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Mobile Banking Impact on Income and Wealth Inequality

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Abstract
This paper examines the impact of mobile banking on income and wealth distribution across different quantiles at the micro-level by exploiting the instrumental variable of the quantile treatment effect approach. The impact of mobile banking on income seems to be higher at the bottom 25th quantile, suggesting financial inclusion through mobile banking significantly affects the bottom poor households compared to top rich households. Similarly, access to mobile banking services narrows wealth disparities between the bottom 10th and 90th quantiles, suggesting it disproportionately benefits the poor than the rich in terms of wealth accumulation.

Keywords: *Mobile Banking, Inequality, Quantile, Income and Wealth Index*

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I. Introduction

In the past decade, low-income countries have made substantial progress growing their economies, but the slow pace of this growth has arguably resulted in the widening of the welfare inequality gap (Niño-Zarazúa, et. al. 2017; Tita & Aziakpono, 2017; Berman et al.; 2016; Allen et al.; 2012). However, in the recent past, financial inclusion has attracted greater debate on its role in spurring economic development and as a tool for poverty reduction, particularly to the formerly excluded population from the formal banking system (Demirgüç-Kunt & Klapper, 2012; Bhavnani, et al., 2008; Claessens & Perotti, 2007; Beck, et al., 2007; Burgess & Pande, 2005). The Findex database suggests that 74 percent of high-income households across the globe participated in the formal financial services, with 61 percent among the low-income households owning abank account by end 2017 (Demirguc-Kunt, et al., 2018).

Indeed, increased developments in the formal banking sector has also provided favorable prospects for a solid growth of other financial innovations designed to benefit the poor population (Gruber & Koutroumpis, 2011; Nanziri, 2016; Park and Mercado; 2015; Nolen, 2008). In particular, mobile money finance has overtime and space expanded financial inclusion, particularly in Sub-Saharan Africa, resulting in dramatic behavioral change among the formerly excluded individuals from formal financial services (Pal & Pal, 2014; Neaime & Gaysset, 2018; Rosengard, 2016; Blechman, 2016). These disruptions of financial services provision impacted by the mobile financial revolution are crucial in addressing the concerns of inclusive development underpinning the SustainableDevelopment Goals (Dabla-Norris, et al., 2015; Orotin, et al., 2014; Aggarwal, Demirgüç-Kunt, & Pería, 2011; Johnson & Nino-Zarazua, 2011; Jalilian & Kirkpatrick, 2005). In particular, the banking sector has partnered with digital mobile service providers to steadily spur financial inclusion in most of the developing countries and this to some ex-tent has arguably eased access to formal financial services (Asongu & Odhiambo, 2019;Tita & Aziakpono, 2017; Law, Tan, & Azman-Saini., 2014).

Despite, rapid development of basic mobile money platform in the provision of formal financial services, its integration with bank led mobile money systems remains largely unexplored. This study, therefore, endeavors to fill this knowledge gap by exploring various channels through which bank-led mobile money services (henceforth mobile banking) influences household's decisions on income and wealth acquisition at the

micro-level.[1] Specifically, we explore the impact of mobile banking on household incomes proxied by consumption expenditure and household asset composition.

Figure 1: Source: Author's Gini Coefficients Calculation for Sub-Saharan using World Income Inequality Data.

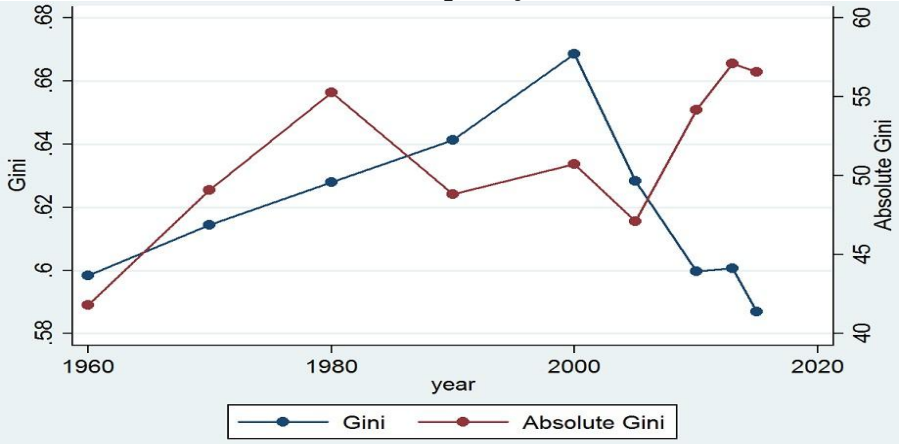


Figure 1 above shows how Sub-Saharan Africa income inequality measured in terms of relative and absolute GINI coefficients have unprecedentedly increased since 1960 through early 2000 and mid 1990 with mixed magnitude beyond 2000's, respectively.[2]

II. Related Literature

Kuznets, (1955) in his paper" Economic Growth and Income Inequality" finds income in- equalities distribution to have narrowed in developed countries due to increased economic growth and data quality. In particular, extending financial services to the rural poor can significantly spur economic development and serve as a tool for poverty reduction (Blumenstock, et al., 2015; Adongo & Deen-Swarray, 2006; Burgess & Pande, 2005; Levine, Loayza, & Beck, 2000). However, income inequality, weak legal framework, and bad governance could potentially affect access to financial services in developing countries (Law, et al., 2014; Rojas-Suarez, 2010). Similarly, unequal access to financial services and the political landscape can influence income distribution (Claessens & Perotti, 2007)

Mallick & Rafi, (2010) using rural Bangladesh micro-level data examines food security between male-headed and female-headed households. Their findings suggest that empowered women are more likely to participate in the labor market in the absence of retrogressive social and cultural norms. Using a panel of 8 countries in the Middle East and North Africa (MENA) overthe period 2003-2016, Neaime & Gaysset, (2018), find a significant impact of financial development on income inequalities and financial stability but does not affect poverty. Samer, Majid, Rizal, & Muhamad, (2015) show that increased access to financial services provide an incentivefor women to participate in income-generating activities. In contrast, Nanziri, (2016) fails to establish a welfare effect on users of financial products across gender. However,her results suggest that women are the majority user of informal financial services, while men are better users of formal financial services.

Studying the effect of expansion of bank branches in rural India, Burgess & Pande, (2005) conclude that increased access to financial services potentially benefits the rural poor, thereby uplifting their welfare. Similar work by Pal & Pal, (2014) explains the financial landscape in India and found the unequal distribution of access to financial services between the poor and the rich. Beck, Demirgüç-Kunt, & Levin, (2007) opine that increased financial development reduces income disparities among the poorest quantile individuals by 40 percent and 60 percent on aggregate. They also suggest that financial development enhances poor household's economic welfare. Asongu & Odhiambo, (2019) uses a cross- country analysis of 93 developing countries to investigate the effect of mobile money of inequality and poverty. Their findings suggest that increased usage

[1] Mobile Banking is defined as the provision of unsecured banking services through linking mobile phone applications with individual's bank accounts (See work by Cook & McKay, (2015) and Demombynes & Thegeya, (2012) for further details.)

[2] See Niño- Zarazúa, Roope, & Tarp, (2017) and Sala-i-Martin & Pinkovskiy, (2010) for other regions income in- equalities comparisons.

of mobile money can have a positive effect on growth, and act as a tool for reducing poverty and income disparities.

The empirical analysis of income and wealth inequalities suggests that an inclusive financial system free of financial market failures and associated transaction costs can play a pivotal role in addressing income and wealth disparities (Nanziri, 2016; Dabla-Norris, et al., 2015; Blumenstock, et al., 2015; Mallick & Rafi, 2010; Claessens & Perotti, 2007). However, the recent expansion of mobile driven financial solutions and substantial improvement in the empirical techniques and researches on financial inclusion alongside the availability of micro-level data, allows for pragmatic inquiry on the causal l ink of the mobile banking on income and wealth distribution at the micro-level.

Thus, the main research question considers the interrelated literature that has extensively reported on the welfare-enhancing financial innovations by seeking to ask if access to mobile banking as a form of financial inclusion leads to reduction in income and wealth inequalities. Also, the study aims to serve as a guide to policymakers to formulate and implement far-reaching reforms with a focus to strengthen formal financial services at the micro-level and beyond. It also extends the literature on the role of digitally-driven financial inclusion as a tool for poverty reduction. Overall, the results suggest that access to mobile banking could significantly increase consumption for the bottom poor individuals compared to top rich individuals.

The other sections of the study are organized as follows: Section 3 discusses the data sources, variables description and descriptive summary statistics. The identification strategy is presented in Section 4, while empirical results and heterogeneous effects are discussed in Section 5. The study concludes and provides policy direction in Section 6.

III. Data Sources

3.1 Survey

The empirical analysis for this study draws its data from a cross-sectional household survey FinAccess 2015/2016 administered by Financial Sector Deepening (FSD) Kenya in partnership with Central Bank of Kenya and Kenya National Bureau of Statistics (KNBS). It is the fourth nationally representative financial access survey conducted in August to October 2015 and designed to periodically assess access and demand for financial services overtime (Central Bank of Kenya, et al., 2016).[3]

A multi-stage stratification technique was applied to a sample of 8,665 household randomly selected adults aged 16 years old and above from 165 primary sampling units (PSUs).[4] The survey captures information on household demographic characteristics, household expenditure patterns, sources of household incomes, household access to and product usage of financial services, and other household's characteristics that include assets ownership, household risks, and vulnerability. We also derived a wealth index of household ownership of durable assets using factor analysis and extract the first-factor loading with the highest variation as the measure of household wealth.

We compliment the main survey using FinAccess 2016 geo-spatial mapping collected by Bill & Melinda Gates Foundation, Financial Sector Deepening Kenya, Kenya National Bureau of Statistics & Central Bank of Kenya to generate our instrument of interest. This survey provides close to 92,000 geographical locations of mobile agent networks and other financial access points, and included 27,684 market locations and other agricultural out-lets across the country (see figure 7 for mobile agents' network distribution after merging both data sets).

3.2 Descriptive Summary Statistics

The summary statistics are reported in the appendix under table 3 below presents of the household characteristics. On average, mobile banking users spend roughly KSh 2100 ($21) per month for consumption purposes, with the majority of the household's units dominated by younger male heads who are relatively married. Also, a household unit has four members who have at least two younger children attending school. In terms of education levels, the majority of mobile banking users have attained secondary education compared to non-users who are likely to have completed primary education. Financial literacy and numeracy play a vital role in the usage of financial products with users of mobile banking reporting to know interest rates, collateral, and inflation rate, while a majority have numerical skills. A significant proportion of households exposed to mobile banking are more likely to participate in off-income activities compared to non-users who prefer engaging in farming. A conventional view is that mobile banking usage could potentially be endogenous, thus the results

[3] All waves are publicly available from www.fsdkenya.org.

[4] The FinAccess 2015/16 sampling frame was constructed using KNBS NASSEP. We adjust all empirical results using the sample weights provided both at the individual proportion to the total adult population. FinAccess 2015/16 includes geo-spatial information upon request from FSD Kenya.

may be overstated or understated. Therefore, we instrument mobile banking using proximity to mobile money agent outlets as an instrument.[5]

Table 4 and Figure 5 in the appendix shows the mean, standard deviation and factor loading of an individual. The wealth index derived from principal component analysis averaged 37.2 percent with a standard deviation of 0.22. The model of fit for the wealth index is adequately appropriate as indicated by the Kaiser-Meyer-Olkin measure of sampling adequacy that is greater than 0.6. On the average majority of the individuals own mobile phones as the main assets, live in a permanent or semi-permanent house, have more than two bedrooms with few having piped water in their homestead. Likewise, about 46.6 percent of the total sample have electricity as the main source of lighting.[6]

IV. Identification Strategy

To explore the effects of mobile banking on income and wealth distribution across different quantiles, we exploit the unconditional quantile treatment effects under endogeneity approach documented by Chernozhukov & Hansen, (2005), Frölich & Melly, (2013) and in Abadie, Angrist, & Imbens, (2002), to account for endogeneity arising from systematic differences in mobile banking as a form of formal financial services. Thus, we protract a linear function of the form:

$$Y_i = f(MB_i), X_i, \epsilon_i \qquad (1)$$

Where Y_i is the outcome of interest measured by household expenditure per adult equivalence and wealth index, MB_i is a dummy variable assuming a value of one if the respondent has access or uses mobile banking, 0 otherwise; X_i is a vector of covariates influencing the outcome variables and comprises of gender, age, marital status, financial literacy and numeracy, number of children attending school, completed education levels, urban dummy, occupation status (farmer, employed and dependent), and proximity to infrastructural developments, while ϵ_i is the disturbance error term assumed to be normally distributed at mean zero. Furthermore, we derive a linear quantile treatment effect as follows:

$$Y^m = X_i\beta^\tau + MB_i\delta^\tau + \epsilon_i \; ; \; Q^\tau_{\epsilon i} = 0 \qquad (2)$$

where i=1..., n and $M \in (0,1)$, while β^τ and δ^τ, are the unknown parameters of the model, with δ^τ representing unconditional quantile treatment effects τ. Also $Q^\tau_{\epsilon i}$ is defined as the τ^{th} quantile of an unobserved error term ϵ_i. From equation (1) vector M_i is assumed to be potentially endogenous and follows:

$$MB_i = \emptyset(Z_i, u) \qquad (3)$$

Where, Z_i is a vector of excluded instrument correlated with the treatment variable, and not correlated with other outcome of interest, and u, is a scalar of the error term. The aim is to identify the distributional impact of MB_i on potential outcome variable Yi (continuous variable). Given that both MB_i and Z_i are dummies, and such that Y_i^1 and Y_i^0 are the potential outcome for the individual i, where superscript, 1=user and 0=non- user of mobile banking, then the quantile treatment effect for τ^{th} quantile corresponding to the distributional effect of mobile banking follows:

$$\Delta^\tau = Q^\tau_{Y_i^1} - Q^\tau_{Y_i^0} \qquad (4)$$

M_i is endogenous and can only be identified through the instrumental variable, Zi. Therefore, allowing the MB_i to be arbitrarily heterogeneous, then it follows that the impact is identified for the population that complied to changes in the instrument (Frölich & Melly, 2013). Thus, the quantile treatment effect for the compliers (c) is given as:

$$\Delta^\tau = Q^\tau_{Y_i^1|c} - Q^\tau_{Y_i^0|c} \qquad (5)$$

Where Δ^τ_c is a partial unconditional eff ect of mobile banking use, given that the condition applies only to the compliers and excludes other covariates. Therefore, the overall bivariate quantile regression estimator is derived

[5] Our instrument is a dummy, where it equals one if an individual lives less than one-kilometer radius from a mobile money agent outlet and zero otherwise (Angrist & Pischke, 2008).

[6] This can be explained in part by the Government of Kenya program dubbed" Last Mile" aimed at connecting most of the Kenyans to the national grid.

using the optimization problem following Frölich & Melly, (2013) as follows:

$$(\alpha_{iv}, \Delta_{iv}) = \arg\min_{\alpha,\Delta} \sum \omega_i \, \rho_\tau(Y_i - \alpha - MB_i\Delta) \qquad (6)^7$$

V. Empirical Results

In the spirit of Blaylock & Smallwood, (1982) the study motivates the empirical findings using Lorenz curve approach, which examines the proportion of the entire wealth or expenditure that is accounted for by a certain fraction of the total household.

Figure 2: Lorenz Curve for total household's expenditure

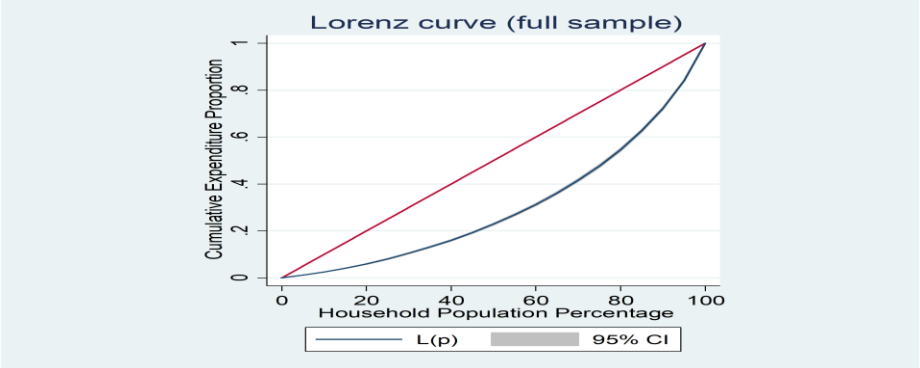
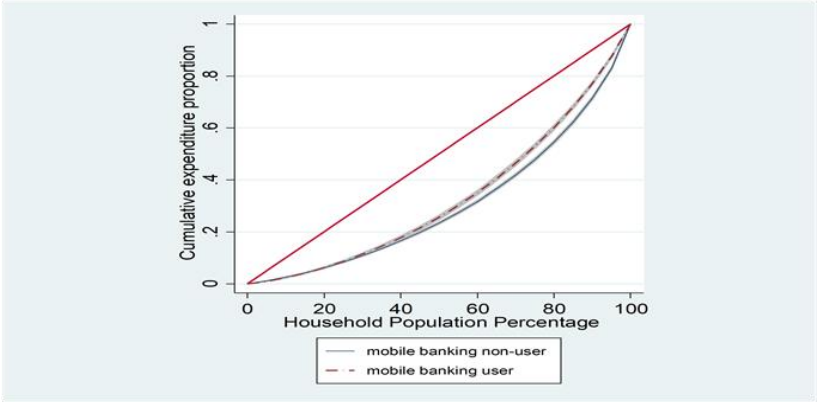


Figure 2 above indicates the Lorenz curve for the entire household's expenditure distribution and it is evident that roughly 40 percent of the total households in the data share less than 20 percent of the cumulative expenditure of the entire population. While, Figure 3 below indicates that the expenditure distribution for accessibility of mobile banking is somewhat less unequal compared to that of non-users, which is an indication of the re-distributive effect of income of the households. Incomes equalize slightly above 40 percent where the two curves separate from each other.

Figure 3: Lorenz Curve by mobile banking status



In support of this Figure 6 in the appendix shows distribution of household consumption across different quantiles. It is evident that the bottom 90 percent are moderately better off if exposed to integrated mobile banking, while the top 10 percent are fairly worse off, while the corresponding Gini coefficient is more than 50 percent for non-user of mobile banking suggesting that exposure to mobile banking improves household's consumption patterns.

[7] Given that,

$$\omega_i = \frac{\mathrm{Z}_i - (1 - \mathrm{pr}(\mathrm{Z}=1|X_i))}{\mathrm{pr}(\mathrm{Z}=1|X_i)(1 - \mathrm{pr}(\mathrm{Z}=1|X_i))}(2MB_i)$$

Where ω_i are nonnegative weights that provide balances between the distribution of the covariates for mobile banking user and non-users.

Figure 4: Welfare ordering of Lorenz curve

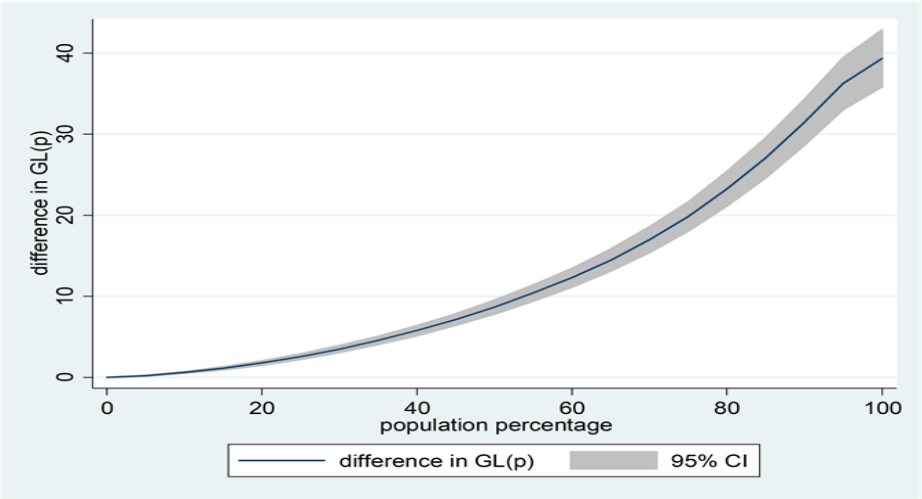


Figure 4 above shows cumulative mean expenditure for users and non-users of mobile banking and suggests unequal expenditure distribution of access to mobile banking. That is, expenditure distribution of access to mobile banking dominates the expenditure distribution of those without access/users, thus it is more desired from a welfare point of view.

5.1 Main Findings

Table 1 and Table 2 reports the instrumental variable of quantile treatment effect empirical results (Frölich & Melly, 2013). Table 1 below results suggest that access to mobile banking increases household consumption in all expenditure distribution though not uniformly distributed across all income levels. For instance, the coefficient for expenditure at 10^{th} and 25^{th} quantiles are higher than that of the 75^{th} and 90^{th} quantiles. The effect of mobile banking on income seems to be higher at the bottom 50^{th} quantile level, suggesting financial inclusion through mobile banking significantly affect the bottom half compared to top rich household

Table 1: Mobile banking Impact on income inequality

	Quintiles				
	(10)	(25)	(50)	(75)	(90)
Mobile Banking	0.668***	0.671***	0.635***	0.565***	0.503***
	(0.15)	(0.11)	(0.09)	(0.10)	(0.15)
Age	0.069*	0.037*	0.024	0.037**	0.037*
	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)
Financial Literacy	0.134	0.157*	0.138**	0.090	0.193*
	(0.08)	(0.08)	(0.05)	(0.07)	(0.08)
Numeracy	0.148	0.127*	0.117*	0.148*	0.156*
	(0.09)	(0.06)	(0.05)	(0.06)	(0.07)
Married	0.505**	0.384***	0.359***	0.291**	0.188
	(0.16)	(0.11)	(0.10)	(0.10)	(0.13)
Urban	0.315**	0.324***	0.315***	0.290**	0.153
	(0.12)	(0.08)	(0.08)	(0.09)	(0.12)
Primary School	-0.111	-0.305*	-0.370**	-0.357**	-0.363*
	(0.20)	(0.14)	(0.14)	(0.12)	(0.18)
High School	-0.124	-0.373*	-0.341*	-0.335*	-0.318
	(0.19)	(0.17)	(0.16)	(0.14)	(0.21)
Farming	0.621*	0.414**	0.329*	0.303*	0.190
	(0.28)	(0.15)	(0.14)	(0.14)	(0.19)
Wages	0.740**	0.476***	0.384**	0.261*	0.185
	(0.26)	(0.14)	(0.13)	(0.13)	(0.16)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	6046	6046	6046	6046	6046

*Note: Dependent variables: logarithm of total household consumption per adult equivalence, while Mobile Banking is instrumented using proximity to mobile money outlet dummy, other controls includes family size, number of children, male head, tertiary education, age squared, number of social networks, and durations to infrastructural developments such as schools and health centres. Robust standard errors are reported in parentheses. ***, ** and * represent significant at 1%, 10%, and 5%.*

5.2 Robustness check

Table 2 reports the effect of mobile banking on wealth distribution. The findings suggest that access to mobile banking decreases the likelihood of wealth disparities between the 10^{th} and 90^{th} quantiles from 24.5 percent to 17.4 percent, respectively. That is the poorer an individual is the more they accumulate wealth. Overall, improving financial inclusion through mobile banking could potentially narrow individual's income inequalities and wealth disparities between the bottom 10^{th} and 90^{th} quantiles.

Table 2: Mobile banking Impact on wealth inequality

	Quintiles				
	(10)	**(25)**	**(50)**	**(75)**	**(90)**
Mobile Banking	0.245**	0.419***	0.524***	0.348*	0.174*
	(0.08)	(0.09)	(0.14)	(0.15)	(0.09)
Age	-0.016	-0.014	-0.007	0.000	0.003
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
Financial Literacy	0.023	0.044	0.108	0.203*	0.204***
	(0.04)	(0.04)	(0.08)	(0.10)	(0.06)
Numeracy	0.028	0.051	0.029	0.035	0.014
	(0.04)	(0.04)	(0.05)	(0.07)	(0.06)
Married	0.163*	0.229**	0.200*	0.092	0.111
	(0.08)	(0.08)	(0.10)	(0.11)	(0.10)
Urban	0.188**	0.384***	0.721***	0.849***	0.688***
	(0.07)	(0.08)	(0.11)	(0.14)	(0.10)
Primary School	-0.029	-0.007	0.012	0.252*	0.458*
	(0.08)	(0.08)	(0.11)	(0.13)	(0.22)
High School	0.051	0.096	0.295	0.610***	0.743***
	(0.10)	(0.10)	(0.17)	(0.18)	(0.22)
Tertiary Education	0.345	0.598**	0.704**	0.715***	0.909***
	(0.19)	(0.19)	(0.24)	(0.18)	(0.21)
Farming	0.003	-0.028	-0.128	-0.258	-0.360*
	(0.08)	(0.10)	(0.14)	(0.14)	(0.15)
Wages	0.091	0.079	-0.051	-0.089	-0.113
	(0.08)	(0.09)	(0.15)	(0.13)	(0.13)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	6046	6046	6046	6046	6046

*Note: Dependent variable is wealth index, while Mobile Banking is instrumented using proximity to mobile money outlet dummy, other controls includes family size, number of children, male head, age squared, number of social networks, and durations to infrastructural developments such as schools and health centres. Robust standard errors are reported in parentheses. ***, ** and * represent significant at 1%, 10%, and 5%.*

VI. Conclusion and Policy Direction

This study sought to explore the distributional effect of mobile banking on income in- equality and wealth disparities at different quantiles. The findings on the effect of mobilebanking on income suggest that mobile banking significantly affects the bottom poor compared to top rich households. Similarly, access to mobile banking services narrows wealth disparities between the bottom 10^{th} and 90^{th} quantiles. These suggest that accessto mobile banking services disproportionately benefits individuals at the lower quantile who are poor than those who fall in the upper quantiles and are likely to be rich.

These findings provide empirical evidence on the role of financial inclusion on incomeand wealth inequality that can inform policymakers on the effect of increased access to financial services. This could be attributed to robust financial reforms tailored towards benefiting the poor; and increased financial restructuring that has provided an enabling environment for financial product development. However, there should be a public-private collaboration tailored towards expanding digital mobile finance solutions, particularly funding research and development.

Similarly, digital service providers should also intensify public campaigns of new products developments in the market. lastly, encourage frequent knowledge-sharing channels through which digital mobile finance providers and regulators can evaluate the deployment of digital financial services to enhance services delivery as well as protect consumers.

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Appendices

Table 3: Descriptive summary statistics

	Mobile Banking									
	Users					Non-Users				
Variables	Obs.	Mean	SD	Min	Max	Obs.	Mean	SD	Min	Max
Total Consumption (KSh 000')	1294	21.157	12.390	3	55	5961	13.836	9.971	3	55
Wealth Index	1519	0.842	0.994	-1	3	7003	-0.154	0.911	-1	3
Mobile Agent Outlet	1508	0.286	0.452	0	1	4652	0.444	0.497	0	1
Male Head	1519	0.617	0.486	0	1	7003	0.459	0.498	0	1
Married	1519	0.612	0.488	0	1	7003	0.607	0.488	0	1
Age	1519	32.745	10.931	16	80	7003	38.674	17.602	16	100
Age Squared	1519	11.917	8.701	3	64	7003	18.055	16.675	3	100
Family Size	1519	3.732	2.315	1	20	7003	4.381	2.464	1	18
#School Children	1519	1.530	1.734	0	14	7003	1.933	1.842	0	13
Primary School	1519	0.259	0.438	0	1	7003	0.510	0.500	0	1
High School	1519	0.464	0.499	0	1	7003	0.267	0.442	0	1
Tertiary Education	1519	0.270	0.444	0	1	7003	0.062	0.241	0	1
Urban	1519	0.610	0.488	0	1	7003	0.302	0.459	0	1
Financial Literacy	1519	2.579	0.607	1	3	7003	1.863	0.783	1	3
Numeracy	1519	2.363	0.701	1	3	7003	1.807	0.792	1	3
Farming	1519	0.181	0.385	0	1	7003	0.344	0.475	0	1
Wages	1519	0.703	0.457	0	1	7003	0.444	0.497	0	1
#Social Network	1519	1.054	1.215	0	4	7003	0.650	0.959	0	4
School Duration	1487	1.755	0.491	1	3	6849	1.893	0.498	1	3
Hospital Duration	1519	1.729	0.499	1	3	7003	1.890	0.486	1	3

Note: Also see Table 5 in the appendix for full variables descriptions and definitions.

Table 4: Summary statistics (Wealth index indicators)

Variables	Definition	Mean	SD	Factor Loading
House Type	1= permanent; = 0 traditional	0.688	0.463	0.402
House Floor	1=cement, tiled, 0=others	0.308	0.462	0.282
House Wall	1= brick, stone; = 0 mud, wood	0.379	0.485	0.236
Cooking Fuel	1= electricity; = 0 others	0.247	0.431	0.542
Lighting Source	1= electricity; = 0 others	0.466	0.499	0.421
Toilet Type	1= flush toilet; = 0 others	0.219	0.414	0.607
Water Source	1= Piped; = 0 others	0.240	0.427	0.682
Television	1= television; = 0 others	0.308	0.462	0.344
Refrigerator	1= refrigerator; = 0 others	0.055	0.228	0.381
Stove	1= Stove; = 0 others	0.020	0.139	0.560
Iron Box	1= Electric; = 0 others	0.366	0.482	0.636
Kitchen Sink	1=Kitchen Sink; = 0 others	0.063	0.242	0.426
VCD/DVD	1= VCD/DVD; = 0 others	0.227	0.419	0.360
Frying Pan	1= frying pan; = 0 others	0.337	0.473	0.606
Mobile Phone	1= own phone; = 0 others	0.753	0.431	0.798
Car	1=own car, motorcycle; 0 others	0.121	0.326	0.747
Sleeping Rooms	Number of Sleeping rooms	1.576	0.686	0.591
Kaiser-Meyer-Olkin measure of sampling adequacy equals 0.900				

Figure 5: Wealth Index Factor Loading

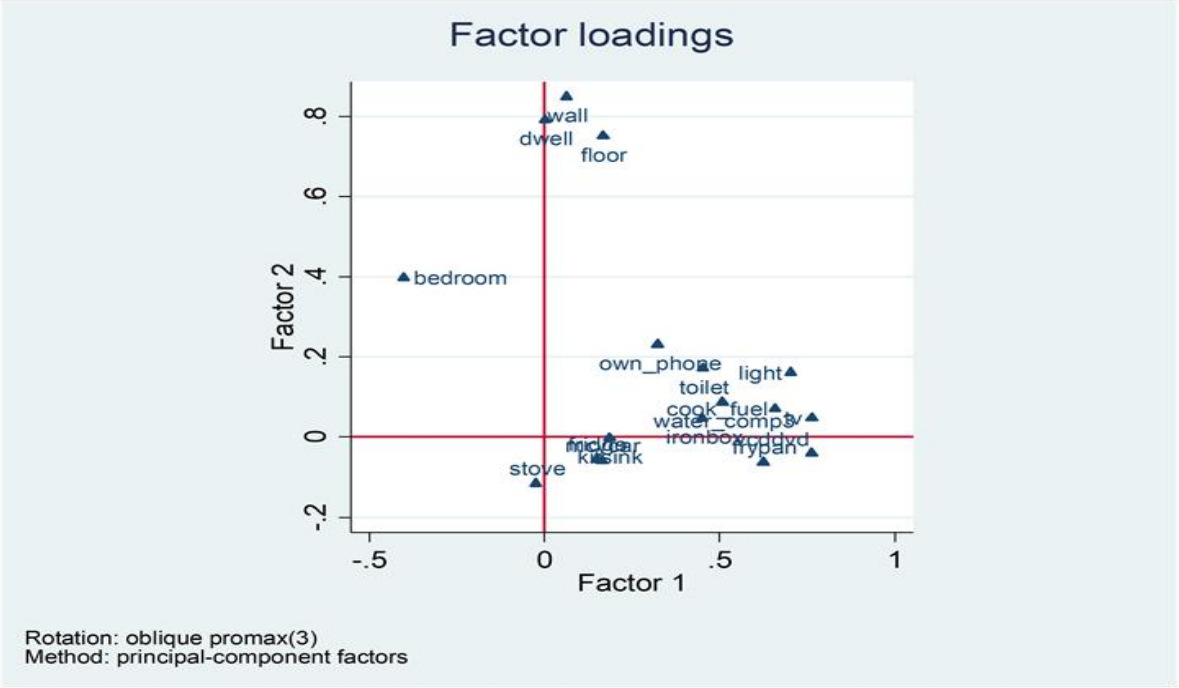

Figure 6: Percentile share for household's consumption

Figure 7: Distribution of mobile agents' network.

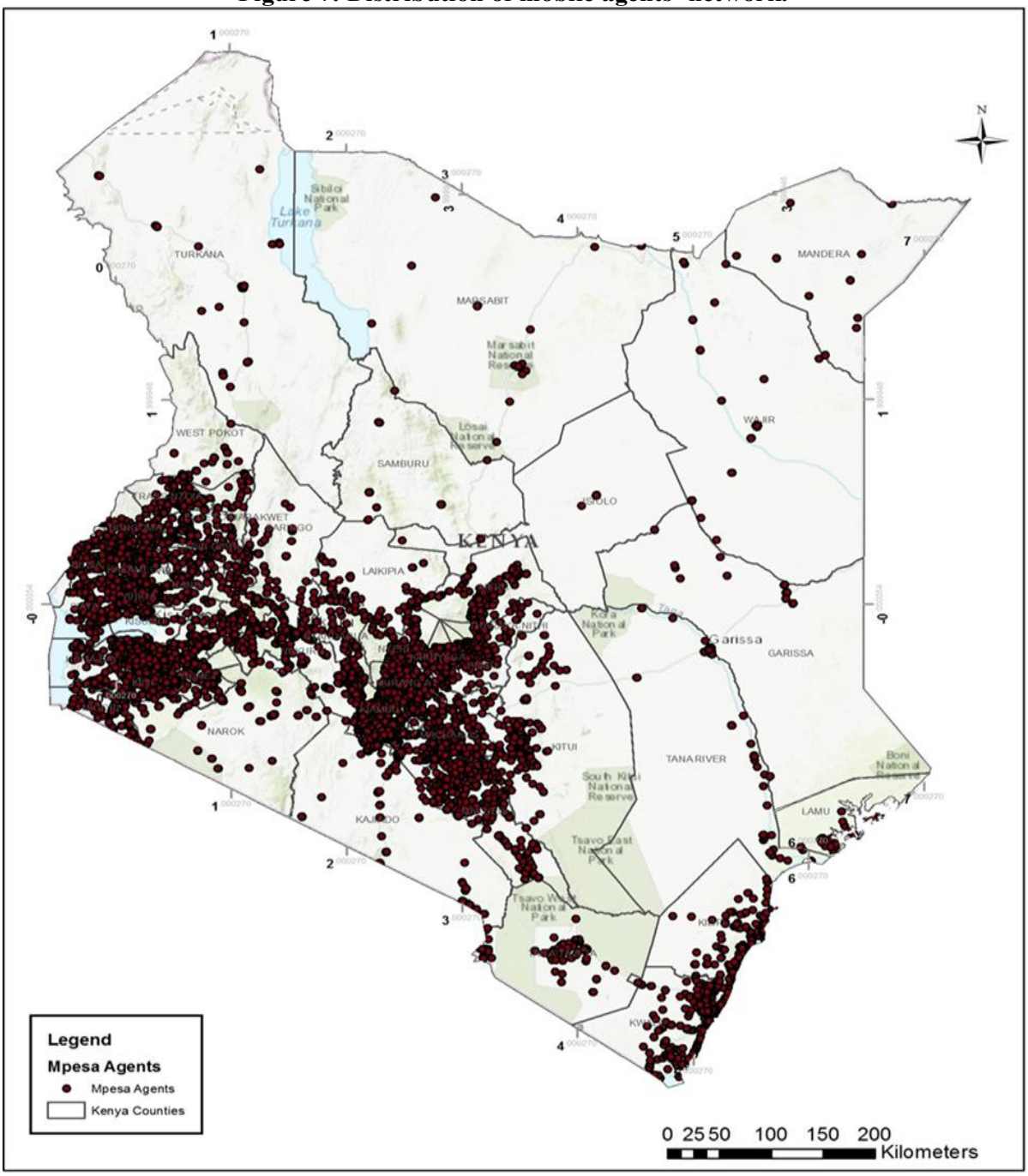

Table 5: Variables definition and units of measurement)

Variables	Defination	Units
Integrated Mobile Banking (IMB)	Equals one if respondent actively uses or has access to IMB, zero otherwise	Dummy
Total Consumption (KSh)	Spending on food consumption and non-food consumption in thousands Kenya Shilling	Continous
Mobile money agent outlet	Equal one if it take less than 1 km radius to walk to a mobile money outlets	Dummy
Age	Indicate the age of respondent	Years
Male Head	Equal one if the household head is male, zero otherwise	Dummy
Married	Equal one if the respondent is married, zero otherwise	Dummy
Family Size	Number of family members living in the household	Discrete
School Children	Number of school going children in the household	Discrete
Education Levels	Where: none (reference), primary school, secondary school and above	Categorical
Financial Literacy	Where: Low (reference), medium and high levels of financial literacy	Discrete
Numeracy	Where: Low (reference), medium and high levels of numeracy	Discrete
Farming	Equal one if main occupation of the household head is farming	Dummy
Wage	Equal one if off-farm activities are main sources of income (i.e. formal or informal employment, self-employed), zero otherwise	Dummy
Urban	Equal one if indivual resides in urban areas, Zero otherwise	Dummy
Social Networks	Number of informal groups an individual is subscribed to	Discrete
Infrastructural Development	Time taken to walk to the closest schools and health centres	Categorical
Wealth Index	First principal component of household assets composition	Continous

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