How Does Adoption of Mobile Money Technology Affect Child Labour and School Enrolment?

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This paper analyses the impact of adoption of mobile money services on child labour and educational outcomes in Tanzania using an instrumental variables strategy. We identify heterogenous impacts across child's gender and age, and we find a positive and significant effect of mobile money adoption on educational outcomes, but the results reveal a negative and significant impact on child labour in the farm and households. Moreover, using mediation analysis, we identify remittances and education expenditure as the potential pathways through which mobile money adoption affects child labour and educational outcomes. Overall, the results suggest that policies that increase mobile money adoption can be effective in improving child educational outcomes and lead to a decline in the incidence of child labour.

Keywords: Mobile Money; Adoption; Child; Labour; Schooling

1. Introduction

The expansion in access to mobile phones in Sub-Saharan Africa, among many of its benefits, led to the introduction of mobile money services, which has been a major boost to financial inclusion, and particularly mobile money adoption among many households across the region. Mobile money services provide a platform that allows individuals and households to send or receive money cheaply, quickly, and safely around the country using mobile phones, thereby increasing financial inclusion of the unbanked poor households, which were previously inhibited by poor infrastructure and high transaction costs. This can have significant effect in terms of facilitating access to sending and receiving of remittances (Riley, 2018; Jack and Suri, 2011, Jack and Suri, 2016; Munyegera and Matsumoto, 2016). A growing number of studies have found other benefits associated with the use of mobile money services to include facilitating savings and borrowings, empowering the poor to smooth consumption and insuring households against negative income shocks (Riley, 2018; Munyegera and Matsumoto, 2016). The highlighted benefits of mobile money services lend credence to its poverty-reducing effect among households in many developing countries (Jack and Suri, 2014; Jack and Suri, 2016).

This paper examines the effect of households' adoption of mobile money on child labour and educational outcomes in Tanzania using data from the Tanzania National Panel Surveys. Moreover, we identify the various channels through which mobile money adoption by households affects child labour and educational outcomes. To the best of our knowledge, this paper is the first to examine the impact of mobile money services on child labour and educational outcomes in the context of Tanzania. The motivation for this paper stems from both theoretical and empirical evidence, which posit that incidence of child labour and children's low educational outcomes in developing countries are largely associated with poverty of households and credit market imperfections (Basu and Van, 1998; Baland and Robinson, 2000; Ranjan, 2001; Beegle, Dehejia and Gatti, 2006; Bandara, Dehejia and Lavie-Rouse, 2015).

Many poor households in developing countries engage in child labour as a source of income that can bring succour and alleviate the pangs of poverty (Basu and Van, 1998). Existing evidence lends credence to a positive association between informal risk sharing and child labour and low school enrolment in developing countries. Households affected by negative income shocks due to exposure to drought, floods,

loss of employment, loss of farmland, pest invasion on farms, economic or financial crisis, and death or illness of family head often result in the use of informal risk-sharing mechanisms such as child labour and withdrawal of children from school as buffers against negative income shocks (Fafchamps, 1999; Portner, 2001; Dercon, 2002; Beegle, Dehejia and Gatti, 2006; Ajefu, 2017).

In many developing countries, policies aimed at reducing child labour, boosting school enrolment and grade attainment have been on the front burner of development discourse for many years. Despite these efforts put forward by the government and interested institutions, both national and international, evidence shows that child labour and low school enrolment are widespread (ILO, 2017). For instance, in 2016, out of the 152 million in child labour, Africa ranks highest both in the percentage of children in child labour – one-fifth – and the absolute number of children in child labour – 72 million (ILO, 2017). These dynamics are likely to be driven by poverty, and imperfect credit and insurance markets, which are prevalent in developing countries (Beegle, Dehejia and Gatti, 2006; Bandara, Dehejia and Lavie-Rouse, 2015; Skoufias, Rabassa and Olivieri, 2011). Mobile money adoption is likely to have implications on child labour and education outcomes based on its poverty-reducing effect on households, and risk-sharing and relaxing of credit constraints through the receipt of remittances. However, there has been limited policy discussion on the causal link between financial inclusion and child labour and educational outcomes in the context of developing countries.

The methodology of this paper entails the use of instrumental variables strategy in which distance to the nearest mobile agent and availability of mobile money agents in the community are used as instruments. The objective of the project is two-fold: (i) to investigate the impact of mobile money on child labour and educational outcomes in Tanzania; and (ii) to investigate the potential channels through which mobile money impact child labour and educational outcomes. In this objective, we examine the mitigating effect of mobile money on the relationship between weather shocks and child labour and education outcomes. Accordingly, this paper addresses the following research questions: Does the use of mobile money services affect child labour and educational outcomes? If so, what are the potential channels through which mobile money affects child labour and educational outcomes? Does the use of mobile money services have mitigating impacts on weather shocks against child labour and educational outcomes? This paper is based on the following hypotheses: (1) households mobile money adoption affects child labour and educational outcomes; (2) the use of mobile money mitigates the effect of weather shocks on child labour and educational outcomes.

This paper contributes to a growing literature on mobile money adoption and household outcomes in developing countries (Mbiti and Weil, 2013; Munyegera and Matsumoto, 2016; Jack and Suri, 2014; Jack and Suri, 2016; Ky, Rugemintwari and Sauviat., 2018). While these existing studies focus on the effects of using mobile money on household welfare, risk-sharing against negative income shocks, and savings behaviour, this paper contributes to the existing literature by exploring not

only the impacts of using mobile money on child labour and educational outcomes in Tanzania, but also the various pathways or mechanisms through which using mobile money services affects child labour and educational outcomes. Similar to studies such as Alcaraz, Chiquiar and Salcedo. (2012), Bargain and Boutin (2015), and Caudros-Menaca and Gaduh (2020), we identify remittances as a potential channel through which mobile money adoption affects child labour and educational outcomes.

The relevance of this paper is underscored in the detrimental costs of child labour on physical health, mental well-being and crowding out of leisure on the part of children. It can also lead to reduced human capital accumulation, which often has deleterious consequences on labour market prospects (Fallon and Tzannatos, 1998; Ravallion and Wodon, 2000; Baland and Robinson, 2000; Ranjan, 2001).

The findings of this paper are summarized as follows: using an instrumental variable strategy in which we use the availability of mobile money agents in the community, and distance to nearest mobile money agents as instruments for mobile money adoption, we find that mobile money adoption has a positive impact on school enrolment or attendance but leads to a decline in different forms of child labour. We identify heterogeneous impacts of mobile money adoption on child labour and educational outcomes by gender and age of children.

Further, the results show that mobile money adoption has greater impact on boys' school attendance compared to girls' school attendance. Precisely, mobile money adoption increases the likelihood of school enrolment for boys by 59 percentage points, while girls' school enrolment is increased by 47 percentage points. We also find differential effects of mobile money adoption between boys and girls on the various dimensions of work-related activities. Mobile money adoption leads to greater decline in farm work and domestic work for girls compared to boys. These discrepancies could stem from the existing imbalance in domestic-related tasks between boys and girls among households in developing countries. Further, we find disaggregated effects based on age cohorts of the children. Mobile money adoption has greater effect on school enrolment for children aged 5-11 years compared to 12-17. However, the negative effect of mobile money on child labour activities is higher for children aged 12-17 years compared to 5-11 years.

In exploring the potential channels or pathways through which mobile money services affect child labour and education, we consider receipt of remittances, risk-sharing from health shocks and household education expenditure as the possible channels in our analysis. The remainder of this paper proceeds as follows: Section 2 discusses the background of the study; Section 3 discusses the relevant literature; Section 4 presents the estimation methodology; Section 5 describes the data sources and 6 discusses the results of the study and concludes the paper.

2. Background on Tanzania

This paper focuses on Tanzania because it provides a compelling context to investigate the impact of mobile money on child labour and educational outcomes. Tanzania has witnessed a significant increase in the use of mobile money across its population since the introduction of mobile money in 2009. As of March 2018, there were six mobile money service providers in the market: Vodacom's M-Pesa, Tigo Pesa, Airtel Money, Ezy Pesa, Halotel Money, and TTCL (Tanzania Invest, 2019). Another motivation for focusing on Tanzania can be linked to the fact that it is one of the early adopters of mobile money services in Sub-Saharan Africa and the growth of mobile money services in the country over time since then (Aaron, 2017)2. The proximity of Tanzania to Kenya, where mobile money was first introduced, also contributed to the growth in the adoption of mobile money services in Tanzania; as such, Tanzania is currently catching up with its neighbour in terms of the number of users and the volume of mobile money transactions (CGAP, 2016). As a result of increase in financial inclusion in Tanzania lately, the country has witnessed rising figures in the receipt of remittances by individuals and households (Utouh and Mutalemwa, 2015).

In Tanzania, child labour is a pervasive phenomenon and children are engaged in hazardous tasks such as fishing, mining, quarrying and domestic work. Some of these are described as the worst forms of child labour, with an estimated 29.3% (3.5 million) children aged 5 to 14 engaged in child labour. It can be considered as a fairly "average" country for Sub-Saharan Africa. According to UNICEF (and following the ILO definition of child labour), 29% of children between the age of 5 to 14 provide labour, against 28% for all Sub-Saharan Africa and 26% for Eastern and Southern African countries. Therefore, Tanzania is a country with intermediate levels of child labour for Sub-Saharan Africa, but high levels of child labour compared to other world regions3 (UCW, 2010). Further, in Tanzania, about 20% of working children reported that their labour activities prevented them from learning correctly, and 20% have already suffered a work-related injury (Dumas, 2013).

Climate change has been identified as a factor that can significantly contribute to the incidence of child labour and low school enrolment. In recent years, Tanzania has witnessed a rise in temperatures, which has resulted in the likelihood of intense rainfall events, droughts, and floods. Specifically, Tanzania has recorded increasing variability in rainfall, with large differences in amounts and seasonality from year to year. In addition, the northeast and much of the southern parts of Tanzania have witnessed increasing cases of dry spells in recent years (Future Climate for Africa, 2017).

3   Relevant Literature

A large fraction of the population in many developing countries lacks access to basic financial services, but the recent introduction of mobile money has helped to circumvent the financial service access gap of the unbanked poor in these countries (Munyegera and Matsumoto, 2016; Jack and Suri, 2014, Jack and Suri, 2016). Mobile money allows individuals to use their mobile phones to deposit and transfer funds and make payments for goods and services (Munyegera and Matsumoto, 2016).

An emerging body of literature shows that financial inclusion in the form of mobile money plays a significant role in reducing poverty by facilitating savings and borrowing, empowering the poor to smooth consumption, and insuring households against negative income shocks (Riley, 2018; Jack and Suri, 2014; Munyegera and Matsumoto, 2016; Demirguc-Kunt and Klapper, 2012; Dupas and Robinson, 2013)4.

This paper contributes to the following two strands of literature: (i) the literature on potential determinants of child labour; and (ii) the literature on the use of mobile money services and its insurance role against shocks in the context of developing countries. The first strand of literature focuses on existing studies that identify some underlying factors that contribute to the perpetuation of child labour and low education outcomes despite the efforts in terms of policies at different levels by government to curb it.

The major arguments for the incidence of child labour stem from poverty, credit market imperfections, imperfect land and labour markets and household characteristics (Basu and Van, 1998; Dumas, 2013; Alvi and Dendir, 2011; Ranjan, 2001; Baland and Robinson, 2000; Dehejia and Gatti, 2002; Beegle, Dehejia and Gatti, 2006; Zeldes, 1989; Cain, 1982). In a seminar paper, Basu and Van's (1998) proposition reveals that poverty is the main driver of child labour. Households send their children to work only if the adult wage falls below a certain threshold where the household subsistence requirements cannot be met without an alternative source of income. Child labour provides that source (the so-called Luxury Axiom). Child labour is considered a substitute for adult labour (the Substitution Axiom). Although household survival is the main underlying reason for child labour in this model, it also relates to the permanent income hypothesis and consumption smoothing.

The second strand of literature evaluates the effect of mobile money on households' outcomes and its insurance role in risk-sharing and smoothing of consumption. Some of the mechanisms through which mobile money services allow for risk-sharing are savings and receipt of remittances. Yang and Choi (2007) provide evidence for

remittances as an insurance against rainfall shocks for households in Philippines, and the study shows that the receipt of remittances compensates for a fall in income after rainfall shocks.

The receipt of remittances can be achieved much faster with the use of mobile money technology, since it involves the use of mobile phones and the attendant lower costs of financial transactions. This allows users access to wider risk-sharing networks and helps households in smoothing consumption (Riley, 2018; Jack and Suri, 2014; Munyegera and Matsumoto, 2016). Similarly, Jack and Suri (2014) investigate how mobile money facilitates consumption smoothing for households that are exposed to negative idiosyncratic shocks in Kenya. They find that the consumption of households that are non-users of mobile money falls by 7%-10% after a shock, and there is no corresponding fall for consumption for users of mobile money services.

This paper contributes to the existing literature by empirically investigating the impact of using mobile money on child labour and educational outcomes. Additionally, we contribute to the literature by identifying potential channels through which the use of mobile money affects child labour and educational outcomes.

4 Empirical Methodology

In this section, we estimate two main equations, separately: (i) the effect of mobile money adoption on child labour and educational outcomes – by using both the Ordinary Least Squares and instrumental variables regressions; and (ii) the mitigating role of mobile money on the impacts of weather shocks (droughts and floods) on child labour and educational outcomes.

(a) Mobile money adoption, child labour and educational outcomes

First, we examine the effect of mobile money adoption on child labour and educational outcomes using the Ordinary Least Squares regression with fixed effects in which we compare the outcomes of child labour and educational outcomes of mobile money users relative to non-users of mobile money.

We estimate the equation below:

$$Y_{iht} = \alpha_i + \mu MM_{ht} + \varphi X_{iht} + \omega Z_{ht} + \tau_t + \varepsilon_{iht} \tag{1}$$

where Y_{ih} is child labour (educational outcomes) for child *i* in household *h* at time *t* (we consider outcomes such as child enrolment in school, child absenteeism, child work, engaged in household farm activities, and engaged in domestic chores or work) for child *i* in household h at period *t*5. Moreover, MM is a binary indicator of mobile money adoption and represents the parameter of interest (mobile money usage impact on child labour and educational outcomes). Based on prior expectations, the effect of mobile money adoption should have a negative (positive) sign on child labour (educational outcomes) from the regressions. X_{iht} represents the characteristics of child *i* in household *h* at time *t* and Z_{ht} captures household-level controls at time *t*. Lastly, α_i τ_t and ε_{iht} denote district fixed effects, year fixed effects and error-term. The use of district fixed effects control for time-invariant unobserved districts' heterogeneities or characteristics that are likely to affect child labour and schooling, while year fixed effects control year-specific characteristics or shocks common to all districts. The standard errors are clustered at the household level.

(b) Instrumental Variables Analysis

Following the estimations based on equation (1), we assumed that the use of mobile money by household is conditionally mean-independent, given the other control variables included in the regressions. In other words, the estimated coefficients are only valid if mobile money adoption is not correlated with the error term conditional on the other controls. Therefore, the decision to use mobile money services may be correlated with time variant unobservable factors that also affect child labour and educational outcomes.6

As a result of the endogeneity associated with the adoption of mobile money by households, we use instrumental variable estimation approach. Following Jack and Suri (2014; 2016), Munyegera and Matsumoto (2016), Riley (2018), Abiona and Koppensteiner (2020), we used two instruments for the instrumental variable analysis. These include: (i) availability of mobile money agent in the village; and, (ii) distance to the nearest mobile money agent as an instrument for mobile money adoption.7 The theoretical justification for using expansion of mobile money network hinges on the assumption that the location of mobile money agent is not likely to be correlated with child labour and educational outcomes, but there is the likelihood of a correlation between distance to the nearest mobile money agent (availability of mobile money point in the village) and mobile money adoption.

A potential source of bias may result from self-selection by mobile money agents into communities. For instance, if mobile money agents are in villages or communities with a greater proportion of wealthier residents, such a characteristic may be correlated with child labour and educational outcomes, and this could confound the results. However, evidence shows that most of the roll-out mobile-money agents during the early launch of mobile money services were existing sellers of airtime and sim cards. These microenterprises had links with mobile operators that spread across the country with high mobile phone ownership and cellular coverage (Shkaratan, 2012).

We used log of household distance to the nearest mobile money agents as instruments for mobile money adoption by the household in the analysis. The basic assumption in the instrumental variable estimation is that the presence of mobile money agent in the village and distance to the nearest mobile money agent are not correlated with household and village characteristics that could affect child labour and education outcomes.

The first stage regression for the impact of mobile money on child labour and schooling is presented below as:

$$MM_{ht} = \alpha_0 + \alpha_1 \log distMM\ Agent_{ht} + X_{ht} + \alpha_i + \tau_t + v_{ht} \qquad (2)$$

where MM_{ht} is adoption of mobile money by household h at time t, $\log distMM\ Agent_{ht}$ - log of distant to nearest mobile money agent8 (and availability of mobility of mobile money point in the village) by household h at time t, and X_{ht} is household and

community covariates. Using the IV approach, from equation (1) is the parameter of interest that captures the impact of mobile money on child labour and schooling, α_i τ_t denote district and year fixed effects, respectively. The error terms in equation (1), ε_{iht}, and equation (2), v_{ht}, uncorrelated.

The first stage regressions are presented in Table 2 on page 18. For different regressions of the outcome variables in the two-stage least estimates, we find that in the first stage results, while household distance to the nearest mobile money agent and mobile money adoption show a negative relationship, the second instrument, dummy for availability of mobile money agent in the village, is positively associated with mobile money adoption. The diagnostic test for weak instrument or weak-identification test reports the Kleibergen-Paap Wald rk F statistic, Cragg-Donald F statistic, and Stock-Yogo weak ID F test. Both Kleibergen-Paap Wald rk F statistic and Cragg-Donald F statistic exceed the Stock-Yogo critical value. The maximum test statistic from Stock-Yogo weak ID F test critical at 10% maximal IV size is 19.93, which exceeds the rule-of-thumb of 10 for strength of instrument. Moreover, the Kleibergen-Paap Wald rk F statistic and Cragg-Donald Wald F statistic are 46.35 and 140.59, respectively. The Hansen J p-value is greater than 0.1 in all specifications, which satisfies over-identification test of the two instruments used in the instrumental variable strategy.

4.1   Mechanisms

We identify potential pathways through which mobile money adoption affects child labour and educational outcomes.

4.1.2 Mobile money adoption, remittance receipts and education expenditure

A number of studies lend credence to mobile money services, promote the receipts of remittances and indirectly have effects on child labour and educational outcomes. To investigate whether remittance receipts differ across households that are mobile money users versus non-users of mobile money, we estimate the equation below:

$$r_{ht} = \alpha_i + \delta MM_{ht} + \varphi X_{ht} + \tau_t + \varepsilon_{ht}$$

(3)

where r_{ht} is the receipt of remittance by household h at period t (both binary and continuous variables), MM_{ht} is a binary indicator of mobile money adoption for household h at time t, α_i is the district fixed effects, X_{ht} represents household-level control variables such as age of household head, marital status of household head, educational attainment of household head, household size, etc. τ_t captures year fixed effects, and ε_{ht} denotes error terms. And standard errors are clustered at the household level.

4.1.3 Drought and flood shocks, child labour and educational outcomes

This paper investigates the extent to which mobile money plays the role of risk-sharing or insurance for households exposed to flood (drought) shocks. Households' exposure to shocks could have negative consequences on children as households seek to cope with negative shocks. The coping measures can be through increased labour market activities and reduced educational outcomes of children. This sub-section speaks to a number of studies on the nexus between economic shocks and child outcomes (Bandara, Dehejia and Lavie-Rouse, 2015; Hyder, Behrman and Kohler, 2015; Alam, 2015; Woode, 2017; Dinku et al., 2018; Tabetando and Matsumoto, 2020).

Moreover, we investigate the mitigating role of mobile money against households' exposure to drought and flood shocks using the equation below:

$$Y_{iht} = \alpha_i + \delta_t + \beta_1(MM_{ht}) + \beta_2(Shocks_{ht}) + \tau(MM_{ht} * Shocks_{ht}) + X'_{iht}\beta_3 + Z'_{ht}\beta_4 + \varepsilon_{iht}$$

(4)

where $Shocks_{ht}$ is a self-reported binary indicator for household h at time t. $MM_{ht} * Shocks_{ht}$ is the interaction of mobile money adoption and drought/flood shocks of the households, and this captures the variable of interest.

5. Data Sources

5.1.1 Tanzanian National Panel Survey

The three waves of data for this paper are drawn from the Tanzania National Panel Surveys (TNPS), which are: the 2010/11, 2012/13 and 2014/15.9. The TNPS is a national representative survey conducted by the National Bureau of Statistics of Tanzania in collaboration with the World Bank Living Standards Measurement Study-Integrated Surveys on Agriculture (LMSA-ISA). The survey collects detailed information on individual, household, and community-level characteristics. The panel nature of the TNPS allows for the same households to be interviewed over time.

The TNPS tracks 3,265 baseline households from the 2008/2009 waves and all the split-offs of these households over time. Across the four waves, the attrition rate of households is 4.8%. The survey has about 96% recapture rate across the wave one to 3.10. In the second wave of data collection, the number of panel households increases to 3,924; in the third wave, to 5,010 households, but declines in the fourth wave to 3,352. The fourth wave was refreshed, and it was not possible to identify the attrition rate for the entire wave three in relation to wave four of the TNPS. The attrition was done for the extended panel households, which was about 860 households, and it corresponds to an attrition rate of 8%. In the analysis of this paper, we use an unbalanced panel from three waves of the survey (2010/11, 2012/13, and 2014/15). The full sample comprises 18,631 children between the age of 5 and 17.

5.1.2 Child labour and educational outcomes data

Following Bandara et al. (2015), and Cuadros-Menaca and Gaduh (2020), the dependent variables of interests include both binary and continuous variables for school enrolment, child labour, farm work in the last 7 days and domestic or home chores in the previous day. In addition, we use as outcomes measures that capture hours worked in the last 7 days prior to the survey for wages, household-owned businesses, and household-run farming and hours per week spent on the household tasks of collecting firewood or fuels and water. The National Panel Survey of Tanzania contains detailed data on education and time-use of each household member of age 5 and above. However, we restrict our analysis to children between the age of 5 and

17 years11. The control variables used include child 'sage, dummy for male child, household size, dummy for male-headed household, dummy for married household head, age of household head, household completed at least primary education, dummy for electricity, log of distance to nearest government primary school, and log of distance to nearest government secondary school.

5.2   Summary Statistics

Table 1 presents the summary statistics for child and household characteristics for the three waves (2010/11, 2012/13, and 2014/15) of the data used in the analysis. Over the three periods, on average as presented in the fourth column, 68% reported school attendance, 8% reported child work (labour), 22% reported farm work and an average of 4.3 hours spent on household farm. Moreover, about 10% of children reported engagement in fetching water and collecting firewood the previous day and that 0.16 hours were spent on those activities. On average, 33% of the households adopted money over the three periods, and 16% reported receipt of remittances. The average child age in the sample was 11 years, and 50% of the children in the sample used in the analysis are boys. Further, we present in Table A1 the summary statistics of child outcomes and household characteristics by using mean difference of households' mobile money adoption status. For the outcome variables, the mean difference descriptive reveals that educational enrolment is higher for houses with mobile money adoption compared to households that are non-users of mobile money. Also, on average, mobile money users reported lower child labour outcomes compared to non-users of mobile money services.

Table 1: Summary statistics of variables

Variable	Mean	Standard Deviation
Outcome variables		
School attendance (=1)	0.681	0.466
Work (=1)	0.080	0.271
Work (farm) labour (=1)	0.223	0.415
Hours spent on household farm	4.280	11.109
Domestic work (=1)	0.095	0.293
Hours spent on domestic work	0.161	0.656
Control variables		
Child's age	10.707	3.733
Male-child	0.499	0.500
Household size	7.680	3.902
Age of household head	48.075	13.186
Male household head	0.768	0.422
Household head married	0.789	0.407

Head HH completed primary education	0.417	0.493
Mobile money	0.327	0.462
Distance to nearest mobile money agent (KM)	12.030	23.946
Availability of mobile money agent (=1)	0.464	0.498
Total education expenditure	95,034.220	348511.400
Remittance receipt	0.162	0.369
Distance to nearest primary school (KM)	0.319	1.463
Observations	18,631	

Source: Authors' computation using the TNPS for 2010/11, 2012/13, and 2014/15

5.3 Results and Discussions

Table 3 presents both the results of Fixed Effects and instrumental variables (IV) regressions of the effect of mobile money on child labour and educational outcomes. From Panel A, results from column 1 reveal that households with mobile money adoption are 15 percentage points more likely to have their children enrolled in school. Column 2 shows that households with mobile money adoption are 0.2 percentage points less likely to have their children engaged in child labour. However, the relationship between mobile money adoption and child work is not statistically significant. Moreover, the results from column 3 to 6 show the relationship between mobile money and different forms of child labour and hours worked. The results in column 3 reveal that households with mobile money are 9 percentage points less likely to have their children in farm labour. Column 4 shows the results of the effect of mobile money adoption on hours spent on household farms. We find that households with mobile money spent 30 percentage points less hours on households' farms. Columns 5 and 6 capture household chores such as fetching water and collecting firewood the day prior to the survey. We find that households with mobile money adoption are 4 percentage points less likely to be engaged in domestic work. Also, households with mobile money spent 4.4 percentage points less hours on household domestic work.

The results from Panel B of Table 3 present the two-stage least squares (2SLS-IV) estimate of the effects of mobile money adoption on child labour and educational outcomes using log of household's distance to the nearest mobile money agents as an instrument for mobile money adoption. In column 1, the results reveal that households with mobile money adoption are 53 percentage points more likely to have their children enrolled in school. Column 2 results reveal that households with mobile money are 9 percentage points less likely to have their children in child labour activities. Column 3 shows that households with mobile money adoption are 58 percentage points less likely to have their children engaged in household farm labour. From column 4 to 6, we find that households that had adopted mobile money had children that spent fewer hours on household farms and domestic work, and were less

likely to be engaged in domestic work (fetching water and collecting firewood). The magnitude of coefficients of the 2SLS-IV of the various outcomes are larger than the coefficients of fixed effects regressions. This may be due to fixed effects regressions under-estimating the effects of mobile money adoption on child labour and schooling.

From the results of educational enrolment and child labour, we observe that the relationship between mobile money and educational enrolment is positive, while child labour reveals negative relationship with mobile money. These findings reinforce the existing idea that school enrolment and child labour are negatively linked. In other words, increased school enrolment or attendance is associated with a decline in the incidence of child labour. These findings contribute to existing studies such as Cuadros-Menaca and Gaduh (2020), Del Carpio et al. (2016), Filmer and Schady (2011), and Kandulu et al. (2020). These studies investigate the relationship between remittances, conditional cash transfer programmes, and microcredit on child labour and school enrolment in the context of developing countries.

5.3.1 Heterogeneous effects

To estimate the heterogeneous effect of mobile money adoption on child labour and schooling by gender and age, we use a split sample in the two-stage least squares (2SLS) analysis similar to Cuadros-Menaca and Gaduh (2020), Del Carpio et al. (2016), and Dumas (2020). We undertake a heterogeneous analysis to investigate the magnitude of the impact of mobile money on child labour and schooling by age and gender. This will allow for policy prescription by the government to be targeted at the group or groups that need interventions. Table 4 reports heterogeneous effect by gender in the relationship between mobile money adoption and child labour and educational outcomes. The results of the analysis of boys' sample are presented on Panel A of Table 4 and the girls' sample on Panel B. The results from column 1 and Panel A of Table 4 show that households with mobile money are 59 percentage points more likely to have boys enrolled in school. Column 2 of Table 4 shows that households with mobile money adoption are 13 percentage points less likely to have boys engaged in child labour. Column 3 reveals that households with mobile money adoption are 55 percentage points less likely to have boys engaged in household farm labour.

Panel B of Table 4 presents results of girls' sample of the effect of mobile money on child labour and school attendance outcomes. Column 1 shows that households with mobile money adoption are 47 percentage points more likely to have girls enrolled in school. Column 3 shows that households with mobile money adoption are 60 percentage points less likely to have girls engaged in household farm labour (work). In terms of hours of household farm work for girls, in column 4, we find that mobile money adoption leads to a decline in hours of work for girls. Column 5 and 6 present results of domestic activities, and the results show that mobile money adoption by households leads to a decline in having girls in domestic activities (such as fetching water and collecting firewood) and hours spent on those domestic activities. The results from Table 4 indicate inequality or disparity between boys and girls in child

labour and schooling outcomes because of the adoption of mobile money services. This brings to the fore an important driver (gender inequality) of poverty and poor household welfare in many developing countries.

Table 5 presents heterogenous effects of mobile money on child labour and educational outcomes by ages of children. The results are for two split samples of children between 5 and 11 years (results shown in Panel A of Table 5) and 12-17 years (results shown in Panel B of Table 5). The intuition behind this categorization is to capture the effects of mobile money on enrolment in primary and secondary school groups or cohorts. From column 1 of Table 5 of Panel A, we find a positive effect of mobile money adoption on the likelihood of being enrolled in school for children within the age range of 5-11 years. Specifically, households that use mobile money are 56 percentage points more likely to have their children enrolled in school compared to households that don't use mobile money. Column 2 shows a negative effect of mobile money on child labour (work) by 9 percentage points, while column 3 shows that mobile money adopters are 44 percentage points less likely to have children aged 5-11 engaged in farm work. Column 4 reveals that mobile money adoption leads to a decline in hours spent on household farm for children aged 5-11. Further, in column 5 we find that households with mobile money adoption are 16 percentage points less likely to have children within the age bracket of 5-11 engaging in domestic work in the day prior to the survey.

From Panel B of Table 5, the results show the effect of mobile money on child labour and school enrolment for children within the age bracket of 12-17 years. Column 1 shows that households that use mobile money are 53 percentage points more likely to have children in age category 12-17 enrolled in school. We find no statistically significant effect of mobile money on child labour as reported in Column 2. From column 3, households with mobile money adoption are 81 percentage points less likely to have children in the age bracket of 12-17 engage in farm work. Column 5 and 6 present the results of the effects of mobile money on domestic work and hours spent on domestic activities in the day prior to the survey. The results from Panel A and Panel B of Table 5.5 show that mobile money adoption has greater impact on children's education for those aged 5-11 years, compared to those in the 12-17 years group. We can argue that mobile money is likely to be effective in promoting school enrolment among children in the age category of 5-11 years, which corresponds to the primary school age, compared to those in the age category of 12-17 years (those in the secondary education category).

5.3.2 Risk coping mechanisms

We investigate the risk coping of mobile money adoption using self-reported drought/flood shocks interacted with mobile money in an instrumental variable framework. The drought and flood shocks used in the analysis constitute a binary variable, which is equal to 1 if the household reported exposure to drought or floods in the past year and 0 if otherwise. The coefficient of the interaction of mobile money and hrough

the self-reported drought/flood shock are our coefficients of interest. The results of the interactions provide the mitigating impacts of mobile money adoption on household exposure to drought shocks and its consequences on child labour and educational outcomes. To provide causal interpretations to the coefficients from column 1 to 6 of Table 6, we used an interaction of the two instruments used in our analysis and drought/flood shocks as instruments for the interaction of mobile money with drought/flood shocks. We find a statistically significant effect for the school attendance and child labour.

5.3.3 *Pathways or mechanisms: Mediation analysis*

We present the results of the mediation analysis in Table 7 using the approach discussed by Imai et al. (2010), and Imai et al. (2011). In the analysis, we consider remittances and education expenditure as potential channels or mediators through which mobile money adoption affects child labour and schooling in Tanzania.12 The results are presented in Panel A and Panel B, which capture remittances and education pathways, respectively. From Panel A and column 1, the results show that mobile money is positively associated with remittance receipt, and mobile money and remittances receipt are positively associated with child school enrolment. In column 1 of Panel B, we find that educational expenditure is positively associated with mobile money adoption, and mobile money and educational expenditure are positively associated with child school enrolment. These results follow for column 2 to column 6 in Panel A and Panel B. It is imperative to note that, though there are patterns of association in the mediation analysis, we cannot infer causality in this relationship because mobile money adoption across households is not randomly assigned, hence there is likelihood of endogeneity associated with its adoption by households.

In Table A2 in the Appendix, we show the 2SLS-IV results on the relationship between adoption of mobile money, remittances, and education expenditure. We find a statistically significant relationship between mobile money adoption, remittances, and educational expenditure. These results are consistent with the findings of Abiona and Koppensteiner (2020), Riley (2018), and Tabetando and Matsumoto (2020). These studies identified remittances (either probability of receipt or amount received) as the potential pathways through which mobile money adoption affects household outcomes.

Table 2: First-stage regressions of the impact of mobile money on child labour and school enrolment

Variable	Attend School (1)	Work (2)	Work (farm) labour (3)	Log. Hrs HH farm (4)	Domestic work (5)	Log. Hrs domestic work (6)
Mobile money adoption						
Distance to mobile money agent	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
MM agent point in village (=1)	0.095*** (0.014)	0.095*** (0.014)	0.095*** (0.014)	0.095*** (0.014)	0.095*** (0.014)	0.095*** (0.014)
Child characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Household and community controls	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,631	18,631	18,631	18,631	18,631	18,631
Weak identification test						
Kleibergen-Paap Wald rk F statistic	46.350	46.350	46.350	46.350	46.350	46.350
Cragg-Donald Wald F statistic	140.594	140.594	140.594	140.594	140.594	140.594
Stock-Yogo weak ID F test critical at 10% maximal IV size	19.930	19.930	19.930	19.930	19.930	19.930
Weak-instrument-robust inference						
Anderson-Rubin Wald test F	27.56 (P-val=0.000)	2.11 (P-val=0.121)	26.59 (P-val=0.000)	31.20 (P-val=0.000)	6.87 (P-val=0.001)	4.31 (P-val=0.013)
Anderson-Rubin Wald test Chi-sq(1)	55.20 (P-val=0.000)	4.22 (P-val=0.121)	53.25 (P-val=0.000)	62.48 (P-val=0.000)	13.76 (P-val=0.001)	8.62 (P-val=0.013)
Stock-Wright LM S Statistic Chi-sq(1)	51.82 (P-val=0.000)	4.52 (P-val=0.104)	54.85 (P-val=0.000)	65.22 (P-val=0.000)	14.27 (P-val=0.001)	9.19 (P-val=0.010)

Note: Robust standard errors, clustered at the household level, are reported in parentheses. ***, ** and * represent significance at 1%, 5% and 10%, respectively. The control variables used include child age, dummy for male child, household size, dummy for male-headed households, dummy for married household head, age of household head, household completed at least primary education, dummy for electricity, and log of distance to nearest government primary school.

Table 3: Impact of mobile money adoption on child labour and schooling

Variable	Attend School (1)	Work (2)	Work (farm) labour (3)	Log. Hours HH farm (4)	Domestic work (5)	Log. Hrs domestic wk (6)
Panel A: Fixed Effects Estimates						
Mobile money	0.150*** (0.014)	-0.002 (0.008)	-0.094*** (0.013)	-0.301*** (0.038)	-0.042*** (0.008)	-0.044*** (0.008)
Child characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Household and community controls	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Household fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18, 631	18, 631	18, 631	18, 631	18, 631	18, 631
Panel B: IV Estimates						
Mobile money	0.526*** (0.088)	-0.093** (0.047)	-0.579*** (0.099)	-1.814*** (0.291)	-0.190*** (0.053)	-0.148*** (0.052)
Child characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Household and community controls	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18, 631	18, 631	18, 631	18, 631	18, 631	18, 631

Note: Robust standard errors, clustered at the household level, are reported in parentheses. ***, ** and * represent significance at 1%, 5% and 10%, respectively. The control variables used include child age, dummy for male child (=1), household size, dummy for male-headed household, dummy for married household head, age of household head, household completed at least primary education, dummy for electricity, and log of distance to nearest government primary school.

Table 4: Impact of mobile money adoption on child labour and schooling by gender (IV–2LS)

Variable	Attend school (1)	Work (2)	Work (farm) labour (3)	Log. Hrs HH farm (4)	Domestic work (5)	Log. Hrs domestic work (6)
PANEL A: Boys						
Mobile money	0.591*** (0.117)	-0.126** (0.064)	-0.546*** (0.120)	-1.737*** (0.366)	-0.081* (0.056)	-0.050 (0.050)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,293	9,293	9,293	9,293	9,293	9,293
PANEL B: Girls						
Mobile money	0.472*** (0.169)	-0.065 (0.053)	-0.603*** (0.116)	-1.855*** (0.335)	-0.295*** (0.079)	-0.243*** (0.081)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,338	9,338	9,338	9,338	9,338	9,338

Notes: Robust standard errors, clustered at the household level, are reported in parentheses. ***, ** and * represent significance at 1%, 5% and 10%, respectively. The control variables used include child age dummy for male child (=1), household size, dummy for male-headed household, dummy for married household head, age of household head, household completed at least primary education, dummy for electricity, and log of distance to nearest government primary school.

Table 5: Impact of mobile money adoption on child labour and schooling by age (IV–2LS)

Variable	Attend school (1)	Work (2)	Work (farm) labour (3)	Log. Hrs HH farm (4)	Domestic work (5)	Log. Hrs domestic work (6)
PANEL A: Age:5-11						
Mobile money	0.555*** (0.101)	-0.092** (0.042)	-0.443*** (0.092)	-1.245*** (0.259)	-0.159*** (0.052)	-0.128*** (0.049)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,668	10,668	10,668	10,668	10,668	10,668
PANEL B: Age:12-17						
Mobile money	0.528*** (0.117)	-0.090 (0.076)	-0.810*** (0.156)	-2.734*** (0.489)	-0.238*** (0.086)	-0.180** (0.088)

Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,963	7,963	7,963	7,963	7,963	7,963

Notes: Robust standard errors, clustered at the household level, are reported in parentheses. ***, ** and * represent significance at 1%, 5% and 10% percent, respectively. The control variables used include child age dummy for male child (=1), household size, dummy for male-headed household, dummy for married household head, age of household head, household completed at least primary education, dummy for electricity, and log of distance to nearest government primary school.

Table 6: Shock and mitigating impacts of mobile money adoption on child labour and schooling (IV-2LS)

Variable	Attend School (1)	Work (2)	Work(farm) labour (3)	Log. Hrs HH farm (4)	Domestic work (5)	Log. Hrs HH domestic work (6)
Mobile money	0.516*** (0.086)	-0.023 (0.046)	-0.564*** (0.091)	-1.778*** (0.271)	-0.185*** (0.051)	-0.150*** (0.049)
MM*drought/flood shock	0.050 (0.107)	-0.160** (0.074)	0.184* (0.117)	0.404 (0.341)	0.138** (0.064)	0.192*** (0.067)
Drought/flood shock	-0.049* (0.033)	0.067*** (0.025)	0.032 (0.036)	0.097 (0.107)	-0.012 (0.020)	-0.019 (0.020)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,631	18,631	18,631	18,631	18,631	18,631

Note: Robust standard errors, clustered at the household level, are reported in parentheses. ***, ** and * represent significance at 1%, 5% and 10%, respectively. The control variables used include child age dummy for male child (=1), household size, dummy for male-headed household, dummy for married household head, age of household head, household completed at least primary education, dummy for electricity, and log of distance to nearest government primary school.

Table 7: Mechanisms of the relationship between mobile money adoption and child labour and schooling using mediation analysis

	Attend School (1)	Work (2)	Farm labour (3)	Log. Hrs HH farm (4)	Domestic work (5)	Log. Hrs domestic work (6)
PANEL A: Effect of mobile money on mediation (remittances)						
Mobile money	0.147*** (0.005)	0.147*** (0.005)	0.147*** (0.005)	0.147*** (0.005)	0.147*** (0.005)	0.147*** (0.005)
Effect of mobile money and mediator on outcome						
Mobile money	0.132*** (0.007)	-0.006 (0.004)	-0.079*** (0.006)	-0.257*** (0.018)	-0.041*** (0.004)	-0.047*** (0.004)
Remittances	0.020** (0.010)	0.005 (0.005)	0.042*** (0.008)	0.056** (0.024)	0.024*** (0.006)	0.028 (0.006)
Direct effect	0.132	-0.006	-0.079	-0.257	-0.042	-0.047
Indirect effect	0.003	0.001	0.006	0.008	0.003	0.004
Total effect	0.135	-0.005	-0.073	-0.249	-0.038	-0.043
% of total effect mediated	0.022	-0.121	-0.081	-0.032	-0.091	-0.097
PANEL B: Effect of mobile money on mediation (Edu. Expend.)						
Mobile money	1.978*** (0.058)	1.978*** (0.058)	1.978*** (0.058)	1.978*** (0.058)	1.978*** (0.058)	1.978*** (0.058)
Effect of mobile money and mediator on outcome						
Mobile money	0.016** (0.006)	0.003 (0.004)	-0.051*** (0.006)	-0.166*** (0.018)	-0.029*** (0.004)	-0.037*** (0.004)
Education expenditure	0.059*** (0.001)	-0.004*** (0.001)	-0.011*** (0.001)	-0.041*** (0.002)	-0.004*** (0.001)	-0.002*** (0.001)
Direct effect	0.016	0.004	-0.051	-0.166	-0.029	-0.043
Indirect effect	0.118	-0.008	-0.022	-0.083	-0.009	-0.037
Total effect	0.134	-0.005	-0.073	-0.249	-0.038	-0.043
% of total effect mediated	0.877	1.460	0.304	0.333	0.241	0.135

Note: The control variables used include child age dummy for male child (=1), household size, dummy for male-headed household, dummy for married household head, age of household head, household completed at least primary education, dummy for electricity, log of distance to nearest government primary school, and year dummies.

***, ** and * represent significance at 1%, 5% and 10%, respectively.

6. Conclusion

There has been a boost to the financial inclusion status of households in Tanzania since the introduction of mobile money. The adoption of mobile money has myriad benefits, including overcoming gaps in financial inclusion of the unbanked poor, facilitating saving, borrowing, empowering the poor to smooth consumption, and insuring households against income shocks. These benefits are likely to be correlated with poverty reduction for the adopters of mobile money. In this paper, we explore the variation in the adoption of mobile money across households over time to examine the causal impact of mobile money adoption on child labour and educational outcomes in Tanzania.

The objective of this paper is to examine the causal impact of mobile money adoption on child labour and school enrolment, and we also identify the pathways or mechanisms through which mobile money adoption impacts child labour and schooling in Tanzania. Further, this paper reveals how the impact of mobile money adoption varies by gender and age of children. To establish a causal relationship between mobile money and child labour (educational outcomes), we use an instrumental variables estimation approach, in which a household's distance to the nearest mobile money agent and availability of mobile money agents in the community are used as instruments for mobile money adoption. We use causal mediation analysis in which we identify remittances and education expenditure as the potential mechanisms or pathways through which mobile adoption affects child labour and educational outcomes.

From the results of this study, we provide evidence in support of a negative (positive) relationship between mobile money adoption and child labour (school enrolment) in Tanzania. We also find heterogenous effects of mobile money on child labour (education outcomes) by child's age and gender, respectively. We, therefore, find higher effects for boys compared to girls on the impact of mobile money adoption on school enrolment, but we find lower effects for boys compared to girls on labour market activities. The effects are identified through mechanisms or pathways such as drought shocks, remittances, and education expenditure. The results reveal that the adoption of mobile money is positively related to the receipt of remittances and educational expenditures by households. Moreover, we find statistically significant evidence for the mitigating effect of mobile money on the relationship between drought shocks, and child labour (educational outcomes). The results in gender

differences in the impact of mobile money on child labour and schooling speaks to the prevailing gender inequality in many developing countries, especially in Tanzania. These findings are important from policy standpoints and would require the design and implementation of other programmes that would support mobile money adoption to have gender-neutral outcomes of the impacts of mobile money adoption across developing countries.

The paper contributes to the literature on child labour and educational outcomes by providing new evidence from the analysis of the relationship between mobile money and child labour (educational outcomes) in Tanzania using an instrumental variable estimation approach. The results suggest that, to curb child labour and improve educational outcomes in developing countries, policy makers should take into cognisance the financial inclusion of households such as the adoption of mobile money. Further research would be required to investigate whether the extent or frequency of usage of mobile money matter on child labour and schooling outcomes. Do the results of the effects of mobile money adoption on child labour and schooling change with intensity or frequency of usage? We are unable to provide answers to this question from the analysis because we have limited information on mobile money adoption provided by the Tanzanian National Panel Surveys. However, empirical findings to this question will enhance the discussions of the implications of mobile money usage in developing countries.

Notes

1   The expansion of mobile money in Sub-Saharan Africa is largely due to limited access to physical banks and traditional financial services. The earliest mobile money services began in Kenya, followed by Uganda and Tanzania. One of the earliest and most successful mobile money service providers is M-Pesa in Kenya, which launched its service in 2007 (Jack and Suri, 2011).

2   According to Finscope (2018), access to and usage of financial services in Tanzania increased from 58% in 2013 to 65% in 2018. The growth in financial access has been remarkable when compared to 2012, when the World Bank estimates show that only 17% of individuals of 15 years and older had a bank account (World Bank, 2015).

3   According to UNICEF, 10% of the children living in East Asia and Pacific are involved in child labour; no statistics are available for the South Asian region, but the figure for India is 12%.

4   Financial inclusion refers to a situation where an individual has access to the services of a formal financial institution such as a commercial bank, micro-finance institution and insurance companies.

5   The choice of the dependent variables in this study follows Cuadros-Menaca and Gaduh (2020); Ajefu and Moodley (2020); Ajefu (2018), and Kafle, Jolliffe and Winter-Nelson (2018).

6   For instance, using remittance as an outcome variable in the econometrics specification from equation (1) above could lead to biased results. Mobile money adoption may be determined by the likelihood of remittance received by the households, leading to a simultaneous bias in coefficient estimates.

7   The three waves of the Tanzania National Panel Surveys provide information on mobile agents in the community, such as distance to the nearest mobile money agents, dummy variable for the presence of mobile money agents in the community or village, and cost (fare) to the nearest mobile money agent.

8   The information on distance to the nearest mobile money agent is not self-reported, rather it is provided by the survey using the household's coordinates. The absence of self-reported information on the instrument allays the concern of measurement errors associated with self-reported information.

9   We focus on these three waves of data because the introduction of mobile money was captured in Tanzania National Panel Surveys from

the 2010/11 waves. We omitted the 2008/09 waves from our analysis and failed to adopt a difference-in-differences estimation strategy because some households in Tanzania adopted mobile money in 2009, but the 2008/09 TNPS did not capture these households because information on mobile money adoption was not provided in the 2008/09 TNPS.

10 Specifically, the second wave of the TNPS tracked 97% of the original households, the third wave tracked 96% of the second wave, and this generated an attrition rate of about 3.9%.

11 Our definition of a child follows ILO Worst Forms of Child Labour Convention, 1999 (No. 182) classification as a person below 18 years of age (International Labour Standards on Child labour (ilo.org)). Similar definition of a child adopted by Ajefu and Moodley (2020), in which age of children used in the analysis was restricted to 5-17 years.

12 Each of the potential channel is estimated in separate regressions using the medeff command in Stata. The medeff command incorporates structural equation modelling (SEM) in which two equations are estimated simultaneously to identify the pathways through the mediators affect the outcome variables

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Appendix

Table A1: Descriptive statistics by mobile money adoption

Variable	No Mobile Money	Mobile Money	Difference
School Attendance	0.644 (478)	0.758 (0.428)	-0.114***
Work	0.0980 (0.297)	0 .0433 (0.203)	0.055***
Work (farm) labour	0.242 (0.428)	0.182 (0.386)	0.059***
Hours spent on farm	4.840 (11.859)	3.126 (9.273)	1.714***
Domestic work	0.104 (0.306)	0.074 (0.262)	0.030***
Hours on domestic work	0.183 (0.701)	0.115 (0.552)	0.068***
Child age	10.614 (3.719)	10.898 (3.755)	-0.284***
Male-child	0.498 (0.500)	0.4995 (0.500)	-0.001
Household size	7.748 (4.147)	7.350 (3.325)	0.397***
Age of household head	48.483 (13.309)	47.235 (12.890)	1.248***
Male household head	0.760 (0.427)	0.783 (0.412)	-0.023***
Household head married	0.792 (0.405)	0.784 (0.411)	0.008
Head HH completed primary educ.	0.431 (0.495)	0.386 (0.486)	0.044***
Distance to nearest mobile money agent (KM)	15.121 (26.714)	5.667 (14.988)	9.453***
Cost to nearest mobile agent (TZS)	1392.161 (2314.290)	623.928 (1489.878)	768.232***
Total education expenditure	183072.2 (603290.2)	701399.3 (1388570)	-518327.1***

Remittance receipt (dummy)	0.097 (0.297)	0.294 (0.456)	-0.196***
Distance to nearest primary school	0.288 (1.372)	0.382 (1.631)	-0.093***

Notes: ***, ** and * represent significance at 1%, 5% and 10%, respectively. Standard deviation in the paratheses.

Table A2: Mobile money, receipt of remittances and education expenditure (IV-2SLS)

Variable	Remittances receipt (1)	Log. remittance received (2)	Log. education expenditure (3)
Mobile money	0.304** (0.126)	3.273** (1.391)	6.039*** (1.513)
Control variables	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
District fixed effect	Yes	Yes	Yes
Observations	18,631	18,631	18,631

Notes: Robust standard errors, clustered at the household level, are reported in parentheses. ***, ** and * represent significance at 1%, 5% and 10%, respectively. The control variables used include child age dummy for male child (=1), household size, dummy for male-headed household, dummy for married household head, age of household head, household completed at least primary education, dummy for electricity, and log of distance to nearest government primary school.

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