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Mobile Money and School Participation: Evidence from Low Income Countries*

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Abstract

This paper investigates the effect of using mobile money technology on children's school participation in low-income societies. We argue that, by reducing transaction costs, and by making it easier and less expensive to receive remittances, mobile money technology reduces the need for coping strategies that are detrimental to child development, such as withdrawing children from school and sending them to work. We test this hypothesis using a set of comparative samples from seven low-income countries. We find that mobile money technology increases the chances of children attending school. This finding is robust to the use of estimation techniques that deal with possible endogeneity issues. We also show that the effect of mobile money is mainly driven by African countries and that, at least for girls, it is significantly higher when the household is living below the poverty line.

Keywords: Mobile money, School, Child Labor, Technology, Digital Revolution.
JEL classification: O16; O17; G20; O33.

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1 Introduction

According to the latest available data, two billion people worldwide are still unbanked, i.e., they do not have access to an account at a formal financial institution (World Bank, 2015). Expanding access to financial services is a crucial factor in poverty reduction, as it facilitates saving and borrowing. Saving and borrowing help in coping with transitory income shocks, by reducing households' needs to resort to strategies that might be detrimental for their members in the longer term (Munyegera and Matsumoto, 2016) such as selling livestocks. These coping strategies are often involving children, who might have to be withdrawn from school and sent to work in order to support their household.

Mobile money, an electronic wallet service that allows users to deposit, transfer and receive money using their mobile phones, is deemed as a way to extend financial services to the unbanked, especially in remote and rural areas. Thanks to the expansion of mobile phones, this financial innovation has spread rapidly in low-income countries to such an extent that according to the latest available Global Mobile Money Dataset[1] in 2016, more than 40 percent of the adult population was using mobile money in Gabon, Ghana, Kenya, Namibia, Paraguay, Tanzania, Uganda, and Zimbabwe.

Mobile money facilitates the exchange of peer-to-peer remittances and promotes informal risk sharing among family members and friends in different ways: by reducing transaction costs; by providing secure and affordable opportunities for savings even in remote areas; by reducing security risks associated with cash-payments (Mbiti and Weil, 2011). Therefore, one could expect mobile money to be linked to higher opportunities to smooth consumption in the face of temporary shocks (Jack and Suri, 2014; Munyegera and Matsumoto, 2016), to reduce food insecurity (Murendo and Wollni, 2016), and to increase financial resilience, savings (Suri and Jack, 2016), and household disposable income (Kikulwe et al., 2014). Mobile money can therefore become a development flywheel.

In this paper we study a potential pathway through which mobile money can act, i.e. school participation of children in school age. Although universal education has been widely recognized as a key building block for sustainable development and a prerequisite for ending poverty and hunger (Lutz, 2017), this goal is far from being reached. In several low-income countries, children still constitute an important source of income either direct (through involvement in formal wage employment) or indirect (through involvement in domestic activities, particularly hazardous chores). Furthermore, in the absence of efficient credit markets, children are often seen as a buffer against shocks, such as production shocks or illness of an household member (Dehejia

[1] http://www.gsma.com/mobilefordevelopment/programmes/mobile-money

and Gatti, 2005; Beegle et al., 2006; Guarcello et al., 2010; Dillon, 2013).[2] No later than in 2015, about 264 million children and youth were out of school (Unesco, 2016) and, according to the latest available data, 168 million children were in child labor in 2013, of which roughly half were in hazardous work (ILO, 2013). Although these figures have declined since 2000, much remains to be done to achieve the fourth Sustainable Development Goal ("Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all") by 2030. Working children still account for almost 11 percent of the child population as a whole (Edmonds and Pavcnik, 2005) and the global number of children of primary school age not attending school has remained almost stable over the past five years (Unesco, 2016).

With this paper we contribute to the literature on child labor, school attendance, and to the growing literature on the adoption of digital technology and mobile money in low-income countries, by empirically showing that, by making it easier and less costly to receive remittances and to save money, mobile money technology reduces the need for child labor as a way to self-insure households, especially the most vulnerable, against unexpected shocks. Mobile money therefore contributes to increasing investments in children's human capital, and to reducing the probability that a household does not send children to school (Suri and Jack, 2016). We test this hypothesis by exploiting the richness of the *InterMedia's Financial Inclusion* set of nationally representative sample surveys covering seven countries in Africa (Kenya, Nigeria, Tanzania, and Uganda) and Asia (Bangladesh, India, and Indonesia).

Our findings suggest that households using mobile money services are significantly less likely to have children in school age that do not attend school. This result is robust to the use of different estimation techniques and model specifications. Furthermore, we show that the effect of mobile money is mainly driven by African countries and that, at least for girls, it is significantly higher for more vulnerable households.

The remainder of the paper is structured as follows. Section 2 presents the conceptual framework. Sections 3 and 4 describe the data and methods, respectively. Section 5 presents the results. Section 6 concludes.

2 Conceptual framework

Children in low-income countries are often seen as risk-coping instruments (De Janvry et al., 2006) that sustain households' consumption during hard times by working in the labor market, by cultivating households' land, or by substituting parents in households' chores and in caring for their younger

[2]For a recent review of the literature see Fors (2012).

siblings. The overwhelming majority of papers[3] supports the view that child labor is rooted in poverty and that, all else equal, parents prefer to send their children to school and dislike to send them to work if they can afford to do so (Basu et al., 2010), the so-called *luxury axiom* in Basu and Van's model (Basu and Van, 1998). As a result, the link between income and school participation appear to be strong enough to be taken for granted[4]: assuming a standard model of allocation of time with schooling and leisure being normal goods, when income increases, schooling and leisure increase as well, while (the need for) child labor decreases.[5]

This simple model implies that households' decision to send children to school does not depend on children's gender. However, in many countries girls continue to face several barriers to getting education. According to Filmer (2005), there are at least three motivations behind this gender gap in education that should be accounted for in theoretical and empirical models. First, the direct costs and, second, the opportunity costs of education may differ by gender. In fact, children play different roles in household production: while girls usually look after their siblings, and help in household's chores, boys are usually employed in cultivating familys land, or in waged jobs. The opportunity costs of schooling therefore crucially depends on the relative importance of each one of these two roles. Third, the returns to the investment in education may also differ by gender (Barro and Lee, 2013).

There are at least two pathways through which mobile money can impact on this relationship. First, mobile money technology makes it easier to receive *remittances*. A growing literature shows that remittances, by serving as an additional income source, can have a positive effect on investment in children's education (Adams and Cuecuecha, 2013; Mendola, 2016) and, under given conditions, a positive effect in terms of reducing child labor (Bargain and Boutin, 2015; Coon, 2016; Binci and Giannelli, 2016). Absent mobile money, remittances can be sent through banking services, or sent through people traveling to the destination (Kikulwe et al., 2014). While banks, when available, are safe enough, sending remittances through personal contacts (i.e., the bus driver traveling to his daily route) is associated to high transaction costs (including corruption and extortion) and is less safe. Mobile money, being a relatively faster and safer financial service innovation, can therefore be seen as the easiest and fastest way to receive remittances

[3]Relevant exceptions are, among others, Bhalotra and Heady (2003) introducing the concept of a "wealth paradox", Kambhampati and Rajan (2006), Dumas (2007) and Kruger (2007).

[4]Note that, however, the relationship between school participation, child labor and income is not always linear. As an example, Basu et al. (2010) have formally and empirically shown that the relationship between wealth and child labor exerts an inverted-U shape.

[5]Note that school participation and child labor are not always mutually exclusive (Edmonds and Pavcnik, 2005), however children that leave school or that do not attend school at all are less likely to go back to school due to higher entrance costs, included social stigma.

especially in rural areas where financial institutions are often missing and connecting infrastructures with neighboring and more developed realities are often lacking.

Second, mobile money, by serving as an electronic wallet that provides a safe although non remunerated savings instrument, can increase *savings*. These savings may free up some money which can be spent on education. In the absence of saving vehicles, such as bank accounts, households resort on less efficient strategies such as the purchase of assets or durables that can be sold to the market during hard times (Edmonds and Shrestha, 2014). Although households with a sufficiently high level of assets are able to cope with transitory income shocks (Beegle et al., 2006), they could have less money to invest in education, a cost of around 1.25 USD a day per child in low-income countries (UNESCO, 2015).

Given the results of previous literature (Jack and Suri, 2014; Kikulwe et al., 2014; Munyegera and Matsumoto, 2016), we expect the remittances pathway to be the predominant mechanism through which mobile money can affect households' decision to send children to school. Furthermore, we expect the effect of mobile money on children outcomes to be more salient for more vulnerable households for which a relatively cheap and simple innovation such as mobile money, can have significantly higher socio-economic consequences. As far as gender is concerned, we expect the effect of mobile money to be higher for boys with respect to their girls for which waged jobs are less relevant. Note, however, that this hypothesis can be particularly weak since in several low-income countries the gender of the child is potentially endogenous. Parents, in fact, often continue to have children until they have a son (Maitra et al., 2016) or practice prenatal sex selection (Kashyap and Villavicencio, 2016).

3 Data

Our empirical analysis is based on cross-sectional data from 2015 and 2016 from the *InterMedia's Financial Inclusion* surveys [6] covering 7 countries in Africa and Asia.[7] The data set contains detailed information on mobile phones, banks, mobile money and non-bank financial institutions, focusing in particular on awareness, access and use. The survey includes information on households composition, poverty status, as well as other geographic and demographic measures. The research is conducted among individuals 15 years and older. The total sample is composed of 151,073 respondents[8] of

[6] http://finclusion.org/

[7] The survey originally covers Nigeria, Tanzania, Kenya, Uganda, Indonesia, Pakistan, India and Bangladesh. As far as the third wave is concerned, we lack data from Pakistan.

[8] Bangladesh (12,000), India (90,576), Indonesia (12,120), Kenya (5,994), Nigeria (12,353), Tanzania (6,030), Uganda (6,000), and Pakistan (6,000).

which roughly 60 percent declare to have at least one child in school age in their household.

Descriptive statistics for the variables used in the empirical analysis are depicted in Table 1.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
Main dependent variables				
HH has boys not going to school	0.04	0.21	0	1
HH has girls not going to school	0.04	0.2	0	1
Main explanatory variable				
Active mm user	0.1	0.29	0	1
Further explanatory variables: Mechanisms				
Mobile money: remittances	0.07	0.25	0	1
Mobile money: savings	0.02	0.15	0	1
Covariates				
Receive Gov. Benefits	0.16	0.37	0	1
Own a bank account	0.5	0.5	0	1
HH has savings	0.63	0.48	0	1
HH has insurance	0.13	0.34	0	1
HH members $>$ 18 earning income	1.62	1.01	0	12
HH members	4.5	2.38	1	39
Bad weather destroys crops or livestock	0.13	0.34	0	1
Natural disaster destroys house/property/business	0.08	0.28	0	1
Increase of costs of inputs	0.08	0.26	0	1
Decrease in price of crop or livestock	0.07	0.26	0	1
Relocated	0.11	0.31	0	1
HH below poverty line	0.70	0.46	0	1
Robustness				
Share of boys (school age) enrolled in school	0.92	0.26	0	1
Share of girls (school age) enrolled in school	0.92	0.26	0	1
HH head				
HH head: rural female	0.14	0.35	0	1
Literacy	0.64	0.48	0	1
Numeracy	0.96	0.19	0	1
Instruments				
Knows mobile money	0.19	0.39	0	1
Access to OTC	2.97	1.42	1	6

Our two main dependent variables are dummy variables taking value one if the household has children (either boys or girls) in school age[9] that do not attend school (*HH has boys/girls not going to school*). As a robustness check, we also compute for each household the share of children (either boys or girls) in school age that attend school (*Share of boys/girls enrolled in school*).[10] In order to avoid confounding effects, we exclude from these measures children

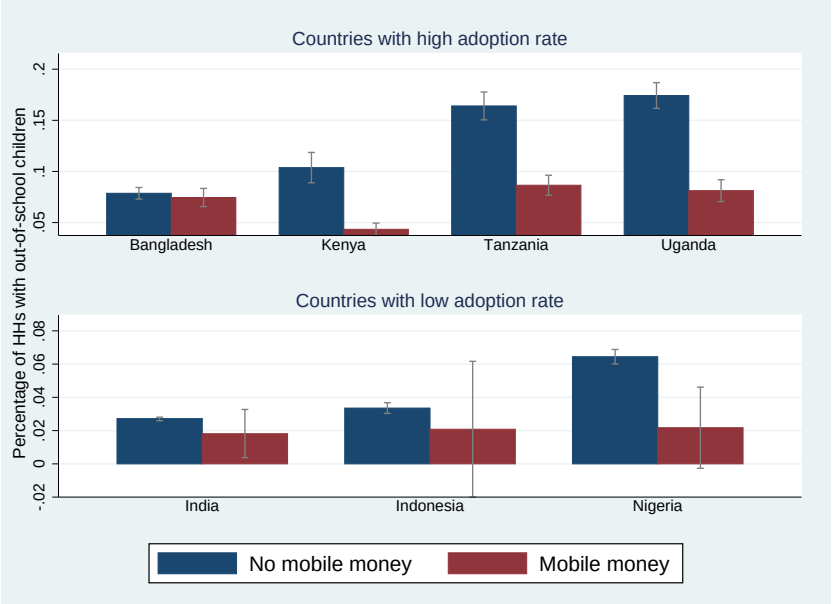
[9]School age is defined on the basis of the regulations in force in each Country.

[10]Note that this variable is calculated only for households having at least one children in school age.

that do not attend school because of illness or disability (around 3 percent of the children in school age).

Overall, 4 percent of the households has boys or girls that do not attend school even if they are in school age. This figure hides, however, significant differences among countries. As shown in figure 1, Uganda overcomes all the other countries in the sample with almost 1 over 5 households having children in school age that do not attend school. Although it is not always easy to access data on child labor at the country-level in low-income countries, our data are consistent with descriptive statistics collected by UNICEF, World Bank and International Labor Organization and freely available on-line.[11]

Figure 1: Percentage of households with out-of-school children, by country and adoption of mobile money



Mobile money use (*Active mm user*) is a binary variable that equals one if at least one member of the household is an active user of mobile money services, zero otherwise. This variable considers therefore both, registered and non-registered users. Overall, 10 percent of the respondents declare to be users of mobile money services. Once more, these rates vary substantially across countries, with Kenya and India displaying respectively the highest (73 percent) and lowest (0.2 percent) rate, consistently with international data on mobile money adoption (GSMA, 2017).[12]

Figure 1 offers a first qualitative assessment of the effect of mobile money on school participation. Overall, the pattern that emerges is that mobile

[11] See, for instance, http://www.ucw-project.org.

[12] https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2017/03/GSMA_State-of-the-Industry-Report-on-Mobile-Money_2016-1.pdf

money is negatively correlated with out-of-school children. However, it is not clear whether this correlation is driven by selection on unobservables or whether it is capturing true a causal effect. In what follows, we will further explore this effect.

4 Methods

Our main approach is to estimate the effect of mobile money on schooling assuming that the probability that a household have children in school age that do not attend school (S) – or, equivalently, the share of children in the household in school age that attend school, – of household h in country c, depends on mobile money usage (MM) and a vector X of individual and household-level controls:

$$S_{hc} = \beta_0 + \beta_1 MM_{hc} + X_{hc} + \lambda_c + \varepsilon_{hc} \tag{1}$$

where λ_c represents country fixed effects to account for possible heterogeneity across different countries, and ε_{hc} the error term. As covariates in the different models (X) we include several household characteristics which would affect mobile money usage by accounting for: the likelihood that a household is living below the poverty line (*HH below poverty line*)[13], household size, the number of adults in the household that earn an income, household's use of financial services (a bank account, an insurance, any type of savings including savings and credit cooperatives and associations), and whether the household has experienced in the last 12 months exogenous shocks[14] or it has relocated. The rationale behind this last control stems from the fact that, as shown for instance in Amuedo-Dorantes and Pozo (2010), migration can negatively affect school attendance of children in migrant households. Apart from household's characteristics, some estimated models also include personal characteristics of the household head such as gender, rural status, and literacy and numeracy that would insure that basic financial capabilities are accounted for.

We start by estimating separate models for our main dependent variables (mobile money use). The models are estimated either by Probit (marginal effect) or by OLS in order to take into account the binary or continuous

[13]Specifically, we make use of the *Progress out of Poverty Index* (http://www.progressoutofpoverty.org/), a poverty measure obtained by 10 questions about a households characteristics and asset ownership scored to compute the likelihood that the household is living below the poverty line

[14]Such as a flood, fire or other natural disaster that have destroyed house, property or business, bad weather or pests that has destroyed all or part of crops or livestock due to a disease, an increase of costs of agricultural inputs, or other additional expenses related to household's farm or business, and a decrease in price of crop, livestock or other goods that the household was used to sell to the market.

nature of the dependent variable of interest. Standard errors are robust to heteroskedasticity and data are weighted to conform to the national population. As a robustness check, we estimate the same models without weights and considering only countries for which mobile money penetration is greater than 20 percent (i.e., Bangladesh, Kenya, Tanzania and Uganda).

As in Munyegera and Matsumoto (2016), Jack and Suri (2014) and Kikulwe et al. (2014), we expect the impact of mobile money on school participation of children to be achieved through an improved access to remittances and savings. We explore these potential pathways by estimating the main model accounting for different usages of mobile money services (to receive remittances and to save money, respectively) as dependent variables.

Furthermore, as discussed above, there are several reasons to expect that the effect of mobile money on out-of-school children is heterogeneous across gender. To formally test for heterogeneous effects of mobile money, equation (1) is estimated separately for households having girls not going to school or boys not going to school.

An important methodological issue in our analysis is the potential endogeneity of mobile money use. Endogeneity may arise from unobserved heterogeneity at the individual and household level, as mobile money use and the decision to send children to school might be jointly determined by unobserved personality traits and attitudes, such as forward looking behavior. In order to address this issue, we make use of Instrumental Variables estimation (IV). Taking into account the binary nature of our main endogenous regressor, we estimate a bivariate marginal effect Probit model consisting of two specifications, a reduced form equation for the potentially endogenous dummy of mobile money use and a structural form equation determining the outcome of interest (Heckman, 1978).

More specifically, the reduced form equation includes two instruments: a proxy for access to an over–the–counter[15] and a dummy for mobile money knowledge[16]. In several low-income countries mobile money transactions are often over–the–counter (OTC) transactions. Unlike personal electronic mobile wallet, OTC transactions are not directly executed by the customers. Instead, they imply the mediation of an agent who receives customers' cash and executes the electronic task on their behalf. The assumption underlying the choice of this instrument is straightforward: an household living next to an OTC has a greater chance to use mobile money with respect to one liv-

[15] "If you had to go to the closest over the counter in a branch of a bank, how much time it would take you? I want to know, if you use your typical mode of transport or walk or ride a bicycle, whatever you usually do – how long would it take you to get there? It does not matter if you use it or not – I just want to know how far it is from you." Whit possible answers being 0.5 km or less (1), More than 0.5 km to 1km (2), More than 1km to 5km (3), More than 5km to 10km (4), More than 10km to 15km (5), More than 15km (6).

[16] "Have you ever heard of something called Mobile Money?"

ing far away. Furthermore, living next to an OTC should be independently related to the decision to send children in school age to school. The ratio behind the second instrument goes in the same direction as the previous one: having a knowledge of mobile money is assumed to be a pre-condition for mobile money adoption but, it is assumed to be independently related to the decision to send children in school age to school.

Although it could be plausible to assume that an household could decide to move with the explicit aim to live next to an OTC, therefore enjoying an easier access to financial services, the estimated specifications include among the controls a dummy for household's relocation during the last 12 months. Accordingly, the estimated specification includes a dummy for living below the poverty line to account for possible wealth effects affecting simultaneously mobile money knowledge and adoption, and the decision to send children to school. What we cannot really exclude is that households sending children to school are more likely to see advertising money mobile in OTC near the school where their children go, so that they change their knowledge of this tool and their decision to adopt it simultaneously. Given this limitation and the impossibility to find more suitable instruments, the results of the Instrumental Variables estimation must be interpreted with caution and in the light of the entire analysis including propensity score matching and robustness checks.

5 Results

This section presents the results of the empirical analysis. We start by estimating the effect of mobile money on the probability that a household has children (boys and girls, respectively) in school age that do not attend school. We focus on the effect of mobile money, while controlling for a wide set of control variables as described in equation (1). We then present some robustness checks and Instrumental Variables estimations.

5.1 Mobile money and schooling

Table 2 presents the results obtained on the whole sample. In order to check the robustness of the results, we consider four alternative specifications. Columns 1-2 report the results of estimating equation (1) while using as dependent variable a dummy indicating weather the household has children (boys in Column 1 and girls in Column 2, respectively) in school age that do not attend school. Columns 3-4 report the results of estimating equation (1) while using as dependent variable a dummy indicating the share of children in the household in school age that attend school (boys in Column 3 and girls in Column 4, respectively). The models depicted in Columns 1-2 are estimated by Probit (marginal effect) while those depicted in Columns 3-4 are estimated by OLS.

Table 2: Effects of mobile money on schooling: Main

	(1)	(2)	(3)	(4)
	HH has children not going to school		Share of children enrolled in school	
	Boys	Girls	Boys	Girls
Active mm user (d)	-0.011***	-0.006***	0.042***	0.031***
	(0.001)	(0.001)	(0.006)	(0.006)
Receive Gov. Benefits (d)	-0.003*	-0.003**	0.007**	0.010***
	(0.001)	(0.001)	(0.003)	(0.003)
Own a bank account (d)	-0.011***	-0.010***	0.026***	0.029***
	(0.001)	(0.001)	(0.003)	(0.003)
HH has savings (d)	0.005***	0.005***	-0.008***	-0.006**
	(0.001)	(0.001)	(0.003)	(0.003)
HH has insurance (d)	-0.005***	-0.006***	0.014***	0.018***
	(0.001)	(0.001)	(0.003)	(0.003)
HH members ¿18 earning income	-0.008***	-0.007***	-0.003*	-0.003**
	(0.001)	(0.000)	(0.001)	(0.001)
HH members	0.008***	0.007***	0.003***	0.003***
	(0.000)	(0.000)	(0.001)	(0.001)
Shock: weather (d)	0.004***	0.003**	-0.003	-0.007*
	(0.002)	(0.001)	(0.004)	(0.004)
Shock: Natural disaster (d)	0.007***	0.008***	-0.013***	-0.021***
	(0.002)	(0.002)	(0.004)	(0.005)
Shock: Increase of costs of inputs (d)	-0.003	-0.002	0.013**	0.006
	(0.002)	(0.002)	(0.005)	(0.006)
Shock: Decrease in price of crop or livestock (d)	-0.000	0.000	0.001	0.007
	(0.002)	(0.002)	(0.006)	(0.006)
Relocated (d)	0.002	0.004**	-0.013***	-0.019***
	(0.002)	(0.002)	(0.004)	(0.005)
HH below poverty line (d)	0.019***	0.019***	-0.024***	-0.033***
	(0.001)	(0.001)	(0.003)	(0.003)
Constant			0.877***	0.918***
			(0.006)	(0.006)
N.	136347	136347	58468	52183

Note: Covariates as described in Table 1. All reported models include country dummies. Columns 1-2 Probit marginal effects. Columns 3-4 OLS. Standard errors robust to heteroskedasticity reported in brackets. (d) indicates discrete change of dummy variable from 0 to 1.* p<0.10, ** p<0.05, *** p<0.01

We first consider the results for the covariates, in order to provide a preliminary assessment of the specification used in the empirical analysis. The estimates for the different specifications are qualitatively similar across models. Several variables turn out to be significant. Households' wealth (proxied by either transfers received or the probability of being below the poverty line) has a significant effect in terms of household's decision to send children to school suggesting that, in line with Basu and Van (1998), household's financial situation matters. Having experienced shocks affects negatively school participation. Overall, these results are consistent with those generally found in the literature.

The results for mobile money usage is consistent with our main hypothesis: households using mobile money services are less likely to have children in school age that do not attend school. This effect is always slightly greater for boys with respect that for girls suggesting that in the decision to send girls to school increasing financial inclusion and improving financial access could have a different impact across children's gender. Specifically, households with at least one mobile money user are 1.1 and 0.6 percentage points less likely to have boys and girls, respectively, in school age that do not attend school.

The size of the effect is small in absolute terms. In relative terms, however, the size of the effect of mobile money is sizable, being at least as large large than that of having insurance (-0.5 and -0.6, respectively in Column 1 and 2).

Table 3: Effects of mobile money on schooling: Mechanisms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	HH has children not going to school				Share of children enrolled in school			
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Mobile money: remittances (d)	-0.009***	-0.005***			0.041***	0.032***		
	(0.002)	(0.001)			(0.006)	(0.006)		
Mobile money: savings (d)			-0.006**	-0.004			0.025***	0.019**
			(0.003)	(0.002)			(0.009)	(0.009)
Constant					0.885***	0.923***	0.890***	0.928***
					(0.006)	(0.006)	(0.006)	(0.006)
N.	136347	136347	136347	136347	58468	52183	58468	52183

Note: Covariates as described in Table 1. All reported models include country and year dummies. Columns 1-4 Probit marginal effects. Columns 5-8 OLS. Standard errors robust to heteroskedasticity reported in brackets. (d) indicates discrete change of dummy variable from 0 to 1.* p<0.10, ** p<0.05, *** p<0.01

Table 3 reports the results for the mechanisms underlying the relationship between mobile money use and school participation of children, using the same set of specifications and control variables used in Table 2. Overall, we find both mechanisms to be related to households' decision to send their children (both boys and girls) to school.

5.2 Robustness

To assess the robustness of our main result, we conduct some sensitivity tests of the main estimates to the use of different samples, estimation techniques and specifications.

Table 4: Effects of mobile money on schooling: Robustness

	(1)	(2)	(3)	(4)	(5)	(6)
	Sample restricted to 4 Countries		Non-weighted regression		Propensity Score Matching	
	Boys	Girls	Boys	Girls	Boys	Girls
Active mm user (d)	-0.021***	-0.010***				
	(0.003)	(0.003)				
Active mm user (d)			-0.010***	-0.007***		
			(0.001)	(0.002)		
Active mm user (d)					-0.019***	-0.010***
					(0.003)	(0.004)
N.	29685	29685	136654	136654	136654	136654

Note: Dependent variable: HH has boys/girls not going to school. Covariates as described in Table 1. All reported models include country and year dummies. Probit marginal effects. Standard errors robust to heteroskedasticity reported in brackets. (d) indicates discrete change of dummy variable from 0 to 1.* p<0.10, ** p<0.05, *** p<0.01

First, we estimate the model in equation (1) when restricting the sample to Bangladesh, Kenya, Tanzania and Uganda, the 4 countries where mobile money usage rate is higher than 20 percent (Columns 1-2 in Table 4), and without weighting the data (Columns 3-4 in Table 4). As an additional way of studying the above presented relationship, we also present results obtained by applying a propensity score matching (PSM) estimator to the data (Columns 5-6 in Table 4). Though PSM could be seen as a good method to evaluate the causal effect of a treatment absent randomization, its main limitation is that it only accounts for observable covariates. As a result, any bias due to latent variables may remain after matching. The main finding of a positive effect in terms of schooling for mobile money users with respect to non users remains statistically significant across models and estimation techniques. Although we cannot say anything about the real magnitude of the effects, the results jointly suggest that mobile money has a robust and significant effect in terms of reduction of out-of-school children – or, equivalently, in terms of school participation of children in school age.

Second, Table 5 shows that the main result, although smaller in size, still holds for boys (not for girls) when we control for characteristics of the household head such as gender, rural status, literacy and numeracy that would insure that basic financial capabilities are accounted for. Note that the size of the effect of literacy is only half that for poverty suggesting that, as argued in Lutz (2017), education is an essential prerequisite for enabling people to eradicate poverty and an engine for self-development.

Third, results, not reported in the paper due to space limitation, are unchanged when one country at time is removed from the sample.

Table 5: Effects of mobile money on schooling: Robustness

	(1) HH has boys not going to school	(2) HH has girls not going to school
Active mm user (d)	-0.005**	-0.001
	(0.002)	(0.002)
HH head: rural female (d)	0.001	0.001
	(0.002)	(0.002)
Literacy (d)	-0.010***	-0.006***
	(0.002)	(0.002)
Numeracy (d)	-0.011**	-0.003
	(0.004)	(0.004)
Standard controls	Yes	Yes
N.	51985	51985

Note: Covariates as described in Table 1. All reported models include country and year dummies. Probit marginal effects. Standard errors robust to heteroskedasticity reported in brackets. Sample restricted to observations for which we do have information regarding the head of the household. * p<0.10, ** p<0.05, *** p<0.01 (d) indicates discrete change of dummy variable from 0 to 1.

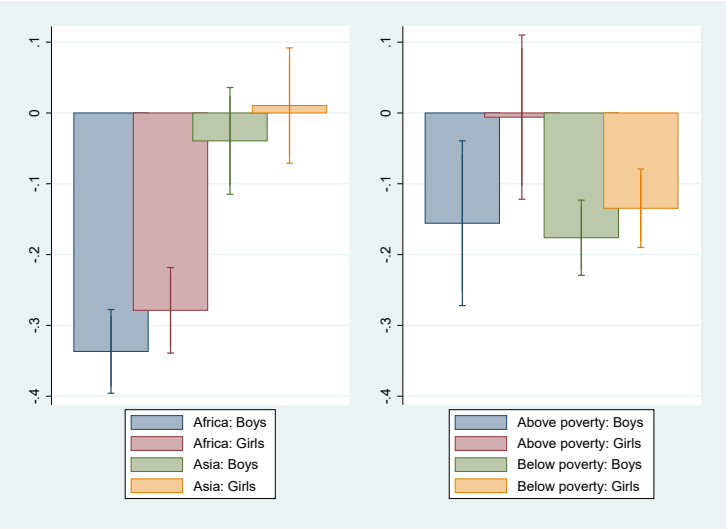
5.3 Heterogeneous effects

It is plausible to suppose that the effect of mobile money is heterogeneous across some dimensions. First of all, we can suppose that there are some difference across geographical areas. Second, as discussed above, it is plausible to suppose that the effect of mobile money is greater for the more vulnerable households. Figure 2 plots the coefficients obtained when estimating equation (1) by splitting the sample between African and Asian countries (Left panel) and between households living above or below the poverty line (Right panel). The whiskers indicate confidence intervals at 95 percent level. The results show that the effect of mobile money is mainly driven by African countries and that, at least for girls, it is significantly higher (at the 10 percent level) when the household is living below the poverty line.

5.4 Accounting for endogeneity

The results of the empirical analysis have so far provided robust evidence of a positive relationship between mobile money and school participation of children in school age. However, as already stated above, we cannot rule out the possibility that the error term in equation (1) is related to the regressors, due to unobserved heterogeneity or simultaneity. The cross-sectional nature of the dataset does not provide a within-subject variation that could be exploited in order to improve the identification strategy. As a result, we turn to the use of an instrumental variable (IV) estimator. This estimator is consistent only under the assumption of instrument validity, i.e., when the instruments are correlated with the endogenous regressor (i.e., mobile money) and uncorrelated with the error term (the dependent variable, i.e.,

Figure 2: Estimated effects of mobile money on schooling: Heterogeneous effects



(a) *Note:* Dependent variable: HH has boys/girls not going to school. Covariates as described in Table 1. Probit marginal effects. Standard errors robust to heteroskedasticity. The models include countries and year fixed dummies.

children in school).

Table 6 reports IV estimation results. Column 1 of Table 6 report the first-stage equation. Both instruments have the expected sign and are significantly related to the endogenous variables.

The IV estimates of the effect of mobile money on the probability of having children in the household that do not attend school is negative and significant. Indeed, the size of the estimated effect is slightly larger when using IV, consistently with a measurement error bias driving the Probit estimates towards zero or with the fact that the estimated coefficients recover, indeed, local average treatment effects (LATE) rather than average treatment effects (ATE). As an example, it could be that by using as an instrument the distance from an OTC we are actually identifying the effect of mobile money on schooling in the subpopulation which would use mobile money if mobile money is present but which would not use it if mobile money is absent. That means that the effect of mobile money is only revealed for the subpopulation of compliers.

A test of over-identifying restrictions is reported at the bottom of Table 6. The specification in column 2 shows a non-significant chi-square statistic, suggesting that the joint validity of the instruments is not rejected. On the opposite, the specification in column 3 shows a significant chi-square statistic and does not allow us to accept the joint validity of the instruments. Although, as stated in section 4, we are aware of the limitations of the IV

Table 6: Effects of mobile money on schooling, Instrumental Variables

	(1) First stage: Active mm user	(2) IV: Boys	(3) IV: Girls
Knows mobile money service	0.094***		
	(0.003)		
Access to OTC	-0.007***		
	(0.001)		
Active mm user (d)		-0.022***	-0.019***
		(0.003)	(0.003)
Athrho		0.136***	0.181***
Hansen J statistic :		$\chi^2 = 2.441$	$\chi^2 = 5.317$
		p= 0.118	p= 0.021
N.	122086	121787	121627

Note: Covariates as described in Table 1. Seemingly unrelated bivariate Probit. First stage reported only for column 2. First stage for column 3 available upon request. * p<0.10, ** p<0.05, *** p<0.01

approach, we are reasonably safe in concluding that the model in column 2 is a possible candidate for the causal process underlying the relationship between mobile money and school participation of children in school age.

6 Concluding Remarks

Mobile phones are rapidly spreading in low-income countries and, with them, their potential especially for poor people in rural areas. One interesting and potentially revolutionary contribution of mobile phones technology to development is through the use of mobile money services, a simple and relatively cheap innovation with the potential to reach the unbanked and increase financial inclusion.

In this paper, we have studied the effect of mobile money on out-of-school children by exploiting the richness of the *InterMedia's Financial Inclusion* set of nationally representative sample surveys covering seven countries in Africa and Asia. Our results suggest that mobile money technology increases the chances of children attending school, with this effect being greater for boys with respect to girls. Our results are largely consistent across the different model specifications and samples and are robust to methods aimed at addressing the potential endogeneity of mobile money use.

Our study complements the growing literature on the effects of mobile money on households' welfare in low-income countries and has a strong policy implication: mobile money services can play a pivotal role as a flywheel for development and, in particular, as a driving force for inclusive growth and shared prosperity by helping to reach "inclusive and equitable quality education for all" by 2030. The availability of this cheap innovation, in fact, can relax households' liquidity constraints and, therefore, can reduce detrimental

coping strategies in the face of income shocks such as pulling children from school to work. Since attitudes and identities are formed at a younger age, and are largely maintained throughout the lifespan, an improvement, however small, in terms of schooling and education can have important long-lasting effects. The literature shows that an increased access to education can lead, among other things, to better institutions (Glaeser et al., 2007; Lutz et al., 2010), to more weight-tested fertility decisions (Duflo et al., 2015; Shapiro and Gebreselassie, 2013; Lutz, 2014), to a more future-oriented society caring also for the environment (Inglehart, 1995) and for gender egalitarianism (Pampel, 2011). In a nutshell, applying our estimate to UNESCO's data (Unesco, 2016), more than 2 million children could start attending school in low-income countries if mobile money was available to all.

Follow-up research should analyze how the access to mobile money could improve not only the probability of being enrolled at school but also to complete education by accounting also for birth order and sibling composition that play an important role in children's allocation of time (Dammert, 2010), two aspects neglected in this paper due to data limitations. In doing so, further research could make use of panel data that are better suited for rigorous analytical purposes. A rather neglected aspect deserving further attention is the analysis of the effect of mobile money on paid child work and, more general, on the underground and informal economy.

This paper opened up only tangentially the discussion on these important and fundamental topics strictly related to a conceptualization of development with a human face.

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