

Does Mobile Money Use Increase Firms' Investment?

Evidence from Enterprise Surveys in Kenya, Uganda,
and Tanzania

Asif Islam

Silvia Muzi

Jorge Luis Rodriguez Meza



WORLD BANK GROUP

Development Economics

Global Indicators Group

November 2016

Abstract

Private investment can be an important engine of economic growth in East African countries, which, despite recent growth rates, are still plagued with adverse economic conditions. Against this backdrop, there has been substantial penetration of mobile money, moving beyond simple person-to-person exchanges toward adoption by private firms. This study explores whether there is a relationship between firm adoption of mobile money and

firm investment. Using firm-level data that are nationally representative of the private sector in three East African countries—Kenya, Tanzania, and Uganda—a positive relationship is found between mobile money use and the probability of a firm's purchase of fixed assets. This relationship is attributed to reduced transaction costs, increased liquidity, and increased credit worthiness associated with the use of mobile phone financial services.

This paper is a product of the Global Indicators Group, Development Economics. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The authors may be contacted at aislam@worldbank.org.

The Policy Research Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about development issues. An objective of the series is to get the findings out quickly, even if the presentations are less than fully polished. The papers carry the names of the authors and should be cited accordingly. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.

Does Mobile Money Use Increase Firms' Investment? Evidence from Enterprise Surveys in Kenya, Uganda, and Tanzania

Asif Islam^a, Silvia Muzi^b, Jorge Luis Rodriguez Meza^c

JEL: E22, G2, L25, O16

Keywords: mobile money, financial development, investment, firms, Africa

^a Email: aislam@worldbank.org

^b Email: smuzi@worldbank.org

^c Email: jrodriguezmeza@worldbank.org

Does Mobile Money Use Increase Firms' Investments? Evidence from Enterprise Surveys in Kenya, Uganda, and Tanzania

1. Introduction

Investment, or the acquisition of assets with the expectation of future returns, is one of the pillars of firm growth. This view has been widely accepted from earlier models of economic development. In the seminal Harrod-Domar model, for instance, the rate of growth of output is in tandem with the rate of growth of investment, assuming constant capital to output ratios (Harrod, 1993; Domar, 1946). That is, investment in fixed assets is directly associated with output growth. The role of investment as a driver for firm growth has been also at the core of a vast empirical literature. Several studies have highlighted how certain types of investments -including investments on IT, R&D, and innovation, can enhance firm productivity (see Syverson, 2011 for a review), increase exports (Liu and Lu, 2015), and promote overall economic growth and development (De Long and Summers, 1993).

The role of private investment for development is particularly important for Sub-Saharan African countries given the low rates of economic growth and high poverty rates in the region (Ouedraogo and Kouaman, 2014). Even for those economies where recent growth rates have picked up, initial low levels of development make the case for considering how to accelerate investment levels. Against this backdrop, several developing countries have witnessed a dramatic transformation in their financial systems due to the emergence of mobile-phone-based technology for the delivery of financial services (also known as mobile banking or mobile money). The dramatic rise of mobile money use has important implications for the private sector, potentially providing expansion opportunities. An important question that arises is whether the use of mobile money has any relationship with firm outcomes, specifically private investment.

The use of mobile phone financial services has rapidly increased during the past years spreading outside of the well-known and successful experience of M-Pesa in Kenya and besides the original person-to-person use. At the end of 2015, mobile money services were available in 93 countries - with a total of over 411 million registered accounts and 134 million active users (GSMA, 2015). Mobile money services are currently used by individuals to pay bills, by institutions to pay salaries or make social transfers (Heyer and Mas, 2011), and by firms to pay bills, suppliers, and employees

or to receive payments from customers. At the firm level, the use of mobile money has been originally promoted by SMEs -mainly retailers, which started offering mobile money to their clients as a method of payment (Higgins et al., 2012). More recently, however, mobile money penetrated beyond the retail-customer relations towards digitizing the entire business-to-business value chain (IFC 2014). An interesting characteristic of the mobile money penetration at the firm level is the higher intensity of mobile money use as compared to individual use. In Kenya 80% of firms that use mobile money report using it once per week or more, compared to an average overall use of twice per month (Higgins et al., 2012). The same evidence is found in Tanzania by a study on mobile money use by SMEs (Bangens and Soderberg, 2011).

In parallel with the increased use of mobile money, an increasing body of literature has analyzed the impact of mobile money usage for both households or individuals and firms. At the household and individual level, the use of mobile money has been shown to reduce travel costs (Aker et al., 2013; Bangens and Soderberg, 2011); to increase welfare, by helping smoothing unexpected income shocks (Jack and Suri, 2014); and to increase security (Wright et al., 2014). Mobile money has also been shown to increase remittances, improve financial inclusion, and improve women's economic empowerment (Batista and Vicente, 2013; Aker et al., 2011; Morawczynski and Pickens, 2009; Munyegera and Matsumoto, 2016). Convenience in terms of time savings and increased safety are reported among the main advantages of using mobile money by firms as well as reducing the dependence on banks (Bangens and Soderberg, 2011). Mobile money has also been shown to be associated with a reduction in the cost of salary administration (Blumenstock, Callen, Ghani, & Koepke, 2015); increased access to different kinds of finance such as trade credit (Beck et al., 2015) as well as with rising profits among micro-enterprises (Frederick, 2014; Samuel, Shah, and Hadingham, 2005).

The literature on mobile money use and firm outcomes is nascent and the studies that exist, despite making important contributions, are characterized by a number of limitations. None of the studies to our knowledge have examined the relationship between mobile money use by firms and private investment. Few studies, as mentioned above, have explored the relationship between mobile money use and firm profitability as well as access to finance, but the data used is typically not representative of the private sector. Furthermore differences in the methodology of survey design and data collection across countries render cross-country comparisons indefensible. There has

been only one study to our knowledge (Gosavi, 2015) that has utilized firm-level data that has been representative of the private sector and allows for cross-country comparisons. However that study explores the adoption of mobile money and does not explore the relationship between mobile money use and firm outcomes.

The goal of this study is to empirically investigate the relationship between the use of mobile money and private investment using firm-level data in three countries in East Africa –Kenya, Tanzania and Uganda. This study adds to the literature in the following ways: (i) it is one of the first studies to explore mobile money use by firms and the likelihood of investments, (ii) it uses nationally-representative firm-level data that follow a consistent methodology across countries allowing for cross-country comparisons, which is a rarity in the literature, and (iii) it establishes a positive relationship between mobile money use and investment that is robust across a number of specifications as well as different measures of mobile money use. The study finds that an increase in the adoption of mobile money leads to a 16 percent increase in the probability of investment by the firm. A further in-depth analysis is conducted of the different purposes of mobile money use and their relationship with the likelihood of investment. The intensity of mobile money use by each type of purpose and the link with firms’ decision to invest is also explored. The findings have important implications for policy makers aiming to improve private investment in East Africa.

The paper is organized as follows. The conceptual framework, including theoretical underpinnings of mobile money use and the state of the empirical evidence is presented in section 2. Section 3 describes the empirical strategy, section 4 presents the main results and section 5 concludes.

2. Conceptual Framework

From a theoretical standpoint the relevance of mobile money and its effect on investment can only be explained by relaxing the assumption of perfect capital markets in traditional investment models. In the neoclassical investment model, for example, in equilibrium investment equals the rate of depreciation, and in the accelerator model, investment is proportional to the rate of growth in output. In both cases, capital stock is adjusted instantaneously to its desired level. In the Q theory of investment, an adjustment cost function is added to the firm’s profit maximization problem with the resulting outcome that investment is defined by the optimal path to the optimal capital stock.

That is investment occurs as long as the marginal return on capital is greater than the opportunity cost of capital. In all three models firms are assumed to be able to adjust with zero transaction costs and no budget restrictions; in all of them as per the Modigliani-Miller theorem (Modigliani and Miller, 1958) perfect capital markets carry the implication that the firm's financial structure has no role in investment decisions.

However, several studies have challenged the assumption of perfect capital markets. Asymmetric information can lead to credit rationing (Stiglitz and Weiss, 1981) which makes the availability of capital the main determinant of investment (Greenwald et al., 1984); managerial agency problems can lead to lower investment if there is lack of internal funds (Jensen and Meckling, 1976); and transaction costs may make external sources of finance prohibitively costly, forcing firms to rely on internal funds. The introduction of transactions costs and budget restrictions into a firm's profit maximization brings about the need to minimize those costs.

Mobile money has the potential to considerably reduce enforcement costs of every transaction: time and distance for services rendered can be reduced to an instantaneous transmission of information; low-cost and consistent record keeping of transactions can increase trust and nurture better terms and conditions as business transactions are repeated, thereby potentially increasing the volume of operations; and lower outstanding liquidity balances are required for the same level of business activity. Even the risks of non-payment for goods and services rendered can be reduced to almost zero provided that the mobile service provider keeps updated records on all its users and their available funds. Resources freed thanks to the reduction on transaction costs can thus be allocated to better uses, potentially increasing investment levels. Even though from a theoretical standpoint, transactions cost reductions or greater liquidity could affect negatively investment levels, by raising the return on savings that would favor holding financial assets over physical investment (Bencivenga, et al. 1995), one can assume that this effect is negligible in developing economies with limited markets for financial assets.

The literature does provide empirical support for the role of mobile money in reducing transaction costs and improving liquidity, although the final link with investment is missing – a gap in the literature this study intends to fill. With poor infrastructure and under-developed banking sectors, accessing banks in developing economies may involve time consuming travel costs as well as waiting in line time costs. Mobile money use has been found to circumvent such transaction costs

especially in Africa (Aker et al., 2013; Jack and Suri, 2015). The reduction of such costs and the ease of money transfer via mobile money improves the liquidity of the firm as cash flows through the firm at a faster rate (Bangens and Soderberg, 2011). There is an established literature that has identified the positive effect of improved cash flows on investment (Kadapakkam et al., 1998) and one can hypothesize that sufficient increases in cash flows induced by mobile money may lead to the same outcome of increased investment. Furthermore the reallocation of time away from dealing with financial transactions, including managerial time, to more productive activities can lead to increasing profitability (Frederick, 2014), potentially leading the firm to pursue growth opportunities through investment.

Beyond reduced transaction costs, there are other channels that have been empirically uncovered by which mobile money use could indirectly lead to increased investment. Using a dynamic general equilibrium model with heterogeneous entrepreneurs, imperfect credit markets, and the risk of theft, Beck et al. (2015) find that mobile money use increases the use of trade credit which in turn improves firm performance. The wider literature has documented the role of trade credit, via reputation effects, in increasing access to external sources of financing such as bank financing (Alphonse et al., 2006; Buckart and Ellingsen, 2004). Increases in access to finance, in turn, can facilitate investment (Rajan and Zingales, 1998; Levine et al., 2000; Demirguc-Kunt and Maksimovic, 1998; Cull and Xu, 2005). Finally, the use of transaction, saving, and financial operations data from the digital financial services platform allows to generate credit scores and evaluate and price credit risk. This can help to overcome the so-called collateral technology hurdle, which has hindered the development of credit markets in Africa (Ndung'u, Morales, and Ndirangu, 2016).

3. Empirical Strategy

Data

The data source used in this paper consists of firm-level surveys for Kenya, Tanzania, and Uganda conducted by the World Bank's Enterprise Surveys with most of the information referencing fiscal year 2012.⁴ The sample used for analysis covers a total of 1,228 manufacturing and services firms

⁴ The same set of questions on the use of mobile money was included in the Enterprise Survey conducted in Zambia as well. The data for Zambia, however, show a very low rate of adoption with only 25 firms out of a total sample of 720 using mobile money. Given the small sample of mobile money users, Zambia is not included in the analysis.

(573 firms in Kenya, 289 firms in Tanzania, and 366 in Uganda) with 5 or more employees. The Enterprise Surveys were conducted in all three countries using the same sampling methodology – stratified random sampling – along with a common questionnaire. Three levels of stratification were employed for each country: firm-size, sector of activity, and location within the country. Weights are used to ensure that the sample is representative of the non-agricultural, non-mining private sector of the economy.⁵

Before exploring the relationship between mobile money use and investment, we provide some basic statistics to explore why firms have or have not adopted mobile money, and what types of firms tend to adopt mobile money for transactions. The latter has already been explored in depth (Gosavi, 2015) and thus we do not delve into details in the analysis. So why has mobile money been adopted by firms? Through the Enterprise Surveys, managers and owners of firms in Kenya, Tanzania, and Uganda provided responses as to why they have or have not adopted mobile money. Despite some heterogeneity in the ranking, the most cited reasons for mobile money adoption across the three countries are reducing costs and risks of transactions and satisfying costumers' requests (Table 1). Concerning the reasons for non-adoption, the majority of non-adopter firms in Kenya cited large payments that were difficult to undertake using mobile money. In Tanzania and Uganda the most frequently cited reason is non-adoption by customers or suppliers.

What types of firms tend to adopt mobile money? In table 2 we present comparisons of averages between firms that use mobile money for transactions and those that do not. As expected, firms that use cell phones for operations are more likely to adopt mobile money; while larger and older firms are less likely to adopt mobile money for transactions. Manufacturing firms and firms that are part of a large company are also less likely to use mobile money, while a higher percentage of firms tend to adopt mobile money if they are in the capital or main business city. Firms that use mobile money tend to have higher labor productivity than firms that do not, although this difference is not statistically significant. In summary, mobile money adopting firms tend to be smaller, younger, concentrated in the service sectors, and are located in main business or capital cities.

⁵ Certain sectors are not covered including: agriculture, mining, and some service sectors such as education, health, and financial intermediaries. More information on the Enterprise Surveys global methodology is available on the website <http://www.enterprisesurveys.org/>.

Dependent variable

In the Enterprise Surveys, firms were asked whether any fixed assets such as machinery, vehicles, equipment, land, or buildings were purchased (new or used) in fiscal year 2012. The amount spent on purchases of fixed assets was also collected. Thus, there are two dependent variables. The first is a binary variable that takes on a value of 1 if the firm purchased any fixed assets, and 0 if it did not. The second is the amount of expenditure on the fixed assets. For the three economies, 42 percent of the firms purchased fixed assets, with Tanzania having the highest (54 percent) followed by Kenya (46 percent) and finally, Uganda (28 percent). Kenyan firms spent the most on fixed assets with a mean of USD 1,205,834, followed by Tanzania (37,200 USD), and Uganda (22,422 USD). Summary statistics are presented in table 3.

Main explanatory variables

The main explanatory variable is a binary variable that takes on a value of 1 if a firm has used mobile money for any transaction, and 0 if it has not. For the three East African economies in the sample, 54 percent of the firms have used mobile money for transactions. Across countries, the percent of firms using mobile money ranges from 50 to 60 percent, with 50 percent in Kenya, 57 percent in Uganda, and 60 percent in Tanzania.

We do consider additional measures of mobile money use in order to capture whether the purpose for which mobile money is used matters. In the sample considered for analysis, 9 percent of firms use mobile money to pay employees, 24 percent to pay suppliers, 23 percent to pay utility bills, and 36 percent to receive payments from customers. There is heterogeneity across the three countries. In Uganda, 28 percent of firms use mobile money to pay suppliers, which is higher than Kenya (20 percent) and Tanzania (25 percent). For paying utility bills using mobile money, Tanzania has the highest percentage of firms (41 percent) followed by Uganda (21 percent) and Kenya (16 percent). There is little variability in both the percent of firms using mobile money to receive payments from customers and pay employees across countries, although far more firms use mobile money to receive payments from customers than to pay employees. Between 35 and 38 percent of firms receive payment from costumers via mobile money (i.e. 38 percent of firms in Uganda, 36 percent in Tanzania, and 35 percent in Kenya) and about 10 percent of firms in Kenya

and Uganda use mobile money to pay employees, while the corresponding figure for Tanzania is 7 percent.

Thus far most of the measures of mobile money usage have been based on the frequency of use, but not the intensity of use. For instance, firms can indicate that mobile money was used for transactions, but such transactions could be of small or large amounts, and accordingly have differential impacts on the likelihood of investment. Four variables are used to capture intensity of mobile money (means presented in parenthesis): the percentage of total labor cost paid using mobile money (3.35 percent), percentage of raw material cost paid using mobile money (3.90 percent), percentage of utility bill paid using mobile money (6.35 percent), and percentage of annual sales from customer payments using mobile money (5.53 percent). Do note that all these variables also take a value of 0 if no mobile money was used at all or if the specific function was not carried out. Regarding percentage of labor cost using mobile money, Uganda has the highest with 4.8 percent followed by Kenya (2.8 percent) and Tanzania (2.3 percent). There is not much difference in the percentage of raw material cost paid for using mobile money across the three countries with Uganda and Tanzania having the highest (4.1 percent) and Kenya having the lowest (3.7 percent). Similarly the variation across the three countries is small for the percentage of annual sales from customer payments paid by mobile money: Kenya – 5.7 percent, Uganda – 5.3 percent, and Tanzania – 5.4 percent. The pattern changes somewhat with regards to percentage of utility bill paid using mobile money with Tanzania having the highest figure at 10.8 percent, followed by Uganda at 6.2 percent and Kenya at 4.8 percent.

Other explanatory variables

The degree of credit worthiness of a firm can influence its level of investment through the ability to access finance. While information on credit worthiness is directly unavailable, several proxies are used instead. The credit worthiness of a firm can be determined by its existing access to finance, such as already having a loan or the array of financing options available, the history with debt, the productivity of the firm, and also its outward orientation. The size of the firm, the age of the firm, and even the location of the firm can also in some sense proxy some level of credit worthiness.

Beyond credit worthiness, larger firms may have different investment needs than smaller firms and thus firm size can influence investment (Cull and Xu, 2005). More importantly, large firms

may have greater access to resources and networks to carry out investments than small firms. Similarly, firms from different sectors may have different investment requirements - manufacturing firms may be more likely to invest in fixed assets than retail firms. Older firms may be less likely to invest as upgrading old technology is difficult and less likely, and opportunities of investments to take advantage of economies of scales are likely to have been long past (Cull and Xu, 2005). On the other hand, older firms may have access to networks that ease the ability to access funds for investments. Along similar lines, multi-establishment firms may have greater access to resources that enable investments. The same applies to firms located in major cities. The vast resources available, including access to financial institutions such as banks in cities increases the opportunities to invest.

Firms that extensively used technology may be more likely to invest in advanced technologies. A valid critique of mobile money is that it may be correlated with the level of technology orientation of the firm, and therefore any finding of a positive correlation between mobile money use and investment may reflect a broader tendency for the firm to use technology. Thus the level of technology use by the firm should be captured to obtain clean estimates of the effect of mobile money use on investment. Finally, manager characteristics may be positively related to investment (McMillan and Woodruff, 2002; Cull and Xu, 2005). Optimistic and more experienced managers may be more likely to invest, and thus manager characteristics such as experience should be captured in the empirical specification.

To this end, the empirical specification controls for firm characteristics such as size, age, location, sector, whether the establishment is part of a multi-establishment firm, and manager experience. Several proxies are used for credit worthiness. First, if the firm did not pay its debts on time, restructured outstanding liabilities, filed for insolvency or bankruptcy, or applied for state aid, then the firm is considered to have an unfavorable credit record. A dummy variable is included in all specifications that takes the value of 1 if the firm has an unfavorable credit record and zero otherwise. Second, several additional variables to capture firm access to finance are used such as whether the establishment has a checking or savings account, a loan or line of credit, the percentage of working capital financed by banks, and the percentage of working capital financed by supplier credit, and the average distance from banks. Firm productivity is captured as the log of sales per worker. Outward orientation of the firm is accounted for by two variables - whether or not firms

export and whether firms have foreign owners. Technology use is controlled for by a dummy variable that captures whether or not a firm uses email to interact with clients or suppliers given the complementary nature of mobile money and email use. As a robustness check, an additional variable -whether the firm has ISO certification – is also used to capture the use of technology by the firm. Finally, country fixed effects are included to account for time invariant country-specific omitted variables.

4. Estimation results

Results with the binary outcome of whether or not a firm invested in fixed assets are presented in table 4. All results are based on Probit regression models using survey weights. Column 1 of table 4 presents a parsimonious specification with a simple regression of investment on mobile money use. A positive relationship is uncovered, statistically significant at the 1 % level of significance. This specification omits a number of variables, many indicated to be important determinants of investment as mentioned in the empirical strategy section. Thus the findings are susceptible to omitted variable bias. In column 2 of table 4 a more comprehensive specification is employed utilizing a number of control variables consistent with the arguments presented in the empirical strategy section. The positive relationship between the use of mobile money and investments is retained, statistically significant at the 1% level of significance. In terms of magnitude (not presented in the table), using the full specification in column 2 the results indicate that the use of mobile money increases the probability of investing by 0.16. In other words, the use of mobile money for transactions results in a 16 percent increase in the likelihood of investing. Of the other covariates considered, only four are found to be statistically significant. Larger firms and firms that are located closer to banks are more likely to invest. These results are statistically significant at the 1% level of significance. Furthermore, firms that tend to use supplier credit are more likely to invest. All three factors in some sense capture the ability to access finance, and thus their positive relationship with investment is expected (Demirguc-Kunt and Maksimovic, 1998; Cull and Xu, 2005). The one odd finding is that firms located in the capital city are less likely to invest. However this finding is statistically significant at the 10% level and is not robust.

An important concern of the findings is that they may just be capturing the use of cell phone technology in general. However, the former is unlikely given that 90 percent of the firms use cell

phones in contrast to 54 percent of firms using mobile money (table 3). Regardless, in column 3 mobile money use is substituted with the use of cell phones in general for operations. The findings show no statistically significant relationship between cell phone use and investment. This in a sense can serve as a falsification test lending some validity to the relationship uncovered between mobile money use and investment. In column 4 of table 4 we include both mobile money use and cell phone use in general and the statistical significance of the coefficient of mobile money use is retained at the 1% level of significance. There is an unexpected negative coefficient for cell phone usage on investment, however this finding is statistically insignificant at all conventional levels. In column 5 we further test whether mobile money use is a proxy for technology in general by including whether or not a firm has ISO certification. Another variable included is the proportion of time managers spend dealing with government regulations, in case mobile money use is a way to avoid bureaucracy prevalent in the economy. Although the coefficient for mobile money retains its sign and significance, with even a positive and statistically significant coefficient for ISO certification, this finding is only used as a robustness check given the drop in the number of observations.

Thus far the relationship between mobile money use in general and investment has been established. Table 5 extends the analysis by exploring the relationship between the likelihood of investment and the purpose of mobile money use. Four purposes of mobile money are explored – payments to suppliers, payments to employees, payments from customers, and payments for utility bills. The results presented in table 5 indicate a positive and statistically significant (at least at the 5 percent level) relationship between investment and all purposes for mobile money use but for the use of mobile money to pay utility bills. The relationship is positive but statistically insignificant at all conventional levels of significance. This may imply that the simple use of mobile money for utility payments may not substantially ease cash flows or raise profitability to warrant investments. Of course, the intensity of use of mobile money for utility payments will provide a clearer indication if this is the case (results presented later). In terms of magnitude, mobile money use for payments to suppliers results in a 27 percent increase in the probability of investments. This is followed by payments from customers at a 21 percent increase in probability of investment and payments to employees at a 17 percent increase in probability of investment.

Thus far the results have explored whether or not mobile money has been used, but not the intensity of use. Thus the following explanatory variables are considered: percent of total labor cost paid using mobile money, percent of raw material cost paid using mobile money, percent of utility bill paid using mobile money, and percent of annual sales from customer payments using mobile money. As presented in table 6, all four variables have a positive and statistically significant relationship with the likelihood of investing. All results are statistically significant at the 1 % level apart from utility bills, which is significant at the 5 % level. The finding regarding percentage of utility bills paid using mobile money is interesting as it implies that just the use of mobile money to pay utility bills has no effect on investment (as indicated in table 5) but the intensity of use of mobile money to pay utility bills may increase the likelihood of investment. The intensity of mobile money use for raw material purchases has the highest association with the likelihood of investing. This provides some confirmation of the importance of the supply chain in influencing the intensity of mobile money use (IFC 2014; Higgins et al., 2012).

Thus far the estimations have been based on the binary outcome variable of whether or not a firm has invested in the last fiscal year. In tables 7 through 9, we repeat the estimations in tables 4 through 6 but by using the amount used to purchase fixed assets as the dependent variable. Table 7 mimics the findings of table 4, with mobile money being positively and statistically significantly related to the amount spent by a firm on the purchase of fixed assets. Table 8 is consistent with most of the findings in table 5 – mobile money used to pay suppliers and receive payments from customers are positive and significantly related to investing, while mobile money use for paying utility bills is not. The only finding that differs is that mobile money use to pay employees is not significantly related to the amount invested. However, tables 6 and 9 are virtually identical in findings, indicating that the intensity of mobile money use for any of the four purposes is positively and statistically significantly related to investing.

Robustness checks: Instrumental variables

There are concerns that the variable of interest - mobile money – may be endogenous. Given the data limitations, endogeneity cannot be completely overruled. However, to provide some sense of robustness of the findings, the results of column 5 of table 4 are re-estimated using an instrumental variables approach. For instruments we use the density of mobile money agents, and microfinance institutions (MFIs) within a 5 km radius. Note that while we expect a positive correlation between

a higher density of mobile money agents with the adoption of mobile money, there is a possibility that the presence of MFIs could substitute for mobile money use due to the ease of access to other forms of liquidity.

The findings are presented in table 10, with the first 2 columns based on the binary outcome variable of investments and the third and fourth columns based on the continuous variable of amount invested. As can be seen, the positive and statistically significant relationship between mobile money use and the probability of investment as well as the amount invested is retained. As expected, the density of mobile money agents is positively and significantly correlated with the adoption of mobile money. The density of MFIs is negatively correlated with mobile money use, implying that MFI access may be a substitute for mobile money use, although this finding is not statistically significant at all conventional levels of significance. The overidentification test does not reject the null hypothesis that the instruments are valid for both estimations. We also reject the null that the question is under identified. This provides some credibility to the findings. However, the instruments are weak with a low F-statistic of 3 for the first-stage regressions. Although this is not sufficient to argue for causality given the weak instruments, it does add to the robustness of the correlation between mobile money use and investment.

5. Conclusions

The explosion of mobile money use in developing economies gives one pause for thought on the possible effects it can have on the formal private sector. One side of the argument is that mobile money mainly serves the informal sector and thus may help micro and small entrepreneurs, implying no tangible benefits for the bigger firms operating in the formal private sector. The flip side of the argument is that mobile money makes significant dents in financial costs and liquidity and increases credit worthiness for formal firms, and that its existence has positive repercussions for various outcomes. This study provides some support for the latter by documenting the positive correlation between mobile money use and investment for three countries in East Africa – Kenya, Tanzania, and Uganda. The finding is robust to different measures of mobile money – from intensity of use to purpose of mobile money use.

This is however just one aspect of the story. The effects of mobile money on the formal private sector is still ripe for research. Several questions remain unanswered regarding various aspects of firm outcomes including productivity and profitability. Much of this research has been restricted by the lack of reliable data that hampers inferences both at the country-level and across countries. Thus there is an urgent need to promote data collection ventures to provide nationally representative data following a consistent methodology across countries. The Enterprise Surveys is an ideal example of the type of data needed.

Finally, policy makers may be able to draw larger inferences about technology in general from studies on mobile money and the formal private business sector. The introduction of mobile money may have similar attributes as other forms of technology, and the findings garnered from the mobile money literature could provide useful in informing the potential impact of new technologies. Given the importance of technology in development, research on the interaction between technology and the private sector is crucial. We hope this study encourages further research in this area.

References

- Aker, Jenny C., Rachid Boumnijel, Amanda McClelland, and Niall Tierney (2011), "Zap it to me: The short-term impacts of a mobile cash transfer program. Center for Global Development Working Paper No. 268
- Aker, Jenny C., Rachid Boumnijel, Amanda McClelland, and Niall Tierney (2013) "How do electronic transfers compare? Evidence from a Mobile Money cash transfer experiment in Niger." Tufts University Working Paper.
- Alphonse, Pascal, Jacqueline Ducret, and Eric Séverin (2006) "When trade credit facilitates access to bank finance: evidence from US small business data." Unpublished working paper, Université de Nancy.
- Bångens, Lennart and Björn Söderberg, B. (2011). "Mobile Money Transfer and Usage Among Micro and Small Businesses in Tanzania" SPIDER, The Swedish Program for Information and Communication Technology in Developing Regions.
- Batista, Catia and Pedro C. Vicente (2013) "Introducing Mobile Money in rural Mozambique: Evidence from a field experiment" NOVAFRICA Working Paper Series No. 1301
- Beck, Thorsten, Haki Pumak, Ravindra Ramrattan and Burak R. Uras (2015) "Mobile money, trade credit and economic development: Theory and evidence", CentER Discussion Paper 2015-023.
- Bencivenga, Valerie R., Bruce D. Smith, Ross M. Starr (1995), "Transactions costs, technological choice, and endogenous growth," *Journal of Economic Theory* 67(1): 153–177
- Burkart, Mike, and Tore Ellingsen (2004) "In-Kind finance: A theory of trade credit," *The American Economic Review* 94(3): 569-590
- Blumenstock, J. E., Callen, M., Ghani, T., & Koepke, L. (2015). Promises and pitfalls of mobile money in Afghanistan: Evidence from a randomized control trial. In Proceedings of the Seventh International Conference on Information and Communication Technologies and Development (p. 15). ACM. Blumenstock, J., & Eagle, N.
- Cull, Robert, and Lixin Colin Xu (2005) "Institutions, ownership, and finance: the determinants of profit reinvestment among Chinese firms" *Journal of Financial Economics* 77(2005): 117-146
- De Long J. Bradford and Lawrence H. Summers (1993) "How Strongly Do Developing Economies Benefit from Equipment Investment?" *Journal of Monetary Economics*, 32(3): 395–415
- Demirguc-Kunt, Asli and Vojislav Maksimovic (1998) "Law, finance, and firm growth," *The Journal of Finance* 53(6): 2107-2137
- Domar, Evsey D. (1946) "Capital expansion, rate of growth, and employment." *Econometrica* 14, 137–147.

- Frederick, Laura I. (2014) ""Impact of Mobile Money Usage on Microenterprise Evidence from Zambia"" in URBAN OPPORTUNITIES: Perspectives on Climate Change, Resilience, Inclusion and the Informal Economy, Wilson Center
https://www.wilsoncenter.org/sites/default/files/USL_140508_Urban%20Opportunities_rpt_0127.pdf#page=162"
- Gosavi, Aparna (2015) "The next frontier of mobile money usage-firms-evidence from Sub-Saharan Africa," 19th Annual Western Hemispheric Trade Conference proceedings April 15-17, 2015 <http://free-trade.tamui.edu/PDF/19Conf-Sessions.pdf#page=149>
- Greenwald, Bruce, Joseph E. Stiglitz, and Andrew Weiss (1984). "Information Imperfections and Macroeconomic Fluctuations", *American Economic Review*, 74(2): 194-199
- Harrod, Roy F. (1939), "An Essay in Dynamic Theory," *Economic Journal* 49(193): 14-33
- Heyer, Amrik and Ignacio Mas (2011) "Fertile grounds for mobile money: Towards a framework for analysing enabling environments" *Enterprise Development and Microfinance* 22(1):30-44
- Higgins, Dylan, Jake Kendall, and Ben Lyon (2012) "Mobile Money usage patterns of Kenyan small and medium enterprises" *Innovations: Technology, Governance, Globalization* 7(2): 67-81.
- International Finance Corporation (IFC) 2014, In the Fast Lane: Innovations in Digital Finance
- Jensen, Michael C. and William H. Meckling (1976) "Theory of the firm: Managerial behavior, agency costs and ownership structure," *Journal of Financial Economics* 3(4): 305-360
- Jack, William and Tavneet Suri (2014) "Risk sharing and transaction costs: Evidence from Kenya's mobile money revolution" *The American Economic Review* 104(1): 183-223
- Kadapakkam, Palani-Rajan, P. C. Kumar, P. C., and Leigh A Riddick (2008) "The Impact of Cash Flows and Firm Size on Investment: The International Evidence." *Journal Banking and Finance* 22(3): 293-320.
- Liu, Qing, and Yi Li (2015) "Firm investment and exporting: Evidence from China's value-added tax reform" *Journal of International Economics* 97(2): 392-403
- Levine, Ross, Norman Loayza, and Thorsten Beck (2000) "Financial intermediation and growth: causality and causes" *Journal of Monetary Economics* 46 (2000): 31-77
- Modigliani F. and Miller, Merton H.(1958) "The cost of capital, corporation finance and the theory of investment." *The American Economic Review* 48(3): 261-297
- Morawczynski, Olga, and Mark Pickens (2009) "Poor people using mobile financial services: Observations on customer usage and impact from M-PESA." World Bank, Washington, DC.
- Munyegera, G.K and Tomoya Matsumoto (2016). "Mobile Money, Remittances, and Household Welfare: Panel Evidence from Rural Uganda". *World Development* Vol. 79, pp. 127-137, 2016

- Njuguna Ndung'u, A. Morales, and Lydia Ndirangu, "Cashing In on the Digital Revolution" *IMF Finance & Development*, June 2016, Vol. 53, No. 2
- Ouedraogo, Idrissa M. and Pascal T. Kouaman (2014) "Governance and private investment in Sub-Saharan Africa" *International Journal of African Development* 2(1):5-25
- Rajan, Raghuram G., and Luigi Zingales (1998) "Financial dependent and growth" *The American Economic Review* 88(3):559-586
- Samuel, Jonathan, Niraj Shah and Wenona Hadingham. 2005. "Mobile Communications in South Africa, Tanzania and Egypt: Results from Community and Business Surveys in Africa: The Economic Impact of Mobile Phones." Vodafone Policy Paper Series, Number 3."
- Stiglitz, Joseph E., and Andrew Weiss, "Credit Rationing in Markets with Imperfect Information," *American Economic Review* 71(3):393-410
- Syverson, Chad (2011) "What Determines Productivity?" *Journal of Economic Literature* 49(2): 326-365
- Wright, Richard, Erdal Tekin, Volkan Topalli, Chandler McClellan, Timothy Dickonson, and Richard Rosenfeld (2014) "Less Cash, Less Crime: Evidence from the Electronic Benefit Transfer Program", *NBER Working paper* no. 19996

Table 1: Reasons for and against adoption of mobile money

	Kenya	Tanzania	Uganda
Main reason for using mobile money from adopters			
Reduce costs of transactions (% of mobile money firms)	10	26	22
Reduce the risks in transactions (% of mobile money firms)	13	5	8
Satisfy suppliers request (% of mobile money firms)	7	4	11
Satisfy costumers request (% of mobile money firms)	24	12	19
Align with competitors use (% of mobile money firms)	2	2	2
Main reason for not using mobile money from non-adopters			
Don't know enough (% of non mobile money firms)	7	8	2
Fees too high (% of non mobile money firms)	10	8	12
Payments too large (% of non mobile money firms)	48	17	18
Not easy to use (% of non mobile money firms)	8	8	6
Customers dont use (% of non mobile money firms)	29	22	17
Suppliers dont use (% of non mobile money firms)	30	17	20

Table 2: Mobile Money Adopters

Mobile Money adopter	YES	NO	Significance
Firm purchased fixed assets Y:1 N:0	0.53	0.43	***
Total number of full time employees, adjusted for temporary workers	46.88	72.86	***
Top manager experience in sector (years)	16.21	16.41	
Establishment uses cell phone for operations Y:1 N:0	0.96	0.88	***
Sales per worker (outliers removed)	110,378	102,734	
age (years)	17.39	20.25	***
Firm is part of a larger firm Y:1 N:0	0.1	0.16	***
Exports 10% or more of sales Y:1 N:0	0.14	0.2	***
Foreign ownership Y:1 N:0	0.08	0.12	**
Firm with unfavorable credit record Y:1 N:0	0.42	0.33	***
Establishment has a line of credit or loan at this time Y:1 N:0	0.32	0.34	
Firms use email to interact with clients/suppliers Y:1 N:0	0.57	0.62	*
Establishment has checking or savings account at this time Y:1 N:0	0.88	0.88	
Mean distance - bank km	236.74	245.73	
Bank financing for working capital(%)	14.65	13.68	
Supplier Credit financing for working capital(%)	12.15	13.29	
Capital or main business city Y:1 N:0	0.5	0.44	**
Manufacturing Firms	0.55	0.62	**
Retail Firms	0.19	0.17	
Other Services Firms	0.26	0.21	*

note: *** p<0.01, ** p<0.05, * p<0.1

Table 3: Summary Statistics

	Obs	Mean	sdtdev	min	max
Firm purchased fixed assets Y:1 N:0	1228	0.42	0.49	0.00	1
Firm purchase of fixed assets amount in USD	1228	606,748	22,900,000	0	1,005,564,928
Mobile money for any financial transactions Y:1 N:0	1228	0.54	0.50	0.00	1
Mobile money to pay employee Y:1 N:0(0 if not adopted)	1228	0.09	0.29	0.00	1
Mobile money to pay supplier Y:1 N:0(0 if not adopted)	1228	0.24	0.42	0.00	1
Mobile money to pay utility bills Y:1 N:0(0 if not adopted)	1228	0.23	0.42	0.00	1
Mobile money to receive pymnts from customers Y:1 N:0(0 if not adopted)	1228	0.36	0.48	0.00	1
% of total labor cost paid using mobile money (0 if not adopted or no payment)	1217	3.35	13.90	0.00	100
% of raw material cost paid using mobile money(0 if not adopted or no payment)	1194	3.90	10.97	0.00	100
% of utility bill paid using mobile money(0 if not adopted or no payment)	1204	6.34	18.22	0.00	100
% of annual sales from customer payments using mobile money(0 if not adopted or	1186	5.53	12.19	0.00	90
Log of size	1228	2.71	1.08	0.08	7.78
Top manager experience in sector (years)	1228	14.96	9.61	1.00	57
Log of sales per worker (outliers removed)	1228	9.06	1.97	2.26	17
Log of age of firm	1228	2.48	0.80	0.00	4.65
Firm is part of a larger firm Y:1 N:0	1228	0.10	0.30	0.00	1
Exports 10% or more of sales Y:1 N:0	1228	0.15	0.36	0.00	1
Foreign ownership Y:1 N:0	1228	0.07	0.26	0.00	1
Firm with unfavorable credit record Y:1 N:0	1228	0.40	0.49	0.00	1
Establishment has a line of credit or loan at this time Y:1 N:0	1228	0.26	0.44	0.00	1
Firms use email to interact with clients/suppliers Y:1 N:0	1228	0.53	0.50	0.00	1
Establishment has checking or savings account at this time Y:1 N:0	1228	0.87	0.33	0.00	1
Bank financing for working capital(%)	1228	11.52	22.03	0.00	100
Supplier Credit financing for working capital(%)	1228	9.93	19.83	0.00	100
Capital or main business city Y:1 N:0	1228	0.58	0.49	0.00	1
Establishment uses cell phone for operations Y:1 N:0	1228	0.90	0.30	0.00	1
Mean distance - bank (km)	1228	219.17	139.73	107.64	669
Firms has ISO certification ownership Y:1 N:0	1171	0.18	0.39	0.00	1
Senior management time spent in dealing government regulations	1004	6.11	8.94	0.00	48
No. of Mobile Money Agents, 5 km radius	1228	1394	1357	0.00	5683
No. of MFIs, 5 km radius	1228	19.35	19.98	0.00	68.00
Manufacturing Firms	1228	0.34	0.47	0.00	1.00
Retail Firms	1228	0.26	0.44	0.00	1.00
Other Services Firms	1228	0.41	0.49	0.00	1.00

Table 4: Firm Investment and Mobile Money Use

Dependent variable: Firm purchased fixed assets Y:1 N:0	Probit				
	coef/se	coef/se	coef/se	coef/se	coef/se
Mobile money for any financial transactions Y:1 N:0	0.376*** (0.116)	0.471*** (0.131)		0.517*** (0.139)	0.506*** (0.158)
Establishment uses cell phone for operations Y:1 N:0			-0.189 (0.258)	-0.364 (0.250)	
Firms has ISO certification ownership Y/N					0.404* (0.232)
Senior management time spent in dealing government regulations					0.005 (0.009)
Log of size		0.254*** (0.083)	0.213** (0.088)	0.250*** (0.085)	0.223*** (0.099)
Top manager experience in sector (years)		-0.004 (0.007)	-0.002 (0.007)	-0.004 (0.007)	-0.005 (0.009)
Log of sales per worker (outliers removed)		-0.016 (0.040)	-0.015 (0.041)	-0.012 (0.040)	-0.033 (0.043)
Log of age of firm		-0.098 (0.110)	-0.128 (0.116)	-0.094 (0.110)	-0.115 (0.122)
Firm is part of a larger firm Y:1 N:0		-0.033 (0.236)	-0.110 (0.227)	-0.049 (0.220)	-0.100 (0.259)
Exports 10% or more of sales Y:1 N:0		-0.119 (0.227)	-0.059 (0.233)	-0.115 (0.218)	-0.287 (0.238)
Foreign ownership Y:1 N:0		0.307 (0.276)	0.263 (0.270)	0.304 (0.275)	0.295 (0.296)
Firm with unfavorable credit record Y:1 N:0		0.133 (0.162)	0.162 (0.169)	0.095 (0.167)	0.284 (0.190)
Establishment has a line of credit or loan at this time Y:1 N:0		0.224 (0.165)	0.256 (0.166)	0.254 (0.166)	0.191 (0.180)
Firms use email to interact with clients/suppliers Y:1 N:0		0.135 (0.184)	0.183 (0.188)	0.177 (0.187)	0.122 (0.211)
Establishment has checking or savings account at this time Y:1 N:0		0.042 (0.255)	0.025 (0.268)	0.041 (0.258)	-0.162 (0.308)
Log of mean distance - bank (km)		-0.834*** (0.215)	-0.775*** (0.224)	-0.796*** (0.222)	-0.760*** (0.225)

Bank financing for working capital (%)		0.000	0.001	0.001	-0.002
		(0.003)	(0.003)	(0.003)	(0.004)
Supplier Credit financing for working capital (%)		0.006*	0.006**	0.006*	0.009**
		(0.003)	(0.003)	(0.003)	(0.004)
Capital or main business city Y:1 N:0		-0.349*	-0.270	-0.315	-0.237
		(0.195)	(0.212)	(0.207)	(0.203)
Manufacturing Firms		0.006	0.008	0.025	-0.033
		(0.191)	(0.204)	(0.197)	(0.220)
Retail Firms		-0.296	-0.322	-0.282	-0.432*
		(0.203)	(0.202)	(0.203)	(0.238)
Constant	-0.420***	3.092**	3.323***	3.128**	3.143**
	(0.085)	(1.228)	(1.249)	(1.232)	(1.253)
Country Fixed Effects	YES	YES	YES	YES	YES
Number of observations	1,228	1,228	1,228	1,228	958

note: *** p<0.01, ** p<0.05, * p<0.1

*Omitted sector: Other services

Table 5: Firm Investment and Purpose of Mobile Money Use

Dependent variable: Firm purchased fixed assets Y:1 N:0	Probit			
	coef/se	coef/se	coef/se	coef/se
Mobile money to pay employee Y:1 N:0(0 if not adopted)	0.506** (0.257)			
Mobile money to pay supplier Y:1 N:0(0 if not adopted)		0.787*** (0.164)		
Mobile money to pay utility bills Y:1 N:0(0 if not adopted)			0.255 (0.179)	
Mobile money to receive payments from customers Y:1 N:0(0 if not adopted)				0.612*** (0.148)
Log of size	0.233*** (0.086)	0.260*** (0.082)	0.231*** (0.086)	0.269*** (0.081)
Top manager experience in sector (years)	-0.001 (0.007)	-0.005 (0.007)	-0.002 (0.007)	-0.005 (0.007)
Log of sales per worker (outliers removed)	-0.021 (0.040)	0.004 (0.040)	-0.022 (0.041)	-0.009 (0.041)
Log of age of firm	-0.139 (0.113)	-0.125 (0.116)	-0.129 (0.115)	-0.072 (0.109)
Firm is part of a larger firm Y:1 N:0	-0.067 (0.240)	-0.093 (0.215)	-0.090 (0.231)	-0.039 (0.226)
Exports 10% or more of sales Y:1 N:0	-0.104 (0.234)	-0.112 (0.209)	-0.101 (0.224)	-0.077 (0.222)
Foreign ownership Y:1 N:0	0.276 (0.262)	0.334 (0.255)	0.268 (0.268)	0.290 (0.272)
Firm with unfavorable credit record Y:1 N:0	0.162 (0.166)	0.149 (0.157)	0.163 (0.166)	0.155 (0.159)
Establishment has a line of credit or loan at this time Y:1 N:0	0.224 (0.163)	0.173 (0.168)	0.210 (0.164)	0.183 (0.167)
Firms use email to interact with clients/suppliers Y:1 N:0	0.120 (0.183)	0.113 (0.181)	0.169 (0.188)	0.162 (0.188)
Establishment has checking or savings account at this time Y:1 N:0	0.091 (0.271)	0.081 (0.230)	0.012 (0.267)	0.011 (0.246)
Log of mean distance - bank (km)	-0.778*** (0.212)	-0.743*** (0.216)	-0.793*** (0.215)	-0.884*** (0.208)

Bank financing for working capital(%)	0.000 (0.003)	0.001 (0.003)	0.001 (0.003)	0.001 (0.003)
Supplier Credit financing for working capital(%)	0.006** (0.003)	0.006** (0.003)	0.006** (0.003)	0.006* (0.003)
Capital or main business city Y:1 N:0	-0.282 (0.198)	-0.304 (0.189)	-0.319 (0.201)	-0.397** (0.193)
Manufacturing Firms	0.002 (0.195)	0.031 (0.187)	0.011 (0.196)	-0.041 (0.197)
Retail Firms	-0.338* (0.200)	-0.275 (0.205)	-0.330 (0.201)	-0.325 (0.208)
Constant	3.118** (1.223)	2.487** (1.237)	3.268*** (1.241)	3.283*** (1.204)
Country Fixed Effects	YES	YES	YES	YES
Number of observations	1,228	1,228	1,228	1,228

note: *** p<0.01, ** p<0.05, * p<0.1

*Omitted sector: Other services

Table 6: Firm Investment and the Intensity and Purpose of Mobile Money Use

Dependent variable: Firm purchased fixed assets Y:1 N:0	Probit			
	coef/se	coef/se	coef/se	coef/se
% of total labor cost paid using mobile money (0 if not adopted or no payment)	0.016*** (0.005)			
% of raw material cost paid using mobile money (0 if not adopted or no payment)		0.022*** (0.007)		
% of utility bill paid using mobile money (0 if not adopted or no payment)			0.009** (0.004)	
% of annual sales from customer payments using mobile money (0 if not adopted or				0.019*** (0.006)
Log of size	0.246*** (0.085)	0.262*** (0.090)	0.209** (0.086)	0.260*** (0.088)
Top manager experience in sector (years)	-0.002 (0.007)	-0.003 (0.007)	-0.003 (0.007)	-0.004 (0.008)
Log of sales per worker (outliers removed)	-0.027 (0.040)	0.002 (0.044)	-0.031 (0.042)	0.001 (0.045)
Log of age of firm	-0.129 (0.111)	-0.125 (0.117)	-0.129 (0.116)	-0.092 (0.120)
Firm is part of a larger firm Y:1 N:0	-0.073 (0.239)	-0.107 (0.250)	-0.131 (0.227)	-0.088 (0.232)
Exports 10% or more of sales Y:1 N:0	-0.104 (0.224)	-0.056 (0.237)	0.005 (0.228)	-0.071 (0.225)
Foreign ownership Y:1 N:0	0.202 (0.245)	0.283 (0.269)	0.370 (0.264)	0.333 (0.264)
Establishment has a line of credit or loan at this time Y:1 N:0	0.239 (0.157)	0.256 (0.163)	0.255 (0.161)	0.273* (0.163)
Firms use email to interact with clients/suppliers Y:1 N:0	0.119 (0.177)	0.173 (0.184)	0.168 (0.188)	0.197 (0.194)
Establishment has checking or savings account at this time Y:1 N:0	0.089 (0.272)	0.046 (0.223)	0.112 (0.277)	0.012 (0.219)
Log of mean distance - bank (km)	-0.768*** (0.214)	-0.848*** (0.224)	-0.854*** (0.218)	-0.897*** (0.217)

Bank financing for working capital(%)	0.000 (0.003)	0.001 (0.003)	0.001 (0.003)	0.001 (0.003)
Supplier Credit financing for working capital(%)	0.007** (0.003)	0.008** (0.003)	0.007** (0.003)	0.006* (0.003)
Capital or main business city Y:1 N:0	-0.271 (0.201)	-0.381* (0.202)	-0.374* (0.196)	-0.450** (0.193)
Manufacturing Firms	0.017 (0.196)	-0.119 (0.189)	0.009 (0.202)	-0.198 (0.194)
Retail Firms	-0.337* (0.195)	-0.280 (0.202)	-0.321 (0.202)	-0.386* (0.214)
Constant	3.117** (1.227)	3.225** (1.270)	3.744*** (1.248)	3.534*** (1.232)
Number of observations	1,217	1,194	1,204	1,186
Country Fixed Effects	YES	YES	YES	YES
Number of observations	1,217	1,194	1,204	1,186

note: *** p<0.01, ** p<0.05, * p<0.1

*Omitted sector: Other services

Table 7: Firm Investment amount and Mobile Money Use

Dependent variable: Log of Purchase of Fixed Assets (amount in USD)	OLS				
	coef/se	coef/se	coef/se	coef/se	coef/se
Mobile money for any financial transactions Y:1 N:0	1.013** (0.434)	1.247*** (0.432)		1.344*** (0.460)	0.486*** (0.158)
Establishment uses cell phone for operations Y:1 N:0			-0.437 (0.875)	-0.866 (0.849)	
Firms has ISO certification ownership Y/N					0.394* (0.231)
Senior management time spent in dealing government regulations					0.006 (0.009)
Log of size		1.150*** (0.271)	1.067*** (0.287)	1.137*** (0.274)	0.226** (0.098)
Top manager experience in sector (years)		-0.038* (0.022)	-0.032 (0.022)	-0.038* (0.022)	-0.007 (0.009)
Log of sales per worker (outliers removed)		0.091 (0.130)	0.099 (0.131)	0.099 (0.128)	-0.032 (0.042)
Log of age of firm		-0.338 (0.396)	-0.403 (0.423)	-0.326 (0.395)	-0.103 (0.121)
Firm is part of a larger firm Y:1 N:0		-0.197 (0.872)	-0.409 (0.857)	-0.226 (0.821)	-0.139 (0.258)
Exports 10% or more of sales Y:1 N:0		-0.051 (0.828)	0.092 (0.864)	-0.034 (0.806)	-0.300 (0.238)
Foreign ownership Y:1 N:0		0.485 (0.938)	0.381 (0.936)	0.461 (0.940)	0.233 (0.289)
Firm with unfavorable credit record Y:1 N:0		-0.068 (0.499)	0.036 (0.517)	-0.158 (0.519)	0.248 (0.191)
Establishment has a line of credit or loan at this time Y:1 N:0		1.523*** (0.560)	1.587*** (0.569)	1.594*** (0.559)	0.240 (0.180)
Firms use email to interact with clients/suppliers Y:1 N:0		0.868* (0.518)	0.962* (0.537)	0.959* (0.514)	0.109 (0.208)
Establishment has checking or savings account at this time Y:1 N:0		-0.339 (0.604)	-0.387 (0.629)	-0.341 (0.609)	-0.171 (0.314)
Log of mean distance - bank (km)		-2.268***	-2.204***	-2.170***	-0.784***

		(0.656)	(0.702)	(0.676)	(0.227)
Bank financing for working capital(%)		-0.007	-0.006	-0.006	-0.002
		(0.012)	(0.012)	(0.011)	(0.004)
Supplier Credit financing for working capital(%)		0.026**	0.028**	0.026**	0.008**
		(0.011)	(0.011)	(0.011)	(0.004)
Capital or main business city Y:1 N:0		-1.012*	-0.834	-0.929	-0.298
		(0.539)	(0.609)	(0.575)	(0.207)
Manufacturing Firms		-0.097	-0.120	-0.061	-0.117
		(0.577)	(0.606)	(0.586)	(0.221)
Retail Firms		-0.854	-0.929	-0.832	-0.470*
		(0.571)	(0.584)	(0.568)	(0.241)
Constant	2.987***	10.815***	11.660***	10.903***	3.343***
	(0.279)	(3.540)	(3.643)	(3.528)	(1.264)
Country Fixed Effects	YES	YES	YES	YES	YES
Number of observations	1,228	1,228	1,228	1,228	958

note: *** p<0.01, ** p<0.05, * p<0.1

*Omitted sector: Other services

Table 8: Firm Investment amount and Purpose of Mobile Money Use

Dependent variable: Log of Purchase of Fixed Assets (amount in USD)	OLS			
	coef/se	coef/se	coef/se	coef/se
Mobile money to pay employee Y:1 N:0(0 if not adopted)	1.364 (0.882)			
Mobile money to pay supplier Y:1 N:0(0 if not adopted)		2.368*** (0.495)		
Mobile money to pay utility bills Y:1 N:0(0 if not adopted)			0.554 (0.609)	
Mobile money to receive payments from customers Y:1 N:0(0 if not adopted)				1.725*** (0.480)
Log of size	1.114*** (0.280)	1.159*** (0.254)	1.103*** (0.281)	1.191*** (0.263)
Top manager experience in sector (years)	-0.030 (0.022)	-0.041* (0.021)	-0.033 (0.022)	-0.041* (0.021)
Log of sales per worker (outliers removed)	0.088 (0.129)	0.155 (0.123)	0.084 (0.133)	0.105 (0.131)
Log of age of firm	-0.428 (0.415)	-0.376 (0.411)	-0.399 (0.423)	-0.260 (0.390)
Firm is part of a larger firm Y:1 N:0	-0.305 (0.892)	-0.347 (0.786)	-0.360 (0.880)	-0.215 (0.834)
Exports 10% or more of sales Y:1 N:0	-0.031 (0.852)	-0.005 (0.752)	0.006 (0.837)	0.062 (0.808)
Foreign ownership Y:1 N:0	0.420 (0.907)	0.553 (0.878)	0.399 (0.923)	0.468 (0.898)
Firm with unfavorable credit record Y:1 N:0	0.026 (0.496)	-0.091 (0.468)	0.037 (0.506)	-0.008 (0.483)
Establishment has a line of credit or loan at this time Y:1 N:0	1.506*** (0.563)	1.365** (0.545)	1.494*** (0.568)	1.400** (0.563)
Firms use email to interact with clients/suppliers Y:1 N:0	0.812 (0.526)	0.769 (0.490)	0.941* (0.545)	0.936* (0.525)
Establishment has checking or savings account at this time Y:1 N:0	-0.251 (0.631)	-0.317 (0.523)	-0.414 (0.621)	-0.477 (0.561)

Log of mean distance - bank (km)	-2.202*** (0.671)	-2.000*** (0.650)	-2.237*** (0.678)	-2.381*** (0.629)
Bank financing for working capital(%)	-0.007 (0.012)	-0.006 (0.011)	-0.006 (0.012)	-0.004 (0.012)
Supplier Credit financing for working capital(%)	0.028** (0.011)	0.026*** (0.010)	0.027** (0.011)	0.025** (0.011)
Capital or main business city Y:1 N:0	-0.862 (0.559)	-0.854* (0.501)	-0.942* (0.563)	-1.150** (0.523)
Manufacturing Firms	-0.146 (0.587)	-0.026 (0.536)	-0.110 (0.591)	-0.230 (0.595)
Retail Firms	-0.969* (0.577)	-0.746 (0.561)	-0.938 (0.580)	-0.904 (0.578)
Constant	11.132*** (3.547)	8.974*** (3.381)	11.487*** (3.604)	11.282*** (3.426)
Country Fixed Effects	YES	YES	YES	YES
Number of observations	1,228	1,228	1,228	1,228

note: *** p<0.01, ** p<0.05, * p<0.1

*Omitted sector: Other services

Table 9: Firm Investment amount and the Intensity and Purpose of Mobile Money Use

Dependent variable: Log of Purchase of Fixed Assets (amount in USD)	OLS			
	coef/se	coef/se	coef/se	coef/se
% of total labor cost paid using mobile money (0 if not adopted or no payment)	0.045*** (0.013)			
% of raw material cost paid using mobile money (0 if not adopted or no payment)		0.065*** (0.020)		
% of utility bill paid using mobile money (0 if not adopted or no payment)			0.030*** (0.012)	
% of annual sales from customer payments using mobile money (0 if not adopted or no payment)				0.055*** (0.016)
Log of size	1.150*** (0.276)	1.180*** (0.280)	1.177*** (0.283)	1.251*** (0.272)
Top manager experience in sector (years)	-0.032 (0.022)	-0.035 (0.022)	-0.029 (0.022)	-0.034 (0.022)
Log of sales per worker (outliers removed)	0.064 (0.125)	0.151 (0.135)	0.053 (0.136)	0.132 (0.140)
Log of age of firm	-0.418 (0.410)	-0.396 (0.425)	-0.385 (0.427)	-0.288 (0.427)
Firm is part of a larger firm Y:1 N:0	-0.263 (0.893)	-0.406 (0.900)	-0.525 (0.871)	-0.384 (0.869)
Exports 10% or more of sales Y:1 N:0	-0.029 (0.825)	0.122 (0.857)	0.144 (0.858)	-0.020 (0.819)
Foreign ownership Y:1 N:0	0.332 (0.859)	0.525 (0.931)	0.649 (0.961)	0.561 (0.933)
Firm with unfavorable credit record Y:1 N:0	-0.041 (0.490)	-0.183 (0.466)	-0.067 (0.502)	-0.111 (0.467)
Establishment has a line of credit or loan at this time Y:1 N:0	1.487*** (0.545)	1.543*** (0.562)	1.705*** (0.555)	1.776*** (0.549)
Firms use email to interact with clients/suppliers Y:1 N:0	0.765 (0.508)	0.916* (0.512)	0.963* (0.533)	1.027* (0.541)
Establishment has checking or savings account at this time Y:1 N:0	-0.271 (0.609)	-0.348 (0.535)	-0.171 (0.633)	-0.617 (0.523)
Log of mean distance - bank (km)	-2.103*** (0.672)	-2.268*** (0.691)	-2.361*** (0.688)	-2.362*** (0.670)

Bank financing for working capital(%)	-0.007 (0.012)	-0.006 (0.012)	-0.005 (0.012)	-0.005 (0.012)
Supplier Credit financing for working capital(%)	0.028*** (0.011)	0.031*** (0.011)	0.027** (0.011)	0.030*** (0.011)
Capital or main business city Y:1 N:0	-0.786 (0.560)	-1.006* (0.555)	-1.111** (0.552)	-1.102** (0.532)
Manufacturing Firms	-0.112 (0.572)	-0.366 (0.573)	-0.342 (0.583)	-0.813 (0.575)
Retail Firms	-0.937* (0.553)	-0.756 (0.571)	-1.104* (0.572)	-1.239** (0.584)
Constant	10.678*** (3.523)	10.670*** (3.598)	12.126*** (3.651)	11.291*** (3.504)
Country Fixed Effects	YES	YES	YES	YES
Number of observations	1,217	1,194	1,204	1,186

note: *** p<0.01, ** p<0.05, * p<0.1

*Omitted sector: Other services

Table 10: Robustness – Instrumental Variables Model: Firm Investment and Mobile Money Use

	Second-stage regression	First-stage regression	Second-stage regression	First-stage regression
Dependent variable:	Firm purchased fixed assets Y:1 N:0	Firm used mobile money for any financial transactions Y:1 N:0	Log of Purchase of Fixed Assets (amount in USD)	Firm used mobile money for any financial transactions Y:1 N:0
	coef/se	coef/se	coef/se	coef/se
Mobile money for any financial transactions Y:1 N:0	1.237** (0.610)		9.576** (4.736)	
Log of no. of Mobile Money Agents, 5 km radius		0.063** (0.029)		0.063** (0.029)
Log of no. of MFIs, 5 km radius - form		-0.045 (0.037)		-0.045 (0.037)
Log of size	0.148*** (0.053)	-0.076*** (0.027)	1.718*** (0.418)	-0.076*** (0.027)
Top manager experience in sector (years)	-0.006 (0.005)	0.004 (0.003)	-0.066* (0.039)	0.004 (0.003)
Log of sales per worker (outliers removed)	-0.018 (0.021)	0.007 (0.016)	-0.002 (0.172)	0.007 (0.016)
Log of age of firm	0.033 (0.062)	-0.062 (0.039)	0.227 (0.509)	-0.062 (0.039)
Firm is part of a larger firm Y:1 N:0	0.198 (0.161)	-0.214*** (0.070)	1.515 (1.315)	-0.214*** (0.070)
Exports 10% or more of sales Y:1 N:0	-0.181* (0.108)	0.080 (0.081)	-1.643* (0.925)	0.080 (0.081)
Foreign ownership Y:1 N:0	0.177 (0.149)	-0.074 (0.093)	1.219 (1.301)	-0.074 (0.093)
Firm with unfavorable credit record Y:1 N:0	0.020 (0.094)	0.069 (0.059)	-0.413 (0.714)	0.069 (0.059)
Establishment has a line of credit or loan at this time Y:1 N:0	0.068 (0.087)	0.002 (0.062)	1.584** (0.721)	0.002 (0.062)
Firms use email to interact with clients/suppliers Y:1 N:0	0.065 (0.095)	-0.014 (0.067)	0.918 (0.743)	-0.014 (0.067)
Establishment has checking or savings account at this time Y:1 N:0	-0.013 (0.112)	-0.050 (0.098)	-0.269 (0.885)	-0.050 (0.098)

Log of mean distance - bank (km)	-0.265*	-0.007	-2.197*	-0.007
	(0.158)	(0.093)	(1.186)	(0.093)
Bank financing for working capital(%)	-0.002	0.001	-0.019	0.001
	(0.002)	(0.001)	(0.013)	(0.001)
Supplier Credit financing for working capital(%)	0.001	0.002*	0.015	0.002*
	(0.002)	(0.001)	(0.016)	(0.001)
Capital or main business city Y:1 N:0	-0.188	0.039	-1.607	0.039
	(0.146)	(0.095)	(1.107)	(0.095)
Firms has ISO certification ownership Y/N	-0.046	0.168**	0.139	0.168**
	(0.142)	(0.070)	(1.177)	(0.070)
Senior management time spent in dealing government regulations	0.004	-0.002	0.054*	-0.002
	(0.004)	(0.003)	(0.033)	(0.003)
Manufacturing Firms	0.003	-0.015	-0.416	-0.015
	(0.111)	(0.071)	(0.859)	(0.071)
Retail Firms	-0.093	-0.055	-0.856	-0.055
	(0.118)	(0.072)	(0.906)	(0.072)
Constant	0.885	0.446	5.426	0.446
	(1.030)	(0.546)	(7.566)	(0.546)
Country Fixed Effects	YES	YES	YES	YES
Number of observations	958	958	958	958
F-stat		3.02		3.02
Hansen J statistic (overidentification test of all instruments) p-value	0.696		0.615	
Underidentification test p-value	0.067		0.067	

note: *** p<0.01, ** p<0.05, * p<0.1

*Omitted sector: Other services