Document de Recherche du Laboratoire d'Économie d'Orléans
Working Paper Series, Economic Research Department of the University of Orléans (LEO), France
DR LEO 2023-11

Entrepreneurship in developing countries: can mobile money play a role?

Ablam Estel Apeti
Jean-Louis Combes
Eyah Denise Edoh

Mise en ligne / *Online* **: 19/06/2023**

Laboratoire d'Économie d'Orléans
Collegium DEG
Rue de Blois - BP 26739
45067 Orléans Cedex 2
Tél. : (33) (0)2 38 41 70 37
e-mail : leo@univ-orleans.fr
www.leo-univ-orleans.fr/

Entrepreneurship in developing countries: can mobile money play a role?

Ablam Estel Apeti[*,1], Jean-Louis Combes[1], and Eyah Denise Edoh[1]

[1]Université Clermont Auvergne, Université d'Orléans, LEO, 45067, Orléans, France

Abstract

This paper examines the impact of mobile money adoption on entrepreneurship in a large panel of 105 developing countries over the period 2006-2020 using entropy balancing method. Results indicate that countries with mobile money have higher entrepreneurial activities. Specifically, countries with mobile money experienced an increase of 0.35 percentage points in their entrepreneurial activity compared to non-mobile money countries. This result is robust to several robustness tests, including altering the definition of mobile money, the definition of entrepreneurship, placebo tests, adding additional control variables, changing the sample design, and alternative estimation methods such as panel fixed effects, and the GMM system. Furthermore, the heterogeneity tests performed indicate the sensitivity of our results to the intensity of mobile money use, some structural factors such as democracy, conflict, regulatory quality, corruption, financial development, internet, and education.

JEL Classification: G23, G32, L26, O32

Keywords: Mobile money, entrepreneurship, entropy balancing, developing countries

1 Introduction

Entrepreneurship is generally recognized as an important component to stimulate economic growth, innovation, and competitiveness, promote development, and may have social effects such as reducing poverty or unemployment (Schumpeter, 1934; Acs and Audretsch, 1988; Acs et al., 2008; Pennisi, 2012; Haltiwanger et al., 2013; Qin and Kong, 2022; Asturias et al., 2023). While developing countries face economic and social challenges, the evolution of entrepreneurship that can help them initiate solid growth

*Corresponding author: ablam_estel.apeti@uca.fr.

or absorb a growing labor force remains shy. Indeed, in contrast to the 7% level of enterprise creation in advanced countries, the average level of entrepreneurship in developing countries is 3%, a difference of 4 percentage points or 56% (World Bank, 2021a).

The existing literature offers a rich analysis of the factors that may hinder enterprise creation, among which access to finance is the most salient issue (Pennisi, 2012; World Bank, 2021b). For example, in the context of China, Qin and Kong (2022) document the role of improved access to finance following the 2006 Postal Savings Bank of China launch in encouraging business creation. Beck et al. (2015) conducted a study on China using the Rural Finance Survey conducted in 2009 to show that access to finance increases entrepreneurship. The link between access to finance and entrepreneurial capacity is also shared by authors such as Allen et al., 2005; Levine, 2005; Pennisi, 2012; Beck et al., 2012; Han and Hare, 2013; Cai et al., 2018; Ma et al., 2019; Herkenhoff et al., 2021; Tian and Xu, 2022; Charfeddine et al., 2022 and supported also by statistics of World Bank (2021b). In this paper, we analyze the effect of a "recent" financial innovation in developing countries, namely mobile money, [1] on entrepreneurship.

The development of digital transactions and mobile payments has transformed the financial landscape in developing countries, making it easier for many people to access basic financial services. Since the success story of M-PESA in Kenya in 2007, mobile money has emerged in developing countries as the most effective way to provide (poor) households with access to financial services on the one hand and to modernize financial transactions on the other, in context of a strong preference for cash.

Mobile money has received considerable attention in the existing literature in recent years. Early studies, essentially microeconomic, present mobile money as a welfare tool by promoting financial inclusion, increasing consumption and household income (Jack and Suri, 2014 Munyegera and Matsumoto, 2016; Suri and Jack, 2016; Riley, 2018). In addition, other studies explore the effect of mobile money on the ability of households to obtain well-paying jobs, receive remittances, invest, and on firm performance (Suri and Jack, 2016; Gosavi, 2018; Islam et al., 2018; Aggarwal et al., 2020; Patnam et al., 2020; Lee et al., 2021). At the macro/cross-country level, some studies identify mobile money as a mechanism for economic formalization (Jacolin et al., 2021), inequality reduction (Asongu, 2015), monetary policy efficiency via low inflation, and better macroeconomic

1. It allows more than half of the population previously excluded from the formal financial system to have access to financial tools.

performance (Adam and Walker, 2015; Aron et al., 2015; Dunne and Kasekende, 2018; Kipkemboi and Bahia, 2019; Mawejje and Lakuma, 2019). In the same perspective, recent studies by Apeti (2023a) and Apeti and Edoh (2023) respectively show that mobile money improves household welfare by reducing consumption volatility and improves government revenues by increasing tax collection. Despite the evolution of the literature on mobile money and its effects on development, little, to the best of our knowledge, is said concerning the capacity of this financial innovation to boost entrepreneurship in developing countries. This paper aims to fill this gap by analyzing whether adopting digital financial services such as mobile money can help developing countries improve their level of entrepreneurship.

To identify the effect of mobile money, we rely on an impact analysis method, namely entropy analysis developed by Hainmueller, 2012 and recently used by Apeti (2023a) and Apeti and Edoh (2023) to analyze respectively the effect of mobile money on household consumption volatility and on tax revenue. Using a sample of 105 developing countries over the period 2006-2020, we show that mobile money adoption increases entrepreneurship in developing countries. This result is robust to several robustness tests, including changing the definition of mobile money, the definition of entrepreneurship, the placebo tests, adding additional control variables, altering the sample design, and alternative estimation methods such as panel fixed effects, and GMM system. Furthermore, the heterogeneity tests performed show that: *i*- the effect of mobile money may depend on the intensity of mobile money use, *ii*- effect of mobile money may depend on some structural factors such as democracy, conflict, quality of regulation, corruption, financial development, internet, and education.

The rest of the paper is organized as follows. The next section presents the theoretical considerations. Section 3 presents the methodology. Section 4 presents the data and descriptive statistics. The results are presented in section 5, with robustness analysis in section 6. Section 7 presents the heterogeneity tests. Section 8 concludes.

2 Theoretical considerations

In this section, we discuss the arguments that support the effect of mobile money on entrepreneurship.

First, mobile money facilitates business creation by easing financial constraints or

barriers for firms/households. Access to finance plays a key role in households' decision to start a business or take risks (Beck et al., 2015; Qin and Kong, 2022). However, access to finance in developing countries is challenging due to information asymmetry issues (Stiglitz and Weiss, 1981) and the concentration of services in urban areas, leaving nearly half of individuals outside the traditional financial system. However, mobile money innovation provides a "new" opportunity for households in developing countries to access financial services at a lower cost. Evidence currently exists regarding the ability of mobile money to promote access to finance and reduce financial market imperfections such as information asymmetry. For example, Dalton et al. (2022) in a Randomized Controlled Trial (RCT) with small and medium-sized enterprises in Kenya estimate the causal impact of an electronic payment technology on business finance. The authors show that e-payment technology or mobile money increased access to mobile loans—in number of loans, as well as amount borrowed—by at least 50% through the reduction of information asymmetries resulting from increased digital transactions. This conclusion is in line with Ahmad et al., 2020 and Beck et al., 2015 which show that users' mobile money transactions can be used to establish credit scores which can help them get loans to finance their investments. Also, as highlighted by Suri and Jack, 2016, mobile money can change financial behavior—increasing financial resilience and savings—and promote efficient labor allocation, resulting in poverty reduction and ultimately a shift from agriculture to business. Finally, by facilitating remittances (Suri and Jack, 2016; Riley et al., 2016), mobile money can reduce households' financial pressure allowing them to use these funds directly for entrepreneurial activities or indirectly through the development of (formal) financial inclusion (Anzoategui et al., 2014; Shapiro and Mandelman, 2016; Yavuz and Bahadir, 2021).

Secondly, mobile money can encourage risk-taking and therefore entrepreneurship through its ability to smooth (idiosyncratic) risks or reduce loss aversion but also by reducing transaction costs. Indeed, uncertainty is one of the major concerns for business creation (Gulen and Ion, 2016). For example, as Boudreaux et al. (2019) show, negative shocks such as natural disasters penalize entrepreneurial activities. Indeed, natural disasters can hinder entrepreneurial activity by increasing entrepreneurial uncertainty and fear of failure by damaging infrastructure, disrupting supply chains, and affecting business performance. In addition, natural disasters can hinder the return to

normal operations and thus decrease productivity (Boudreaux et al., 2022b). Therefore, by helping to smooth risks (Jack and Suri, 2014; Riley et al., 2016; Koomson et al., 2021; Apeti, 2023a), digital financial instruments such as mobile money can increase households motivation to conduct entrepreneurial activity. Evidence on the effect of mobile money on risk but especially on business dynamics is offered by Patnam et al. (2020) in India. Using granular transaction data from Paytm, one of India's largest mobile money providers with over 400 million users, the authors analyze the effect of mobile money on business outcomes in India. Drawing on the period surrounding the demonetization policy, which led to a sharp increase in mobile money adoption, they analyze how mobile money affects traditional risk-sharing arrangements. First, the authors find that the use of mobile money increases resilience to shocks by mitigating the impact of rainfall on nightlights-based economic activity and household consumption. Second, by conducting enterprise survey around a progressive targeting intervention that incentivized enterprises to adopt mobile payments technology, they conclude that firms that adopt mobile payments have improved sales after six months of use, compared to other firms. In addition, when they ask businesses about their subjective expectations for future sales, they find that mobile payments adoption is associated with lower subjective uncertainty and greater sales optimism.

Another aspect of risk that can increase the risk of loss and therefore the fear of entering into entrepreneurial activities comes from the lack of digitalization of transactions. Indeed, the limited capacity to make transactions digitally pushes households to carry cash for the provision of intermediate goods needed from their suppliers but also after the sale of products on the (domestic) market which exposes them to the risk of theft/robbery. Thus, by offering digital savings/transactions opportunities, mobile money can help limit insecurity such as theft and potential production losses for entrepreneurs, thereby increasing the willingness to engage in entrepreneurial activity, while lowering transaction costs will reduce production costs and consequently reduce the minimum capital requirements for engaging in entrepreneurial activities (Beck et al., 2018; Suri et al., 2023).

Finally, infrastructure (both physical and human) and institutions are crucial elements for business creation (Van der Sluis et al., 2008; Chowdhury et al., 2019; Chauvet and Ferry, 2021; Boudreaux et al., 2022a). Accordingly, by providing an opportunity

for governments to better collect taxes (Apeti and Edoh, 2023)—necessary for infrastructure financing (Chauvet and Ferry, 2021)—, facilitate investment in human capital (Ahmed and Cowan, 2021; Rotondi and Billari, 2021), and by creating the opportunity for a strong institutional quality (Krolikowski, 2014; Apeti and Edoh, 2023), mobile money can help foster business creation. Putting these arguments together, we assume that mobile money—a financial innovation that promotes financial inclusion by connecting a sizable section of previously unbanked people—helps to promote entrepreneurial activity.

3 Methodology

This study analyzes the effect of mobile money adoption on entrepreneurship—measured by new business density rate defined as the number of newly registered corporations per 1,000 working-age people—in mobile money countries (treatment group) compared to non-mobile money countries (control group). Mobile money adoption is far from being a random feature (Apeti, 2023a; Apeti and Edoh, 2023. It may depend on several factors, including economic performance, level of development, access to cell phones, and access to traditional financial services. These factors—which may also affect entrepreneurship—make mobile money adoption endogenous (not random) through the problem of selection bias (Allcott, 2015). To circumvent this problem and identify the effect of mobile money, we follow Apeti (2023a) and Apeti and Edoh (2023) using an impact analysis method in particular entropy balancing—a method developed by Hainmueller (2012). This approach is also used by several authors in the economic literature including Neuenkirch and Neumeier (2016) to assess the impact of U.S. sanctions on poverty, Ogrokhina and Rodriguez (2019) to assess the effect of inflation targeting on the international debt denomination, Caselli and Wingender (2021) to evaluate the effect of fiscal rules and by Apeti, 2023b to analyse the effect of sovereign debt default on inequality. A similar approach is adopted by Riley (2018) to assess the effect of mobile money on risk-sharing, and Munyegera and Matsumoto (2016) to assess the effect of mobile money on the welfare of a panel of 846 rural Ugandan households.

Entropy balancing allows us to identify the effect of mobile money by comparing mobile money and non-mobile money countries (or units) that are similar in observable characteristics, while controlling for time and country fixed effects. This method offers

some advantages compared to concurrent impact analysis methods [2] such as propensity score matching (PSM) or difference-in-differences. First, it allows for a high degree of balance between the treatment and control groups by creating a synthetic group as close as possible to the treatment group. Second, unlike other impact analysis methods such as PSM, it does not require an empirical model for mobile money adoption, thus limiting specification and multicollinearity problems. Third, unlike classical matching methods, entropy balancing uses a more flexible reweighting approach by keeping the weights closer to the base weights to avoid information loss. Unlike conventional matching, which is based on the assumption of conditional independence, the fourth advantage is that entropy balancing allows us to exploit the panel aspect of our data and control for time and country-fixed effects in the second stage of our regression.

The approach used in this study is based on the principle that mobile money adoption is the treatment and entrepreneurship is the outcome variable. The units of observation are country-year observations. The observations with mobile money are the treatment group, and those without mobile money are the control group. The treatment effect on the treated (ATT) is defined as follows:

$$ATT = E[Y_{(1)}|T = 1] - E[Y_{(0)}|T = 1] \tag{1}$$

where $Y_{(.)}$ is the outcome variable measuring the entrepreneurship. T indicates whether the observation unit is subject to mobile money adoption ($T = 1$) or not ($T = 0$). $E[Y_{(1)}|T = 1]$ the entrepreneurship during the mobile money period, $E[Y_{(0)}|T = 1]$ is the counterfactual result for countries that had adopted mobile money, i.e. the entrepreneurship in countries that had adopted mobile money if they had not.

The issue is that $E[Y_{(0)}|T = 1]$ is not observable due to the non-random nature of mobile money adoption. If this were the case, the ATT could easily be identified by comparing entrepreneurship in mobile money countries with non-mobile money countries. Identifying ATT then requires a good proxy for $E[Y_{(0)}|T = 1]$. To do so, we match mobile money units with non-mobile money units that are as close as possible on observable characteristics that meet two criteria: correlated with mobile money adoption and entrepreneurship. Under the condition that the non-mobile money units are fairly close

2. Hainmueller (2012), using Monte Carlo simulations as well as empirical applications, demonstrates that entropy balancing outperforms other matching techniques, such as propensity score matching and genetic matching, in terms of estimation bias and mean square error.

to the mobile money units, any difference in entrepreneurship is attributable to mobile money adoption. Based on these different elements, we can rewrite equation (1) as follows:

$$ATT = E[Y_{(1)}|T = 1, X = x] - E[Y_{(0)}|T = 0, X = x] \tag{2}$$

where $X = x$ is a vector of observable covariates that may affect both the decision to adopt mobile money and entrepreneurship, $E[Y_{(1)}|T = 1, X = x]$ is the entrepreneurship of mobile money units, and $E[Y_{(0)}|T = 0, X = x]$ is the expected entrepreneurship for the synthetic control units. Estimating the ATT by entropy balancing involves two steps. The first is to compute weights for the control group (non-treated group). These weights may satisfy pre-specified balanced constraints involving sample moments of observable characteristics (X). Following Neuenkirch and Neumeier (2016), we choose balance constraints that impose equal covariates means between the treatment and control groups. In doing so, we want to ensure that the control group, on average, has non-treatment units that are as similar as possible to the treated units.[3] The second uses the weights from the first step in a regression analysis where entrepreneurship is the dependent variable. In the second step, we control for the covariates employed in the first step. This is equivalent to including control variables in a randomized experiment and increases estimation efficiency. In addition, time- and country-specific effects are included in the second step to respectively account for time-specific effects such as the Global Financial Crisis or pandemics and country-specific heterogeneity arising from, for instance, differences with regard to political, economic, institutional environments, or country-specific entrepreneurial culture.

Despite the various advantages of entropy balancing discussed above, we note that this approach may have some limitations. Indeed, entropy balancing may fail to control for the potential endogeneity biases resulting from unobserved time-varying factors that may affect both mobile money and entrepreneurship, and on the other hand, to successfully deal with the inertia of entrepreneurship. Consequently, to test the robustness of our conclusions, we complete the entropy balancing by alternative estimation methods such as Ordinary Least Squares (OLS), and two-step system-GMM dynamic panel

3. This procedure ensures that once the weights are generated, mobile money and non-mobile money countries exhibit similar trends in their outcome variable over the pre-treatment period (see Ogrokhina and Rodriguez, 2019).

estimator.

4 Data, and descriptive statistics

4.1 Data

To analyze the effect of mobile money on entrepreneurship, we use panel data covering 105 developing countries over the period 2006-2020. The study focuses on developing countries as the adoption of mobile money is specific to them. In other words, no developed country has adopted this policy to date. The choice of the sample and time period is primarily dictated by the availability of reliable data. Specifically, our sample begins (ends) in 2006 (2020) since this is the first (last) year of available data on entrepreneurship. Summary statistics and the list of countries used in the paper are available in the Appendix.

For our dependent variable, we follow previous studies on entrepreneurship (Klapper and Love, 2011; Ayyagari et al., 2014; Boudreaux et al., 2022b; Qin and Kong, 2022; Tian and Xu, 2022), by using data from the World Bank's Entrepreneurship Database (WBED). Specifically, we use the *new business entry density* which is defined as the number of newly registered firms per 1,000 working-age people (ages 15-64) per year. The WBED also provides information on total business density defined as the total number of registered businesses per 1,000 working-age persons (ages 15-64) and closed business density defined as the number of written-off businesses per 1,000 working-age persons (ages 15-64) that we use for robustness tests.

Our main variable of interest is mobile money. Following previous studies (Munyegera and Matsumoto, 2016; Riley, 2018; Apeti, 2023a; Apeti and Edoh, 2023), we measure mobile money as a dummy variable taking 1 when a country i at date t adopts mobile money and 0 otherwise, using GSMA's mobile money deployment tracker. [4]

Regarding the control variable, we select the control group of units with no mobile money that is on average as similar as possible to the treatment group of mobile money units in terms of relevant pretreatment characteristics. Following previous studies, we include a set of control variables that prior literature identifies as relevant determinants of mobile money adoption. These variables include: real GDP per capita, mobile cellular, urban population growth, rule of law, investment freedom, education, and globalisation

4. https://www.gsma.com/mobilemoneymetrics/#deployment-tracker

index.

We expect a negative correlation between real GDP per capita and mobile money given that mobile money is considered to be a low cost solution for low-income countries compared to relatively high-income countries, which would have access to a variety of payment methods (Jacolin et al., 2021). We expect a positive sign for mobile cellular and urban population growth as the deployment of mobile money is fundamentally linked to the cell phone market's dynamism (Jacolin et al., 2021; Apeti, 2023a; Apeti and Edoh, 2023) and that mobile money transactions are mainly from urban to rural areas. We also expect a positive correlation between mobile money and the level of education as individuals with higher education are more likely to easily adapt to financial innovations, such as mobile money services, than less educated individuals (Seng, 2021; Apeti and Edoh, 2023). As highly globalized countries may have access to international "best" practices, which can support the widespread adoption and increased efficiency of mobile money, we expect a positive correlation between mobile money and the globalization index. Finally, the rule of law and investment freedom are included to capture countries' institutional framework. Hence, we expect a positive sign for the rule of law and investment freedom as non-restrictive regulatory environments and the lack of investment barriers are important incentives for mobile money adoption (Jacolin et al., 2021). Finally, to contain the reverse causality we lag these variables by one period (see for instance, Neuenkirch and Neumeier, 2016; Apeti, 2023a; Apeti and Edoh, 2023 for similar exercise). [5] Finally, as part of the robustness checks, we add to these variables a large number of other potential determinants of mobile money and entrepreneurship. We provide a detailed description of all variables used, and their sources in Appendix.

4.2 Descriptive statistics and covariate balance

Table 1 (columns [1]-[2]) shows the sample means of all matching covariates before weighting for country-year observations for the treatment group (with mobile money) and the control group (without mobile money). Column [3] reports the differences in means between both groups and their statistical significance. The findings reveal that mobile money countries are characterized by *i*- low real GDP per capita, *ii*- high mobile cellular, *iii*- high rule of law, *iv*- high urban population growth, *v*- high investment free-

5. Robustness tests conducted and not reported in the paper show similar results without lagging these variables.

dom, *vi-* high education, and *vii-* high globalisation. These descriptive statistics, which are consistent with the expected relationship between mobile money and the covariates discussed above, show the importance of selecting an appropriate control group when estimating the treatment effect of mobile money in order to avoid spurious treatment effect estimates.

In Table 2, we present in columns [1] and [2] the mean values for country-year observations after weighting between the treated and the synthetic control groups. Column [3] shows the difference in mean between the treated and the synthetic control groups. A comparison of the average pre-treatment characteristics of the treatment group to those of the synthetic control group reveals the efficiency of entropy balancing as no statistically significant difference in the mean values remains. Consequently, entropy balancing allows us to construct a perfect control group that is closely similar to mobile money countries in terms of the mean values of the pre-treatment covariates.

To provide a first idea on the relationship between mobile money and entrepreneurship, we compute average entrepreneurship in mobile money and non-mobile money countries.[6] The results are presented in Table 3. A closer look at this table shows that when comparing the control group, i.e. the non-mobile money countries, to the treatment group before the introduction of mobile money, i.e. the pre-mobile money situation, we observe similar entrepreneurship dynamics. Indeed, the average number of new businesses created or entrepreneurship in the treated countries before the introduction of the treatment, i.e. mobile money countries before the introduction of mobile money, is 1.26% compared to 1.29% for the control group. The mean comparison test performed—to compare 1.26% and 1.29%—between these two groups reveals a p-value of 0.8159 highlighting that the control group countries and the pre-mobile money situation of the treated countries are similar i.e. entrepreneurship is similar in these two groups. Next, we compare the situation after the treatment introduction with the control group. The observations show that the adoption of mobile money improves the level of entrepreneurship in the treated countries (1.67% vs. 1.29% with a p-value of 0.0340). Finally, we complete our analysis by comparing the level of entrepreneurship before and after the adoption of mobile money in the treated countries. The results highlight a rise in the level of entrepreneurship after the adoption of mobile money captured by a new

6. A similar approach is adopted by Neuenkirch and Neumeier (2016).

business creation rate of 1.26% before the implementation of mobile money compared to 1.67% after, a difference of 0.4 percentage points.[7] These different observations, although "purely" descriptive, provide a first picture of the relationship between mobile money and business creation/entrepreneurship.

Table 1 – Covariate balance before weighting.

	[1] Mobile money	[2] No mobile money	[3]=[2]-[1] Difference
Lag GDP per capita (Log)	7.65	7.76	0.11*
Lag mobile cellular	91.63	62.48	-29.15***
Rule of law	-0.48	-0.59	-0.11***
Lag urban population growth	3.00	2.74	-0.26*
Investment freedom	52.45	45.60	-6.85***
Lag education	38.95	38.58	-0.37
Lag globalisation	54.42	51.76	-2.66***
Observations	531	282	

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

Table 2 – Covariate balance after weighting.

	[1] Mobile money	[2] No mobile money	[3]=[2]-[1] Difference
Lag GDP per capita (Log)	7.65	7.65	0
Lag mobile cellular	91.63	91.63	0
Rule of law	-0.48	-0.48	0
Lag urban population growth	3	3	0
Investment freedom	52.45	52.45	0
Lag education	38.95	38.95	0
Lag globalisation	54.42	54.42	0
Observations	531	282	
Total of weights	531	531	

7. This difference is statistically significant at 10% level (p-value: 0.0634).

Table 3 – Entrepreneurship and mobile money

	Entrepreneurship
Treatment group	
Before mobile money	1.26
During mobile money	1.67
Control Group	1.29

5 Main results

Table 4 report the baseline results. With the synthetic controls of Table 2, we estimate the effect of mobile money on entrepreneurship (ATT) using the weighted least squares method. In column [1], we only show the association between our key variable of interest (mobile money) and entrepreneurship while controlling with country and year-fixed effects. The estimated coefficient is positive and statistically significant at the 5% level. In column [2], we present our baseline specification that contains all matching covariates used in the first step to construct the synthetic group as well as country and year fixed effects. It is important to note that including the matching covariates in the second stage of entropy balancing increases the quality of the estimation (as in a randomized experiment) while controlling for country and year-fixed effects eliminates any country- or year-specific effects.

Based on our complete specification that includes both fixed effects and matching covariates (column [2]), we observe that the effect of mobile money on entrepreneurship is positive and statistically significant at 1%. The magnitude of the coefficient is 0.35 percentage points (column [2]). In other words, when a country adopts or uses mobile money, its entrepreneurial activity increases by 0.35 percentage points compared to non-mobile money countries. This result is economically meaningful as it represents 18.42 percent of the average of entrepreneurship in our sample. Compared to the control group, this coefficient represents 26.52 percent of their non-conditional average of entrepreneurship, i.e. 1.32 percent.

Table 4 – Entrepreneurship and mobile money

	[1] Entrepreneurship	[2] Entrepreneurship
Mobile money	0.243**	0.351***
	(0.1113)	(0.1215)
Covariates	No	Yes
Year fixed effect	Yes	Yes
Country fixed effect	Yes	Yes
Observations	622	622

Unreported constant included. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

6 Robustness checks

In this section, we conduct several robustness checks to verify the validity of our results.

6.1 Alternative specifications

We start this section by excluding the Global Financial Crisis (GFC) episodes and the Covid-19 crisis from our sample to isolate the potential impact of crises on entrepreneurship (Klapper and Love, 2011). Results compiled in Table A1, (columns [1]-[2]) in Appendix show a similar result to our baseline conclusions.

Second, we test the robustness of our results to alternative measures of entrepreneurship. Although our main dependent variable is *new business entry density* we also consider *total business density rate* and *closed business density rate* as alternative measures of entrepreneurship by re-estimating our baseline model using the same covariate as in Table 4. These alternative variables are from the World Bank's Entrepreneurship Database. Results are provided in [3] and [4] Table A1 in Appendix. We find that mobile money increase the number of total business density. However, the coefficient of closed business density is negative and statistically significant which is quite normal. Thus, we could argue that changing the definition of our dependent variable produces conclusions consistent with those previously discussed.

Third, we make some adjustments regarding our treatment variable, mobile money. We begin with the possible concern about a potential endogeneity problem that could

bias our results. Indeed, mobile money adoption can lead to a change in the economic, political or institutional environment of countries that have adopted it. Consequently, the effect we capture might not be driven by mobile money adoption but by any change in the institutional, political, social, or economic conditions after its adoption. In addition, since no country has abandoned mobile money after its adoption, any feature that may determine the deployment of mobile money can potentially be a source of endogeneity. To circumvent these problems, we construct a treatment variable defined over a window from one year before adoption to the year of adoption (Neuenkirch and Neumeier, 2015; Apeti, 2023a; Apeti and Edoh, 2023). Then, we re-estimate our baseline model with this new variable assuming that this time window will provide a more robust effect of mobile money on entrepreneurship as the institutional, political, social, and economic environments—which generally change very slowly—is likely to be more stable over a narrow time period. The result in column[4] of Table A2 in Appendix underlines findings consistent with our baseline results: mobile money increases entrepreneurship. Second, we change the definition of our treatment variable by removing mobile money services provided by banks and the first year of mobile money adoption (Apeti, 2023a; Apeti and Edoh, 2023). Finally, we exclude non-mobile money countries from our sample and keep only the treated group as mobile money countries may differ from non-mobile money countries in ways that go beyond the country and time fixed effects (Neuenkirch and Neumeier, 2015). The results are compiled in Table A2, columns [1]-[3] in Appendix. Altering the mobile money variable does not affect our previous finding: the estimated coefficients of mobile money remain positive, and statistically significant.

Fourth, we perform a placebo (falsification) test in two different ways. First, we define placebo or arbitrary dates for mobile money by randomly assigning an adoption date to the countries in our sample (Apeti, 2023a; Apeti and Edoh, 2023). Second, we define a placebo date for mobile money by computing a mobile money variable that incorrectly assigns the mobile money start date before the actual start date, i.e. one year before the actual mobile money date of each mobile money country in our sample. The intuition behind these tests is that, if our baseline findings are due to mobile money adoption, using placebo dates should produce a non-statistically significant estimate, otherwise this would indicate a misspecification of the entropy balancing estimate. Results based on entropy balancing using these placebo dates are reported in the last columns [5]-[6] of

Table A2 in Appendix. The non-statistically significant results of the placebo variables suggest that our results are robust, especially with respect to measurement error.

Five, we check if our result is sensitive to the inclusion of additional covariates that may affect both mobile money adoption and entrepreneurial activity. For this purpose, we include one at time and then simultaneously a set of additional controls to our baseline model. These variables include: inflation, public investment, current expenditure, tax payments, procedures to register property, start-up procedures to register a business, cost of business start-up procedures, disaster intensity (in log), climate vulnerability, resilience, political stability, financial development, self-employment, financial crisis, GDP growth, labor force, Official Development Assistance (ODA), and remittances. Inflation can impact new entrepreneurs in several ways. First, inflation can increase prices in the marketplace. Second, higher inflation will also lead to higher wages as with a higher cost of living, workers are more likely to demand higher wages to limit the erosion of their purchasing power. Also, higher inflation can also lead to higher borrowing costs and create a liquidity constraint for businesses by reducing accounting profits for leveraged firms (Madsen, 2003). [8] Public expenditure allows the financing of basic public services (health, education), which are favorable to the development of entrepreneurship. Therefore, we control the effect of public expenditure by including current expenditure and public investment. Variables related to the regulatory environment such as tax payments, the number of procedures to register property, start-up procedures, and start-up costs for a new business are also included. Tax payments are the total number of taxes paid by businesses. The number of procedures to register property is the number of procedures required for businesses to secure rights to property. Start-up procedures are those required to start a business, including interactions to obtain necessary permits and licenses and to complete all inscriptions, verifications, and notifications to start operations. The start-up costs for a new business are measured as a percentage of the respective country's income per capita. These variables are included in the model to control for their potential influence on the entrepreneurial activity as the existence of administrative barriers reduces nascent entrepreneurship (Dreher and Gassebner, 2013; Chambers and Munemo, 2019; Boudreaux et al., 2022b; Boudreaux et al., 2022a). For example, Klapper et al. (2006) show that the costs of entry measured in terms of

8. Gillman and Kejak (2011) also note the negative effect of inflation on investment and, by extension, on entrepreneurship.

money outlay, reduce the fraction of new firms significantly. Fisman and Sarria-Allende (2004) also find that in countries with high levels of entry regulation, industries respond to growth opportunities through expanding existing firms rather than creating new firms. We also included climate-related variables such as disaster intensity, climate vulnerability, and resilience, to control the effect of climate shocks. Natural disasters can damage infrastructure, disrupt supply chains, and affect firm performance, thereby hindering entrepreneurial activity by increasing uncertainty and fear of failure (Monllor and Murphy, 2017; Boudreaux et al., 2019;Boudreaux et al., 2022a Boudreaux et al., 2022b). In addition, natural disasters can impede the return to normal operations and thus decrease productivity (Grube and Storr, 2018; Boehm et al., 2019; Boudreaux et al., 2022b). However, natural disasters can also generate entrepreneurial opportunities as destruction generates market inefficiencies and reduce the market entry requirement by reducing the opportunity cost of capital if other business opportunities become unprofitable (Boudreaux et al., 2022a, Boudreaux et al., 2019). Like natural disasters, financial crises can also undermine entrepreneurial activity as shown by Klapper and Love (2011). However, these variables may also drive significant adoption of mobile money since mobile money can protect households in times of crisis or disaster (Riley, 2018). As sound government policies or "institutions" can promote and support entrepreneurship in a country, we assume that countries with greater political stability are likely to have a higher degree of entrepreneurial activity. In addition, politically stable nations will have lower risk and transaction/contracting costs, and higher levels of government transparency, predictability, and accountability (Dutta et al., 2013), which may favor the development of entrepreneurship. Financial development can significantly affect entrepreneurship. Indeed, better credit availability might push some self-employed individuals into formal employment and others into formal entrepreneurial activities as shown by Boustanifar (2014) and Qin and Kong (2022). Financial development can also impact mobile money adoption. Indeed, countries with high financial development would not be interested in adopting mobile money as they have a multitude of formal financial services such as banks. On the other hand, financial development may also be positively correlated to mobile money adoption as less restrictive regulatory environments and investment barriers are important incentives for mobile money adoption (Jacolin et al., 2021). We also control for self-employment, as Faggio and Silva (2014)

show that a higher incidence of self-employment positively and strongly correlates with business creation and innovation. Next, we include GDP growth. The effect of growth on entrepreneurship is unclear. Indeed, while Ovaska et al. (2005) find no significant impact on the number of new enterprises per 1000 inhabitants, Parker and Robson (2004) for their part, show that growth may increase entrepreneurship. However, others authors such as Noorderhaven et al. (2004), Wennekers et al. (2007), Bjørnskov and Foss (2008), claim that economic growth reduces entrepreneurial activity. Finally, external financing such as aid and remittances can also enhance entrepreneurial activity as they contribute to technology transfers, facilitates building infrastructure, and promotes productive capacities. The results are reported in Table A3, column [1]-[19] in Appendix and support the result of our baseline findings. We find that all the estimated effects are positive, and statistically significant with a magnitude comparable to the baseline one, providing evidence that our results are robust to potential omitted covariates.

Finally, we control for country-Specific time trends. Indeed, controlling for country-specific linear time trends allows us to remove distinctive trends in the entrepreneurial activity in individual countries that might otherwise bias our estimates if they accidentally coincided with other mobile money-related changes (Saka et al., 2022). Results compiled in column [20] of Table A3 (Appendix) show findings in line with our baseline conclusions.

6.2 Alternative estimation methods

To ensure that our findings are independent of the chosen estimator, we further compute the effects of mobile money on entrepreneurship using panel fixed effect and system GMM methods. The results of these exercises are reported in Appendix.

Table A4 presents the results of the estimates based on the Blundell and Bond, 1998 two-step system-GMM dynamic panel estimator controlling for the baseline entropy balancing covariates. This method allows us to include a lag of the dependent variable to account for entrepreneurial dynamism and to address the lack of valid external instruments for estimating the causal effect of mobile money on entrepreneurship while controlling for the Nickell bias that arises when estimating a dynamic panel with fixed effects. We find that the GMM regression provides results that are qualitatively consistent with the entropy balancing's finding. The estimated effect of mobile money is

positive and statistically significant at the 10 percent level. Finally, we note that entrepreneurial activity is fairly persistent as the lagged entrepreneurship is positive and statistically significant with a coefficient of 0.92.

We conclude this section by panel regression controlling for the baseline entropy balancing covariates, and country and year fixed effects. The results are presented in column [1] of Table A5 and the effect of mobile money remains positive and statistically significant. We test the robustness of the panel regressions by augmenting the baseline specification one at a time and simultaneously with the same additional control variables used in the robustness section of the entropy balancing approach. The results compiled in columns [2]-[20] of Table A5 show a consistent result to our baseline results.

7 Heterogeneity

In this section, we performed some heterogeneity tests by analyzing whether the positive effect of mobile money on entrepreneurship is influenced by the intensity of mobile money usage and by some structural characteristics describing countries' political and economic environment. To ease interpretation, we report all the results in Figure 1, 2, and 3.

7.1 Intensity of mobile money usage

First, we hypothesize that, the effect of mobile money on entrepreneurship may depend on the intensity of mobile money usage or adoption. Indeed, one of the main constraints of using dummy variables in a cross-country study is that it fails to capture the depth of mobile money use (Ogrokhina and Rodriguez, 2018; Apeti, 2023a; Apeti and Edoh, 2023). For that purpose, we interact our binary mobile money indicator with four variables:[9] the number of active mobile money accounts per 1,000 adults, the value of mobile money transactions in percentage of GDP, the number of mobile money transactions per 1,000 adults, and the average number of transaction per active mobile money accounts. Figure 1 graphically illustrates the result of the marginal effect of mobile money relative to those variables that take into account the intensity of mobile money use. We observe that the effect of mobile money on entrepreneurship increases with the

9. The interaction approach is also used by Ogrokhina and Rodriguez (2018) to test the intensity of policy adoption.

number of active mobile money accounts per adult, the value of mobile money transactions, the number of mobile money transactions per adults, and the average number of transaction per active mobile money accounts. These results thus provide support for our hypothesis that the effect of mobile money may depend on the intensity of the use of mobile money.

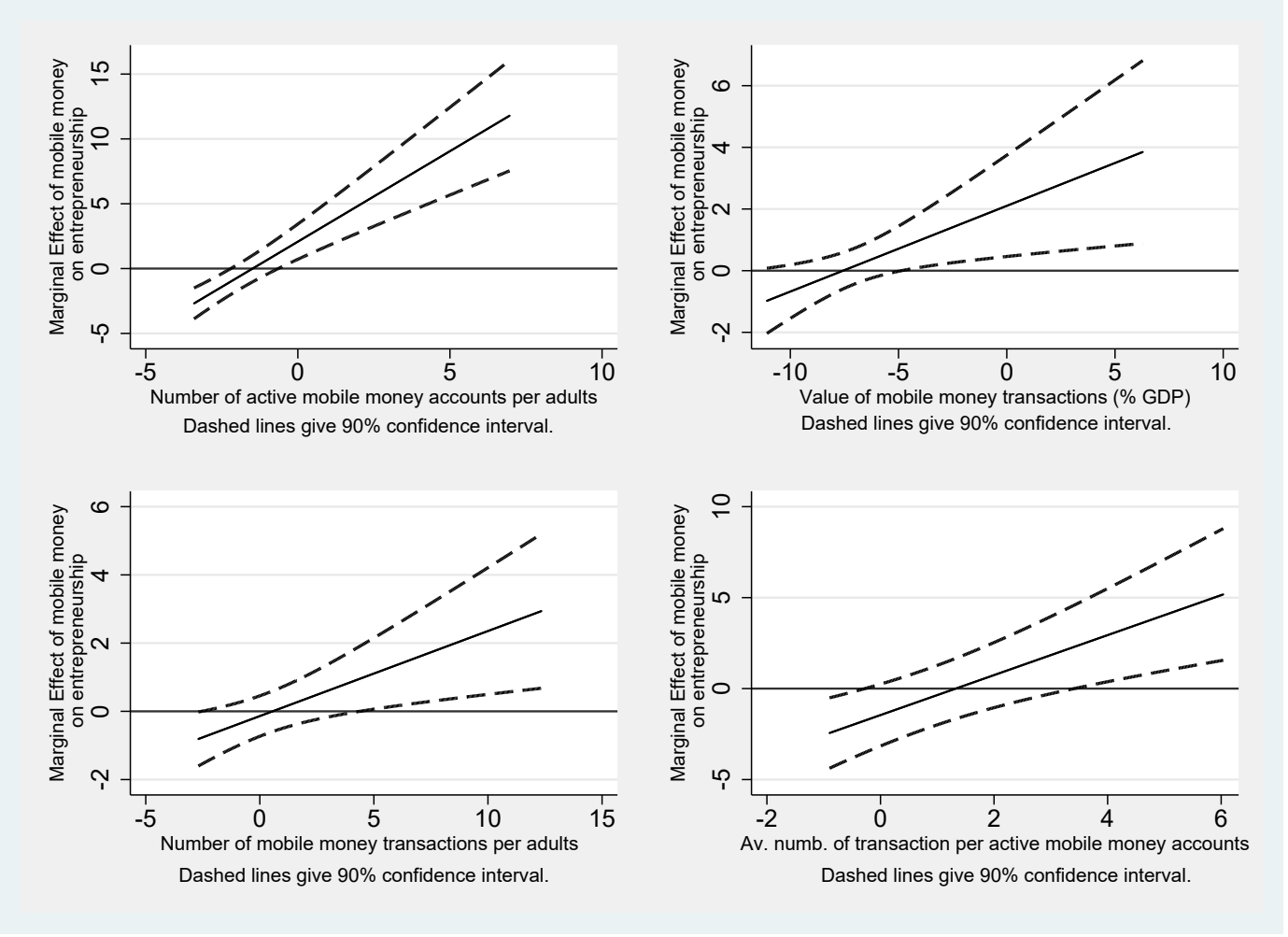

Figure 1 – Entrepreneurship and mobile money: intensity of mobile money

7.2 Structural factors

In this subsection, we analyze whether the positive effect of mobile money may depend on some structural characteristics that may affect the efficiency of mobile money.

First, we analyze the sensitivity of our results to the political and institutional environment of the treated countries. Indeed, it can be argued that mobile money can be more efficient in a political environment characterized by strong democratic institutions, high-quality of regulation, and less corruption, since good institutions are likely

to promote reform efficiency.To test this, we interact the binary mobile money indicators with a variable depicting the quality of the political/institutional environment. The first three graphs of Figure 2 illustrate the marginal effects of mobile money on entrepreneurship relative to democracy, quality of regulation, and the level of corruption. Indeed, the figure shows that the effect of mobile money increases when the political environment of countries is favorable, i.e. when institutions are more democratic, when the quality of regulation is sound, and when the level of corruption is low. Next, we assume that the effect of mobile money would be less effective in an environment where individuals are more exposed to conflict. Indeed, Blumenstock et al. (2021) provides evidence that violence affects how people make financial decisions. The authors show that individuals who are exposed to violence are less likely to adopt and use mobile money, a new financial technology, and are more likely to retain cash on hand. We test this hypothesis by interacting our mobile money indicator with a conflict intensity variable. The last graph of the Figure 2 shows that the effect of mobile money on entrepreneurship decreases with the intensity of the conflict and becomes non-statistically significant around a score of 7, thus supporting our assumption.

Second, we test if the effect of mobile money depends on some characteristics such as education, internet usage, and (formal) financial institutions. First, individuals with higher levels of education are likely to adapt more easily to financial innovations, such as mobile money services, than those with less education (Seng, 2021; Apeti and Edoh, 2023). Accordingly, the effect of mobile money would be more efficient with higher levels of education. Second, countries with high internet access are more likely to have access to formal financial services such as banks, thus making the adoption of digital financial services like mobile money less attractive (Owusu-Agyei et al., 2020). Moreover, countries with high internet access may already have a high level of entrepreneurship (Hjort and Poulsen, 2019; Luo et al., 2022), and therefore the marginal effect of mobile money would be less in such conditions. Taken together, we assume that the effect of mobile money would be less efficient in countries with high internet. Third, the effect of mobile money would be less efficient in high financial development conditions as countries with high financial development already have access to a multitude of formal financial services thus the adoption of mobile money in these countries would be less attractive. The last three graphs in Figure 3 illustrate the results. We find that as the level of financial

development and internet adoption increases, the marginal effect of mobile money on entrepreneurship decreases. However, we find that the effect of mobile money is greater when the level of education is high, thus corroborating our above hypotheses.

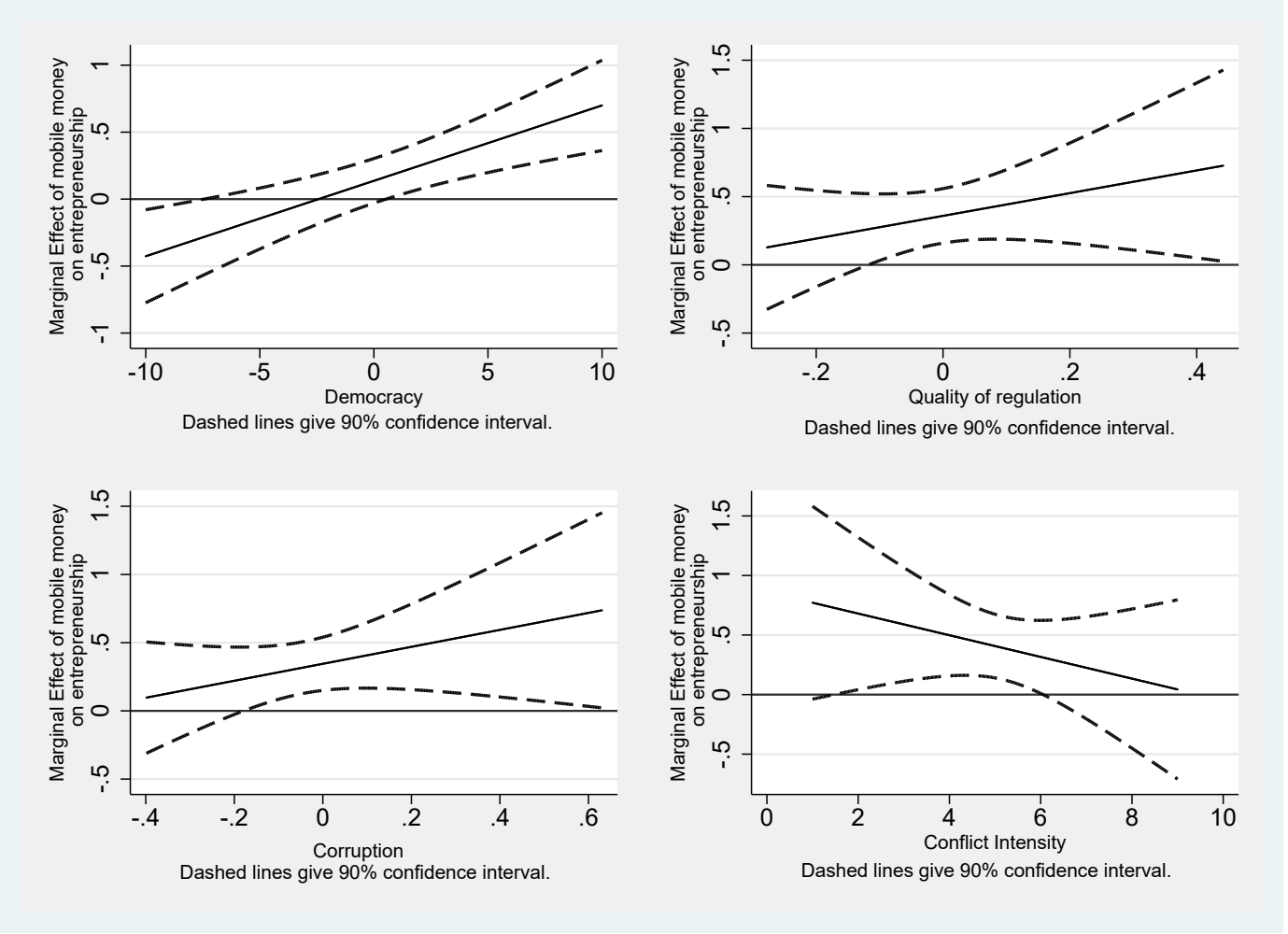

Figure 2 – Entrepreneurship and mobile money: structural factors

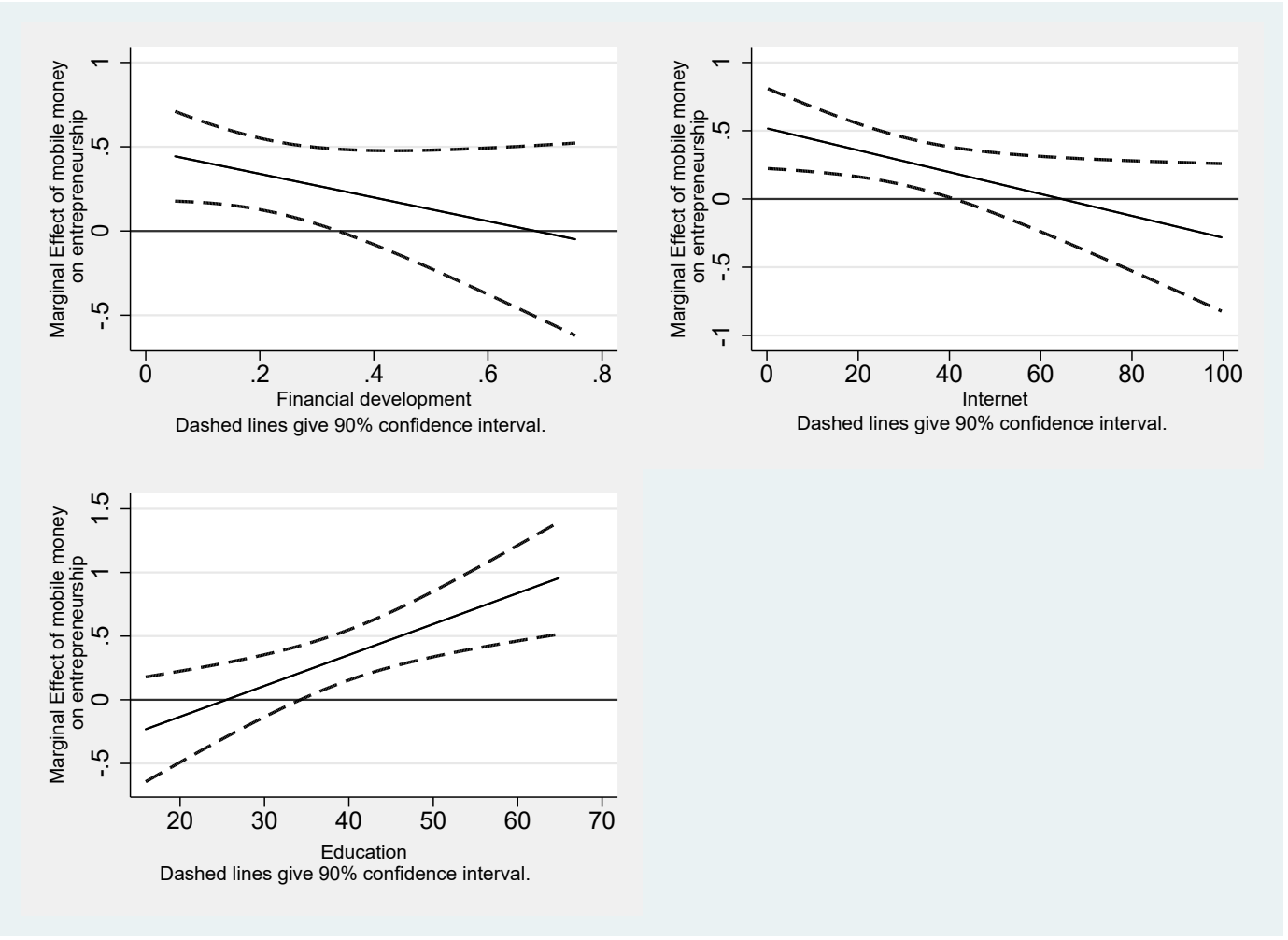

Figure 3 – Entrepreneurship and mobile money: structural factors

8 Conclusion

This paper analyzes whether adopting mobile money improves developing countries' entrepreneurial activity. Using entropy balancing to control endogeneity and based on a sample of 105 developing countries over 2006-2020, our study concludes that mobile money increases entrepreneurship in mobile money countries relative to non-mobile money countries. This result is robust to several robustness tests, including changing the definition of mobile money, the definition of entrepreneurship, placebo tests, adding additional control variables, altering the sample design, and alternative estimation methods such as panel fixed effects, and GMM system. Furthermore, the heterogeneity tests performed show that: *i*- the effect of mobile money depends on the intensity of mobile money use, *ii*- effect of mobile money depends on some structural factors such as democracy, conflict, quality of regulation, corruption, financial development, internet, and education.

Entrepreneurship is identified as a driver of development, growth, innovation, and welfare. Given that developing countries—which face crucial challenges such as low growth, low innovation, high poverty, and high unemployment—entrepreneurial activities are "very" weak compared to developed countries, looking for instruments to foster entrepreneurship seems necessary to help these countries boost their development/growth process. Consequently, mobile money—a "recent" financial innovation—could be a valuable tool for these countries to promote business creation/entrepreneurship. In sum, mobile money could offer economic growth and prosperity benefits for developing countries by promoting entrepreneurship.

References

Acs, Z. J. and Audretsch, D. B. (1988). Innovation in large and small firms: an empirical analysis. *The American economic review*, pages 678–690.

Acs, Z. J., Desai, S., and Hessels, J. (2008). Entrepreneurship, economic development and institutions. *Small business economics*, 31:219–234.

Adam, C. and Walker, S. E. (2015). *Mobile money and monetary policy in East African countries*. Available at: www. sbs. ox. ac. uk/sites/default/files/research-projects/mobile-money/Monetary-policypaper. pdf (accessed 30 March 2017).

Aggarwal, S., Brailovskaya, V., and Robinson, J. (2020). Cashing in (and out): Experimental evidence on the effects of mobile money in malawi. In *AEA Papers and Proceedings*, volume 110, pages 599–604.

Ahmad, A. H., Green, C., and Jiang, F. (2020). Mobile money, financial inclusion and development: A review with reference to african experience. *Journal of economic surveys*, 34(4):753–792.

Ahmed, H. and Cowan, B. (2021). Mobile money and healthcare use: Evidence from east africa. *World Development*, 141:105392.

Allcott, H. (2015). Site selection bias in program evaluation. *The Quarterly Journal of Economics*, 130(3):1117–1165.

Allen, F., Qian, J., and Qian, M. (2005). Law, finance, and economic growth in china. *Journal of financial economics*, 77(1):57–116.

Anzoategui, D., Demirgüç-Kunt, A., and Pería, M. S. M. (2014). Remittances and financial inclusion: Evidence from el salvador. *World Development*, 54:338–349.

Apeti, A. E. (2023a). Household welfare in the digital age: Assessing the effect of mobile money on household consumption volatility in developing countries. *World Development*, 161:106110.

Apeti, A. E. (2023b). Sovereign debt default and inequality. *Industrial and Corporate Change*.

Apeti, A. E. and Edoh, E. D. (2023). Tax revenue and mobile money in developing countries. *Journal of Development Economics*, 161:103014.

Aron, J., Muellbauer, J., and Sebudde, R. (2015). Inflation forecasting models for uganda: is mobile money relevant? *CEPR Discussion Papers No. 10739*.

Asongu, S. (2015). *The impact of mobile phone penetration on African inequality*. *International Journal of Social Economics*. https://doi.org/10.1108/IJSE-11-2012-0228.

Asturias, J., Hur, S., Kehoe, T. J., and Ruhl, K. J. (2023). Firm entry and exit and aggregate growth. *American Economic Journal: Macroeconomics*, 15(1):48–105.

Ayyagari, M., Demirguc-Kunt, A., and Maksimovic, V. (2014). Who creates jobs in developing countries? *Small Business Economics*, 43:75–99.

Beck, T., Büyükkarabacak, B., Rioja, F. K., and Valev, N. T. (2012). Who gets the credit? and does it matter? household vs. firm lending across countries. *The BE Journal of Macroeconomics*, 12(1).

Beck, T., Lu, L., and Yang, R. (2015). Finance and growth for microenterprises: evidence from rural china. *World Development*, 67:38–56.

Beck, T., Pamuk, H., Ramrattan, R., and Uras, B. R. (2018). Payment instruments, finance and development. *Journal of Development Economics*, 133:162–186.

Bjørnskov, C. and Foss, N. J. (2008). Economic freedom and entrepreneurial activity: Some cross-country evidence. *Public Choice*, 134:307–328.

Blumenstock, J., Callen, M., Ghani, T., and Gonzalez, R. (2021). Violence and financial decisions: Evidence from mobile money in afghanistan. *Review of Economics and Statistics*, pages 1–45.

Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics*, 87(1):115–143.

Boehm, C. E., Flaaen, A., and Pandalai-Nayar, N. (2019). Input linkages and the transmission of shocks: Firm-level evidence from the 2011 tōhoku earthquake. *Review of Economics and Statistics*, 101(1):60–75.

Boudreaux, C. J., Escaleras, M. P., and Skidmore, M. (2019). Natural disasters and entrepreneurship activity. *Economics Letters*, 182:82–85.

Boudreaux, C. J., Jha, A., and Escaleras, M. (2022a). Natural disasters, entrepreneurship activity, and the moderating role of country governance. *Small Business Economics*, pages 1–26.

Boudreaux, C. J., Jha, A., and Escaleras, M. (2022b). Weathering the storm: How foreign aid and institutions affect entrepreneurship activity following natural disasters. *Entrepreneurship Theory and Practice*, 46(6):1843–1868.

Boustanifar, H. (2014). Finance and employment: Evidence from us banking reforms. *Journal of Banking & Finance*, 46:343–354.

Cai, D., Song, Q., Ma, S., Dong, Y., and Xu, Q. (2018). The relationship between credit constraints and household entrepreneurship in china. *International Review of Economics & Finance*, 58:246–258.

Caselli, F. and Wingender, P. (2021). Heterogeneous effects of fiscal rules: The maastricht fiscal criterion and the counterfactual distribution of government deficits. *European Economic Review*, 136:103748.

Chambers, D. and Munemo, J. (2019). Regulations, institutional quality and entrepreneurship. *Journal of Regulatory Economics*, 55:46–66.

Charfeddine, L. et al. (2022). Financing new entrepreneurship: Credit or microcredit? *Economics Letters*, 216:110634.

Chauvet, L. and Ferry, M. (2021). Taxation, infrastructure, and firm performance in developing countries. *Public Choice*, 187:455–480.

Chowdhury, F., Audretsch, D. B., and Belitski, M. (2019). Institutions and entrepreneurship quality. *Entrepreneurship Theory and Practice*, 43(1):51–81.

Dalton, P. S., Pamuk, H., Ramrattan, R., Uras, B., and van Soest, D. P. (2022). *E-payment technology and business finance: A randomized controlled trial with mobile money (revision of CentER DP 2019-032)*. (CentER Discussion Paper; Vol. 2022-031). CentER, Center for Economic Research.

Dreher, A. (2006). Does globalization affect growth? evidence from a new index of globalization. *Applied economics*, 38(10):1091–1110.

Dreher, A. and Gassebner, M. (2013). Greasing the wheels? the impact of regulations and corruption on firm entry. *Public choice*, 155:413–432.

Dunne, J. P. and Kasekende, E. (2018). Financial innovation and money demand: Evidence from sub-saharan africa. *South African Journal of Economics*, 86(4):428–448.

Dutta, N., S. Sobel, R., and Roy, S. (2013). Entrepreneurship and political risk. *Journal of Entrepreneurship and Public Policy*, 2(2):130–143.

Faggio, G. and Silva, O. (2014). Self-employment and entrepreneurship in urban and rural labour markets. *Journal of Urban Economics*, 84:67–85.

Fisman, R. and Sarria-Allende, V. (2004). Regulation of entry and the distortion of industrial organization.

Gillman, M. and Kejak, M. (2011). Inflation, investment and growth: a money and banking approach. *Economica*, 78(310):260–282.

Gosavi, A. (2018). Can mobile money help firms mitigate the problem of access to finance in eastern sub-saharan africa? *Journal of African Business*, 19(3):343–360.

Grube, L. E. and Storr, V. H. (2018). Embedded entrepreneurs and post-disaster community recovery. *Entrepreneurship & Regional Development*, 30(7-8):800–821.

Gulen, H. and Ion, M. (2016). Policy uncertainty and corporate investment. *The Review of Financial Studies*, 29(3):523–564.

Hainmueller, J. (2012). Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies. *Political analysis*, pages 25–46.

Haltiwanger, J., Jarmin, R. S., and Miranda, J. (2013). Who creates jobs? small versus large versus young. *Review of Economics and Statistics*, 95(2):347–361.

Han, L. and Hare, D. (2013). The link between credit markets and self-employment choice among households in rural china. *Journal of Asian Economics*, 26:52–64.

Herkenhoff, K., Phillips, G. M., and Cohen-Cole, E. (2021). The impact of consumer credit access on self-employment and entrepreneurship. *Journal of financial economics*, 141(1):345–371.

Hjort, J. and Poulsen, J. (2019). The arrival of fast internet and employment in africa. *American Economic Review*, 109(3):1032–79.

Islam, A., Muzi, S., and Meza, J. L. R. (2018). Does mobile money use increase firms' investment? evidence from enterprise surveys in kenya, uganda, and tanzania. *Small Business Economics*, 51(3):687–708.

Jack, W. and Suri, T. (2014). Risk sharing and transactions costs: Evidence from kenya's mobile money revolution. *American Economic Review*, 104(1):183–223.

Jacolin, L., Keneck Massil, J., and Noah, A. (2021). Informal sector and mobile financial services in emerging and developing countries: Does financial innovation matter? *The World Economy*, 44(9):2703–2737.

Kipkemboi, K. and Bahia, K. (2019). The impact of mobile money on monetary and financial stability in sub-sahara africa. *GSMA Report*.

Klapper, L., Laeven, L., and Rajan, R. (2006). Entry regulation as a barrier to entrepreneurship. *Journal of financial economics*, 82(3):591–629.

Klapper, L. and Love, I. (2011). The impact of the financial crisis on new firm registration. *Economics Letters*, 113(1):1–4.

Koomson, I., Bukari, C., and Villano, R. A. (2021). Mobile money adoption and response to idiosyncratic shocks: Empirics from five selected countries in sub-saharan africa. *Technological Forecasting and Social Change*, 167:120728.

Krolikowski, A. (2014). Can mobile-enabled payment methods reduce petty corruption in urban water provision? *Water Alternatives*, 7(1).

Lee, J. N., Morduch, J., Ravindran, S., Shonchoy, A., and Zaman, H. (2021). Poverty and migration in the digital age: Experimental evidence on mobile banking in bangladesh. *American Economic Journal: Applied Economics*, 13(1):38–71.

Levine, R. (2005). Finance and growth: theory and evidence. *Handbook of economic growth*, 1:865–934.

Luo, Q., Hu, H., Feng, D., and He, X. (2022). How does broadband infrastructure promote entrepreneurship in china: Evidence from a quasi-natural experiment. *Telecommunications Policy*, 46(10):102440.

Ma, S., Wu, X., and Gan, L. (2019). Credit accessibility, institutional deficiency and entrepreneurship in china. *China Economic Review*, 54:160–175.

Madsen, J. B. (2003). Inflation and investment. *Scottish Journal of Political Economy*, 50(4):375–397.

Mawejje, J. and Lakuma, P. (2019). Macroeconomic effects of mobile money: evidence from uganda. *Financial Innovation*, 5(1):1–20.

Monllor, J. and Murphy, P. J. (2017). Natural disasters, entrepreneurship, and creation after destruction: A conceptual approach. *International Journal of Entrepreneurial Behavior & Research*, 23(4):618–637.

Munyegera, G. K. and Matsumoto, T. (2016). Mobile money, remittances, and household welfare: Panel evidence from rural uganda. *World Development*, 79:127–137.

Neuenkirch, M. and Neumeier, F. (2015). The impact of un and us economic sanctions on gdp growth. *European Journal of Political Economy*, 40:110–125.

Neuenkirch, M. and Neumeier, F. (2016). The impact of us sanctions on poverty. *Journal of Development Economics*, 121:110–119.

Noorderhaven, N., Thurik, R., Wennekers, S., and Van Stel, A. (2004). The role of dissatisfaction and per capita income in explaining self–employment across 15 european countries. *Entrepreneurship Theory and Practice*, 28(5):447–466.

Ogrokhina, O. and Rodriguez, C. M. (2018). The role of inflation targeting in international debt denomination in developing countries. *Journal of International Economics*, 114:116–129.

Ogrokhina, O. and Rodriguez, C. M. (2019). The effect of inflation targeting and financial openness on currency composition of sovereign international debt. *Journal of International Money and Finance*, 97:1–18.

Ovaska, T., Sobel, R. S., et al. (2005). Entrepreneurship in post-socialist economies. *Journal of Private Enterprise*, 21(1):8–28.

Owusu-Agyei, S., Okafor, G., Chijoke-Mgbame, A. M., Ohalehi, P., and Hasan, F. (2020). Internet adoption and financial development in sub-saharan africa. *Technological Forecasting and Social Change*, 161:120293.

Parker, S. C. and Robson, M. T. (2004). Explaining international variations in self-employment: Evidence from a panel of oecd countries. *Southern economic journal*, 71(2):287–301.

Patnam, M., Yao, W., et al. (2020). Real effects of mobile money: Evidence from a large-scale fintech expansion. *IMF working Paper No. 20/138*.

Pennisi, E. (2012). Understanding entrepreneurship in developing countries. *Global Edge Business Review, Michigan State University*.

Qin, N. and Kong, D. (2022). Access to credit and entrepreneurship: Evidence from china. *Economic Development and Cultural Change*, 71(1):295–331.

Riley, E. (2018). Mobile money and risk sharing against village shocks. *Journal of Development Economics*, 135:43–58.

Riley, E. et al. (2016). Mobile money and risk sharing against aggregate shocks. *Work. Pap*, 16.

Roser, M. and Ortiz-Ospina, E. (2016). Global education. *Our World in Data*. https://ourworldindata.org/global-education.

Rotondi, V. and Billari, F. C. (2021). Mobile money and school participation: Evidence from africa. *Population Research and Policy Review*, pages 1–20.

Saka, O., Eichengreen, B., and Aksoy, C. G. (2022). Epidemic exposure, financial technology, and the digital divide. *Journal of Money, Credit and Banking*, 54(7):1913–1940.

Schumpeter, J. A. (1934). *The theory of economic development*. Cambridge, MA: Harvard University Press.

Seng, K. (2021). The mobile money's poverty-reducing promise: Evidence from cambodia. *World Development Perspectives*, 22:100310.

Shapiro, A. F. and Mandelman, F. S. (2016). Remittances, entrepreneurship, and employment dynamics over the business cycle. *Journal of International Economics*, 103:184–199.

Stiglitz, J. E. and Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American economic review*, 71(3):393–410.

Suri, T., Aker, J., Batista, C., Callen, M., Ghani, T., Jack, W., Klapper, L., Riley, E., Schaner, S., and Sukhtankar, S. (2023). Mobile money. *VoxDevLit*, 2(2):3.

Suri, T. and Jack, W. (2016). The long-run poverty and gender impacts of mobile money. *Science*, 354(6317):1288–1292.

Teorell, J., Dahlberg, S., Holmberg, S., Rothstein, B., Alvarado Pachon, N., and Axelsson, S. (2020). *The Quality of Government Standard Dataset, version Jan20*. University of Gothenburg. The Quality of Government Institute. doi = 10.18157/qogstdjan20, url = http://www.qog.pol.gu.se.

Tian, X. and Xu, J. (2022). Do place-based policies promote local innovation and entrepreneurship? *Review of Finance*, 26(3):595–635.

Van der Sluis, J., Van Praag, M., and Vijverberg, W. (2008). Education and entrepreneurship selection and performance: A review of the empirical literature. *Journal of economic surveys*, 22(5):795–841.

Wennekers, S., Thurik, R., van Stel, A., and Noorderhaven, N. (2007). Uncertainty avoidance and the rate of business ownership across 21 oecd countries, 1976–2004. *Journal of Evolutionary economics*, 17:133–160.

World Bank (2021a). *The Entrepreneurship Database*. World Bank, Washington, DC.

World Bank (2021b). *The World Bank Enterprise Surveys (WBES)*. World Bank, Washington, DC.

Yavuz, R. I. and Bahadir, B. (2021). Remittances, ethnic diversity, and entrepreneurship in developing countries. *Small Business Economics*, pages 1–22.

Appendix

Table A1 – Entrepreneurship and mobile money: altering the sample

	[1] Excluding GFC	[2] Excluding Covid-19	[3] Total business density rate	[4] Closed business density rate
Mobile money	0.460***	0.414***	6.651***	-0.138*
	(0.1526)	(0.1326)	(1.3611)	(0.0793)
Covariates	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Observations	541	580	423	90

Unreported constant included. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table A2 – Entrepreneurship and mobile money: alternative definition of mobile money

Entrepreneurship	[1]	[2]	[3]	[4]	[5]	[6]
Excl. non mobile money countries	0.431***					
	(0.1258)					
Mobile money w/o banks		0.266**				
		(0.1253)				
Excl. mobile money start date			0.451***			
			(0.1553)			
Mobile money [1;0]				0.070**		
				(0.0343)		
Placebo mobile money					-0.073	
					(0.0902)	
Placebo mobile money (t+1)						0.037
						(0.0795)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	611	786	575	328	659	207

Unreported constant included. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table A3 – Entrepreneurship and mobile money: additional control

	[1] Inflation	[2] Public investment	[3] Current expenditure	[4] Tax payments	[5] Procedures to register property	[6] Procedures to start a business	[7] Costs of starting a business	[8] Disaster intensity	[9] Climate vulnerability	[10] Resilience
Mobile money	0.360***	0.351***	0.342***	0.342***	0.360***	0.392***	0.390***	0.350***	0.345***	0.323***
	(0.1250)	(0.1117)	(0.1178)	(0.1219)	(0.1211)	(0.1316)	(0.1322)	(0.1233)	(0.1212)	(0.1172)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	585	610	597	582	580	542	542	622	622	622
	[11] Political stability	[12] Financial development	[13] Self employment	[14] Financial crisis	[15] Growth	[16] Labor force	[17] ODA	[18] Remittances	[19] All covariates	[20] Time trend
Mobile money	0.351***	0.380***	0.355***	0.353***	0.377***	0.349***	0.361***	0.351***	0.287***	0.280**
	(0.1213)	(0.1209)	(0.1225)	(0.1215)	(0.1277)	(0.1222)	(0.1163)	(0.1223)	(0.1094)	(0.1145)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	622	574	622	622	583	622	610	604	479	622

Unreported constant included. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table A4 – Entrepreneurship and mobile money: GMM-system

	[1] Entrepreneurship
Lag entrepreneurship	0.923***
	(0.0649)
Mobile money	0.221*
	(0.1302)
Log GDP per capita	0.239
	(0.2661)
Mobile cellular	0.003
	(0.0029)
Rule of law	0.299
	(0.3995)
Urban population growth	-0.033
	(0.0486)
Investment freedom	0.001
	(0.0060)
Education	0.014
	(0.0237)
Globalisation	-0.013
	(0.0168)
Fixed effects	Yes
Hansen test p-value	0.712
Numb. of instruments/numb. of countries	45/60
Observations	599

Unreported constant included. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table A5 – Entrepreneurship and mobile money: Panel fixed effects

Entrepreneurship	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]
Mobile money	0.154*	0.172*	0.187**	0.171*	0.170*	0.179*	0.212*	0.210*	0.157*	0.156*	0.155*	0.154*	0.168*	0.158*	0.154*	0.165*	0.157*	0.188**	0.156*	0.212*
	(0.0918)	(0.0974)	(0.0939)	(0.0966)	(0.0963)	(0.0947)	(0.1088)	(0.1086)	(0.0927)	(0.0915)	(0.0895)	(0.0919)	(0.0992)	(0.0930)	(0.0918)	(0.0984)	(0.0920)	(0.0950)	(0.0947)	(0.1194)
Inflation		-0.013																		-0.025**
		(0.0092)																		(0.0104)
Public investment			0.524***																	0.553***
			(0.1847)																	(0.2055)
Current expenditure				-0.713																0.487
				(0.6440)																(0.7743)
Tax payments					0.001															0.007*
					(0.0036)															(0.0039)
Procedures to register property						-0.052														0.130
						(0.0986)														(0.1069)
Procedures to start a business							0.026													-0.018
							(0.0286)													(0.0312)
Costs of starting a business								-0.000												-0.001*
								(0.0002)												(0.0004)
Log disaster intensity									-0.002											-0.002
									(0.0077)											(0.0091)
Vulnerability										3.649										6.964
										(6.8738)										(7.5578)
Resilience											5.542***									19.625***
											(1.0316)									(4.0390)
Political Stability												0.006								-0.079
												(0.0739)								(0.1028)
Financial development													-0.670							-2.195
													(3.0579)							(3.6573)
Self-employed														-0.008						-0.006
														(0.0134)						(0.0145)
Financial crisis															0.006					-0.016
															(0.1314)					(0.2525)
Growth																-0.205				-2.615
																(0.8834)				(1.9832)
Labor force																	-0.542			0.058
																	(0.7242)			(0.9265)
ODA																		-0.022		-0.051
																		(0.0163)		(0.0322)
Remittances																			-0.014	-0.008
																			(0.0109)	(0.0142)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	622	585	610	597	582	580	542	542	622	622	622	622	574	622	622	583	622	610	604	453

Unreported constant included. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table B1 – Descriptive statistics of baseline variables

Variables	Obs	Mean	Std. Dev.	Min	Max
Entrepreneurship	622	1.531	2.401	0.017	20.091
Mobile money	813	0.653	0.476	0	1
Log GDP per capita	813	7.720	1.073	5.812	11.152
Mobile cellular	811	87.106	38.896	0.499	186.158
Rule of law	813	-0.520	0.499	-1.852	0.958
Urban population growth	813	2.885	1.723	-1.028	17.763
Investment freedom	813	50.073	17.331	0	85
Year of schooling	813	38.824	10.579	15.930	64.870
KOF Globalisation Index	752	53.823	10.174	25.773	80.065

Table B2 – Mobile money country

Albania	Indonesia	Niger
Argentina	India	Nigeria
Armenia	Iran, Islamic Rep.	Nepal
Benin	Jamaica	Peru
Burkina Faso	Jordan	Paraguay
Bangladesh	Kazakhstan	Qatar
Bolivia	Kenya	Rwanda
Brazil	Kyrgyz Republic	Senegal
Botswana	Cambodia	Sierra Leone
Central African Republic	Sri Lanka	El Salvador
Colombia	Lesotho	Chad
Dominican Republic	Morocco	Togo
Egypt, Arab Rep.	Madagascar	Thailand
Fiji	Mexico	Tajikistan
Gabon	Mali	Tunisia
Georgia	Myanmar	Turkey
Ghana	Mongolia	Tanzania
Guinea	Mozambique	Uganda
Guatemala	Mauritania	South Africa
Guyana	Malawi	Zambia
Haiti	Namibia	Zimbabwe

Table B3 – Country list

Afghanistan	Georgia	Montenegro	Timor-Leste
Albania	Ghana	Mongolia	Tonga
Argentina	Guinea	Mozambique	Trinidad and Tobago
Armenia	Guatemala	Mauritania	Tunisia
Azerbaijan	Guyana	Malawi	Turkey
Benin	Croatia	Malaysia	Tanzania
Burkina Faso	Haiti	Namibia	Uganda
Bangladesh	Hungary	Niger	Ukraine
Bulgaria	Indonesia	Nigeria	Uruguay
Bosnia and Herzegovina	India	Nepal	Uzbekistan
Belarus	Iran, Islamic Rep.	Oman	Vietnam
Bolivia	Iraq	Pakistan	Samoa
Brazil	Iceland	Peru	South Africa
Brunei Darussalam	Jamaica	Poland	Zambia
Bhutan	Jordan	Paraguay	Zimbabwe
Botswana	Kazakhstan	Qatar	
Central African Republic	Kenya	Romania	
Chile	Kyrgyz Republic	Rwanda	
Congo, Dem. Rep.	Cambodia	Saudi Arabia	
Colombia	Kiribati	Senegal	
Comoros	Kuwait	Sierra Leone	
Cabo Verde	Lao PDR	El Salvador	
Costa Rica	Sri Lanka	Serbia	
Djibouti	Lesotho	South Sudan	
Dominican Republic	Morocco	Sao Tome and Principe	
Algeria	Madagascar	Suriname	
Egypt, Arab Rep.	Maldives	Chad	
Ethiopia	Mexico	Togo	
Fiji	Mali	Thailand	
Gabon	Myanmar	Tajikistan	

Data sources, and definitions

Mobile money: dummy variable taking 1 if a country at date t adopts mobile money and 0 otherwise. *Source*: Authors' calculation based on GSMA Mobile Money Deployment Tracker

P2P transfer: 1 if a country use P2P service. Person-to-Person (P2P) transfers are domestic transfers that are made between two customer accounts, including OTC transactions, off-net/cross-net transfers, bank account-to-mobile money account transfers, and mobile money-to-bank account transfers. *Source*: Authors' calculation based on GSMA Mobile Money Deployment Tracker

Airtime top up: 1 if a country use airtime top-up service. Airtime top-up is a purchase of airtime via mobile money, funded from a mobile money account. *Source*: Authors' calculation based on GSMA Mobile Money Deployment Tracker

Merchant payment: 1 if a country use merchant payment service. Merchant payment is a payment made from a mobile money account via a mobile money platform to a retail or online merchant in exchange for goods or services. *Source*: Authors' calculation based on GSMA Mobile Money Deployment Tracker

International remittances: 1 if a country use international remittances service. International remittances service is a cross-border fund transfer made from one person to another person. This transaction can be a direct mobile money remittance or can be completed using an intermediary organization, such as Western Union. *Source*: Authors' calculation based on GSMA Mobile Money Deployment Tracker

Bill payment: 1 if a country use bill payment service. Bill payment is a payment made by a person from either their mobile money account or over-the-counter to a biller or billing organization via a mobile money platform in exchange for services provided. *Source*: Authors' calculation based on GSMA Mobile Money Deployment Tracker

new business density: the number of newly registered corporations per 1,000 working-age people (those ages 15–64). *Source*: The World Bank entrepreneurship Database

Total business density: The total number of registered firms with limited liability per 1,000 working-age people (ages 15-64) at the end of each calendar day. *Source*: The World Bank entrepreneurship Database

Closed business density: The number of deregistered firms with limited liability per 1,000 working-age people (ages 15-64) per calendar year. *Source*: The World Bank en-

trepreneurship Database

GDP per capita: GDP per capita is gross domestic product (constant 2010 U.S. dollars) divided by midyear population. *Source*: WDI

Mobile cellular: mobile cellular subscriptions (per 100 people). *Source*: WDI

Rule of law: the rule of law includes several indicators which measure the extent to which agents have confidence in and abide by the rules of society. *Source*: Teorell et al. (2020)

Urban population growth: urban population refers to people living in urban areas. *Source*: WDI

Investment freedom: this factor scrutinizes each country's policies toward foreign investment, as well as its policies toward capital flows internally, to determine its overall investment climate. The country's investment freedom ranges between 0 and 100, where 100 represents the maximum degree of investment freedom. *Source*: Teorell et al. (2020)

Education: average total years of schooling for adult population. *Source*: Roser and Ortiz-Ospina (2016)

Globalisation index : KOF Globalisation Index. *Source*: Dreher (2006)

Inflation: inflation, average consumer prices (Percent change). *Source*: WDI

Current expenditure: Cash payments for operating activities of the government in providing goods and services. *Source*: WEO-IMF

Public investment: Public gross fixed capital formation. *Source*: WEO-IMF

Tax payments: Number of tax payments *Source*: WDI

Procedures to register property: Number of procedures to register property. *Source*: WDI

Procedures to register property: Number of start-up procedures to register a business. *Source*: WDI

Procedures to register property: Cost of business start-up procedures (% of GNI per capita). *Source*: WDI

Disaster intensity: the sum of people affected, injured, or rendered homeless by natural disasters. *Source*: Centre for Research on the Epidemiology of Disasters (CRED)

Vulnerability: Propensity or predisposition of human societies to be negatively impacted by climate hazard. *Source*: Notre Dame Global Adaptation Index

Resilience: Readiness to make effective use of investments for adaptation actions

thanks to a safe and efficient business environment. *Source*: Notre Dame Global Adaptation Index

Political Stability: Political Stability and Absence of Violence/Terrorism. *Source*: Teorell et al., 2020

Financial development: Financial development index . *Source*: IMF Financial Development database

Self-employment: Self-employed, total (% of total employment) . *Source*: WDI

Financial crisis: dummy variable taking 1 if a country experiences a financial crisis and 0 otherwise.*Source:* Authors' calculations based on **?** *Source*: WDI

Growth: Annual percentage growth rate of GDP at market prices based on constant local currency. *Source*: WDI

Labor force : labor force participation rate is the proportion of the population ages 15 and older that is economically active: all people who supply labor for the production of goods and services during a specified period. *Source*: WDI

ODA: net ODA received (% GNI). *Source*: WDI

Remittances (% GDP): personal remittances comprise personal transfers and compensation of employees. *Source*: WDI

Number of active accounts: number of active mobile money accounts per 1,000 adults. *Source*: IMF Financial Access Survey (FAS)

Value of transactions: value of mobile money transactions (during the reference year) (% of GDP). *Source*: IMF Financial Access Survey (FAS)

Number of transactions: Number of mobile money transactions (during the reference year) per 1,000 adults. *Source*: IMF Financial Access Survey (FAS)

Av. number of transactions per active accounts : Average number of transaction per active mobile money accounts. *Source*: IMF Financial Access Survey (FAS)

Conflict Intensity: Conflict Intensity . *Source*: Fund for Peace

Regulatory quality: Regulatory quality index. *Source*: Fund for Peace

Control of Corruption: measures perceptions of corruption, conventionally defined as the exercise of public power for private gain. *Source*: Teorell et al. (2020)

Internet: individuals using the internet (% of population). *Source*: WDI