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Abstract

This study examines the impact of remittances and information and communication technology (ICT) on pension at the country level. Our empirical evidence, based on data from 96 countries, indicate a significant non-linearity between remittances, ICT and pension income coverage. First, we find a convex relation between remittances and pension income coverage, indicating that increases in remittance, initially decreases pension income coverage, but as remittance increases beyond a certain point, so too does pension income coverage. This inflection point, where the effect of remittances turns from negative to positive, is estimated to be around 3.09% of GDP. Second, we document a concave relationship between ICT (i.e. mobile subscription and internet penetration) and pension income coverage. An increase in ICT results in increased pension income coverage. However, when ICT reaches a certain point, any further increase is associated with lower pension income coverage. The estimated optimal point is found to be around 140.14 subscriptions (per 100 people) for mobile phone and 27.93 (per 100 people) for internet penetration, respectively. Other implications are discussed.

Keywords: Pension income coverage; Remittances; Mobile subscription; Internet penetration; ICT

1. Introduction

This study examines the impact of remittances and information and communication technology (ICT) on pension income coverage. The motivation for this inquiry is threefold, notably: (1) the growing concern over the persistent low pension coverage; (2) the role of remittances and ICT in inclusive finance; and (3) gaps in the literature. We explicate the elements of motivation as follows.

First, pension coverage continues to be persistently low for the majority of economies around the world. For instance, pension coverage is still low with less than 20% of the population covered in developing economies (Kpessa, 2011), suggesting that the good of pension is enjoyed by only a few elderly people (Laryea, Andoh and Asuming, 2019). According to Barrientos (2006), the low pension income coverage is occasioned by over-reliance on employment-based pension plans. To tackle this menace, a large number of countries have introduced significant changes to their pension provisions. This has been done by giving pension holders the freedom to direct contributions to their individual account, in their names, with benefits directly linked to contributions paid in. However, it is unclear whether the objective of improved coverage has been achieved consistently (Rusconi, 2009).

Second, remittances remain a key income for many people and have implications for obtaining proper healthcare, education, nutrition and total wellbeing (World Bank, 2017). Indeed, various researchers in the past document significant impacts of remittance on poverty alleviation, economic development and growth (Adams, 2006; Adams and Page, 2005; Gupta, Pattillo and Wagh, 2009). Contemporary development finance literature suggests that remittances respond to the lack of pensions and especially to overall household financial deficits (Bebczuk and Battistón, 2010). Moreover, remittances boost contributions to health and pension for informal workers, two components to fight against poverty (Cuadros-Meñaca, 2020). However, there is also the crowding-out effect of remittances on social security (La and Xu, 2017). Consequently, in theory, it is unclear how remittances may influence pension income coverage.

Third, literature shows that there is great potential for ICT penetration (Tchamyou, 2017; Tchamyou, Erreygers and Cassimon, 2019) and its associated benefit of reducing information asymmetry (Asongu, Biekpe and Tchamyou, 2019a; Tchamyou, 2019), poverty and inequality (Meniago and Asongu, 2018; Neaime and Gaysset, 2018). The above literature suggests that the

good of ICT is made possible through the financial inclusion channel. Indeed, from the perspective of (Andrianaivo, Kpodar and Allum, 2011), ICT growth is associated with more financial inclusion. Moreover, access to finance is also being made possible by recent digital finance innovations (see AfDB, 2013). However, the contemporary inclusive development literature on the role of ICT in financial inclusion also presents a setback. Generally, there is the neglect of access to pension or participation in pension plans or pension income coverage while the vast number of studies is mainly focused on access to financial (banking) services in the definition of inclusive finance. Therefore, in many respects, access to formal financial institutions is referred to as financial inclusion (Leyshon and Thrift, 1995; Sinclair, 2001). Meanwhile, pension service is a major part of the broader financial ecosystem (Aggarwal and Goodell, 2013). We address this gap in the literature by examining the role of ICT (i.e. mobile penetration and internet penetration) on pension income coverage.

Our empirical evidence, based on data from 96 countries, indicate a significant non-linearity between remittances, ICT and pension income coverage. First, we find a convex relation between remittances and pension income coverage, indicating that increases in remittance, initially decreases pension income coverage, but as remittance increases beyond a certain point, so too does pension income coverage. This inflection point, where the effect of remittances turns from negative to positive, is found to be around 3.09% of GDP. Second, we document a concave relationship between ICT (i.e. mobile subscription and internet penetration) and pension income coverage. An increase in ICT results in increased pension income coverage. However, when ICT reaches a certain point, any further increase is associated with lower pension income coverage. When ICT is relatively lower, the complementary effect dominates, leading to greater pension income coverage. When ICT reaches a certain point, the substitution effect dominates, resulting in lower pension income coverage. The estimated optimal point is found to be around 140.14 subscriptions (per 100 people) for mobile phone and 27.93 (per 100 people) for internet penetration, respectively.

The contributions of the study are as follows. First, we extend and complement the literature on remittances-inclusive finance nexus by presenting for the first time, a cross-country evidence of the relationship between remittances and inclusive finance from the perspective of pension. Prior studies typically focus on access to banking services in the definition of inclusive

finance (Ambrosius, 2016; Ambrosius and Cuecuecha, 2016; Le, Chuc and Taghizadeh-Hesary, 2019; Neaime and Gaysset, 2018). Additionally, whereas most studies focused on single country analysis (Cuadros-Meñaca, 2020; La and Xu, 2017), we study a panel of 96 countries from five regions, namely: (1) Africa, (2) Asia-Pacific, (3) Eastern Europe, (4) Latin America, and (5) Western Europe and Others. Consistent with this, our paper is closely related to Bebczuk & Battistón (2010), which investigates the relationship between remittances and pensions in a cross-country sense. However, Bebczuk & Battistón (2010) do not focus specifically on the role of remittances in pension income coverage. Additionally, our sample covers a wider spectrum of countries while Bebczuk & Battistón (2010) focus on only 4 countries in the Latin American region. Therefore, our findings are more likely to fully capture heterogeneity that may exist in the influence of remittances and ICT between countries.

Our paper also complements and extends contemporary literature on the crowding-out effect of remittances on social security (La and Xu, 2017). We explore the relevance of nonlinearity of remittances on pension income coverage and control for possible endogeneity of remittances. The literature on the threshold level of remittances has mainly focused on household consumption instability (Combes and Ebeke, 2011), total factor productivity (Kumar Stauvermann, Kumar and Shahzad, 2018), bank credit (Brown and Carmignani, 2015), financial development (Akçay, 2020), and inclusive human development (Asongu, Uduji and Okolo-Obasi, 2019). By engaging in threshold analysis, we provide the critical mass of remittances for enhanced pension income coverage. This is consistent with empirical considerations that show a significant threshold effect of remittances in crossing out any negative impact caused due to the low level of remittances received. Therefore, we provide an understanding of the level of remittances that create an environment where remittances co-evolve with enhanced pension income coverage.

Further, we provide new evidence on the effect of ICT on pension income coverage as our evidence adds to the growing relevant literature concerning the potential of ICT penetration for inclusive finance (Meniago and Asongu, 2018; Neaime and Gaysset, 2018). As far as we have reviewed, no paper has examined the role of ICT in inclusive finance from the perspective of pension income or participation in a pension plan. Therefore, for the first time, we present evidence of the unconditional and threshold effects of ICT on pension income coverage at the macro level based on international dataset. The literature on the threshold level of ICT has

mainly focused on African countries and the modulating role of ICT (Asongu, Biekpe and Tchamyou, 2019; Asongu and Odhiambo, 2020, 2018). Our paper provides the policy relevance of leveraging on ICT penetration for enhanced pension income coverage by establishing the optimal level of mobile subscription and internet penetration rate. Finally, we complement the literature on the determinants of pension income coverage (Huberman, Iyengar and Jiang, 2007; Luchak, Fang and Gunderson, 2004; Nivakoski, 2014). We show that remittances, mobile penetration, and internet penetration are factors that significantly affect the level of pension income coverage.

The remainder of the paper is as follows. Section 2 engages the related literature and develops testable hypotheses. Section 3 describes the methodology and data. Section 4 presents the empirical results. Finally, section 5 concludes, and presents the implications of findings.

2. Related literature and hypotheses development

2.1 Remittances and pensions income coverage

The contemporary literature investigates the role of remittances (1) as a support mechanism for the elderly (Pfau and Long, 2010), (2) in the participation of pension and health schemes for individuals working in informal jobs (Cuadros-Meñaca, 2020), (3) in the use of formal financial services (Ambrosius and Cuecuecha, 2016) and (4) in social security systems (La and Xu, 2017). In theory, it is unclear how remittances may influence pension income coverage. Consistent with the threshold analysis studies, remittances may be a double-edged sword. Therefore, there may be a good and bad of personal remittances received. Remittances may respond to the lack of pensions and especially to overall household financial deficits; encourage co-residence of the elderly with younger relatives; facilitate elderly retirement; increase household expenditures in health and education; foster public and private school attendance; inhibit child labor, and improve anthropometric measures (Bebczuk and Battistón, 2010). Moreover, remittances can boost contributions to health and pension for informal workers, two components to fight against poverty (Cuadros-Meñaca, 2020). However, other studies suggest significant crowding-out effects for both domestic and international remittances on social security systems (La and Xu, 2017) and argues that remittances foster moral hazard problem in migrants' families (Azam and Gubert, 2006), which in turn may affect pension participation and coverage.

We argue that it is reasonable that remittances can occasion a moral hazard problem in the remittances-receiving families by lowering incentives to participate in pension schemes or crowd-out social security systems. However, the issue of moral hazard or crowding-out effect occasioned by remittances may be a reality only in some regions because of the quantum of remittances received and that, remittances must reach a certain level before its performance-enhancing effect on pensions accrues. This hypothesis is consistent with prior studies which posit the threshold effect of remittances in the contemporary literature (Akçay, 2020; Brown and Carmignani, 2015; Combes and Ebeke, 2011; Kumar et al., 2018). Therefore, based on these considerations, our first hypothesis is formulated as follows.

H1: *There is a U-shaped relationship between remittances and pension income coverage.*

Additionally, as pension service is a major part of the broader financial ecosystem (Aggarwal and Goodell, 2013), remittances can affect pension income coverage through access to financial services channel. This channel is supported by the importance of finance for economic well-being (Claessens, 2006). Indeed, receiving remittances is strongly correlated with the ownership of savings accounts and to a limited degree with the availability of borrowing options (Ambrosius, 2016). Remittances also serve as a framework that curbs the deficiencies of the formal financial sector in addressing the financial needs of remittance-receiving households (Ambrosius and Cuecuecha, 2016). Moreover, remittances act as a substitute for the formal banking system (Opperman and Adjasi, 2019).

The other channel through which remittances may affect pension income coverage is through education because a key determinant of household investment in education is remittances (Kusunose and Rignall, 2018). Remittances tend to increase education in human capital formation. Moreover, remittances increase prospects for economic growth and poverty reduction in the long run through the human capital channel (Gyimah-Brempong and Asiedu, 2015). By implication, an adequately educated population is better placed to understand systems (van Groezen, Kiiver and Unger, 2009). We argue that education can increase the likelihood that, the populace has an appreciable knowledge level of either finance or pension. Indeed, it is well noted that financial literacy significantly increases the probability of pension plan participation (Fornero and Monticone, 2011). Moreover, pension literacy among informal workers or the self-

employed is associated with a greater likelihood of joining a voluntary pension savings plan offered by a pension system (Landerretche and Martínez, 2013). Therefore, remittances can foster an adequately educated population, who have a better understanding of their pension system, thereby, increase the likelihood of pension plan participation or coverage. Therefore, based on these considerations, our second hypothesis is formulated as follows.

H2: *There is a positive net effect of remittances on pension income coverage*.

2.2 ICT and Pensions Income Coverage

In this paper, we argue that ICT (i.e. mobile penetration and internet penetration) improves pension income coverage through the financial inclusion and information sharing channels, and the arguments presented below highlight why these two channels improve pension income coverage. First, from the perspective of Andrianaivo et al. (2011), ICT growth is associated with more financial inclusion. Ouma, Odongo, & Were (2017) noted that the availability and usage of mobile phones to provide financial services promotes the likelihood of saving at the household level. Moreover, access to mobile financial services also has a significant impact on the amounts saved. Similarly, the provision of financial services through mobile telephony has been found to promote savings mobilization, especially among the poor and low-income groups with constrained access to formal financial services (Abor, Amidu and Issahaku, 2018). Therefore, mobile phones can help to boost savings culture (Kwena and Turner, 2013). Evans (2018) found that internet and mobile phones have significant positive relationships with financial inclusion, meaning that increased internet and mobile phone penetrations are associated with increased financial inclusion.

Based on these considerations, we advance two opposing hypotheses. First, unlike the working populations who have access to financial services with very little or no constraints, the aged population has limited dealings with formal financial institutions and are therefore not exposed to financial services and planning and advice target towards the aged. ICT, specifically, mobile financial services provide the aged population with the avenue to access government support, health insurance products and other financial services. Additionally, contemporary literature shows that financial inclusion is directly related to financial security in respect of savings and retirement behaviour (e.g., Demirgüç-Kunt, Klapper, & Panos, 2016; Heller, 2016; Hsieh & Tung, 2016). Lyons, Grable, & Joo (2018) found that financial inclusion has a

significant and positive impact on financial security. In other words, financial inclusion plays a key role in promoting savings and improving financial security in aging populations.

On the contrary, mobile financial services have weak link to a number of economic and social outcomes. For instance, Mbiti and Weil (2011) document that M-PESA accounts may not serve as a place to store wealth. Given the importance of assets described as a *store of wealth* in retirement (Doling and Ronald, 2010), implicit in this view is that, increased use of mobile based financial products and services is associated with lower pension income. We test these considerations and formulate our third hypothesis as follows.

H3: *There is an invented U-shaped relationship between ICT and pension income coverage.*

Second, Li (2014) argues that information sharing plays a crucial role in household financial decisions. The author observed that, in the US, household investors are 20% - 30% more likely to enter the stock market if their parents or children had entered the stock market during the previous years. As maintained by Ivković & Weisbenner (2007), there exists a correlation between households' stock purchases and stock purchases made by neighbours because of word-of-mouth communication. Therefore, information sharing underscores peer effect in savings and investment decisions (Bursztyn, Bruno, Ferman and Yuchtman, 2014). Moreover, Van Schie, Donkers, & Dellaert (2012) noted that deciding how much to save for retirement is a difficult task and individuals encounter many uncertainties in this decision-making process. Therefore, individuals engage in ongoing information search processes to directly reduce uncertainty to ensure increased pensions contributions. Additionally, Binswanger & Carman (2012) concluded that large variation in retirement wealth accumulation can be surmounted if financial planning advice were based on simple rules of thumb as that would help people without any systematic approach to wealth accumulation save substantially more. Asongu, le Roux, Nwachukwu and Pyke (2019b) find that ICT complements this information sharing and search processes by reducing information asymmetry. Therefore, based on the above discussions, we formulate our fourth hypothesis as follows.

H4: *There is a positive net effect of ICT on pension income coverage.*

3. Data and method

This section covers the methodology and data. Section 3.1 focuses on the dataset. Section 3.2 describes our econometric estimation strategy.

3.1 Data and sample

This study focuses on ninety-six (96) countries with annual data from 2013 to 2015. The composition of the sampled countries is as follows: 11 countries in sub-Saharan Africa (SSA), 23 countries in Asia-Pacific, 20 countries in Eastern Europe, 18 countries in Latin America and 24 countries in Western Europe and others (Appendix 4 lists countries included in each region). The number of sampled countries and periodicity are motivated by constraints in data availability. Due to unavailability of data on pension income coverage for a longer period, we relied on three-year period data points that were available at the time of study. We employed three main data sources, namely: (1) HelpAge, (2) Heritage Foundation (HF),and (3) the World Bank. See Appendix 1 for definitions and sources of variables.

Table 1 displays the summary statistics for pension income coverage, remittances and ICT. The average pension income coverage is 51.39% (51.05% median). This varies from an average of 24.07% in Africa to 74.41% in Western Europe and others. Remittances average 4.3% of GDP (1.57% median). Asia-Pacific region has the highest average remittances of 8.31% of GDP. Mobile subscription and internet penetration average 113.87 and 16.46 per 100 people, respectively.

"Insert Table 1 here"

3.2. Econometric estimation strategy

Consistent with prior studies, we employed the (i) baseline Ordinary Least Squares (OLS), (ii) Fixed Effect (FE) regression and the two-stage least squares instrumental variables (2SLS-IV) regression. The use of multiple estimation strategies was motivated by the need to ensure the robustness of our findings, provide increased room for policy relevance and consistency with recent studies.

3.2.1 Ordinary least squares and fixed effects regressions

Following prior studies (e.g., Asongu et al., 2019a; Neaime and Gaysset, 2018), the baseline OLS specification with heteroscedasticity robust standard errors clustered at country level is presented as follows:

$$Pension_{i,t} = \alpha + \beta_1 Remit_{i,t} + \sum_{j=2}^{3} \beta_j ICT_{j,i,t} + \sum_{j=4}^{6} \beta_j Z_{j,i,t} + \sum_{j=7}^{8} \beta_j W_{j,i,t} + \varepsilon_{i,t} \quad \text{Eq. 1}$$

where *Pension* $_{i,t}$ is the pension income coverage in country i in year t; α is an intercept, $Remit_{i,t}$ is the personal remittances received as percentage of GDP in country i in year t,ICT is a vector of two information communication technology variables (mobile phone penetration and internet penetration), Z is a vector of three pensioners' characteristics variables (poverty, social and freedom), W is a vector of two other control variables (institutional quality and population density), and $\varepsilon_{i,t}$ is the error term.

The baseline OLS regression specification above accounts for observed country characteristics but not the unobserved country-specific fixed effects. Therefore, the error term $\varepsilon_{i,t}$ includes the unobserved country-specific fixed effects. Given this possible bias due to unobserved country characteristics, we consider fixed effects models with standard errors clustered at country level. This approach is consistent with contemporary inclusive finance literature (Le et al., 2019; Neaime and Gaysset, 2018). We also performed a formal test of heterogeneity due to unobserved country characteristics. The test statistics obtained from the clustered robust Hausman test reported Chi2(8) equals 39.36 with p-value of 0.000. The alternative panel fixed effects regression is specified as follows:

$$Pension_{i,t} = \alpha + \beta_1 Remit_{i,t} + \sum_{j=2}^{3} \beta_j ICT_{j,i,t} + \sum_{j=4}^{6} \beta_j Z_{j,i,t} + \sum_{j=7}^{8} \beta_j W_{j,i,t} + \eta_i + \varepsilon_{i,t} \quad \text{Eq. 2}$$

where *Pension* $_{i,t}$ is the pension income coverage in country i in year t; α is an intercept, *Remit* $_{i,t}$ is the personal remittances received as percentage of GDP in country i in year t,ICT is a vector of two information communication technology variables (mobile phone penetration and internet penetration), Z is a vector of three pensioners' characteristics variables (poverty, social and freedom), W is a vector of two other control variables (institutional quality and population density), η_i is the unobserved country-specific effect and $\varepsilon_{i,t}$is the error term.

Further, we examine the non-linear effect of remittances and ICT on pension income coverage, following the empirical framework used in Asongu et al. (2019b) and Asongu and Odhiambo (2019). Using both OLS and FE specifications with pension income coverage as the dependent variable, we employ the quadratic term of both remittances and ICT while controlling for various pensioners' and country characteristics. Appendix 2 reports correlation coefficients.

3.2.2 Addressing possible reverse causality problem

Although, the fixed effects regression ensures that we have minimized the omitted variable bias induced by unobservable characteristics, thus, ensuring that we capture the variation over time within countries, we run a two stage least squares instrumental variable (2SLS-IV) analysis to ensure the robustness of the results against the problem of possible reverse causality in the relationship between remittances, ICT and pension income coverage. We use as our instrumental variable, the regional median remittances, mobile subscription, and internet penetration. The logic is that, while it is possible for the extent of pension income coverage at country level to influence country-specific remittances, mobile subscription and internet penetration, it is highly unlikely that it would affect remittances, mobile subscription and internet penetration at the regional level because there are many countries in each region. Consequently, shocks to remittances and ICT at the regional level are much more likely exogenous.

3.2.3. Definitions of variables

This study uses as dependent variable, *pension income coverage*, which measures the percentage of population 60 years plus, with pension coverage. The calculation is based on the United Nations (UN) Population Division data and recipient numbers. Our main independent variables are *remittances* and *ICT*. In accordance with Combes & Ebeke (2011) and La and Xu (2017), remittance is measured as remittance received as percentage of GDP. This is consistent with prior studies. In accordance with Asongu et al. (2019b), we use two measures of ICT, namely: (1) mobile phone penetration rate and (2) internet penetration rate. Again, consistent with the literature on the threshold level of remittances (e.g. Akçay, 2020; Brown and Carmignani, 2015) and ICT (e.g. Asongu et al., 2019b), we include the quadratic terms of remittances and ICT variables to examine the threshold effect.

We control for pensioners' characteristics. The pensioners' characteristics we control for include poverty rate in old age ($Poverty$), social connectedness ($Social$), and freedom in life ($Freedom$). According to Barrientos (2006), poverty in old age ($Poverty$) is occasioned by over-reliance on employment-based pension plans which implied that the good of pension is enjoyed by only a few elderly people (Laryea et al., 2019) who were employed in the formal sector of an economy. Therefore, with a greater percentage of the world's population employed in the informal sector (International Labour Organization, 2018a), a decrease in pension income coverage can be expected. Moreover, consistent with health and quality of life framework (i.e. minimum income for healthy living) employed by governments to meet the challenges of ageing population (O'Sullivan and Ashton, 2012); social connectedness ($Social$) can be expected to increase pension income coverage. Recent pension reforms seek to provide more options to pension holders to make choices that suit their preferences (van Dalen and Henkens, 2018). Therefore, an increase in pension income coverage can be expected when there is an increase freedom in life ($Freedom$).

$Institutional\ Quality$ is measured using the HF index of Economic Freedom in natural logarithm.[1] From the literature on financial liberalization (Delis, 2012), a higher level of institutional quality should provide an improved mechanism for increased pension coverage. $Population\ density$ is controlled for to explore possible variability in the population.

4. Results and discussions

This section reports the regression results on the hypotheses. We employ the following empirical approaches: first, we examine the relationship between remittances and pension income coverage but exclude the controls of the ICT variables (i.e. mobile and internet), and second, the relationship between mobile and internet separately and pension income coverage without the control of remittances.

"Insert Table 2 here"

[1] The index is comprised of 10 components with equal weights namely fiscal burden, banking and finance, trade policy, government intervention, black market, monetary policy, property rights, capital flows and foreign investment, wages and prices, and regulation. Also, it ranges from 0 to 100 where a higher value is indicative of a higher level of institutional quality.

4.1 The impact of remittances on pension income coverage

In ***H1***, we predict that there is a significant U-shaped relationship between remittances and pension income coverage. We estimate a nonlinear model from the baseline pooled OLS and FE estimation strategies with standard errors adjusted for clustering at the country level to test this hypothesis. Table 2 shows the regression results. Models 1 and 2 are the OLS and FE regressions for the effect of remittances on pension income coverage. In both models, $REMIT$ (remittance) carries a negative and significant coefficient, whereas the quadratic term of $REMIT$ exhibits a significantly positive coefficient. It appears that the effect of remittances on pension income coverage is non-monotonic. An increase in remittance results in lower pension income coverage. However, when remittances reach a certain point, any further increase in is associated with more pension income coverage. When remittance is relatively lower, the crowding out effect dominates, leading to lower pension income coverage. When remittances reach a certain point, the complementary effect dominates; resulting in increased pension income coverage. Therefore, hypothesis ***H1*** is supported. The 2SLS-IV regression results are shown in Table 3. Models 7 and 8 relate to remittances, Models 7 is the first-stage regression, when the dependent variable is remittances. Regional median remittance has significant explanatory power, as expected. Model 8 is the second-stage regression. In model 8, the coefficient of $REMIT(instrumented)$ is negative and significant, while its squared term, $REMIT2(instrumented)$, carries a positive and significant coefficient. This finding is consistent with the earlier results from the pooled OLS and FE regression and support hypothesis ***H1***.

"Insert Table 3 here"

Consistent with prior studies that employ interactive regression, the overall effect of remittances on pension income coverage is determined by computing net effects(e.g. Asongu and Acha-Anyi, 2020) from the unconditional and marginal or conditional impacts of remittances. Thus, in ***H2***, we predict that there is a significant positive net effect of remittances on pension income coverage. In model 1, the results show that the net effect of remittances on pension income coverage is negative and statistically significant with coefficient -0.607 (2x[0.031x4.3]+[-0.874]). In the computation, the average value of remittances is 4.3, the unconditional effect of remittances -0.874 while the conditional effect from increased

remittances is 0.031. In Model 2, the net effect of remittances on pension income coverage is negative and statistically significant with coefficients -7.976 (2 x[0.114 x4.3] + [-8.956]). In the computation, the average value of remittances is 4.3, the unconditional effect of remittances -8.956 while the conditional effect from increased remittances is 0.114. Consequently, with the consistent negative net effect from both the pooled OLS and FE regression results, hypothesis ***H2*** is not supported. This finding is consistent with the argument put forward by La and Xu (2017) that, remittances crowd-out social security or pensions because remittances provide social benefits similar public transfers and support the altruistic motive overall. Contrary to these findings, it is noteworthy to mention that, the results from the 2SLS-IV regression support hypothesis ***H2*** as the net effect of remittances on pension income coverage is positive with coefficient 2.206 (2 x[0.913x4.3] + [-5.646]).

4.2 The impact of ICT on pension income coverage

We start with the specification where our ICT variable is mobile subscription. Models 3 and 4 in Table 2 present the results. Concerning the role of mobile subscription in pension income coverage, we document in significant coefficients on $MOBILE$ (i.e. mobile phone penetration) and its quadratic term, $MOBILE2$ in both the pooled OLS and FE regressions, respectively. We address the possible reverse causality problem and present the results in Table 3. In Model 10, the coefficient of $MOBILE$ $(instrumented)$ is positive and significant, while its squared term, $MOBILE2$ $(instrumented)$, carries a negative and significant coefficient. The implication is that, the effect of mobile subscription on pension income coverage is non-monotonic. An increase in mobile subscription results in increased pension income coverage. However, when mobile subscription reaches a certain point, any further increase is associated with lower pension income coverage. When mobile subscription is relatively lower, the complementary effect dominates, leading to greater pension income coverage. When mobile subscription reaches a certain point, the substitution effect dominates, resulting in lower pension income coverage. This finding provides a strong evidence of the non-monotonic relationship between mobile subscription and pension income coverage; thus, it affirms the earlier results from FE regression in a significant manner and provides support for hypothesis ***H3***. Clearly, hypothesis ***H4*** is supported as the net effect of mobile subscription on pension income coverage is positive with coefficient 0.368 (2 x[-0.007x113.87] + [1.962]).

Models 5 and 6 shows the pooled OLS and FE regression of the second specification where our ICT variable is internet penetration. We document a significant nonlinear relationship between internet penetration rate and pension income coverage, although, the results are conflicting in both the pooled OLS and FE regressions, respectively. In Model 5, $INTERNET$ (internet penetration) carries a positive and significant coefficient, whereas the quadratic term of $INTERNET$ exhibits a significantly negative coefficient. Therefore, from the OLS model, we document significant inverted U-shaped relationship between internet penetration and pension income coverage. Therefore, hypotheses ***H3*** and ***H4*** are supported by the pooled OLS regression. However, in Model 6, $INTERNET$ carries a negative and significant coefficient, whereas the quadratic term of $INTERNET$ exhibits a significantly positive coefficient. This finding documents a significant U-shaped relationship between internet penetration and pension income coverage. Therefore, hypotheses ***H3*** and ***H4*** are not supported by the FE regression. We therefore conclude that the empirical results from OLS and FE models yield mixed findings on the overall net effect of ICT on pension income coverage. We address the possible reverse causality problem and present the results in Table 3. In Model 12, the coefficient of $INTERNET(instrumented)$ is positive and significant, while its squared term, $INTERNET2(instrumented)$ carries a negative and significant coefficient. It appears that the effect of internet penetration on pension income coverage is non-monotonic. An increase in internet penetration results in increased pension income coverage. However, when internet penetration reaches a certain point, any further increase is associated with lower pension income coverage. When internet penetration is relatively lower, the complementary effect dominates, leading to greater pension income coverage. When internet penetration reaches a certain point, the substitution effect dominates, resulting in lower pension income coverage. This finding provides a strong evidence of the nonlinear relationship between internet penetration and pension income coverage; thus, it affirms the earlier results from the pooled OLS regression in a significant manner and provides support for hypothesis ***H3***. Clearly, hypothesis ***H4*** is supported as the net effect of internet penetration on pension income coverage is positive with coefficient 0.459 (2 x[-0.020x16.46] + [1.117]).

Thus far, the following findings can be established. First, we find a convex relation between remittances and pension income coverage, indicating that increases in remittance, initially decreases pension income coverage, but as remittance increases beyond a certain point, so too

does pension income coverage. Second, we document a concave relationship between ICT (i.e. mobile subscription and internet penetration) and pension income coverage. An increase in ICT results in increased pension income coverage. However, when ICT reaches a certain point, any further increase is associated with lower pension income coverage. The significant control variables have the expected signs.

4.3 Threshold of remittances for enhanced pension income coverage

Following the literature on thresholds of remittances (e.g. Kumar et al., 2018; Akcay, 2019; Asongu et al., 2019a) for economic development outcomes, we examine whether there exist thresholds of remittances for enhanced pension income coverage. Although, the net effect from the 2SLS-IV is positive on pension income coverage, the corresponding unconditional impact is consistently negative. Implicit in the threshold analysis, is the inflection point where the effect of remittances turns from negative to positive. We find that it is when remittances is 3.09 (5.646/[2 x0.913]) based on Model 8. Accordingly, 3.09 of remittances (% of GDP) is the minimum value required for the effect of remittances on pension income coverage to turns from negative to positive in the sampled countries. This inflection point is economically reasonable because it is within the maximum limit of 43.47% of GDP imposed by the summary statistics.

4.4 Optimal level of ICT for enhanced pension income coverage

Given the parabolic shape of the relationship between ICT and pension income coverage, we calculate the optimal level of both mobile subscription and internet penetration that result in the highest level of pension income coverage for countries in the sample. We calculate the optimal point and find that it is when mobile subscription is 140.14 (per 100 people) based on Model 10 and when internet penetration is 27.93 (per 100 peaople). Accordingly, 140.14 mobile subscription (per 100 people) and 27.93 internet penetration (per 100 people) are the maximum values ICT required for optimal pension income coverage in the sampled countries. These results are not only statistically significant but also economically significant bacause they are wihtin the maximum limit imposed by the summary statistics. The ICT thresholds further indicate that complementarry policies are needed to reverse the decreasing marginal effect of ICT on pension income coverage.

5. Conclusion and implications

This study has examined the role of remittances and ICT in pension income coverage. Our empirical evidence, based on data from 96 countries, indicate a significant non-linearity between remittances, ICT and pension income coverage. First, we find a convex relation between remittances and pension income coverage, indicating that increases in remittance, initially decreases pension income coverage, but as remittance increases beyond a certain point, so too does pension income coverage. This inflection point, where the effect of remittances turns from negative to positive, is estimated to be around 3.09% of GDP. Second, we document a concave relationship between ICT (i.e. mobile subscription and internet penetration) and pension income coverage. An increase in ICT results in increased pension income coverage. However, when ICT reaches a certain point, any further increase is associated with lower pension income coverage. The estimated optimal point is found to be around 140.14 subscriptions (per 100 people) for mobile phone and 27.93 (per 100 people) for internet penetration, respectively.

The empirical results in this study provide a practical tool to policy makers. First, the results suggest that pension income coverage can be enhanced by increasing the level of remittances inflows. However, these strategies can be effective only when remittances reach the established threshold. On average, there are only 31 countries in our sample of 96 countries that may enjoy the positive effect of remittances on pension income coverage because the average remittances received in these countries are greater than the threshold value of 3.09%.[2] On regional basis, remittances levels in Africa lag behind the established threshold, on average. Thus, policy makers in Africa need to do a lot more to boost remittances inflow for enhanced pension income coverage. One such ways is for policy makers to drive increased availability of domestic financial services to migrants in the diaspora. This is consistent with the view of Posso (2015) about attracting remittances into developing countries.

Second, the result that ICT optimizes pension income coverage is interesting. On average, countries with high levels of pension income coverage (i.e. 70% and above) have reached the established optimal point of internet penetration rate, although, they lag behind the

[2] These 31 countries are Albania, Armenia, Bangladesh, Bolivia, Croatia, Dominican Republic, El Salvador, Georgia, Ghana, Guatemala, Honduras, Hungary, India, Jordan, Kyrgyzstan, Latvia, Lithuania, Montenegro, Morocco, Nepal, Nicaragua, Nigeria, Pakistan, Philippines, Serbia, Sri Lanka, Tajikistan, Uganda, Ukraine, Viet Nam and West Bank and Gaza.

optimal level of mobile subscription marginally. These countries account for 18.75% of our sampled countries and these are mainly developed economies. This finding reaffirms the growing importance being ascribed to ICT growth for developing economies in contemporary literature. Policy maker can take digital leapfrogging to provide pension solutions to the aged population. Thus, digitally enabled pension provision can reduce transaction cost and can be well targeted at the aged population. Moreover, given that pension income coverage is a form of insurance against future uncertainties, complementing ICT measures with information sharing offices designed to reduce information asymmetry would contribute towards reducing the decreasing marginal incidence of ICT on pension income coverage. This is essentially because such information sharing offices have been documented to promote life and non-life insurance in contemporary development literature (Asongu and Odhiambo, 2021).

Although, the results in this study are robust to some sources of endogeneity (i.e. unobserved heterogeneity and reverse causality), there are a few limitations that should be considered by future research. First, the study uses a large number of countries but due to unavailability of data on pension income coverage for a long period of time, the study relies on a three-year period only. Thus, we are unable to control for some dynamics of endogeneity. Future research should use a longer period to examine the dynamics and persistence of pension income coverage. Second, this study did not explore the unique institutional and legal framework in the finance and growth literature. Therefore, future studies should engage in a comparative analysis across income levels, legal origin, *inter alia*, for an enhanced understanding of the determinants of pension income coverage.

Table 1: Summary statistics for key variables

	Full Sample	Africa	Asia-Pacific	Eastern Europe	Latin America & Caribbean	Western Europe & Others
Panel A: Pension Income Coverage - Regional Comparison						
Mean	51.39	24.07	39.73	49.46	51.09	74.41
Median	51.05	23.25	39.45	50.96	50	76.6
Maximum	93.4	58	83.1	70.5	70.6	93.4
Minimum	3.3	4.1	3.3	25.5	25.8	34.5
Std. Dev.	20.33	13.3	18.08	9.8	10.38	13.01
Observations	270	26	62	60	54	68
Panel B: Remittances - Regional Comparison						
Mean	4.3	2.84	8.31	4.91	4.52	0.53
Median	1.57	1.63	2.77	3.38	2	0.31
Maximum	43.47	13.27	43.47	19.71	17.95	2.83
Minimum	0.04	0.04	0.05	0.3	0.05	0.04
Std. Dev.	6.79	3.1	10.86	4.36	5.54	0.59
Observations	264	26	62	57	51	68
Panel C: Mobile Subscription - Regional Comparison						
Mean	113.87	86.13	103.12	126.42	119.43	119.17
Median	115.53	75.75	102.64	122.05	112.33	117.19
Maximum	177.02	145.35	149.81	161.7	177.02	160.99
Minimum	33.4	33.4	52.08	90.73	79.84	80.35
Std. Dev.	26.17	33.19	26.54	18.32	25.5	16.3
Observations	270	26	62	60	54	68
Panel D: Internet Penetration - Regional Comparison						
Mean	16.46	1.65	7.98	19.87	8.31	33.18
Median	13.16	0.16	2.99	20.24	7.96	33.14
Maximum	44.6	15.67	39.4	30.76	26.4	44.6
Minimum	0.004	0.01	0.004	6.29	0.78	23.29
Std. Dev.	13.34	3.89	10.99	19.87	5.8	5.62
Observations	269	26	61	60	54	68

Table 2: The effect of remittances and ICT on Pension Income Coverage

Model	(1)	(2)	(3)	(4)	(5)	(6)
	Pooled OLS	**Fixed Effect**	**Pooled OLS**	**Fixed Effect**	**Pooled OLS**	**Fixed Effect**
Independent variables	Remittances		Mobile Subscription		Internet Penetration	
Constant	**62.643*** **	102.215	-32.404	322.66	**71.689*** **	92.894
	(8.062)	(186.43)	(43.626)	(454.49)	**(9.994)**	(170.81)
Remit	**-0.874** **	**-8.956*** **				
	(0.412)	**(2.031)**				
Remit2	**0.031** **	**0.114*** **				
	(0.012)	**(0.030)**				
Mobile			-0.505	1.082		
			(0.328)	(2.618)		
Mobile2			**7.345***	-17.015		
			(3.738)	(33.581)		
Internet					**1.079*** **	**-6.372***
					(0.295)	**(3.795)**
Internet2					**-0.018** **	**0.310*** **
					(0.008)	**(0.071)**
Poverty	**-0.658*** **	**-0.754*** **	**-0.660*** **	**-0.765*** **	**-0.667*** **	**-0.660*** **
	(0.031)	**(0.042)**	**(0.031)**	**(0.040)**	**(0.033)**	**(0.046)**
Social	0.037	0.005	0.051	0.0004	0.033	0.017
	(0.057)	(0.063)	(0.054)	(0.064)	(0.056)	(0.068)
Freedom	-0.091	-0.058	-0.099	-0.115	-0.101	-0.136
	(0.102)	(0.159)	(0.099)	(0.148)	(0.107)	(0.145)
Institutional quality	**0.398*** **	3.531	**0.203***	3.320	0.100	**3.619***
	(0.107)	(2.204)	**(0.107)**	(2.181)	(0.109)	**(2.047)**
Population density	**-0.013** **	-1.376	**-0.012** **	-1.244	**-0.013** **	**-1.810** **
	(0.006)	(0.970)	**(0.006)**	(0.937)	**(0.006)**	**(0.705)**
Net effect	-0.607	-7.976	n/a	n/a	0.486	-3.833
F-statistics	61.24	123.00	60.56	120.10	67.84	150.90
R-squared	58.1%	66.8%	57.2%	65.9%	58.2%	71.0%
Adjusted R-squared	56.2%	65.9%	55.4%	65.0%	56.4%	70.2%
Number of countries	-	94	-	96	-	95
Observations	264	264	270	270	269	269

Notes: PENSION=Pension income coverage; REMIT=Personal remittances received (% of GDP); REMIT2 = is a deterministic non-linear function of REMIT;MOBILE=Mobile subscription per 100 people;MOBILE2 = is a deterministic non-linear function of MOBILE;INTERNET=Internet penetration rate per 100 people; INTERNET2 = is a deterministic non-linear function of INTERNET;POVERTY= Poverty rate in old age; SOCIAL=Social connectedness; FREEDOM=Freedom in your life; POP DENSITY=Population density (people per sq. km of land area); INSTIQUA=Institutional quality. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3: 2SLS-IV regression of the effect of remittances and ICT on Pension Income Coverage

Model	(1)	(2)	(3)	(4)	(5)	(6)
	First-stage	Second-stage	First-stage	Second-stage	First-stage	Second-stage
Dependent variables	Remit	Pension	Mobile	Pension	Internet	Pension
Constant	3.082	**51.408*** **	-6.848	-45.525	**-16.187*** **	**72.708*** **
	(4.284)	**(12.363)**	(22.628)	(43.587)	**(5.589)**	**(9.213)**
Reg Median Remit	**1.708*** **					
	(0.394)					
Remit (Instrumented)		**-5.646*** **				
		(1.866)				
Remit2 (Instrumented)		**0.913*** **				
		(0.229)				
Reg Median Mobile			**0.747*** **			
			(0.200)			
Mobile (Instrumented)				**1.962** **		
				(0.859)		
Mobile2 (Instrumented)				**-0.007***		
				(0.004)		
Reg Median Internet					**0.757*** **	
					(0.074)	
Internet (Instrumented)						**1.117*** **
						(0.338)
Internet2 (Instrumented)						**-0.020** **
						(0.008)
Poverty	0.003	**-0.637*** **	0.049	**-0.684*** **	**0.028*** **	**-0.662*** **
	(0.010)	**(0.033)**	(0.032)	**(0.033)**	**(0.008)**	**(0.031)**
Social	0.008	0.078	0.010	0.045	0.007	0.044
	(0.015)	(0.054)	(0.039)	(0.056)	(0.011)	(0.055)
Freedom	-0.007	-0.060	-0.008	-0.092	**0.067** **	-0.096
	(0.020)	(0.112)	(0.102)	(0.099)	**(0.027)**	(0.112)
Institutional quality	-0.043	**0.517*** **	**0.586*** **	-0.005	**0.224** **	0.061
	(0.063)	**(0.140)**	**(0.185)**	(0.113)	**(0.094)**	(0.135)
Population density	0.002	**-0.018*** **	-0.009	-0.008	0.005	**-0.014** **
	(0.002)	**(0.006)**	(0.009)	(0.007)	(0.004)	**(0.006)**
Net effect	-	2.206	-	0.368	-	0.459
F-statistics	**7.64*** **	**87.54*** **	**7.23*** **	**91.03*** **	**76.65*** **	**90.07*** **
R-squared	11.4%	56.8%	28.7%	56.7%	74.2%	55.5%
Adjusted R-squared	9.3%	55.6%	27.1%	55.5%	73.6%	54.3%
Observations	264	270	270	270	269	270

Notes: PENSION=Pension income coverage; REMIT=Personal remittances received (% of GDP); REMIT2 = is a deterministic non-linear function of REMIT;MOBILE=Mobile subscription per 100 people;MOBILE2 = is a deterministic non-linear function of MOBILE;INTERNET=Internet penetration rate per 100 people; INTERNET2 = is a deterministic non-linear function of INTERNET;POVERTY= Poverty rate in old age; SOCIAL=Social connectedness; FREEDOM=Freedom in your life; POP DENSITY=Population density (people per sq. km of land area); INSTIQUA=Institutional quality. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix

Appendix 1. Definitions and sources of variables

Variables	Signs	Definitions of variables (measurements)	Sources
Pension Income Coverage	Pension	Pension income coverage	Helpage.org
Independent variables			
Remittances	Remit	Personal remittances received (% of GDP)	World Bank (WDI)
Mobile phone	Mobile	Mobile phone subscription (per 100 people)	World Bank (WDI)
Internet	Internet	Internet subscription (per 100 people)	World Bank (WDI)
Pensioners' characteristics			
Poverty rate in old age	Poverty	Poverty rate in old age	Helpage.org
Social Connectedness	Social	Social connectedness	Helpage.org
Freedom in your life	Freedom	Freedom in your life	Helpage.org
Other controls			
Institutional quality	Instiqua	Institutional quality	Heritage Foundation
Pop Density	Pop Density	Population density (people per sq. km of land area)	World Bank (WDI)

WDI: World Development Indicators. GDP: Gross Domestic Product.

Appendix 2. Correlation matrix

	Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	VIF
(1)	PENSION	1.000									-
(2)	REMIT	-0.011	1.000								1.28
(3)	MOBILE	0.027	-0.069	1.000							1.26
(4)	INTERNET	0.064	-0.450	0.363	1.000						2.02
(5)	POVERTY	-0.723	-0.019	0.167	0.125	1.000					1.53
(6)	SOCIAL	0.351	0.012	-0.038	-0.008	-0.426	1.000				1.24
(7)	FREEDOM	0.241	-0.128	0.070	0.308	-0.334	0.087	1.000			1.42
(8)	POP DENSITY	-0.004	0.036	-0.124	0.046	-0.113	-0.051	0.185	1.000		1.08
(9)	INSTIQUA	0.026	-0.178	0.361	0.573	0.110	-0.041	0.347	0.081	1.000	1.64

PENSION: Pension income coverage; REMIT: Personal remittances received (% of GDP); MOBILE: Mobile subscription per 100 people; INTERNET: Internet penetration rate per 100 people; POVERTY: Poverty rate in old age; SOCIAL: Social connectedness; FREEDOM: Freedom in your life; INSTIQUA: Institutional quality; POP DENSITY: Population density (people per sq. km of land area); VIF: Variance inflation factor.

Appendix 3: Country-specific average values pension income coverage, ICT and remittances

Country name	Pension Income Coverage	Internet	Mobile	Remittances
Afghanistan	3.53	0.01	54.84	1.49
Albania	50.47	7.29	120.20	8.80
Argentina	59.57	15.34	148.94	0.09
Armenia	51.53	9.18	117.56	17.26
Australia	74.77	27.32	107.04	0.16
Austria	76.73	27.26	153.56	0.76
Bangladesh	43.30	2.57	83.09	8.28
Belarus	44.13	29.59	120.04	1.56
Belgium	64.77	35.53	112.36	2.16
Bolivia	49.50	1.58	96.67	3.73
Brazil	50.47	11.64	133.13	0.13
Bulgaria	49.63	20.79	134.16	2.98
Cambodia	32.30	0.40	134.36	1.86
Canada	86.50	35.30	81.23	0.08
Chile	68.13	14.07	132.38	0.05
China	53.05	16.63	90.07	0.30
Colombia	51.30	10.70	115.54	1.29
Costa Rica	61.60	10.84	150.61	1.07
Croatia	46.27	22.92	106.52	3.95
Cyprus	54.73	28.69	129.85	1.34
Czech Republic	64.30	27.68	126.15	1.18
Denmark	77.37	41.31	125.19	0.39
Dominican Republic	42.47	5.94	86.27	7.41
Ecuador	55.80	8.06	96.60	2.46
El Salvador	46.87	5.06	145.70	16.46
Estonia	64.27	28.25	145.00	2.11
Finland	75.20	31.80	136.80	0.35
France	73.67	40.39	101.49	0.91
Georgia	58.87	14.71	131.70	11.51
Germany	86.63	36.38	121.08	0.45
Ghana	35.80	0.26	114.19	7.46
Greece	39.73	29.63	115.98	0.29
Guatemala	41.00	2.61	118.98	10.08
Honduras	32.03	1.57	87.62	17.40
Hungary	52.93	26.84	112.90	3.47
Iceland	82.60	36.79	112.57	1.28
India	37.30	1.22	72.82	3.50
Indonesia	38.60	1.33	127.62	0.96

Iraq	23.20	n/a	94.34	0.15
Ireland	75.23	27.04	105.76	0.26
Israel	70.77	26.75	125.42	0.27
Italy	56.27	23.90	151.53	0.48
Japan	82.17	29.54	121.29	0.07
Jordan	19.00	3.71	131.45	16.05
Kyrgyzstan	48.03	2.95	124.72	28.92
Lao People's Dem. Republic	29.70	0.16	65.12	0.54
Latvia	54.90	24.81	124.23	5.10
Lithuania	46.43	27.73	146.02	4.05
Luxembourg	69.50	34.46	142.36	2.83
Malawi	9.43	0.05	35.73	0.60
Malta	52.80	35.60	125.76	1.87
Mauritius	54.90	14.30	131.04	0.01
Mexico	54.90	11.22	88.47	2.01
Mongolia	36.77	6.17	101.71	2.12
Montenegro	35.37	16.59	160.38	9.48
Morocco	28.73	2.91	126.38	6.89
Mozambique	4.30	0.15	72.39	1.12
Nepal	36.93	1.07	88.93	30.10
Netherlands	85.73	40.79	118.08	0.18
New Zealand	80.40	30.48	112.83	0.24
Nicaragua	47.97	1.95	114.70	9.68
Nigeria	25.00	0.01	78.71	4.03
Norway	90.83	38.48	111.18	0.15
Pakistan	11.10	0.93	66.48	6.82
Panama	63.93	7.98	161.16	1.36
Paraguay	38.67	2.84	109.95	2.06
Peru	51.77	5.95	106.12	1.37
Philippines	51.30	2.78	110.05	10.03
Poland	53.80	18.84	147.36	1.40
Portugal	55.33	27.40	113.89	0.19
Republic of Korea	44.77	38.18	112.59	0.47
Republic of Moldova	35.03	12.38	91.24	n/a
Romania	51.67	20.09	114.74	1.75
Russian Federation	38.37	17.41	153.60	0.40
Rwanda	20.90	0.08	69.60	1.75
Serbia	39.83	13.81	103.77	8.76
Slovakia	51.67	21.94	118.27	2.31
Slovenia	63.73	26.52	112.29	1.58
South Africa	35.20	3.13	145.35	0.26
Spain	65.63	27.64	108.30	0.22
Sri Lanka	53.23	2.59	106.35	8.64
Sweden	87.53	34.13	127.13	0.75

Switzerland	88.63	43.36	135.88	0.36
Tajikistan	46.63	0.07	96.95	36.29
Thailand	55.13	8.21	143.14	1.56
Turkey	36.83	11.77	92.87	0.21
Uganda	21.30	0.18	54.04	3.51
Ukraine	36.07	9.99	142.23	5.74
United Kingdom	79.33	36.40	120.44	0.17
United Republic of Tanzania	13.30	0.19	70.41	0.83
United States of America	82.20	30.97	109.63	0.04
Uruguay	64.17	24.29	156.16	0.22
Venezuela	39.40	8.02	100.69	n/a
Viet Nam	51.13	6.83	138.21	6.56
West Bank and Gaza	8.40	5.69	75.08	13.72
Zambia	21.70	0.14	69.23	0.22

Appendix 4. List of countries included in the sample

Africa	**Asia-Pacific**	**Eastern Europe**	**Latin America and Caribbean**	**Western European and Others**
Ghana	Afghanistan	Albania	Argentina	Australia
Malawi	Bangladesh	Armenia	Bolivia	Austria
Mauritius	Cambodia	Belarus	Brazil	Belgium
Morocco	China	Bulgaria	Chile	Canada
Mozambique	Cyprus	Croatia	Colombia	Denmark
Nigeria	India	Czech Republic	Costa Rica	Finland
Rwanda	Indonesia	Estonia	Dominican Republic	France
South Africa	Iraq	Georgia	Ecuador	Germany
Uganda	Japan	Hungary	El Salvador	Greece
Tanzania	Jordan	Latvia	Guatemala	Iceland
Zambia	Kyrgyzstan	Lithuania	Honduras	Ireland
	Lao People's Dem. Republic	Montenegro	Mexico	Israel
	Mongolia	Poland	Nicaragua	Italy
	Nepal	Republic of Moldova	Panama	Luxembourg
	Pakistan	Romania	Paraguay	Malta
	Philippines	Russian Federation	Peru	Netherlands
	Republic of Korea	Serbia	Uruguay	New Zealand
	Sri Lanka	Slovakia	Venezuela	Norway
	Tajikistan	Slovenia		Portugal
	Thailand	Ukraine		Spain
	Turkey			Sweden
	Viet Nam			Switzerland
	West Bank and Gaza			United Kingdom
				United States of America

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