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Research Article

Analysis of Finance--Growth Nexus in Developing Economies: Does the Quality of Leadership and Technology Matter?

Mannir Salisu

Hassan Usman Katsina Polytechnic, P. M. B. 2052, Katsina State, Nigeria

Abstract.

This article investigates the effects of national leadership and telecommunication technology on the finance–growth nexus using balanced panel data from 50 developing countries for the 1997–2017. The study employs a set of nonstationary panel data approaches to investigate the long-run relationships between the variables of interest. The findings show that there is a long-term relationship between the variables wherein financial development, telecommunication technology, and quality of national leadership were found to have significant positive impact on economic growth in developing countries. This implies that financial development, telecommunication technology, and the quality of national leadership are important factors for promoting growth. Moreover, the results suggest that the effects of financial development on economic growth is contingent on the quality of national leadership and the sophistication of telecommunication technology in developing countries. The interaction term and marginal effects computed are positive and significant at all levels of telecommunication technology as well as on the quality of national leadership. This means that both the quality of national leadership and telecommunication technology have large direct and indirect positive impacts on economic growth in developing countries, and that financial development contributes more significantly and robustly to economic growth when telecommunication technology is sophisticated and national leadership is of high quality.

Keywords: economic growth, financial development, ICT, panel data

Corresponding Author: Mannir Salisu; email: mannirsalisu@gmail.com

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1. Introduction

Sustainable growth is of prime importance when conceptualising macroeconomic policies particularly in developing countries because sustainable economic growth is crucial in reducing poverty, unemployment, and inequality [1]. In recent years, the financial sector has emerged as an important engine of economic growth. Research by [2] documented that the financial sector and the sophistication of its development have been repeatedly highlighted as one of the possible determinants of long-term growth. Even though financial development has been widely recognised as a catalyst for economic growth, the impact of developing countries' financial frameworks on economic growth

and the factors that determine their efficiency as drivers of that growth have yet to be clearly elucidated.

Thus, this study aimed to investigates the effect of national leadership and telecommunication technology on finance-growth nexus in developing economies. The rest of this research work is organised as follows. The next section discusses the related literature. Section III reports the research methodologies used in the present study. Section IV presents the empirical findings. Section V presents the conclusion, and finally, section VI presents the policy implications.

2. Theory and Literature Review

The conceptualisation of linkages between financial development and economic growth can be traced back to proponents of economic growth theories, who viewed the relationship from different perspectives. Study by [3],[4],[5],and [6], observed that the services rendered by financial intermediaries can promote overall economic efficiency through capital allocation, innovation and entrepreneurship which are essential components of economic growth. Additionally, the relationship between financial development and economic growth was initially examined by [7] although, studies on this aspect only gained momentum in the 1990s. According to [2],[8],[9],[10], and [11], in their analysis of the finance-growth relationship observed that a well-developed financial system had a significant positive impact on growth. They further affirmed that sophisticated financial systems promoted financial stability and scaffolded the implementation of successful economic policies.

Moreover, Leadership refers to the way an organisation or a country's power is exercised to administer its economic and political frameworks [12],[13],[14]. Research by [15] observed that leaders play an essential role in influencing growth as their decision-making impacts policy outcomes. Consequently, the lack of good leadership would, by default, negatively impact a country's output growth. [16], [17] and [18]suggested that quality of national leadership or good governance contributed significantly to economic growth.

Furthermore, the impact of telecommunication technology (ICT) on output growth in both developed and developing economies have been cited in numerous studies. For instance, [19],[20] observed that ICT contributed significantly and longitudinally to GDP growth in the United States. Similarly, [21], and [22], noted that ICT contributed substantially to the economic growth of the United Kingdom. Related studies in Germany

[23],[24],[25], Spain [26], Canada [27], [28], France [29], and the Netherland, [30] also affirmed the important role played by ICT in real output growth.

Studies pertaining to ICT adoption and utilisation in developing economies have also shed more light on the impact of ICT on real output growth. For instance, in the Middle East, North African, and the Sub-Saharan Africa countries, [31] identified that telecommunication technology is being the major contributor to the real GDP growth in the economy. Likewise, [32], and [33] confirmed that ICT plays a positive role in the GDP growth of Vietnam and Fiji, respectively. Similarly, In Nigeria, [34] suggested that the globalisation of the Nigerian economy has influenced by the adoption of new technologies.

The above review reveals that the linkages between finance and growth, leadership and growth, as well as ICT and economic growth have been extensively studied. Nevertheless, there is a dearth of studies pertaining to the influence of national leadership and telecommunication technology in the finance-growth nexus and this is particularly so in developing countries. Therefore, this study examines how quality of national leadership and telecommunication technology will make a difference in the way financial development affect output growth. The findings of this research are expected to reveal new insights into the complex connection between financial sector development and economic growth. Accordingly, this study would contribute significantly by investigating critically the direct and indirect (moderating) impacts of quality of national leadership and telecommunication technology on economic growth in developing countries. In light of this, more effect and comprehensive growth policy initiative can be derived from the findings of the present study.

3. Research Methods

This section discusses the empirical model, data, and the research methodology applied to achieve the goal of this research.

3.1. Empirical Model

A growth model premised on the [35] growth framework which was developed to analyse the impact of quality of national leadership and telecommunication technology

on the finance-growth linkages in developing countries. The model incorporated the Cobb-Douglas production function:

$$Y_{it} = K_{it}^{\alpha}(A_{it}L_{it})^{1-\alpha} \tag{1}$$

wherein, Y_{it} denotes the real output in the country i at time t.K_{it} refers to stock of physical capital, L_{it} is the labour with A_{it} being the labour-augmenting factor indicating technological progress and economic efficiency. The rate of return on capital according to neoclassical economic growth theory is deemed as diminishing; where $\alpha < 1$. Equally, labour and the labour-augmenting factor are expected to expand as per the following functions:

$$L_{it} = L_{i0}e^{n_i t} \tag{2}$$

$$A_{it} = A_{i0}e^{g_i t}Z_{it}^{\theta_i} \tag{3}$$

where n indicates the exogenous growth rate of labour, and g refers to the exogenous growth rate of technology. Therefore, L_{it} and A_{it} grows at rate of n and g, respectively. Based on the objectives of this study, θZ_{it} represents the vector of explanatory variables, which are financial development(FD), quality of national leadership (QL), and telecommunication technology(ICT), with θ denoting a vector of coefficients of these explanatory variables.

$$Z_{it} = \left(FD_{it}, ICT_{it}, QL_{it}\right) \tag{4}$$

wherein Z_{it} stands as a vector of the three explanatory variables used in this study, namely, financial development $\left(FD_{it}\right)$, telecommunication technology $\left(ICT_{it}\right)$ and quality of national leadership $\left(QL_{it}\right)$.

Given $y_{it} = \frac{Y_{it}}{L_{it}}$ and $k_{it} = \frac{K_{it}}{L_{it}}$ represent output per labour as well as capital per labour correspondingly, the output per labour function is evolve as:

$$y_{it} = A_{it}(k_{it})^{\alpha} \tag{5}$$

As capital per labour is assumed to be constant at the steady-state level, it can be better defined as follows:

$$k^* = \left(\frac{s}{n+g+\delta}\right)^{\frac{1}{1-\alpha}} \tag{6}$$

where δ signifies the rate of depreciation of physical capital. However, when Equation (6) substitutes into Equation (5) and applying its natural logarithm, the resulting growth model will be obtained:

$$lny_{it} = lnA_0 + \theta_i lnZ_{it} + \frac{\alpha}{1-\alpha}lns_{it} - \frac{\alpha}{1-\alpha}lnln(n+g+\delta)_{it} \tag{7}$$

Equation (7) describes the steady-state output per worker as a function of savings and population growth, and as a vector of the study's 3 explanatory variables, namely, quality of national leadership, telecommunication technology, and financial development.

According to [36], $lnA_0 = \beta_0 + \epsilon_{it}$ because A_0 reflects not only progress in technology, but it encompasses resource endowments, climate changes, etc. which vary across countries, therefore, the growth model for this study can be re-written as:

$$lnGDP_{it} = \beta_0 + \beta_1 lnk_{it} + \beta_2 lnln(n+g+\delta)_{it} + \theta_3 lnFD_{it} + \theta_4 lnICT_{it} + \theta_5 lnQL_{it} + \epsilon_{it} \quad (8)$$

where ln indicates the natural logarithm, GDP is a per capita real GDP which is used as an indicator of economic growth, $(n+g+\delta)_{it}$ is the population growth, whereas savings (lns) is measured by investment – capital stock$\left(k_{it}\right)$, suggested in [36]. The data of real Gross Fixed Capital Formation (GFCF) was used to denote capital stock data. However, to construct the financial development variable, four indicators of financial sector development (i.e. the ratio of M2, M3, domestic credit to the private sector, and the domestic credit provided by the banking sector to GDP) were combined using the Principal Component Analysis approach (PCA). In addition, the ICT variable used in this study was constructed by applying PCA to the number of internets, mobile phone, and telephone line subscribers per 1000 population. Similarly, we constructed the quality of national leadership variable using PCA based on several leadership-related indicators such as political stability, control of corruption, government effectiveness, and the voice and accountability as suggested in [37].

Moreover, as the interest of the present study is to estimate the moderating effects of national leadership quality and telecommunication technology on the impact of financial development on economic growth in developing countries, the model is extended by incorporating interaction terms, $ln(FD \times QL)_{it}$ and $ln(FD \times ICT)_{it}$ into the growth model as shown below:

$$\begin{aligned} lnGDP_{it} = {} & \beta_0 + \beta_1 lnk_{it} + \beta_2 lnln(n+g+\delta)_{it} + \theta_3 lnFD_{it} + \theta_4 lnICT_{it} \\ & + \grave{e}_5 lnQL_{it} + \gamma_1 ln(FD \times QL)_{it} + \epsilon_{it} \end{aligned} \quad (9)$$

$$\begin{aligned} lnGDP_{it} = {} & \beta_0 + \beta_1 lnk_{it} + \beta_2 lnln(n+g+\delta)_{it} + \theta_3 lnFD_{it} + \theta_4 lnICT_{it} \\ & + \theta_5 lnQL_{it} + \gamma_2 ln(FD \times ICT)_{it} + \epsilon_{it} \end{aligned} \quad (10)$$

Based on the equations presented above, if γ_1 is statistically significant, this indicates that the marginal effect of financial development on economic growth is facilitated by quality of national leadership (QL). Likewise, the significance of γ_2 shows that the finance-growth nexus is contingent on telecommunication technology (ICT). The marginal effects

of financial development on economic growth can be computed by applying the partial derivatives of financial development, namely $\frac{\partial lnGDP_{it}}{\partial lnFD_{it}} = \theta_3 + \gamma_1 lnQL_{it}$ for Equation (9) and $\frac{\partial lnGDP_{it}}{\partial lnFD_{it}} = \theta_3 + \gamma_2 lnICT_{it}$ for Equation (10).

3.2. Sample and Data

The datasets employed in this study consist of a balanced yearly panel data of 50 developing countries over the period from 1997 to 2017. The selection of developing countries and the sample period depend entirely on the availability of data. The list of developing countries under investigation is presented in the Appendix. All the data used in this study are obtained from two major databases provided by the World Bank, i.e. the *World Development Indicators* (WDI) and the *World Governance Indicators* (WGI). Following [36],the present study measures n as the growth rate of the working-age population and concerning our dataset we assume that $g + \delta = 0.08$ where it is constant across countries and time.(In tandem with calculation in Mankiw et al. (1992), we compute g and based on the growth rate of per capita GDP and the capital-output ratio, respectively with our dataset. The average growth rate of per capita GDP is approximately 0.03 and the capital-output ratio is approximately 0.05. Therefore, g+□=0.08 is determined.)

Following [38], [39], and [40], we borrow the approach of principal component analysis (PCA) to construct a single financial development index with four different indicators of financial development, namely the ratio of M2 to GDP, the ratio of M3 to GDP, the ratio of domestic credit to private sector to GDP, and the domestic credit provided by the banking sector to GDP. Besides, the ICT variable used in this study is also constructed by PCA on the number of internets, mobile phone, and telephone line subscribers per 1000 population. Similarly, we also construct the overall quality of national leadership variable using PCA based on several national leadership-related indicators such as (i) *political stability*, (ii) *control of corruption*, (iii) *government effectiveness*, and (iv) *the voice and accountability* indicators suggested in Tan et al. (2010). All the data are converted into natural logarithm for standardisation.

3.3. Econometric Methods

In the present study, a set of panel data approaches is employed to estimate the growth models. Given the time series structure of our panel data is more than 20 years, we believe the non-stationary panel data methods are more appropriate. Our econometric

analysis involves three steps. First, we begin by testing the existence of a unit root in each variable to determine its order of integration. For this purpose, we use the Im, [41] and panel unit root tests. Second, if the variables are integrated at the same order, then the heterogeneous panel cointegration tests proposed by [42] and [43] will be employed to examine the presence of a long-run relationship between per capita real GDP and its explanatory variables. In order to the Pedroni's test for cointegration, the following panel regression is estimated:

$$W_{it} = \alpha_i + \delta_i t + \phi_{1i} H_{1it} + \phi_{2i} x_{2it} + \cdots \cdots, + \phi_{Mi} H_{Mit} + e_{it} \tag{11}$$

where W_{it} represents the $NT \times 1$ dimension of dependent variables whereas H_{Mit} is the $NT \times M$ dimension of explanatory variables where N, T, and M represent cross-sectional, time series and the number of explanatory variables in the regression model, respectively. e_{it} is the residual and to test for the presence of cointegrated, [42] and [43] suggested to examine the stationarity of the estimated residuals via the following model:

$$e_{it} = \vartheta_i e_{it-1} + \mu_{it} \tag{12}$$

In an effort to check for the presence of panel cointegration, [42] and [43] developed seven statistical tests where these tests can be categorised into two dimensions, namely the within-dimension tests (i.e. panel v-statistic, panel ρ-statistic, panel PP-statistic, and panel ADF-statistics which are based on pooling of the residuals and the between-dimension tests (i.e. Group ρ-statistic, Group PP-statistic, and Group ADF-statistic) which permits for heterogeneity across countries.

Once the presence of cointegration is confirmed, we estimate the long-run elasticities between per capita real GDP and its explanatory variables using the panel Fully Modified OLS (FMOLS) estimator introduced in [44] which is extended from [45]. The panel FMOLS estimator is used in this study because [46] and [45] found that the results provided by this estimator is more robust and account for the endogeneity as well as autocorrelation that are usually present among the explanatory variables [47]. Following [44],the panel FMOLS estimator is given as:

$$\hat{\beta}^{*}_{NT} - \beta = \left(\sum_{i=1}^{N} \hat{L}_{22i}^{-2} \sum_{t=i}^{T} \left(x_{it} - \underline{x}_i \right)^2 \right)^{-1} \sum_{i=1}^{N} \hat{L}_{11i}^{-1} \hat{L}_{22i}^{-1} \left(\sum_{t=1}^{T} \left(x_{it} - \underline{x}_i \right) \mu^{*}_{it} - T \hat{\gamma}_i \right) \tag{13}$$

where $\mu^{*}_{it} = \mu_{it} - \frac{\hat{L}_{21i}}{\hat{L}_{22i}} \Delta x_{it}$ and $\hat{\gamma}_i = \hat{\Gamma}_{21i} + \hat{\Gamma}^{0}_{21i} - \frac{\hat{L}_{21i}}{\hat{L}_{22i}} \left(\hat{L}_{22i} + \hat{\Gamma}^{0}_{22i} \right)$.

The term Γ^{0}_{i} and Γ_i are the covariance and sum of auto-covariance for the estimated model respectively while the *t*-statistic of this panel FMOLS estimator follows the standard normal distribution.

4. Results and Discussion

This section provides interesting results based on the non-stationary panel data methods. The summary of various descriptive statistics is as presented in Table 1. The mean value, which is a measure of central tendency, represents the average value that a variable assumes, over time and across countries. GDP_{it} seemed to have the highest mean value, while $(n+g+\delta)_{it}$ had the lowest mean value. Similarly, GDP_{it} possessed the high standard deviation, while $(n+g+\delta)_{it}$ had the lowest standard deviation. Standard deviation measures the variability of the data and deviation of the actual values from the mean value. Essentially, standard deviation is far less than the mean value in the cases of GDP_{it}, ICT_{it} and $(n+g+\delta)_{it}$ while the reverse is the case for FD_{it}, k_{it} and QL_{it}, wherein they are greater than the mean value. Given these variations, applying natural logarithm on the variables may help to limit such deviations. Finally, it was observed that the data was consistent as the mean was within the range of the maximum and minimum values.

TABLE 1: Summary of descriptive statistics.

Variables	Mean	Std. Dev.	Min	Max
k_{it}	1372.828	2490.946	19.129	24988. 61
$(n+g+\delta)_{it}$	0.100	0.014	0.049	0.141
GDP_{it}	6452.819	5109.868	688.790	35309.87
FD_{it}	3.791	7.639	0.002	64. 713
ICT_{it}	1.938	1.740	0.002	8.806
QL_{it}	2.466	3.646	0.003	24.316

Moreover, prior to the conduct of panel regression analysis, it is essential to check the stationarity of the variables. If any of the variable in the regression is non-stationary and not cointegrated, then the regression analysis would likely to produce spurious results. Therefore, the panel unit root tests are conducted in this regard. Consequently, three-unit root tests are employed in this study, namely; Im-Pesaran-Shin (IPS), ADF-Choi and PP-Choi panel unit root tests, respectively. The results of these panel unit root tests at both the level and first difference of the variables are presented in Table 2.

Table 2 illustrates the results of the IPS, ADF-Choi and PP-Choi panel unit root tests. The results show that all the variables are non-stationary at level, particularly the results of IPS and ADF-Choi test for the model of intercept and trend. However, the results at the first difference show that all the IPS, ADF-Choi and PP-Choi tests steadily reject the null hypothesis of a unit root irrespective of whether a model with intercept or with

Table 2: Results of panel unit root tests.

Variables	IPS test		ADF-Choi Z-test		PP-Choi Z-test	
	Constant	Constant and trend	Constant	Constant and trend	Constant	Constant and trend
Level:						
$lnGDP_{it}$	–0.516	–1.614	7.244	4.698	8.656	0.864
lnk_{it}	–1.323	–2.250	1.799	0.709	–0.122	–1.944**
$ln(n+g+$	–1.009	–1.569	3.875	4.857	4.548	3.094
$lnFD_{it}$	–1.226	–1.780	2.150	3.250	0.296	2.235
$lnICT_{it}$	–2.354***	–1.310	–5.950***	7.118	–18.508***	4.098
$lnQL_{it}$	–1.554	–2.171	–0.234	–0.010	–1.227	–1.646**
First difference:						
$\Delta lnGDP_{it}$	–2.632***	–3.083***	–7.634***	–6.245***	–14.057***	–10.887***
Δlnk_{it}	–3.419***	–3.459***	–12.123***	–8.071***	–21.651***	–14.964***
$\Delta ln(n+g$	–2.898***	–3.289***	–9.218***	–7.435***	–16.576***	–15.144***
$\Delta lnFD_{it}$	–2.672***	–3.649***	–7.743***	–9.943***	–17.050***	–16.162***
$\Delta lnICT_{it}$	–1.475	–3.863***	0.345	–11.717***	–7.137***	–15.352***
$\Delta lnQL_{it}$	–1.449***	–4.075***	–12.497***	12.575***	–20.682***	–18.510***

Note: The asterisks *** and ** denotes statistical significance at the 1 and 5 per cent levels, respectively. The optimal lag

order for ADF-Choi and IPS tests are selected by Modified Akaike Information Criterion (MAIC), while bandwidth for

PP-Choi test is based on Newey-West using Bartlett Kernel. The critical values for IPS test refer to Im et al. (2003).

intercept and trend is used. Given majority of the results in Table 2 showed that all the variables were non-stationary at the level but became stationary after first difference, we concluded that the variables were integrated at order one, I(1).

Having established the integration order of the variables, the next task is to test for the existence of cointegration or long-term relationship among the variables using the residuals-based test for panel cointegration proposed by [42], [43]. The panel cointegration results are reported in Table 3.

The results of the Pedroni's panel cointegration test in Table 3 show that four out of the seven statistics were significant at the one per cent level, hence rejecting the null hypothesis of no cointegration. In fact, $lnGDP_{it}$, $lnFD_{it}$, $lnICT_{it}$, $lnQL_{it}$, lnk_{it} and $ln(n+g+\delta)_{it}$ in developing countries were cointegrated, indicating the existence of long-run relationships between them. Similar results were also obtained in other

TABLE 3: Results of Pedroni's Panel Cointegration Analysis.

Tests	Statistics	*p*-values
Panel v-statistic	6.735***	0.000
Panel rho-statistic	7.588	1.000
Panel PP-statistic	– 0.393	0.153
Panel ADF-statistic	– 4.612***	0.000
Group rho-statistic	9.065	1.000
Group PP-statistic	– 11.426***	0.000
Group ADF-statistic	– 7.819***	0.000

Note: *** denote statistical significance at the 1 per cent level. Deterministic intercept and trend are involved in the test. The lag length and bandwidth are chosen by AIC while the Bartlett kernel is based on Nerwey-west.

studies on developing countries [48],[49],[50],[51]. Subsequent to the confirmation of cointegration between the variables, the next step was to estimate the magnitude, sign and statistical significance of such relationships.

A total of 4 Models are estimated using the panel FMOLS estimator, where Table 4 illustrated the estimated coefficients of the Models. We find that the estimated coefficients of lnk_{it} and $ln(n+g+\delta)_{it}$ are consistent with the economic growth theory and some existing empirical studies (e.g. [36], [49], [52]). Moreover, the empirical results based on Model 2 reveal that financial development has a positive impact on economic growth in developing countries. This is contradicted with the findings of [53], but corroborated with [54], [11], [32], and [55] who found that a well-functioning domestic financial sector contributes greatly to an increase in savings and investments, which eventually trigger economic growth. Specifically, a 1 per cent increases in financial development would improve GDP by approximately 0.065 per cent, holding other factors constant.

Equally, the results reported in Table 4 shows that ICT has a significant and positive impact on growth, meaning that the progress of ICT has strongly enhanced growth in developing countries. This is in accordance with the findings of [56], and that of [32] who highlight that ICT is an essential ingredient to growth. Apart from financial development and telecommunication technology, the quality of national leadership also plays an important role in stimulating economic growth. Based on the results in Table 4, it is apparent that the quality of national leadership is an important determinant of output growth in developing countries. This is signified by the fact that a one per cent increase in the quality of national leadership concomitantly enhanced GDP by approximately 0.047 per cent, implying that countries with good leadership were more likely to enjoy better

economic growth. This is consanguineous with [18], who averred that when leaders are less corrupt and more accountable, a more stable political environment ensues and this in turn, spurs economic growth.

Next, we extend the analysis to examine the role of national leadership and telecommunication technology in enabling the positive impact of financial sector development to flow through into output growth. It should be well-known that both Model 3 and Model 4 contain an interaction term that mediates financial development and quality of national leadership i.e. $ln(FD \times QL)_{it}$, as well as financial development and ICT i.e. $ln(FD \times ICT)_{it}$.Study by [57] documented that, when an interaction term is significant statistically, the interpretation for individual variables, such as financial development, quality of national leadership and telecommunication technology in this study, are rendered less meaningful since their effects on output growth are reliant on the value of their counterparts [58].

Accordingly, the results in Model 3 indicate that the coefficient of the interaction term among financial development and quality of national leadership, $ln(FD \times QL)_{it}$ was positive and significant at the 1 per cent level. This result confirms that the quality of national leadership is crucial in improving the contribution of finance to growth in developing economies. This finding is in accord with that of [59], who stressed that effective national leadership plays a vital role in stewarding economic growth via effective pro-growth initiatives and informed policy formulation and implementation. Similarly, the estimated results for the interaction term between financial development and ICT, $ln(FD \times ICT)_{it}$ in Model 4, was positively related to output growth as well as statistically significant at the 1 per cent level. This finding was in concordance with the results obtained by [60] and [53], who postulated that sophisticated ICT infrastructure significantly enhanced financial deepening and output growth. In addition, the findings also corroborated that of [61] and [62] who demonstrated that advances in ICT development strengthened the impact of finance on growth.

After assessing the presence of these facilitative mechanisms, we then calculated the marginal effects of financial sector development on output growth at the minimum, mean as well as maximum levels of national leadership quality as well as on telecommunication technology. To assess the implication of the marginal effects, we utilised a procedure as proposed by [58] to re-calculate the new standard errors for the t-statistic. The marginal effects as well as the t-test are presented in Table 4.

The findings pertaining to the quality of national leadership revealed that the marginal effects were significant at the 1 per cent level at the mean, minimum and maximum levels respectively. However, positive effects were only discerned at the mean and maximum

Table 4: Results of panel FMOLS estimation.

Variables	Model 1	Model 2	Model 3	Model 4
lnk_{it}	0.291*** (0.000)	0.143*** (0.000)	0.139*** (0.000)	0.141*** (0.000)
$ln(n+g+\delta)_{it}$	–0.700*** (0.000)	–0.553*** (0.000)	–0.553*** (0.000)	–0.542*** (0.000)
$lnFD_{it}$	–	0.065*** (0.000)	0.078*** (0.000)	0.067*** (0.000)
$lnICT_{it}$	–	0.072*** (0.000)	0.073*** (0.000)	0.072*** (0.000)
$lnQL_{it}$	–	0.047*** (0.000)	0.040*** (0.000)	0.047*** (0.000)
$ln(FD \times QL)_{it}$	–	–	0.021*** (0.000)	–
$ln(FD \times ICT)_{it}$	–	–	–	0.003*** (0.000)
Marginal effects: $\frac{\partial lnGDP}{\partial lnFD}$				
Minimum	–	–	–0.048*** [3.392]	0.047*** [4.710]
Mean	–	–	0.078*** [38.188]	0.067*** [35.627]
Maximum	–	–	0.147*** [20.214]	0.074*** [26.371]

Note: The asterisk *** denote the statistical significance at the 1 per cent level. Figures in the parenthesis (.) are the
p-values, whereas [.] indicates the *t*-statistics for marginal effects calculated based on the procedure suggested in
Brambor et al. (2006).

levels, as the effect was negative at the minimum level. Essentially, a 1 per cent increase in quality of national leadership at the mean level, stimulated financial development to increase output growth by approximately 0.078 per cent. Conversely, the quality of national leadership attained 0.147 per cent at the maximum level. This result indicates that a minor increase in the quality of national leadership does not substantially enhance the impact of financial development on economic growth in developing countries. In other words, only countries with an average or high-quality national leadership cohort were likely to experience accelerated financial development which in turn contributed to output growth.

The marginal effects computed for interaction between financial development and ICT were positive and statistically significant at the 1 per cent level, at the minimum, mean and maximum levels of ICT. Specifically, a 1 per cent increase in financial development, at the minimum level of ICT, will elevate economic growth by approximately 0.047 per cent. Likewise, a 1 per cent increase in financial development at the mean level of ICT will engender a 0.067 per cent increase in GDP while a 1 per cent increase at the maximum level of ICT will trigger a 0.074 per cent increase in output growth. These findings clearly demonstrate that financial development's impact on output growth in developing economies is contingent upon the level of ICT development.

5. Finding and Conclusion

This study has achieved its objectives of investigating the role of national leadership quality and telecommunication technology in finance-growth nexus in developing countries over the period 1997 to 2017. The findings of the study show that there is a strong positive impact of financial development, telecommunication technology, and quality of national leadership on economic growth in the examined countries. The results also reveal that countries with a better quality of national leadership and advanced ICT could effectively enhance the process of financial development to accelerate long-term economic growth, meaning that finances, ICT, as well as national leadership quality are important growth catalysts for the developing economies.

The estimated results also imply that the impact of finance on growth is directly contingent upon the excellence of the quality of national leadership and the sophistication of its telecommunication technology. The marginal effect computed is significant at all levels of ICT as well as at two levels of national leadership quality. Since it was established that the effects of financial development on growth was negative at the minimum level of the quality of national leadership, it can be inferred that only substantial increases in the quality of national leadership and ICT significantly and robustly impacted financial development's overall effect on output growth in developing economies. Finally, it can be surmised that the findings linked to the interaction terms indicate that both quality of national leadership and telecommunication technology have significant direct and indirect positive impacts on economic growth in developing countries, and that financial development is more robust and capable of propelling economic growth when both the sophistication of telecommunication technology and the quality of national leadership improved concomitantly.

6. Implications, Limitations, and Suggestions

Since it has been conclusively established that financial development is vital for economic growth in developing countries, policymakers should set up an efficient and functional financial architecture that can mobilise savings and channelling them into productive investments. In addition, policies and reforms capable of unleashing the latent potential of financial institutions as catalysts for economic growth should be fast-tracked. These include further liberalisation of the financial sector that would enable the emergence of subsidiary capital markets to complement the existing predominantly

Table 5: Appendix: List of Developing Countries under Review.

No.	Country	No.	Country	No.	Country
1	Albania	18	Equatorial Guinea	35	Namibia
2	Angola	19	Fiji	36	Nigeria
3	Armenia	20	Gabon	37	Pakistan
4	Bangladesh	21	Georgia	38	paraguay
5	Belarus	22	Ghana	39	Peru
6	Benin	23	Guatamala	40	Philippines
7	Bolivia	24	Honduras	41	Romania
8	Brazil	25	India	42	Senegal
9	Bulgaria	26	Indonesia	43	South Africa
10	Cambodia	27	Jordan	44	Thailand
11	China	28	Kazakhstan	45	Tunisia
12	Columbia	29	Kenya	46	Turkey
13	Costa Rica	30	Lebanon	47	Uganda
14	Cote D'ivoire	31	Malaysia	48	Ukraine
15	Dominican Republic	32	Mexico	49	Vietnam
16	Ecuador	33	Moldova	50	zambia
17	Egypt	34	morocco		

bank-centred financial architecture in developing countries. Given that ICT plays a crucial role in financial development and output growth, initiatives to promote ICT adoption and use should be prioritised. These include incentives such as tax-holidays for ICT related investments, promoting increased government and private sector technology expenditure aimed at improving and broadening existing ICT infrastructure in terms of hardware, lower tariffs on the importation of ICT related hardware and software goods and the adoption of emerging ICT protocols such as 5G based frameworks. Additionally, governments should promote policies to increase internet use, mobile cellular and telephone line subscription, and advancements in telecommunication infrastructure to stimulate economic growth.

Since the study also unequivocally demonstrated that national leadership plays a fundamental role in accelerating economic growth, policymakers should endeavour to enhance the quality of national leadership to support and accelerate economic growth. Hence measures aimed at enshrining the best practices of good governance should be accorded due emphasis. This would include the creation of a Competent, Accountable and Transparent (CAT) administrative framework that is both corruption and red tape

free while simultaneously being one that upholds the rule of law. The leadership can also burnish its progressives credentials to attract financial sector investments by championing participatory and inclusive democracy, valorising the freedom of expression, promoting civil society engagement, and guaranteeing the free flow of information.

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