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Abstract

Mobile money can play an important role in improving financial inclusion and, as a consequence, employment outcomes, especially in areas where adequate financial infrastructures are lacking. In this paper, we study the effects of mobile money use on the employment outcomes of individuals in 8 developing countries. Our findings indicate that, relative to non-users, individuals who use mobile money are more likely to become self-employed and to receive a regular wage. In particular, the positive association between mobile money use and regular wage is found to be robust also when explicitly addressing the potential endogeneity of mobile mobile money. Overall, the evidence suggests that policies aimed at favoring access to and use of mobile money can provide an effective and relatively inexpensive tool in the agenda for sustainable development.

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1 Introduction

Creating more and better jobs is a development priority for policy makers worldwide. According to the latest available data from the International Labour Organization, 5.6% of the global population were unemployed in 2017 (International Labour Organization, 2018b). Given the current population age structure, 470 million jobs will be needed between 2016 and 2030 to keep up with newcomers in the labour market. As a consequence, "promoting [...] employment and decent work for all" has been identified as the eighth sustainable development goal (SDG henceforth) of the 2030 agenda for sustainable development (United Nations, 2018).

One of the key instruments towards higher labor productivity and lower unemployment rates is financial inclusion (target 8.3 of SDG 8). Mobile money, an electronic wallet service that allows users to deposit, transfer and receive money through mobile phones (Morawczynski and Pickens, 2009), can play an important role in improving financial inclusion and, as a consequence, employment conditions, by compensating for inadequate financial infrastructures, especially in underdeveloped and remote areas. Thanks to the increased availability of mobile phone services worldwide, this financial innovation has rapidly spread, especially in low and middle-income countries, to such an extent that, in 2017, the mobile money industry processed over a billion dollars a day (Global System for Mobile Communications, 2017).

A growing body of evidence indicates that business income increases food security, prevents over-exploitation of natural resources, and helps individuals to face credit constraints, relative to farming activities which are often rain-dependent (see, for instance, Zereyesus et al. (2017)). However, creating new business does not immediately translate into better economic prospects. In fact, even though the role played by non-farm business activities in promoting sustainable development in low and middle income countries has become more important in recent years (Nagler and Naudé, 2017; Gulyani and Talukdar, 2010), many new business are still created to escape destitution and out of necessity (Quatraro and Vivarelli, 2014). These new businesses are unlikely to be productive, unless they are run by skilled individuals (e.g., Lanjouw and Lanjouw, 2001). From a policy perspective, it is therefore crucial to consider not only the creation of new business activities as a poverty-reduction strategy, but also what can ultimately contribute to the emergence of undeclared and irregular work. Having an irregular job might in fact constitute a poverty trap, whereby irregular workers under-invest in their education,

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social protection, and health, which in turn can perpetuate their precarious condition with deleterious social consequences.

In this paper, we study empirically the association between mobile money and the labor market outcomes of individuals living in developing countries. More specifically, we investigate the hypothesis that, through easier saving opportunities and better access to loans, an active user of mobile money is more likely to become self-employed and to shift from an irregular to a regular wage. Our analysis is based on the Financial Inclusion Insights dataset by InterMedia (InterMedia, 2019), covering 8 developing countries in Africa (Kenya, Nigeria, Tanzania, Uganda) and Asia (Bangladesh, India, Indonesia, Pakistan).

Our findings provide support to the hypothesis that mobile money users are more likely to become self-employed, or to shift from irregular to regular-wage jobs. In particular, the negative association between mobile money and irregular wage is found to be robust to the use of alternative estimators that take into account the potential endogeneity of mobile money use. Overall, we interpret these results as evidence that mobile money plays an important role in improving employment outcomes. As a consequence, policies aimed at favoring access to mobile money can provide an effective tool towards the achievement of SDG 8 in low- and middle-income countries.

The remainder of the paper is organized as follows. Section 2 briefly reviews the related literature and presents the conceptual background of the paper. Sections 3 and 4 discuss the data and methods, respectively. Section 5 presents the results. Section 6 concludes.

2   Conceptual Background

Financial inclusion and employment outcomes are strictly linked to each other. At the macro level, financial institutions stimulate the growth of a well-functioning business environment with a resulting positive effect in terms of job creation and employment. At the micro level, access to financial services allows individuals and firms to better manage changes in income and savings (Dupas and Robinson, 2013), balance their expenses, and deal with fluctuating economic conditions. This, in turn, facilitates investment in assets that are crucial to employability, such as education and health. In the absence of appropriate financial instruments, low-income individuals have to rely on informal sources of finance (Klapper and Singer, 2014), including

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family and friends networks, that can be unreliable and expensive. Financial inclusion can therefore constitute a key lever to face the dangers of high levels of unemployment and underemployment in developing countries. However, financial inclusion is far to be reached. Only 41% of poor adults in developing countries currently have an account at a formal financial institution, a figure that falls to 20% when considering only extremely poor adults (Klapper and Singer, 2014).

Mobile money can act as a flywheel for financial inclusion, especially in poor and remote rural areas where formal financial institutions are often not available. This financial instrument was initially introduced with the aim to allow people to send remittances. Thereafter, mobile money wallets have been improved so as to include access to microcredit, loans and savings products. Currently, virtually all the most common financial transactions can be performed anywhere and anytime simply through the smartphone. Mobile money services constitute a cheaper, easier, safer, and more reliable instrument relative to formal and informal financial institutions, especially in developing countries, where financial intermediaries are often missing exactly in those areas where access to credit and remittances would be more necessary.

With the increasing diffusion of mobile money, scholars have started to study its effects in terms of economic and social development. A growing body of literature, recently reviewed by Aron (2018), shows that the diffusion and adoption of mobile money is related, among other things, to increased monthly food expenditure (Murendo and Wollni, 2016), per capita consumption and income (Suri and Jack, 2016), quantity of products sold to the market (Sekabira and Qaim, 2017), frequency of sending and receiving remittances (Mbiti and Weil, 2011; Jack and Suri, 2014), savings among female entrepreneurs (Bastian et al., 2018), access to finance for firms (Gosavi, 2018), intra-household savings for health emergencies (Ky et al., 2017), and firms investments (Islam et al., 2018).

Consistent with the evidence on the impact of microcredit on occupational choices (Banerjee et al., 2015), mobile money has been shown to be related to employment prospects and, particularly, to business activity. Suri and Jack (2016) estimate that the spread of mobile money induced 185,000 women to switch to business or retail as their main occupation. More generally, their results show that the expansion of mobile money access induces people to abandon farming activities, that are often rain-fed and therefore more exposed to climate change and its deleterious consequences, and work

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in business or sales occupations. One possible explanation for these results is that mobile money facilitates internal remittances, leading to a more efficient allocation of labor over space and time (Suri and Jack, 2016). This hypothesis is partially supported by Mbiti and Weil (2011), who show that mobile money led to an increase in the employment rate of about 15% with respect to the period before its diffusion. Kikulwe et al. (2014) find that mobile money may lead to improvements in off-farm labor demand by reducing market entry barriers for smallholder farmers. Sekabira and Qaim (2017) show that mobile money may spur self-employement activities by facilitating transactions among workers.

Against this background, our analysis investigates the effects of mobile money on individual employment outcomes through easier saving opportunities and better access to loans. We formulate two main hypotheses. First, as suggested by previous literature on the topic, access to mobile money is expected to be positively related to the probability of becoming self-employed. In developing countries, people are often unemployed or contributing family workers (International Labour Organization, 2016). If they have the intention to start a business activity, they generally do not have access to financial institutions, or the costs for obtaining loans are excessively high. Mobile money offers the opportunity to obtain short-term loans at a very low interest rate. At the same time, banks and mobile money agents have the opportunity to monitor the financial performance of individuals. As a result, individuals may have more incentives to start a self-employment activity, since they have more opportunities to receive loans when they request for them.

Second, access to mobile money is expected to be positively related to the probability that an employed worker earns a regular wage. The rationale for this hypothesis comes from the fact that mobile money increases savings (e.g., Morawczynski and Pickens, 2009; Karlan et al., 2014; Suri and Jack, 2016). More savings means more opportunities to invest in education, opening the way to jobs with regular pay (e.g. Klonner and Nolen, 2010). Furthermore, employers might be incentivized to provide wages through mobile money instead of cash, which is often a less secure mechanism (Blumenstock et al., 2015). Finally, since mobile money transactions are easily traceable, governments might favor this technology in order to deter tax evasion. All these factors together might ultimately result in a shift from irregular- to regular-pay jobs. To the best of our knowledge, no other paper has empirically addressed this issue.

To sum up, in this paper we test two main hypotheses:

H1: *mobile money users are more likely to be self-employed, relative to non-users.*

H2: *mobile money users are more likely to earn a regular wage, relative to non-users.*

In addition, we expect the effect of mobile money on self-employment and regular wage to differ by gender and poverty status (Suri and Jack, 2016; Muto, 2012). By allowing women to directly access remittances, mobile money may enhance women agency and support their willingness to be employed outside their household. Likewise, by granting access to finance even in remote and rural areas, mobile money might act as an equalizer of opportunities especially for the most disadvantaged individuals. As a consequence, we expect the effects of mobile money on employment outcomes to be stronger for females and for individuals below the poverty line.

3   Data

Our empirical analysis is based on the Financial Inclusion Insights (FII) surveys (InterMedia, 2019), providing annual data between 2014 and 2016 for individuals in 8 developing countries (Kenya, Nigeria, Tanzania, Uganda, Bangladesh, India, Pakistan, Indonesia).[1] In addition to socio-demographic characteristics of the respondents, the data set contains detailed information on use of mobile phones, bank accounts, mobile money and non-bank financial instruments. We excluded from the analysis individuals who declare to be out of the labor force (housewife, student, retired, disabled, or other not differently specified). Among those in the labor force, we consider only employed individuals (about 95% of the total, declaring to be employed full-time, part-time, per season, occasionally, or self-employed). We thus obtain a sample of 116,532 respondents. Among the employed, about 25% receive an irregular payment for their work and about 35% declare to be self-employed. Descriptive statistics for the variables used in the empirical analysis are presented in Table 1.

Our key explanatory variable of interest is *Mobile money user*, a binary variable that equals one if at least one member of the household is an active

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[1]Data for 2016 are not available for Pakistan.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Mobile money user	0.12	0.32	0	1	116532
Self-employed	0.35	0.48	0	1	116532
Irregular wage	0.25	0.43	0	1	116532
Male	0.68	0.47	0	1	116532
Age	39.11	13.64	15	100	116532
No education	0.23	0.42	0	1	116532
Primary education	0.26	0.44	0	1	116532
Secondary education	0.41	0.49	0	1	116532
Tertiary education	0.10	0.29	0	1	116532
Above tertiary education	0.01	0.08	0	1	116532
Household receives benefits	0.11	0.31	0	1	116532
Household has savings	0.50	0.50	0	1	116532
Household has insurance	0.16	0.37	0	1	116532
Household relocated	0.09	0.29	0	1	116532
Household below poverty line	0.72	0.45	0	1	116532
Household head: rural female	0.22	0.41	0	1	116532
Literacy	0.67	0.47	0	1	116532
Numeracy	0.95	0.23	0	1	116532
Access to mobile phone	0.86	0.35	0	1	116532

Source: Financial Inclusion Insights surveys (InterMedia, 2019)

user of mobile money services, zero otherwise. This variable therefore considers both registered and non-registered users. Overall, 12% of the respondents declare to be users of mobile money services. This rate varies substantially across countries, with Kenya and India displaying the highest (78%) and lowest (0.4%) rates, respectively, consistent with international data on mobile money adoption (Global System for Mobile Communications, 2017).

Figure 1 provides descriptive evidence on the relationship between mobile money adoption and either self-employment or irregular wage (left and right panel, respectively). Overall, mobile money is positively related to self-employment and negatively related to receiving an irregular wage. However, it is not clear whether this relation is driven by selection on unobservables or it is capturing a causal effect. In what follows we leverage a variety of estimation tools to further unpack this preliminary evidence.

Figure 1: Mobile money and employment outcomes
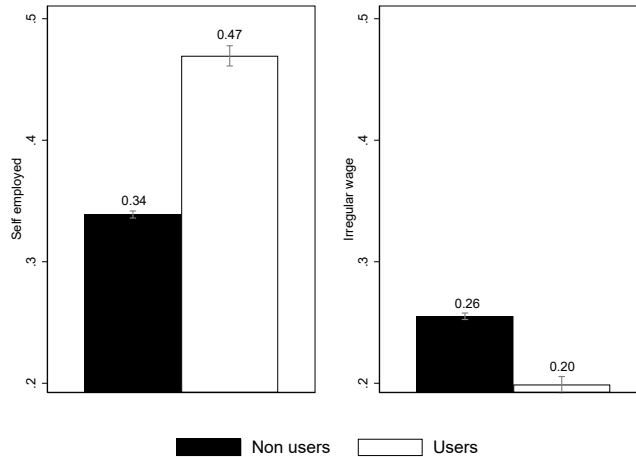
4   Methods

We consider a specification that relates the employment outcome (E) of individual i in country c to the use of mobile money (MM), while controlling for a vector X of individual and household-level characteristics:

$$E_{ic} = \beta_0 + \beta_1 MM_{ic} + X_{ic} + \lambda_c + \gamma_t + \lambda_c * \gamma_t + \varepsilon_{ic} \tag{1}$$

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where E is a dummy variable indicating, alternatively, being self-employed or receiving an irregular wage, λ_c are country fixed effects accounting for possible heterogeneity across countries, γ_t are time fixed effects, $\gamma_t * \lambda_c$ are country-specific time effects, and ε_{ic} is the error term. Among covariates (X) we include individual as well as household-level characteristics that can be expected to be related to mobile money usage and employment outcomes, such as living below the poverty line (*HH below poverty line*)[2], household's use of financial services (a bank account, an insurance, any type of savings, including savings and credit cooperatives and associations), the fact that the household has received any government transfer, an indicator of whether the household has relocated in the last 12 months, whether the household has access to (i.e., they own or they can borrow) a mobile phone, and standard socio-demographic characteristics such as gender, age and education level of the respondent.

The specifications in equation (1) are estimated by Probit, given the binary nature of the dependent variable, with marginal effects being reported. Standard errors are robust to heteroskedasticity, and observations are weighted on the basis of nation population size. As a robustness check, we also estimated the same models without weights or by considering only countries for which mobile money penetration is higher than 20% (i.e., Bangladesh, Kenya, Tanzania and Uganda). In order to test for heterogeneous effects of mobile money, we also estimated equation (1) by adding an interaction for mobile money with either gender or poverty status.

A key aspect in estimating the model presented above is the potential endogeneity of mobile money, the key explanatory variable. Either unobserved heterogeneity at the individual/ household level, or reverse causality could undermine the causal interpretation of Probit estimates. In order to address this issue, we make use of Instrumental Variables estimation (IV). Given the binary nature of our potentially endogenous regressor, we estimate a bivariate marginal effect Probit model. We therefore estimate 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). Similarly to Munyegera and Matsumoto (2016), in the reduced form

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[2]Specifically, in the dataset this variable is defined as the *Progress out of Poverty Index* (http://www.progressoutofpoverty.org/), a poverty measure obtained by 10 questions about a household's characteristics and asset ownership. The PPI is, therefore, country-specific.

equation we include a proxy for access to an over-the-counter (OTC)[3] under the assumption that the farther the household is located from an OTC, the lower is the probability of using mobile money services. Furthermore, living next to an OTC should not be related to employment prospects, at least when controlling for poverty status.

The rationale for this instrument is that, in several developing countries, mobile money transactions are often performed over-the-counter. This means that customers do not use their own accounts, but bring cash to an agent who executes the electronic task on their behalf. Note that our estimated specification includes a dummy for mobile phone possession and one for being below the poverty line, in order to account for possible wealth effects affecting simultaneously mobile money usage and employment opportunities. Although it is possible that an household decides to move with the explicit aim to live next to an OTC, therefore enjoying easier access to financial services, the estimated specifications include among the controls a dummy for household relocation during the last 12 months. We cannot rule out, however, that employed subjects are more likely to see advertisements of money mobile in OTC close to their job, so that they may change their decision to adopt and to be employed simultaneously.

We therefore also estimate an endogenous treatment-regression model. This is a a linear potential-outcome model that allows for a specific correlation structure between the unobservables that affect the treatment and the unobservables that affect the potential outcomes (Heckman, 1978). Since there are no interactions between the treatment variable and the covariates, we obtain the average treatment effect (ATE) of being a mobile money user on employment outcomes. As a further robustness check, we also estimate the average treatment effect on the treated (ATET) through a propensity score matching technique (PSM). In the PSM, the average treatment effect is computed by taking the average of the difference between the observed and potential outcomes for each subject, where the missing potential outcome for each mobile money adopter is an average of the outcomes of similar

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[3] "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." With 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).

non-adopters.

5   Results

This section presents the results of the empirical analysis. We start by discussing estimation results for the overall sample and some robustness checks. We then examine heterogeneous effects. Finally, we address the possible endogeneity of mobile money by applying IV estimation, endogenous treatment-regression model and propensity score matching techniques.

Table 2 presents Probit estimates (marginal effects) for equation (1). The use of a mobile money account is found to be positively and significantly related to the probability of being self-employed (column 1). The estimated coefficient for mobile money is 0.015, comparable in size to that of having an insurance or living below the poverty line. Use of mobile money is also found to be negatively and significantly related to the likelihood of receiving an irregular wage (column 2). The relevant estimated coefficient (-0.065) is close to the coefficient for having an insurance. Overall, these preliminary findings are consistent with our main hypotheses: mobile money usage is associated with better employment outcomes in terms of both self-employment and regular wage.

As for the control variables, older individuals are more likely to be self-employed and less likely to earn an irregular wage. Males are less likely to earn an irregular wage. The results for the educational dummy variables suggest that individuals with primary and secondary education have a higher likelihood to be self-employed and a lower likelihood to earn a regular wage, relative to individuals with no education. The results from tertiary education seem to suggest that, as suggested in the literature, entrepreneurship in developing countries tends to be necessity-driven (Quatraro and Vivarelli, 2014): individualas with low educational attainment end up being entrepreneurs in the absence of other better employment opportunities, i.e., out of necessity rather than out of opportunity. Households receiving government benefits or living below the poverty line face worse employment opportunities relative to households that are better off. More specifically, households receiving government benefits or living below the poverty line display a lower probability to be self-employment and a higher likelihood to earn an irregular wage.

Table 3 provides a robustness check of the findings by considering alternative specifications for equation (1). First, we estimate the model without

Table 2: Mobile money and employment outcomes

	(1)	(2)
	Self-employed	Irregular wage
Mobile money user	0.015**	-0.065***
	(0.007)	(0.005)
Male	0.004	-0.010***
	(0.004)	(0.003)
Age	0.004***	-0.006***
	(0.001)	(0.001)
Age squared	-0.000*	0.000***
	(0.000)	(0.000)
Primary education	0.047***	-0.042***
	(0.005)	(0.004)
Secondary education	0.038***	-0.120***
	(0.005)	(0.003)
Tertiary education	-0.110***	-0.180***
	(0.006)	(0.003)
Above tertiary education	-0.015	-0.123***
	(0.022)	(0.012)
Receive Government Benefits	-0.047***	0.036***
	(0.005)	(0.004)
Household has savings	0.042***	-0.025***
	(0.004)	(0.003)
Household has insurance	-0.011**	-0.066***
	(0.005)	(0.004)
Household Relocated	-0.061***	-0.040***
	(0.006)	(0.005)
Household below poverty line	-0.010***	0.098***
	(0.004)	(0.003)
Household access to mobile phone	0.033***	-0.057***
	(0.005)	(0.004)
N.	116532	116532

Note: dependent variable as indicated in column heading. Probit marginal effects. Covariates as described in Section 4. Standard errors robust to heteroskedasticity reported in brackets. * p<0.10, ** p<0.05, *** p<0.01

weighting the data by population size (column 1). Second, we report in column 2 estimates obtained by restricting the sample to countries where the mobile money usage rate is higher than 20% (Bangladesh, Kenya, Tanzania and Uganda). The estimated coefficient for mobile money is found to be generally robust to the use of alternative specifications, in terms of both sign and significance. Indeed, when restricting the sample to countries with higher adoption rates, the estimated coefficient for mobile money is larger than in the full sample.

Table 3: Robustness check

	Self-employed	
	No weights	High adoption
Mobile money user	0.014**	0.040***
	(0.006)	(0.008)
Observations	116532	26301

	Irregular wage	
	No weights	High adoption
Mobile money user	-0.066***	-0.085***
	(0.005)	(0.007)
Observations	116532	26301

Note: Probit marginal effects. Covariates as described in Table 2. Standard errors robust to heteroskedasticity reported in brackets. * p<0.10, ** p<0.05, *** p<0.01

As discussed in Section 2, it is plausible to expect differences among individuals in terms of gains from using mobile money. We thus augmented the model in equation (1) to include an interaction term between mobile money and either gender or poverty status. Note that, due to the difficulty of interpreting estimated coefficients for interaction terms in probit models (Ai and Norton, 2003), estimates for these specifications were obtained by OLS. Table 4 presents the results. The positive association between mobile money and self-employment is stronger for women, consistent with the findings reported in Suri and Jack (2016). However, males benefit more than females in terms of regular wage. This is consistent with recent figures from the International Labor Organization, showing that women are over-represented in informal and vulnerable employment, and that women are more than twice as likely than men to be contributing family workers (International Labour

Organization, 2018a). This has often to do with social norms that are difficult to reshape, and with a still large gender gap in education, two issues deserving more attention by policy makers and scholars (Dhar et al., 2018). Mobile money users living below the poverty line display a higher probability to be self-employed, in line with the existing literature on the topic (e.g., Suri and Jack, 2016), while no significant interaction between mobile money and poverty is found for irregular wage.

Table 4: Mobile money and employment: Heterogenous effects

	Self-employed	
Mobile money user	-0.002	-0.015*
	(0.007)	(0.009)
Female	-0.013***	
	(0.003)	
Mobile money user × female	0.063***	
	(0.010)	
HH below poverty line		-0.017***
		(0.004)
Mobile money user × HH below pov. line		0.053***
		(0.010)
Observations	116532	116532

	Irregular wage	
Mobile money user	-0.058***	-0.065***
	(0.006)	(0.007)
Female	0.022***	
	(0.003)	
Mobile money user × Female	-0.048***	
	(0.008)	
HH below poverty line		0.096***
		(0.003)
Mobile money user × HH below pov. line		-0.013
		(0.010)
Observations	116532	116532

Note: OLS estimates. Covariates as described in Table 2. All reported models include country and year dummies and country-specific time trends. Standard errors robust to heteroskedasticity reported in brackets. * p<0.10, ** p<0.05, *** p<0.01

Table 5 presents estimation results for IV, ATE and ATET models (as described in section 4) for self-employment (first panel) and irregular wage (second panel), respectively. First stage IV estimates (not reported) indicate that distance from an OTC is negatively and significantly related to mobile money use ($\beta = -0.093$, p-value=0.000): the farther away the OTC, the lower the likelihood that an individual is a mobile money user, as expected. The findings reported in Table 5 indicate that the estimated coefficient for self-employment is not robust to the use of estimators that take into account potential the endogeneity of mobile money. On the other hand, the negative association between mobile money and irregular wage is robust across alternative estimators and can therefore be given a causal interpretation. The size of the estimated effects is comparable across models, being only slightly larger for IV, consistent with the presence of measurement error in the indicator for mobile money.

Table 5: Mobile money and employment outcomes: endogeneity

	IV	ATE	ATET
	Self- employed		
Mobile money user	-0.027	0.009	0.020*
	(0.063)	(0.017)	(0.011)
Observations	70053	116532	116532
	Irregular wage		
Mobile money user	-0.152***	-0.045***	-0.068***
	(0.076)	(0.004)	(0.011)
Observations	70053	116532	116532

Note: covariates as described in Table 2. All reported models include country-specific time trends. (d) indicates discrete change of dummy variable from 0 to 1.* p<0.10, ** p<0.05, *** p<0.01

6 Conclusion

This paper shows that an inexpensive financial innovation, as represented by mobile money, might contribute to improve employment prospects in low- and middle-income developing countries. As mobile money use has the potential to close the financial inclusion gap, it can lead to a shift from irregular-

to regular-pay jobs, with relevant consequences in terms of long-term individual investments. We show that this association can be given a causal interpretation.

Unemployment is among the crucial challenges faced by policy makers in developing countries. For countries that are slowly going through the demographic transition, this issue is related to the demographic structure of the population. In sub-Saharan Africa, for instance, high fertility is often coupled with increased life expectancy. This means that when the young enter working age, the dependency ratio (the ratio between non-working age and working age population) declines. Since demographic changes are slow, from a demographic perspective this might constitute either a dividend or a curse. In fact, if the labor market can absorb the increased number of working age individuals, other things being equal, per capita income will increase as well. On the other hand, if those young adults remain unemployed, the demographic imbalance might lead to social and political instability. The consequences could be significant also for developed countries in terms, for instance, of increased migration flows. This paper shows that promoting access to and use of mobile money can be an effective tool to *promote decent work for all*, as foreseen by the eighth Sustainable Development Goal.

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