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Article

A new reading of the relationship between financial development, trade openness, vulnerability and economic growth in Africa: New perspectives from method of moment's quantile regression

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Abstract: One of the most frequently debated subjects in international forums is economic growth, which is regarded as a global priority. Consequently, researchers have turned their attention from conventional economic growth at a single average coefficient to divisible economic growth at levels of its value. Although the existing literature has discussed several determinants of economic growth, our article contributes to examining the sources of economic growth in African countries during the generations of reforms from 1990 to 2019 and in the context of economic vulnerability. The variables used in the analysis are gross domestic product, trade openness, financial development, and economic vulnerability. The study uses a quantile regression econometric model to examine these variables at different stages of reform. Quantile regression (QR) estimates for quantiles 0.05 to 0.95 showed mixed results: financial development is favorable to African economic growth at all quantile levels. However, economic vulnerability is a major impediment to economic growth at all quantile levels. In addition, it was found that a high degree of trade openness has a detrimental effect on African economic growth from quantile 0.5 of the dependent variable. Finally, another important result proves that financial development is a remedy for decision-makers against economic vulnerability.

Keywords: economic growth; financial development; vulnerability; quantile regression

1. Introduction

Economists study the factors that influence the growth of a country's economy in order to comprehend why certain countries have greater growth rates than others. Among these factors are the significance and function of the financial sector's development in various economic activities. The financial system, in fact, creates a connection between agents with the ability to finance and agents in need of funding by transferring the capital assets of those with capital but no available investment opportunities to investors in need of these funds to fund their projects.

A critical function of the financial system is to allocate capital to its most productive uses. Other things equal, a country with a financial system that efficiently allocates capital will grow faster than a country with a financial system that allocates capital inefficiently. Banks that lend based on commercial merit will be far more efficient than banks that lend because of personal relationships. As a country's finance sector develops, it will become better at allocating capital.

This because an effective financial system directs savings toward more lucrative and profitable activities, this topic has attracted attention in the theoretical and

empirical literature in recent years due to research showing a correlation between a country's growth rate and its degree of financial development.

The majority of economists argue that financial development supports growth; Bagehot (1873) suggested that the financial sector plays a significant role in funding the real sector; Schumpeter (1912) emphasized the services provided by the financial system, particularly its ability to provide credit for profitable investments and foster technological innovation that raises capital productivity. The McKinnon and Shaw financial liberalization theory first surfaced in the 1970s. Financial system reestablishment and positive reflection of savings, number and quality of investments, and, eventually, economic progress have resulted from financial system liberalization.

The 1990s saw the emergence of a new trend in which endogenous growth models were identified. These models placed an intense focus on the distribution and diversification of risks, the collection and analysis of data on various investment projects in order to mitigate the issue of information asymmetry, and the role that financing plays in the process of economic activity. Endogenous growth models thus emphasize how financial deepening contributes to higher capital productivity. However, several notable economists, including Modigliani, Miller (1958), Chandavarkar (1992), Sterm (1989), and Lucas (1988), claimed that the emergence of the financial system has little bearing on the process of economic development.

Many academic and empirical studies have examined the relationship between the growing size of the financial sector and growth in various contexts. The findings generally indicate that financial development promotes growth; however, there are some extremely rare instances that demonstrate the opposite relationship and some that demonstrate no relationship at all.

While the literature on international trade has demonstrated that trade openness can expose nations to exogenous shocks, it can also have many positive effects on countries under specific circumstances. In fact, Easterly et al. (2001), Haddad et al. (2011), and Loayza and Raddatz (2007) demonstrate that the volatility of aggregate output has historically been used in the empirical literature to characterize a country's susceptibility to shocks. This measure, however, has drawn criticism because it captures both the economic policies put in place to reduce the effects of shocks as well as the susceptibility of countries to shocks.

The economic literature that studies the link between financial development and economic growth is quite abundant, with the pioneering contributions of Goldsmith (1969), McKinnon (1973), and Shaw (1973), then King and Levine (1993). The relationship between economic growth and financial development has remained a hot topic of debate among economists, academics, and policymakers.

According to De Gregorio and Guidotti (1995), Godwin et al. (2020), Samson (2020), and Standley (2010), African capital markets are underdeveloped. Despite the recent boom in financial markets, the financial systems of African nations do not adequately support economic growth. The high degree of economic growth and Africa's vulnerability to external shocks could be partially explained by the banking system's sluggish development.

Many studies have focused on how vulnerable African nations are economically. According to Guillaumont (2014), vulnerability is "the risk that a country will be exposed to exogenous shocks, whether they be external (such as declining terms of

trade) or natural (such as drought or earthquake)". While general vulnerability also includes the impact of current and future policies and thus changes more quickly, structural vulnerability only includes factors that are fully determined by exogenous and enduring factors and do not depend on a country's current policies.

The effect of economic vulnerability on growth has been the subject of abundant research (Cariolle et al., 2015). In actuality, compared to other developing nations, the economies of Africa are more erratic. However, this higher vulnerability is an obstacle to African development.

According to a few studies, the development of the financial sector boosts growth (Beck et al., 2000; Christopoulos and Tsionas, 2004; Durusu-Ciftci et al., 2017; Pradhan et al, 2016).

Moreover, financial development can serve as an insurance policy against economic risks in addition to mediating growth in the economy. It decreases the negative effects of outside shocks on the economic system of a country.

Mili (2021) confirms that financial development and openness have a positive effect on economic growth in Africa. Indeed, his study shows that financial development reduces the negative effect of growth vulnerability on Africa's economy.

Askenzy (1997) finds evidence demonstrating that openness promotes growth by directing human capital toward the field of research and development, which produces the innovations that drive economic growth. Regarding Aubin (1994), he pointed out that appropriate economic policies must be implemented in combination with market integration in order to achieve optimal growth.

In contrast to these writings, other scholars demonstrate that openness is not necessarily conducive to growth, such as Krugman (1987), Lucas (1988), and Young (2004).

- Financial development and economic growth in Africa

The financial sector is critical in supporting economic growth and development by facilitating capital allocation, promoting savings and investment, and improving financial inclusiveness. The development of the financial sector in East Africa has made considerable progress in recent years, albeit to varying degrees, in the region's different countries. The financial sector is generally essential in promoting economic growth, mobilizing savings, allocating resources, facilitating investment in productive sectors, and creating a strong and stable banking system. Many African countries, mainly East African countries, have made significant progress in improving the stability and resilience of their banking sectors by implementing prudential reforms, such as improved risk management, stricter prudential standards, and enhanced supervision. This has helped boost public confidence in the banking sector and attract domestic and foreign investors.

In addition, financial inclusion is an essential focus in the region. Efforts have been made to improve access to financial services for all sections of society, especially those in rural and underserved areas. Various initiatives, including expanding mobile banking and digital financial services, have helped improve financial inclusion and promote economic participation among previously non-banked populations. However, the development of the financial sector in East Africa continues to face challenges. Limited access to affordable credit, inadequate infrastructure, weak legal and regulatory frameworks, an underdeveloped financial market, and a high degree of

informality continue to be obstacles. This hinders companies' access to capital for expansion and innovation, and individuals lose the appetite to invest their savings effectively and cannot promote economic growth.

Several studies showed the relationship between financial development and economic growth. Keho (2020), from a panel of 11 West African countries over the period from 1985 to 2018, proved that financial development and trade openness have, on average, positive effects on economic growth both in the short and long run. In a related development on South Africa, Umar (2010) noted that while there is a short-term positive correlation between financial development and economic growth, over time the causal relationship between the two becomes very weak. The financial development proxy measures stock market turnover as a percentage of GDP.

The results from the panel analysis show that financial development and trade openness have, on average, positive effects on economic growth both in the short and long run. The Granger causality tests show that real GDP, financial development and trade openness are mutually causal, implying that their simultaneous development should be promoted.

- Trade openness and economic growth

The investigation of how trade openness and the financial system support economic growth in vulnerable Africa sets this work apart from others.

The selected time period of our study was based on the reforms known in African countries. During the 1990s, many African countries have moved to implement important structural reforms: price controls have been abolished or liberalized; some inefficient public sector monopolies have been dismantled and many state enterprises privatized; nontariff barriers have been eliminated and import duties lowered; exchange rates have been freed and unified; and direct controls on bank credit have been eliminated and market-determined interest rates established, included reducing import tariffs, deregulating markets, and lowering taxes, which led to an increase in foreign investment and high economic growth.

The relationship among financial development, trade openness and economic growth in Africa was subject of several studies. As a result, researchers have conducted several empirical studies to determine the impact of international trade on economic development in Africa and the rest of the continents. On the one hand, several empirical research has found that foreign trade has a favorable impact on economic growth (Chang and Mendy, 2012; Doan, 2019; Frankel and Romer, 1999; Manwa and Wijeweera, 2016; Zahonogo, 2016). On the other hand, some researchers claim that international trade has a negative or inconsistent impact on economic progress in Africa and the rest of the globe (Gabriel and David, 2021; Hye and Lau, 2015; Manwa et al., 2019; Menyah et al., 2014; Ramzan et al., 2019; Ulaşan, 2012).

The rest of the paper is structured as follows: this introductory section is followed by the methodology in Section 2; Section 3 focuses on results and discussion of findings while Section 4 provides conclusion and recommendation.

2. Materials and methods

2.1. Model specification

Our study's primary goal is to determine how financial development, economic openness, and vulnerability affect economic growth. A second section of our analysis looks at how financial development affects economic vulnerability. In accordance with Krueger and Grossman (1995), we carry out the following model:

$$GDP_{it} = \alpha_{0i} + \alpha_{1i}EVI_{it} + \alpha_{2i}OPN_{it} + \alpha_{3i}FD_{it} + \varepsilon_{it} \quad (1)$$

where α_0 refers to the country fixed effects. α_1, denotes the elasticity of economic growth with economic vulnerability (EVI). α_2 measures the effects of the country's openness on economic growth. α_3 is the weight of financial development in the country. Finally, ε_{it} is the assumed independent and normally distributed error term. where the country fixed effects are denoted by α_0. The elasticity of economic growth with economic vulnerability (EVI) is represented by α_1. α_2 calculates how openness affects economic growth in the nation. The weight of financial development in the nation is represented by α_3. Ultimately, ε_{it} represents the presumed independent error term with a normal distribution.

$$GDP_{it} = \beta_{0i} + \beta_{1i}EVI_{it} \times FD_{it} + \varepsilon_{it} \quad (2)$$

where β_0 refers to the country fixed effects. β_1, conceive the effects of financial development on economic vulnerability.

2.2. Methodology

In this research, we examined the effects of financial development, trade openness, and vulnerability on GDP using panel quantile regression, which was initially developed by Koenker and Bassett (1978). Viewed as an extension of the conventional least squares estimate of conditional mean models to the estimation of an ensemble of models for numerous conditional quantile functions, quantile regression was first described by Koenker and Bassett (1978). The estimator of median regression, which minimizes the sum of absolute errors, is the central case. The process involves reducing an asymmetrically weighted sum of absolute errors to estimate additional conditional quantile functions.

Compared to traditional regression techniques that focus on mean effects, like OLS, this method is more powerful because it allows the slopes of the regression lines to differ between quantiles of the dependent variable, giving more comprehensive pictures of the influence of independent variables. Also, quantiles regression models can be used to obtain a richer characterization of the relationships between independent and dependent variables that go beyond the mean.

Furthermore, if the random error term is not normally distributed and there are outliers, this method performs better (Zhu et al., 2018). Thus, in an environment of economic vulnerability, testing the effects of macroeconomic variables on growth is made possible by the implementation of this panel quantile regression. Because it ignores any unobserved variability between people, quantile regression with individual effects has several difficulties. As a result, we used the fixed-effect quantile moment regression technique that Machado and Silva (2019) just presented. This approach enables the conditional quantiles to be estimated by combining estimates of the location and scale functions based on conditional means.

Indeed, the MM-QR allows individual effects to influence both the location and scale of the dependent variable *Y* (PDG) and impact the entire distribution instead of just shifting the location, as in Koenker (2004) and Canay (2011). In other words, this method provides information on how the conditional heterogeneous covariance effects of the determinants of economic growth are identified. Moreover, MM-QR is very relevant when estimating a quantile regression, including individual effects, and when the explanatory variables possess endogenous properties. The MM-QR estimates conditional quantiles of a dependent variable *Y* whose conditional distribution to a k-vector of covariates *X* belongs to location scale variant models. *Y* is defined by the following form:

$$Y_{\mathrm{it}} = \alpha_{\mathrm{i}} + X'_{\mathrm{it}}\beta + (\delta_{\mathrm{i}} + Z'_{\mathrm{it}}\gamma)U_{\mathrm{it}} \tag{3}$$

where the probability, $P\{(\delta_i + Z'_{it}\gamma) > 0\} = 1$ ($\boldsymbol{\alpha}$, $\boldsymbol{\beta}$', $\boldsymbol{\delta}$, $\boldsymbol{\gamma}$')' are unknown parameters to be estimated.

α_i, (δ_i), i = 1, …, n, represent the individual i fixed effects and Z includes k-vector of specified components of X. These components are differentiable transformations with element l given by:

$$Z_l = Z_l(X) \quad l = 1, \ldots, \mathrm{k} \tag{4}$$

$$Q_{\mathrm{y}}(\tau \mid X_{\mathrm{it}}) = \left(\alpha_{\mathrm{i}} + \delta_{\mathrm{i}}\, q\,(\tau)\right) + X'_{\mathrm{it}}\beta + Z'_{\mathrm{it}}\gamma q(\tau) \tag{5}$$

$$\mathrm{Min}_q = \sum_{\mathrm{i}}\sum_{\mathrm{t}} \rho_\tau(R_{\mathrm{it}} - (\delta_{\mathrm{i}} + Z'_{\mathrm{it}}\gamma)q) \tag{6}$$

$R_{it} = Y_{it} - (\alpha_i + X'_{it}\beta)$ and $\rho_\tau(A) = ((\tau - 1)\, A \mid \{A \leq 0\} + TA \mid \{A > 0\})$

3. Results and discussion

The variables of the data are presented in **Table 1** as follow:

Table 1. Variables definition.

Variable	Definition and measure	Source
EVI	Economic vulnerability Index	FERDI (Fondation pour les études et recherches sur le développement international) Data base
GDP	Real gross domestic product per capital (constant 2015 US$)	World Development Indicators
DCPS	Domestic credit to private sector (% of GDP)	World Development Indicators
OPN	Exports and imports (% of GDP)	World Development Indicators

Source: (World Bank Group, 2024; FERDI, 2020).

The caracteristics of the data is presented in the **Table 2**:

As reported in **Table 2**, skewness values are positive. This means an excessive skewness to the right for all variables except the vulnerability. The Jarque-Bera statistical test strongly rejects the null hypothesis of normality confirming, once again, that applying OLS estimation will be inconsistent while employing quantile regression remains suitable and more robust for this study.

Table 2. Descriptive statistics.

	LNGDP	LNFD	LNEVI	LNEVI__FD	LNOPEN
Mean	6.656421	−2.075799	3.526498	−7.373507	4.995835
Median	6.357977	−2.152386	3.594603	−7.733885	4.762795
Maximum	12.99884	−0.467349	4.264411	−1.488090	10.05341
Minimum	3.912867	−3.929566	2.466029	−14.18208	1.794221
Std. Dev.	1.180188	0.544662	0.328225	2.148152	1.132422
Skewness	1.139271	0.372559	−0.732904	0.467812	0.673111
Jarque-Bera	554.2879	34.42229	129.9165	44.54158	100.4868
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	1204	1198	1204	1198	1202

The results of this table show that:

First, our study shows that the estimate of the economic vulnerability index is statistically negative for all quantile levels (column 1, **Table 3**). This result proves that vulnerability has a negative effect that slows down economic growth in African countries.

Table 3. Model estimation (Equation (1)).

	EVI	OPN	FD
Location	−1.128 (0.000)	−0.0032 (0.002)	0.5186 (0.000)
Scale	−0.130 (0.000)	−0.0061 (0.000)	0.0290 (0.198)
5th	−0.919 (0.000)	0.0066 (0.000)	0.4721 (0.000)
10th	−0.964 (0.000)	0.0045 (0.000)	0.4821 (0.000)
20th	−0.992 (0.000)	0.0032 (0.000)	0.4882 (0.000)
30th	−1.021 (0.000)	0.0184 (0.018)	0.4946 (0.000)
40th	−1.053 (0.000)	0.0003 (0.000)	0.5018 (0.000)
50th	−1.096 (0.000)	−0.0017 (0.000)	0.5114 (0.000)
60th	−1.138 (0.000)	−0.0036 (0.001)	0.5208 (0.000)
70th	−1.180 (0.000)	−0.0563 (0.000)	0.5301 (0.000)
80th	−1.243 (0.000)	−0.0086 (0.000)	0.5441 (0.000)
90th	−1.3291 (0.000)	−0.0126 (0.000)	0.5631 (0.000)
95th	−1.484 (0.000)	−0.1986 (0.000)	0.5976 (0.000)

Secondly, our work shows that the estimate of the trade openness coefficient is statistically positive from the 5th quantile to the 40th, and then it becomes negative from the 50th quantile (Column 2, **Table 3**). This result indicates that a low degree of trade openness can have a positive effect that stimulates African economic growth. This result was approved in literature review (Chang and Mendy, 2012; Doan, 2019; Manwa and Wijeweera, 2019; Zahonogo, 2016).

However, if the degree of openness becomes high, this can hamper economic growth in these countries, as the latter becomes unstable and vulnerable to external shocks. Indeed, the economic instability of African countries, mainly from the instability of exports and imports during the period 1990–2020, had adverse effects on the African crossing.

Finally, the results show that financial development has positive effects on economic growth regardless of the quantile level (column 3, **Table 3**). This result is lined with the findings of literature review (Keho, 2020). This result can be explained by the effectiveness of the policies adopted in Africa. Indeed, during the 1990s, Africa began to adopt economic reforms that improved the public finance situation of African countries.

The graph presented by **Figure 1** below confirms the evolution of coefficients of independent variables within the different quantiles (5th to 95th). Indeed, trade openness and the EVI have in general the same evolution. Contrary with the EVI, the financial development evolves to decrease the economic vulnerability.

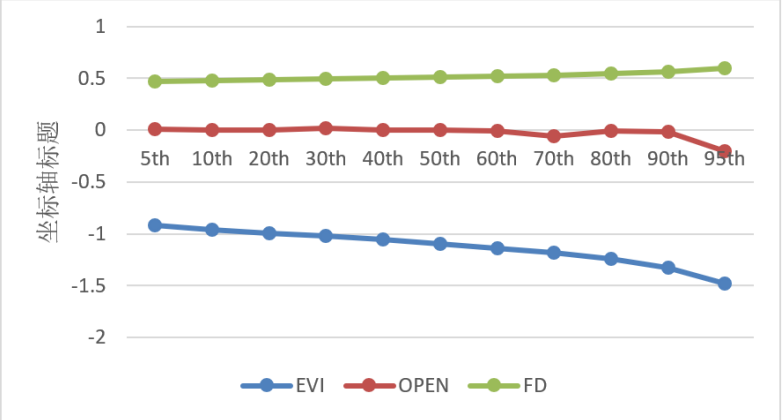

Figure 1. Quantile regression results.

According to the results of **Table 4**, the new variable, namely the multiplication of the variable of economic vulnerability by financial development, is statistically significant for all levels of the quantiles. This indicates that financial development positively influences growth through the reduction of the negative effect of vulnerability.

This multiplication shows a remarkable reduction in the negative effect of vulnerability on economic growth and that financial development has been able to dampen this effect in order to revive economic growth. Our results can be confirmed by the limited integration of the continent in the international financial market and the development of the policies adopted, in Africa, during the study period.

Development Finance Institutions in Africa can help manage and ensure sustainable practices that can help decision makers. Indeed, the development of financial services like financial inclusion can be a solution de decrease the non-stability of economy coming from outside.

Table 4. Model estimation (Equation (2)).

	EVI*FD
Location	0.1452 (0.000)
Scale	0.0278 (0.000)
5th	0.1008 (0.000)
10th	0.1074 (0.000)
20th	0.1171 (0.000)
30th	0.1236 (0.000)
40th	0.1305 (0.000)
50th	0.1370 (0.000)
60th	0.1455 (0.000)
70th	0.1598 (0.000)
80th	0.1723 (0.000)
90th	0.1904 (0.000)
95th	0.2164 (0.000)

4. Conclusion

Our study examines the effect of vulnerability on economic growth with the mediating role of supporting factors, such as trade openness and financial development. This important research agenda has been largely overlooked in previous studies. Moreover, the recent evolutions of the financial system require an analysis of these relations. This study questions the effects of vulnerability on economic growth and their interaction with the phenomenon of financial development. The results show that economic vulnerability has a negative effect on growth in African countries. Indeed, Africa's major economic sectors are vulnerable to the current climate sensitivity, with enormous economic impacts, and this vulnerability is exacerbated by existing development challenges such as endemic poverty, complex governance, and institutional dimensions; limited access to capital, including markets, infrastructure, and technology; ecosystem degradation; and complex disasters and conflicts. All of these factors have in turn contributed to Africa's low adaptive capacity, increasing the

continent's vulnerability to projected climate changes, unlike financial development, which has a beneficial effect on economic growth.

Another interesting result that adds to the first is that economic vulnerability increases with increasing openness. Indeed, we find that openness had a positive effect up to the 40th quantile, and then it became negative at the 50th quantile. These results prove that when openness is not controlled, it harms economic growth by increasing the intervention of external factors that increase vulnerability.

Finally, the multiplication of financial development with economic vulnerability showed that financial development absorbed the negative effect of vulnerability on economic growth. Indeed, a developed financial system can reduce economic instability and strengthen the economy in the face of external shocks.

In summary, the result of the paper shows that the economic vulnerability of African countries comes mainly from outside and especially from trade openness. comes mainly from outside and especially from trade openness. The financial development can be a remedy for financial decision-makers for the reduction of economic vulnerability. this can be done by the development of financial services which is called financial inclusion.

Our paper can be extended by the applying the same problematic in other samples like in developing or developed countries for to compare the results. Also, the sample of African countries can be split by economic income.

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