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Evidence from an Experiment in Rural Africa

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ABSTRACT

Adopting Mobile Money:
Evidence from an Experiment in Rural Africa[*]

Who uses mobile money? What is mobile money used for? This paper describes the mobile money adoption patterns following the experimental introduction of mobile money for the first time in rural areas of Southern Mozambique. We use a combination of administrative and household survey data to characterize early and late adopters, as well as their mobile money usage patterns during the three years after mobile money was introduced. We find that a large proportion of the individuals who were offered mobile money services actively adopted this technology. Adopters of mobile money (and early adopters in particular) are more educated than non-adopters, and they are also more likely to already hold a bank account. Positive self-selection of mobile money adopters raises questions about the effectiveness of mobile money as a tool for financial inclusion.

JEL Classification:	O16, O33, G20
Keywords:	fintech, mobile money, technology adoption, self-selection, financial inclusion, financial deepening, Mozambique, Africa

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Mobile money creates the opportunity for individuals with basic cell phones in poor areas underserved by formal financial services to save and receive long-distance transfers instantly, safely and inexpensively.

Mozambique is a country with extremely limited financial exclusion even by sub-Saharan standards. According to Demirgüç-Kunt et al. (2018), in 2017 only 10 percent of adults living in rural areas of the country held savings in a formal bank account. And only 15 percent of migrant remittances were received via formal channels in these rural locations.

We conducted a randomized controlled trial to investigate the impact of introducing mobile money services for the first time in rural areas of Southern Mozambique. In this paper we describe the mobile money adoption patterns following this intervention. Batista and Vicente (2013) describe the randomized introduction of mobile money in detail, whereas Batista and Vicente (2018) examine its broader economic impact using the randomized controlled trial.

This article describes the individual characteristics of early and late adopters and examines their mobile money usage patterns. We use a combination of administrative and household survey data to characterize the adoption of mobile money services in the three years following their initial introduction.

A large proportion of the sampled individuals who were offered mobile money services adopted this technology. These adopters of mobile money (and early adopters in particular) are likely to be more educated than non-adopters, and they also are more likely to already hold a bank account. These findings are in line with Suri (2011) in that education and financial inclusion are both associated with lower costs of using mobile money technology. Education in particular is also possibly linked with higher potential benefits of mobile money – especially when this technology is used to receive remittances from migrants who also tend to be positively selected on education.

Positive-self-selection into mobile money usage raises the question of whether mobile money is an effective tool for financial inclusion. Indeed, if those who adopt mobile money first and keep using this technology over time are disproportionately those who already had bank accounts, this is an effective tool for financial deepening – and new approaches to promote financial inclusion must be devised together with strategies for organic technology adoption following its initial dissemination.

I. Sampling and Data

Our work builds on a large randomized controlled trial by Batista and Vicente (2018). This project evaluated the broad economic impact of randomly introducing mobile money services for the first time in rural areas of Southern Mozambique.

As described in detail by Batista and Vicente (2013), mobile money was introduced in 51 enumeration areas (EAs) that were followed over time using household surveys and administrative data. The baseline household survey, performed before mobile money was made available, provides us with the baseline characteristics of all the individuals who were offered the mobile money technology in the treated areas. The administrative data on mobile money usage were provided by *Carteira Movel*, the operator of the *mKesh* mobile money brand in Mozambique. These data allow us to characterize the mobile money transactions performed by adopters of the service between July 2012 and June 2015.

II. Who Are the Adopters?

The measured adoption rate for mobile money in this project was large: 87 percent of the individuals offered mobile money services made at least one transaction over the three-year period for which we have administrative records. As shown in Table 1, 36 percent of our sample are *Early Adopters* who start using the service from its inception and keep on doing so in the following three years - they perform at least one transaction in each of the three years included in our data. *Experimenters,* who conduct at least one transaction in the first year and stop making transactions afterwards, are 18 percent of the sample, whereas *Late Adopters*, who only start using mobile money in the second or third year after it was made available, correspond to 6 percent.

Table 1 shows the characteristics of adopters in our sample. Adopters of mobile money are positively self-selected. They are significantly more educated than non-adopters and are also significantly more likely to have a bank account of their own, to have a job and to be wage earners. This positive self-selection pattern is reinforced for *Early Adopters:* these early and continued adopters of mobile money have an average additional year of schooling (relative to non-*Early Adopters*) and they are 13 percentage points more likely to hold their own bank account. *Early Adopters* are also more likely to have jobs and be wage earners than average adopters.

		Full Sample (1)	Non-Adopters (2)	All Adopters Early Adopters (3)	All Adopters Experimenters (4)	All Adopters Late Adopters (5)
Age (In Years)	Mean	36.907	36.490	37.066	35.353	35.885
	Std. Dev.	(14.143)	(14.629)	(13.529)	(14.612)	(13.645)
Female	Mean	0.594	0.534	0.601	0.625	0.500
	Std. Dev.	(0.018)	(0.501)	(0.491)	(0.486)	(0.505)
Years of Education	Mean	5.725	4.832***	6.363***	5.669	5.604
	Std. Dev.	(3.595)	(3.225)	(3.718)	(3.271)	(3.865)
Log Expenditure Per Capita	Mean	8.327	8.379	8.322	8.414	8.463
	Std. Dev.	(0.942)	(0.989)	(0.870)	(1.063)	(0.947)
Car Ownership	Mean	0.044	0.028	0.046	0.077**	0.019
	Std. Dev.	(0.206)	(0.167)	(0.210)	(0.268)	(0.137)
Farm Ownership	Mean	0.883	0.905	0.855*	0.887	0.889
	Std. Dev.	(0.322)	(0.295)	(0.353)	(0.317)	(0.317)
Own Bank Account	Mean	0.264	0.186*	0.345***	0.209†	0.226
	Std. Dev.	(0.441)	(0.391)	(0.476)	(0.408)	(0.423)
Catholic Religion	Mean	0.307	0.352	0.329	0.275	0.241
	Std. Dev.	(0.462)	(0.480)	(0.471)	(0.448)	(0.432)
Zionist Religion	Mean	0.194	0.229	0.170	0.225	0.241
	Std. Dev.	(0.396)	(0.422)	(0.376)	(0.419)	(0.432)
Other Christian Religion	Mean	0.372	0.295*	0.367	0.387	0.370
	Std. Dev.	(0.484)	(0.458)	(0.483)	(0.489)	(0.487)
Changana Ethnic Group	Mean	0.685	0.708	0.665	0.676	0.648
	Std. Dev.	(0.465)	(0.457)	(0.473)	(0.470)	(0.482)
Wage Earner	Mean	0.079	0.039†	0.104**	0.059	0.038
	Std. Dev.	(0.270)	(0.195)	(0.306)	(0.236)	(0.194)
No Job	Mean	0.168	0.235*	0.137*	0.206	0.231
	Std. Dev.	(0.374)	(0.426)	(0.344)	(0.406)	(0.425)
Average Value of Mobile Money Transactions (in MZN)	Mean	48.051	0.000***	74.494***	37.030*	34.338
	Std. Dev.	(2.919)	(0.000)	(6.346)	(2.134)	(2.994)
Number of Mobile Money Transactions Performed	Mean	12.856	0.000***	27.592***	3.482***	4.315*
	Std. Dev.	(1.276)	(0.000)	(3.368)	(0.373)	(0.929)
Number of Observations		798	106	284	143	54

Note: "Non-Adopters" do not have any transaction recorded in the administrative data. "Early adopters" are defined as having performed at least one mobile money transaction in each of the three years covered by data. "Experimenters" are defined as having performed at least one mobile money transaction in the first year after its introduction, but not in subsequent years. "Late Adopters" are defined as having performed at least one mobile money transaction in the second or third years after its availability, but not in the first year after the service was introduced. Statistical significance is assessed on the estimated difference between mean utilization rates of adopters and non-adopters in the full sample, for each definition of adopter. Estimated difference is not shown. The USD to MZN exchange rate varied between 28 and 38 over the 3 year-period included in our sample. † significant at 15%; * significant at 10%; ** significant at 5%; *** significant at 1%.

Experimenters who adopted the service early on and afterwards stopped using it are not positively selected from the full sample. They are marginally less likely to own a bank account and more likely to have a car – which may enable them to travel to nearby urban areas and make use of formal financial services (e.g., to send remittances) at a lower cost than other residents in rural areas. *Late Adopters* cannot be statistically distinguished from other individuals in the full sample.

Interestingly, unlike prior work on mobile phone and mobile money technology adoption, such as Aker and Mbiti (2010) or Jack and Suri (2011), respectively, we do not find any evidence that adopters are statistically different from non-adopters in terms of age, gender or expenditure profile. This may be because our intervention targeted all household heads. For this reason, it is not skewed by individuals self-selecting to be registered in the mobile money system.

III. What Do Adopters Do?

In order to understand the incidence and average value of each type of transaction made by the different types of mobile money adopters, we estimate the following regression:

$$(1)\ Y_{il} = \alpha + \beta_1 EarlyAdopter_{il} + \beta_2 Experimenter_{il} + \beta_3 LateAdopter_{il} + \gamma X_i + \theta_l + \varepsilon_{il}$$

where Y_{il} is the outcome variable of interest for household i in location l; $EarlyAdopter_{il}$ equals one if individual i has a recorded transaction in all three years in the administrative dataset; $Experimenter_{il}$ equals one if individual i has a recorded transaction in the first year after mobile money is introduced but not in any of the subsequent years; $LateAdopter_{il}$ equals one if individual i does not have a recorded transaction in the first year after mobile money is introduced, but has recorded transactions in any of the later years; X_i is a vector of individual controls including demographics and financial indicators; and θ_l is a vector of location fixed effects.

Table 2 describes the predictors of each type of mobile money transaction being performed. As could be expected, *Early Adopters* are more likely to perform all transactions, but they are especially prone to receive and send transfers, as well as to purchase airtime. *Experimenters*, in contrast, are more likely to purchase airtime and less likely to receive transfers. *Late Adopters* tend to receive and send less transfers than all other mobile money adopters in the sample – this is consistent with their lack of initial adoption, unlike *Early Adopters* who base their continued adoption on transfers – unlike Experimenters who may have access to alternative ways of receiving transfers.

TABLE 2: PREDICTORS OF INCIDENCE OF MOBILE MONEY TRANSACTIONS PERFORMED

	Any Transaction	Cash-In	Cash-Out	Transfers Received	Transfers Sent	In-Shop Payments	Remote Payments	Airtime
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Early Adopters	0.289***	0.323***	0.296***	0.402***	0.362***	0.253***	0.126***	0.362***
	(0.034)	(0.040)	(0.034)	(0.047)	(0.048)	(0.037)	(0.031)	(0.036)
Experimenters	0.301***	-0.042	-0.034	-0.151**	-0.08*	-0.071**	-0.004	0.119**
	(0.035)	(0.048)	(0.053)	(0.063)	(0.045)	(0.034)	(0.012)	(0.051)
Late Adopters	0.336***	0.013	0.091	-0.157**	-0.128**	0.090	0.021	0.013
	(0.035)	(0.075)	(0.076)	(0.073)	(0.056)	(0.057)	(0.023)	(0.091)
Age in Years	0.002*	0.001	0.003**	0.005**	0.002	0.000	-0.001	0.000
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Female	0.035	-0.092*	0.069	0.029	0.078*	0.032	-0.013	0.029
	(0.027)	(0.046)	(0.042)	(0.036)	(0.040)	(0.035)	(0.023)	(0.034)
Years of Education	0.015***	0.017**	0.005	0.02***	0.006	0.002	-0.001	0.014**
	(0.005)	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)	(0.003)	(0.007)
Catholic Religion	-0.043	-0.034	-0.061	-0.043	-0.031	0.069	0.094***	-0.012
	(0.038)	(0.060)	(0.059)	(0.062)	(0.056)	(0.061)	(0.034)	(0.050)
Zionist Religion	-0.028	-0.032	0.01	-0.044	0.037	0.131**	0.038	-0.07
	(0.042)	(0.058)	(0.059)	(0.065)	(0.067)	(0.065)	(0.024)	(0.068)
Other Christian Religion	-0.003	-0.078	-0.071	-0.058	-0.074	0.041	0.065**	-0.023
	(0.031)	(0.050)	(0.055)	(0.065)	(0.052)	(0.047)	(0.025)	(0.046)
Changana Ethnic Group	0.021	0.079	-0.055	-0.068	-0.05	-0.006	0.116**	0.002
	(0.059)	(0.083)	(0.088)	(0.082)	(0.077)	(0.082)	(0.053)	(0.090)
Log Yearly Expenditure per Capita (in MZN)	-0.021	-0.012	-0.005	-0.008	-0.031	0.005	-0.005	0.000
	(0.014)	(0.020)	(0.019)	(0.020)	(0.019)	(0.017)	(0.010)	(0.020)
Owns Farm	-0.031	0.019	0.016	-0.07	0.025	-0.034	-0.043	-0.012
	(0.029)	(0.057)	(0.073)	(0.051)	(0.074)	(0.058)	(0.038)	(0.039)
Owns Car	0.03	-0.109	0.059	0.134*	0.12	0.034	-0.006	-0.023
	(0.052)	(0.082)	(0.090)	(0.078)	(0.085)	(0.070)	(0.034)	(0.084)
Own Bank Account	0.013	-0.039	-0.106**	0.061	0.025	0.042	0.016	0.011
	(0.029)	(0.043)	(0.051)	(0.048)	(0.038)	(0.041)	(0.032)	(0.042)
R^2	0.31	0.29	0.23	0.32	0.27	0.36	0.22	0.26
Number of Observations	721	721	721	721	721	721	721	721

Notes: "Non-Adopters" do not have any transaction recorded in the administrative data. "Early adopters" are defined as having performed at least one mobile money transaction in each of the three years covered by data. "Experimenters" are defined as having performed at least one mobile money transaction in the first year after its introduction, but not in subsequent years. "Late Adopters" are defined as having performed at least one mobile money transaction in the second or third years after its availability, but not in the first year after the service was introduced. Dependent variables are binary and take value 1 when the respective transaction was performed. All specifications estimated using LPM. All control variables measured at baseline. Standard errors clustered at the EA level. * significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 3: PREDICTORS OF THE AVERAGE VALUE OF MOBILE MONEY TRANSACTIONS (IN MZN)

	Any Transaction	Cash-In	Cash-Out	Transfers Received	Transfers Sent	In-Shop Payments	Remote Payments	Airtime
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Early Adopters	37.624***	54.509***	134.176***	89.51***	15.585**	10.056***	29.611**	9.205***
	(7.601)	(13.531)	(25.006)	(20.428)	(6.630)	(2.810)	(14.207)	(1.325)
Experimenters	-1.83	4.701	-35.478**	-26.984**	-6.380	-1.836	-2.629	4.031**
	(5.640)	(8.805)	(17.433)	(12.362)	(4.812)	(1.633)	(3.898)	(1.963)
Late Adopters	4.865	-1.400	-9.325	-13.232	-10.994*	0.402	4.116	-1.996
	(6.035)	(5.971)	(13.672)	(10.503)	(5.579)	(1.794)	(5.147)	(2.495)
Age in Years	0.223	0.504	-0.182	-0.435	0.155	0.055	0.498	0.083
	(0.217)	(0.415)	(0.680)	(0.453)	(0.107)	(0.083)	(0.497)	(0.054)
Female	-6.742	-26.136**	-30.655	-29.823	-3.926	4.023*	-9.157	1.584
	(8.593)	(12.412)	(26.995)	(18.914)	(5.803)	(2.336)	(11.928)	(1.483)
Years of Education	0.464	2.653	1.648	1.917	-0.477	0.084	1.537	0.485**
	(1.140)	(1.873)	(3.845)	(2.300)	(0.783)	(0.299)	(2.208)	(0.224)
Catholic Religion	-10.768	14.563	-17.487	-32.717	-0.717	5.44*	25.742	-1.647
	(12.728)	(18.240)	(30.267)	(29.875)	(7.441)	(3.060)	(17.149)	(2.046)
Zionist Religion	-4.465	10.734	-18.111	-47.214*	14.133	6.323**	21.038	-2.016
	(12.747)	(16.633)	(28.420)	(24.756)	(10.091)	(2.934)	(13.449)	(2.436)
Other Christian Religion	-1.430	-10.118	5.321	-10.595	-1.280	2.149	8.438	-2.083
	(13.667)	(14.225)	(41.201)	(39.113)	(5.882)	(2.171)	(7.909)	(1.992)
Changana Ethnic Group	3.436	-14.753	53.657	48.315**	-10.568	-2.309	15.872*	-1.053
	(7.640)	(21.406)	(58.026)	(20.749)	(9.461)	(7.053)	(9.482)	(2.801)
Log Yearly Expenditure per Capita (in MZN)	-1.194	-0.07	-8.765	-7.887	-0.126	-0.566	-1.377	0.425
	(3.191)	(4.837)	(9.369)	(6.166)	(2.180)	(1.454)	(5.265)	(0.672)
Owns Farm	-22.45	-16.122	-32.362	-30.443	7.216	-1.016	-34.826	-0.777
	(18.622)	(30.522)	(46.320)	(32.857)	(6.045)	(3.764)	(39.594)	(1.948)
Owns Car	14.389	39.092	115.233	57.606	30.862	3.485	-9.120	-1.647
	(14.436)	(33.089)	(71.748)	(49.725)	(25.476)	(7.138)	(11.761)	(2.585)
Own Bank Account	-7.012	-11.779	-15.627	-10.124	-5.226	2.937	0.186	4.192**
	(7.491)	(14.190)	(29.939)	(21.974)	(6.749)	(2.489)	(9.724)	(1.734)
R²	0.14	0.19	0.18	0.2	0.13	0.28	0.11	0.19
Number of Observations	721	721	721	721	721	721	721	721

Notes: "Non-Adopters" do not have any transaction recorded in the administrative data. "Early adopters" are defined as having performed at least one mobile money transaction in each of the three years covered by data. "Experimenters" are defined as having performed at least one mobile money transaction in the first year after its introduction, but not in subsequent years. "Late Adopters" are defined as having performed at least one mobile money transaction in the second or third years after its availability, but not in the first year after the service was introduced. Dependent variables are the average value of mobile money transactions, expressed in MZN. The USD to MZN exchange rate varied between 28 and 38 over the 3 year-period included in our sample. All specifications estimated using OLS. All control variables measured at baseline. Standard errors clustered at the EA level. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3 shows that the average value per mobile money transaction is again higher for all transactions performed by *Early Adopters* relative to all other mobile money adopters in the sample. These average values are particularly higher for transfers received and cash-outs – a pattern consistent with individuals who often receive transfers from migrants in urban areas – in line with the results discussed by Batista and Vicente (2018). On the contrary, *Experimenters* tend to have lower average values of cash-outs and transfers received, whereas *Late Adopters* display lower average values of transfers sent.

IV. Concluding Remarks

Our analysis shows that adoption of mobile money tends to be positively self-selected. Early adopters in rural areas who continuously use the technology (and receive most remote transfers) are better educated and often already own a bank account. Spreading further the financial inclusion benefits of mobile money requires designing technology dissemination strategies that go beyond the financial literacy, free experimentation, and in-person support provided by the experimental intervention we implemented.

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