Open access • Journal Article • DOI:10.1108/IJSE-11-2012-0228

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Published on: 06 Jul 2015 - International Journal of Social Economics (Emerald Group Publishing Limited)

Topics: Mobile phone

Asongu, Simplice A.

Working Paper

The impact of mobile phone penetration on African inequality

AGDI Working Paper, No. WP/13/021

Provided in Cooperation with:
African Governance and Development Institute (AGDI), Yaoundé, Cameroon

Suggested Citation: Asongu, Simplice A. (2013) : The impact of mobile phone penetration on African inequality, AGDI Working Paper, No. WP/13/021, African Governance and Development Institute (AGDI), Yaoundé

This Version is available at:
http://hdl.handle.net/10419/123599

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A G D I Working Paper

WP/13/021

The impact of mobile phone penetration on African inequality

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 WP/13/021

AGDI Working Paper

Research Department

The impact of mobile phone penetration on African inequality

Simplice A. Asongu[1]

May 2013

Abstract

Purpose – The aim of this paper is to complement theoretical and qualitative literature with empirical evidence on the income-redistributive effect of mobile phone penetration in 52 African countries.

Design/methodology/approach – Robust Ordinary Least Squares and Two Stage Least Squares empirical strategies are employed.

Findings – The findings suggest that mobile penetration is pro-poor, as it has a positive income equality effect.

Social implications – 'Mobile phone'-oriented poverty reduction channels are discussed.

Originality/value – It deviates from mainstream country-specific and microeconomic survey-based approaches in the literature and provides the first macroeconomic assessment of the 'mobile phone'-inequality nexus.

JEL Classification: E00; G20; I30; L96; O33
Keywords: Mobile Phones; Shadow Economy; Poverty; Inequality; Africa

1. Introduction

Many lives have been transformed by the mobile revolution, which is providing not just communication but also basic financial access in the forms of phone-based money transfer and storage (Jonathan & Camilo, 2008; Demombynes & Thegeya, 2012). The significant growth and penetration rates of mobile telephony that are transforming cell phones into pocket-banks in Africa are also providing countries on the continent with increased affordable and cost-

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effective means of bringing on board a large part of the population that hitherto has been excluded from formal financial services for decades. At the 2007 'Connect Africa' summit, Paul Kagame, president of Rwanda emphasized: "*in ten short years, what was once an object of luxury and privilege, the mobile phone has become a basic necessity in Africa*" (Aker & Mbiti, 2010, 208). An article in *The Economist* (2008) earlier supported this claim: "*a device that was a yuppie toy not so long ago has now become a potent for economic development in the world's poorest countries*"[2]. This paper seeks to assess how these sentiments and slogans are reflected in the incidence of 'mobile phone penetration' on income-redistribution in Africa. The assessment is of significant interest not only to banks and Micro Financial Institutions (MFIs) but also to governments, financial regulators as well as to development partners who are providing support to improve the livelihoods of Africans through poverty reduction and sustained economic growth.

Apart from the need to assess these sentiments, there is a growing body of work pointing to the imperative of more scholarly research on the phenomenon of mobile penetration[3]. To the best of our knowledge, one of the most exhaustive accounts in the 'mobile penetration' development literature concludes: "*Existing empirical evidence on the effect of mobile phone coverage and services suggest that the mobile phone can potentially serve as a tool for economic development in Africa. But this evidence while certainly encouraging remains limited. First, while economic studies have focused on the effects of mobile phones for particular countries or markets, there is little evidence showing that this has translated into macroeconomic gains…*" (Aker & Mbiti, 2010, 224). More so, as sustained by Maurer (2008) and confirmed in subsequent literature (Jonathan & Camilo, 2008; Thacker & Wright, 2012),

[2] Many studies have also assessed how tendencies of globalization have affected inequality and poverty (Ukpere & Slabbert, 2009; Shahbaz, 2010; O'Boyle & O'Boyle, 2012; Akerele et al., 2012).

[3] "*Relative to the spread of some other technologies that have been introduced in sub-Saharan Africa-improved seeds, solar cook stoves and agricultural technology-mobile phones adoption has occurred at a staggering rate on the continent. Yet few empirical economic studies have examined mobile phone adoption. This could be due to a variety of factors, including unreliable or nonexistent data on individual level adoption (leading to measurement error)…*" Aker & Mbiti (2010, 225).

scholarly research on the adoption and socioeconomic impacts of mobile-banking (payments) systems in the developing world is scarce. Most studies on mobile penetration have been theoretical and qualitative in nature (Maurer, 2008; Jonathan & Camilo, 2008; Merritt, 2010; Thacker & Wright, 2012). The few existing empirical works hinge on country-specific and micro-level data mostly collected from surveys (Demombynes & Thegeya, 2012).

The aim of this paper is to complement theoretical literature with empirical evidence on the income-redistributive effect of mobile phone penetration. As far as we know, the macroeconomic pro-poor evidence of the mobile phenomenon is missing in the literature. This study covers 52 African countries and hence, provides a broad assessment of the incidence of mobile penetration on the poor in a continent most affected by stubbornly high poverty rates and growing income-inequality (Asongu, 2013a). The rest of the paper is organized as follows. We briefly review existing literature in Section 2. Data and methodology are presented and outlined respectively in Section 3. Empirical analysis is covered in Section 4. Section 5 concludes.

2. Mobile phone penetration, mobile banking and the poor

2.1 Mobile phone penetration

Consistent with Asongu (2013b), we begin by presenting a clear picture of the depth of mobile phone penetration in Africa with some statistics. With respect to Mbiti & Weil (2011), the story of the growth of mobile phones in Africa is one of a tectonic and unexpected change in communications technology. Accordingly, from virtually unconnected in the 1990s, over 60% of Africa now has mobile phone coverage and there are now over ten times as many mobiles as landline phones in use (Aker & Mbiti, 2010). Consistent with Aker & Mbiti, mobile phone coverage in Africa has progressed at jaw-breaking rates over the past decade. In 1999, only 11% of the African population had mobile phone coverage, primarily in Northern (Egypt, Algeria, Libya, Morocco and Tunisia) and Sothern (Kenya and South Africa) Africa. As

sustained by Asongu (2013b), by 2008, 60% of the population (477 million) could get a signal and an area of 11.2 million square kilometers had mobile phone coverage: equivalent to the United Sates and Argentina combined. According to Asongu, it was expected that by the end of 2012, most villages in Africa would have had coverage with only a handful of countries relatively unconnected. In line with Demombynes & Thegeya (2012), Kenya is the example of an African country that has undergone a remarkable information and communication technology (ICT) revolution. Accordingly, towards to end of the 1990s, less than 3% of Kenyan households owned a telephone and less than 1 in 1000 Kenyan adults had mobile phone service. By the end of 2011 however, 93 percent of Kenyan households owned a mobile phone. This spectacular growth is largely credited to the M-PESA mobile-banking network (Demombynes & Thegeya, 2012, 23-25).

2.2 Mobile banking and the poor

The growth of mobile-banking (payments) systems has been particularly significant in the Philippines (where three million customers use systems offered by mobile operators Smart & Globe; Neville, 2006); Kenya (where nearly two million users registered with Safaricom M-PESA system within a year of its nationwide rollout, Vaughan, 2007; Ivatury & Mas, 2008) and South Africa where 450, 000 people use Wizzit ('the bank in your pocket'; Ivatury & Pickens, 2006) or one of two other national systems (Porteous, 2007). Borrowing from Asongu (2013b), there are three main avenues along which the incidence of mobile phone penetration on mobile banking could be discussed. While the first strand captures the usefulness of mobile transactions (store of value, conversion of cash and transfer of stored value), the second strand elucidates the concepts of savings (basic or partially integrated) in mobile banking. The last strand relates mobile banking to GSM[4] phones.

[4] Global System of Mobile Communications.

The first strand that largely draws from Jonathan & Camilo (2008) stresses that most mobile transactions in developing countries enable users to do three main things: store value in an account, covert cash into and out of the bank account and transfer stored value between accounts. (a) Store value (currency) in an account is accessible with the help of a handset. When the user already has a bank account, this is generally a matter of linking to a bank account. If the user does not possess an account, then the process opens one for him/her or creates a pseudo bank account, held by a third party or the user's mobile operator. (b) Conversion of cash into and out of the store value account. In a situation where the account is linked to a bank account, then users can visit banks to cash-in and cash-out. In many scenarios, users can also visit the GSM providers' retail stores. When most services are flexible, a user can visit a corner kiosk or grocery store (maybe the same one where he/she purchases airtime) and transact with an independent retailer working as an agent for the transaction system. (c) Transferring of stored value between accounts. Accordingly, users can generally transfer funds between accounts linked to two mobile phones by using a set of SMS messages (or menu commands) and PIN[5] codes. Hence, the new services offer a way to move money from place to place and therefore present an alternative to the payments system offered by banks, pawn shops, remittance firms…etc.

The second strand elucidates the concept of savings. Demombynes & Thegeya (2012) have approached the mobile-finance nexus through this concept[6]. They have laid emphasis on two types of mobile savings. (a) *Basic mobile* savings; that is simply the usage of a standard

[5] Personal Identification Number.

[6] Accordingly, in order to have a mobile money account and make a deposit, a customer must own a cell phone SIM card with the mobile operator and register for a mobile money account. The customer can then make cash deposits (savings) at the physical offices of one of the operator's mobile money agents. Hence, these cash deposits create electronic money credit in the account. The customer can make person-to-person transfers of mobile money credit to the accounts of other mobile money users in the same network. (S)he can also use their mobile money credit to pay bills and to buy phone airtime. Cash withdrawals could be made at the offices of the network's mobile money agents. There is also an option for a mobile money customer to make a transfer to someone who is not registered with the same network. In this option, when notice of the transfer is received through an SMS text message, the recipient can receive the cash at a mobile money agent (Demombynes, & Thegeya, 2012; Asongu, 2013b).

mobile money system such as M-PESA to store funds. These basic mobile savings do not generate interest. The strand on bank-integrated mobile savings has received a great deal of attention as a way of providing banking services to the poor. They particularly have the advantage of offering access to basic banking services without requiring proximity to a physical bank branch. Therefore, with a bank-integrated mobile savings account, basic banking services can be accessed with the help of a network of mobile phone agents, which in Kenya outnumber the weight of bank branches significantly (Mas & Radcliffe, 2011). (b) The term '*partially integrated'* mobile savings system is also used to describe circumstances in which the access to bank account through mobile phones is contingent on the establishment of a traditional account at a physical bank. Accordingly, banks are beginning to build their own agent networks as means of assuming a more competitive bargaining position in accessing mobile service platforms. Fully and partially integrated savings present distinct types of contracts among partnering banks and mobile service providers. On the one hand, a *partially* integrated product clearly delineates the role of the bank (which provides and owns banking services) from that of the mobile service provider which provides mobile telephony infrastructure and controls the agent network (Demombynes & Thegeya, 2012). Hence, the bank compensates the mobile service provider for access to the network and reaps the remaining profits. This type of contract more closely resembles a debt contract among the parties. On the other hand, a *fully* integrated solution may not lay emphasis on the same distinction between bank and mobile service providers. In this scenario, the distribution of surplus depends on the relative bargaining power of the bank and mobile service provider. This type of contract more closely looks like an equity contract between two parties. Equity-oriented contracts are more likely to be complex and hence more difficult to negotiate than debt-like contracts, there-by presenting a potential draw-back in the goal of facilitating access.

In the last strand, mobile banking is linked to GSM phones. To the best of our knowledge, Ondiege (2010) Chief Economist at the African Development Bank provides one of the most exhaustive accounts on the nexuses between mobile banking and GSM phones. According to him, there are four main linkages. Firstly, the mobile phone can serve as a virtual bank card where information on the customer and institution is securely stored, thereby avoiding the cost of distributing cards to customers. He lays emphasis on the fact that, the subscriber identity module (SIM) card inside most GSM phones is in itself a smartcard that is similar to the virtual bank card. Hence, the banks customer's PIN and account number can be saved on this SIM card to perform the same functions as the bank virtual card. Secondly, the mobile phone could play the role of a point of sale (POS) terminal. Thus, a mobile phone could be used to transact and communicate with the appropriate financial institution to solicit transaction authorization. These are similar functions of a POS terminal at mails, retail or other stores. A mobile phone can therefore duplicate these functionalities with ease. Thirdly, the mobile phone can also be used as an automatic teller machine (ATM). A POS is therefore used to pay for commodities at the store. If cash and access to savings were to be considered as commodities that customers buy and store, then the POS will also serve as a cash collection and distribution point which basically is the function of an ATM. Lastly, the mobile phone may be used as an internet banking terminal. This implies, it offers two fundamental customer services: a) ability to make payments and transfers remotely and; b) instant access to any account. Ultimately, the mobile phone device and wireless connectivity bring the internet terminal into the hands of otherwise unbanked customers.

In light of the above interesting literature, as far as we have reviewed there is currently no study that has assessed the effects of mobile phone penetration on poverty. As highlighted in the introduction, most studies on mobile penetration have been theoretical and qualitative in nature (Maurer, 2008; Jonathan & Camilo, 2008; Merritt, 2010; Thacker & Wright, 2012). The

few existing empirical works hinge on country-specific and micro-level data mostly collected from surveys (Demombynes & Thegeya, 2012). Hence, this missing gap in the literature provides a unique opportunity to complement existing literature with a macroeconomic assessment of the mobile-inequality nexus.

3. Data and Methodology

3.1 Data

We examine a sample of 52 African countries with data from World Development Indicators (WDI) and the Financial Development and Structure Database (FDSD) of the World Bank (WB). The mobile penetration rate is obtained from the African Development Bank (AfDB). This rate could also proxy for mobile banking/activities (Ondiege, 2010; Aker & Mbiti, 2010). Due to constraints in the time series properties of the mobile penetration measurement, the data structure is cross-sectional and consists of 2003-2009 average growth rates. The indicator for inequality is the GINI coefficient which measures income disparity among values of the frequency distribution. A value of zero denotes equality while a coefficient of one expresses maximal inequality. The GINI index has been used in recent Africa inequality literature (Batuo et al., 2010), as well as in many disciplines studying inequality (sociology, economics, health science, agriculture…etc).

In the regressions, we shall control for the macroeconomic environment (*inflation, GDP growth, financial depth*), globalization (*trade*), *foreign-aid* and quality of institutions (*rule of law*). The following discussion is relevant to their expected signs in relation to inequality. We expect: high *inflation* to fuel inequality (Albanesi, 2007) while, low *inflation* should reduce it (Bulir, 1998; Lopez, 2004); *GDP growth* to reduce inequality conditional on even-distribution of the fruits of economic prosperity; *financial depth* decreases uneven income distribution (Kai & Hamori, 2009); the impact of *foreign-aid* depends on the quality of institutions and nature of

development assistance[7]; consistent with recent African inequality literature (Kai & Hamori, 2009, p. 15), *trade openness* should have a negative income-redistributive effect[8] and; the *rule of law* is expected to have an equalizing income-effect.

Details about the variables' definitions and sources of data, descriptive statistics with presentation of countries and correlation analysis (showing the basic correlations between key variables employed in this paper) are presented in the appendices. The summary statistics (Appendix 1) of the variables used in the cross-sectional regressions show that, there is quite a degree of variation in the data utilized so that one should be reasonably confident that estimated relationships should emerge. The object of the correlation matrix (Appendix 2) is to manage issues resulting from overparametization and multicolinearity. Based on the correlation coefficients, there do not seem to be any serious concerns in terms of the relationships to be modeled. Definition and corresponding sources of the variables are reported in Appendix 3.

3.2 Methodology

Due to the cross-sectional structure of our data, we follow an empirical specification employed in the inequality literature for this type of data structure (Andrés, 2006)[9]. This empirical strategy has also been employed in recent African mobile phone literature (Asongu, 2013b). The model to be estimated is as follows:

$$Inequality = \sigma_0 + \sigma_1 Mobile + \sigma_2 Trade + \sigma_3 Inflation + \sigma_4 M2 + \sigma_5 NODA + \sigma_6 RL + \sigma_7 GDPg + \varepsilon \quad (1)$$

where, *Inequality* denotes the GINI coefficient, *Mobile* is the mobile phone penetration rate, *Trade* refers to trade openness, *Inflation* is the inflation rate, *M2* stands for financial depth,

[7] For instance, but for a few exceptions, military targeted aid should not be expected to reduce inequality.
[8] However from intuition, trade can either increase or decrease inequality depending on the proportion of the poor relying on agricultural exports. On the other hand, cheap imports could increase savings and thus, indirectly improve the income-distribution of the population in lower-income brackets. In the same vein, a significant import of 'substitution goods' produced by domestic industries could fuel income-inequality if majority of the poor depend substantially on the affected industries for subsistence income.
[9] An OLS approach with a lot of controls for the omitted variable bias problems is convenient because of lack of good instruments at a macro level necessary for an Instrumental Variable empirical strategy.

NODA represents foreign-aid, *RL* is the rule of law, *GDPg* stands for economic prosperity and, ε is the error term. Robustness of the analysis will be ensured by: (1) use of alternative specifications; (2) modeling with Heteroscedasticity and Autocorrelation Consistent (HAC) standard errors; (3) RAMSEY's Regression Equation Specification Error Test (RESET) for validity of model specification and; (4) modeling with Two-Stage Least Squares to control for endogeneity. Since the baseline modeling is with Ordinary Least Squares (OLS), the four basic concerns of this approach are addressed. While, autocorrelation in residuals and heteroscedasticity are tackled with HAC standard errors, the assumption of linearity is verified with the RESET. As we have already highlighted above, the correlation analysis in Appendix 2 has guided us to avoid issues of multicolinearity and overparametization.

4. Empirical results

This empirical section addresses two main issues: (1) the ability of 'mobile phone penetration' to explain income-inequality conditional on other covariates (control variables) and; (2) the possibility of non-linear combinations of the fitted values explaining the response variable. While, the first issue is addressed by the significance and signs of estimated coefficients, the second depends on the result of RAMSEY's RESET. The intuition behind the RESET is that, if non-linear combinations of the explanatory variables have any power in explaining the response variable, then the model is misspecified. Hence, the RESET is a general specification test for the linear regression model. The null hypothesis of this test is the position that, non-linear combinations of the fitted values have no explanatory power on income-inequality. Thus, failure to reject the null hypothesis lends credit to the linear model specification.

Table 1 reports regressions of inequality on the mobile phone penetration (mobile) channel. At first glance, from a general standpoint, it could be noticed that the linearity assumption in our model specification is valid since all the null hypotheses of the RESET are

not overwhelmingly rejected. The White tests for heteroscedasticity also fail to reject the null hypotheses of no heteroscedasticity. From specific outcomes, it could be established that, 'mobile penetration' has an equalizing income effect. Most of the control variables are significant with the right signs. Financial depth has a positive income-redistributive effect in Africa: consistent with Kai & Hamori (2009). High inflation (above 117% in the mean from Appendix 1) fuels inequality, in line with Albanesi (2007). Trade openness has a negative income-redistributive effect for a significant part of the African continent (Kai & Hamori, 2009).

Table 1: Effect of mobile penetration on inequality (HAC standard errors consistent)

	Dependent Variable: GINI Index					
	Regressions without HAC standard errors			**Regressions with HAC standard errors**		
	Model 1	Model 2	Model 3	Model **1***	Model **2***	Model **3***
Constant	**65.605*** **	**67.834*** **	**74.214*** **	**65.605*** **	**67.834*** **	**74.214*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Mobile penetration	**-17.844** **	**-18.509** **	**-21.837** **	**-17.844*** **	**-18.509*** **	**-21.837** **
	(0.017)	**(0.016)**	**(0.021)**	**(0.003)**	**(0.005)**	**(0.014)**
Trade	**0.084*** **	**0.078** **	**0.077** **	**0.084*** **	**0.078*** **	**0.077*** **
	(0.009)	**(0.023)**	**(0.029)**	**(0.000)**	**(0.002)**	**(0.004)**
Inflation	**0.444** **	**0.508** **	**0.471***	**0.444** **	**0.508** **	**0.471** **
	(0.041)	**(0.041)**	**(0.074)**	**(0.014)**	**(0.013)**	**(0.024)**
Financial depth	**-8.672***	**-9.584***	**-12.392** **	**-8.672***	**-9.584***	**-12.392***
	(0.077)	**(0.068)**	**(0.047)**	**(0.073)**	**(0.081)**	**(0.071)**
NODA	---	-0.068	-0.057	---	-0.068	-0.057
		(0.560)	(0.633)		(0.565)	(0.588)
Rule of Law	---	---	1.825	---	---	1.825
			(0.437)			(0.283)
GDP growth	---	---	0.321	---	---	0.321
			(0.614)			(0.530)
RAMSEY RESET	**1.505**	**1.536**	**1.745**	**1.505**	**1.536**	**1.7455**
	(0.242)	**(0.237)**	**(0.200)**	**(0.243)**	**(0.237)**	**(0.200)**
White's test	**15.322**	**21.421**	**7.272**	**15.322**	**21.421**	**7.272**
	(0.356)	**(0.372)**	**(0.923)**	**(0.356)**	**(0.372)**	**(0.923)**
Adjusted R^2	0.492	0.478	0.456	0.492	0.478	0.456
Fisher	**8.023*** **	**6.321*** **	**4.480*** **	**12.153*** **	**9.004*** **	**6.106*** **
Observations	52	52	52	52	52	52

*;**;***: significance levels of 10%, 5% and 1% respectively. HAC: Heteroscedasticity and Autocorrelation Consistent. NODA: Net Official Development Assistance. P-values in brackets.

Table 2 below reports results of an Instrumental Variable (IV) Two Stage Least Squares (2SLS) approach. Since, "mobile phone penetration" can be assimilated to "mobile banking" (Ondiege, 2010; Aker & Mbiti, 2010), we employ instrumental variables documented in the finance-growth literature. We are limited to only two control variables because of constraints in degrees of freedom necessary for the Sargan overidentifying restrictions (OIR) test of

instrument validity[10]. From the results: (1) endogeneity does not appear to be an issue in the data set (see Hausman test); (2) the instruments are valid (see Sargan test) and; (3) but for a slight change in the magnitude of the estimated coefficients, the signs and significance of the independent variables are the same as in Table 1.

The results are broadly consistent with recent African literature (Asongu, 2013c,d; Asongu, 2012a,b). Accordingly, the growth of information and communication technologies (ICTs) has been documented to have a positive income-redistributive effect through software piracy (Asongu, 2013c). Generally, the ICTs sector has positively affected the informal financial sector (Asongu, 2012a) which in tend has had an inequality mitigating effect (Asongu, 2013d) or a general improvement of African paths towards knowledge-based economies (Asongu, 2012b).

Table 2: Robustness checks with a Two-Stage Least Squares approach

	Dependent Variable: GINI Index					
	Regressions without HAC standard errors			**Regressions with HAC standard errors**		
	Model 1	Model 2	Model 3	Model **1***	Model **2***	Model **3***
Constant	**72.232*** **	**75.707*** **	**77.887** **	**72.232*** **	**75.707*** **	**77.887*** **
	(0.000)	**(0.000)**	**(0.014)**	**(0.000)**	**(0.000)**	**(0.002)**
Mobile penetration	**-17.099***	**-23.607*** **	-24.819	-17.099	**-23.607*** **	**-24.819** **
	(0.073)	**(0.003)**	(0.104)	(0.153)	**(0.000)**	**(0.039)**
Inflation	**---**	**0.852** **	**0.846***	---	**0.852** **	**0.846** **
		(0.038)	**(0.056)**		**(0.021)**	**(0.021)**
Financial depth	---	---	-0.508	---	---	-0.508
			(0.974)			(0.975)
Hausman test	0.330	2.340	1.676	0.330	2.340	1.676
	(0.565)	(0.310)	(0.642)	(0.565)	(0.310)	(0.642)
Sargan OIR	**3.022**	**0.721**	**0.597**	**3.022**	**0.721**	**0.597**
	(0.388)	**(0.697)**	**(0.439)**	**(0.388)**	**(0.697)**	**(0.439)**
Adjusted R^2	0.083	0.289	0.273	0.083	0.289	0.273
Chi-Square	**3.200***	---	---	2.038	---	---
Fisher	---	**6.294*** **	**4.057** **	---	**9.266*** **	**6.205*** **
Observations	52	52	52	52	52	52
Instruments	Lower Middle Income, Middle Income, English Legal origin, Christian domination					

*;**;***: significance levels of 10%, 5% and 1% respectively. HAC: Heteroscedasticity and Autocorrelation Consistent
. P-values in brackets. OIR: Overidentifying restrictions test.

[10] An OIR test is only employable in the presence of over-identification. That is, the instruments must be higher than the endogenous explaining variables by at least one degree of freedom. In the cases of exact-identification (instruments equal to endogenous explaining variables) and under-identifications (instruments less than endogenous explaining variables) an OIR test is by definition not possible.

5. Concluding remarks

The aim of this paper has been to complement theoretical literature with empirical evidence on the income-redistributive effect of mobile phone penetration. The findings suggest that mobile penetration is good for the poor, as it has a positive income-redistributive effect. This equalizing incidence could be explained from several angles. Firstly, many lives have been transformed by the mobile revolution thanks to basic financial access in the form of phone-based money transfer and storage (Jonathan & Camilo, 2008; Demombynes & Thegeya, 2012). Hence, the significant growth and penetration rates of mobile telephony that is transforming cell phones into pocket-banks in Africa is providing countries in the continent with increase affordable and cost-effective means of bringing on board a large part of the population that have until now been excluded from formal financial services for decades.

Secondly, mobile phones can assist households' budget when faced with unpredictable shocks which drive poverty. The probability of a poor family incurring drastic loss due to an unpredictable shock is certainly mitigated and lowered when families are able to respond to the shock in a more timely fashion. Hence, the mobile phone could have the greatest effects on poverty reduction during vulnerable shock experiences through driving down costs associated to the shock. Better financial management and coping with shock include: incurring lower travel costs, more efficient action, less trauma and improved access to information. Immediate positive feedbacks of income saving and cost mitigation are found particularly during vulnerable situations like death or illness in the family. It is also interesting to cite security increases for poor families through reduced loss of poverty. For instance, a family's ability to scale-down the number of overnight hospital days or capacity to avoid transport cost during desperate situations are some major cost saving strategies implemented with the quick dial of the mobile phone. In a nutshell, the communication device provides a means of timely

response, reduced surprises, multi-task and plans during shocks, as well as less time to physically search individuals during difficult ordeals.

Thirdly, mobile phones could empower women to engage in small businesses (and/or run existing businesses more efficiently), hence enabling them to bridge the gap between gender income inequality.

It is also interesting to point-out that, mobile phones represent long-term economic growth investments for the disadvantaged in income-distribution. Hence, many households maybe willing to cope with unpleasant sacrifices (such as reduction in food consumption or sanitation in the perceived short-term) in the hope that, the mobile phone would improve their opportunities with income and jobs in the long-term.

Appendices

Appendix 1: Summary statistics

		Mean	S.D	Min	Max	Observations
GINI Coefficient		43.100	7.702	29.760	65.770	52
Mobile Penetration		1.674	0.217	1.043	2.242	52
	Trade	82.221	37.303	34.609	211.28	52
	Inflation	117.95	764.60	1.953	5304.8	52
Control	Financial Depth	0.339	0.242	0.079	1.022	52
Variables	NODA	11.015	12.229	0.0549	65.461	52
	Rule of Law	-0.703	0.667	-2.419	0.950	52
	GDP growth	4.760	3.087	-6.959	12.894	52

S.D: Standard Deviation. Min: Minimum. Max: Maximum.

Appendix 2: Correlation matrix

Mobile	Trade	Inflation	Fin. depth	NODA	R. of Law	GDPg	GINI	
1.000	-0.444	-0.031	-0.496	0.268	-0.367	0.255	-0.3355	Mobile
	1.000	0.026	0.268	-0.160	0.147	-0.107	0.451	Trade
		1.000	-0.092	-0.024	-0.258	-0.569	0.161	Inflation
			1.000	-0.259	0.665	-0.234	0.170	Fin. depth
				1.000	-0.262	-0.083	-0.198	NODA
					1.000	0.075	0.115	R. of Law
						1.000	-0.272	GDPg
							1.000	GINI

Fin: Financial. NODA: Net Official Development Assistance. R. of Law: Rule of Law.

Appendix 3: Variable definitions

Variables	Signs	Variable definitions	Sources
Inequality	GINI	GINI Inequality Index	WDI
Mobile Phone Penetration	Mobile	Seven year average growth rate (% of population)	AfDB
Trade Openness	Trade	Export plus Imports of commodities (% of GDP)	WDI
Inflation	Inflation	Consumer Price Index (Annual %)	WDI
Financial Depth	M2	Money supply (% of GDP)	FDSD
Rule of Law	RL	Rule of Law (Estimate)	WDI
Economic Prosperity	GDPg	Gross Domestic Product (Annual %)	WDI

WDI: World Development Indicators. AfDB: African Development Bank. FDSD: Financial Development and Structure Database.

Acknowledgements
This author is highly indebted to the editor and referees for useful comments.

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