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Information Technology, Governance and Insurance in Sub-Saharan Africa[1]

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Research Department

Information Technology, Governance and Insurance in Sub-Saharan Africa

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Abstract

Purpose –This study investigates the role of ICT in modulating the effect of governance on insurance penetration in 42 sub-Saharan African countries using data for the period 2004-2014.

Design/methodology/approach –Two insurance indicators are used in the analysis, namely: life insurance and non-life insurance. The three ICT modulating dynamics employed include: mobile phone penetration, internet penetration and fixed broadband subscriptions. Six governance channels are also considered, namely: political stability, "voice & accountability", regulation quality, government effectiveness, the rule of law and corruption-control. The empirical evidence is based on generalized method of moments.

Findings –The following main findings are established. First, mobile phone penetration does not significantly modulate governance channels to positively affect life insurance while it effectively complements "voice & accountability" to induce a positive net effect on non-life insurance. Second, internet penetration complements: (i) governance dynamics of political stability, government effectiveness and rule of law to induce positive net effects on life insurance: and (ii) corruption-control for an overall positive effect on non-life insurance. Third, the relevance of fixed broadband subscriptions in promoting life insurance is apparent via governance channels of regulation quality, government effectiveness and the rule of law while fixed broadband subscriptions do not induce significant overall net effects on non-life insurance though the conditional effects are overwhelmingly significant.

Orginality/value – To the best our knowledge, studies on the relevance of ICT in promoting insurance consumption through governance channels are sparse, especially for a region such as sub-Saharan Africa where insurance penetration is low compared to other regions of the world.

1. Introduction

The insurance market is very relevant in the sustainable development of a country because it offers opportunities of risk mitigation by enabling people to hedge risks and reduces negative extenalities of disasters and macroeonomic shocks on household welfare and economic activities. Moreover, insurers play an intermediary role by mobilizing aggregate domestic capital and transforming it into long-term investments. This role of intermediation has positive ramifications on the development of financial markets and economic prosperity. Against this background, there are three main motivational factors underpinning the positioning of this study on the relevance of information and communication technology (ICT) in moderating the effect of governance on insurance penetration in Sub-Saharan Africa (SSA), notably: the low penetration of insurance in the sub-region, the importance of ICT in development outcomes and gaps in the literature. These three motivational elements are expanded in the following passages.

First, compared to other regions of the world, the insurance market in SSA is very small. Kyerematen (2015) maintains that in the African continent, with the exception of South Africa, only approximately 5% citizens in the continent subscribe to insurance services. According to the narrative, the underlying low penetration is traceable to difficiencies in a number of factors, *inter alia*: low financial access and absence of infrastructure. This research focuses on how burgeoning ICT infrastructure can be leveraged to promote insurance in the light of the high potential for ICT penetration in SSA.

Second, an important body of economic development literature has been recently focusing on the importance of ICT in development outcomes within and across developing countries. The attendant literature is consistent on the position that information technology can be leveraged to improve *inter alia*: agricultural productivity, corporate performance, equitable income distribution, financial access and health facilities. The corresponding contemporary studies supporting this perspective on the importance of ICT include: Penard, Poussing, Yebe and Ella (2012), Asongu (2013), Tchamyou (2017), Afutu-Kotey, Gough and Owusu (2017), Asongu and Nwachukwu (2018a, 2018b), Abor, Amidu and Issahaku (2018), Gosavi(2018), Asongu and Boateng(2018), MinkouaNzie, Bidogeza and Ngum (2018), Humbani and Wiese (2018), Isszhaku, Abu and Nkegbe (2018) and (Asongu & Odhiambo, 2019a). Inspite of the growing literature on the importance of information technology in socio-economic development, the role of information technology and insurance development

in SSA is scarce in contemporary African development literature. Hence, the positioning of this study builds on an apparent gap in the insurance literature.

Third, as expanded in section 2, extant contemporary studies on the development of the insurance sector in Africa has focused on two main strands, namely: linkages between insurance development and economic prosperity (Ioncică, Petrescu, Ioncicaand Constantinescu, 2012; Akinlo, 2015; Chang and Lee, 2012; Chen, Lee and Lee, 2012; Lee Lee and Chiu, 2013a; Lee, Huang and Yin, 2013b; Guerineau and Sawadogo, 2015; Sawadogo,Guérineau and Ouedraogo, 2018; Alhassan and Biekpe, 2015, 2016a) and determinants of insurance development (Guerineau and Sawadogo, 2015; Alhassan an Biekpe, 2016b; Zerriaa, Amiri, Noubbigh and Naoui, 2017). The present research is closer to the second strand on drivers of insurance penetration and extends both strands by engaging governance channels via which ICT promotes insurance penetration in SSA. In essence, this research argues that contrary to the engaged literature which is based on linkages between insurance development and macroeconomic outcomes, it is more policy-relevant to go a step further by providing policy makers with policy channels through which policy moderating variables (i.e. ICT dynamics in the case of this study) affect insurance penetration. The governance channels used in this study are motivated both by the: (i) need to fill a gap in the literature and (ii) documented importance of good governance in promoting economic development in Africa (Efobi, 2015; Asongu and Kodila-Tedika, 2016;Ajide and Raheem, 2016a, 2016b).

In the light of the above, the research question this study aims to answer is the following: how does ICT modulate the effect of governance on insurance penetration in SSA? In order to make this assessment, the study focuses on 42 sub-Saharan African countries using data for the period 2004-2014.The empirical evidence is based on generalized method of moments.The following main findings are established. First, mobile phone penetration does not significantly modulate governance channels to positively affect life insurance while it effectively complements "voice & accountability" to induce a positive net effect on non-life insurance. Second, internet penetration complements: (i) governance dynamics of political stability, government effectiveness and rule of law to induce positive net effects on life insurance: and (ii) corruption-control for an overall positive effect on non-life insurance. Third, the relevance of fixed broadband subscriptions in promoting life insurance is apparent via governance channels of regulation quality, government effectiveness and the rule of law

while fixed broadband subscriptions do not induce significant overall net effects on non-life insurance though the conditional effects are overwhelmingly significant.

The rest of the study is structured as follows. The intuition for the empirical analysis and attendant literature are discussed in section 2 while section 3 presents the data and methodology. Section 4 discloses and discusses the empirical results before the research concludes in section 5 with implications and future research directions.

2. Intuition and literature review

This section is discussed in two main sub-sections. The first focuses on the intuition motivating the positioning of the study while the second expands the highlighted literature in the introduction on which the positioning of the study is based.

2.1 Intuition

For every policy or phenomenon to affect a macroeconomic outcome, the governance climate (political, economic and institutional) of the country has to be favourable. Hence, there is a fundamental intuition for the association between good governance and development outcomes. Such outcomes can be socio-economic (e.g. poverty alleviation, reduction in inequality...etc), financial (e.g. access to finance) and security against risks (e.g. insurance), *inter alia*.

In the first section, this research is cognizant of the risks involved in engaging an empirical analysis without an established theoretical underpinning. However, the study posits that applied econometrics is not used exclusively for the acceptance and rejection of existing theories. Hence, an applied economics study based on sound intuiton is a useful scientific activity that could provide the basis for theory-building, especially in the light of connections between ICT, governance and insurance. It follows that the positioning of this study is consistent with an evolving stream of literature on the importance of empirical studies that are motivated by logic and intuition (Costantini and Lupi, 2005; Narayan, Mishra and Narayan, 2011; Asongu and Nwachukwu, 2016a). In what follows, the relationships between ICT, governance and insurance are substantiated.

ICT has been documented to improve political, economic and institutional dimensions of good governance in Africa (Asongu, le Roux, Nwachukwu and Pyke, 2019a). Hence, there is an underpinning assumption that ICT modulates political ("political stability and "voice & accountability"), economic (government effectiveness and regulation quality), institutional

(rule of law and corruption-control) dimensions of governance. The conceptions and definitions of these governance dynamics are in accordance with contemporary literature: "*The first concept is about the process by which those in authority are selected and replaced (Political Governance): voice and accountability and political stability. The second has to do with the capacity of government to formulate and implement policies, and to deliver services (Economic Governance): regulatory quality and government effectiveness. The last, but by no means least, regards the respect for citizens and the state of institutions that govern the interactions among them (Institutional Governance): rule of law and control of corruption*" (Andres, Asongu and Amavilah, 2015, p. 1041). Governnace provides enabling conditions for insurance development because policy makers are aware of benefits of insurance penetration in economic development, especially in the promotion of a conduicive investment climate and sustainable economic prosperity (Kumari, 2016). The intuition for the role of ICT in modulating governance for development outcomes is broadly consistent with the literature on innovating existing networks and institutions with information technology to influence social change, entreneurship and economic development (Pittaway, Robertson, Munir, Denyer, and Neely, 2014; Centobelli, Cerchione, Esposito and Shashi, 2019; Shashi, Centobelli, Cerchione and Singh, 2019; Lashitew, van Tulder, and Liasse, 2019; Asongu, Orim and Nting, 2019b).

2.2 Literaure review on insurance

In the second section, building on the narrative in the introduction, the extant contemporary literature on insurance penetration has principally focused on two main strands, notably, on: drivers of insurance penetration (Guerineau and Sawadogo, 2015; Alhassan and Biekpe, 2016b; Zerriaa *et al.*, 2017) and nexuses between insurance and economic development outcomes (Ioncică *et al.*, 2012; Akinlo, 2015; Alhassan and Biekpe, 2015, 2016a). The two strands are expanded in the following passages.

With regard to the strand on drivers of insurance consumption, focusing on 20 countries with data for the period 1996-2011, Guerineau and Sawadogo (2015), after accounting for the concern of endogeneity with the help of an endogeneity-robust empirical strategy, have concluded on a positive nexus between life insurance consumption and per capita income. Furthermore, the penetration of life insurance is negatively associated with life expectancy and the young dependency ratio while features that are positively linked with life insurance include: old dependency ratio, government stability and property rights.

Determinants of life insurance have been assessed by Zerriaa *et al*. (2017) using data from 1990-2014. The findings show that interest and inflation rates do not have significant impacts on the dependent variable. Moreover, the demand for life insurance is reduced by pension expenditure whereas features that promote negative impacts are: urbanization, financial development, income, dependency and life expectancy.

Alhassan and Biekpe (2016b) have investigated factors promoting life insurance in 31 countries in Africa using data from 1996 to 2010. The findings reveal that compared to financial drivers, demographic features are more worthwhile in elucidating life insurance. Moreover, life insurance is also reduced by life expectancy, inflation and dependency whereas positive effects are apparent from insurance consumption, health expenditure, financial development and institutional quality.

In the second strand, Alhassan and Biekpe (2015) assess linkages between economies of scale, efficiency and productivity in the non-life insurance market in South Africa with data from 2007 to 2012. The empirical evidence is based on logistic, bootstrapped and "data envelopment analysis" regressions. The findings reveal that about one-fifth of insurers perform their operations in an optimal manner while non-life insurers are linked with about 50% of inefficiency. The corresponding findings show that ameliorations in productivity depend on technological improvements and the non-linear incidence of size on efficiency and constant returns to scale. According to the conclusions of the study, leverage, product line diversification and reinsurance have considerable linkages with efficiency and constant returns to scale.

Akinlo (2015) has investigated causal nexuses between insurance and economic growth in 33 countries in SSA for the period 1995-2011. Using panel data with an estimation approach that accounts for heterogeneity, the results show evidence of bidirectional causality between economic growth and insurance penetration. In another study, Alhassan and Biekpe (2016a) have examined the relationship beteen insurance penetration and economic development in Africa. The study focuses on a selected number of countries (Algeria, Gabon, Kenya, Madagascar, Mauritius, Morocco, Nigeria and South Africa) using data for the period 1990-2010. The empirical evidence is based on autoregressive distributed lag (ARDL) and vector error correction model (VECM) regressions. From the ARDL findings, there is a long term relationship between economic growth and insurance development in Kenya, Mauritius, Morocco, Nigeria and South Africa. As for the VECM findings: (i) mixed causality is apparent in Gabon; (ii) unidirectional causality is found in Algeria and Madagascar and (iii)

bidirectly causality is established in Morroco. The positioning of this research in the light of the engaged studies has been discussed in the introduction.

3. Data and methodology

3.1 Data

The focus of this study is on forty-two nations in SSA with data for the period 2004-2014[2]. The choice of the sampled countries and corresponding periodicity of analysis are determined by constraints in data availability at the time of the study. The variables used in the research are obtained from three main sources, notably: (i) World Governance Indicators of the World Bank for the governance indicators (i.e. political stability, "voice & accountability", government effectiveness, regulation quality, corruption-control and the rule of law); (ii) World Development Indicators of the World Bank for ICT indicators (i.e. mobile phone penetration, internet penetration and fixed broadband subscriptions) and a control variable (i.e. tertiary school enrolment) and (iii) the Financial Development and Structure Database (FDSD) of the World Bank for the insurance dynamics (i.e. life insurance and non-life insurance).

In the light of the above, the choice of the governance indicators is consistent with recent African governance literature (Oluwatobi, Efobi, Olurinola, Alege, 2015; Andrés *et al.*, 2015; Ajide and Raheem, 2016a, 2016b; Asongu, le Roux, Nwachukwu and Pyke, 2019). The adopted insurance variables are also in line with the attendant literature highlighted in the introduction and expanded in section 2. Moreover, we have engaged all the insurance indicators available in the FDSD of the World Bank. Hence, no concerns of data omission bias are apparent. As for the ICT variables, in accordance with contemporary literature on the relevance of engaging more technology indicators in order to provide more room for policy implications (Efobi, Tanaken and Asongu, 2018; Tchamyou, Erreygers and Cassimon, 2019), the three ICT indictors disclosed in the preceeding paragraph are used.

Before discussing the estimation strategy, it is important to articulate why only one control variable (i.e. tertiary school enrolment) is used in the empirical exercise. The objective of limiting elements in the conditioning information set to one variable is motivated by the

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[2]The 42 countries include: "Angola, Benin, Botswana, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo Democratic Republic, Congo Republic, Côte d'Ivoire, Djibouti, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome & Principe, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda and Zambia".

need to limit instrument proliferation even when the collapse option is used in the estimation exercise. Accordingly, in the generalised method of moments (GMM) regressions, the employment of limited control variables is acceptable provided that the purpose for doingso is to avoid the proliferation of instruments that can substantially bias estimated coefficients (Bruno, De BonisandSilvestrini, 2012). Drawing on the attendant literature, there are studies that have used no control variable as in this research, notably: Osabuohien and Efobi (2013) and Asongu and Nwachukwu (2017). The definitions and sources of variables are provided in Appendix 1, whereas the summary statistics is disclosed in Appendix 2. The correlation matrix is covered by Appendix 3.

3.2 Methodology

3.2.1 GMM Specification

Building on contemporary literature using the GMM regression technique (Asongu and Nwachuwku, 2016a; Asonguand Odhiambo, 2019b; Tchamyou, 2019a, 2019b; Tchamyou *et al.*, 2019), four main motivations underpin the choice of the estimation strategy. These motivational elements are expanded in the following passages. First, an elementary condition for the choice of the estimation approach is that the number of agents (i.e. N) should exceed the number of periods (i.e. T) that each agent is characterised with. Hence, the N>T condition for the employment of this estimation technique is fulfilled because the research is dealing with 42 countries for the period 2004-2014 (i.e. 11 years). Second, persistence is apparent in the outcome variables because both have correlation coefficients between the level and first lag values that are higher than the established threshold of 0.800 (Meniago and Asongu, 2018; Tchamyou *et al.*, 2019). In essence, the corresponding correlations for life insurance and non-life insurance are respectively, 0.992 and 0.975. Thrid, in the light of the panel nature of the datastructure, cross-country differences are factored into the estimations. Fourth, the concern of endogeneity is addressed from a dual perspective: (i) reverse causality or simultaneity is tackled with a process of instrumentation and (ii) the unobserved heteorogeniety is addressed by controlling for time invariant omitted variables.

Among available GMM options in the empirical literature (i.e. *difference* versus *system* estimators), this research is in accordance with recent studies in adopting the Roodman (2009a, 2009b) extension of Arellano and Bover (1995) which has been documented to produce more efficient estimates, partly because it controls for cross-sectional dependence

and mitigates the proliferation of instruments (Asongu and Nwachukwu, 2016b; Boateng, Asongu, Akamavi and Tchamyou, 2018).

The following equations in level (1) and first difference (2) summarise the standard *system* GMM estimation procedure.

$$I_{i,t} = \sigma_0 + \sigma_1 I_{i,t-\tau} + \sigma_2 T_{i,t} + \sigma_3 G_{i,t} + \sigma_4 TG_{i,t} + \sigma_5 E_{i,t} + \eta_i + \xi_t + \varepsilon_{i,t} \qquad (1)$$

$$\begin{aligned} I_{i,t} - I_{i,t-\tau} = {} & \sigma_1(I_{i,t-\tau} - I_{i,t-2\tau}) + \sigma_2(T_{i,t} - T_{i,t-\tau}) + \sigma_3(G_{i,t} - G_{i,t-\tau}) + \sigma_4(TG_{i,t} - TG_{i,t-\tau}) \\ & + \sigma_5(E_{i,t} - E_{i,t-\tau}) + (\xi_t - \xi_{t-\tau}) + (\varepsilon_{i,t} - \varepsilon_{i,t-\tau}) \end{aligned} \qquad (2)$$

where, $I_{i,t}$ denotes an insurance indicator (i.e. life insurance and non-life insurance) of country i in period t, σ_0 is a constant. T is an ICT indicator (i.e. mobile phone penetration, internet penetration and fixed broadband subscriptions) of country i in period t. E is tertiary educationof country i in period t. G denotes a governance dynamic (i.e. political stability, "voice & accountability", regulation quality, government effectiveness, corruption-control and the rule of law) of country i in period t. TG reflects interactions between ICT and governance indicators("mobile phone penetration" × "political stability"; "mobile phone penetration" × "voice & accountability"; "mobile phone penetration"× "regulation quality"; "mobile phone penetration" × " government effectiveness"; "mobile phone penetration" × "corruption control"; "mobile phone penetration"× "the rule of law ";"internet penetration" × "political stability"; "internet penetration" × "voice & accountability"; "internet penetration"× "regulation quality"; "internet penetration" × " government effectiveness"; "internet penetration" × "corruption control"; "internet penetration"× "the rule of law ";"fixed broadband subscriptions" × "political stability"; "fixed broadband subscriptions" × "voice & accountability"; "fixed broadband subscriptions"× "regulation quality"; "fixed broadband subscriptions" × " government effectiveness"; "fixed broadband subscriptions" × "corruption control" and "fixed broadband subscriptions"× "the rule of law "). τ represents the coefficient of auto-regression which is one within the framework of this study because a year lag is enough to capture past information, ξ_t is the time-specific constant, η_i is the country-specific effect and $\varepsilon_{i,t}$ the error term.

3.2.2Identification and exclusion restrictions

It is worthwhile to susbantiatethe GMM specification with attendant identification and exclusion restrictions because they are indispensible for a robust GMM specification. In

accordance with contemporary empirical literature on the subject, years are identified as strictly exogenous whereas elements in the conditioning information set (i.e. tertiary school enrolment) and the independent variables of interest (i.e. governance and ICT dynamics) are considered as endogenous explaining or predetermined variables (Asongu and Nwachukwu, 2016c; Tchamyou and Asongu, 2017; Boateng *et al.*, 2018; Tchamyou *et al.*, 2019). Roodman (2009b) is sympathetic to this strategy of identification because he has argued that it is not feasible for years (i.e. identified as strictly exogenous) to be endogenous after a first difference[3].

In the light of the identification strategy covered in the preceding section, the exclusion restriction assumption is examined with the Difference in Hansen Test (DHT) whichis used to assess the exogeneity of instruments. The null hypothesis of the DHT maintains that the acknowledged strictly exogenous variables affect the insurance dynamics exclusively through the predetermined variables and elements in the conditioning information set.

Cognizant of the clarifications provided above, in the findings that are reported in the following section, the alternative hypothesis of the DHT should not be accepted in order for the assumptions underpinng the identification and exclusions narrative to hold. Such assumptions are consistent with less contemporary specifications (i.e. in instrumental variable regressions) where-by the rejection of the alternative hypothesis of the Sargan/Hansen test is warranted for the identified instruments or strictly exogenous variables to affect the outcome variable exclusively through the exogenous components of the predetermined variables (see Beck, Demirgüç-Kunt and Levine, 2003; Asongu and Nwachukwu, 2016d).

4. Empirical results

Results of the empirical analysis are disclosed in this section in Tables 1-6. Table 1 shows findings on life insurance, governance and mobile phone penetration while Table 2 shows results on non-life insurance, governance and mobile phone penetration.It is important to note that governance entails all the six governance dynamics employed in the study, namely: political stability, "voice & accountability", regulation quality, government effectiveness, the rule of law and corruption-control. Hence, aspects of political governance (i.e. the first-two governance variables), economic governance (i.e. the third and the fourth governance

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[3]Hence, the procedure for treating *ivstyle* (years) is 'iv (years, eq(diff))' whereas the *gmmstyle* is employed for predetermined variables.

variables) and institutional governance (i.e. the last-two governance variables) are taken on board.

The regressions in Table 3 pertain to nexuses between governance, internet penetration and life insurance whereas those in Table 4 are related to linkages between governance, internet penetrarion and non-life insurance. In Table 5, connections between governance, fixed broadband subscriptions and life insurance are apparent while in Table 6, the results disclosed are related to governance, fixed broadband subscriptions and non-life insurance. Each table has six main specifications that are respectively associated with each of the governance dynamics, notably: political stability, "voice & accountability", regulation quality, governance effectiveness, rule of law and corruption control (i.e. in this order). For every specification, four main information criteria are employed to assess the validity of estimated models[4]. Based on these criteria, the estimated models are overwhelmingly valid.

In the light of the attendant information criteria, first and foremost, it is apparent from the findings that the second-order Arellano and Bond autocorrelation test in difference confirms the absence of autocorrelation in the residuals because of the failure to reject the null hypothesis of no autocorrelation. Second, the Hansen test is given priority over the Sargan test because it is more robust. It is worthwhile to articulate that the Sargan test is not robust but not weakened by instrument proliferation while the Hansen test is robust but weakened by the proliferation of instruments. In order to avoid conflicts in these information criteria, while the Hansen test is given prioritiy, instrument proliferation is avoided by ensuring that for every specification, the number of instruments is lower than the corresponding number of countries. Third, as clarified in the previous section, the DHT is used to assess the validity of the exclusion restrictions assumption, notably: that the identified strictly exogenous variables influence the outcome variables exclusively through the independent variables. Fourth, a Fisher test for the joint validity of estimated coefficients overwhelmingly confirms the validity of estimated models.

"Insert Tables 1-6"

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[4] "*First, the null hypothesis of the second-order Arellano and Bond autocorrelation test (AR (2)) in difference for the absence of autocorrelation in the residuals should not be rejected. Second the Sargan and Hansen over-identification restrictions (OIR) tests should not be significant because their null hypotheses are the positions that instruments are valid or not correlated with the error terms. In essence, while the Sargan OIR test is not robust but not weakened by instruments, the Hansen OIR is robust but weakened by instruments. In order to restrict identification or limit the proliferation of instruments, we have ensured that instruments are lower than the number of cross-sections in most specifications. Third, the Difference in Hansen Test (DHT) for exogeneity of instruments is also employed to assess the validity of results from the Hansen OIR test. Fourth, a Fisher test for the joint validity of estimated coefficients is also provided*" (Asongu and De Moor, 2017, p.200).*

In order to assess the overall relevance of ICT in the role of governance on insurance penetration, net effects are computed as in recent literature based on interactive regressions (AsonguandOdhiambo, 2019c; Agoba et al., 2019).For example, in the third column of Table 2, the net effect from the relevance of mobile phone penetration in moderating the effect of "voice & accountability" on non-life insurance is 0.0172 ([-0.0007 × 45.330] + [0.049]). In the computation, the average value of mobile phone penetration 45.330, the unconditional effect of "voice & accountability" is 0.049while the conditional or interaction effect between "voice & accountability" and mobile phone penetration is -0.0007. The same computational procedure is followed for the remaining tables with mean values of internet penetration and fixed broadband subscriptions being respectively, 7.676 and 0.643.

The following findings can be established. No net effects are apparent in Table 1 because at least one of the estimated coefficients relevant for the computation of net effects is not significant. Accordingly, if the unconditional effect of governance dynamic or the conditional effect (i.e. from the interaction between a governance dynamic and mobile phone penetration) is insignificant, a net effect cannot be feasibly computed. In Table 2, mobile phone penetration effectively complements "voice & accountability" to induce a positive net effect on non-life insurance. In Table 3, internet penetration complements the following governance dynamics to induce positive net effects on life insurance: political stability, government effectiveness and rule of law. In Table 4, internet penetration effectively complements corruption-control for an overall positive effect on non-life insurance.

The relevance of fixed broadband subscriptions in promoting life insurance is apparent via governance channels of regulation quality, government effectiveness and the rule of law in Table 5. In Table 6 whilefixed broadband subscriptions do not significantly induce overall net effects on non-life insurance penetration via governance mechanisms, the corresponding conditional or interactive effects are positive which is further indicative of the fact that increasing fixed broadband subscriptions to certain thresholds can ultimately induce overall positive net effects. The control variable is largely siginificant with the expected sign because university graduates are more educated on the importance of insurance in security, risk mitigation and economic development.

5. Concluding implications, limitations and future research directions

This study investigates the role of ICT in modulating the effect of governance on insurance penetration in 42 sub-Saharan African countries using data for the period 2004-2014. Two insurance indicators are used in the analysis, namely: life insurance and non-life insurance. The three ICT modulating dynamics employed include: mobile phone penetration, internet penetration and fixed broadband subscriptions. Six governance channels are also considered, namely: political stability, "voice & accountability", regulation quality, government effectiveness, the rule of law and corruption-control. The empirical evidence is based on generalized method of moments.

The following main findings are established. First, mobile phone penetration does not significantly modulate governance channels to positively affect life insurance while it effectively complements "voice & accountability" to induce a positive net effect on non-life insurance. Second, internet penetration complements: (i) governance dynamics of political stability, government effectiveness and rule of law to induce positive net effects on life insurance: and (ii) corruption-control for an overall positive effect on non-life insurance. Third, the relevance of fixed broadband subscriptions in promoting life insurance is apparent via governance channels of regulation quality, government effectiveness and the rule of law while fixed broadband subscriptions do not induce overall net effects on non-life insurance though the conditional effects are overwhelmingly positive. As a main policy implication, ICT is an important policy tool that can be used to promote insurance consumption in SSA via governance channels.

Managerial and policy implications

In the light of the findings, enhancing information technology in sub-Saharan Africa will go a long way to increasing the consumption of both life insurance and non-life insurance in the sub-region. However, the positive incidence of ICT in effectively moderating governance for insurance consumption is contingent on specific governance and ICT dynamics. Among the considered ICT tools, fixed broadband subscribtions are most instrumental, followed by internet penetration and mobile phone penetration (in this order). Moreover, in the light of the overwhelming positive conditional effects in the regressions pertaining to fixed broadband subscriptions and non-life insurance, enhancingfixed broadband subscriptions will substantially promote life insurance. Such enhancement is feasible given the comparatively low penetration rate of fixed broadband subscriptions compared to other

ICT dynamics. The comparative importance of fixed broadband subscriptions relative to other ICT tools is consistent with recent ICT literature (Efobi *et al*., 2018).

Limitations

There are two main limitations in the study. On the one hand, the findings apply to a sample of countries and not to country-specific cases, partly because country-specific effects are eliminated from the generalised method of moments modelling in order to avoid potential concerns of endogeneity pertaining to the correlation between the lagged dependent variable and country-specific effects. On the other hand, the governance measurements are perception-based indicators which may be subject to biases. Unfortunately, to the best of our knowledge, the World Governance Indicators from the World Bank used in this study are the mostemployed in the literature (Pelizzo and Nwokora, 2016, 2018; Pelizzo, Araral, Pak and Xun, 2016; Asongu and Nnanna, 2019).

Future research directions

Sub-Saharan Africa also has a comparative advantage in the enhancement of ICT because compared to other regions of the world; it is the sub-region with the lowest rate of ICT penetration (Tchamyou *et al*., 2019). It will therefore be worthwhile for future studies to be positioned on how ICT penetration can be increased in Africa in order to achieve targeted effects on socio-economic development outcomes such as the consumption of life insurance. Moreover, considering other policy instruments by which insurance penetration can be increased via governance channels is alsoa worthwhile future research direction.

Table 1: Life insurance, governance and mobile phone penetration

	Dependent variable: Life Insurance					
Life Insurance (-1)	**0.932*** (0.000)**	**0.962*** (0.000)**	**0.950*** (0.000)**	**0.930*** (0.000)**	0.918 (0.000)	**0.937*** (0.000)**
Mobile Phone (Mobile)	0.0002 (0.718)	0.0001 (0.776)	-0.0002 (0.788)	0.0001 (0.837)	0.0004 (0.355)	-0.0001 (0.739)
Political Stability (PolS)	0.020 (0.392)	---	---	---	---	---
Voice & Accountability (VA)	---	-0.023 (0.441)	---	---	---	---
Regulation Quality (RQ)	---	---	0.055 (0.282)	---	---	---
Government Effectiveness(GE)	---	---	---	0.032 (0.551)	---	---
Rule of Law (RL)	---	---	---	---	0.033 (0.291)	---
Corruption-Control (CC)	---	---	---	---	---	0.004 (0.931)
Mobile × PolS	-0.0001 (0.439)	---	---	---	---	---
Mobile × VA	---	-0.0001 (0.462)	---	---	---	---
Mobile × RQ	---	---	-0.0006 (0.203)	---	---	---
Mobile × GE	---	---	---	**-0.0007* (0.063)**	---	---
Mobile × RL	---	---	---	---	0.00007 (0.714)	---
Mobile × CC	---	---	---	---	---	**-0.0005* (0.078)**
Tertiary Education	-0.021 (0.832)	0.042 (0.677)	-0.008 (0.946)	0.017 (0.837)	-0.024 (0.777)	0.049 (0.688)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	na	na	na	na	na	na
AR(1)	**(0.306)**	**(0.295)**	**(0.289)**	**(0.300)**	**(0.294)**	**(0.298)**
AR(2)	**(0.357)**	**(0.344)**	**(0.346)**	**(0.356)**	**(0.355)**	**(0.353)**
Sargan OIR	(0.088)	(0.217)	(0.096)	(0.198)	(0.072)	(0.062)
Hansen OIR	**(0.762)**	**(0.621)**	**(0.644)**	**(0.560)**	**(0.714)**	**(0.232)**
DHT for instruments (a)Instruments in levels						
H excluding group	(0.058)	(0.034)	**(0.105)**	(0.031)	(0.060)	(0.040)
Dif(null, H=exogenous)	**(0.995)**	**(0.988)**	**(0.895)**	**(0.973)**	**(0.984)**	**(0.576)**
(b) IV (years, eq(diff))						
H excluding group	(0.126)	(0.107)	(0.115)	(0.096)	(0.084)	(0.056)
Dif(null, H=exogenous)	**(0.951)**	**(0.873)**	**(0.881)**	**(0.835)**	**(0.963)**	**(0.508)**
Fisher	**17319***	**2973.18***	**2891.47***	**4513.46***	**6120.05***	**10385.83***
Instruments	28	28	28	28	28	28
Countries	33	33	33	33	33	33
Observations	158	158	158	158	158	158

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. 45.330, 7.676 and 0.643 are respectively mean values of mobile phone penetration, internet penetration and fixed broadband subscriptions. na: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant. Constants are included in the regressions. PolS: Political Stability. VA: Voice & Accountability. GE: Government Effectiveness. RQ: Regulation Quality. CC: Corruption-Control. RL: Rule of Law.

Table 2: Non-Life insurance, governance and mobile phone penetration

	Dependent variable: Non-Life Insurance					
Non-Life Insurance (-1)	**0.993*****	**0.861*****	**0.950*****	**0.850*****	**0.918*****	**0.937*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Mobile Phone (Mobile)	0.0003	-0.00007	-0.0002	-0.0004	0.0004	-0.0001
	(0.286)	(0.837)	(0.788)	(0.167)	(0.355)	(0.739)
Political Stability (PolS)	0.034	---	---	---	---	---
	(0.118)					
Voice & Accountability (VA)	---	**0.049****	---	---	---	---
		(0.037)				
Regulation Quality (RQ)	---	---	0.055	---	---	---
			(0.282)			
Government Effectiveness(GE)	---	---	---	0.049	---	---
				(0.109)		
Rule of Law (RL)	---	---	---	---	0.033	---
					(0.291)	
Corruption-Control (CC)	---	---	---	---	---	0.004
						(0.931)
Mobile × PolS	**-0.0003***	---	---	---	---	---
	(0.067)					
Mobile × VA	---	**-0.0007*****	---	---	---	---
		(0.006)				
Mobile × RQ	---	---	-0.0006	---	---	---
			(0.203)			
Mobile × GE	---	---	---	**-0.0007*****	---	---
				(0.004)		
Mobile × RL	---	---	---	---	0.00007	---
					(0.714)	
Mobile × CC	---	---	---	---	---	**-0.0005***
						(0.078)
Tertiary Education	**-0.098***	0.092	-0.008	**0.130***	-0.024	0.049
	(0.063)	(0.922)	(0.946)	**(0.090)**	(0.777)	(0.688)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	na	0.0172	na	na	na	na
AR(1)	(0.018)	(0.020)	(0.289)	(0.021)	(0.294)	(0.298)
AR(2)	**(0.970)**	**(0.880)**	**(0.346)**	**(0.832)**	**(0.355)**	**(0.353)**
Sargan OIR	(0.012)	(0.005)	(0.096)	(0.006)	(0.072)	(0.062)
Hansen OIR	**(0.353)**	**(0.283)**	**(0.644)**	**(0.145)**	**(0.714)**	**(0.232)**
DHT for instruments (a)Instruments in levels						
H excluding group	**(0.421)**	(0.112)	(0.105)	(0.040)	(0.060)	(0.040)
Dif(null, H=exogenous)	**(0.318)**	**(0.458)**	**(0.895)**	**(0.395)**	**(0.984)**	**(0.576)**
(b) IV (years, eq(diff))						
H excluding group	(0.096)	(0.081)	**(0.115)**	(0.002)	(0.084)	(0.056)
Dif(null, H=exogenous)	**(0.591)**	**(0.520)**	**(0.881)**	**(0.954)**	**(0.963)**	**(0.508)**
Fisher	**718.35*****	**1064.53*****	**2891.47*****	**691.25*****	**6120.05*****	**10385.83*****
Instruments	28	28	28	28	28	28
Countries	35	35	35	35	35	33
Observations	168	168	168	158	158	158

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. 45.330 is the mean value of mobile phone penetration. na: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant. Constants are included in the regressions. PolS: Political Stability. VA: Voice & Accountability. GE: Government Effectiveness. RQ: Regulation Quality. CC: Corruption-Control. RL: Rule of Law.

Table 3: Life insurance, governance and internet penetration

	Dependent variable: Life Insurance					
Life Insurance (-1)	**0.915*****	**0.917*****	**0.884*****	**0.872*****	**0.877*****	**0.908*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Internet	-0.001	**-0.010*****	**-0.012*****	**-0.007*****	**-0.006*****	**-0.003****
	(0.162)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.011)**
Political Stability (PolS)	**0.026***	---	---	---	---	---
	(0.064)					
Voice & Accountability (VA)	---	0.029	---	---	---	---
		(0.335)				
Regulation Quality (RQ)	---	---	0.018	---	---	---
			(0.788)			
Government Effectiveness(GE)	---	---	---	**0.135****	---	---
				(0.013)		
Rule of Law (RL)	---	---	---	---	**0.078*****	---
					(0.009)	
Corruption-Control (CC)	---	---	---	---	---	**0.076****
						(0.024)
Internet × PolS	**0.004*****	---	---	---	---	---
	(0.000)					
Internet × VA	---	**0.005*****	---	---	---	---
		(0.000)				
Internet × RQ	---	---	**0.010*****	---	---	---
			(0.000)			
Internet × GE	---	---	---	**0.004*****	---	---
				(0.000)		
Internet × RL	---	---	---	---	**0.005*****	---
					(0.000)	
Internet × CC	---	---	---	---	---	-0.0008
						(0.493)
Tertiary Education	-0.056	**0.197****	**0.328*****	**0.139****	0.069	0.056
	(0.342)	**(0.011)**	**(0.002)**	**(0.015)**	(0.209)	(0.444)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	0.0567	na	na	0.1657	0.1163	na
AR(1)	**(0.291)**	**(0.288)**	**(0.290)**	**(0.282)**	**(0.300)**	**(0.297)**
AR(2)	**(0.363)**	**(0.386)**	**(0.404)**	**(0.395)**	**(0.367)**	**(0.363)**
Sargan OIR	**(0.632)**	**(0.491)**	**(0.424)**	**(0.679)**	**(0.474)**	**(0.182)**
Hansen OIR	**(0.646)**	**(0.357)**	**(0.259)**	**(0.331)**	**(0.812)**	**(0.520)**
DHT for instruments						
(a)Instruments in levels						
H excluding group	**(0.250)**	**(0.195)**	**(0.226)**	(0.042)	**(0.107)**	(0.056)
Dif(null, H=exogenous)	**(0.744)**	**(0.455)**	**(0.306)**	**(0.729)**	**(0.984)**	**(0.888)**
(b) IV (years, eq(diff))						
H excluding group	**(0.354)**	**(0.356)**	**(0.128)**	**(0.216)**	**(0.152)**	**(0.156)**
Dif(null, H=exogenous)	**(0.672)**	**(0.349)**	**(0.399)**	**(0.402)**	**(0.962)**	**(0.700)**
Fisher	**8728.65*****	**4887.86*****	**6495.43*****	**3811.19*****	**4439.58*****	**4390.30*****
Instruments	28	28	28	28	28	28
Countries	33	33	33	33	33	33
Observations	158	158	158	158	158	158

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. 7.676 is the average internet penetration rate. na: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant. Constants are included in the regressions. PolS: Political Stability. VA: Voice & Accountability. GE: Government Effectiveness. RQ: Regulation Quality. CC: Corruption-Control. RL: Rule of Law.

Table 4: Non-Life insurance, governance and internet penetration

	Dependent variable: Non-Life Insurance					
Non-Life Insurance (-1)	**0.840*****	**0.749*****	**0.825*****	**0.813*****	**0.812*****	**0.846*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Internet	**-0.005*****	**-0.009*****	-0.003	**-0.003***	**-0.006*****	**-0.004****
	(0.009)	**(0.000)**	(0.011)	**(0.078)**	**(0.001)**	**(0.011)**
Political Stability (PolS)	0.015	---	---	---	---	---
	(0.426)					
Voice & Accountability (VA)	---	0.056	---	---	---	---
		(0.233)				
Regulation Quality (RQ)	---	---	-0.019	---	---	---
			(0.529)			
Government Effectiveness(GE)	---	---	---	0.050	---	---
				(0.112)		
Rule of Law (RL)	---	---	---	---	**0.058***	---
					(0.052)	
Corruption-Control (CC)	---	---	---	---	---	**0.045***
						(0.093)
Internet × PolS	-0.001	---	---	---	---	---
	(0.190)					
Internet × VA	---	0.001	---	---	---	---
		(0.181)				
Internet × RQ	---	---	0.0004	---	---	---
			(0.727)			
Internet × GE	---	---	---	**-0.003****	---	---
				(0.049)		
Internet × RL	---	---	---	---	0.0005	---
					(0.631)	
Internet × CC	---	---	---	---	---	**-0.002****
						(0.033)
Tertiary Education	**0.213*****	**0.278****	**0.196*****	**0.138***	**0.155****	**0.170***
	(0.007)	**(0.014)**	**(0.009)**	**(0.087)**	**(0.038)**	**(0.051)**
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	na	na	na	na	na	0.0296
AR(1)	(0.015)	(0.022)	(0.026)	(0.030)	(0.021)	(0.020)
AR(2)	**(0.818)**	**(0.747)**	**(0.704)**	**(0.888)**	**(0.850)**	**(0.812)**
Sargan OIR	(0.007)	(0.085)	(0.012)	(0.025)	(0.007)	(0.030)
Hansen OIR	**(0.177)**	**(0.357)**	**(0.566)**	**(0.158)**	**(0.469)**	**(0.253)**
DHT for instruments						
(a)Instruments in levels						
H excluding group	**(0.500)**	**(0.252)**	**(0.628)**	**(0.378)**	**(0.540)**	**(0.377)**
Dif(null, H=exogenous)	**(0.132)**	**(0.407)**	**(0.468)**	**(0.136)**	**(0.396)**	**(0.230)**
(b) IV (years, eq(diff))						
H excluding group	**(0.418)**	**(0.197)**	(0.079)	**(0.165)**	**(0.350)**	**(0.376)**
Dif(null, H=exogenous)	**(0.146)**	**(0.452)**	**(0.873)**	**(0.215)**	**(0.475)**	**(0.231)**
Fisher	**876.36*****	**252.16*****	**1767.21*****	**1213.81*****	**977.80*****	**1633.71*****
Instruments	28	28	28	28	28	28
Countries	35	35	35	35	35	35
Observations	167	167	167	167	167	167

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. 7.676 is the mean values of internet penetration. na: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant. Constants are included in the regressions. PolS: Political Stability. VA: Voice & Accountability. GE: Government Effectiveness. RQ: Regulation Quality. CC: Corruption-Control. RL: Rule of Law.

Table 5: Life insurance, governance and fixed broadband subscriptions

	Dependent variable: Life Insurance					
Life Insurance (-1)	**0.907*****	**0.939*****	**0.786*****	**0.879*****	**0.861*****	**0.952*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Fixed BroadBand (BroadBand)	**0.046*****	-0.003	**-0.120*****	**-0.115*****	**-0.052****	**0.022*****
	(0.003)	(0.859)	**(0.000)**	**(0.000)**	**(0.023)**	**(0.001)**
Political Stability (PolS)	**0.116*****	---	---	---	---	---
	(0.009)					
Voice & Accountability (VA)	---	0.007	---	---	---	---
		(0.853)				
Regulation Quality (RQ)	---	---	**0.320*****	---	---	---
			(0.000)			
Government Effectiveness(GE)	---	---	---	**0.216***	---	---
				(0.090)		
Rule of Law (RL)	---	---	---	---	**0.182*****	---
					(0.000)	
Corruption-Control (CC)	---	---	---	---	---	0.086
						(0.196)
BroadBand × PolS	-0.016	---	---	---	---	---
	(0.317)					
BroadBand × VA	---	0.030	---	---	---	---
		(0.131)				
BroadBand × RQ	---	---	**0.133*****	---	---	---
			(0.000)			
BroadBand × GE	---	---	---	**0.141*****	---	---
				(0.000)		
BroadBand × RL	---	---	---	---	**0.070*****	---
					(0.005)	
BroadBand × CC	---	---	---	---	---	0.009
						(0.475)
Tertiary Education	**-0.220*****	0.001	**0.504*****	**0.134***	0.137	**-0.166*****
	(0.000)	(0.985)	**(0.000)**	**(0.092)**	(0.176)	**(0.007)**
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	na	na	0.4055	0.3066	0.2270	na
AR(1)	**(0.288)**	**(0.294)**	**(0.266)**	**(0.273)**	**(0.275)**	**(0.296)**
AR(2)	**(0.334)**	**(0.357)**	**(0.384)**	**(0.363)**	**(0.362)**	**(0.366)**
Sargan OIR	(0.093)	(0.019)	**(0.185)**	**(0.209)**	(0.030)	(0.002)
Hansen OIR	**(0.750)**	**(0.241)**	**(0.320)**	**(0.621)**	**(0.701)**	**(0.622)**
DHT for instruments						
(a)Instruments in levels						
H excluding group	**(0.174)**	**(0.250)**	(0.069)	(0.043)	(0.238)	(0.080)
Dif(null, H=exogenous)	**(0.906)**	**(0.270)**	**(0.610)**	**(0.975)**	**(0.810)**	**(0.915)**
(b) IV (years, eq(diff))						
H excluding group	**(0.265)**	**(0.134)**	**(0.234)**	(0.064)	**(0.396)**	**(0.108)**
Dif(null, H=exogenous)	**(0.841)**	**(0.364)**	**(0.375)**	**(0.941)**	**(0.711)**	**(0.872)**
Fisher	33787.31***	34883.80***	11032.76***	57162.64***	23352.36***	8824.49***
Instruments	28	28	28	28	28	28
Countries	33	33	33	33	33	33
Observations	142	142	142	142	142	142

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. 0.643is the mean value of fixed broadband subscriptions. na: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant. Constants are included in the regressions. PolS: Political Stability. VA: Voice & Accountability. GE: Government Effectiveness. RQ: Regulation Quality. CC: Corruption-Control. RL: Rule of Law.

Table 6: Non-Life insurance, governance and fixed broadband subscriptions

	Dependent variable: Non-Life Insurance					
Non-Life Insurance (-1)	**0.976*****	**0.791*****	**0.839*****	**0.907*****	**0.847*****	**0.914*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Fixed BroadBand (BroadBand)	-0.015	**-0.104*****	**-0.078*****	**-0.059*****	**-0.088*****	**-0.007***
	(0.185)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.054)**
Political Stability (PolS)	**0.059*****	---	---	---	---	---
	(0.002)					
Voice & Accountability (VA)	---	0.022	---	---	---	---
		(0.470)				
Regulation Quality (RQ)	---	---	0.020	---	---	---
			(0.623)			
Government Effectiveness(GE)	---	---	---	-0.007	---	---
				(0.788)		
Rule of Law (RL)	---	---	---	---	-0.029	---
					(0.441)	
Corruption-Control (CC)	---	---	---	---	---	0.024
						(0.394)
BroadBand × PolS	0.002	---	---	---	---	---
	(0.825)					
BroadBand × VA	---	**0.093*****	---	---	---	---
		(0.000)				
BroadBand × RQ	---	---	**0.063*****	---	---	---
			(0.000)			
BroadBand × GE	---	---	---	**0.050*****	---	---
				(0.000)		
BroadBand × RL	---	---	---	---	**0.085*****	---
					(0.000)	
BroadBand × CC	---	---	---	---	---	-0.002
						(0.825)
Tertiary Education	0.016	**0.387*****	**0.386*****	**0.218*****	**0.358*****	**0.063*****
	(0.478)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.001)**
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	na	na	na	na	na	na
AR(1)	(0.036)	(0.036)	(0.020)	(0.029)	(0.034)	(0.046)
AR(2)	**(0.783)**	**(0.404)**	**(0.294)**	**(0.595)**	**(0.823)**	**(0.933)**
Sargan OIR	(0.036)	**(0.160)**	(0.069)	(0.005)	(0.082)	(0.020)
Hansen OIR	**(0.168)**	**(0.581)**	**(0.299)**	**(0.214)**	**(0.176)**	**(0.178)**
DHT for instruments						
(a)Instruments in levels						
H excluding group	**(0.338)**	**(0.104)**	**(0.110)**	(0.069)	(0.033)	**(0.457)**
Dif(null, H=exogenous)	**(0.156)**	**(0.841)**	**(0.484)**	**(0.436)**	**(0.499)**	**(0.140)**
(b) IV (years, eq(diff))						
H excluding group	**(0.125)**	**(0.226)**	**(0.250)**	**(0.454)**	**(0.126)**	**(0.143)**
Dif(null, H=exogenous)	**(0.265)**	**(0.692)**	**(0.339)**	**(0.173)**	**(0.275)**	**(0.262)**
Fisher	492548.67***	54467.02***	9319.74***	7008.05***	177030.10***	3570.30***
Instruments	28	28	28	28	28	28
Countries	34	34	34	34	34	34
Observations	148	148	148	148	148	148

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. 0.643 is the mean value of fixed broadband subscriptions.na: not applicable because at least one estimated coefficient needed for the computation of net effects is not significant. Constants are included in the regressions. PolS: Political Stability. VA: Voice & Accountability. GE: Government Effectiveness. RQ: Regulation Quality. CC: Corruption-Control. RL: Rule of Law.

Appendices
Appendix 1: Definitions of Variables

Variables	Signs	Definitions of variables (Measurements)	Sources
Life Insurance	LifeIns	Life Insurance Premium Volume to GDP (%)	FDSD
Non-Life Insurance	NonLifeIns	Non-life Insurance Premium Volume to GDP (%)	FDSD
Mobile Phones	Mobile	Mobile cellular subscriptions (per 100 people)	WDI
Internet	Internet	Internet users (per 100 people)	WDI
Fixed Broad Band	BroadB	Fixed broadband subscriptions (per 100 people)	WDI
Political Stability	PolS	"Political stability/no violence (estimate): measured as the perceptions of the likelihood that the government will be destabilised or overthrown by unconstitutional and violent means, including domestic violence and terrorism"	WDI
Voice & Accountability	VA	"Voice and accountability (estimate): measures the extent to which a country's citizens are able to participate in selecting their government and to enjoy freedom of expression, freedom of association and a free media"	WDI
Government Effectiveness	GE	"Government effectiveness (estimate): measures the quality of public services, the quality and degree of independence from political pressures of the civil service, the quality of policy formulation and implementation, and the credibility of governments' commitments to such policies".	WDI
Regulation Quality	RQ	"Regulation quality (estimate): measured as the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development".	WDI
Corruption-Control	CC	"Control of corruption (estimate): captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests"	WDI
Rule of Law	RL	"Rule of law (estimate): captures perceptions of the extent to which agents have confidence in and abide by the rules of society and in particular the quality of contract enforcement, property rights, the police, the courts, as well as the likelihood of crime and violence"	WDI
Tertiary School	TSE	School enrollment, tertiary (gross), gender parity index (GPI)	WDI

WDI: World Bank Development Indicators of the World Bank. FDSD: Financial Development and Structure Database of the World Bank.

Appendix 2: Summary statistics (2004-2014)

	Mean	SD	Minimum	Maximum	Observations
Life Insurance	0.881	2.126	0.0006	12.220	346
Non-Life Insurance	0.798	0.536	0.005	2.774	367
Mobile Phone Penetration	45.330	37.282	0.209	171.375	558
Internet Penetration	7.676	10.153	0.031	54.26	453
Fixed Broad Band	0.643	1.969	0.000	14.569	369
Political Stability	-0.471	0.905	-2.687	1.182	462
Voice & Accountability	-0.509	0.683	-1.780	0.970	462
Government Effectiveness	-0.711	0.599	-1.867	1.035	462
Regulation Quality	-0.608	0.529	-1.879	1.123	462
Corruption-Control	-0.577	0.590	-1.513	1.139	462
Rule of Law	-0.651	0.604	-1.816	1.007	462
Tertiary School Enrollment	0.775	0.437	0.064	3.295	293

S.D: Standard Deviation.

Appendix 3:Correlation matrix (uniformsample size : 152)

Mobile	Internet	BroadB	PolS	VA	GE	RQ	CC	RL	TSE	LifeIns	Non LifeIns	
1.000	0.734	0.590	0.315	0.381	0.381	0.369	0.331	0.347	0.553	0.285	0.178	Mobile
	1.000	0.799	0.363	0.465	0.552	0.461	0.497	0.533	0.775	0.286	0.360	Internet
		1.000	0.407	0.436	0.577	0.513	0.470	0.526	0.672	0.404	0.283	BroadB
			1.000	0.796	0.724	0.707	0.763	0.769	0.443	0.390	0.505	PolS
				1.000	0.790	0.810	0.734	0.837	0.401	0.412	0.477	VA
					1.000	0.899	0.876	0.933	0.542	0.516	0.498	GE
						1.000	0.793	0.880	0.400	0.573	0.462	RQ
							1.000	0.891	0.582	0.444	0.525	CC
								1.000	0.518	0.533	0.584	RL
									1.000	0.324	0.404	TSE
										1.000	0.648	LifeIns
											1.000	NonLife Ins

Mobile: Mobile phone penetration. Internet: Internet penetration. BroadB: Fixed broad band subscriptions. PolS: Political Stability. VA: Voice & Accountability. GE: Government Effectiveness. RQ: Regulation Quality. CC: Corruption-Control. RL: Rule of Law. TSE: Tertiary School Enrolment. LifeIns: Life Insurance. NonLifeIns.

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