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# Is Financial Innovation and Structural Transformation Friends or Enemies? Evidence from *Sub-Saharan Africa*

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## Abstract

This research analyzes the impact of financial innovation on structural transformation in sub-Saharan Africa. While the transformation of productive structures remains a crucial challenge for the region's sustainable development, the catalytic role of new financial technologies remains largely unexplored. Drawing on the theoretical frameworks of Lewis's sectoral dualism and Schumpeter's innovation, we model this impact through two key dimensions: the adoption of mobile banking services (process approach) and the development of digital finance infrastructure. The empirical analysis is conducted on a panel of 46 sub-Saharan African countries covering the period 2000-2020. To correct for heteroscedasticity and autocorrelation of the residuals, the estimations are performed using Indicator Least Squares (ILS) with robust standard errors (HAC). The results reveal that mobile banking and digital finance have a significant positive impact on labor productivity and GDP per capita, validating the leverage role of FinTech. However, the observed negative impact on GDP per employed person highlights a preferential reallocation towards a low-productivity informal service sector, confirming a biased structural change process. Among the control variables, urbanization dynamics emerge as the most powerful driver of resource reallocation. These findings underscore the importance for policymakers of supporting the growth of FinTech with appropriate regulatory frameworks and increased interoperability to maximize its leverage on industrialization and economic diversification in the sub-region.

Keywords: Financial innovation; Digital finance; Structural transformation; Indicator Least Squares (ILS); Sub-Saharan Africa

## Introduction

The pursuit of economic development and the sustainable improvement of the socio-economic well-being of populations remains the major challenge for policymakers and social scientists. Contemporary economic literature reaffirms that sustainable growth cannot be a mere quantitative expansion; it fundamentally rests on the interaction between an inclusive financial system and a robust dynamic of structural transformation. Historically theorized by Kuznets (1966), structural transformation is defined as the process of reallocating productive resources (labor and capital) from low-productivity activities (the traditional agricultural sector) to modern, higher-productivity activities (manufacturing and services). It is precisely the speed and direction of this transformation

that determine a nation's ability to definitively escape the low- or middle-income trap.

In this context, the African continent has adopted ambitious strategic agendas, such as the United Nations' 2030 Agenda and the African Union's Agenda 2063. While significant progress has been made in GDP growth since the beginning of the millennium, the overall empirical picture remains tinged with dismay. Sub-Saharan Africa (SSA) continues to lag behind in its industrial modernization trajectories. More than half of the world's population living in extreme poverty resides on the continent. Moreover, recent work by the World Bank [1] and Rodrik et al., [2] highlights an atypical trajectory: the sub-region's rapid urbanization is accompanied by a major structural distortion. Lacking a dynamic manufacturing sector capable of absorbing the surplus of labor, rural migration flows are massively reallocated towards an informal subsistence service sector with very low productivity, drastically limiting the expected macroeconomic efficiency gains.

Analysis of this transformation in sub-Saharan Africa reveals profound structural heterogeneity. On the one hand, growth remains largely dependent on natural resource endowments and is characterized by high volatility (Nigeria, Angola, Botswana). On the other hand, the rate of worker migration out of agriculture is slower than in Asia, and a few economies (Cameroon, Zambia) even exhibit phases of "regressive structural change," characterized by a shift in employment toward sectors with lower average productivity (McMillan and Rodrik [3]). Beyond the traditional shortcomings in investment coordination, analyses by the African Development Bank (2025) identify major institutional obstacles: the lack of formal legal identification for more than 500 million African citizens and the chronic underdevelopment of traditional banking infrastructure, which hinders the capitalization of the productive sector.

It is precisely at the heart of this banking underdevelopment that a major technological paradox can be observed. Despite the liberalization reforms undertaken since the 1990s, the traditional system exhibits a particularly low rate of formal inclusion, characterized by the rationing of bank credit to SMEs (Nguena and Tsafack Nanfosso [4]). This rationing is explained by the remoteness of branches, information asymmetry, and disproportionate requirements for physical collateral. However, the last two decades have witnessed a paradigm shift: the advent and rapid spread of FinTech and Mobile Money. By overcoming geographical constraints and capitalizing on mobile network penetration, financial innovation has profoundly transformed the architecture of payments and service delivery, making sub-Saharan Africa the world leader in mobile finance (GSMA [5]).

The analysis of interactions between the financial sphere and structural changes in the real economy divides the empirical literature into two main streams. The first, classically inspired, assesses the impact of financial development using traditional aggregates such as the ratio of private sector credit to GDP or the money supply (M2/GDP). Recent extensions of this work (Beck et al.,[6]) demonstrate that traditional financial deepening facilitates the reallocation of capital towards industrial sectors by reducing information costs. However, in sub-Saharan Africa, this classical channel encounters structural limitations due to the high degree of informality in the economy. The second, rapidly expanding, stream focuses on the changes brought about by the digital revolution (FinTech). The work of Ozili [7], Demirgüç-Kunt et al., [8], and Ngongang [9] establishes a consensus that financial innovation overcomes the failures of the traditional market. By acting as a catalyst for financial inclusion, it enables historically excluded populations to smooth their consumption, accumulate digital savings, and finance productive micro-entrepreneurial activities outside of agriculture. Recently, Domeher et al., [10] and Bashir [11] highlighted that the adoption of digital financial technologies improves transaction efficiency and supports the diversification of the real sector in Africa.

Despite the wealth of research, contemporary literature presents two significant gaps. First, most existing studies analyze FinTech solely from the perspective of household financial inclusion or overall GDP growth, without explicitly modeling the mechanisms by which mobile banking and digital finance influence sectoral productivity or labor reallocation. Second, analyses of financial innovation in sub-Saharan Africa are often limited to partial approaches based on a single indicator (mobile penetration rate), ignoring the multidimensional nature of the current digital financial ecosystem.

This research is positioned precisely at the intersection of these debates. By mobilizing panel data covering 46 sub-Saharan African countries over the period 2000-2020, our study goes beyond traditional financial indicators to capture the net effect of mobile banking innovations and digital finance infrastructure on the overall dynamics of structural transformation.

Faced with these challenges, this research poses the following fundamental question: **What is the impact of financial innovation on structural transformation in sub-Saharan Africa?** In response to this issue, the overall objective of this study is to analyze the impact of financial innovation on structural transformation in Africa. Specifically, it will first assess the effect of mobile banking services on this transformation, and second, determine the precise role played by digital finance infrastructures in modifying the productive structures of sub-Saharan Africa.

The remainder of this article is organized as follows: the second section reviews the theoretical and empirical literature; the third section presents the econometric methodology and the data; the fourth section presents and discusses the empirical results; finally, the fifth section concludes by formulating recommendations for economic policies.

## Literature Review

Analyzing the interactions between financial system development and macroeconomic dynamics is a central pillar of contemporary development economics. In the context of sub-Saharan Africa, the rapid emergence of new financial technologies is redefining traditional channels for resource allocation and productivity. This review aims to critically examine the theoretical and empirical

literature on the impact of financial innovation on the structural transformation of developing economies.

## Conceptual and theoretical framework

### 1.1.1. *The concept of structural transformation and its contemporary mutations*

Structural change traditionally refers to the reallocation of labor and economic activities from traditional, low-productivity sectors (subsistence agriculture) to modern, high-productivity sectors (manufacturing and services) (Kuznets [12]; Chenery [13]. Clark [14]) formalized this shift through two mechanisms: differential growth in intersectoral productivity and the elasticity of demand effects (Engel effects).

However, recent analyses (Rodrik [1]; UNECA [15]) show that the classic sequential transition model (Agriculture, Industry, Services) is undergoing a fundamental shift in sub-Saharan Africa. A phenomenon of "leapfrogging" *or* premature tertiarization is observed. Modern structural transformation now incorporates the concept of *digital structural change*, characterized by the direct transfer of informal labor to higher value-added digital services and technology platforms, partially bypassing the stage of heavy industrialization.

### 1.1.2. *Determinants and frictions of structural change*

The pace of this transformation is governed by the balance between labor supply and demand, strongly constrained by two types of friction:

I. **Government Failures*:*** Regulatory rigidities, sectoral tax distortions, and the lack of secure land reforms inhibit sectoral mobility and hinder the rural-urban transition.

II. **Market Failures:** Information asymmetries in credit markets lead to the systematic rationing of high-potential SMEs due to a lack of collateral. Furthermore, chronic underinvestment in connectivity infrastructure and digital skills creates a mismatch between the supply of unskilled labor and the demands of modern sectors.

### 1.1.3. *The evolution of financial innovation: from Mobile Money to integrated Fintechs*

Financial innovation encompasses all changes in structure, instruments and operational processes that contribute to financial deepening and lower transaction costs (Frame and White, 2014; Tufano, 2003). It takes the form of institutional, product and process innovations.

In sub-Saharan Africa, mobile money has historically distinguished itself from traditional mobile banking because it relies on the infrastructure of mobile network operators (MNOs), thus eliminating the need for users to hold a formal bank account. Recent work (GSMA, 2025; Osei & Diallo [16]) analyzes the transition of these basic payment services to the second-generation fintech ecosystem. This new ecosystem integrates instant algorithmic microcredit, cross-border payment interoperability (notably via the AfCFTA's PAPSS system), and decentralized finance. Process innovation is currently dominated by the use of big data and artificial intelligence for alternative credit scoring, making it possible to overcome the lack of collateral that traditionally hindered access to capital for productive entrepreneurship.

## Theoretical foundations of interactions

The analysis of the interactions between financial innovation and macroeconomic dynamics is structured around four main theoretical currents:

I. **Schumpeter's theory of economic evolution:** Schumpeter [17] posits that development is based on real transformations driven by innovation, with credit acting as the linchpin of "creative destruction." Applied to digital finance, this framework shows how technological innovations bypass the frictions of the traditional banking market to reallocate capital to the most efficient entrepreneurs.

II. **Lewis's economic dualism model (1955):** This model formalizes a dual economy where the traditional (agricultural) sector provides surplus labor to the highly productive modern (industrial) sector. The reinvestment of industrial profits generates capital accumulation, which sustains development. Digital finance plays a crucial role in accelerating this capitalization [18].

III. **The Clark-Fisher and Fuchs structural change model:** This framework models the intersectoral transition towards the service sector, justified by a high income elasticity of demand for services and differential labor productivity. It emphasizes the need for technological modernization of the service sector to maintain overall productivity growth.

IV. **The Technology Acceptance Model (TAM - Davis, 1986):** This model posits that the adoption of an innovation depends on its perceived usefulness and ease of use. The simplicity of mobile interfaces in Africa has enabled the integration of agents excluded from the formal system, promoting the smoothing of shocks and productive investment at the base of the economic pyramid [19].

### IV.3. **Contemporary Empirical Literature**

Recent empirical literature highlights increasingly documented transmission channels as well as new threshold effects:

**The channel of financial inclusion and inclusive growth:** Domeher's [10] work confirms that financial inclusion plays a comprehensive mediating role between financial innovation and economic performance. Using dynamic panels, Nguena [20] highlights the positive link between mobile finance and inclusive growth in sub-Saharan Africa, while Dunne (2018) demonstrates that these innovations structurally alter the stability of money demand in the region.

Regarding long-term dynamics, Qamruzzaman and Jianguo (2017) employed a phased lag autoregression (ARDL) model with

bounded tests, combined with an error correction model (ECM) based on Granger causality, to study the impact of financial innovation on economic growth in Bangladesh from 1988 to 2016. Using domestic credit to the private sector and the ratio of broad money supply to broad money supply, they analyzed the impact of financial innovation on economic growth in Bangladesh from 1988 to 2016. Using restricted (M2/M1) ratios as indicators of financial innovation, and real GDP per capita as an indicator of economic growth, the study confirms the existence of a stable, long-term cointegration relationship. This impact proved to be both positive and statistically significant, reinforcing the hypothesis that structural modernizations of the financial system accelerate economic expansion.

**Agricultural Productivity and the Lewis Channel Revisited:** A crucial body of literature (Agyekum et al., 2024; Mensah, 2025) analyzes the direct effect of access to mobile microcredit and FinTech services on agricultural productivity in Africa. By enabling rural households to more easily finance technological inputs (improved seeds, fertilizers, equipment), financial innovation increases marginal agricultural productivity. This efficiency gain frees up surplus labor for non-agricultural and manufacturing activities, empirically validating the Lewis channel.

Threshold Effects, Institutional Quality, and Infrastructure: Using dynamic panel models (DPMs) and threshold *panel regressions*, Osei & Diallo [21] and Ibrahim [22] qualify the overly optimistic conclusions of earlier studies. They demonstrate that the impact of financial innovation on structural transformation is only statistically positive and significant if the country crosses a certain threshold of institutional quality (control of corruption, rule of law) and digital connectivity (access to electricity, cost of bandwidth). Below this threshold, digital innovation tends to primarily fuel a very low-productivity informal service sector, without any spillover effect on industrialization [23].

Productivity Decomposition and TFP: Research by Kim et al., [21] confirms the importance of decomposing the effect of financial innovation on Total Factor Productivity (TFP). The introduction of mobile technologies interacts positively with capital accumulation per worker in the manufacturing sector, accelerating economic diversification.

Finally, the complex temporal trade-offs between market structure, innovation, and growth were highlighted by Aboagye (2014) in an analysis of Ghana using quarterly data covering the period 1990-2009. Applying the ARDL cointegration procedure revealed contrasting short- and long-term effects. On the one hand, banking competition negatively impacts economic growth in the short term but becomes a positive driver in the long term. On the other hand, financial innovation exhibits the opposite dynamic: its impact is immediately positive in the short term but proves negative in the long term.

Moreover, directionality tests indicate unidirectional Granger causality from banking competition to economic growth. Conversely, bidirectional causality was observed between financial innovation and economic growth, highlighting a feedback loop where financial innovation and economic expansion reinforce each other over time.

Analysis of the contemporary literature highlights three major limitations that our study aims to overcome:

(i) The scarcity of comprehensive macroeconomic empirical validations integrating both mobile banking and digital infrastructure finance;

(ii) The frequent use of rudimentary proxy *variables* (e.g., the simple rate of cellular subscriptions), a gap we fill by constructing a synthetic index using PCA; and

(iii) The need to assess the net impact of these innovations through the lens of a Cobb-Douglas type production function applied to 46 countries over a long period (2000-2020).

## Data and Methodology

### Research design and estimation strategy

This study adopts a quantitative empirical approach with descriptive and analytical aims, formalized to model the causal relationships between financial innovation and structural transformation in sub-Saharan Africa (SSA). The econometric architecture is based on dynamic panel data modeling, a methodological choice dictated by the two-dimensional nature of the data (cross-sectional and temporal). This approach allows for the simultaneous capture of individual inter-country heterogeneity (financial development gaps at a given point in time) and the temporal dynamics specific to each nation over the period studied.

### Scope of the study and sampling

The empirical setting is sub-Saharan Africa, a geographical area characterized by significant infrastructural challenges and a high proportion of populations excluded from the formal banking system. The sample comprises 46 sub-Saharan African countries observed over a time horizon of 2000-2020 . The choice of this time frame is rigorously justified by the availability, consistency, and continuity of secondary data over these two decades.

### Specification of econometric models

To assess the macroeconomic impact of financial innovation on the dynamics of structural transformation, we specify a main model based on the foundations of a Cobb-Douglas type production function:

$$\begin{cases} \left(StructTransf\right)_{it} = \alpha_0 + \alpha_1 \left(Financial\ \ Innovation\right)_{it} + \alpha_2 f\left(X_{i,t}\right) + \varepsilon_{i,t} \\ \varepsilon_{i,t} \sim iidN\left(0, \sigma_\varepsilon^2\right) \end{cases} \quad (1)$$

In order to isolate the transmission channels and to meet the specific objectives of the research, equation (1) is decomposed into two distinct operational models: the first captures innovations related to mobile telephony (*Mobile Banking*) and the second evaluates innovations in global digital finance (*Digital Finance*).

**Model 1: Mobile *Banking* Channel**

$$\begin{cases} \left(StructTransf\right)_{it} = \alpha_0 + \alpha_1 \left(Mobile\ \ Banking\right)_{it} + \alpha_2 f\left(X_{i,t}\right) + \varepsilon_{i,t} \\ \varepsilon_{i,t} \sim iidN\left(0, \sigma_\varepsilon^2\right) \end{cases} \quad (2)$$

**Model 2: Digital *Finance* Channel**

$$\begin{cases} \left(StructTransf\right)_{it} = \alpha_0 + \alpha_1 \left(Digital\ \ Finance\right)_{it} + \alpha_2 f\left(X_{i,t}\right) + \varepsilon_{i,t} \\ \varepsilon_{i,t} \sim iidN\left(0, \sigma_\varepsilon^2\right) \end{cases} \quad (3)$$

The signs of the expected coefficients *a priori* are positive (> 0$ and > 0), indicating a spillover effect of financial innovation on the modernization of economic structures.

## Definition and measurement of variables

***Dependent variable: Structural transformation***

In accordance with theoretical approaches to factor reallocation, it is captured empirically using three alternative indicators of overall productivity: GDP per worker, GDP per capita, and GDP per employed person.

***Independent variables: Financial innovation***

**Mobile Banking (Model 1):** Evaluated via a *synthetic Mobile Banking Index* constructed using Principal Component Analysis (PCA). This index incorporates the number of internet users, the rate of mobile phone usage for bill payments, and the frequency of sending and receiving money via mobile platforms.

**Digital Finance (Model 2):** Represented by the density of digital payment infrastructure, operationalized by the **number of automated teller machines (ATMs)** per 100,000 adults.

***Control Variables***

To stabilize the model and avoid omission bias, we introduce a control vector based on empirical literature: the institutional environment (Index of Economic Freedom), economic policy (trade openness, M3 money supply, monetary policy credibility - MPC, public investment), economic development and physical capital (infrastructure, urban population), external flows (FDI, remittances) and human development (secondary school enrollment rate - SSE, HDI).

**Table 1:** Definition of variables.

| Nature of the variable | Variable name | Substitution variable (Proxy) | Data source |
|---|---|---|---|
| Dependent | Structural Transformation | GDP per worker, GDP per capita, GDP per employed person | World Development Indicators (WB) |
| Independent (1) | Financial Innovation (Process) | Mobile Banking Index (ACP: Internet users, mobile transfers and payments) | GSMA / World Bank (IDA, IDP) |
| Independent (2) | Digital Finance (Infrastructure) | Number of Automated Teller Machines (ATMs) | Financial Development Database (BDDF) |
| Control | Institutional Environment | Index of Economic Freedom | Heritage Foundation |

***Data Sources and Instrument Validation***

All the data used in this study comes exclusively from leading institutional secondary sources, ensuring the reliability and reproducibility of the results: The World Bank: Data are extracted from the African Development Indicators (IDA), the Public Development Indicators (PDI), and the Financial Development and Structures Database (FDSD). The Heritage Foundation: For the Economic Freedom Index. The Global System for Mobile Communications (GSMA): For cellular technology penetration metrics.

## Presentation and Discussion of Results

This section presents the results of empirical estimations regarding the impact of financial innovation on structural transformation in sub-Saharan Africa. The analysis is divided into two parts: firstly, an evaluation of the mobile banking channel, and secondly, an evaluation of digital finance. The data, processed using Stata software for a panel of 46 countries (2000-2020), undergo preliminary graphical analysis before the interpretation of the regression models.

## Statistical analysis and stylized facts

The initial examination of the data using graphical representations highlights an overall weak relationship between financial innovation and structural change:

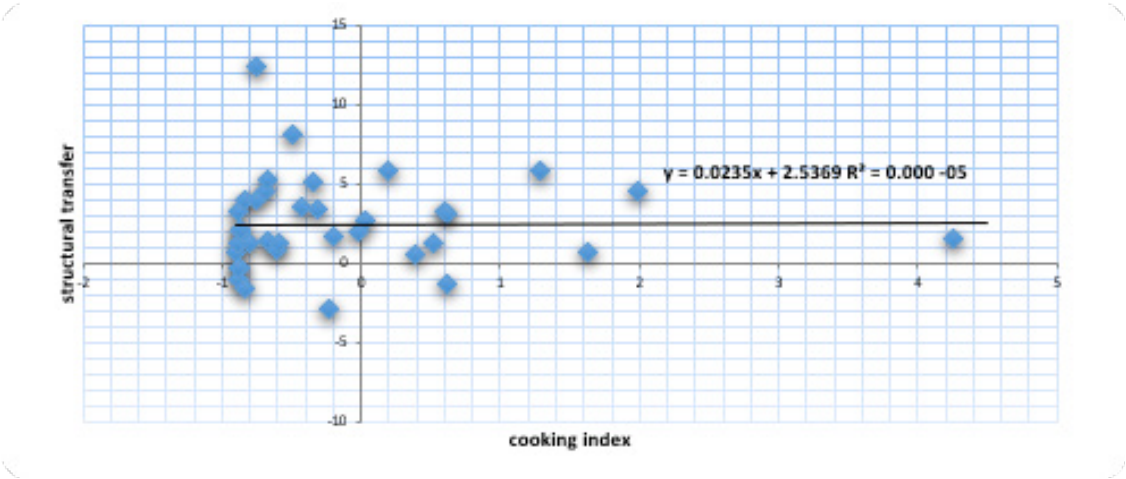


**Figure 1:** Mobile banking services and structural transformation.
**Source:** Authors' calculations

According to Figure 1 above, the mobile banking index has an $R^2$ of -0.00005, indicating that its contribution to structural transformation is only 0.005%. This means that there is no linear relationship between the mobile banking index and structural transformation, and that these two variables are not correlated. The remaining 99.995% is influenced by other variables, including control variables such as economic policy, economic development, institutional economics, and external flows.

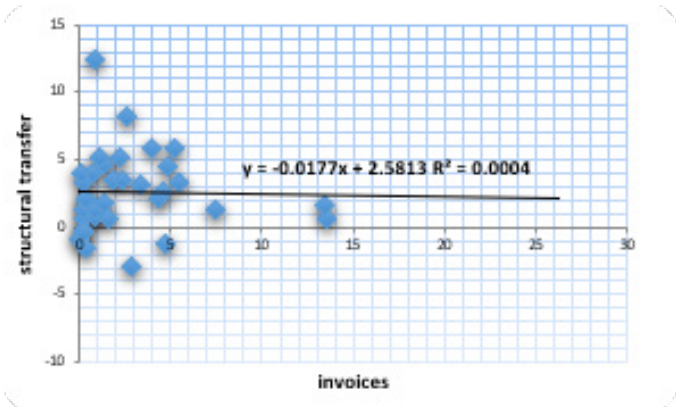


**Figure 2:** Mobile billing and structural transformation.
**Source:** Authors' calculations

According to Figure 2, mobile billing influences structural transformation by 0.04 %. This means there is no linear relationship between mobile billing and structural transformation. The correlation between the variables is very weak. A 1% increase in the number of mobile billing users leads to a 0.4% increase in structural transformation.

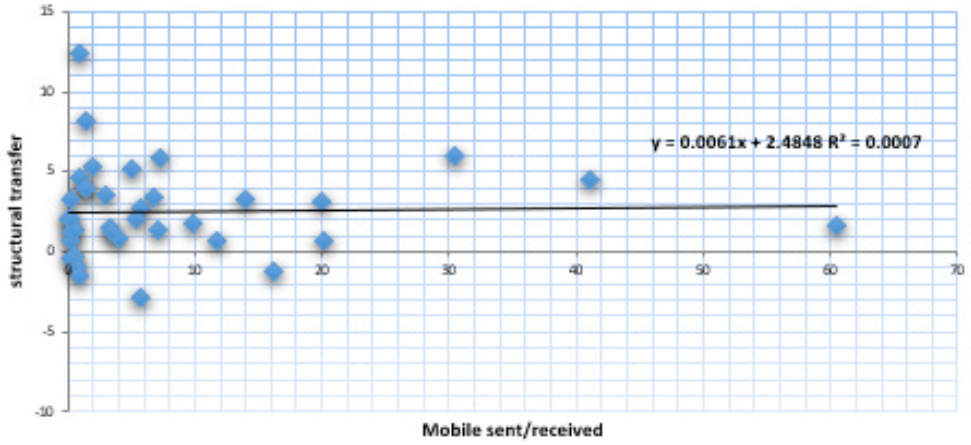


**Figure 3:** Mobile sending/receiving and structural transformation in Africa.
**Source:** Authors' calculations.

According to Figure 3 above, mobile sending and receiving data, which is an indicator of mobile banking services, influences the structural transformation by only 0.07 %. This means that this data, which represents the independent variable, explains only a small part of the variation in the dependent variable (the structural transformation). The influence of mobile sending and receiving data on the structural transformation is therefore minimal.

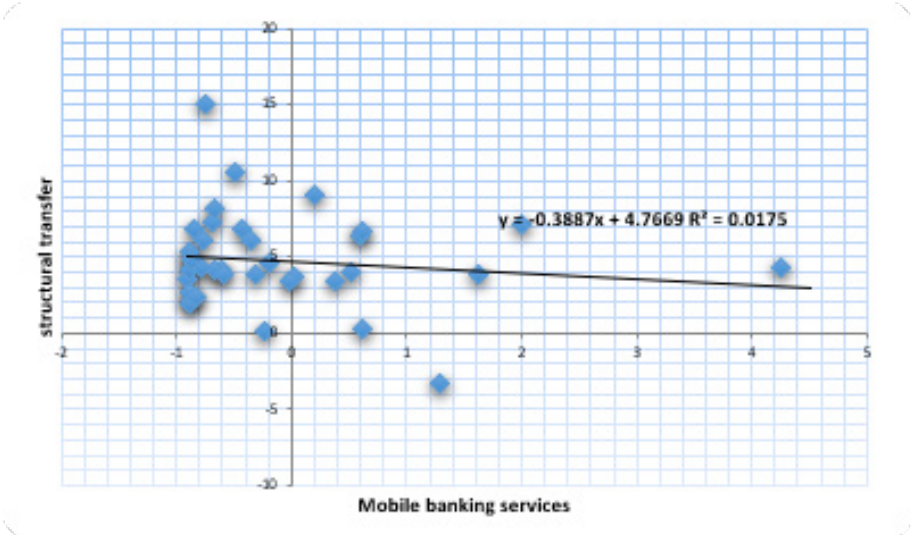


**Figure 4:** Mobile banking services (Internet users) and structural transformation in Africa.

According to Figure 4 above, internet users influence the structural transformation by 1.75%. This means that the result is invalid, as the coefficient of determination ($R^2$) cannot be greater than 1.

**Table 2:** Impact of the development of mobile finance and banking services on structural transformation.

| Variable category | Proxy |
|---|---|
| Structural transformation of productivity | GDP per employed person; GDP per worker; GDP per capita (University of Pennsylvania databases) |
| Development of mobile finance and banking services (4) | Internet users/manager, Mobile billing, Mobile customer service, Mobile banking services |

| | |
|---|---|
| digital finance | Number of ATMs |
| Economic policy (5) | CMP, commercial opening, financial opening, public investment, M3 |
| Economic development and physical capital (3) | Market size, market growth, market structure (infrastructure, population per capita) |
| Institutional economics (3) | Governance, Education (SSE). |
| External flows (3) | FDI, development aid, remittances |
| Human development (4) | Net transfer, HDI, HHC expenditure, domestic savings |

**Source:** Author's calculations.

CMP: Credible Monetary Policy. Mobile S/ R: Mobile phone used to send and receive money. M3: Money supply. GFCF: Gross fixed capital formation. NIM: Net interest margin. IRS: Interest rate spread. ROA: Return on assets. ROE: Return on equity. GDPg: GDP growth. Popg: Population growth. SSE: Secondary school enrollment rate. Ubanpop: Urban population. FDI: Foreign direct investment. HDI: Human Development Index. HHCExp: Household consumption expenditure. The sample size for this research is based on the population of 46 sub-Saharan African countries and is analyzed over a period of 21 years (from 2000 to 2020).

## Interpretation of results

**Table 3:** Impact of mobile finance &banking on structural transformation (Panel data estimation).

| | | GDP Per workers | | | GDP per capita | | | GDP per person employed | |
|---|---|---|---|---|---|---|---|---|---|
| | Internet users | **0.175**** | **0.043***** | --- | **-0.01***** | **-0.01***** | **---** | **-0.52**** | **---** |
| | | **(0.015)** | **(0.000)** | | **(0.000)** | **(0.000)** | | **(0.008)** | |
| | Mobile billing | **0.042**** | --- | --- | --- | **-0.97**** | --- | **-0.053**** | --- |
| | | **(0012)** | | | | **(0.021)** | | **(0.019)** | |
| | Mobile S/R | --- | **0.007*** | --- | **0.01***** | --- | **---** | --- | **---** |
| | | | **(0.086)** | | **(0.000)** | | | | |
| | Mobile banking | -2.65 | **0.422***** | **1.729***** | **---** | **---** | **-0.68**** | **---** | -0.001 |
| Economic policy | | (0.375) | **(0.000)** | **(0.000)** | | | **(0.009)** | | (0.348) |
| | Economic freedom | **1.058***** | **0.175***** | **---** | **-0.009***** | 0.124 | --- | 0.14 | --- |
| | | **(0.000)** | **(0.000)** | | **(0.000)** | (0.245) | | (0.702) | |
| | Trade openness | **1.05***** | --- | 0.315 | -2.377 | -3.008 | **-0.22***** | 0.031 | **-0.008**** |
| | | **(0.000)** | | (0.112) | (0.433) | (0.199) | **(0.008)** | (0.342) | **(0.022)** |
| | Financial openness | 0.458 | --- | 0.155 | --- | --- | -0.411 | --- | 0.086 |
| | | (0.428) | | (0.455) | | | (0.183) | | (0.175) |
| | Money Supply | **-0.11*** | --- | **0.191*** | --- | --- | 0.529 | --- | -1.001 |
| | | **(0.071)** | | **(0.076)** | | | (0.806) | | (0.444) |
| | CMP | **0.055**** | --- | **0.102*** | --- | --- | **-0.078**** | --- | -0.177 |
| | | **(0.004)** | | **(0.058)** | | | **(0.016)** | | (0.753) |
| | Public Investment | -1.01 | --- | -0.971 | --- | --- | **1.22***** | --- | **0.01***** |
| | | (0.239) | | (0.354) | | | **(0.000)** | | **(0.007)** |
| Economic development & capital | Infrastructure | 5.009 | 0.21 | **1.435*** | -2.099 | -1.093 | **-0.86***** | -0.409 | **-1.55**** |
| | | (0.922) | (0.235) | **(0.064)** | (0.222) | (0.603) | **(0.000)** | (0.189) | **(0.026)** |
| | Population growth | --- | 1.62 | -35.18 | --- | --- | 0.448 | --- | 0.117 |
| | | | (0.804) | (0.105) | | | (0.341) | | (0.102) |
| | Urban population | --- | **12.0***** | **17.27***** | --- | --- | 1.547 | --- | 0.448 |
| | | | **(0.000)** | **(0.000)** | | | (0.391) | | (0.993) |
| External Flows | Foreign Investment | 0.289 | --- | 1.09** | 0.306 | 0.139 | **-0.496*** | 0.089 | -1.008 |
| | | (0.133) | | (0.029) | (0.312) | (0.362) | **(0.062)** | (0.721) | (0.229) |
| | Foreign Aid | --- | 0122 | 2.099 | 0.185 | -0.051 | -0.002 | -1.04 | -0.018 |
| | | | (0.288) | (0.422) | (0.285) | (0.502) | (0.989) | (0.955) | (0.575) |
| | Remittances | --- | --- | 0.009 | -0.187 | **-0.75***** | -0.060 | **-0.009**** | 0.001 |
| | | | | (0.339) | (0.431) | (0.000) | (0.814) | (0.017) | (0.113) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Institutional Economy | Education | -0.099 | 0.006 | -1.449 | **2.51*** ** | --- | **-1.49*** ** | --- | **-0.646*** ** |
| | | (0.437) | (0.111) | (0.118) | **(0.000)** | | **(0.000)** | | **(0.002)** |
| | Governance | --- | --- | 1.001 | -3.627 | 0.922 | **-17.8*** ** | 1.001 | **-2.05*** ** |
| | | | | (0.221) | (0.736) | (0.934) | **(0.003)** | (0.444) | **(0.001)** |
| | Constant | -28.65 | **-432*** ** | **-468*** ** | **-85.8*** ** | **-216*** ** | -96.68 | **-12.6** ** | 88.12 |
| | | (0.375) | **(0.000)** | **(0.000)** | **(0.000)** | **(0.000)** | (0.109) | **(0.018)** | (0.447) |
| LSDV $R^2$ | | 0.981 | 0.903 | 0.985 | 0.901 | 0.809 | 0.999 | 0.706 | 0.802 |
| Within $R^2$ | | 0.859 | 0.805 | 0.960 | 0.801 | 0.801 | 0.850 | 0.622 | 0.702 |
| LSDV Fisher | | **41.9*** ** | **42.4*** ** | **98.06*** ** | **29.95*** ** | **29.5*** ** | **37.5*** ** | **18.9*** ** | **24.7*** ** |
| Observations | | 238 | 190 | 190 | 251 | 238 | 145 | 109 | 145 |

**Source:** Author's calculations. OLS with heteroscedasticity- and autocorrelation-robust standard errors (HAC SE). ** * ; ** ; * : respective significance levels of 10%, 5%, and 1%. LSDV: least squares indicator variable.

**Source:** Author's calculations.

OLS with HAC SE: Ordinary least squares with standard errors consistent with heteroscedasticity and autocorrelation.

** * ; ** ; * : respective significance levels of 10%, 5%, and 1%. LSDV: least squares indicator variable.

The results presented in Table 3 above show that the development of mobile banking services has an overall positive impact on structural transformation. More specifically, mobile banking services have a positive impact on GDP per worker, and this effect is even more pronounced when our index is used; moreover, regardless of the indicator used to represent mobile banking services, the sign is positive. Control variables, such as public investment and urban population, also exhibit the expected signs. Overall, our estimate shows the expected sign and we can therefore extrapolate the usefulness of the development of mobile banking services in terms of structural transformation in the case of Africa; what about digital finance indexed by the number of ATMs.

***Development of mobile banking services and technological innovation***

In the context of mobile banking and technological innovation, we have three surrogate variables: the number of Internet users, mobile billing, mobile sending and receiving, and mobile banking, which is one of our main independent variables, separate from financial innovation.

***Internet users***

Structural transformation can be determined by the number of internet users. Using GDP per worker as a measure of this transformation, we find that the number of internet users has a positive impact of 0.043 and 0.175 on GDP per worker, with significance levels of 5% and 10%, respectively. After robustness analysis, we still observe positive significance, with both values being significant. Since all p-values associated with internet users are less than 0.01, we reject the null hypothesis. This means that in the short term, an increase of one internet user will have a positive impact on structural transformation of 0.043, all else being equal. To ensure the robustness of the result, we also used GDP per capita and GDP per employed person as measures of structural transformation in this research. Regarding GDP per capita, we observe two negative values of -0.01 with a significance level of 10%, and regarding GDP per employed person, we obtain -0.52 with a significance level of 5%. Based on the results of these analyses, it is impossible to draw a clear conclusion regarding internet users, as we observe negative values for internet users in both GDP per employed person and GDP per capita, and a positive value for GDP per worker.

***Mobile billing***

Mobile billing is an alternative payment method that allows customers to pay for purchases directly on their phone bill, without using a credit card, bank transfer, or cash. The use of this system is closely linked to technological developments in recent years. In the context of the digital transformation of businesses, mobile payment and e-wallet applications can positively impact the five key business strategies proposed by Rogers (5): customer, competition, data, innovation, and value. Mobile payment is a valuable tool for businesses in their digital transformation and, ultimately, their structural transformation.

According to Table 3 above, mobile billing influences the structural transformation of GDP per worker (0.042), with moderate significance at the 5% level. Conversely, it has a negative impact on this transformation ( -0.97), also significant at the 5% level, and on GDP per employed person (-0.53), also significant at the 5% level. This means that in the short term, payments made by customers, individuals, or even workers contribute positively to the structural transformation of GDP per worker. Rogers refers to this when he considers mobile payment as a tool for digital transformation. The application of mobile payment in businesses and other sectors, such as healthcare (for settling hospital bills), education (for paying tuition fees), and finance (for disbursing salaries), will have a positive impact on the sub-Saharan economy and facilitate digital transformation, thereby inducing structural transformation.

At the same time, mobile billing contributes negatively using GDP per capita and GDP per employed person. This manifests itself when the government increases taxes and the cost of mobile payment transactions rises due to the tax hikes imposed to boost GDP. This increase negatively impacts mobile payments, as many people prefer to pay in cash rather than via mobile because of the

high fees. This is the case in Cameroon, where the mobile money tax increased by 3% in 2022. This measure reduced the number of mobile phone transactions, leading to a decline in mobile banking performance and structural transformation.

According to Table 3 above, we can see that GDP per capita has a negative impact of 5% on mobile billing, and GDP per employed person also has a negative impact of 5% on mobile billing. This can be observed in rare cases where, with the innovation of new technologies, jobs are laid off due to automation, leading to a reduction in GDP per employed person and thus a decline in structural transformation.

***Messages sent and received from a mobile phone***

According to Table 1, sending and receiving mobile messages has a positive impact on the structural transformation of GDP per capita (0.07) relative to GDP per worker, a significant impact at 1% and a very significant impact (0.01) relative to GDP per capita at the significance level of 10%. This implies that in the short term, An increase of 1 unit of GDP per capita invested in financial messages sent and received via mobile technologies will have a positive impact of 0.01 on structural transformation in sub-Saharan Africa. This occurs when the government, in partnership with the telecommunications and financial sectors, innovates in the financial field and raises public awareness through telecommunications. This approach will foster economic growth and structural transformation. Taxes collected from the mobile telecommunications industry, through activities such as sending and receiving mobile messages, contribute to a country's GDP per capita and ultimately lead to structural transformation.

***Mobile banking services***

Mobile banking has a positive effect on structural transformation, with a magnitude of 0.422 for GDP per worker (significance level of 10%). In the short term, a one-unit increase in mobile banking leads to a 0.422-unit increase in structural transformation. Conversely, when considering GDP per employed person, mobile banking has a negative relationship with structural transformation (-0.68 , significance level of 5%). Since the p-value associated with mobile banking is 0.000, below the 10% significance level, we reject the null hypothesis and accept the alternative hypothesis. In conclusion, mobile banking has a positive impact on structural transformation.

***Economic policy***

Economic policy influences structural transformation in various ways, including through trade openness, the money supply, the credibility of monetary policy, and public investment. These elements are detailed below.

***Opening***

Trade openness has a positive and significant impact on GDP per worker at the 10% threshold (p = 0.175), while it has a negative and significant impact at the same threshold on GDP per capita (p = -0.22) and on GDP per employed worker (p = -0.008). The reduction of trade and financial barriers has considerably decreased the cost of international transactions (Bos et al., 2011). Abor et al. (2014) argue that firms' access to finance increases their likelihood of trading internationally. According to these authors, this access allows them to cover the high fixed costs associated with exporting, international marketing, and brand promotion, as well as to meet the higher quality standards demanded by foreign markets. Ekpo and Chuku (2017) assess the progress and experiences of financial integration in Africa, as well as the effect of this integration on economic activity. They also note that a higher level of integration is associated with greater growth and investment, but not necessarily with higher total factor productivity.

***Freedom economic***

freedom positively influences structural transformation ($\alpha$ = 1.05), and this influence is significant at the 10 % threshold. In the short term, a one-unit increase in the level of economic freedom on the continent will lead to a 1.05- unit increase, all other things being equal.

Countries with greater economic freedom also experience stronger financial growth and higher per capita income (King and Levine, 1993a, 1993b; Levine and Zervous, 1998). Reduced regulation decreases the likelihood of banking crises and thus promotes economic growth. Baier et al. (2012) find that countries with relatively weak regulation and greater economic freedom are less likely to experience a short-term financial crisis than countries with stricter regulation. Similar to De Haan et al. (2009), Baier et al. observe that, in the period immediately following a crisis, the definition of economic freedom is generally influenced by increased regulation, which suggests a slowdown in future economic growth.

***Money supply***

According to the table above, the money supply has a negative impact on structural transformation, as indicated by GDP per worker (-0.11) and the positive sign (0.191). This result is therefore not very robust and cannot be used for estimation purposes; no conclusions can be drawn from it. A negative significance threshold of 1%. This translates into an increase in the money supply in the short term. An increase of one unit will lead to inflation of -0.11 in the economy and, in the long run, a decline in structural transformation due to rising prices, all other things being equal.

***Credible monetary policy***

A credible monetary policy positively influences structural transformation by 5%, as shown in the graph above (0.055) of GDP per worker. This means that in the short term, a one- unit increase in government influence over monetary policy (interest rates and open market operations) will have a 0.055-unit impact on structural transformation, all else being equal. A credible monetary policy appears important and is so, and is therefore legitimized as contributing to the development of mobile finance and the banking sector in Africa.

***Public investment***

Public investment positively influences GDP per capita and GDP per employed person, by 1.22 for GDP per capita and 0.01 for GDP

per employed person, with a significance level of 10%. In terms of structural transformation, this is manifested when the government supports the services sector by one unit and provides aid to various sectors. This contributes to promoting structural transformation by 1.22 units.

***Economic development and capital***

Economic development has a positive impact on structural transformation. Within the framework of economic development, we will examine how the urban population influences this structural transformation.

***Urban population***

Urban populations positively influence structural transformation (12) in terms of GDP per worker; they are therefore the main indicator of structural transformation, as shown in the table, with the highest level of significance (10% threshold). An increase of one person in an urban area leads to a 12-unit increase in GDP per worker. The number of people living in urban areas also has a positive impact on structural transformation, as they are more exposed to the manufacturing and service sectors than those living in rural areas.

***External flows***

External flows play an important role in structural transformation. Two aspects of these flows will be examined: foreign investment and remittances.

***Foreign investments***

Foreign direct investment (FDI) influences structural transformation with an average influence of 1.09 (5% significance level) in terms of GDP per worker, and -0.496 (1% significance level). The adoption of endogenous growth theory has encouraged research into the mechanisms by which FDI is likely to promote long-term growth (Grossman and Helpman, 1991; Barro and Sala-i-Martin, 1995). It is recognized that the benefits of FDI can be substantial and include technological spillovers, support for human capital development, improvements in the competitive environment for businesses, contributions to international trade integration, and enterprise development (Kastrati, 2013). The effects of FDI on a host country can be either positive or negative. According to Hill (2003), FDI can affect the country of origin through resource transfers, employment effects, effects on production and competition, and innovations in production processes.

***Discount***

Remittances have a negative impact on structural transformation, with a significance level of 10%, a negative impact of -0.75 on GDP per capita, and a negative impact of -0.009 on GDP per employed person (5% significance level). These remittances can reduce the labor supply and create a culture of dependency that hinders economic growth, particularly in terms of GDP per worker. They can also increase consumption of non-tradable goods, drive up their prices, appreciate the real exchange rate, and decrease exports, thereby harming the recipient country's global competitiveness. Regarding the negative impact on GDP per employed person, remittances can be mitigated by international migration, rising anti-immigrant sentiment, and stricter migration policies in host countries, which will have a significant negative impact on structural transformation.

***Institutional economics***

In an institutional economy, we have two variables: education and governance.

These results show that the process of structural change and industrialization persists.

It has also been suggested that good institutions have a positive impact on industrialization. This confirms previous findings suggesting a strong correlation between institutions and industrialization (Anaman and Osei-Amposah, 2009; Martorano, 2017). This supports the data we have collected so far regarding the positive correlation between the quality of institutions and industrialization outcomes.

***Education***

According to the table above, education has a negative impact on the structural transformation of GDP per capita (-1.49) and GDP per employed person (-0.646), with a significance level of 10%. Education has a positive impact on structural transformation because educated individuals contribute to human capital and improve the service sector. Conversely, a low level of education has a negative impact on the structural transformation of GDP per capita, as unskilled labor will be primarily assigned to unproductive sectors of the economy. Regarding GDP per employed person, a low level of education leads to a reduction in the number of skilled workers, resulting in a decrease in this GDP.

***Governance***

According to Table 2 above, governance has a negative impact on the structural transformation of GDP per capita (-17.8) at the 10% significance level and on GDP per employed person (-2.05) at the same level. Poor governance can hinder structural transformation through corrupt practices that stifle economic growth. This manifests itself in corruption and bribery, as well as excessive bureaucracy that limits access to skilled jobs. The result is a decline in GDP per employed person in the formal sector, favoring the potentially unproductive informal sector and thus contributing to the reduction of structural transformation in GDP per capita.

***The LSDV $R^2$***

The LSDV (Least Squares dummy variable regression model) is a linear model that includes indicator variables (or binary variables) for each panel unit. This allows us to account for sectoral heterogeneity by assigning each sector a different y-intercept value. This difference can be explained by specific characteristics of certain sectors, such as varying adoption rates of mobile banking services across countries.

**$R^2$**

$R^2$ is greater than 0.80, indicating that 80% of the total variation in the structural transformation is explained by the independent variables included in the model. The remaining 20%, which is unexplained, is accounted for by the control variables.

The number of observations corresponds to a small and unbalanced panel, with unequal cross-sections and time series. The number of countries is greater than the number of years.

**Table 4:** Impact of digital finance on structural transformation in productivity (Panel data estimation). Table 3: Impact of digital finance on structural transformation in productivity (Panel data estimation).

| | | GDP Per workers | | GDP per capita | | GDP per person employed | |
|---|---|---|---|---|---|---|---|
| Digital finance | (number of ATM) | 0.045**<br>(0.010) | --- | 0.002**<br>(0.050) | --- | 0.045**<br>(0.027) | --- |
| Economic devel-op-ment & capital | GDP growth | 0.122 | --- | 0.078 | --- | --- | -0.001 |
| | | (0.669) | | (0.244) | | | (0.803) |
| | Population growth | --- | 1.099 | --- | 1.001 | --- | 0.924 |
| | | | (0.144) | | (0.703) | | (0.334) |
| | Urban population | --- | 0.802 | --- | 1.077 | --- | 1.001 |
| | | | (0.338) | | (0.201) | | (0.129) |
| | Infrastructure | --- | **0.144**** | --- | **0.082*** | --- | **0.293**** |
| | | | **(0.018)** | | **(0.065)** | | **(0.042)** |
| | GDP per capita growth | --- | 0.008 | --- | 0.177 | -0.000 | --- |
| | | | (0.188) | | (0.933) | (0.449) | |
| External Flows | Foreign Invest-ment | -1.007 | --- | -1.089 | --- | 0.001 | --- |
| | | (0.233) | | (0.924) | | (0.155) | |
| | Foreign Aid | --- | 0.071 | --- | 0.048 | --- | -0.188 |
| | | | (0.577) | | (0.199) | | (0.805) |
| | Remittances | --- | **0.022**** | --- | **0.048***** | --- | **0.122*** |
| | | | **(0.039)** | | **(0.000)** | | **(0.075)** |
| Institu-tio-nal economy | Education | -0.024 | --- | 0.065 | --- | --- | -0.369 |
| | | (0.277) | | (0.279) | | | (0.364) |
| | Governance | --- | 0.100 | --- | 0.044 | -0.369 | --- |
| | | | (0.277) | | (0.111) | (0.304) | |
| | Constant | -0.572 | **11.07*** | 3.711 | **15.78**** | **-2.72***** | **-3.14***** |
| | | (0.413) | **(0.077)** | (0.650) | **(0.031)** | **(0.000)** | **(0.007)** |
| Adjusted $R^2$ | | 0.420 | 0.608 | 0.489 | 0.169 | -0.169 | 0.397 |
| Fisher | | **5.87***** | 3.869 | **45.1***** | 0.935 | 1.393 | **5.31***** |
| RAMSEY RESET | | **1.968** | n.a | **1.083** | 4.79** | **0.336** | **1.800** |
| | | **(0.179)** | | **(0.375)** | (0.031) | **(0.721)** | **(0.204)** |
| Observations | | 238 | 190 | 190 | 251 | 238 | 145 |

**Source:** Author's calculations.

*, **, *** indicate significance levels of 10%, 5%, and 1%, respectively. Regressions are based on standard errors robust to heteroscedasticity.

Table 4 above highlights the positive and significant impact of digital finance. Our main findings indicate that structural transformation can be driven by digital finance, as well as by other minor factors identified, such as infrastructure and money transfers.

***Digital finance (number of ATMs)***

Digital finance positively influences structural transformation, as evidenced by the impact of new technologies on the financial sector, such as the use of automated teller machines (ATMs), mobile banking, and artificial intelligence. The influence of these technologies on structural transformation is illustrated by the number of ATMs (see Table 4 above). GDP per worker (0.45), GDP per capita (0.002), and GDP per employed person (0.045) are all significant at the 5% level. An increase of one ATM leads to an increase in GDP

per worker, per capita, and per employed person of 0.045, 0.002, and 0.045 units, respectively. Therefore, it can be concluded that digital finance positively influences structural transformation.

***Economic development and capital***

Economic development positively influences structural transformation. We will discuss infrastructure development and its influence on this transformation in more detail.

***Infrastructure***

Infrastructure represents the most significant share (10%) of GDP per worker (0.144). A one-unit improvement in infrastructure leads to a 0.144 increase in structural transformation. This strongly confirms the data collected so far regarding the positive correlation between infrastructure quality and industrialization outcomes. Infrastructure development appears to be a key driver of mobile banking growth, as mobile phones rely on a more efficient telecommunications infrastructure, and users feel more comfortable interacting with high-quality institutions.

***External flows***

External capital flows have a positive impact on structural transformation. We will examine fund transfers as one aspect of external capital flows and their influence on structural transformation.

***Fund transfers***

Money received from relatives abroad has a significant positive impact of 10% on GDP per capita (0.048), 5% on GDP per worker (0.022), and 1% on GDP per employed person (0.122). Remittances from migrants constitute an important source of external financing for many developing countries. In 2018, these remittances reached a record level of US$29 billion. Balanced growth can be maintained through trade -offs between foreign exchange flows and net import-export flows, which can promote the structural transformation of the economy (Chenery and Bruno, 1962). This rebalancing of resources, initially devoted to the production of tradable goods, represents the main driver of development and growth (Kuznets, 1971; Chenery, 1975, 1979). According to the two-factor model, imports of capital goods and raw materials are essential drivers of development.

## Robustness Verification

To ensure the robustness of our results, we performed additional estimations by replacing some variables with surrogate variables and modifying the specification and estimation method. The modification of the specification aimed to maximize the number of observations relative to one of the main estimates. Specifically, this involved either adding control variables that could influence the dependent variable or removing others to maximize the number of observations. Our results are conclusive because we use the same sign and significance level as in the main results presented. By replacing some variables with surrogate variables, we were able to verify whether we obtained the same result regardless of the use of different measures for the same variable.

Overall, the estimation results confirm that the sign and significance of the coefficients remain unchanged. Furthermore, our conclusions remain broadly unchanged even when considering the development of mobile finance and banking services using alternative indices.

***Adjusted $R^2$***

The adjusted coefficient of determination ( adjusted $R^2$ ) This measures the goodness of fit (model accuracy) for a linear model. The adjusted $R^2$ values are very low, less than 0.6, indicating that the additional input variables add no value to the model.

***Ramsey Reset***

This is a general specification for a linear model; it tests whether the nonlinear combination of fitted values helps to explain the response variable.

***Fisherman***

According to Fisher, the significance level is 10% with (5.87) and (5.3). The results show that the model is suitable and valid for the study. We therefore reject the null hypothesis because our p-value is less than 5% ($p < 0.05$).

**I. Heteroscedasticity test**

The Breuch-Pagan test is a non-graphical method for detecting heteroscedasticity. Heteroscedasticity is present when the assumption of equal variances is violated. It manifests as a different dispersion of variables. Heteroscedasticity exists when the estimates of the coefficients ( $\beta_1$ ) are no longer effective, which makes the regression results unreliable. The null hypothesis is that the residuals are homoscedastic. In the example above, we do not reject the null hypothesis at the 95% significance level and conclude that the residuals are homogeneous. However, at the 90% significance level, we do reject the null hypothesis and conclude that the residuals are homogeneous. The Breuch-Pagan test suggests the presence of heteroscedasticity in our model. The problem lies in the fact that we might have erroneous estimates of the standard error of the coefficients and, consequently, of their t-values.

There are two ways to address this problem: one involves using heteroscedasticity-robust standard errors, and the other uses weighted least squares (MLS) (Stock and Watson, 2003, Chapter 15). The MLS method requires knowledge of the conditional variance on which the weights are based. If this variance is known (which is rarely the case), then the MLS method is used. In practice, it is recommended to use heteroscedasticity-robust standard errors to address heteroscedasticity.

**II. Omitted variable test**

It is important to test for omitted variable bias in our model, as this is related to the assumption that the error term and the independent variables of the model are uncorrelated (E(e/x)=0). The null hypothesis is that the model does not exhibit omitted variable bias;

Since the p-value is greater than the usual threshold of 0.05 (95% significance), we cannot reject the null hypothesis and con-

clude that we do not need additional variables.

### III. Specification error test

To test the model specification and determine if additional variables are needed, we perform a new regression with the observed variables against the predicted independent variables and their squares. Since the p-value of the squared predicted independent variables is not significant, we do not reject the null hypothesis and conclude that there is no specification error: our model is therefore correctly specified.

### IV. Ramsey regression equation specification error test (RESET)

This test allows us to verify the presence of omitted variables and the existence of a significant nonlinear relationship between them, in order to validate our linear regression model. The RESET test, proposed by Ramsey (1969), is a general specification test designed to detect omitted variables, an inappropriate functional form, and correlations between independent variables and error terms. These correlations can be due to measurement errors in the independent variables, simultaneity problems, or the combination of a lagged dependent variable with autocorrelated error terms. Based on the results, our model is well-specified.

### V. Multicollinearity test

An important assumption of multiple regression models is that the independent variables are not perfectly multicollinear. A control variable should not be a linear function of another. Using the variance inflation factor allowed us to observe the absence of multicollinearity.

### VI. Normality test

Another assumption is that the residuals follow a normal distribution; if this is not the case, it is necessary to check for omitted variables, the model specification, its linearity, and functional forms. In summary, it might be necessary to re-evaluate our model/theory. Our result is convincing since it does not highlight any problem with the reference above.

## Conclusion and Economic Policy Recommendations

While structural transformation in sub-Saharan Africa has historically lagged behind other developing regions-due to weak reallocation of labor toward high-productivity sectors-this article highlights the driving role of digital financial innovation in addressing this structural gap. Using panel data modeling covering 46 countries over the period 2000-2020, this research demonstrates that the expansion of mobile banking services and the strengthening of financial infrastructure significantly boost labor productivity and the reallocation of factors of production.

Based on these empirical findings, several strategic orientations are formulated for policymakers and regional authorities in sub-Saharan Africa:

Tax optimization and strengthening the mobile ecosystem: Governments must urgently streamline sector-specific taxation on FinTech. Punitive taxes on mobile money, which discourage financial inclusion and lead to an inefficient return to cash transactions, should be avoided. Instead, strategic partnerships between banks and mobile network operators (MNOs) should be encouraged, along with support for cross-border and interoperable mobile payment systems (such as the PAPSS system) to facilitate intra-African trade.

Massive investment in critical infrastructure and connectivity: As the development of financial technologies remains dependent on network quality, public policies must prioritize the deployment of low-cost, high-speed internet infrastructure. These efforts must be combined with investments in human capital (digital skills training), research and development (R&D), and the maintenance of a credible monetary policy (CMP).

Establishing an agile regulatory framework and a universal digital identity: It is urgent to design regional legal frameworks that protect users' private data without stifling technological innovation (Blockchain, AI). At the same time, states must deploy reliable national biometric digital identification systems to end the statistical anonymity of more than 500 million African citizens and secure access to algorithmic microcredit for underbanked populations.

Modernization and technological agility of SMEs: Industrialization policies must encourage the adoption by SMEs of advanced infrastructures, including cloud computing, in order to reduce their fixed operating costs and optimize their integration into regional value chains. Future research would benefit from explicitly incorporating the variable of Internet connectivity costs and adopting methodological pluralism, combining quantitative macroeconomic analyses with microeconomic field surveys of African households and SMEs.

## Declaration of Interest

None

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None

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