025187	-11.20812	0.0000
Panel (B)reliability check			
R-squared		0.993915	
DW statistic		2.735819	

Note: * and **represent significance level at one and five percent. In panel (B), figures in the parentheses are the p values

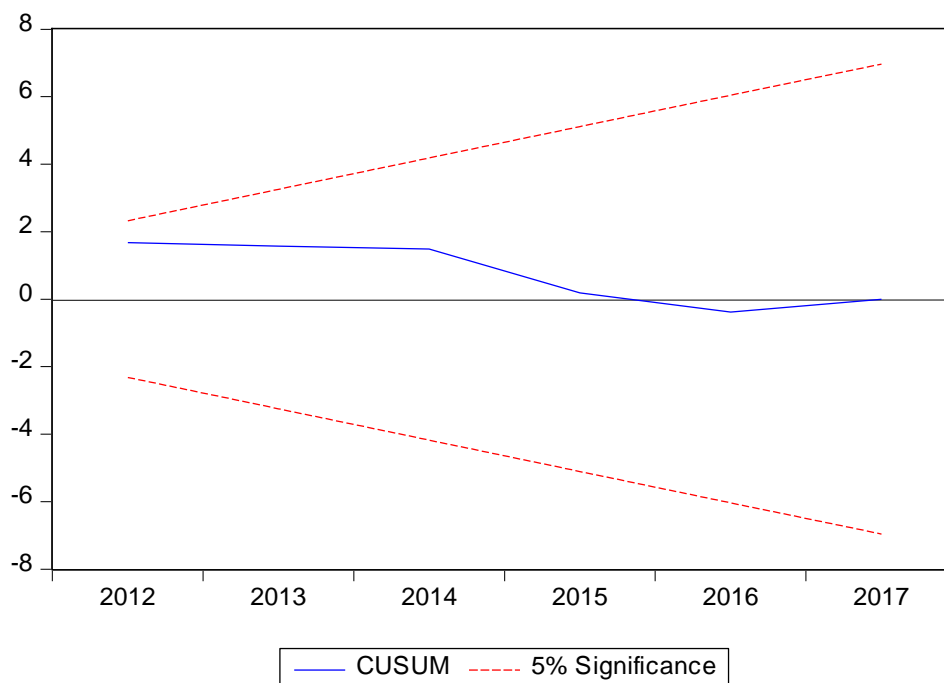
The results show that the short-term variable coefficients (EVI) have a negative and significant sign. Indeed, economic vulnerability has a negative effect on Rwanda's economic growth. As for variable opening (OPEN), it has a positive and significant effect

on economic growth. However, all coefficients of the explanatory variables are lower than those of the long-term estimate.

The results of this study imply that trade openness has a smaller long-term impact on economic growth than financial development. It is true that openness has minimal impact on reducing economic vulnerability.

Moreover, the data demonstrate that the recovery force coefficient to balance ECM $(-1) = -2.025187$ is negative and deviates noticeably from 0 to the 1% threshold. Error correction is therefore possible through a process. The template for error correction has been verified. According to our ARDL model, this coefficient, which describes the degree to which the y variable (growth rate) will be biased towards the long-term aim, is expected to be -2.025187 . This indicates that the long-term target will be adjusted quite quickly.

The error correction term's negative sign confirm the long-term dynamics predicted convergence process. In actuality, 202.5% of the imbalances from the previous year were made up this year, indicating that the connection process adjusted very quickly following the shock of the prior year.



We reject the hypothesis of structural change because the CUSUM test figure, as produced by the Eviews 10 software, shows that the recursive residuals consistently stay within the interval for the 5% confidence threshold, indicating that the coefficients are stable over time.

5. Conclusion and implications

This article's primary goal was to investigate how trade openness, economic vulnerability, and financial development, three macroeconomic characteristics, affect Rwanda's economic growth. The analysis employed the most recent ARDL technique to determine the effects of both long- and short-term variables, and it was based on annual macroeconomic data from 1995 to 2017.

Three theoretical and empirical perspectives on how the relevant variables affect Rwanda's economic growth were presented in the article. First, trade openness in Rwanda promotes economic expansion. The second contends that economic growth is hampered

by vulnerability. Actually, the latter is negatively impacted by the vulnerability. In conclusion, financial development functions as a buffer against the detrimental effects of susceptibility on growth by mitigating the adverse effects of susceptible tensions on economic growth, provided that a specific degree of trade openness is maintained. Empirical research has shown that trade openness contributes significantly and favorably to economic growth, with a longer-term effect than a short-term one. In addition, it has been confirmed that economic fragility has a detrimental impact on economic growth. Ultimately, we discover that the most recent addition to this document validates the notion that financial development has played a significant role in lessening the economic susceptibility of the Rwandan economy. Policymakers found these findings useful in their quest for responses to outside financial and economic shocks.

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