

Government and private sectors electronic transfer practices and financial inclusion in the economic community of the West African States

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Abstract:

Relying on a pooled-cross-sectional panel of the 2014 and 2017 Global Findex data, and a Random Utility Theoretic Model for revealed financial preferences data analysis, this paper examines the impact of government and private sector electronic transfer practices on financial inclusion, in terms of individuals' ability to save and borrow within the Economic Community of the West African States (ECOWAS). For sensitivity analysis, we adopt a sequential empirical strategy in which we estimate and contrast four specifications of the saving and borrowing processes. Overall, our findings are stable across all specifications and show that along with socio-economic factors such as age and income, public welfare transfers and employment based salary transfers foster financial inclusion by significantly raising individuals' marginal propensity to save (MPS) (by 11.6% and 12.9% respectively) and marginal propensity to borrow (MPB) (by 12.6% and 8.2% respectively) within ECOWAS. We found however that within ECOWAS, both MPS and MPB have decreased by 21.4% and 7.2% respectively between 2014 and 2017. Therefore, in addition to other economic growth promoting fiscal tools in the government toolkit, mandates on public (government to citizens) and private (Business to citizens) electronic financial transfers are significant policy leverages for improving financial inclusion and growth within ECOWAS.

Keywords: *Borrowing, ECOWAS, Economic Growth, Electronic Government, Financial inclusion, saving.*

JEL Codes: E42, E61, E70

Introduction

Financial inclusion defined as: “a state whereby individuals and businesses have access to useful and affordable financial products and services that meet their needs, which are delivered in a responsible and sustainable way” (Demirguc-Kunt et al., 2018) has received a growing attention from many stakeholders, including governments, policy makers, and international organizations, and academic scholars (Sanderson, 2018; Maity & Sahu, 2019; Lee et al., 2020). The growing interests on the topic of financial inclusion finds its roots in its potential to foster socio-economic inclusion (Muralidhar et al., 2019), growth and stability (Siddik & Kabiraj, 2020), and therefore could assist traditionally underserved nations in achieving the united Nations 2030 sustainable development goals (SDGs).

Among the recent developments on the topic are two key complementary reviews by Demirguc-Kunt et al. (2017), and Ozili (2020). Together these two reviews summarize the state of art on the contemporary discussion on financial inclusion worldwide. Two important areas identified in Ozili (2020) for future research, because of coverage gap in the current literature are:

- (i) studies that analyze how governments influence financial inclusion objectives, funding and outcomes (see section 4.2. in Ozili, 2020);
- (ii) Studies evaluating financial inclusion strategies in regional economic blocks such as ASEAN, ECOWAS and the European Union (see section 4.5. in Ozili, 2020).

The present analysis aims solely at bridging the above highlighted gap in the literature. More specifically, we consider the marginal contribution of government and private sector financial transfers in fostering financial inclusion, in terms of enabling saving and borrowing within the economic community of the West African states (ECOWAS). Because country members of the ECOWAS economic bloc have historically been among the least developed and financially excluded in the global economy, knowing how public and private electronic transfer programs affect saving and borrowing choices within the block will not only help us answer the normative question of mandatory electronic deposits, but also evaluate the potential welfare effects of these policies for people in the west African states. Therefore, the specific question this study seeks to answer is:

“How do current government and private sector electronic transfer practices affect saving and borrowing choices in the economic community of the West African States?”

In order to address the above question, we structure the rest of this paper as follows: in section 2 we review the empirical literature on financial inclusion in Africa; in section 3 we present a behavioral economic model of saving and borrowing choices, with its econometric specification described in section 4; in section 5 we describe the data and the variables used in the econometric estimations; while in section 6 we present the results, which are then discussed in section 7; finally in section 8 we conclude the analysis, and provide directions for future research.

1. Literature Review

As a region, Africa has received a great deal of attention from scholars lately on the topic of financial inclusion (Adegbite & Machethe, 2020; Anarfo & Abor, 2020; Chinoda & Akande, 2019; Mustafa et al., 2018; Nwafor, 2018; Oyinlola & Adedeji, 2019). Despite this growing interest, only a limited number of studies focus specifically on financial inclusion and growth at the ECOWAS regional economic bloc level (Olaoye et al., 2019; Udo, 2016; Yaya, 2019). At the theoretical level, Yaya (2019) finds support for the Keynesian view through modelling the

response of private consumption to income among ECOWAS country members. Olaoye et al. (2019) on the other hand show evidence of neither the Keynesian view nor Wagener's law while looking at the nexus of government expenditure and economic growth within ECOWAS. Similarly, in testing the validity of Wagner's law in the region using sixteen West African economies, Udo (2016) reports mixed findings, with the Keynesian view holding in four countries out of the sixteen, and Wagener's law finding validation in two countries, while neither one is supported by the evidence from the remaining nine countries. Together, the above discussion shows that, not only is the literature on financial inclusion and economic growth within ECOWAS limited in number, it remains also unresolved as to whether growth in public sector causes economic growth (Keynesian view), or economic growth drives public sector growth (Wegner's law).

In addition to the above unreconciled theoretical views at the ECOWAS level, several authors have adopted a single country approach on the topic of financial inclusion and economic growth in Africa. For example Abdu et al. (2015) and Adegbite & Machethe (2020), focusing on the drivers of financial inclusion and gender gap in Nigeria, provide sustainable solutions to bridging the gap in smallholder agriculture in the country. Similarly, using a two-stage least squares regression approach to investigate the nexus between financial inclusion and economic growth, Nwafor (2018) reveals that although financial industry intermediation does not influence financial inclusion, this latter significantly impacts economic growth in Nigeria, during the period covered by the study.

In Ghana, Baidoo & Akoto (2019), and Sakyi et al. (2019) looked at financial inclusion from the perspective of saving. While Sakyi et al. (2019) point out individual proximity with financial institutions as a key determinant of saving habits among commercial drivers in Ghana, Baidoo & Akoto (2019) tabulates on trust in financial institutions as the driver of formal saving habits in the country. In Rwanda, Bigirimana & Hongyi (2018) analyze the role that commercial banks play in the process of financial inclusion. They report that although a long way still remains to go as only 26% of Rwandan are formally plugged into the financial sector, all three dimensions of financial inclusion from commercial banks (access, penetration, and usage) have increased significantly in the country, contributing to its economic growth between 2004 and 2016.

Similarly, relying on a selected number of districts in Western Uganda, Eton et al. (2019) looks at how financial inclusion is influencing economic growth in the country. Their findings reveal that financial inclusion significantly supports economic growth by upholding equitable distribution of growth benefits, transforming people's way of life, enhancing capital creation and empowering Ugandan to seek financial services when needed. Keho (2019) also reports a similar link between financial inclusion, savings and economic growth in Ivory Coast.

In addition to the above country level treatments, few authors have also looked at financial inclusion and growth at the monetary union level. For example, relying on both supply and demand side indicators of financial inclusion, Gourène & Mendy (2017) use a multiscale heterogeneity panel causality approach to examine the causal link between financial inclusion and economic growth in the West African Monetary Union (WAEMU) between 2006 and 2015. Their findings reveal that at scale 1 (which is between 2 to 4 years), no causal relationship exists between economic growth and financial inclusion, however at scale 2 (between 4 to 8 years), a bidirectional causality link prevails between the two. Relying on the accelerating role of digital technologies, mobile phone penetration and internet usage, Senou et al (2019) also look at the recent trends in access to digital technology as the key trigger factor for changes in financial inclusion within

WAEMU. Their findings show that beyond the specific effects of mobile phone penetration and internet usage, the joint use of these two technologies contribute significantly to improving the state of financial inclusion within the monetary union.

Numerous authors have also taken a slightly broader perspective on the topic, to look at financial inclusion in the whole of sub-Saharan Africa (SSA). Among those studies are Abdu et al (2018), which revealed that the introduction of Islamic banking and finance system in some organization of Islamic Cooperation (OIC) countries in SAA enhanced financial inclusion in the sub-region. The study also uncovered that households from OIC countries with Islamic banking and finance are more likely to be financially included than their counterparts in OIC countries without Islamic banking and finance. On the other hand, Anarfo et al (2019) investigating the link between financial inclusion and financial sector development (FSD) in Sub-Saharan Africa, report a bidirectional causality link, suggesting that financial inclusion and FSD are complementary in the promotion of economic growth in SSA.

Furthermore, focusing on the moderating role of financial stability, Anarfo & Abor (2020) examine the link between financial regulation (macro-prudential regulation) and financial inclusion in SSA. They report that capital adequacy requirement as a macro-prudential measure significantly reduces banks' capacity to provide financial services, leading to credit rationing, and thereby reducing financial inclusion; At the same time, the interaction of financial regulation with financial stability spurs financial inclusion, therefore they concluded that financial stability augments financial regulation to have an affirmative impact on financial inclusion in SSA. Finally, still within the context of SSA, Asuming et al (2019), in a comparative analysis of thirty-one SSA countries, find that while financial inclusion has increased significantly at the aggregate level between 2011 and 2014, there are still significant cross-country heterogeneity in the SSA region.

Extending the above sub-Saharan perspective one step farther, are Chinoda & Akande (2019), Chinoda & Kwenda (2019), Popoola (2019), which look at financial inclusion within the context of the whole African continent. Indeed, while Popoola (2019) relies on panel data analysis of 36 African countries to investigate the link between financial inclusion and health shocks, the former two focus on the dynamics between technology, financial inclusion and economic growth in Africa. More specifically, Chinoda & Akande (2019) investigates the dynamics between mobile diffusion, economic growth and financial inclusion in Africa, with further extension in Chinoda & Kwenda (2019), through the introduction of bank competition and stability in the dynamics.

In addition to the geographical dimensionality in the above-discussed literature, authors have also considered a wide array of thematic on the topic of financial inclusion in Africa. From the perspective of the drivers of financial inclusion in the region, studies have pointed out numerous factors including technology (Chu, 2018; Oluwatayo, 2014; Oluwatayo, 2017), micro-finance (Hussaini & Chibuzo, 2018), entrepreneurial innovativeness (Nguli & Odunga, 2019), and socio-demographic factors such as gender (Chowdhury et al., 2018; Ogunleye, 2017) and religion (Mustafa et al., 2018; Umar et al., 2019). Similarly, from the perspective of the consequential outcomes of financial inclusion in Africa, the review by Demirgüç-Kunt et al. (2017) summarized the empirical literature on the importance of financial inclusion for inclusive growth, which was further supported by Gretta (2017), and recently updated by Demirgüç-Kunt et al. (2020) that pointed out the opportunities to expand access to and usage of financial services, through greater financial inclusion in Africa.

In addition to the above literature that focused either on single African countries, or Africa as a whole, several authors also studied financial inclusion in the region, in comparison with other

world regions. This includes Sanderson et al. (2018), which takes a more global perspective in reviewing the determinants of financial inclusion, and Ozili, (2020), which also provides a comprehensive review of financial inclusion research around the world. Within this context, while Maity & Sahu (2019) focus on how regional disparities in banks performances affects regional variations in financial inclusion, Muralidhar et al. (2019) suggest the need to rethink financial inclusion away from its current access point of view to that of autonomy.

Finally, on a more general consensus on the link between financial inclusion and economic growth, Lee (2020) reports their joint dynamics with financial innovation and firms sales, consistently with the cross-country evidence provided by Sethi & Acharya (2018). Looking at the evidence from SAARC countries, Siddik (2019) also reports a similar positive link between financial inclusion and economic growth. This result is further confirmed by the theoretical and empirical review of the literature (Sulong & Bakar, 2018), and corroborates further with the importance of digital finance for inclusion and inclusive growth (Siddik & Kabiraj, 2020).

Although the above discussed literature on financial inclusion in Africa is rich and varied, it does not address the political economy of financial inclusion in the region, as previously highlighted by Ozili (2020); Indeed, the role that governments can play in fostering financial inclusion in relation to saving and borrowing, especially within the economic community of the West African states remains to be addressed. For this reason, our current research endeavor will focus on bridging this gap. In the next section we present our behavioral economic model of saving and borrowing choices, which was initially introduced in (Niankara & Muqatash, 2020).

2. Economic model of saving and borrowing within ECOWAS

The model relies on the inter-temporal choice theory (Thaler and Shefrin, 1981; Modigliani, 2005). In setting up the model, we assume the typical consumer within ECOWAS lives for two periods (t and $t + 1$), and we denote by Y^d , his/her disposable income available for consumption. The first and second periods disposable income are given by Y_t^d and Y_{t+1}^d respectively, with corresponding consumptions C_t and C_{t+1} . Furthermore, we assume that consumers within ECOWAS can borrow or save (whether formally or informally) at an interest rate r , and therefore we define the accounting variable:

$$S_t = Y_t^d - C_t$$

And allow S_t to assume both positive and negative values such that:

- $S_t > 0$ when the consumer is a net Saver in the credit market
- $S_t < 0$ when the consumer is a net Borrower in the credit market (dis-savings)

The inter-temporal budget constraint (IBC) facing the consumer is derived from periods t and $t + 1$ consumption levels given by:

$$\begin{aligned} C_t &= Y_t^d - S_t \\ C_{t+1} &= Y_{t+1}^d + (1 + r)S_t \end{aligned} \tag{1}$$

The above two equations can be combined as:

$$C_{t+1} = Y_{t+1}^d + (1 + r)(Y_t^d - C_t) \quad (2)$$

We get therefore the consumer's IBC as:

$$C_t + \frac{1}{1+r} C_{t+1} = Y_t^d + \frac{1}{1+r} Y_{t+1}^d \quad (3)$$

The above IBC in equation (3) presents some important aspects:

- From the perspective of the consumer, $Y_t^d + \frac{1}{1+r} Y_{t+1}^d$ is quantitative value, M in monetary terms. C_t and C_{t+1} , are the intertemporal consumption choices, which together define the size and sign of S_t as either $S_t > 0$ if saving or $S_t < 0$ if borrowing. Therefore suggesting that saving and borrowing behaviors are derived from the inter-temporal consumption choices the consumer make.
- $C_t + \frac{1}{1+r} C_{t+1}$ is the discounted value of the consumption plan (C_t, C_{t+1}) while $Y_t^d + \frac{1}{1+r} Y_{t+1}^d$ is the present value of the consumer's income, with periodic earnings Y_t^d, Y_{t+1}^d .
- Finally $1 + r = \frac{1}{\frac{1}{1+r}} = \frac{\text{Normalized price of consumption in period } t}{\text{price of consumption in period } t+1} = \frac{P_t}{P_{t+1}}$ such that the inter-temporal consumption equals the total value at present time of all period's income.

The consumer is assumed to have preferences over the two period consumptions C_t and C_{t+1} , which is described by indifference curves, with the following characteristics:

1. Non-satiation: consumers welfare increase with more consumption;
2. Negatively sloped: consumers are faced with a trade-off between C_t and C_{t+1} ;
3. Convex: Consumers prefer to smooth consumption overtime.

The inter-temporal marginal rate of substitution (IMRS) between C_t and C_{t+1} is captured by the slope of the indifference curve. It shows the number of units of first period consumption one is willing to forsake for a one unit increase in second period consumption. Since the indifference curve is convex, the IMRS is high when the ratio C_t/C_{t+1} is small, and the consumer present oriented, that is willing to give up more of second period consumption to increase first period consumption by one unit. The consumer will be more open to borrowing against his future income and thus S_t will be negative. Conversely, when C_t/C_{t+1} is large, then the IMRS will be low, and the consumer less inclined to trade much of second period consumption for a unit increase in period one consumption. Hence the algebraic representation of the consumer's preference can be expressed as:

$$U(C_t, C_{t+1}) = u(C_t) + \delta u(C_{t+1})$$

Where δ is the discount factor and $u(C)$ is some "instantaneous" concave *utility function*, with decreasing slope $u'(C)$, that is $u(C)$ exhibits diminishing marginal utility. With the usual assumption that the consumer is impatient or $\delta < 1$, then for a reasonably low and fixed interest rate r the individual wants to consume more today than tomorrow. The consumer's intertemporal choice problem becomes:

$$\max_{C_t, C_{t+1}} u(C_t) + \delta u(C_{t+1}) \quad (4)$$

$$\text{Subject to } C_t + \frac{1}{1+r} C_{t+1} = Y_t^d + \frac{1}{1+r} Y_{t+1}^d \equiv M,$$

$$C_t \geq 0,$$

$$C_t \leq M.$$

Substituting away C_t , and ignoring the boundary constraints we get:

$$\max_{C_{t+1}} u\left(M - \frac{1}{1+r} C_{t+1}\right) + \delta u'(C_{t+1}) \quad (5)$$

The first order condition (FOC) is

$$u'\left(M - \frac{1}{1+r} C_{t+1}\right) \left(-\frac{1}{1+r}\right) + \delta u'(C_{t+1}) = 0 \quad (6)$$

Or

$$\frac{u'(C_t)}{\delta u'(C_{t+1})} = 1 + r \quad (7)$$

The above condition in equation (7) stipulates that the IMRS equals the slope of IBC $\left(-\frac{P_t}{P_{t+1}}\right)$, and holds for any concave utility function $u(\cdot)$ depending on the relationship between r and δ in the second period because:

$$u'(C_t) > u'(C_{t+1}) \Leftrightarrow C_t < C_{t+1} \text{ or} \quad (8)$$

$$\frac{u'(C_t)}{u'(C_{t+1})} > 1 \Leftrightarrow \frac{C_t}{C_{t+1}} > 1$$

Reorganizing further the first order condition in equation (7) we have that:

$$\frac{u'(C_t)}{u'(C_{t+1})} = \delta(1+r) \quad (9)$$

To be more concret, let $u(C) = \ln C$ with $u'(C) = \frac{1}{C}$, then the first order condition simplify to:

$$\frac{C_{t+1}}{C_t} = \delta(1+r) \quad (10)$$

Combining (10) with (8) we get

- i. $C_t > C_{t+1}$ if $\delta < \frac{1}{1+r} \Rightarrow S_t < 0$, and the consumer is a net borrower in the credit market;
- ii. $C_t = C_{t+1}$ if $\delta = \frac{1}{1+r} \Rightarrow S_t = 0$, and the consumer is neither borrowing nor saving;
- iii. $C_t < C_{t+1}$ if $\delta > \frac{1}{1+r} \Rightarrow S_t > 0$, and the consumer is a net saver in the credit market.

The claims about the above relations between r and δ hold also in terms of a simple graphical analysis (see figure (1)). Graphically, the point of tangency between the highest achievable indifference curve and the inter-temporal budget constraint (IBC) defines the optimal inter-temporal consumption choices C_t^* and C_{t+1}^* . The subjective discount factor δ can be seen as measuring the consumer's relative consumption valuation between first and second period. If δ is high, the consumer is viewed as patient, and if δ is low she is viewed as impatient. Therefore, as

shown in figure (1) panel (c), and also in result (i) above, if the consumer is less patient than the market, (s)he will tend to consume more than his current period income Y_t^d , by borrowing (whether formally or informally) against future income Y_{t+1}^d . On the contrary, as shown in figure (1) panel (a) and also in result (iii) above, if a consumer is more patient than the market, (s)he will tend to consume less than current period income Y_t^d , thereby acting as a saver in the credit market. Finally, as figure (1) panel (b) and result (ii) above show, if the consumer values equally the two period consumptions, then she will neither borrow nor save, but instead will resort to period t income Y_t^d , to cover the first period consumption C_t^* , and subsequently use all of period two income Y_{t+1}^d to cover its corresponding consumption C_{t+1}^* .

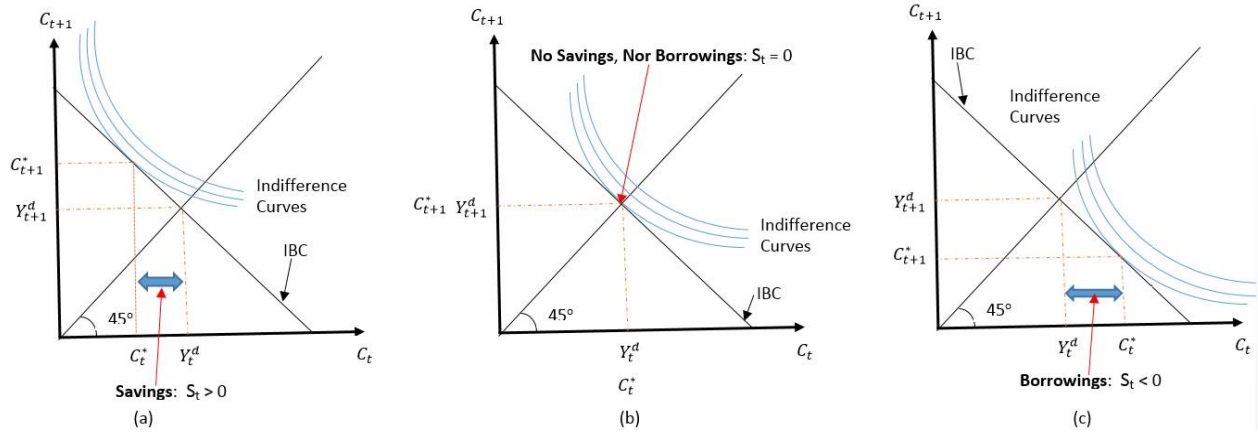


Figure 1: Consumer optimal consumption, saving, and borrowing choices within ECOWAS

3. Econometric model of saving and borrowing within ECOWAS

3.1. Model Specification

Making Random Utility Theory operational for modeling consumers' financial choice behaviors as influenced by public and private sectors financial transfer practices, within the economic community of the West African states, requires the following utility representations:

$$\begin{cases} U_S^* = V_S + \varepsilon_S \\ U_{\bar{S}}^* = V_{\bar{S}} + \varepsilon_{\bar{S}} \end{cases} \quad (4)$$

$$\begin{cases} U_B^* = V_B + \varepsilon_B \\ U_{\bar{B}}^* = V_{\bar{B}} + \varepsilon_{\bar{B}} \end{cases}$$

Where:

S: represents the binary choice to « save » and \bar{S} its complement event;

B: represents the binary choice to « borrow » and \bar{B} its complement event.

With V_S , $V_{\bar{S}}$, V_B , $V_{\bar{B}}$ capturing the deterministic components of the utility functions, while ε_S , $\varepsilon_{\bar{S}}$, ε_B , $\varepsilon_{\bar{B}}$ represent the random components. Given the latent nature of the utility functions, they are unobservable, what we observe are the indicators variables, showing the decision maker's choice of saving, and borrowing, such that:

$$\begin{aligned}
D_1 &= \begin{cases} S & \text{if } U_S^* - U_{\bar{S}}^* > 0 \\ \bar{S} & \text{Otherwise} \end{cases} \\
D_2 &= \begin{cases} B & \text{if } U_B^* - U_{\bar{B}}^* > 0 \\ \bar{B} & \text{Otherwise} \end{cases}
\end{aligned} \tag{5}$$

Given the binary nature of each choice situation (Decision), we can define the choice of each financial service as success (or 1), and the choice of its corresponding complement as failure (or 0), such that the choice processes described in equation (5) could be equivalently rewritten as:

$$\begin{aligned}
D_1 &= \begin{cases} 1 & \text{if } U_S^* - U_{\bar{S}}^* > 0 \\ 0 & \text{Otherwise} \end{cases} \\
D_2 &= \begin{cases} 1 & \text{if } U_B^* - U_{\bar{B}}^* > 0 \\ 0 & \text{Otherwise} \end{cases}
\end{aligned} \tag{6}$$

Such that the marginal probabilities of account ownership, saving and borrowing are given by:

$$\begin{aligned}
P[D_1 = 1] &= P[U_S^* - U_{\bar{S}}^* > 0] \\
P[D_2 = 1] &= P[U_B^* - U_{\bar{B}}^* > 0]
\end{aligned} \tag{7}$$

Considering first the equation expressing the choice of account ownership, we have that:

$$\begin{aligned}
P[U_S^* - U_{\bar{S}}^* > 0] &= P[(V_S + \varepsilon_S) - (V_{\bar{S}} + \varepsilon_{\bar{S}}) > 0] \\
&= P[(\varepsilon_S - \varepsilon_{\bar{S}}) > (V_{\bar{S}} - V_S)] \\
&= P[(\varepsilon_{\bar{S}} - \varepsilon_S) < -(V_{\bar{S}} - V_S)]
\end{aligned} \tag{8}$$

Similarly, we obtain from the borrowing equation that:

$$P[U_B^* - U_{\bar{B}}^* > 0] = P[(\varepsilon_{\bar{B}} - \varepsilon_B) < -(V_{\bar{B}} - V_B)] \tag{10}$$

In further simplifying our notation with:

$$\begin{aligned}
V_{\bar{S}} - V_S &= \tilde{V}_S & \text{and} & & \varepsilon_{\bar{S}} - \varepsilon_S &= \tilde{\varepsilon}_S \\
V_{\bar{B}} - V_B &= \tilde{V}_B & \text{and} & & \varepsilon_{\bar{B}} - \varepsilon_B &= \tilde{\varepsilon}_B
\end{aligned} \tag{11}$$

Then the marginal probabilities of saving and borrowing as described in equations (9) and (10) become respectively:

$$P[D_1 = 1] = P[\tilde{\varepsilon}_S < -\tilde{V}_S] = \int_{-\infty}^{-\tilde{V}_S} f(\tilde{\varepsilon}_S) d \tilde{\varepsilon}_S \tag{13}$$

$$P[D_2 = 1] = P[\tilde{\varepsilon}_B < -\tilde{V}_B] = \int_{-\infty}^{-\tilde{V}_B} f(\tilde{\varepsilon}_B) d \tilde{\varepsilon}_B \tag{14}$$

Such that relaxing the independence assumption between the three choice processes, in order to test the potential inter-dependence between account ownership, saving and borrowing choices, we define their joint probability as:

$$P[D_1 = 1, D_2 = 1] = \int_{-\infty}^{-\tilde{V}_S} \int_{-\infty}^{-\tilde{V}_B} f(\tilde{\varepsilon}_S, \tilde{\varepsilon}_B) d\tilde{\varepsilon}_B d\tilde{\varepsilon}_S \quad (15)$$

Where $f(\tilde{\varepsilon}_S, \tilde{\varepsilon}_B)$ represents the joint Bivariate probability density function of the error differences. In this formulation, we obtain the Bivariate logit Model (BLM) when we assume this density to follow the bivariate extreme value (or logistic) distribution, such that $f(\tilde{\varepsilon}_S, \tilde{\varepsilon}_B) = \Lambda(\tilde{\varepsilon}_S, \tilde{\varepsilon}_B)$. On the other hand, the bivariate probit model results when we assume the density function to follow a bivariate normal distribution, such that $f(\tilde{\varepsilon}_S, \tilde{\varepsilon}_B) = \Phi(\tilde{\varepsilon}_S, \tilde{\varepsilon}_B)$. In either case, the variance-covariance matrix of the joint trivariate distribution is of the form

$$\Sigma = \begin{bmatrix} \theta_{SS} & \theta_{SB} \\ \theta_{BS} & \theta_{BB} \end{bmatrix} \quad (17)$$

Where θ_{SS} and θ_{BB} represent the variances of the saving, and borrowing processes respectively; while $\theta_{SB} = \theta_{BS}$ represent the covariance between them. In this Random Utility Model formulation, the explicit forms of the deterministic components parts of utility are given by:

$$\begin{aligned} \tilde{V}_S = & \beta_{10} + \beta_{11} \text{GovTransf12m} + \beta_{12} \text{WagPaiRec12m} \\ & + \beta_{13} \text{EmerFundAces} + \beta_{14} \text{DebCard} + \beta_{15} \text{CredCard} \\ & + \beta_{16} \text{InterntBasdPaymt} + \beta_{17} \text{UtBillsPaid12m} \\ & + \beta_{18} \text{female} + \beta_{19} \text{age} + \beta_{110} \text{educ} + \beta_{111} \text{icome}_q \\ & + \beta_{112} \text{year} + \beta_{113} \text{country} + \beta_{113} \text{Account} \end{aligned} \quad (18)$$

$$\begin{aligned} \tilde{V}_B = & \beta_{20} + \beta_{21} \text{GovTransf12m} + \beta_{22} \text{WagPaiRec12m} \\ & + \beta_{23} \text{EmerFundAces} + \beta_{24} \text{DebCard} + \beta_{25} \text{CredCard} \\ & + \beta_{26} \text{InterntBasdPaymt} + \beta_{27} \text{UtBillsPaid12m} \\ & + \beta_{28} \text{female} + \beta_{29} \text{age} + \beta_{210} \text{educ} + \beta_{211} \text{icome}_q \\ & + \beta_{212} \text{year} + \beta_{213} \text{country} + \beta_{213} \text{Account} \end{aligned} \quad (19)$$

Where the β_{ij} represent the coefficients (unknown population parameters) capturing the effects of the explanatory variables on the likelihood of saving and borrowing respectively within the ECOWAS bloc, and are estimated using the data sample described in the next section. Note that the effects of public and private sectors transfers on the likelihood of saving are captured by β_{11} and β_{12} respectively, while β_{21} and β_{22} represent their respective effects on the likelihood of borrowing. These four are the main effects of interest in our present analysis, while the remaining variables are used as control factors.

3.2. Parameter Identification

To identify the parameters in equation (18) and (19), we adopt a sequential strategy allowing us to compare various specifications of the saving and borrowing processes within ECOWAS. More specifically we start with fully parametric binary representations of saving and borrowing (M1), which assumes that the two processes are fully linear and independent within ECOWAS. We then proceed to relax the independence assumption in M1, using a fully parametric bivariate probit representation (M2), which allows the two processes of saving and borrowing to correlate. From M2, we relax further the linearity assumption, through a semi-parametric bivariate probit representation of the two processes (M3), with fixed country level heterogeneity (to account for

non-explicitly included supply and demand sides, country level determinants of saving and borrowing) and a general smooth function specified for the continuous predictor “age” (to account for the likely non-linear life cycle effects of age on saving and borrowing propensities) in both equations. Finally, our last specification of the saving and borrowing processes relaxes further the fixed parameter effects assumption in M3, using a Markov random field smoothing (to account for the cross-country variations in non-explicitly accounted for determinants of saving and borrowing propensities) instead of the country fixed effects in M3. As the last specification, M4 represents the semiparametric bivariate probit model with random country level heterogeneity.

We estimate all of the above four model specifications of the saving and borrowing processes within the R statistical software (R Core Team, 2015), using the estimators from the library “SemiParBIVProbit” (see Wojtys et al., 2018). Following estimation, the performance of the four models are compared using objective criteria including the AIC and BIC measures, to identify the most appropriate model specification of the saving and borrowing processes within ECOWAS.

4. Data and variables description

The data used in this study is extracted from the pooled cross-sectional sample of the 2014 and 2017 waves of the Global Findex survey. Each wave of the survey covers approximately 1000 respondents in each of nearly 160 economies and in over 140 languages, using randomly selected, nationally representative samples. Conducted face to face in nations with less than 80 percent telephone coverage, the survey targets the entire civilian, non-institutionalized population age 15 and above in each country.

The first stage in face to face surveys consists of a random selection of primary sampling units, which are then stratified by population size, geography, or both; and further clustered through one or more stages of sampling. Where possible, proportional probability sampling is used to select final participants, otherwise simple random sampling is used. In countries where telephone interviewing is implemented, random digit dialing or a nationally representative list of phone numbers is used. Where cell phone penetration is high, a dual sampling frame is used. In all instances, the final data is weighted to ensure a nationally representative sample in each wave for each country. Van Oudheusden et al. (2015) and Demirg-Kunt et al. (2018) provide further details on the methodology and interview procedures of the 2014 and 2017 Global Findex surveys respectively.

The worldwide raw sample of the 2014 wave contains 146688 observations, while the 2017 wave covers 154923 respondents. After selecting the key common variables, from the two waves, and merging them, the final pooled cross-sectional panel data has a total of 224677 observations, 84144 of which from the 2014 wave, and the 140533 remaining, from the 2017 wave. The full sample covers 157 countries worldwide, therefore we extract the ECOWAS sub-sample as the set of all respondents from the 12 country members in the bloc. As graphically mapped in figure (2) and further summarized in table (A2) in the appendix, this extract contains a total of 15583 observations on 12 countries, 5292 of the observations come from the 2014 wave, and the remaining 10291 come from the 2017 wave. The full description of all variables are shown in table (A1), with their summary statistics provided in table (A3).

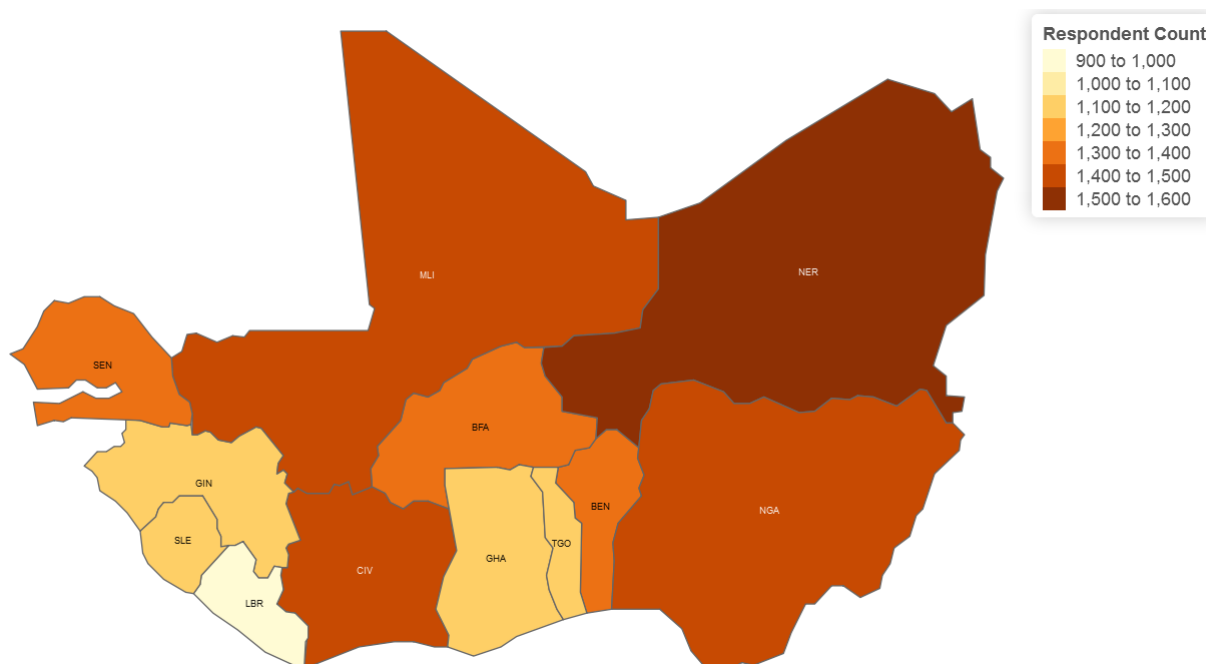


Figure (2): Geographical Map of country level respondents count within the ECOWAS economic bloc

5. Results

Our research findings are organized into six sub-sections. The first sub-section presents the descriptive statistics of the variables in the pooled sample; the second sub-section highlights the spatial trends in financial inclusion within ECOWAS; the third sub-section describes the outcomes of the statistical tests implemented to validate the empirical model; the fifth sub-section discusses the cross-country fixed and random heterogeneity in saving and borrowing; Finally the sixth sub-section presents the estimated marginal effects of the included predictors of saving and borrowing within ECOWAS.

6.1. Descriptive Statistics

Table (A3) summarizes the descriptive findings from the study sample. It can be noted that although recent years campaigns to increase individuals access to finance in the African continent, through technology driven mobile money accounts expansion have improved account coverage, from 37.38% in 2014 to 43.64% in 2017; most key demand side indicators of financial inclusion still appear to be on the declining trend within ECOWAS.

For example both savings and borrowings have decreased from 69.50% and 52.93% in 2014 to respectively 54.7% and 47.44% in 2017. Similar trends are observed for the percentages of individuals with government transfers and those with electronic salary transfers, which have also decreased from 6.27% and 22.15% in 2014 to respectively 5.91% and 20.36% in 2017. Moreover, the share of individuals with debit cards have also declined from 16.10% in 2014 to 14.43% in 2017. With regard to gender, the percentage of female remains higher in both years, although relatively more gender balance is observed in 2017 compared to 2014.

With respect to education level, except for secondary education which seems to have increased from 38.44% in 2014 to 39.94% in 2017, both primary education and tertiary education have been on the decline from respectively 57.22% and 4.35% in 2014 to 56.53% and 3.54% in

2017. With regards to income, table (A3) indicates rising poverty levels between 2014 and 2017, characterized by an increased share of individuals in the bottom three income quintiles, and a decline in the share of individuals in the top two income quintiles.

Balancing however the above challenging patterns is an observed increase in reported emergency fund access from 39.44% in 2014 to 43.64% in 2017. Similarly, although both still very low, access to credit cards allowing for formal borrowing and internet based purchases and payments have increased respectively from 2.85% and 3.06% in 2014 to 3.71% and 7.06% in 2017. Together the above discussed statistics seem to point out the need for strategies to reverse the observed declining tendencies within the ECOWAS economic bloc.

More specifically, the desperate need for increased activities in both the government sector and the private sector is visible. Since these would potentially lead to more financial transfers, which will contribute to boosting people up the income ladder, and subsequently increase consumer confidence, leading to more saving and borrowing. All of which, should contribute to reversing the downward tendencies and drive the needed growth in the ECOWAS bloc.

6.2. Spatial Trends in Financial Inclusions within ECOWAS

The spatial trends in financial inclusion in terms of weighted frequencies of individuals with savings and borrowing within each country are graphically summarized in the regional bivariate maps shown in figure (4-7) below. The weighted likelihood of individuals with any savings (left panel) and any borrowing (right panel) in 2014 and 2017 across the 12 country members of ECOWAS are presented in figure (4).

Focusing on the left panel of figure (4), it can be noted that among the 12 countries in the bloc, Nigeria shows the greatest percentage of individuals that saved for any purpose over the previous 12 months, followed by Liberia, then Sierra Leone. Following these three in terms of percentage of national savers, are Ghana, Ivory Coast and Mali; then follows Senegal, Burkina Faso, and Benin respectively; finally, among the least savers for any purpose are Guinea, Togo and Niger respectively in the bloc. With respect to borrowing for any reason, as shown in the right panel of figure (4), it can be noted that Niger leads the way with the greatest percentage of individuals that borrowed for any reason, followed by Liberia, and Sierra Leone; this first group of countries is followed by Senegal and Burkina Faso respectively, which are also followed by Mali, Guinea, Ivory coast, Ghana, Benin, and Nigeria. Finally, Togo appears to be the country with the least national share of reported borrowers, among the 12 countries in the ECOWAS bloc.

Turning our focus now to the share of individuals with formal saving (left panel) and formal borrowing (right panel) within each country, figure (5) shows that among the 12 countries, formal saving through a bank account at a financial institution is the greatest in Nigeria, followed by Ghana. These two are then followed by the group of Liberia, Sierra Leone, Burkina Faso, Benin and Togo; which are also followed by the group of Senegal, Mali, Ivory Coast and Guinea. Finally, standing as the country with the least reported share of individuals with formal saving is Niger.

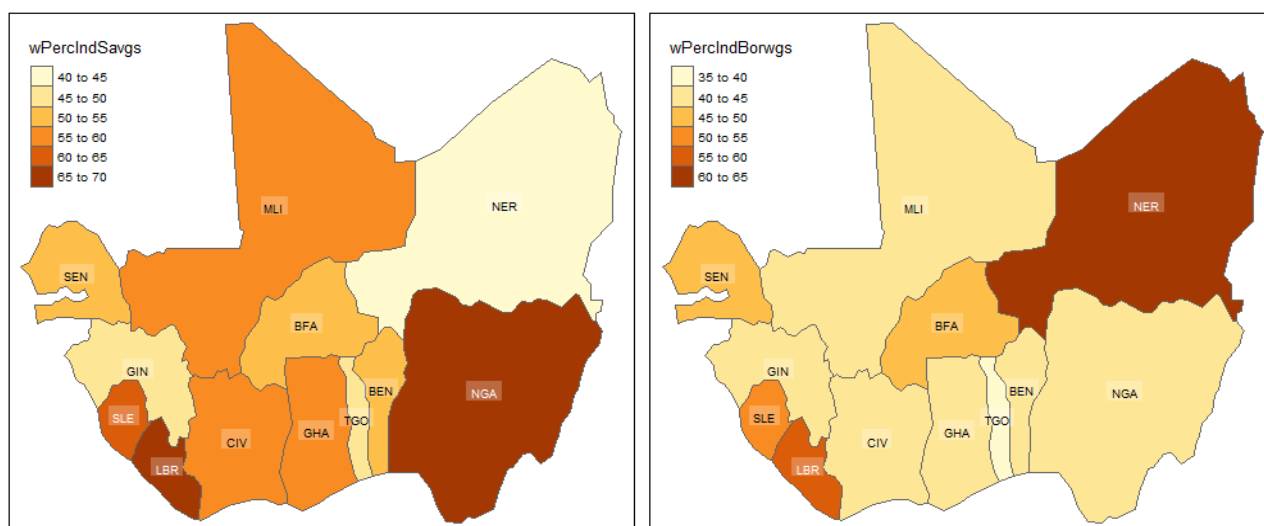


Figure (4): Country level Percentage (Weighted Likelihood) of Individuals Saving (left panel) and Borrowing (right panel) in 2014 and 2017 within ECOWAS

With respect formal borrowing, the right panel of figure (5) shows that the country with the greatest share of individuals that borrowed from a financial institution is Ghana, followed by Burkina Faso and Benin respectively. This group of countries, is then followed by Senegal, Liberia and Togo; which are also followed by Nigeria, Mali, Guinea, and Senegal. Niger appears now to have one the lowest percentage of individuals with reported formal borrowing, although the last country in the group based on this indicator is Ivory Coast. In comparison with the right panel of figure (4), the spatial results in the right panel of figure (5) seem to suggest that much of the previously reported borrowings for Niger are of informal nature.

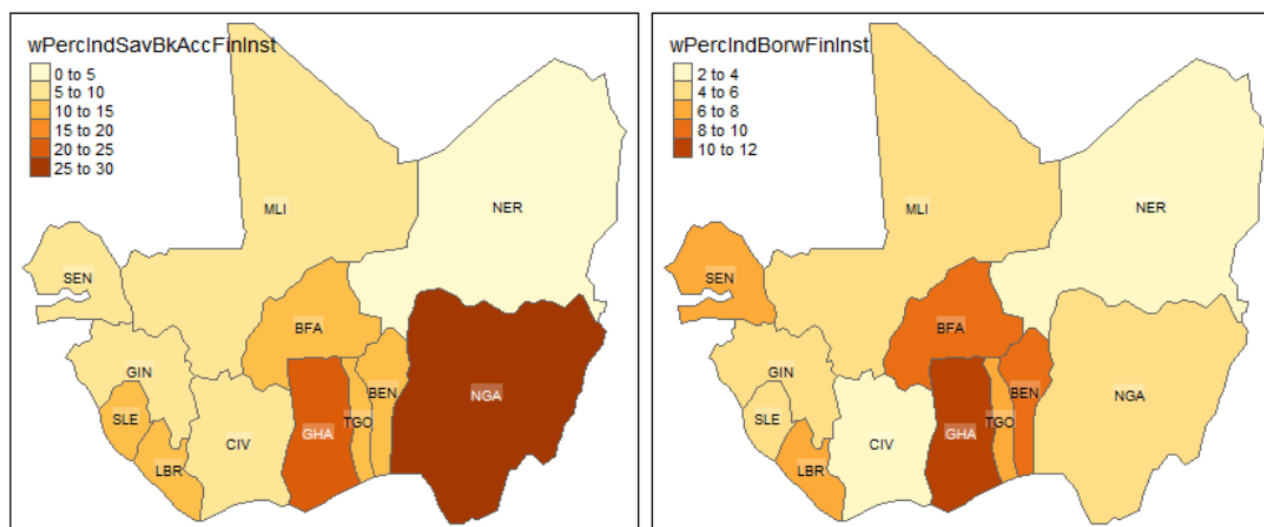


Figure (5): Country level Percentage (Weighted Likelihood) of Individuals Formal Saving (left panel) and Formal Borrowing (right panel) in 2014 and 2017 within ECOWAS

Figure (6) below describes the national percentages of individual savers (left panel) and borrowers (right panel) for farming and business purposes. On these national indicators, the left panel shows that among the 12 ECOWAS country members, Liberia presents the greatest share of individuals who save for the purposes of farming or starting a business, followed by Nigeria, then Ghana. This first group is then followed by the group of Mali, Burkina Faso, Senegal, Guinea, Sierra Leone, Ivory Coast and Benin. Saving for Business purposes appears to be the least prevalent in Niger and Togo.

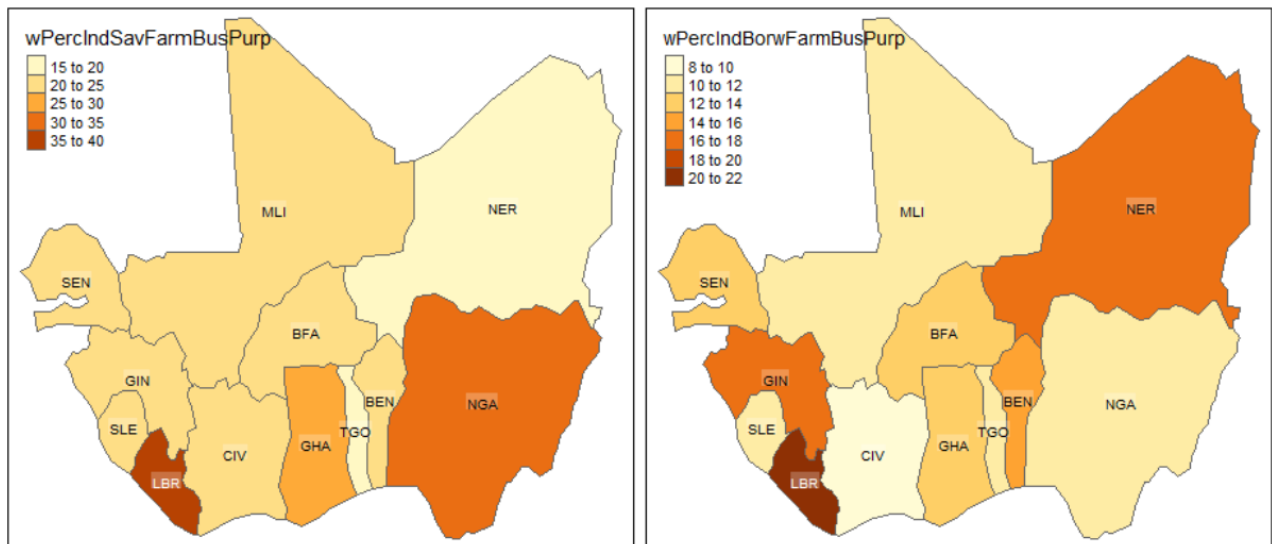


Figure (6): Country level Percentage (Weighted Likelihood) of Individuals with saving (left panel) and Borrowing (right panel) for Farming and business purposes in 2014 and 2017 within ECOWAS

On individual borrowing for farming and business purposes, the right panel of figure (6) suggests that Liberia leads the way, followed by Guinea, Niger and Benin. Following this first group of countries is Ghana, Burkina Faso and Senegal; which are also followed by Nigeria, Mali, Sierra Leone, and Togo. Just as previously reported in the case of formal borrowing between 2014 and 2017, Ivory Coast remains the country with the least reported share of individuals that borrowed for farming and business purposes among the 12 countries. Given Ivory Coast heavy reliance on export of cocoa and other agricultural products for economic growth, this spatial finding is suggestive of low producer confidence in the country between 2014 and 2017.

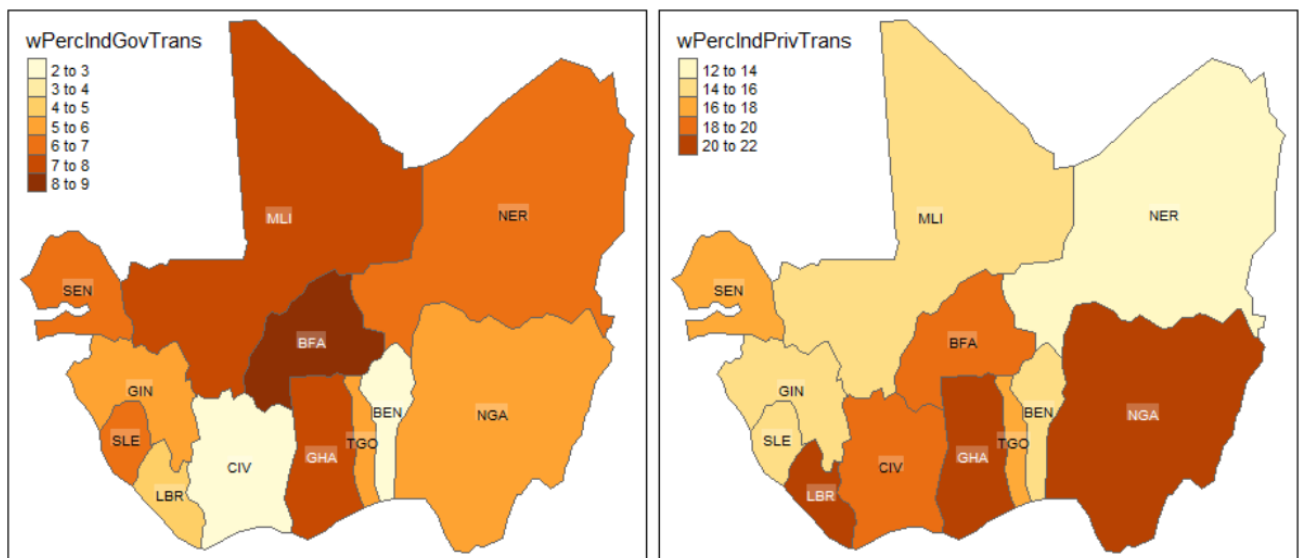


Figure (7): Country level Percentage (Weighted Likelihood) of Individuals with government transfers (left panel) and salary transfer (right panel) in 2014 and 2017 within ECOWAS

Finally we conclude our discussions in this section by describing the spatial characteristics of the financial inclusion enablers of primary interest to us in this study, namely the national percentages of individuals with reported government transfers (left panel) and private sector transfers (right panel) in figure (7).

In terms of government transfers, the right panel of figure (7) show that leading all ECOWAS countries is Burkina Faso with the greatest percentage of individuals with reported public transfers receipts, followed by Mali, Ghana, Senegal, Sierra Leone, and Niger. Following this group of countries are Nigeria, Togo and Guinea; which are also followed by Benin and Ivory Coast. With respect to electronic wage transfer deposits however, as shown in the right panel of figure (7), leading the way are Nigeria, Ghana, and Liberia with the greatest shares of individuals reporting having received electronic wage transfers from employers. This group of countries is followed by Ivory Coast, Burkina Faso, Senegal and Togo; which are themselves followed by Mali, Guinea, Sierra Leone, and Benin. Finally, Niger appears to be the country with the least share of individuals with salary transfer receipts within ECOWAS.

6.3. Empirical Model Validation

To validate our adopted empirical model, we begin by describing the association between the two primary endogenous indicators of financial inclusion (Saving, and Borrowing) with each of the nominal predictors (including government transfers and electronic salary transfers) using the chi-square test of (in)dependence. Table (A4) summarizes the results of these tests. We then test the link between the dependent variables (saving and borrowing) and the quantitative predictor “age”, using Welch’s t-test of difference in group means, with the results presented in table (A6).

6.3.1. Saving and Borrowing associations with the nominal predictors

In the case of the saving process, table (A4) shows that the p-values of the individual tests are all less than the 5% significance level, suggesting the dependence of these variables with saving choices within ECOWAS. A similar observation is made with respect to the borrowing process, which is also summarized in table (A4). However here education level does not show a significant linkage with borrowing choices within ECOWAS.

6.3.2. Saving and Borrowing associations with the quantitative predictor Age

In order to describe the relationship between respondent “age” and observed saving and borrowing choices, we first implement Levine’s test of homogeneity in variances, the results of which is presented in table (A5), followed by Welch t-test of difference in groups means as shown in table (A6). The F-statistics value of 103.37 with corresponding p-value $< 2.2e-16$ on Levine’s test provide enough evidence to suggest unequal age variance between individuals with savings and those without savings. Similarly, the F-statistics value of 39.106 with corresponding p-value $= 4.118e-10$ also suggests unequal age variance between individuals with borrowing and those without borrowing within ECOWAS.

The implications of Levine’s test results above are that we can now proceed to implement Welch t-test of difference in mean age between “savers” and “non-savers” on the one hand, and between “borrowers” and “non-borrowers” on the other hand, under the reasonable assumption of unequal groups’ variances within ECOWAS. The results of such tests are indeed presented in table (A6), and suggest that the mean age of respondents with savings (33.86 years) is significantly different than that of respondents without savings (33.11 years), since the 95% confidence interval on the difference in mean (-1.229; -0.268) is void of zero. On the other hand, the mean age of the respondents with borrowings (33.64 years) is not significantly different than that of respondents without savings (33.48 years), as evidenced by the 95% confidence interval on the difference in mean (-1.93; 1.90), which includes zero. These described numerical results appear consistent with the boxplots results in figure (10) below.

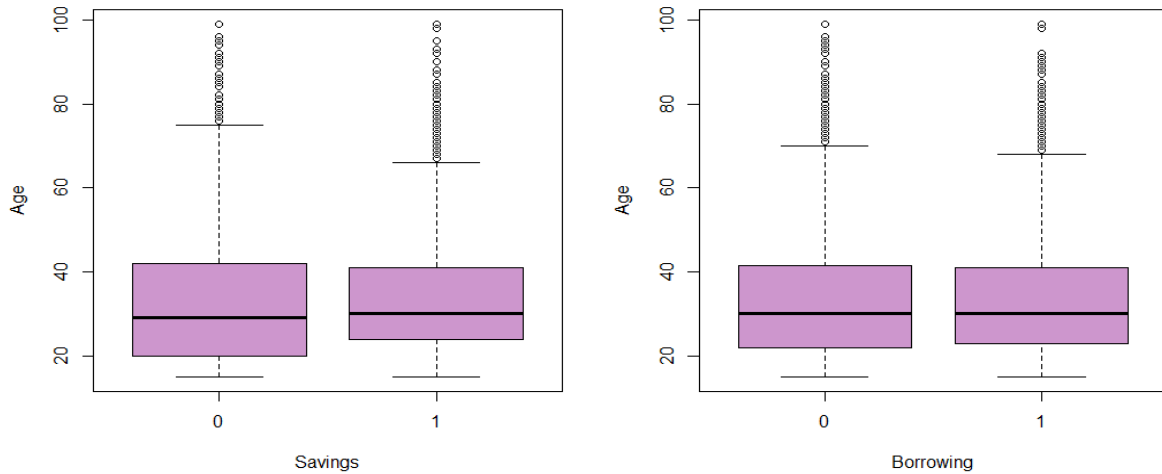


Figure 10: Descriptive Boxplots of Age against Saving and Borrowing within ECOWAS

6.4. Probability models results and sensitivity analysis

As previously discussed in the parameter identification strategy in section 4.2, to ensure the robustness of our empirical model to mis-specification, we formulate and estimate four models describing the processes of saving and borrowing within ECOWAS, with their results summarized in table (A7) and table (A8) respectively.

Recall that the binary probit model (M1) assumes full linearity and independence of the saving and borrowing functions, while M2 is its bivariate probit representation, which assumes saving and borrowing inter-dependence, and therefore allows for the errors of the two processes to correlate accordingly. In order to decide between M1 and M2, we test the hypothesis of absence of correlation between saving and borrowing within ECOWAS. We achieve this using the Lagrange multiplier test (also referred to as score test), implemented through the function “LM.bpm” within the R library “SemiParBIVProbit” (see Wojtys et al., 2018). Asymptotically, the corresponding test-statistic follows a Chi-squared distribution with one degree of freedom, and returns a numeric p-value corresponding to the null hypothesis that the correlation, θ , between saving and borrowing is equal to 0. In our present case, the test produced a p-value = $4.151713e-174$ which is less than $\alpha = 0.05$, therefore the null of no correlation is rejected, for the alternative of a significant correlation between the unobserved factors affecting saving and borrowing choices within ECOWAS. This inter-dependence is further confirmed by the estimated correlation coefficient $\hat{\theta}_{SB} = 0.387$ with 95% C.I. (0.365, 0.405) in M2.

Based on the above tests results and discussions, we conclude the adequacy of the bivariate representation in M2, over the individual binary specifications in M1. Now given that M2, M3, and M4 are all bivariate specifications, the question becomes which one is the most appropriate. To answer this question, it is important to note that the three models were estimated using variants of the trust region iteration algorithm described in Wojtys et al. (2018). In all three instances, the information matrices were positive definite, the largest absolute gradients were close to zero ($8.597e-06$, $2.095e-09$ and $1.625e-08$), and Eigenvalue ranges were acceptable, thus validating the satisfactory convergences of the trust region algorithms in each case.

Furthermore, although fairly similar, comparing the AIC measures across all three bivariate models, it can be noted that the semi-parametric bivariate probit with random country

effects (M4), with its lowest AIC value, appears to be the most adequate specification of the saving and borrowing processes within ECOWAS. Therefore, our presentation of the coefficient estimates on the likelihood of saving and borrowing is based on the results of this latter model. For this model, M4, the smooth function plots of the estimated effects of age on the probabilities of saving and borrowing within ECOWAS, are shown in figure (8). Table (A7) and table (A8) show their corresponding numerical estimated density functions (edfs), which are 5.845 and 6.087 for the saving and borrowing processes respectively. Given their p-values less than the 5% significance level, we conclude that age does have a significant non-linear effect on both saving and borrowing within ECOWAS. This conclusion is further validated by the graphical smooth function plots in figure (8) below, which show a quadratic age effect on both saving and borrowing. Indeed, globally in its domain defined between 20 to 100 years, age seem to have a positive marginal effect on both saving and borrowing, up to approximately age 40; Above this threshold of 40 years however, age appears to have a negative marginal effects on both saving and borrowing within ECOWAS.

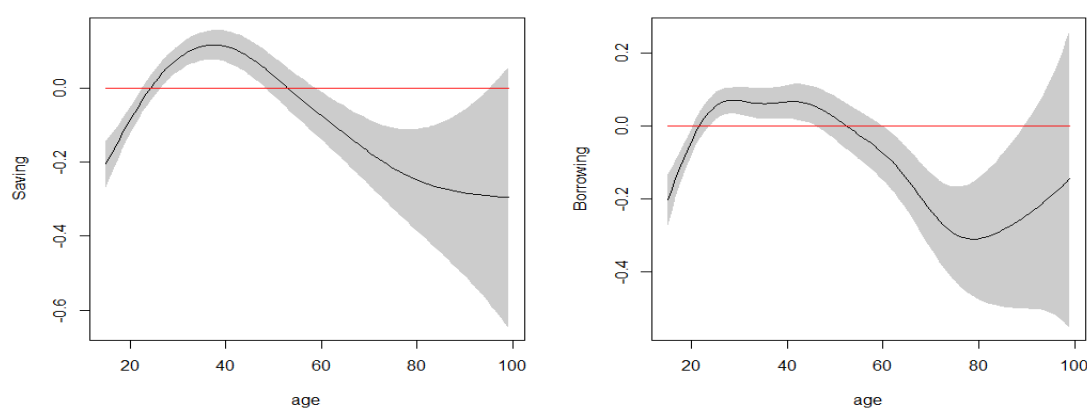


Figure (8): Smooth function plots with 95% confidence bands on the effects of consumer’s age on saving (left panel) and borrowing (right panel) within ECOWAS

In addition to the above described effects of age on the likelihood of saving and borrowing, and independently of the model chosen, the estimated effects of our primary variables of interests (GovTransf12M, and WagPaiRec12M) are fairly stable (in terms of their signs, magnitudes, and significances) across the various specifications of the saving and borrowing processes, suggesting the robustness of our results (see tables (A7) and (A8)). For example, focusing specifically on the effects of government transfers, and electronically deposited salary transfers as potential inducers of financial inclusion within ECOWAS, table (A7) shows that on the probability scale, individuals with government transfers over the past 12 months have between [31.8%, 36.1%] greater probability to save, while individuals with electronic wage transfers have between [33.4%, 36%] greater likelihood of saving. Similarly, looking at the probability of borrowing, as shown in table (A8) we note that individuals with government transfers in the past year are [31.2%, 32.7%] more likely to borrow, while those with electronic wage transfers are [19.9%, 23.2%] more likely to also borrow.

Based on demographic influences, it is worth noting that all models consistently show that between 2014 and 2017, education does not significantly influence the likelihood of saving nor borrowing within ECOWAS. However, income does, and so does gender. In fact increased income level is seen to significantly and consistently raise the likelihood of saving across all income

quintiles, while only affecting significantly relative borrowing in the bottom four quintiles. With respect to gender, although there appear to be no significant gender based difference in the probability of borrowing, we do observe about 6% less likelihood of saving for the female gender, compared to their male counterparts within ECOWAS. Also worth pointing out on the probability scale, are the consistent and significant 57.8% and 18% reduction in the likelihood of saving and borrowing respectively, between 2014 and 2017 as captured by the year dummy variable in the probability models (see table (A7) and table (A8)).

6.5. Cross-country fixed and random heterogeneity in saving and borrowing

Although not of direct interest in the present study, the cross-country fixed and random effects on the likelihood of saving and borrowing are estimated jointly with the parameters reported in table (A7) and table (A8). The fixed effects are summarized in table (A9) for M2 and M3, while the random effects from M4 are spatially mapped in figure (A9).

Worth pointing out from table (A9), is the sizeable reduction in the estimated fixed country effects, between the fully parametric bivariate probit model (M2), and the semi-parametric bivariate probit model (M3). This is due to the latter model ability to capture better the variations in saving and borrowing choices, leaving relatively lesser country level unexplained variations than the former. For the cross-country random heterogeneity shown in figure (A9), they are produced after estimating M4, with Markov random field smoothing over the country parameter space [see (Wojtys et al., 2018)]. Since the estimated empirical density functions are 10.795 and 10.671 for the saving and borrowing equations respectively, with corresponding p-values less than the 5% significance level, we conclude that non-linear country level determinants significantly influence saving and borrowing choices within ECOWAS.

6.6. Marginal Effects results

As summarized in table (A8) Model 4, a significant inter-dependence exists between the two processes of saving and borrowing within ECOWAS. This is established by both the positive correlation coefficient $\hat{\theta}_{SB} = 0.376$ with 95% Confidence interval (0.348, 0.402); and the positive copula dependence parameter $\hat{\tau}_{SB} = 0.245$ with confidence interval (0.226, 0.263). In addition to their inter-dependence, both processes are significantly determined by a number of factors, including government and private sectors electronic transfers. The marginal effects of these factors on actual saving and borrowing within ECOWAS are shown in table (A10).

6.6.1. Findings from the estimated saving process

The marginal effects of the factors explaining individuals saving propensity within ECOWAS are shown in the first column of table (A10). In agreement with the outcome of the empirical model validation analysis in section 6.3, we note that at the exception of educational level, all the included explanatory factors of individual saving propensity have significant marginal effects. Concerning our two primary variables of interest in the present analysis, the results show that government transfer receipts over the past twelve months raise individual marginal propensity to save (MPS) by 11.6%, while private salary transfer receipts raise MPS by 12.9% within ECOWAS. With respect to the remaining control factors in the model, we note a mixture of positive and negative marginal effects, with only education level failing to significantly influence saving propensity.

Indeed, the results in table (A8) suggest that having an account at a financial institution, and/or a mobile money account raises individuals MPS by 18.2%. Similarly, individuals with the ability to come up within a month time, with at least 5% of the Gross National Income (GNI) of their country of residence within ECOWAS are found to have 14.8% higher MPS than their counterparts who do not have access to such emergency funds. In addition, individuals with debit cards, those with credit cards, and those with internet based purchases within the twelve months prior to the study show respectively 9.7%, 11.5% and 11.6% greater MPS than their respective counterparts without debit cards, credit cards, or internet based payments. Furthermore, although education does not seem to significantly impact MPS within ECOWAS, the marginal effect of gender suggests that females have 2.4% lower MPS than their male counterparts. Conversely, income is found to significantly raise individuals MPS at all income levels, from 4.2% to 10.3% between the lowest income quintile and the top income quintile.

The estimated marginal effect of the year dummy variable suggests that individual MPS has decreased by 21.4% between 2014 and 2017 within ECOWAS. Moreover, the direct effect of age contributes to raising MPS by 1.1% while its quadratic effect reduces MPS by less than 1%, leaving an overall small yet positive effect of age on individual MPS within ECOWAS. From the estimated marginal effects of the country dummy variables, it can be noted that compared to Nigeria, only two countries (Liberia and Sierra Leone) show higher MPS at respectively 9.8% and 4.6%. All remaining country members of ECOWAS (i.e. Benin, Burkina Faso, Ivory Coast, Ghana, Guinea, Mali, Niger, Senegal and Togo) show respectively 9.7%, 12.2%, 7%, 15.6%, 11.6%, 20.7%, 11.8% and 17.4% lower MPS than Nigeria.

6.6.2. Findings from the estimated borrowing process

The marginal effects of the explanatory factors of individuals borrowing within ECOWAS are shown in the second column of table (A10). Overall, these effects are also consistent with the outcome of the empirical model validation discussed in section 6.3. Indeed, except for gender and secondary education, all included explanatory factors exert significant effects on individual marginal propensity to borrow (MPB) within ECOWAS. Concerning our primary factors of interests in the current study, it can be noted that government transfer receipts in the past year increase individual MPB by 12.6%, while electronic wage transfer receipts increase individual MPB by 8.2% within ECOWAS.

Regarding the remaining control factors in the borrowing function, table (A10) shows a mixture of positive and negative marginal effects. For example, having a formal account before a financial institution and/or a mobile money account is seen to raise individual MPB by 9.3%. Conversely, having access to emergency funds or an Automated Tailor Machine (ATM) debit card allowing for instantaneous money withdrawal when needed, are both found to not contribute significantly to individual MPB within ECOWAS. On the other hand, having a credit card that allows for credit consumption, with balance to be paid at a later time, raises by 26.3% individual MPB within COWAS.

Similarly, individuals' with internet based purchases in the twelve months prior to the study, whether through mobile phones, computers or other devices, are seen to have 8.2% greater MPB. Regarding gender, the results show no significant difference in marginal propensity to borrow between males and females within ECOWAS. With respect to education, although no significant difference seems to exist between individuals with secondary education and those with primary or less, we do observe a relative 5.5% lower MPB for individuals with tertiary education

or more, compared to their counterparts with primary or less. The marginal effects of income show that except for individuals in the second and fifth quintiles that do not appear to differ significantly from their peers in the first income quintile, in terms of MPB, those in the middle and fourth quintiles show respectively 3.2% and 3.8% greater MPB than their peers in the first income quintile.

The estimated marginal effect of the year dummy variable suggests that individuals MPB within ECOWAS has decreased by 7.2% between 2014 and 2017. Moreover, while the direct effect of age is found to increase MPB by 0.8%, its quadratic effect reduces borrowing by less than 0.1% leaving an overall positive marginal effect of age on individual borrowing within ECOWAS. Finally, the marginal effect of the country dummy variables show that compared to Nigeria, countries such as Benin, Ivory Coast, Ghana, Mali and Togo show no significant difference in MPB. On the other hand, countries such as Burkina Faso, Guinea, Liberia, Niger, Senegal and Sierra Leone show respectively 68.1%, 6.3%, 16.9%, 2.3%, 9.1% and 13.1% greater individuals MPB than Nigeria.

6. Discussions

Digital technologies contribute crucially as strategic drivers to create open, participatory and trustworthy public and private sectors. They improve social inclusiveness with government and corporate accountability, and help bring together government and non-government actors to collaborate in the development of innovative approaches that contribute to national development and long-term sustainable growth.

Because of traditionally poor ICT infrastructural development in West Africa, digitalization of both public and private processes have remained fairly low within ECOWAS. As part of the United Nations Sustainable Development goals (SDGs) target 9.c, nations worldwide, including ECOWAS country members have been investing in information and communication technology (ICT) infrastructural development, and extending access to ICT resources including the internet to citizens (United Nations, 2015). These efforts have been laying the foundations upon which government and non-government including private sectors could be digitized within ECOWAS.

The resulting emergence of “digital welfare¹” and digital payroll processes within ECOWAS, would then facilitate the direct delivery of welfare benefits and employee salary into digital (bank or mobile money) accounts (Katz, 2002), thereby contributing to plugging more ECOWAS citizens to financial Markets. One of which is the “BRVM” regional stock exchange, which is currently shared by eight of the twelve country members of ECOWAS, and is fully electronic and perfectly integrated to international financial markets. Such financial inclusion should provide the safe environment for individuals to save, borrow and more generally use financial services to improve their lives within ECOWAS.

Indeed, unlike the case of high income countries such as USA and UAE, where Niankara & Muqattash (2020) found government transfer deposits to not significantly influence saving behavior, here we found that government transfer receipts increase individual marginal propensity to save by 11.6% within ECOWAS. This finding further corroborates with Keho (2019), which

¹ The digitization and electronic management of education, healthcare, and social care and protection services, including smarter use of well-proven assistive technologies (Katz, 2002; O’leary et al., 2019), which allow quick secure and efficient delivery of welfare benefits (including payments for educational and medical expenses, unemployment benefits, subsidy payments, or any kind of social benefits).

reports domestic savings to significantly influence economic growth in both, short and long run in Ivory Coast. In addition, within ECOWAS country members, accounting for individual income level, education does not appear to influence saving behavior significantly. This finding contrasts with the 20.9% education based gradient reported by Niankara & Muqattash (2020) in the context of the US and UAE. This observation might however be explained by the fact that typically, in high-income countries, individuals with the most education are the main drivers of economic activities, through active participation in the formal sector; where as in low-income countries, much of economic activities are concentrated in the informal sector, where little education is needed. Informal sector participants with typically lesser education are still able to thrive in commerce activities, the proceeds of which are either formally or informally saved and consumed. This latter observation corroborates further with the findings in Sakyi et al. (2019) within the specific context of commercial drivers in Ghana; although their findings go one-step further, to suggest an adverse effect of education on commercial drivers' savings behavior.

Our findings on the effect of gender on saving within the context of low income ECOWAS country members, are consistent with those reported by Niankara & Muqattash (2020) in the UAE and USA. Indeed, in both context, females are found to have significantly lower marginal propensity to save than their male counterparts, although these similarities are most likely driven by different processes in the two contexts. In the current context of ECOWAS, the central role of women in raising and taking care of the children and their needs, contributes to their potential inability to save. Indeed even when women are able to generate income, most of it goes to current consumption of all family members, leaving very little room for saving. This characteristic contributes further to explaining the observed differences in income effect on individual propensity to save between high and low income economies. Indeed, while Niankara & Muqattash (2020) found no income based gradient in saving in the US and UAE, our present analysis shows that within ECOWAS, a significant income based gradient in saving prevails, with higher income level leading to significantly higher MPS within the bloc.

In addition to the above discussions on individual saving behavior within ECOWAS, our analysis also provided interesting findings on individual propensity to borrow within the bloc. For example consistently with the results reported by Niankara & Muqattash (2020) in the context of the US and UAE, we found that electronic transfers from government and private sector significantly raise individuals marginal propensity to borrow (MPB) within ECOWAS. Similarly, with respect to gender, while Niankara & Muqattash (2020) report a significantly lesser borrowing likelihood for females compared to their male counterparts, our present analysis show no significant difference in borrowing propensity between the two genders within ECOWAS. On the other hand, while education did not seem to significantly influence borrowing behavior in Niankara & Muqattash (2020), in the context of ECOWAS, we find that this holds true for secondary education, although for individuals with tertiary education the relative likelihood of borrowing within the previous 12 months decreases significantly.

These results seem to indicate that in terms of vulnerability within ECOWAS country members, a secondary education does not significantly shield individuals to income shocks over their counterparts with primary education or less. However, those with tertiary education or more seem to be relatively better shielded from such income chocks, leading to relatively lesser need for borrowing than their counterparts with primary education or less. This observation corroborates further with the findings in Niankara & Traoret (2019), which looked at the impact

of formal education on the contemporaneous dynamics of literacy, labor market participation and poverty reduction in Burkina Faso, a country member of the ECOWAS bloc.

Furthermore, the marginal effects of income on borrowing as shown in table (A10) fully support this view as the relative marginal propensity to borrow increases significantly at lower income level, while appearing insignificant among individuals in the top income quintile within ECOWAS. This latter result contrasts however with the findings in Niankara & Muqattash (2020) that report no significant difference in borrowing between individuals of different income quintiles in the USA and the UAE.

Considering both the ability to save and borrow as demand side indicators of financial inclusion as previously discussed, then our results are further in line with the findings in Nigeria where Abdu et al. (2015) using the 2011 global finindex data reported the existence of a gender gap in financial inclusion in favor of the male gender. Although our results did not show a gender based borrowing gradient, we did find a significant saving gradient when using the 2014 and 2017 global finindex data on ECOWAS country members. Adegbite & Machethe (2020) also arrived at similar conclusions using a mixed method review of secondary sources to investigate the trends in financial inclusion gender gap in smallholder agriculture in Nigeria. They recommended among other measures digital financial inclusion as a viable option for closing the gender gap.

7. Conclusion

This paper has concerned itself with analyzing the impact of public and private sectors electronic transfer practices on financial inclusion in terms of individuals' ability to save and borrow within the economic community of the West African states. In doing so, the paper outlined the political imperative for improving the efficiency, effectiveness and governance of both public and private services design and delivery through digitization. The study was motivated by the latest review on the topic of financial inclusion and growth Ozili (2020), which pointed out the lack of studies addressing the role of government in the promotion of financial inclusion, but also the lack of studies addressing the topic of financial inclusion from a regional economic bloc perspective. After a thorough review of the empirical literature on the topic within the African context, we identified the ECOWAS economic bloc as a potential candidate to further regional economic bloc level analysis on the topic of financial inclusion, as suggested in Ozili (2020).

As demand side measures of financial inclusion we focused on saving and borrowing choices as drivers of economic growth, to look at how government transfers and electronic salary transfers could contribute to fostering financial inclusion by increasing both indicators. At the methodological level, we relied on a fairly innovative study design, which helped us meet our research objectives, while also allowing us to contribute to expanding further the methodological literature on the topic of regional analysis of financial inclusion and economic growth.

With respect to the main question we set out to answer, the results of our analysis showed that government and private sector electronic transfer practices affect positively and significantly saving and borrowing choices within the economic community of the West African States. Indeed, across all specified four probability models, we found that individuals with government transfers over the previous 12 months leading to the study, had between [31.8%, 36.1%] higher probability to save and [31.2%, 32.7%] greater likelihood of borrowing. Similarly, individuals with reported electronic wage transfers over the past 12 months had between [33.4%, 36%] higher likelihood of saving, and between [19.9%, 23.2%] higher probability to borrow within ECOWAS.

On the marginal scale of the above described probabilistic effects, the above figures translated to a 11.6% higher marginal propensity to save, and a 12.6% higher marginal propensity to borrow respectively for government transfers recipients. Similarly for electronic wage transfer recipients, the above probabilistic effects translated to an increased marginal propensity to save by 12.9%, and an increased marginal propensity to borrow by 8.2%.

Together these results do point out the potential of government transfers and mandated electronically deposited wage transfers to significantly improve financial inclusion within ECOWAS, through improving public and private sector efficiency, but also boosting both individual saving and borrowing within the bloc. Indeed, given the decreasing trends in most indicators of financial inclusions within ECOWAS between 2014 and 2017, as previously acknowledged in our descriptive statistics in section 6.1, the above suggested financial transfer measures from both government and private sector within ECOWAS, should provide the needed boost to create more saving, and borrowing, while raising consumers' income and confidence, which should translate into increased aggregate demand and consumption, and hence increased production to meet the increased demand. This would eventually work through the multiplier effect to drive growth within each country, and result in the growth of the whole ECOWAS economic bloc.

As an initial attempt at jointly bridging the highlighted gap in the political economy of financial inclusion, and the regional economic bloc level analyses on the topic of financial inclusion, the current treatment by focusing on ECOWAS as a single economic bloc has been able to bring forth consolidated electronic transfer policy recommendations that could contribute to promoting financial inclusion, improving access to finance, saving, borrowing and growth in the historically underserved West African States. A potential iteration from this study includes extending the single economic bloc analysis to several blocs, so as to gain additional insights into the potential benefits of financial transmission mechanisms across-and-within-blocs, which we hope would contribute to better policy coordination across various economic blocs for sustainable growth and development.

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This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Interest:

None

Appendix

Table (A1): Description of all variables used in the analysis

Variable	Description
saved	Binary indicator equals 1 (and 0 otherwise) if the respondent, saved or set aside money in the past year. This includes using an account at a financial institution, a savings club or person outside the family, or for education or school fees, old age, or to start, operate, or expand a farm or business, or for any other reason.
borrowed	Binary indicator taking the value 1 (and 0 otherwise) if the respondent, personally or together with someone else, borrowed money in the past year from any source. This includes financial institution, a store through instalment credit, family or friends, or another private lender, or for education or school fees, medical purposes, to start, operate, or expand a farm or business, or for any other reason.
GovTransf12m	Binary indicator equals 1 (and 0 otherwise) if respondent received any financial support from the government in the past 12 months, including payments for educational and medical expenses, unemployment benefits, subsidy payments, or any kind of social benefits, but excluding wages or any payments related to work.
WagPaiRec12m	Binary indicator equals 1 (and 0 otherwise) if respondent received any money from an employer, in the form of salary or wages in the past year, but excluding money directly received from clients or customers, for doing work.
account	Binary indicator equals 1 (and 0 otherwise) if the respondent has an account at a financial institution, a mobile money account, or both.
EmerFundAces	Binary indicator equals 1 (and 0 otherwise) if respondent is able to come up with 5% of his country of residence Gross National Income (GNI) per capita amount in the local currency, within the next month. Used to measure respondent ability to come up with emergency funds.
DebCard	Binary indicator equals 1 (and 0 otherwise) if respondent has an automated tailor machine (ATM) card, which is connected to an account at a financial institution, allowing respondent to withdraw money right away when needed.
CredCard	Binary indicator equals 1 (and 0 otherwise) if respondent has a credit card, which allows the respondent to borrow money in order to make payments or buy things, with the balance to be paid off later.
InterntBasdPaymt	Binary indicator, equals 1 (and 0 otherwise) if respondent has made online purchases or bill payments, or both using the internet in the past 12 months, including using mobile phone, a computer, or some other devices.
educ	Respondent's level of education. (1 if primary or less, 2 if secondary, and 3 if tertiary or more).
inc_q	Respondent's within economy household income quintile. Constructed from before tax household income; includes income from wages and salaries, remittances from family living elsewhere, farming, and all other sources.
female	Binary indicator, equals 1 (and 0 otherwise) if respondent is female.
age	Respondent's Age in years.
year	Year of data collection (2014 or 2017).
economy2	Respondent's country within ECOWAS (one 12 countries-see table 2 below)
wgt	Respondent's country level weight in the sample for representativeness, and unbiased statistical inferences.

Source: Extracted from the 2014 and 2017 waves of the Global Findex survey

Table (A2): Respondents absolute and percent relative frequency counts by country

Country	2014 Sub-sample (N = 5292)		2014 Sub-sample (N = 10291)		Full Sample (N= 15583)	
	Abs. Freq.	% Rel. Freq.	Abs. Freq.	% Rel. Freq.	Abs. Freq.	% Rel. Freq.
Benin	472	8.92	909	8.83	1381	8.86%
Burkina Faso	465	8.79	851	8.27	1316	8.45%
Ivory Coast	536	10.13	909	8.83	1445	9.27%
Ghana	476	8.99	698	6.78	1174	7.53%
Guinea	357	6.75	760	7.39	1117	7.17%
Liberia	NA	NA	957	9.30	957	6.14%
Mali	541	10.22	891	8.66	1432	9.19%
Niger	699	13.21	853	8.29	1552	9.96%
Nigeria	560	10.58	922	8.96	1482	9.51%
Senegal	554	10.47	836	8.12	1390	8.92%
Sierra Leone	325	6.14	856	8.32	1181	7.58%
Togo	307	5.80	849	8.25	1156	7.42%

Source: Authors' construction based on the 2014 and 2017 waves of the Global Findex survey

Table (A3): Descriptive Statistics for the variables used in the analysis

Quantitative Variables	Units	2014 Sub-sample (N = 5292)		2017 Sub-sample (N = 10291)	
		Mean	S.D.	Mean	S.D.
Sampling Weight (wgt)	-----	0.94	0.63	0.99	0.69
AGE	(in years)	35.01	14.51	32.81	14.58
Qualitative Variables	levels	Abs. Freq.	Rel. Freq. (%)	Abs. Freq.	Rel. Freq. (%)
SAVED	1: Yes	3678	69.50	5629	54.70
	0: No	1614	30.50	4662	45.30
BORROWED	1: Yes	2801	52.93	4882	47.44
	0: No	2491	47.07	5409	52.56
GovTransf12M	1: Yes	332	06.27	608	05.91
	0: No	4960	93.73	9683	94.09
WagPaiRec12M	1: Yes	1172	22.15	2095	20.36
	0: No	4120	77.85	8196	79.64
ACCOUNT	1: Yes	1978	37.38	4491	43.64
	0: No	3314	62.62	5800	56.36
EmerFundAccess	1: Yes	2087	39.44	5601	54.43
	0: No	3205	60.56	4690	45.57
DEBITCARD	1: Yes	852	16.10	1485	14.43
	0: No	4440	83.90	8806	85.57
CREDITCARD	1: Yes	151	02.85	382	03.71
	0: No	5141	97.15	9909	96.29
InterntBasdPaymt	1: Yes	162	03.06	727	07.06
	0: No	5130	96.94	9564	92.94
FEMALE	1: Yes	3076	58.13	5705	55.44
	0: No	2216	41.87	4586	44.56
EDUCATION	1: Primary or less	3028	57.22	5817	56.53
	2: Secondary	2034	38.44	4110	39.94
	3: Tertiary or more	230	04.35	364	03.54
INCOME_QUINTILE	1: Poorest 20%	588	11.11	1614	15.68
	2: Second 20%	762	14.40	1725	16.76
	3: Middle 20%	895	16.91	1905	18.51
	4: Fourth 20%	1225	23.15	2187	21.25
	5: Richest 20%	1822	34.43	2860	27.79

Source: Authors' construction based on the 2014 and 2017 waves of the Global Findex survey

Table (A4): Conditional Frequency Distribution and Chi-square test of Independence for the nominal explanatory variables

Full Sample (N = 15583)	Modalities/levels	Chi ² Test					
		SAVED			BORROWED		
		X-stat	df	p-value	X-stat	df	p-value
GovTransf12M	1: Yes 0: No	139.37	1	< 2.2e-16***	130.97	1	< 2.2e-16***
WagPaiRec12M	1: Yes 0: No	619.45	1	< 2.2e-16***	166.44	1	< 2.2e-16***
ACCOUNT	1: Yes 0: No	1269.5	1	< 2.2e-16***	156.77	1	< 2.2e-16***
EmerFundAccess	1: Yes 0: No	617.81	1	< 2.2e-16***	41.098	1	1.448e-10***
DEBITCARD	1: Yes 0: No	732.74	1	< 2.2e-16***	58.39	1	2.15e-14***
CREDITCARD	1: Yes 0: No	143.21	1	< 2.2e-16***	195.77	1	< 2.2e-16***
InterntBasdPaymt	1: Yes 0: No	180.05	1	< 2.2e-16***	71.256	1	< 2.2e-16***
FEMALE	1: Yes 0: No	29.894	1	4.562e-08***	16.086	1	6.054e-05***
EDUCATION	1: Primary or less 2: Secondary 3: Tertiary or more	341.6	2	< 2.2e-16***	2.2382	2	0.3266
INCOME_QUINTILE	1: Poorest 20% 2: Second 20% 3: Middle 20% 4: Fourth 20% 5: Richest 20%	415.37	4	< 2.2e-16***	24.556	4	6.179e-05***

* indicates significance at alpha of 0.05; ** significance at 0.01; and *** significance at 0.001 for the chi-square tests

Source: Authors' construction based on the 2014 and 2017 waves of the Global Findex survey

Table (A5): Levine’s Test for homogeneity in variances across groups

		Age
SAVED	Degree of freedom	1
	F-statistic	103.37
	P-value	< 2.2e-16***
BORROWED	Degree of freedom	1
	F-statistic	39.106
	P-value	4.118e-10***

* indicates significance at alpha of 0.05; ** significance at 0.01; and *** significance at 0.001 for Levine’s tests

Ho: Equal age variance between individuals “savers” and “non-savers” V.S. Ha: Unequal variances

Ho: Equal age variance between individuals “borrowers” and “non-borrowers” V.S. Ha: Unequal variances

Source: Authors’ construction based on the 2014 and 2017 waves of the Global Findex survey

Table (A6): Welch t-test of difference in mean age across groups, with corresponding 95% confidence interval

			Age
SAVED	Group Mean Values	No	33.11
		Yes	33.86
	Difference in group means		-0.75
	Confidence Interval on the Difference in group means		(-1.229 ; -0.268)
	P-value		0.00227**
BORROWED	Group Mean Values	No	33.48
		Yes	33.64
	Difference in group means		-0.16
	Confidence Interval on the Difference in group means		(-1.93 ; 1.90)
	P-value		0.478

* indicates significance at alpha of 0.05; ** significance at 0.01; and *** significance at 0.001 for Levine’s tests

Ho: Average Age of “savers” exceeds that of “non-savers” V.S. Ha: not Ho

Ho: Average Age of “borrowers” exceeds that of “non-borrowers” V.S. Ha: not Ho

Source: Authors’ construction based on the 2014 and 2017 waves of the Global Findex survey

Table (A7): Determinants of consumers' probability of saving within ECOWAS

		Fully Parametric		Semi-Parametric Bivariate Probit	
		Binary Probit (M1)	Bivariate Probit (M2)	With Fixed Country Effects (M3)	With Random Country Effects (M3)
(INTERCEPT)		-0.280*** (0.077)	-0.284*** (0.077)	0.222*** (0.053)	-0.008 (0.035)
GovTransf12M	1: Yes	0.361*** (0.052)	0.348*** (0.051)	0.319*** (0.051)	0.318*** (0.051)
WagPaiRec12M	1: Yes	0.360*** (0.033)	0.351*** (0.032)	0.334*** (0.030)	0.334*** (0.030)
ACCOUNT	1: Yes	0.478*** (0.028)	0.474*** (0.028)	0.483*** (0.027)	0.482*** (0.027)
EmerFundAccess	1: Yes	0.397*** (0.023)	0.393*** (0.023)	0.388*** (0.023)	0.389*** (0.023)
DEBITCARD	1: Yes	0.214*** (0.047)	0.203*** (0.046)	0.249*** (0.042)	0.250*** (0.042)
CREDITCARD	1: Yes	0.389*** (0.081)	0.373*** (0.078)	0.308*** (0.074)	0.306*** (0.074)
InterntBasdPaymt	1: Yes	0.311*** (0.060)	0.305*** (0.059)	0.312*** (0.054)	0.311*** (0.054)
FEMALE	1: Yes	-0.066** (0.022)	-0.067** (0.022)	-0.059** (0.023)	-0.060** (0.023)
EDUCATION	2: Secondary	0.027 (0.028)	0.026 (0.028)	0.003 (0.026)	0.003 (0.026)
	3: Tertiary or more	0.028 (0.086)	0.007 (0.084)	-0.050 (0.066)	-0.052 (0.066)
INCOME QUINTILE	2: Second 20%	0.154*** (0.035)	0.159*** (0.035)	0.117** (0.039)	0.117** (0.039)
	3: Middle 20%	0.208*** (0.035)	0.213*** (0.035)	0.165*** (0.038)	0.165*** (0.038)
	4: Fourth 20%	0.247*** (0.035)	0.254*** (0.035)	0.211*** (0.037)	0.210*** (0.037)
	5: Richest 20%	0.334*** (0.362)	0.335*** (0.036)	0.277*** (0.036)	0.276*** (0.036)
YEAR	2017	-0.618*** (0.025)	-0.609*** (0.025)	-0.580*** (0.025)	-0.578*** (0.024)
AGE		0.029*** (0.003)	0.028*** (0.003)	p-val < 2e-16*** (edf = 4.071)	p-val < 2e-16*** (edf = 5.845)
AGE Square		-0.0003*** (0.0001)	-0.0003*** (0.0001)	---	---
N		15583	15583	15583	15583
$\hat{\theta}_{SS} = \hat{\theta}_{SS}$ (variance parameters)		---	1	1	1
$\hat{\theta}_{SB} = \theta$ (correlation coefficient)		---	0.387* (0.365, 0.405)	0.376* (0.347, 0.400)	0.376* (0.348, 0.402)
$\hat{\tau}_{SB} = \tau$ (dependence parameter)		---	0.253* (0.238, 0.266)	0.245* (0.225, 0.262)	0.245* (0.226, 0.263)
AIC		38596.17	37812.24	37776.67	37776.16
BIC		39040.10	38263.82	38275.29	38270.8
Largest Absolute Gradient		8.597e -06		2.095e-09	1.625e-08
Eigenvalue Range		[41.048, 39204048645]		[1.018, 33117.68]	[1.009, 32343.56]

Numbers in parenthesis are respectively: the standard error (s.e.) of the coefficients, and the 95% Confidence Intervals (C.I.) on Tau and Theta. * indicates significance at alpha of 0.05; ** significance at 0.01; and *** significance at 0.001.

Source: Authors' construction based on the 2014 and 2017 waves of the Global Findex survey

Table (A8): Determinants of consumers' probability of borrowing within ECOWAS

		Fully Parametric		Semi-Parametric Bivariate Probit	
		Binary Probit (M1)	Bivariate Probit (M2)	With Fixed Country Effects (M3)	With Random Country Effects (M4)
(INTERCEPT)		-0.680*** (0.074)	-0.676*** (0.073)	-0.304*** (0.049)	-0.146*** (0.034)
GovTransf12M	1: Yes	0.312*** (0.047)	0.312*** (0.047)	0.326*** (0.045)	0.327*** (0.045)
WagPaiRec12M	1: Yes	0.232*** (0.030)	0.231*** (0.029)	0.199*** (0.027)	0.200*** (0.027)
ACCOUNT	1: Yes	0.285*** (0.027)	0.287*** (0.027)	0.231*** (0.026)	0.229*** (0.026)
EmerFundAccess	1: Yes	0.069** (0.022)	0.069** (0.022)	0.039* (0.022)	0.04* (0.022)
DEBITCARD	1: Yes	-0.081* (0.041)	-0.080* (0.040)	-0.030 (0.036)	0.031 (0.036)
CREDITCARD	1: Yes	0.758*** (0.073)	0.747*** (0.072)	0.704*** (0.065)	0.703*** (0.065)
InterntBasdPaymt	1: Yes	0.258*** (0.053)	0.256*** (0.053)	0.203*** (0.047)	0.203*** (0.048)
FEMALE	1: Yes	0.003 (0.021)	0.004 (0.021)	0.032 (0.022)	0.031 (0.022)
EDUCATION	2: Secondary	-0.021 (0.027)	-0.021 (0.027)	-0.022 (0.025)	-0.023 (0.025)
	3: Tertiary or more	-0.168* (0.074)	-0.167* (0.072)	-0.150** (0.058)	-0.153** (0.058)
INCOME QUINTILE	2: Second 20%	0.093** (0.034)	0.092** (0.034)	0.070* (0.038)	0.070* (0.038)
	3: Middle 20%	0.110** (0.034)	0.109** (0.034)	0.080* (0.037)	0.080* (0.037)
	4: Fourth 20%	0.099** (0.034)	0.097** (0.034)	0.093** (0.035)	0.093** (0.035)
	5: Richest 20%	0.017 (0.035)	0.016 (0.035)	-0.017 (0.035)	-0.017 (0.035)
YEAR	2017	-0.224*** (0.023)	-0.226*** (0.023)	-0.181*** (0.023)	-0.180*** (0.022)
AGE		0.021*** (0.003)	0.021*** (0.003)	p-val = 1.5e-13*** (edf = 6.074)	p-val < 2e-16*** (edf = 6.087)
AGE Square		-0.0003*** (0.0001)	-0.0003*** (0.0001)	---	---
N		15583	15583	15583	15583
$\hat{\theta}_{SS} = \hat{\theta}_{SS}$ (variance parameters)		---	1	1	1
$\hat{\theta}_{SB} = \theta$ (correlation coefficient)		---	0.387* (0.365, 0.405)	0.376* (0.347, 0.400)	0.376* (0.348, 0.402)
$\hat{\tau}_{SB} = \tau$ (copula dependence parameter)		---	0.253* (0.238, 0.266)	0.245* (0.225, 0.262)	0.245* (0.226, 0.263)
AIC		38596.17	37812.24	37776.67	37776.16
BIC		39040.10	38263.82	38275.29	38270.8
Largest Absolute Gradient			8.597e-06	2.095e-09	1.625e-08
Eigenvalue Range			[41.048, 39204048645]	[1.018, 33117.68]	[1.009, 32343.56]

Numbers in parenthesis are respectively: the standard error (s.e.) of the coefficients, and the 95% Confidence Intervals (C.I.) on Tau and Theta. * indicates significance at alpha of 0.05; ** significance at 0.01; and *** significance at 0.001.

Source: Authors' construction based on the 2014 and 2017 waves of the Global Findex survey

Table (A9): Country level fixed effects (heterogeneity in likelihood of saving and borrowing) from M2 and M3

Country	Model 2		Model 3	
	Saving	Borrowing	Saving	Borrowing
Benin	-2.084e-01*** (5.403e-02)	7.424e-02 (5.082e-02)	-0.237*** (0.054)	0.037 (0.050)
Burkina Faso	-3.309e-01*** (5.500e-02)	1.913e-01*** (5.161e-02)	-0.304*** (0.055)	0.174*** (0.050)
Ivory Coast	-2.442e-01*** (5.322e-02)	-2.724e-02 (4.987e-02)	-0.175** (0.054)	-0.033 (0.049)
Ghana	-4.641e-01*** (5.503e-02)	-7.768e-02 (5.172e-02)	-0.392*** (0.056)	-0.056 (0.051)
Guinea	-4.491e-01*** (5.671e-02)	1.447e-01** (5.381e-02)	-0.383*** (0.057)	0.161** (0.053)
Liberia	2.334e-01*** (6.039e-02)	4.196e-01*** (5.605e-02)	0.283*** (0.062)	0.444*** (0.056)
Mali	-3.188e-01*** (5.247e-02)	4.305e-03 (4.978e-02)	-0.287*** (0.054)	0.033 (0.050)
Niger	-5.531e-01*** (5.346e-02)	6.383e-01*** (5.074e-02)	-0.521*** (0.054)	0.623*** (0.051)
Nigeria [Reference country]	-2.837e-01*** (7.675e-02)	-6.763e-01*** (7.313e-02)	0.222*** (0.053)	-0.304*** (0.049)
Senegal	-3.593e-01*** (5.403e-02)	1.829e-01*** (5.047e-02)	-0.289*** (0.055)	0.237*** (0.050)
Sierra Leone	3.929e-02 (5.608e-02)	3.218e-01*** (5.222e-02)	0.130* (0.057)	0.341*** (0.053)
Togo	-4.785e-01*** (5.555e-02)	-7.347e-02 (5.272e-02)	-0.435*** (0.056)	-0.053 (0.052)

* indicates significance at alpha of 0.05; ** significance at 0.01; and *** significance at 0.001.

Standard error (s.e.) of the fixed effects are shown in parenthesis.

Note: M2 is to the fully parametric bivariate probit model with country fixed effects; M3 is the semi-parametric bivariate probit model with country fixed effects.

Nigeria is used as the reference country in the block, as such its fixed effect is captured by the overall model intercept; for the remaining non-reference countries, their overall fixed effect is obtained by adding their current reported value to that of the reference level (Nigeria).

Source: Authors' construction based on the 2014 and 2017 waves of the Global Findex survey

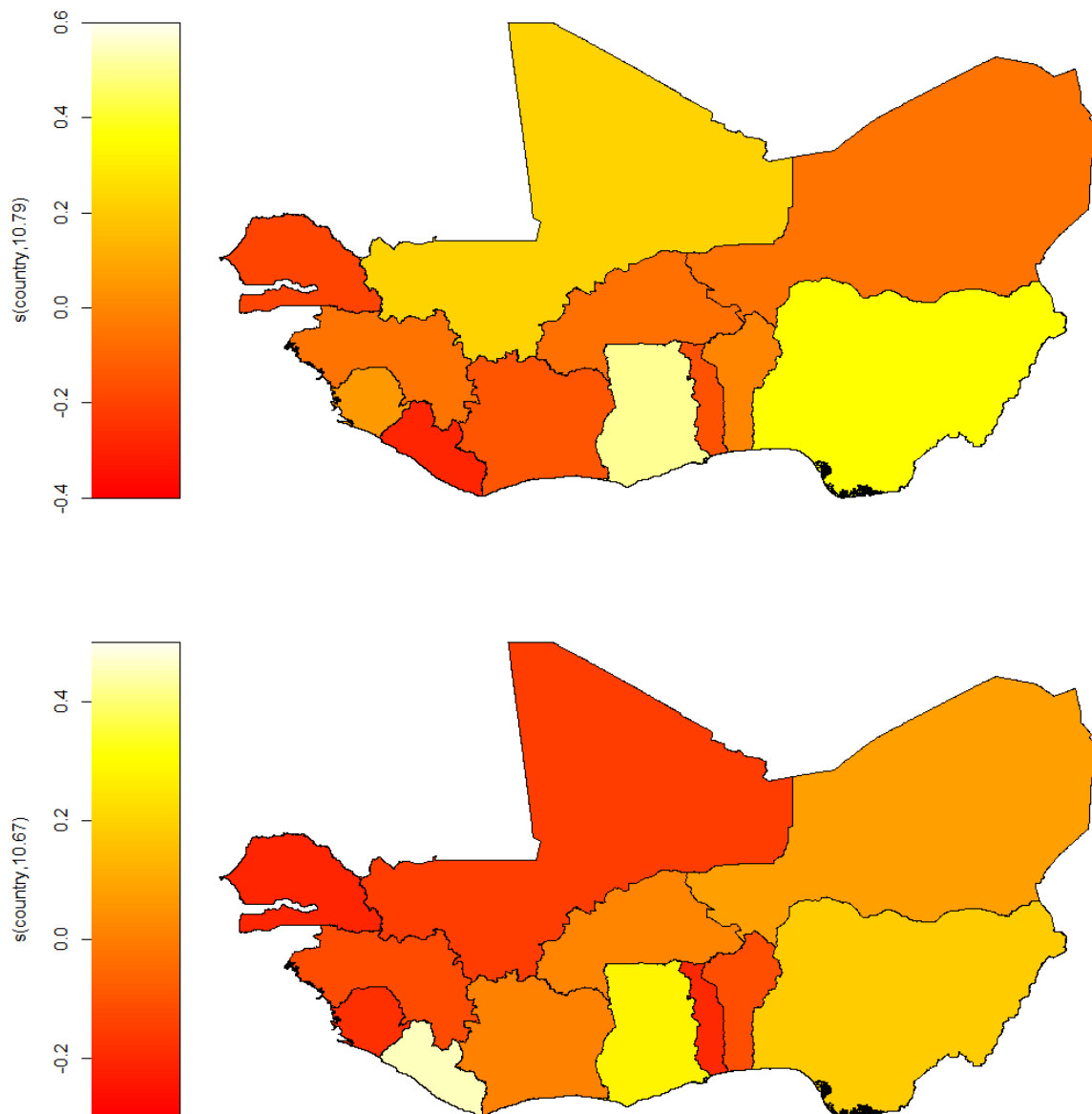


Figure (9): Cross-country “Random Heterogeneity” in consumers’ likelihood of saving (top Panel) and borrowing (Lower Panel) within ECOWAS. These are generated after estimating Model 4.
Note: In the saving function, the empirical density function is $edf = 10.795$ with $p\text{-value} < 2e-16^{***}$; while in the borrowing function the estimated $edf = 10.671$, with $p\text{-value estimated} < 2e-16^{***}$.
 For smooth density function estimates, when the empirical density function (edf) is close to 1, the respective estimated effect is linear, and hence the covariate can enter the model parametrically. However, the higher the edf value the more complex is the estimated curve, and thus the corresponding covariate have a non-linear relationship with the outcome variable. Based therefore on the p -values, we conclude the presence of significant nonlinear country level heterogeneity in the likelihood of saving and borrowing within ECOWAS.

Table (A10): Marginal Effects of the determinants of consumers' saving and borrowing choices within ECOWAS

Variables		Any Savings Last 12 months		Any Borrowings Last 12 months	
		$\frac{dF}{dx}$	s.e.	$\frac{dF}{dx}$	s.e.
GovTransf12M	1: Yes	0.116***	(0.017)	0.126***	(0.017)
WagPaiRec12M	1: Yes	0.129***	(0.011)	0.082***	(0.011)
ACCOUNT	1: Yes	0.182***	(0.010)	0.093***	(0.010)
EmerFundAccess	1: Yes	0.148***	(0.009)	0.016*	(0.009)
DEBITCARD	1: Yes	0.097***	(0.015)	-0.011	(0.015)
CREDITCARD	1: Yes	0.115***	(0.025)	0.263***	(0.021)
InterntBasdPaymt	1: Yes	0.116***	(0.018)	0.082***	(0.019)
FEMALE	1: Yes	0.024**	(0.009)	0.011	(0.009)
EDUCATION	2: Secondary	0.001	(0.010)	-0.006	(0.010)
	3: Tertiary or more	-0.007	(0.026)	-0.055*	(0.023)
	2: Second 20%	0.042**	(0.014)	0.028*	(0.015)
INCOME QUINTILE	3: Middle 20%	0.060***	(0.014)	0.032*	(0.015)
	4: Fourth 20%	0.076***	(0.013)	0.038**	(0.014)
	5: Richest 20%	0.103***	(0.013)	-0.005	(0.014)
YEAR	2017	-0.214***	(0.008)	-0.072***	(0.009)
AGE		0.011***	(0.001)	0.008***	(0.001)
AGE Square		-0.0001***	(0.00001)	-0.0001***	(0.00001)
Benin		-0.097***	(0.022)	0.140	(0.020)
Burkina Faso		-0.122***	(0.022)	0.681***	(0.020)
Ivory Coast		-0.070**	(0.021)	-0.014	(0.020)
Ghana		-0.156***	(0.022)	-0.024	(0.020)
Guinea		-0.153***	(0.023)	0.063**	(0.021)
Liberia		0.098***	(0.021)	0.169***	(0.021)
Mali		-0.116***	(0.022)	0.010	(0.020)
Niger		-0.207***	(0.021)	0.023***	(0.018)
Senegal		-0.118***	(0.022)	0.091***	(0.019)
Sierra Leone		0.046*	(0.021)	0.131***	(0.020)
Togo		-0.174***	(0.022)	-0.023	(0.021)

Numbers in parenthesis are respectively: the standard error (s.e.) of the estimated marginal effects coefficients,

* indicates significance at alpha of 0.05; ** significance at 0.01; and *** significance at 0.001.

Source: Authors' construction based on the 2014 and 2017 waves of the Global Findex survey

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