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CERDI
POLE TERTIAIRE
26 AVENUE LÉON BLUM
F- 63000 CLERMONT FERRAND
TEL. + 33 4 73 17 74 00
FAX + 33 4 73 17 74 28
<http://cerdi.uca.fr/>

The author

Tarna Silue

PhD Student, Université Clermont Auvergne, CNRS, CERDI, F-63000 Clermont-Ferrand, France

Email address: tarna.silue@etu.uca.fr



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Abstract

The paper focuses on the relationship between economic growth and financial inclusion in developing countries. One of the main innovations of the analysis is to report on the contribution to developing new digital financial services such as mobile money. To do this, I first realize a simple endogenous growth model in which the role of the financial sector is to provide sources of investment to included population. The model indicates that consumption could be the main channel through financial inclusion, contributing to growth. Then, the empirical estimation realized using the Generalized Method of Moments (GMM) with 57 countries over 2007-2017 evaluates the impacts of traditional and digital inclusion on growth. The results confirm the positive effect of financial inclusion on growth. For formal inclusion, estimators reveal that the financial system deposits contribute to growth in developing countries. Concerning digital inclusion, we note that an active mobile money account has a higher positive impact on growth than standard inclusion.

Keywords

Endogenous Growth, Financial Inclusion, Mobile Money, GMM System

JEL Codes

O16, O30, O40, G21, G23, C23

1 Introduction

The development of an economy refers to all the technical, social, and cultural transformations that accompany production growth. In other words, economic development is a set of positive evolution in structural changes of a country.

Access to finance is essential for funding the economy's transition to the level of development to which it aspires. Schumpeter (1982) already argued that this link is reflected in the impact of bank credit on economic growth. He points out early that "financial services such as savings mobilization, project evaluation, risk management, advice to managers of industrial and commercial companies, supervision and simplified settlement of domestic and international transactions... are essential for technological innovation and development". King and Levine (1993) reinterpret Schumpeter's idea by emphasizing the importance of innovation through the pace of capital accumulation and factor productivity. From this point of view, financial systems would make it possible, on the one side, to channel savings towards more productive uses and, on the other side, to diversify the various risks associated with productive activity. Levine (2005) pushes the reflection on causality by underlining the coevolution of finance and growth. In his view, the financial system would be able to provide different services at different steps of economic development, as the system would have to evolve if growth was to continue.

In doing so, while it is clear that economic development requires access to finance, it is worth noting that the flexibility available to developing countries to finance development is limited. Indeed, following the Monterrey Consensus on financing for development in 2002, the structure of development financing policy will evolve with particular attention

to the mobilization of internal and external resources. Resource mobilization policy now considers the increase in private financing flows such as remittances and Foreign Direct Investments. Therefore, the challenge is to propose new means of funding to countries with underdeveloped financial systems and must also face the failure to respect the promises of foreign donors.

In this context, financial inclusion is often presented as a new financing stake. It is the provision of low-cost essential financial and banking services to all economic agents, the latter having on average a utility in these services offered.

Financial inclusion has been identified as an enabler for some objectives¹ of the 17 Sustainable Development Goals adopted by the United Nations from September 2015 until 2030. Thus, the World Bank Group is committed to financial inclusion through the Universal Financial Access 2020 initiative. This initiative aims to ensure that everyone in the world has a current account to deposit money and send and receive payments.

Therefore, this analysis aims to examine the impact of financial inclusion in developing countries on economic growth. Specifically, how to first explain the effects of financial inclusion on growth and how formal and mainly digital financial inclusion affect wealth accumulation in these countries. To the best of my knowledge, no article has studied this issue in the existing literature. Almost all of the current theoretical literature has focused on the effect of financial development on economic growth. It generally emerges that financial development has a positive impact on the level of growth (Kablan and Chhikara (2013); Ji et al. (2014); Karpowicz (2016)).

¹ Financial Inclusion contributes to poverty elimination, the reduction of gender inequalities, the removal of hunger and then some more

Empirical literature deals mainly with the impact of formal inclusion on growth in developing countries. This literature can be grouped into two main categories. The first includes studies finding that financial inclusion has a significant positive effect on economic growth (Mihasonirina and Kangni (2011); Inoue and Hamori (2016); Lenka and Sharma (2017); Pradhan et al. (2017); Kim et al. (2018); Sethi and Acharya (2018)). The idea put forward is that access for all to banking and financial services at a lower cost leads to an increase in growth (Swamy, 2014).

Secondly, there are a relatively more minor number of empirical studies that point to a negative impact of financial inclusion on economic growth (Naceur and Ghazouani (2007); Pearce (2011); Bhattarai (2015); Barajas et al. (2016)). This negative effect of formal inclusion, or even insignificant at times, can explain the fragile financial system, insufficient financial instruments, and inappropriate policies in developing countries (Arestis et al., 2018).

In doing so, the purpose of this paper is twofold. As a first step, it will provide an economic analysis of financial inclusion in economic growth in some developing countries. This contributes to the enrichment of the literature linking financial inclusion and growth in developing countries.

In a second step, I highlight the significant involvement of telecommunications operators in the progress of the inclusion process in these countries. Indeed, the recent digital revolution in developing countries has led to digital financial services whose leading providers are telecommunication companies. Telecommunications companies provide microfinance and remittance services, particularly in African countries. One example is M-Pesa, a microfinance and money transfer system launched by the Vodafone group in

Kenya and Tanzania. Services thus enable individuals excluded from the traditional financial system to benefit from essential financial services such as deposits and money transfers. However, there is no research on the impact of this digital financial inclusion on economic growth. Our study will aim to cover this issue to fill this gap.

To achieve the objectives, the rest of the paper will follow the following plan. In section 2, we will discuss the theoretical modeling of the relationship between financial inclusion and economic development by carrying out a simulation that considers the features of developing countries. The section presents the theoretical framework for understanding the link between financial inclusion and economic growth. Section 3 describes the data, the econometric model, and the main results obtained. Finally, we conclude with Section 4.

2 Theoretical Model

I consider an economy with a constant population, the labor supply being equal to the active population. The labor force is standardized to the unit. It is assumed that there is a financial sector whose role is to provide sources of investment to the population. The idea is that this financial sector would be able to make available to individuals wishing to invest resources mainly derived from total savings. There is a trade-off between the activity of intermediation and the production of goods and services within the economy. Nevertheless, individuals must belong to the financial system to be able to access financial services.

The Cobb-Douglas production function is written as follows:

$$Y_t = A(\bar{K}_t)K_t^\alpha(n_t(1 - r_t)L)^{1-\alpha} \quad 0 \leq \alpha \leq 1 \quad (1)$$

where Y_t is the production level at time t , K_t the level of capital used and L the amount of labor. $A(\bar{K}_t)$ represents technical progress as a function of the average capital stock per unit of production K_t , n_t the proportion of individuals included in the financial system, r_t the proportion of labor used in the financial sector. I assume that the externality to the production process is as follows:

$$A(\bar{K}_t) = A\bar{K}_t^{1-\alpha} \quad (2)$$

A being a constant parameter of the production technology. Knowing that the amount of work has been normalized per unit, we obtain a per capita production function of the following form:

$$y_t = A\bar{k}_t^{1-\alpha}k_t^\alpha(n_t(1 - r_t))^{1-\alpha} \quad (3)$$

r_t can be seen as an indicator of financial development, reflecting changes in the size of the financial sector. I also assume a full use of the mobilized r_t proportion. As for n_t , it is an indicator of the inclusive nature of the financial system. It reflects the proportion of the population not working in the financial sector who have chosen to use the financial services provided. To ensure that this inclusiveness is only the result of the public's interest in services, I assume a zero collateral value (solvency).

I am placed in a continuous framework with an instant utility function of the agents represented by:

$$U(c_t) = \frac{c_t^{1-\sigma}-1}{1-\sigma} \quad \sigma \neq 1 \quad (4)$$

c_t represents the household's level of consumption and σ the risk aversion coefficient, which is positive ($\sigma > 0$). I also choose this utility function to ensure that we obtain a stationary growth path.

The representative household with perfect expectations maximizes the following inter-temporal utility function:

$$V_0 = \int_0^{+\infty} e^{(-\rho t)} U(c_t) dt \quad (5)$$

ρ the discount rate reflects the preferences of the representative individual. An exponential discount is chosen for reasons of simplicity reasons and avoids cases of temporal inconsistencies, knowing that the rationality hypothesis of the agents has already been made. Indeed, a decreasing factor proposed, for example, by hyperbolic or quasi-hyperbolic discounts (Pollak, 1968), can reverse preferences according to the horizon (Strotz, 1955). In this perspective, the individual will have to face problems of temporal incoherence.

Drawing on the pioneering work of Pagano (2001), investment level is defined as essentially a function of a part of the savings of S_t .

$$I_t = \Phi(r_t)S_t \quad (6)$$

$\Phi(r_t)$ represents the technology used to transform savings into productive investments.

$$\Phi(r_t) = \frac{1}{\theta} r_t^\theta \quad 0 < \theta < 1 \quad (7)$$

Savings transformation technology is an increasing function of the level of resources mobilized by the financial sector.

Let the equation reflecting the dynamics of capital accumulation be as follows:

$$\dot{k}_t = I_t - \delta k_t \quad (8)$$

where δ represents the rate of capital depreciation. Using equation (6) and (7), (8) becomes

$$\dot{k}_t = \frac{1}{\theta} r_t^\theta [A \bar{k}_t^{1-\alpha} k_t^\alpha (n_t (1 - r_t))^{1-\alpha} - c_t] - \delta k_t \quad (9)$$

The representative agent maximization program is as follows:

$$\left\{ \begin{array}{ll} \max_{(c_t, n_t, r_t)} & V_0 = \int_0^{+\infty} \frac{c_t^{1-\sigma} - 1}{1-\sigma} e^{(-\rho t)} dt \\ \text{subject to} & \dot{k}_t = \frac{1}{\theta} r_t^\theta [A \bar{k}_t^{1-\alpha} k_t^\alpha (n_t(1-r_t))^{1-\alpha} - c_t] - \delta k_t \end{array} \right. \quad (10)$$

The current Hamiltonian associated with this program is written:

$$H_c \equiv \frac{c_t^{1-\sigma} - 1}{1-\sigma} + \mu_t \left[\frac{1}{\theta} r_t^\theta [A \bar{k}_t^{1-\alpha} k_t^\alpha (n_t(1-r_t))^{1-\alpha} - c_t] - \delta k_t \right] \quad (11)$$

The first-order conditions are:

$$\left\{ \begin{array}{l} \bullet \frac{\partial H_c}{\partial c} = c_t^{-\sigma} - \mu_t \frac{1}{\theta} r_t^\theta = 0 \\ \bullet \frac{\partial H_c}{\partial n} = \mu_t \left[\frac{(1-\alpha)}{\theta} r_t^\theta [A \bar{k}_t^{1-\alpha} k_t^\alpha n_t^{-\alpha} (1-r_t)^{1-\alpha}] \right] = 0 \\ \bullet \frac{\partial H_c}{\partial r} = r_t^{\theta-1} [A \bar{k}_t^{1-\alpha} k_t^\alpha (n_t(1-r_t))^{1-\alpha} - c_t] - \frac{(1-\alpha)}{\theta} r_t^\theta A \bar{k}_t^{1-\alpha} k_t^\alpha n_t^{1-\alpha} (1-r_t)^{-\alpha} = 0 \\ \bullet \dot{\mu}_t = \rho \mu_t - \mu_t \left[\frac{1}{\theta} \alpha r_t^\theta [A \bar{k}_t^{1-\alpha} k_t^{\alpha-1} (n_t(1-r_t))^{1-\alpha}] - \delta \right] \end{array} \right.$$

The condition of transversality that results from this program is: $\lim_{t \rightarrow \infty} \mu_t k_t e^{(-\rho t)} = 0$

By differentiating the first condition concerning time, we obtain::

$$\frac{\dot{\mu}_t}{\mu_t} = -\sigma \frac{\dot{c}_t}{c_t} - \theta \frac{\dot{r}_t}{r_t} \quad (12)$$

From the second to last condition, I deduce the following equality:

$$r_t^{\theta-1} [A \bar{k}_t^{1-\alpha} k_t^\alpha (n_t(1-r_t))^{1-\alpha} - c_t] = \frac{(1-\alpha)}{\theta} r_t^\theta A \bar{k}_t^{1-\alpha} k_t^\alpha n_t^{1-\alpha} (1-r_t)^{-\alpha} \quad (13)$$

Using the last condition and equation (12), I determine the Keynes-Ramsey equation indicating a stationary growth rate of consumption:

$$\frac{\dot{c}_t}{c_t} = \frac{1}{\sigma} \left[\frac{\alpha}{\theta} A \bar{k}_t^{1-\alpha} k_t^{\alpha-1} (n_t(1-r_t))^{1-\alpha} r_t^\theta - \delta - \rho - \theta \frac{\dot{r}_t}{r_t} \right] \quad (14)$$

Note that at equilibrium, the average capital stock per capita equals the capital level per capita ($\bar{k}_t = k_t$). Moreover, in a steady-state, the financial sector's growth rates and labor share are constant. Taking these facts into account, we have the growth rate of consumption which becomes:

$$\frac{\dot{c}_t}{c_t} = \frac{1}{\sigma} \left[\frac{\alpha}{\theta} A (n_t(1-r_t))^{1-\alpha} r_t^\theta - \delta - \rho \right] \quad (15)$$

To determine the growth rate of capital accumulation, I rewrite the equation (13), which becomes at equilibrium:

$$\frac{c_t}{k_t} = A(n_t(1 - r_t))^{1-\alpha} - \frac{1-\alpha}{\theta} r_t A n_t^{1-\alpha} (1 - r_t)^{-\alpha} \quad (16)$$

From equation (9) and equation (16), I deduce the rate of capital accumulation per capita, which therefore constitutes a second formulation of the stationary growth rate:

$$\frac{\dot{k}_t}{k_t} = \frac{1}{\theta^2} A(1 - \alpha) n_t^{1-\alpha} (1 - r_t)^{-\alpha} r_t^{1+\theta} - \delta \quad (17)$$

Two variables of interest are financial inclusion and financial development. In the long term, r_t has a direct positive impact on the growth rate of the economy, while n_t has an amplifying effect. Indeed, the effect of the financial sector on the level of growth comes from the use of financial services that encourage productive investment. Financial development would therefore be related to each economy, the consumption habits of agents, and cultures once the financial system can provide the population's services, thus promoting growth. This positive impact on growth will depend on the number of people who use it. The higher this number, the higher the growth rate will be.

Simulations are performed with the following parameter values: $\sigma = 0.7$, $\theta = 0.7$, $\alpha = 0.5$, $\rho = 0.05$, $\delta = 0.6$ and $A=0.5$. However, the qualitative properties of the model don't depend on these values. Simulations aim to capture the long-term association between growth, financial development, and inclusion.

Figure 1 shows the long-term relationship between consumption accumulation, financial development, and financial inclusion. Taken separately, as Eggoh and Villieu (2013), I note a non-linearity of the relationship between financial development and growth rate. The graph describes an inverted U-shaped association, thus emphasizing the presence of a threshold effect. This association is more pronounced with a higher level of inclusion. From agents' consumption perspective, financial development would be

desirable up to a certain threshold. Past this threshold, the individuals included will tend to prefer services rather than consumer goods. As for the inclusion level, we notice an increased relationship between the proportion of individuals had and the consumption growth rate. The dynamic is steadily rising with a slight slowdown from the beginning. This growing trend reflects that the value of operations made by new users is, on average higher than the average value before their arrival. This may be since people benefit significantly from the service.

Figure 1. Relation between Financial Growth, Financial Inclusion, and Consumption Growth

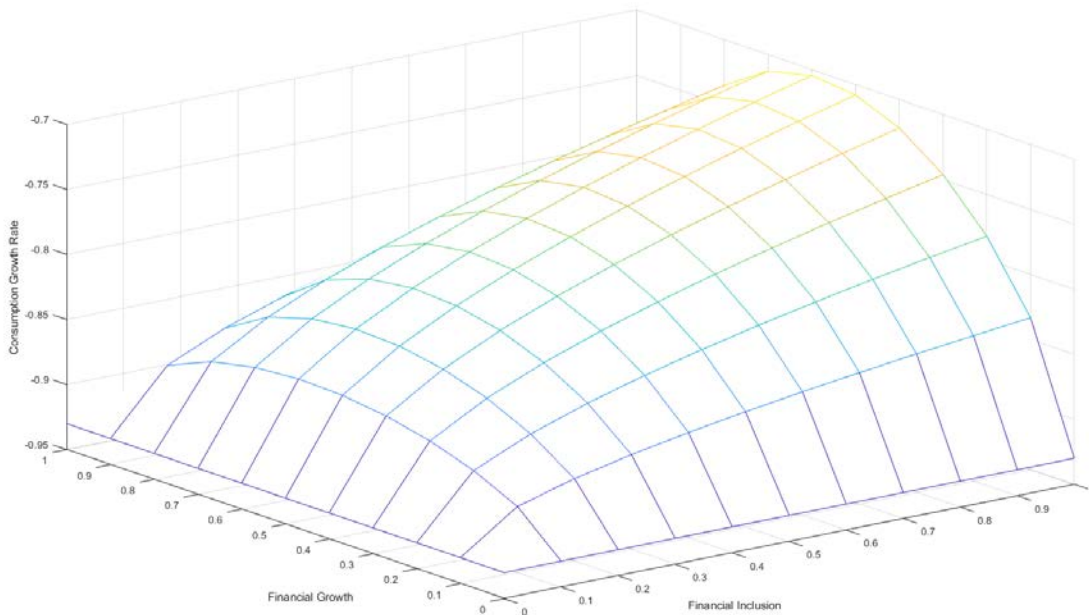
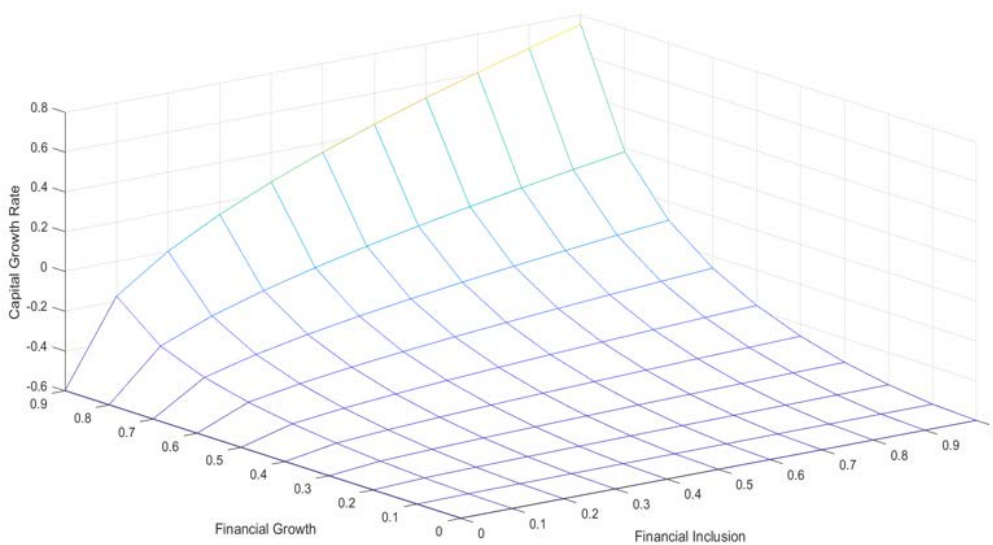


Figure 2 reflects the long-term relationship between growth in capital accumulation, financial development, and financial inclusion. We see that the proportion of individuals included has no direct impact on the rate of capital growth. The latter only amplifies the

effect that the level of financial development could have on the growth rate. It should also be noted that the level of financial development positively impacts the rate of capital growth. The slope of this positive relationship is even higher as the proportion of individuals included increases its maximum level to 1.

Figure 2. Relation between Financial Growth, Financial Inclusion, and Capital Growth



Generally, it should be noted that financial inclusion does indeed lead to economic growth from a theoretical point of view. This economic growth comes from the stimulation of consumption through the accumulation of human and technological capital. Thus, previously financially excluded individuals, once included, will have access to resources that will allow them to invest in their education and health, which in turn will lead to increased labor productivity. Productivity being stimulated, the country can innovate and incorporate innovations into the production process, and growth is generated.

I also find the same process with the accumulation of technological capital, to the extent that individuals, once included, will invest in research and development, which leads to

the birth of new processes, allowing an improvement in productivity and a decrease in unit costs of production. Of course, it should also be noted that the autonomous character of growth resides because the accumulation processes described are generators of positive externalities.

As a logical extension of this theoretical argument, it is necessary to empirically test this positive relationship between financial inclusion and economic growth in the study countries.

3 Empirical Evidence

3.1 Data

The empirical analysis will work with a panel of 57 developing countries for the period 2007-2017. Mobile money services started in developing countries in the 2007s, thus dictating the study period. Indeed, I recall that the significant innovation of the analysis besides providing a theoretical analysis is to account for the impact of digital financial services on growth.

The countries included in the database come from Africa, Latin America, Eastern Europe, and Oceania. The data retrieved from the Penn World Table (PWT) 9.1, the Financial development and structure database designed by Beck et al., the ICT regulatory tracker, and the World Bank database. I do not use the Financial Access Survey and the Global Findex because these databases have too many missing observations and do not provide continuous time horizon observations for mobile money.

Table 1 provides the countries included in the sample.

Table 1. Sample Countries

Albania	Ghana	Mozambique
Angola	Guatemala	Myanmar
Armenia	Guinea	Namibia
Bangladesh	Guinea-Bissau	Niger
Benin	Haiti	Nigeria
Botswana	India	Pakistan
Burkina Faso	Indonesia	Paraguay
Cambodia	Jamaica	Philippines
Cameroon	Jordan	Romania
Central African Republic	Kenya	Rwanda
Chad	Lesotho	Senegal
Congo, Rep,	Madagascar	South Africa
Côte d'Ivoire	Malawi	Sudan
Dominican Republic	Malaysia	Tanzania
Ecuador	Maldives	Thailand
Egypt, Arab Rep,	Mali	Togo
Eswatini	Mauritania	Uganda
Fiji	Mauritius	Zambia
Gabon	Mexico	Zimbabwe

3.2 Model Specification

In this part, I will conduct an empirical analysis that highlights the potential impact of financial inclusion on economic growth.

I seek to present the contributions of two financial agents separately. These are Commercial Banks and Telecoms. These two agents are the main actors in the financial inclusion process in developing countries. Commercial Banks are essentially financial

institutions that materialize any country's formal financial system and are the leading providers of deposit, savings, and credit services. Telecoms are the top providers of Mobile Money services. These services include money transfers, micro-financing, and deposits. Nevertheless, money transfer remains the service most used by the population.

For empirical analysis, following Mihasonirina and Kangni (2011), Waverman et al. (2005), I use a dynamic panel model to study the relationship between financial inclusion and economic growth. The endogenous model can be defined as follows:

$$\gamma_{i,t} = \alpha\gamma_{i,t-1} + \beta_{10}X_{i,t} + \beta_{11}X_{i,t-1} + \Gamma Z_{i,t} + \eta_i + \mu_{i,t} \quad (18)$$

where i and t respectively represent individual and time indices, $\gamma_{i,t}$ the economic growth, $\gamma_{i,t-1}$ the initial level of GDP per capita, $X_{i,t}$ the financial inclusion variable whose first-lag $X_{i,t-1}$ is also a regressor, $Z_{i,t}$ the matrix of control variables, η_i a country-specific fixed effect and $\mu_{i,t}$ the error term in the equation.

To estimate our dynamic panel model, I use the panel dynamic generalized method of moment (GMM) estimator proposed by Blundell and Bond (1998). The GMM estimator in the system combines the first difference equations with the level equations. One advantage of this methodology is that it controls endogeneity biases related to financial inclusion indicators and other control variables. Indeed, with the first difference estimator, I eliminate individual-specific effects, and by integrating the level equations, I obtain unbiased results in finite samples when the instruments are weak. The instruments in the first difference equation are expressed in levels and vice versa. I also choose this model because our time dimension that not long. For example, I can't run Dynamic Ordinary Least Square (DOLS) or Pooled Mean Group (PMG), which need more than fifteen years.

Economic growth is captured through the logarithm of the country's GDP per capita

growth rate. Financial inclusion is measured by two variables: the logarithm of the financial system deposits to GDP and the logarithm² of active Mobile Money account. The first one captures the level of Commercial Banks' formal inclusion³, and the second expresses digital inclusion.

Concerning active Mobile Money account, based on the GSMA's State of the Industry Report on Mobile Money of 2018, I have identified three determinants for the number of active Mobile Money accounts. These are the number of mobile subscriptions, access to electricity⁴, and enabling regulation that directly influences the adoption and use of Mobile Money services. Thus, by using mobile subscriptions, access to electricity, and regulation, we build a synthetic index with PCA⁵, this index allowing us to measure the number of active Mobile Money accounts.

Population growth rate, inflation rate, openness rate and government expenditures labor are our four control variables. Table 2 indicates the summary statistics of variables.

² All these variables are expressed in logarithms to provide an elasticity analysis

³ It would have been better to use depositors to avoid the formal inclusion overestimation, knowing that an individual can make more than one deposit. We use deposits than the number of depositors because of missing data for some countries of our sample

⁴ Population use mobile money to pay electricity and water bills

⁵ Principal Components Analysis

Table 2. Descriptive Statistics

Variables	Observations	Mean	Std. Dev.	Min	Max
GDP per capita growth rate (log)	570	0.0220799	0.0435327	-0.4593397	0.4786493
Initial GDP per capita (log)	570	8.3089	0.9039889	6.392678	10.09818
Population growth rate	570	0.0205858	0.010919	-0.010667	0.0551331
Inflation rate	570	0.0140312	0.1435726	-0.6598689	2.388937
Openness rate	627	-0.079580	0.1449723	-0.6091282	0.6253507
Government expenditures	627	0.1631975	0.0663236	0.0151194	0.4060143
Financial system deposits (log)	619	3.286671	0.6797125	0.8164545	4.858567
Active mobile money account (log)	625	1.341744	0.3847388	0.0899879	1.958363
Mobile cellular subscriptions (log)	627	4.187808	0.6684843	0.4054651	5.334167
Deposit money bank assets (log)	619	3.317805	0.7454707	1.022286	4.960848
Private credit by deposit money banks (log)	618	3.023796	0.7613919	0.7920645	4.787427

3.3 Results

Table 3 presents the impact of financial inclusion on economic growth, particularly the impact of the inclusion of the traditional and digital financial sectors. The first column reports the baseline growth model. The signs of control variables are broadly consistent with theoretical predictions. The negative and significant coefficient of initial GDP per capita verifies the convergence hypothesis. In addition, as shown by past studies, without a sufficiently sustained pace of technological progress, population growth negatively affects the product per capita growth (Blanchet, 2001). The results of the baseline regression also suggest that government expenditure favors growth while. By the way, the inflation rate capturing macroeconomics instability positively impacts growth. Indeed, inflation damages growth only above a certain threshold which depends mainly on the economy's structure.

In column 2, I introduced the traditional finance inclusion variable in the baseline model. In doing so, it is noted that an increase in the level of inclusion measured by the

financial system deposits to GDP leads to an increase in GDP per capita. Then, in column 3, the first-order lag is introduced in addition to the traditional finance inclusion variable. I include the first-order lag in the specification to judge the impact of advancing the financial inclusion process on growth. Then, if formal finance inclusion still has a positive effect on growth, its lag negatively impacts. These results reflect the fact that improved access to financial services increases growth. Indeed, including individuals in the system generally leads to productive investment. This translates into an increase in GDP per capita. Better access to deposits ensures that everyone can access financial services and generates economic opportunities allocated to the most profitable projects. Formal financial inclusion generates growth through the creation of opportunities for individuals excluded from the system.

For digital inclusion, following the same procedure as for standard inclusion, the model estimates are presented in columns 4 and 5, respectively.

There is a positive impact of digital mobile inclusion on GDP per capita growth. The rise of digital finance creates opportunities for individuals and businesses that have been excluded from the formal banking system. Digital finance improves living conditions by offering financial services such as transactions accounts, credit, and insurances. Nevertheless, mobile inclusion coefficients on growth are higher than that of formal finance. This is due to the use that people have of Mobile Money accounts in these developing countries. Indeed, with the facilities implemented by new technologies, people can use their Mobile Money account to make low-cost bill payments, tuition fees ⁶, money transfers in rural areas, and large disbursements. Also, the primary financial services

⁶ Bill and tuition fees are mainly consisting of electricity bill, water bill, medical emergencies, school and university fees

proposed by Telecoms are accessible to the entire population, the cost of access being the price of the telephone chip, which happens to be low. There is, therefore, no cost to create a mobile account for money transfers and other financial services. Populations benefit significantly from services, and there are still individuals with often high economic potential⁷ who do not use services.

3.4 Robustness Test

To test the robustness of our results, I conducted estimates to check the sensitivity of the coefficients on financial inclusion. Table 4 shows forecasts for formal and mobile inclusion by changing our interest variables. The traditional inclusion is captured by two new variables: deposit money bank to GDP and private credit by deposit money banks to GDP. Columns 1 and 2 present the deposit money bank, while columns 3 and 4 show personal credit by deposit money banks. From the latter, traditional finance coefficients stay significant, positive for the variable, and harmful for its lag.

Concerning digital inclusion, I change in columns 5 and 6 our index by the mobile cellular subscriptions. Digital inclusion still has a positive impact on growth, and an improvement of financial access increases growth.

I also test the stability of the financial inclusion coefficient to the sample composition. Based on the country's geographical area, I can classify our countries into two groups: Africa and Other⁸. I strictly run regression on the sample of African countries⁹.

In doing so, Table 5 presents the impact of financial inclusion on growth in African

⁷ We are referring to individuals who may regularly make large financial transfers

⁸ Countries belonging to the Other's group are from Asia, Europe, Latin America, Middle East, and North Africa

⁹ Estimates could not be made for the other group because there were not enough observations. This did not allow us to perform the tests of self-correlation and proliferation of the instruments to validate the results obtained with the GMM.

countries. Formal financial inclusion contributes to growth in African countries except that the elasticity is less than that obtained without the restriction of the sample. Even though the coefficient on the lag of formal inclusion retains its negative sign, I can't affirm that improved access to traditional finance has increased economic growth in African because this coefficient is not significant (column 3).

When we look at digital inclusion in Africa, results seem interesting in that they reveal that improved access to digital finance has increased growth and that digital inclusion has an elasticity high (column 5) than that general elasticity obtained from Table 3. This result underlines the fact that digital inclusion appears like a natural growth issue for African countries. Nevertheless, it should be noted that digital inclusion also has Africa higher positive impact on growth than those of standard inclusion.

Thus, these results reveal a specific heterogeneity between countries according to their geographical area. Therefore, the coefficients estimated for the entire sample must be carefully interpreted. Indeed, as demonstrated by the theoretical model presented above, the benefits of financial inclusion do not have the same magnitude. This magnitude depends on country-specific factors. So, to the extent that the data allow, it would be helpful to take these specific factors into account.

4 Conclusion

This paper examines the impact of financial inclusion on economic growth in developing countries with a considerable rise in digital financial services. To reach this, I realize both theoretical and empirical analyses. Focusing on a growth model for the financial sector, this paper argues that consumption could be one of the channels through which financial inclusion, in general, contributes to growth. Concerning empirical analysis, considering a panel of 57 developing countries during 2007-2017, I distinguish the impact of formal inclusion and digital inclusion on growth with the GMM estimator in system. Concerning standard inclusion, the results of the estimations reveal that financial system deposits contribute to economic growth in developing countries. As for digital inclusion, measured by the number of active Mobile Money accounts being confronted with inaccessible data, we constructed an index based on the determinants of active accounts. The GMM estimators present a positive impact of digital inclusion on growth.

The findings of this paper underline that digital inclusion, which telecommunications companies in developing countries mainly provide, contributes more to growth than formal inclusion. Policies in developing countries should encourage telecommunications companies to invest and promote this activity of financial inclusion. Reflections could focus on the regulation of this sector. Indeed, restrictive regulatory frameworks can negatively affect activity expansion because restrictive law raises costs for consumers and limits the rollout of new services. According to GSMA, 2018 regulatory developments appeared encouraging at first glance, yet their layers of complexity reveal increasingly restrictive requirements. To illustrate, the telecommunication sector, which is already one of the highest taxed in Sub-Saharan Africa, witnessed in 2018 the introduction of taxes on

mobile money transactions throughout the region. This new tax feeds debates in regards to the impact it could have on digital inclusion.

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Appendices

Figure 3. **Correlation between Formal Inclusion and Economic Growth**

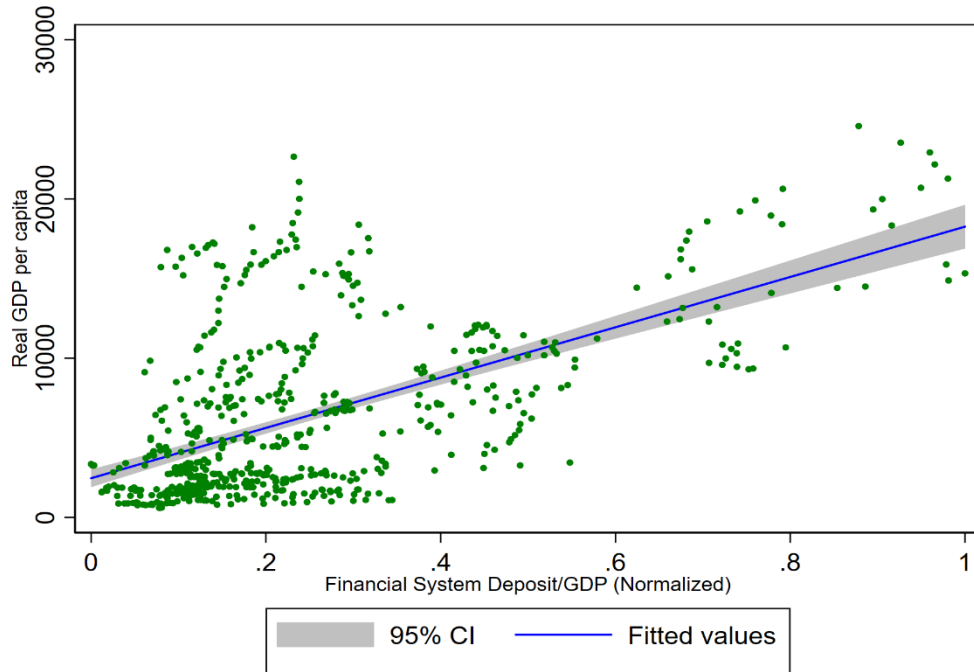


Figure 4. **Correlation between Mobile Inclusion and Economic Growth**

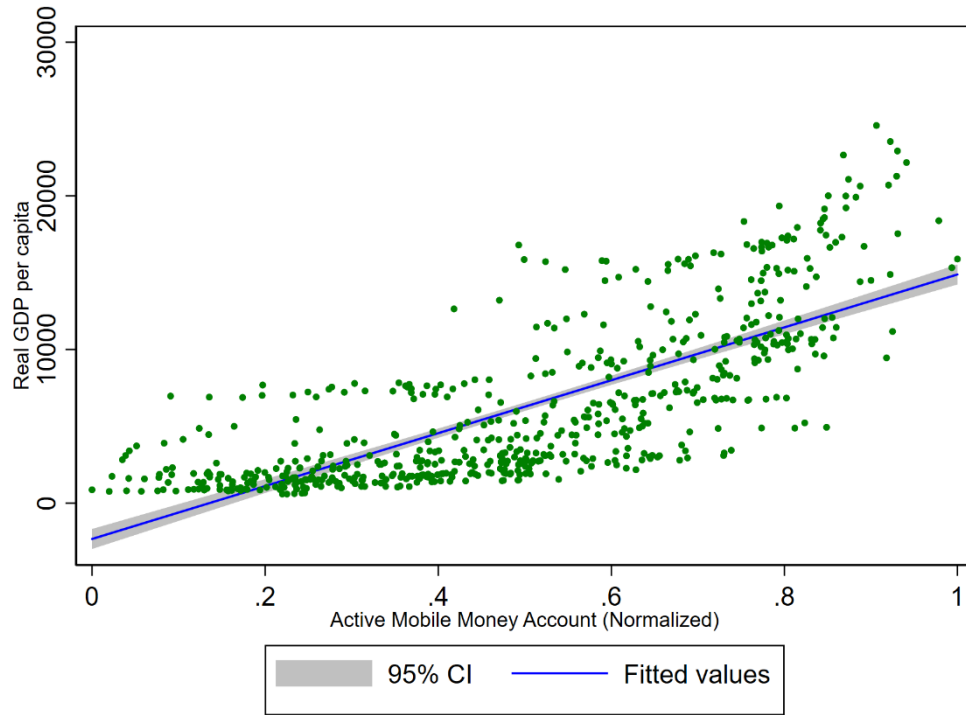


Figure 5. **Trends in Active Mobile Money Account and Financial System Deposit**

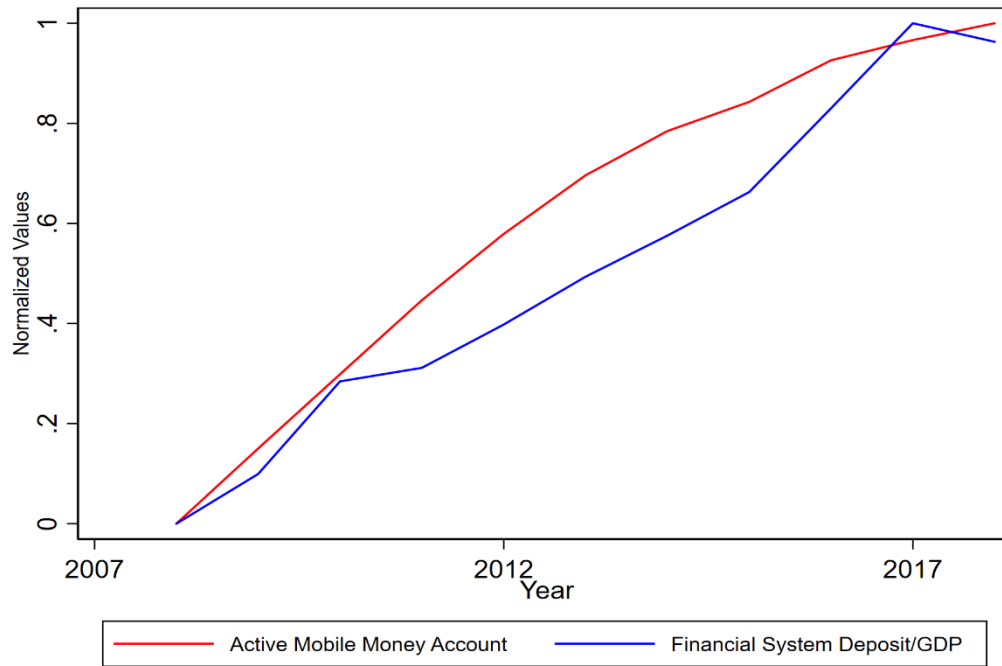


Figure 6. **International Comparison with Indicators of Formal Inclusion**

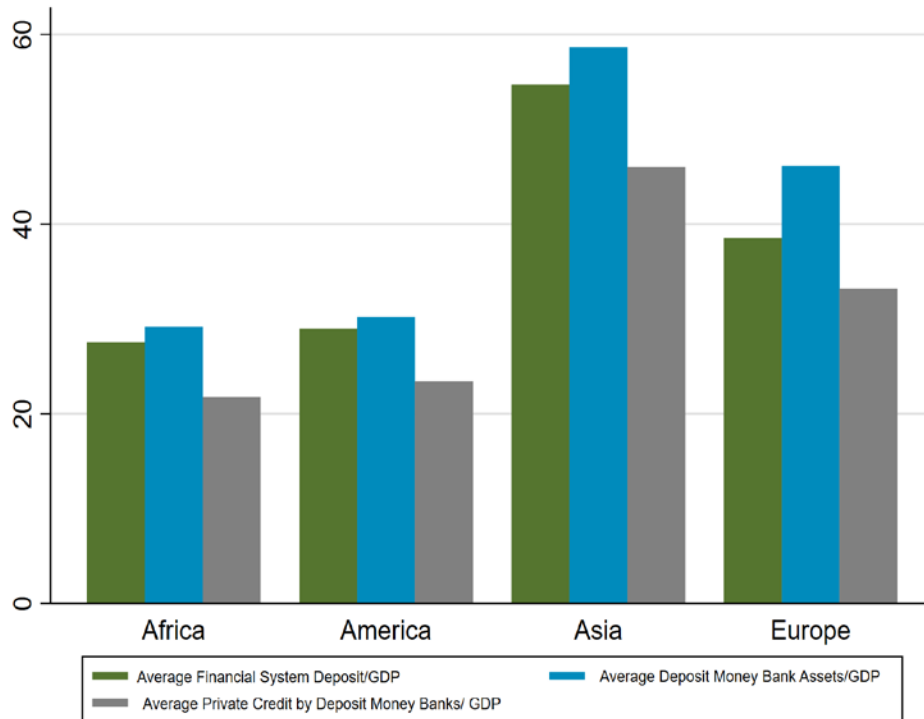


Figure 7. **Mobile Inclusion According to Continent**

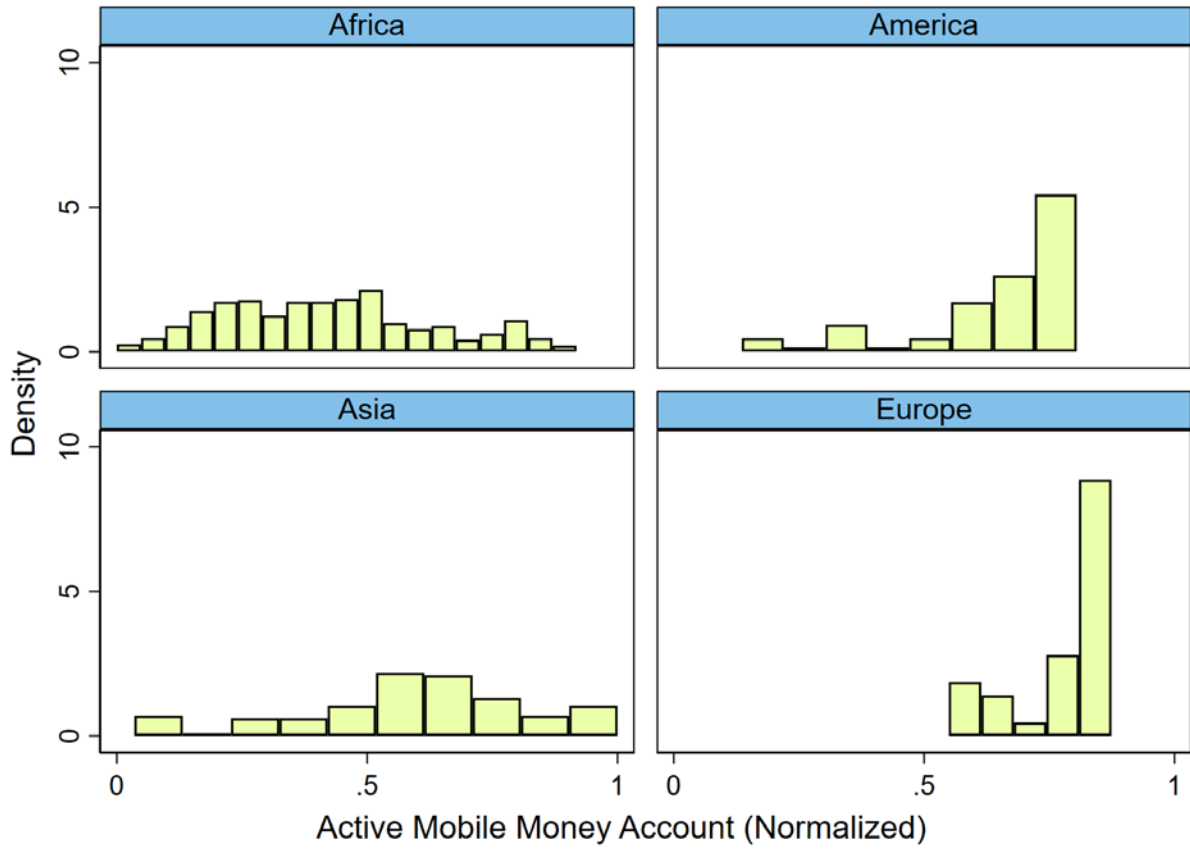


Table 3. Impact of Formal and Mobile Inclusion on Growth

	(1)	(2)	(3)	(4)	(5)
Initial GDP per capita (log)	-0.0122*** (0.00239)	-0.0375*** (0.0130)	-0.0503*** (0.0118)	-0.0199*** (0.00410)	-0.0429*** (0.00604)
Financial system deposits (log)		0.0236** (0.0112)	0.0911** (0.0362)		
L.Financial system deposits (log)			-0.0541* (0.0284)		
Active mobile money account (log)				0.0349*** (0.0112)	0.557*** (0.0759)
L.Active mobile money account (log)					-0.443*** (0.0649)
Population growth rate	-0.848*** (0.139)	-1.464*** (0.410)	-1.725*** (0.347)	-0.780*** (0.140)	-1.115*** (0.199)
Inflation rate	0.0304*** (0.00511)	0.0350*** (0.01000)	0.0422*** (0.0109)	0.0306*** (0.00501)	0.0546*** (0.0107)
Openness rate	0.00585 (0.00863)	0.0785** (0.0355)	0.102*** (0.0342)	0.0228** (0.0106)	0.0867*** (0.0183)
Government expenditures	0.0666** (0.0259)	0.126* (0.0655)	0.155** (0.0684)	0.0506** (0.0246)	0.0935*** (0.0298)
Constant	0.129*** (0.0183)	0.271*** (0.0794)	0.333*** (0.0680)	0.147*** (0.0209)	0.214*** (0.0308)
Observations	513	503	501	512	511
Number of countries	57	57	57	57	57
Hansen test (prob.)	0.108	0.340	0.280	0.106	0.368
AR2 (prob.)	0.430	0.361	0.360	0.440	0.488

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01

Table 4. Sensitivity Test for Robustness

	(1)	(2)	(3)	(4)	(5)	(6)
Initial GDP per capita (log)	-0.0349*** (0.00898)	-0.0353*** (0.0105)	-0.0404*** (0.00916)	-0.0206*** (0.00211)	-0.0492*** (0.00666)	-0.0559*** (0.00509)
Deposit money bank assets (log)	0.0253*** (0.00640)	0.148*** (0.0447)				
L.Deposit money bank assets (log)		-0.113*** (0.0422)				
Private credit by deposit money banks (log)			0.0266*** (0.00654)	0.0381*** (0.00541)		
L.Private credit by deposit money banks (log)				-0.0195*** (0.00461)		
Mobile cellular subscriptions (log)					0.0452*** (0.0111)	0.213*** (0.0202)
L.Mobile cellular subscriptions (log)						-0.140*** (0.0146)
Population growth rate	-1.261*** (0.352)	-1.026** (0.441)	-1.456*** (0.334)	-0.740*** (0.124)	-1.825*** (0.243)	-1.791*** (0.204)
Inflation rate	0.0369*** (0.0104)	0.0535** (0.0240)	0.0337*** (0.0103)	0.0401*** (0.00382)	0.0340*** (0.00726)	0.0375*** (0.00602)
Openness rate	0.0598** (0.0261)	0.0438 (0.0379)	0.0785*** (0.0276)	0.0449*** (0.00939)	0.0882*** (0.0163)	0.108*** (0.0164)
Government expenditures	0.0853* (0.0464)	0.0768* (0.0444)	0.0973* (0.0544)	0.0400** (0.0166)	0.103** (0.0405)	0.0811*** (0.0226)
Constant	0.243*** (0.0614)	0.204*** (0.0779)	0.297*** (0.0623)	0.146*** (0.0149)	0.261*** (0.0283)	0.189*** (0.0237)
Observations	503	501	502	500	513	513
Number of countries	57	57	57	57	57	57
Hansen test (prob.)	0.246	0.489	0.243	0.121	0.113	0.120
AR2 (prob.)	0.369	0.484	0.389	0.396	0.387	0.302

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01

Table 5. Stability Test for Robustness

	(1)	(2)	(3)	(4)	(5)
Initial GDP per capita (log)	-0.0395*** (0.00677)	-0.0298*** (0.00438)	-0.0357*** (0.00398)	-0.0182*** (0.00253)	-0.0416*** (0.00361)
Financial system deposits (log)		0.0283*** (0.00506)	0.0363*** (0.00969)		
L.Financial system deposits (log)			-0.00443 (0.00996)		
Active mobile money account (log)				0.0303*** (0.00551)	0.619*** (0.0455)
L.Active mobile money account (log)					-0.505*** (0.0426)
Population growth rate	-1.952*** (0.601)	-0.106 (0.283)	-0.185 (0.194)	0.0729 (0.148)	-0.483** (0.240)
Inflation rate	0.0165 (0.0114)	0.0333*** (0.00971)	0.0264*** (0.00617)	-0.00819 (0.00793)	0.00139 (0.0130)
Openness rate	0.0727** (0.0333)	0.0395*** (0.0141)	0.0623*** (0.0186)	-0.0137 (0.0111)	0.0665*** (0.00730)
Government expenditures	0.132** (0.0518)	0.0364 (0.0349)	0.0454 (0.0315)	0.0297 (0.0243)	0.0415** (0.0200)
Constant	0.366*** (0.0492)	0.166*** (0.0250)	0.203*** (0.0275)	0.116*** (0.0143)	0.186*** (0.0214)
Observations	306	297	295	306	306
Number of countries	34	34	34	34	34
Hansen test (prob.)	0.137	0.276	0.245	0.239	0.551
AR2 (prob.)	0.319	0.274	0.253	0.334	0.382
Africa	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01