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Can Mobile Money Remittances Reduce Short-Term Poverty? Evidence from Kenya

Aya MIZUTANI

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名古屋大学大学院国際開発研究科
GRADUATE SCHOOL OF INTERNATIONAL DEVELOPMENT
NAGOYA UNIVERSITY

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Aya MIZUTANI*

Abstract

The majority of low-income people in developing worlds did not have access to affordable financial services until recently. The mobile money service is a breakthrough and provides financial services for those who were previously unbanked. This study investigates whether mobile money remittances can really help low-income people prevent themselves from falling into short-term poverty, using the detailed transaction data collected in Kenya. By using Difference-in-Difference strategy, I find short-term income shocks affect household consumption immediately and drive households into short-term poverty by 5.6%. Meanwhile, mobile money receiver households are less likely to consume below the poverty line, by asking help from relatives or friends living far away across the country. This effect is observed not only in worse-off months but also in better-off months, indicating its effect on lower-income people in wider financial conditions. By running some robustness checks with other covariates controlled for as well as with sub-samples, I find the results of which are consistent with the main effects.

Keywords: Mobile Money, Short-Term Poverty, Kenya

1 Introduction

Financial inclusion has been one of the challenges in many developing countries over the years to tackle poverty. The majority of low-income people, especially those in rural areas, did not have access to affordable financial services and thus relied on informal risk-sharing strategies and social networks until the recent innovation, mobile money service, was introduced. Since the emergence of this innovation, an increasing number of formerly unbanked people have been able to access more affordable and formal financial services around the world.¹

Mobile money is a financial service that enables users to save, send, and receive, and pay for goods and services through their mobile phones. One of the remarkable features is that mobile money services can remove geographical barriers between people living far, allowing them to send money safely and quickly. They are also inexpensive compared to the traditional risk-sharing strategies in which people send money through friends or bus drivers (Mbiti & Weil 2011).

Kenya is one of the first and successful countries where mobile money services have penetrated the population and spread quickly. The first Kenyan mobile money service M-Pesa was launched in

* Former Master Student at Graduate School of International Development, Nagoya University

2007, and since then, the number of M-Pesa users as well as of agents has been increasing significantly. Within just six years from its introduction, the number of registered M-Pesa users reached over 17 million with an agent number of 65,000. In the same year, mobile money agents are the nearest financial service points for over 76% of Kenyans.²

Previous studies (Abiona & Koppensteiner 2018; Batista & Vicente 2019; Jack & Suri 2014; Riley 2018) documented positive effects of mobile money services on consumption smoothing during shocks, not through mobile money savings but remittances, using two different periods. For instance, Jack and Suri (2014) find that shocks reduce consumption of non-users by 7%, but the consumption of mobile money user households is unaffected.

However, it is well known that low-income people in developing economies, especially those in agrarian societies, experience fluctuations of income and consumption over the seasons. This paper is the first study to examine how mobile money remittances function in the context of people's daily activities using highly accurate and detailed money inflow and outflow data. The objectives of this study are to examine (1) how mobile money remittances affect household consumption in a short term, and (2) whether mobile money services are a substitute for the existing risk-sharing strategies or expand the existing risk-sharing networks.

The rest of the study is structured as follows. In Section 2, I review the previous works of relevant literature. In Section 3, I explain the background of mobile money services in Kenya and present a theoretical framework in Section 4. Section 5 describes the survey data, followed by a discussion of the empirical strategy in Section 6. In Section 7, I report the results, and in Section 8, I conclude.

2 Literature Review

In recent years, there has been a growing number of researches documenting the impacts of mobile money on consumption smoothing. Jack and Suri (2014) provide clear evidence from Kenya that mobile money user households can better smooth their consumption after a shock through reduction of transaction costs promoted by M-Pesa, while non-user households reduce their total consumption by 7%. While Jack and Suri (2014) use idiosyncratic shocks reported by the sample households, Abiona and Koppensteiner (2018) employ climate shocks to objectively test the impact of mobile money in Tanzania and find similar results. Riley (2018) further extends the previous studies and examines whether there are spillover effects of mobile money remittances on non-users and finds only the direct impacts of mobile money. Batista and Vicente (2019) first use a randomized control trial to examine the economic impacts of mobile money in rural areas in Mozambique and demonstrate the introduction of mobile money smooth consumption of mobile money user households against adverse weather and self-reported shocks. Furthermore, they observe an increase in the number of migrants to urban areas in the presence of adverse shocks, driven by reduced transaction costs.

Jack and Suri (2016), furthermore, provide the first evidence that M-Pesa contributes to poverty reduction and demonstrate that M-Pesa helps increase per capita consumption levels and lifted 2% of Kenyan households, or 194,000 households out of poverty. Ismailov et al. (2019) find structural changes in risk-sharing strategies, where mobile money users are less likely to borrow money in the face of shocks, while non-users increase borrowings. They also find that mobile money users are more likely to receive remittances regardless of negative shocks and use mobile money savings rather than savings in less liquid assets.

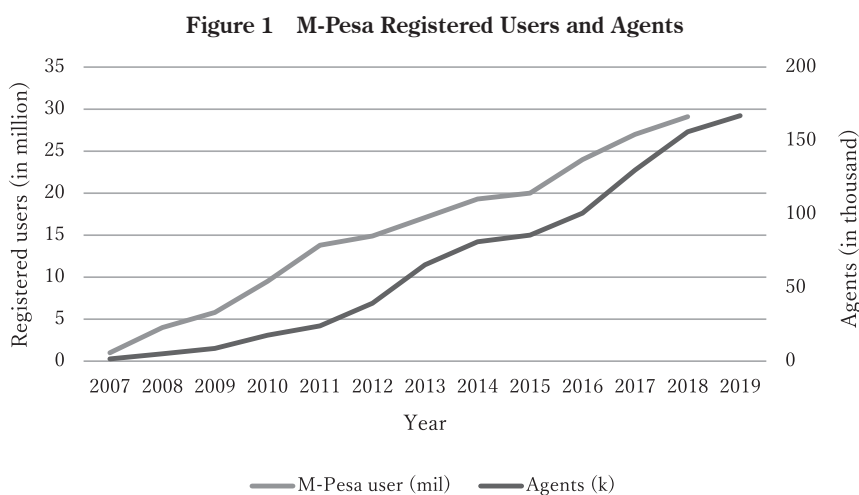
These contributions extend the previous works by Townsend (1994), Rosenzweig and Stark (1989), and Dercon (2002), who documented the role of informal risk-sharing networks to smooth consumption following idiosyncratic shocks and its incompleteness. Collins et al. (2009) describe how low-income people manage day-to-day activities and make ends meet using diversified financial strategies available to them as well as providing evidence of significant fluctuations of income and consumption over the year. Khandker (2009) observes seasonal consumption is greatly influenced by seasonal income and finds that better access to microcredit, social safety net programs, dynamic labor markets, together with income diversification, has helped reduce seasonal poverty. Dercon and Krishnan (2000) study short-run variability in and out of poverty and find high fluctuations of consumption over the seasons, implying a significant number of seasonal poor who are not captured in the standard poverty statistics.

There are some other works in the literature related to mobile money use in Kenya. Stuart and Cohen (2011) find M-Pesa is still mainly used to send money home, usually from urban to rural areas, rather than to save money, and mobile money transactions were in part replacement for the existing social networks. Mbiti and Weil (2011) observe mobile money services have quickly replaced the former money sending services offered by bus companies, the post office, Western Union, or through friends. Dizon, et al. (2019) find promoting mobile money saving reduces risk-sharing, but improves the ability of women to cope with negative shocks. Dubus and Hove (2017) find the introduction of mobile money services has improved financial inclusion, but still those who left behind are the poor, non-educated, and women. Yokossi (2017) demonstrates the positive impacts of mobile money on economic growth using satellite imagery.

3 Background on Mobile Money in Kenya

The first mobile money in Kenya M-Pesa was introduced in March 2007 by Safaricom, a subsidiary of Vodacom and the dominant telecommunication provider in Kenya. Since then, multiple mobile money services were launched successively. As of December 2012, five mobile money operators were providing services in Kenya.³ Figure 1 presents the transition of the numbers of registered users and agents of M-Pesa. It is clear that the number of registered users has been increasing consistently year by year and had reached 17 million in 2013. Not taking multiple account holders into account, over

82% of the Kenyan population aged over 20 had opened an M-Pesa account in six years. Together with the increase in the M-Pesa users, the number of agents has also been increasing, with access points of over 65,000 across the country in 2013. In the same year, the number of bank branches was just 1,310 and, together with bank agents, it was still 5,800. This trend continues, and over 29 million people were using M-Pesa, with 156,000 agents operating all over the country as of 2018.



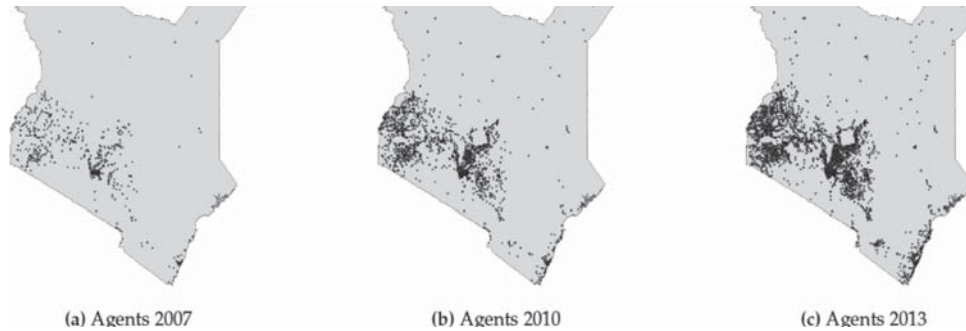
Source: Safaricom Website, Investor Relations.

<https://www.safaricom.co.ke/investor-relation/financials/reports/annual-reports> Accessed on Aug. 4.

The agent roll-out expansion is presented in Figure 2. The number of agents had been increasing rapidly, especially in densely populated areas. This rapid agent roll-out provides households with better access to financial points, accelerating the adoption of mobile money services in both urban and rural households. Since the use of “e-money” as a payment method was yet to be prevalent at the time of the data survey, most of the mobile money receivers still have to go to an agent to withdraw e-money sent from others to buy goods and services. In this context, the availability of and accessibility to mobile money agents are essential for users. FinAccess survey 2013 reveals that the nearest financial service point is a mobile money agent for 76% of Kenyan households while a bank branch accounts for only 10.3%. This fact might be an explanation of why mobile money services have spread so quickly among Kenyans.

4 Theoretical Framework

Townsend (1994) reveals that household consumption correlates to the average village consumption instead of own income, illness unemployment, or other idiosyncratic shocks, while access to financial institutions often improves insurance over the traditional insurance mechanisms. This provides

Figure 2 Agents Roll-out from 2007 to 2013

Source: Tite Yokossi. 2017

evidence of strong risk-sharing within the community and imperfection of the village-level risk-sharing strategies. Under such conditions, households would not fully insure themselves without any other alternatives outside the village or community if shocks are village-level aggregate shocks such as climate or seasonal income shocks. Although households may still be able to use more extensive risk-sharing networks composed of relatives and friends living outside their community or village, it will be costly and time-consuming due to high transaction costs (Mbiti & Weil 2011). Not having a fast, safe, low-cost, and secure means of sending money long-distance, households may not be able to make the most use of more extensive risk-sharing networks.

Mobile money services remove geographical barriers and allow users to send and receive mobile money quickly, cheaply, and safely over the country using their phones. This helps them expand the existing risk-sharing networks outside the community. The contributions of mobile money services are two-fold. First, mobile money services can work simply as a substitute for the existing risk-sharing arrangements, namely an alternative or replacement to the existing risk-sharing tools. Second, mobile money services allow users to build an extensive risk-sharing network, namely an expansion of the existing risk-sharing network. My assumption is that, in the beginning, mobile money users would start using mobile money services as an additional tool for conventional risk-sharing strategies. As gradually they find it is easier or less costly, or mobile money remittances are sufficient for their needs, mobile money services would replace the conventional tools.

5 Data and Summary Statistics

The research data used in this study is drawn from the Kenya Financial Diaries collected by Digital Data Divide and Bankable Frontier Associates. The data contains all transactions carried out by 298 households in 14 communities in 5 regions in Kenya (Nairobi, Mombasa, Eldoret, Makueni, and Vihiga). The survey was targeting low-income households to capture the diversified cash flow patterns and

behaviors of low-income households in Kenya. The sample households were interviewed every two weeks over approximately one year between August 2012 and December 2013. The data are recorded on a transaction basis except for the demographic information on the sample households. Table A1 in the appendix provides an example of how the data are recorded. Different from the ordinary household survey, the data contains detailed information on dates, items, the value that they bought and spent, means used for transactions, etc., allowing me to identify how much they earned and spent, what they purchased, and what means they used to make transactions. Accuracy and thoroughness of the data were checked by comparing the balance of assets and total inflow and outflow between the interviews. According to the data user guide, the median margin of difference between inflow and outflow was large (80%) until September 2012, meaning that some transactions are missed and not recorded. Due to this reason, I use the data between October 2012 and October 2013.⁴

Before conducting the analyses, I aggregated the transactions on a monthly basis for each household to create a panel dataset. Since some other literature has already demonstrated that mobile money remittances, instead of mobile money savings, help improve the ability of households to absorb shocks (Abiona & Koppensteiner 2018; Batista & Vicente 2019; Jack & Suri 2014), I focus on mobile money remittances⁵ received by households rather than whether a household has or uses a mobile money service or not. Among 297 sample households, 3.3% had received mobile money remittances every month (10 households), while 55.9% had received mobile money some months (166 households). Of the remaining 40.7% (121 households), 37% had sent mobile money at least once (45 households), and 45% had withdrawn money from their mobile money savings account (55 households). Only 7% of all the sample households had never used mobile money services (21 households) during the survey period, demonstrating high penetration of mobile money services among Kenyans. See Table 1 for a detailed composition of the sample.

Table 1 Composition of Households

Use of mobile money services	Oct. 12	Nov. 12	Dec. 12	~	Sep. 13	Oct. 13	No. of HHs
(A) Received every month	1	1	1	~	1	1	10
(B) Received some month	1	0	1	~	0	1	166
(C) Never received but sent mm	0	0	0	~	0	0	45
(D) Never received but used mm	0	0	0	~	0	0	55
savings							
(E) Never used mm service	0	0	0	~	0	0	21

Notes: Assignment of treatment and control is based on mobile money remittances separated by the month. Note that those who never used mobile money during the survey period do not necessarily mean that they do not have a mobile money account.

Table 2 presents summary statistics of mobile money receiver households and non-receiver households in November 2012. Column 3 indicates whether the differences between the two groups

Table 2 Household Summary Statistics by Receivers vs. Non-Receiver

	(1)	(2)	(3)
	Non-receiver	Receiver	Difference
HH earned income (Kes)	10314.06 (15863.07)	4655.24 (5137.41)	5658.81*** (2324.71)
Per capita income (Kes)	2733.50 (5313.23)	1242.52 (1811.32)	1490.98** (779.77)
Per capita consumption (Kes)	2046.93 (2584.21)	1864.80 (1478.19)	182.13 (389.32)
Sex of HH head (male = 1)	0.65 (0.48)	0.29 (0.46)	0.36*** (0.08)
Urban (urban = 1)	0.29 (0.45)	0.13 (0.33)	0.16** (0.07)
Received cash (percentage)	0.21 (0.41)	0.48 (0.50)	-0.27*** (0.07)
Value of cash received (Kes)	509.31 (1771.35)	1377.29 (2661.66)	-867.98*** (323.20)
Used savings (percentage)	0.82 (0.39)	1.00 (0.00)	-0.18*** (0.06)
Value of savings used (Kes)	6689.62 (25804.04)	4664.48 (4656.66)	2025.14 (3746.45)
Used risk-sharing (percentage)	0.56 (0.50)	0.48 (0.50)	0.08 (0.08)
Value of risk-sharing used (Kes)	2440.26 (5827.70)	819.79 (1794.88)	1620.46** (852.95)
Below poverty line (\$2)	0.85 (0.36)	0.96 (0.20)	-0.97** (0.05)
Observations	180.00	48.00	228.00

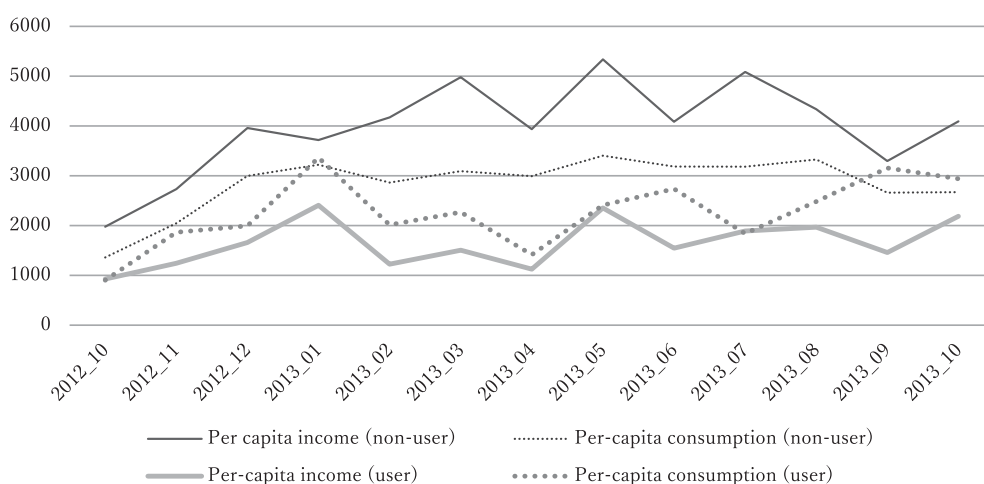
Notes: Standard deviations in parenthesis. Kes denotes Kenyan shilling, which is the currency of Kenya. 1 USD is roughly equal to 85 Kenyan shillings at the time of the data survey. Received cash means money received from others, which receivers do not have to repay.

are statistically significant or not. In general, monthly income, as well as per-capita income of receiver households, is lower than those of non-receiver households, but their consumption is similar. Female-headed households and those in rural areas are more likely to receive mobile money. Mobile money receiver households tend to depend more on others, for example, cash received from others, while non-receiver households are more self-reliant. Although the difference of the per-capita consumption between the receivers and the non-receivers is not statistically significant, well over 90% of receiver

households live under the poverty line.

Figure 3 shows transitions of the average income and consumption of the receivers and the non-receivers. There have been slight variations in income for the non-receivers, but the expenditures are more stable and stay within the income. The non-receivers seem to earn more and can cover whatever they need, which means they are richer than the receivers and can go without mobile money remittances. In contrast, the income and consumption of the receivers show a different profile. What is striking is first the large fluctuations of income and consumption over the year and second the higher total consumption per capita than the income per capita most of the time, clearly showing the insufficiency of household earned income to cover their needs.

Figure 3 Monthly Household Consumption (Receivers vs Non-receivers)



Note: The unit is Kenyan shillings. 1 US dollar is equal to approx. 85 Kenyan shillings as of 2013. The income means earned and does not include any support or contributions from others.

6 Empirical Strategy

6.1 Empirical Specifications

In this paper, I test whether mobile money remittances reduce the propensity of households falling into short-term poverty. The main specification used in this paper is written as:

$$\begin{aligned}
 Poverty_{ijt} = & \alpha_i + \beta_1 MM_{ijt} + \beta_2 Inshock_{ijt} + \beta_3 MM_{ijt} * Inshock_{ijt} + \beta_4 Fintool_{ijt} * Inshock_{ijt} \\
 & + \beta_5 Income_{ijt} + T + \eta_{ijt} + \epsilon_{ijt}
 \end{aligned}
 \tag{1}$$

where, $Poverty_{ijt}$ is a dummy variable taking 1 if consumption of household i in region j in month t is below the poverty line, and 0 otherwise. The poverty line here is set to 170 Kenyan shillings, which is equivalent to 1.94 to 2.04 USD at the exchange rate during the survey period and very close to the international poverty line defined by the World Bank in October 2015. In calculating per-capita

consumption, I use the OECD-modified magnitude, which is 1.0 to the first adult, 0.5 to the second and each subsequent person aged 14 and over, and 0.3 to each child aged under 14. The use of this poverty line is a proxy to measure how much a household can spend money on consumption, and is not necessarily used to measure the exact poverty itself. α is a household fixed effect, T is a set of month dummies, η_{jt} is a set of location-by-time dummies. MM is a dummy variable equal to 1 if a household receives mobile money (not use or send mobile money) in a given month and Inshock is also a dummy variable taking 1 if the income of household i in month t is below the median monthly income of household i . This is to assign income shocks to half of the household observations and thus of the whole samples to equally treat income shocks.

Fintool represents a set of financial tools, in particular, cash received, withdrawal from saving accounts (bank, mobile money or at home), and use of informal group saving or informal person to person borrowing. Each of the financial tools takes 1 if a household uses an applicable financial tool and 0 otherwise. The interaction of Fintool with Inshock is to control for these financial instruments that might be used together with mobile money remittances during income shocks. The η_{jt} is included to control for regional level shocks. Income denotes the log of income and is included to control for effects of income, which would most contribute to the consumption.

The parameter of interest is β_3 , which allows for mobile money remittances to affect the household's ability to prevent themselves from sliding into poverty. This enables me to predict the empirical estimation as: (1) if income shocks (or decrease) do not affect the household consumption, the coefficients β_2 and β_3 should be zero. If, however, income shocks reduce consumption to below the poverty line, the coefficient β_2 will be positive, and β_3 tests whether mobile money remittances raise the ability of receiver households to absorb income shocks.

6.2 Identification

I estimate Equation 1 using a Difference-in-Difference approach with household fixed effects. By adopting the Difference-in-Difference approach, it eliminates biases resulting from permanent differences between the receiver and non-receiver groups as well as changes resulting from a time trend. To identify the effect of mobile money remittances on short-term poverty reduction, it must be assumed that the interaction term of $MMijt * Inshockijt$ is independent of the error term εijt , conditional on the main effect of becoming a receiver and having an income shock, the time fixed effects, the household fixed effects and other covariates.

For this assumption to hold, the income shocks must be exogenous. Household income would be affected by occupation, sex, age, etc. In this data, those household characteristics do not change so much as it captures only one-year information. Given that those characteristics are invariant through the survey period, the income differences or changes are attributed to external shocks. Another concern is that mobile money remittances are correlated with the use of other risk-sharing tools,

which may help households absorb shocks. To deal with this problem, I include all the major risk-sharing tools interacted with the shocks ($Fintool * Inshock$), as shown in Equation 1.

7 Results

7.1 Main Results

Table 3 shows the results of the main analysis. Column 1 shows the baseline results without controls for interactions with other financial tools nor the location-by-time dummies. My interest is the interaction term of income shocks with mobile money remittances. The coefficient of the interaction is negative and statistically significant at the 1% level, showing the positive effects of mobile money remittances on the reduction of short-term poverty by 10.5% during income shocks. The coefficient of mobile money remittances on poverty is positive, but this is not causal effects. As shown in Table 2, the average household income and per-capita income are much smaller for receiver households, which is the main reason why the receiver households are more likely to consume less and below the poverty line. In other words, although they received mobile money, the value they receive was not enough to push them out of poverty in general. Income shocks raise the propensity toward poverty by 13.7%, demonstrating that adverse income fluctuations drive sample households into poverty temporarily.

In Column 2, I include the interaction of income shocks with cash received, which is a major traditional risk-sharing strategy to cope with income shocks. The effect of mobile money remittances during income shocks decreases slightly, but it is significant. Column 3 controls for withdrawal from savings and time-by-region dummies, showing more strong effects of mobile money remittances to reduce short-term poverty. Columns 4 and 5 include all the other financial tools that interacted with income shocks. The difference between the two columns is controlling for time dummies. Across the five specifications, the coefficients of mobile money remittances interacted with income shocks are consistent and statistically significant at the 1% level, demonstrating mobile money remittances help shock-households better cope with the shocks and prevent themselves from falling under the poverty line.

Table 4 presents how the effect of mobile money remittances changes due to different levels of income shocks. In the previous table, I used monthly household income below the median as shocks. Here, I change the threshold of income shocks from two negative standard deviations to four positive standard deviations from the median and examine changes of the effect. In Column 1, the income shocks are set to below two standard deviations from the median, and the number of shock-households is only 598 (compared to 1431 in the previous analyses, where half of the sample is in a situation of short-term income shock). The coefficient of the interaction of mobile money remittances with income shocks is negative and statistically significant. The magnitude is also larger compared to the median shock threshold, implying higher effects of protecting households under financially severer conditions

Table 3 Main Difference-in-Difference Results

Dep. variable	170 kes poverty line				
	(1)	(2)	(3)	(4)	(5)
Log of income	-0.029*** (0.003)	-0.029*** (0.003)	-0.030*** (0.003)	-0.031*** (0.003)	-0.030*** (0.003)
Mobile money (MM) remittances	0.044*** (0.017)	0.033* (0.017)	0.056*** (0.019)	0.056*** (0.019)	0.056*** (0.019)
Income shock	0.137*** (0.011)	0.161*** (0.012)	0.051*** (0.016)	0.052*** (0.018)	0.054*** (0.018)
MM remittances*Income shock	-0.105*** (0.020)	-0.082*** (0.020)	-0.135*** (0.022)	-0.133*** (0.022)	-0.135*** (0.022)
Cash*Income shock		-0.041*** (0.014)	-0.037*** (0.014)	-0.034** (0.014)	-0.036** (0.014)
Saving*Income shock			0.091*** (0.015)	0.088*** (0.015)	0.091*** (0.015)
Risk-sharing*Income shock				-0.014 (0.014)	-0.014 (0.014)
Constant	1.007*** (0.035)	0.993*** (0.035)	1.038*** (0.091)	0.987*** (0.031)	1.041*** (0.091)
Observations	3,077	3,077	3,077	3,077	3,077
R-squared	0.676	0.678	0.687	0.687	0.687
Time fixed effect	Yes	Yes	Yes	No	Yes
HH fixed effect	Yes	Yes	Yes	Yes	Yes
Time*location fixed effect	No	No	Yes	Yes	Yes

Notes: Dependent variable: 170 kes poverty threshold. Robust standard errors in parentheses. Controls: cash given, withdrawals from savings account (formal, at home, mobile money), use of risk-sharing tools (informal person to person transfer, informal group savings).*** p < 0.01, ** p < 0.05, * p < 0.1

from short-term poverty. From Column 2 to Column 6, the coefficients of the main variables are consistent and statistically significant, although the magnitude varies slightly. Throughout Table 4, it is demonstrated that mobile money remittances are effective to reduce short-term poverty not only in worse-off months but also in better-off months.

7.2 Mechanisms

Through the above results, I find that mobile money remittances contribute to the reduction of

Table 4 Difference-in-Difference Using Different Shock Levels

Dep. variable	170 kes poverty line					
	(1)	(2)	(3)	(4)	(5)	(6)
Shock threshold	-2sd	-1sd	+1sd	+2sd	+3sd	+4sd
Log of income	-0.034*** (0.003)	-0.032*** (0.003)	-0.032*** (0.003)	-0.032*** (0.003)	-0.035*** (0.003)	-0.038*** (0.002)
Mobile money remittances	0.032** (0.015)	0.045*** (0.016)	0.081*** (0.022)	0.105*** (0.025)	0.093*** (0.029)	0.088** (0.035)
Income shock	0.030 (0.026)	0.049** (0.023)	0.096*** (0.022)	0.119*** (0.024)	0.144*** (0.027)	0.146*** (0.032)
MM*Income shock	-0.194*** (0.030)	-0.169*** (0.026)	-0.131*** (0.025)	-0.149*** (0.027)	-0.124*** (0.031)	-0.110*** (0.036)
Constant	1.074*** (0.028)	1.047*** (0.029)	1.000*** (0.030)	0.978*** (0.032)	0.965*** (0.034)	0.984*** (0.038)
Mean income of shock group	2215	2946	6716	7296	7873	8514
Observations	3,082	3,082	3,082	3,082	3,082	3,082
R-squared	0.676	0.680	0.687	0.689	0.684	0.676
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
HH fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Time*location fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variable: 170 kes poverty threshold. Standard errors in parentheses. Controls: cash given, withdrawals from savings account (formal, at home, mobile money, use of risk-sharing tools (informal person to person transfer, informal group savings) interacted with income shocks are all included.

*** p < 0.01, ** p < 0.05, * p < 0.1

short-term poverty, but it is not clear whether these remittances are a substitute for the conventional risk-sharing strategies or an additional tool to the existing networks. However, it is more likely that mobile money receiver households are using other financial tools together with mobile money remittances as incorporating those financial tools in the regressions reduces the effects of mobile money remittances. To statistically examine how mobile money services change the existing risk-sharing structure, I use

$$Fintool_{ijt} = \alpha_i + \beta_1 MM_{ijt} * Inshock_{ijt} + T + \eta_{jt} + \varepsilon_{ijt} \quad (2)$$

where, $Fintool_{ijt}$ is each financial tool (cash received, withdrawal from formal savings, informal savings, mobile money savings, informal group savings, and person to person transfers). This variable takes 1 if a household used such financial tool and 0 otherwise, same as written in Section 6.1.

Table 5 Mechanisms (Panel)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variables	Cash received	Formal saving	Informal savings	Mobile Savings	Group savings	P2P borrowing
(A) Non-receiver without shocks	0.315*** (0.011)	0.244*** (0.008)	0.314*** (0.012)	0.607*** (0.011)	0.277*** (0.012)	0.545*** (0.013)
(B) Non-receiver with shocks	0.349*** (0.012)	0.24*** (0.009)	0.302*** (0.013)	0.585*** (0.012)	0.292*** (0.013)	0.54*** (0.014)
(C) Receiver without shocks	0.365*** (0.024)	0.228*** (0.016)	0.274*** (0.025)	1.005*** (0.023)	0.263*** (0,024)	0.481*** (0.026)
(D) Receiver with shocks	0.369*** (0.025)	0.237*** (0.017)	0.273*** (0.026)	0.962*** (0.023)	0.226*** (0.025)	0.537*** (0.027)
Observations	3,077	2,685	2,685	2,685	2,685	2,685
R-squared	0.419	0.694	0.377	0.496	0.39	0.417
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
HH fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Time*location fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5 presents the results for the mechanism. Interestingly, mobile money savings remain the top financial tool for non-receivers as well as receivers. The probability of withdrawing money from those savings significantly increases when they receive mobile money. Although mobile money receivers were less likely to use group savings and person to person borrowing compared to non-receivers, they were still using a variety of financial tools, implying mobile money services were an additional tool rather than a substitute for the existing risk-sharing strategies. This finding contradicts with what the other paper claimed (Ismailov, et al. 2019), but supports the other paper (Cohen 2011). This may be explained by the year that this data was collected. Since the survey was performed only after 5 years from the launch of the service in Kenya, mobile money receivers may still have been using the conventional risk-sharing tools together with mobile money services. In addition, this survey was targeting low-income households in Kenya, this implies that mobile money remittances alone may not suffice to cover income shocks or their needs.

7.3 Robustness Checks

To estimate the causal effect of the analysis, the parallel trend assumption of the receiver and

Table 6 Robustness Checks: Additional Controls and Sub-Sample Tests

Dep. Variable	Kes 170 poverty line				
	(1)	(2)	(3)	(4)	(5)
Samples	Sub-samples	Sub-samples	Sub-samples	PSM > 0.4	PSM > 0.3
Log of income	-0.026*** (0.003)	-0.020*** (0.004)	-0.020*** (0.004)	-0.011** (0.005)	-0.012*** (0.004)
Mobile money remittances	0.046** (0.019)	0.046** (0.021)	0.050** (0.020)	0.077* (0.041)	0.048* (0.026)
Income shock	0.068*** (0.018)	0.076*** (0.025)	0.077*** (0.025)	0.051 (0.035)	0.070** (0.032)
MM remittances*Income shocks	-0.123*** (0.022)	-0.133*** (0.027)	-0.140*** (0.026)	-0.153*** (0.051)	-0.096*** (0.031)
Constant	1.010*** (0.088)	0.886*** (0.123)	0.884*** (0.122)	1.102*** (0.187)	1.091*** (0.135)
Observations	2,730	1,841	1,893	457	808
R-squared	0.675	0.649	0.648	0.739	0.607
Time fixed effect	Yes	Yes	Yes	Yes	Yes
HH fixed effect	Yes	Yes	Yes	Yes	Yes
Time*location fixed effect	Yes	No	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. (1) excludes samples if they sent mobile money or used mobile savings in an applicable month. (2) includes only samples (B) and (E) in Table 1. (3) includes samples (A), (B), and (E) in Table 1. (4) includes samples whose propensity score is above 40%. (5) includes samples whose propensity score is above 30%. *** p < 0.01, ** p < 0.05, * p < 0.1

the non-receiver groups must hold. Over 80% of the non-receiver households were actually using mobile money services to send or withdraw mobile money, even if they had never received mobile money. Since those who used mobile money services but never received mobile money (Groups C and D in Table 1) and those who never used mobile money services (Group E in Table 1) might have been fundamentally different, the estimation might be biased. To eliminate the possibility of biased estimation, I run some robustness checks and present the results in Table 6. Column 1 excludes the samples that sent mobile money or used mobile money savings in a given month. Column 2 only includes samples that received mobile money for some months and those who never used any mobile money services during the survey period. In Column 3, I used samples that received mobile money and those who never used any mobile money services. In Columns 4 and 5, I use a propensity

score matching technique that includes only those that are comparable in estimating the impact. The variables used to make comparable samples are household size, educational attainment of the household head, demographic location (urban or rural), and household income. In Column 4, samples that match 40% or more in propensity are used and in Column 5, 30% or more are used. All the specifications include the time fixed effects, household fixed effects, and time-by-region dummies, as well as controls for other financial tools interacted with income shocks. Those results are very similar to the main results and consistent across the different specifications.

8 Conclusion

Thanks to the recent ICT development and innovation of mobile money services, more and more rural households in developing countries are now able to access formal financial services that allow households to save, receive and send e-money through their mobile phones. In this study, I focus on the potential of mobile money services that remove a geographical barrier and provide opportunities for rural households to expand their existing risk-sharing networks to examine the effects of mobile money services on the reduction of short-term poverty.

This study contributes to the existing knowledge of mobile money remittances by providing evidence on how mobile money remittances affect consumption in response to short-term income shocks using very accurate, detailed, and unique transaction data. The study reveals that mobile money remittances can reduce the probability of households entering into short-term poverty by 13.5% during income shocks, while income shocks drive households into poverty by 5.3%.

As already mentioned, a limitation of this study is that it may not be appropriate to generalize the results as the sample households are small and purposively selected to cover a wide variety of low-income people in Kenya. This study is based on a small sample of participants, but this study offers a more in-depth insight into immediate impacts on mobile money remittances and how low-income people strategically use financial and risk-sharing tools in their daily activities.

In this study, I only focus on how mobile money remittances affect short-term poverty, together with the existing risk-sharing strategies. However, over 90% of the sample households have been using mobile money services, whether as a sending or receiving, or saving tool. Further research in other roles of mobile money services, especially as a saving tool, is an essential next step in confirming how mobile money services contribute to people in developing countries.

Notes

- 1 The account ownership has grown from less than 50% in 2011 to just below 70% in 2017 for males in developing countries and less than 40% to just below 60% in the same period for females, according to the World Bank Global

Findex Database.

- 2 The ratio of access points is calculated using the raw data collected by FSD Kenya for 2013 FinAccess Household Survey.
- 3 Accion International. CENTER for FINANCIAL INCLUSION. The Kenya Journey to Digital Financial Inclusion. <https://www.centerforfinancialinclusion.org/the-kenyan-journey-to-digital-financial-inclusion>. Accessed on April 22, 2020
- 4 The difference between the inflow and outflow fell to 6 percent by October and less than 2 percent by January of 2013 according to Kenya Financial Diaries Datasets User Guide.
- 5 The mobile money remittances, as well as cash remittances in this data, are full remittances from others and do not include borrowing from others.

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Appendix

Table A1 Record of Transactions in Data

No.	Transaction date	Transaction description	Transaction purpose	Transaction mode	Transaction direction	Transaction value
1	21-Oct-12	Casual employment	Income	Cash	Inflow	250
2	23-Oct-12	Self-employment	Revenue or sales	Cash	Inflow	9580
3	23-Oct-12	Food	Multi-item shopping	Cash	Outflow	200
4	25-Oct-12	Self-employment	Stock purchase	Cash	Outflow	4460
5	26-Oct-12	Resource received	Household	Cash	Inflow	50
6	26-Oct-12	Rental income	Income from rental	Cash	Inflow	500
7	27-Oct-12	Medical	Medicines	Cash	Outflow	500
8	28-Oct-12	Resource given	Household	Mobile money	Outflow	1975
9	28-Oct-12	Energy	Gas (for cooking)	Cash	Outflow	100
10	29-Oct-12	Agriculture income	Agriculture revenue (sales)	Cash	Inflow	150

Note: This is a simplified version of how transactions are recorded. The original data contains more detailed information, for example, who in the household earned specific money or where this transaction was held.