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Transparency and Financial Inclusion: Experimental Evidence from Mobile Money*

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Abstract

Electronic payment instruments have the potential to spur the transparency of business transactions and thereby reduce information frictions. We design a field experiment to understand whether e-payments facilitate the financial inclusion of SMEs in developing world and to study adoption barriers. We encourage a random sample of Kenyan merchants to adopt a new mobile-money payment instrument and find that the decision to adopt is hampered by the combination of information, know-how and seemingly small transaction costs barriers. In addition, we find that business owners who are more averse to transparency are more reluctant to adopt. Sixteen months after the intervention, we observe that treated firms have better access to finance in the form of mobile loans. The impact on financial access is more pronounced for smaller establishments, which also experience a considerable reduction in sales volatility. We conclude that e-payments can help un-collateralized firms become transparent and get financially integrated.

Keywords: SME Finance; Transparency; Payment Technology; Lipa Na M-Pesa.
JEL Classification: D22, G00, G21, O33.

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§This paper is dedicated to the memory of our dear friend Ravindra Ramrattan, who inspired us to begin research in Mobile Money and lost his life at the tragic Westgate Mall terrorist attacks in Nairobi, Kenya. Ravi's soul has guided us until the completion of this paper.

1 Introduction

Electronic payment instruments can foster market exchange and expand financial connectedness. Despite their advantages, adoption of e-payments in developing countries has been slow among small-and-medium sized establishments (SMEs).[1] A good understanding of the reluctance of SMEs to adopt these payment instruments and the consequences of their adoption is essential to inform financial policy reform.

This paper makes a first order contribution by providing the first field experiment on the adoption of an e-payment instrument by SMEs and investigating its effects on financial inclusion and other business outcomes in the context of a developing country. The underlying argument of our research is that e-payments may induce transparency, alleviate information constraints and help with financial integration of individuals with limited collateral.

Low income groups in the developing world are often times faced with steep hurdles when borrowing from formal financial institutions[2] Information frictions prevail as a key aspect to understand the roots of financial constraints. For instance, in a seminal paper, Karlan and Zinman (2009) show that asymmetric information, and in particular moral hazard, affects the repayment behavior of un-collateralized borrowers at a South African financial institution.[3] In environments characterized by asymmetric information and lack of collateral, micro-finance institutions (MFI) tend to rely on innovative schmemes, such as joint-liability group loan contracts and dynamic lending relationships, to alleviate financing constraints.[4]

As another alternative we suggest that e-payments can also help alleviate information

[1] According to the estimates of World Bank (2016a), the fraction of electronic payments in SME transactions is 20% in South Asia, 25% in Sub-Saharan Africa, 46% in Latin America, while the same ratio is about 71% in high income OECD countries.

[2] Levy (1993), De Mel, McKenzie and Woodruff (2009), Firth, Liu and Wong (2009), Beck, Demirguc-Kunt, and Maksimovic (2011) show evidence for MSME financial constraints. Karlan and Zinman (2010) and Kaboski and Townsend (2011) show that alleviating financial constraints improve small business performance.

[3] In another study on testing the presence of adverse selection and moral hazard frictions associated with un-collateralized borrowing, Gine, Goldberg and Yang (2012) find that fingerprinting increases the traceability of credit customers and enhances the repayment rates of borrowers with high default risks. Also, Arraiz, Bruhn and Stucchi (2016) show that psychometric tests can be used as a tool to detect high credit risk borrowers.

[4] See Armendariz and Morduch (2010).

frictions associated with the challenge of signalling the type and business performance of a borrower vis-a-vis formal loan providers. In both developed and developing countries, e-payment operators tend to collaborate with banks, providers of formal external finance. Digital e-payment platforms could therefore allow technology operators to electronically observe business transactions and reduce information asymmetries between - otherwise - financially constrained borrowers and external finance providers.

We design a randomized-controlled trial to encourage the adoption of an e-payment instrument and address a number of policy relevant questions: What are the important barriers that prevent businesses from adopting e-payment instruments? Can e-payments significantly influence financial access; and if so, what is the role of financial transparency for this relationship? Finally, which business outcomes may get affected by the financial inclusion induced through e-payments?

We address these questions by offering SMEs in the central business district of Nairobi, Kenya, the opportunity to adopt a mobile payment technology. We take advantage of a particular moment in time in which the country's major mobile money provider, *Safaricom*, was launching a new payment instrument, *Lipa Na M-Pesa*, which is a product specially designed to facilitate retail transactions by SMEs. This particular product allows us to investigate the financial inclusion consequences of e-payments, because Safaricom partners with Commercial Bank of Africa in providing (un-collateralized) mobile loans, *M-Shwari*.

The objectives of our study are twofold: understanding (i) the determinants of e-payment adoption and (ii) the outcome effects of e-payments. Therefore, at first, we test the relevance of exogenous adoption barriers and business-specific factors in determining the interest to adopt the Lipa Na M-Pesa technology. Second, we study the impact of Lipa Na M-Pesa adoption on business finances and other business outcome variables. To implement these tests we randomly assign 1222 restaurants and pharmacies, which did not have a Lipa Na M-Pesa account by the time of our study, to a treatment (615 businesses) and a control group (607 businesses). We choose to conduct our experiment with pharmacies and restaurants, because these type of retailers are at the "cross-roads" in the economy - connected to both households and suppliers. In this respect, understanding their adoption behavior could provide crucial insights about the diffusion of digital money instruments for the whole

economy.[5]

Our experimental treatment aims to stimulate an interest in the new payment technology by mitigating three potential adoption barriers: lack of product information, insufficient technological know-how, and the transaction costs related to registering the business with Safaricom. Specifically, we visit all merchants in the treatment group and provide them with leaflets highlighting the benefits and costs of the technology as well as a short movie featuring the experiences of successful merchants who use Lipa Na M-Pesa e-payment instrument. We then offer the merchant to open a Lipa Na M-Pesa account on behalf of the business and ask about her/his interest in signing up for an account.

Per Safaricom's regulations, only officially licensed firms are able to register for Lipa Na M-Pesa. Our set of 1222 firms consists of both licensed and non-licensed businesses. We thus use two different subsets of firms to answer our two research questions. To learn about the drivers of technology adoption, we use all firms assigned to the treatment group, regardless of being licensed or non-licensed. This allows us to assess differences in the willingness to adopt the technology between these two types of SMEs, providing insight into the potential benefits of expanding access to non-licensed firms as well. To estimate the impact of Lipa Na M-Pesa on business outcomes, we use a subset of 870 firms with an official business license by the time of our experiment, as those were the only ones eligible to receive the technology.

We obtain five key results. First, our experiment uncovers a significant unmet demand for the technology: 62% of the restaurants and 21% of the pharmacies in the treatment group indicate that they would like to sign up for the e-payment technology. This result is in line with Bertrand, Mullainathan, and Shafir (2004), who argue that relatively small barriers could play a decisive role in preventing people to take advantage of available technologies. Quoting from Bertrand, Mullainathan, and Shafir (2004, p. 420) "[small situational] barriers might be a testy bus ride, challenging hours, or the reluctance to face a contemptuous [agent]." Indeed, many businesses which expressed interest in the technology reported that, prior to our intervention, lack of information & know-how and transaction costs were reasons for not adopting the technology.

[5]See World Bank (2016b).

Second, we find that business owners who are less averse to disclose their sales and profits to us during the survey interview, and thus are more transparent, are more willing to adopt the technology. This is consistent with a-priori expectations, because every Lipa Na transaction is traceable by Safaricom as business activity. We also find that businesses with past exposure to standard mobile money products and those which are more future biased and more trusting are more likely to want to adopt the technology.

Third, and most importantly, sixteen months after the intervention, we find that financial connectedness of treated firms improve, especially in the form of access to mobile loans. At the extensive margin, we observe a sizeable increase in the number of mobile loans provided by the Commercial Bank of Africa in partnership with Safaricom, without a significant change in access to loans from other financial institutions, formal and informal. As we already highlighted, one plausible channel for this outcome is that signing up for Lipa Na M-Pesa is interpreted by the lender as a signal that the borrower is willing to become transparent. We observe also an effect at the intensive margin, as the amount borrowed increases among treated firms. A potential reason for that outcome is that Lipa Na M-Pesa's electronic payment mechanism allows Safaricom to track business transactions, observe creditworthiness of SMEs and lend mobile loans to those with higher probability of repayment. Both results on access to mobile loans are more pronounced for small scale establishments, which are likely to suffer the most from opacity and the lack of hard information to attract external financiers. We conclude that financial transparency induced by Lipa Na M-Pesa fosters access to short-term loans and replaces the necessity to build-up long-term relationships with providers of external finance.

Fourth, we also find that small-scale establishments in the treatment group end up having less volatile sales over the course of the past 12 months compared to the control group. This is consistent with the rising access to mobile loans that we observe in the treatment group, as mobile loans are designed to cope with short-term liquidity needs and business fluctuations.

Fifth and last, we also find that safety concerns at endline (with respect to theft and robbery) are less of an issue among SMEs in the treatment group compared to those in the control group. This outcome is significantly more pronounced for businesses operating in

relatively unsafe areas.

Overall, our paper shows that the electronic traceability of business transactions can be an important impediment for the adoption of e-payment instruments among business owners who prefer to keep transactions anonymous. However, once the technology is adopted, on the flip-side of the same coin, electronic visibility has a positive impact on financial integration, which we interpret as an opportunity cost of opacity.

The changes induced by our experiment in *financial connectedness*, *reduced sales volatility* and *improved safety* are potentially welfare improving, because perceived safer and less uncertain business environments typically induce growth in the long-run and also because the change in financial structure is reflective of improved financial inclusion. These findings are thus important for policy makers as well as designers of electronic payment instruments in developing countries, where anonymity of transactions could pose serious challenges.

The rest of the paper is organized as follows. Section 2 relates this paper to the existing literature. Section 3 introduces the context and the technology. Section 4 describes the design of both the RCT and the survey which was used for the data collection. Section 5 presents the results on the adoption, usage and impact of the technology. Section 6 concludes.

2 Contribution to the Literature

This paper primarily contributes to the recent and rapidly growing literature on the economic effects of electronic money products, such as Safaricom's M-Pesa, in developing countries. Most of the studies in this line of research aim to understand the implications of M-Pesa on household or micro-entrepreneurial finance. For instance, Mbiti and Weil (2011) find that the increased use of M-Pesa lowers the use of informal savings mechanisms (for instance ROSCAS), and raises the propensity to save via formal bank accounts. Jack, Ray and Suri (2013) and Jack and Suri (2014) show that M-Pesa helps households manage financial uncertainties caused by crop failures, or health issues and smooth consumption. Wieser, Bruhn, Kinzinger, Ruckteschler, and Heitmann (2019) show that mobile money agent roll-out significantly increases remittance transactions and non-farm employment.

Also in a recent study Aggarwal, Brailovskaya, and Robinson (2019) investigate mobile money adoption among micro-enterprises and find out that mobile money adoption raises saving behavior and the likelihood of extending credit to suppliers - thus financial connectedness. The overarching conclusion of these studies is that the users of M-Pesa can access a wider network of support whenever financial needs arise, and receive and save funds more efficiently. The conclusions of our paper complement these studies as we show that Lipa Na M-Pesa can improve financial connectedness and reduce sales volatility especially for small-scale enterprises.[6]

Complementary to the papers on household finance, Beck, Pamuk, Ramrattan and Uras (2018) develop a dynamic general equilibrium model, calibrated with firm-level survey data from Kenya, to study the interaction between mobile-money, entrepreneurial finance and macroeconomic activity. The authors quantify a substantial impact of M-Pesa on SME trade credit arrangements and aggregate outcomes. While we also study mobile money in the context of SMEs, and also uncover a complementarity between payment-technologies and access to finance, our focus and method is substantially different. Our focus is on the identification of the determinants to adoption of a technology designed to cater the needs of SMEs, and on the implications for the SMEs of adopting the technology.

This paper also contributes to the literature of cashless payment instruments by conducting what constitutes, to our knowledge, the first field experiment with a payment technology. Existing studies in this literature utilize non-experimental data or data from laboratory experiments. Using survey data, for instance, Humphrey, Pulley and Vesela (1996) document a positive association between the availability of ATMs and debit card usage, and a negative association between debit card adoption and aggregate crime rates. Chakravorti (2007) argues that market competition is important in determining firms' electronic payment adoption behavior, while Schuh and Stavins (2010) show that technological developments in debit-card payments drive out payment checks and suggest that there are strong substitutions between comparable payment methods based on efficiency differences.

[6]Also in an important contribution, Suri and Jack (2016) show evidence of notable long-term effects of mobile-money on poverty reduction in Kenya. The authors estimate that since 2007, access to mobile-money services increased daily per capita consumption levels considerably, lifting thousands of Kenyan households out of extreme poverty.

Bolt, Jonker and v. Renselaar (2010) address the issue of surcharges and suggest that allowing for surcharges at retailers could be an important determinant of electronic payment adoption. Arifovic, Duffy, and Jiang (2017) develop a game theoretic framework to show that fixed adoption fees could be important in inhibiting the adoption of an electronic money instrument – a theory which they subsequently test in a laboratory experiment. Similarly, Camera, Casari, and Bortolotti (2016) design a laboratory experiment and show that eliminating service fees or introducing rewards can have significant implications for the adoption of electronic money instruments. We contribute to this literature in that we identify and measure the barriers preventing adoption of a cashless payment technology by SMEs in their own environment, as well as estimate the impacts of adopting such technology.

Our paper is also related to the vast literature on SME finance. In particular, the findings presented in this paper and the key underlying mechanism are relevant to studies on relationship lending. Seminal papers in this line of research, such as Petersen and Rajan (1994), Berger and Udell (1995) and Degryse and Cayseele (2000), suggest that because of apparent difficulty associated with collateral-based lending, extending loans to small and opaque businesses requires the build-up of soft information, necessitating the formation of long-term bank-firm relations. In a recent paper, Beck, Degryse, De Haas and van Horen (2018) show, for instance, that long-term lending relationships help especially during business downturns and significantly more so for the smallest firms with non-transparent operations. Our findings in this paper are in line with this research, while we also propose a policy-relevant novel angle: connecting payment and lending means of financial services spectrum - using electronic financial instruments - can overcome transaction frictions associated with the formation of long-term lending relations and help small businesses to have fast access to loan products. In this respect, we also relate to Norden and Weber (2010), a study which shows how checking account activity and credit line usage might help lenders to monitor borrowers. We complement this line of research with a field experiment and identify a causal linkage between electronic payments and access to business finance, while suggesting a signalling role associated with signing up for an electronic payment instrument.

Finally, our paper also contributes to the technology adoption literature in the context

of developing countries.[7] The studies that are most closely related to our research are the field experiments on adoption of efficient technologies.[8] Most studies in this literature concentrate on the agricultural sector and in particular on the adoption of farming techniques by small and micro enterprises, as do the seminal papers by, for example, Duflo, Kremer and Robinson (2004, 2008, 2011) and Foster and Rosenzweig (2010). We add to this important literature by studying the financial technology adoption decisions of SMEs in the service sector and understanding the barriers to adopt and business outcome effects to this end. Importantly, several papers in this literature highlighted the role of behavioral factors on technology adoption, such as complexity of information, present bias and loss aversion.[9] Our experimental design reduces the complexity of information required to evaluate the benefits of Lipa Na M-Pesa, while our survey design allows us to measure important behavioral factors such as present bias, future bias, trust and cognitive ability.[10]

3 Institutional Context: Mobile Money in Kenya

Over the past decade peer-to-peer money-exchange products, such as mobile money, have created profound transformations in cashless money circulation in the developing world. In 2007, Kenya's *Safaricom* introduced the first mobile-phone based money instrument, called *M-Pesa*, to enhance P2P (Person to Person) money transfers. In this section we provide an overview of the *standard* M-Pesa and then focus on *Lipa Na* M-Pesa, an extension of M-Pesa designed specially to facilitate P2B (Person to Business) money transfers.

[7] A large literature argues that differences in technology adoption rates explain per-capita income differences across countries (Caselli and Coleman (2001) and Comin and Hobijn (2004)).

[8] See Magruder (2018) for an overview of this literature.

[9] See Hanna, Mullainathan, and Shafir (2014), and Drexler, Fisher, and Schoar (2014).

[10] Also relevant for our paper are the empirical studies on technology adoption, which are interested in understanding the heterogenity in technology adoption decisions across firms, such as Jack and Suri (2011) and Foster and Rosenzweig (2013). This strand of literature finds a positive correlation between technology adoption and firm characteristics. Our empirical findings also uncover a heterogeneity in the adoption of the Lipa Na M-Pesa payment instrument, based on which we argue that the heterogeneity in relative costs and benefits of the technology could be important to explain differences in payment instrument take-up rates.

3.1 Standard M-Pesa

M-Pesa is the brand name of the most commonly utilized P2P mobile money service in Kenya, which allows users to transfer money via mobile-phone text messages (SMS) to other mobile money users.[11] The way *standard* M-Pesa works is as follows. Users sign up for an M-Pesa account and top it up by converting cash in M-Pesa units at specialized agents, called M-Pesa kiosks.[12] The electronic money units can then be transferred to any other mobile money user, utilized to make payments, or kept stored in one's mobile money account. The recipients of M-Pesa transfers can use the units to make new transfers or redeem them for cash at M-Pesa kiosks.

Signing up for a standard M-Pesa account does not entail any monetary cost. All that is required is to visit an M-Pesa kiosk with an official identity document and a mobile phone. Cash can be exchanged for M-Pesa units free of charge, and receiving M-Pesa units is also costless. A transfer fee is charged only when converting M-Pesa units back to cash, or when units are transferred to another account. Both fees are step-wise increasing in the size of the transaction, as shown in Figures 1 and 2.

Figures 1 and 2 here

With this electronic money technology, Safaricom has revolutionized P2P money transfers in Kenya. By 2013 and only six years after having been launched, more than 70% of Kenyan households had an M-Pesa account.[13] In that year 733 million M-Pesa transactions took place, with an aggregate value of about 1.9 trillion Kenyan shillings (about 22 billion US dollars), an equivalent of 40% of Kenyan GDP at the time.[14] However, despite the high adoption rate of M-Pesa by households, businesses did not show the same enthusiasm to use M-Pesa for P2B and B2B money transactions. According to a nation-wide survey

[11] At the time of the study, there were other mobile money providers in Kenya like Airtel Money, Orange Money, Equitel, Mobikash, and Tangaza. However, according to the Communications Authority of Kenya (2015), 77% (about 21 million) of the people who hold a mobile money account in June 2015 were M-Pesa users.

[12] In December 2014, there were about 124,000 M-Pesa kiosks scattered across all Kenya. Around 20 percent of them are located in Nairobi (FSP interactive maps, 2013) with approximately 25 million customers.

[13] See Jack and Suri (2014).

[14] The annual transaction volumes of mobile money transactions are the sum of the monthly transaction volumes reported by the Central Bank of Kenya National Payment https://www.centralbank.go.ke/national-payments-system/mobile-payments/.

conducted by FSD-K, only 35 percent of SMEs accepted M-Pesa as a common method of payment over the years of 2013-2014, especially because of technological challenges and financial considerations.[15] Safaricom was well-aware of these barriers and, recognizing the niche in the P2B market, introduced *Lipa Na M-Pesa* in 2014, a mobile money facility developed to stimulate P2B transactions. In what follows we briefly describe the main characteristics of Lipa Na M-Pesa, which constitutes the core of this paper.

3.2 Lipa Na M-Pesa

Lipa Na M-Pesa is a product especially designed for merchants, allowing them to receive payments in retail transactions. Different from standard M-Pesa, Lipa Na M-Pesa accounts are registered under the name of the business. For this reason, the transactions made through Lipa Na M-Pesa become visible to Safaricom as business activity - inducing *transparency*. In addition to reducing cash-based transfer frictions in the same way as standard M-Pesa does, Lipa Na M-Pesa offers monetary and technological benefits that make the product attractive for P2B purposes.

With respect to the monetary benefits, standard M-Pesa users can make Lipa Na M-Pesa payments at zero financial cost. This is a major difference compared to the P2P transactions made between two standard M-Pesa accounts, where the account holder making the transaction (in this case, the buyer) needs to pay a transaction fee (Figure 1). Second, while the business has to incur a payment receipt fee of 1% of the transaction value, the costs are lower than those incurred by the customer when using standard M-Pesa for all transactions below 8500 KSh (more than US$ 80). Importantly, the typical transaction of the merchants in our sample has a value well below that threshold, implying that using Lipa Na M-Pesa raises the surplus generated by an economic transaction between a customer and a business.

Lipa Na M-Pesa also has two key technological advantages compared to standard M-Pesa. First, there are restrictions on the amount of money one can store in a standard M-Pesa account, while such restrictions are virtually absent for Lipa Na M-Pesa. This implies that a business owner with Lipa Na M-Pesa does not need to cash-out as often

[15] See FinAccess Business Survey, 2014.

as with standard M-Pesa, substantially reducing the costs of cash withdrawals.[16] Second, Safaricom records all the transactions made via Lipa Na M-Pesa, and allows the business owner free-of-charge access to daily transaction-records over a six-month period; all that is required is to send the request via a simple e-mail. In this way, Lipa Na M-Pesa offers business owners an option for a bookkeeping system at zero cost.

3.3 Potential Factors Affecting Lipa Na M-Pesa Adoption

The positive features of Lipa Na M-Pesa do not imply that the adoption of this technology would be immediate among merchants. The literature on technology adoption – in developed as well as in developing countries – has consistently shown that adoption of a new technology, regardless of how efficient it may be, tends to be slow due to the existence of pecuniary and non-pecuniary factors. In the context of Lipa Na M-Pesa we identify a number of factors that may prevent adoption of this new payment instrument.

First, the merchants may lack information about the costs and benefits of the technology, since the technology was new in the market. Second, even though Safaricom does not charge a fee to register and open an account, there are transaction costs associated with the time and effort to do the paperwork, e.g. filling out a form and handing it in at a Safaricom office. Such costs, even if seemingly low compared to the benefits of the technology, have proven to be consequential especially in the context of developing countries (Bertrand, Mullainathan and Shafir, 2004). Third, there could be technology implementation barriers. For instance, merchants may not know how to make optimal use of the various Lipa Na M-Pesa features and services. We consider these three as "soft barriers", because they could be mitigated at relatively low cost.

Willingness to adopt Lipa Na M-Pesa can also be affected by other potential factors. Notably, Safaricom traces all transactions made through Lipa Na M-Pesa as business activity. In addition to its money transfer and payment services, Safaricom partners with Commercial Bank of Africa to provide mobile loans (called M-Shwari). For financially constrained firms, which otherwise do not have the chance to signal their creditworthiness to external

[16]The fees charged for cash withdrawal from Lipa Na M-Pesa and standard M-Pesa accounts are the same; see Figure 2.

financiers, signing up for Lipa Na M-Pesa and willing to share business transactions with Safaricom could help with accessing external finance in the form of M-Shwari loans. For other businesses, however, transparency could be more of a concern if the owner is not willing to disclose business transactions to third parties. Additional potential factors that can explain adoption relate to exposure to sophisticated payment products in the past, exposure to cash theft and behavioral characteristics of the business owner.

4 Research Design

The purpose of our paper is twofold. The first is to estimate the willingness to adopt the payment instrument when three "soft adoption barriers" (information, know-how and non-financial costs associated with account registration) were removed all at once. Are these barriers binding? If so, for which type of firms?[17] The second purpose is to estimate the impact of Lipa Na M-Pesa adoption on business outcomes of the subset of licensed firms in our sample – as those are the only ones that are allowed to own a Lipa Na M-Pesa account. In what follows, we introduce the experimental design and the survey data.

4.1 Experimental Design

4.1.1 Sampling and Randomization

The study took place in the periphery of Nairobi's central business district. We chose this location because lower business densities mitigate possible spillover concerns between treated and control businesses. To construct a sample of comparable businesses, we focused only on two types of businesses: restaurants and pharmacies. The choice of just two sectors was the result of the trade-off between representativeness and statistical power. With respect to the latter, selecting just one or two sectors increased power because the variance in outcomes is plausibly smaller within sectors than between sectors. The services sector is a good candidate as it makes up for almost half of Kenyan GDP (47.5% in 2017, compared to 34.5% for Agriculture and 17.8% for Manufacturing; see World Factbook, 2019), and be-

[17] Because of the combination of budgetary constraints and statistical power issues, we were not able to separately test the impact of each of these potential barriers on adoption. Instead we implemented just one intervention aimed at mitigating (if not completely removing) all three at the same time.

cause it is growing fast at about 6% per year.[18] Also importantly, retailers are intermediary businesses - connected to both household and producer sides of the economy - and they contribute to the largest portion of the aggregate value added from the services sector (about 8.8% in 2017; see economiesafricaines.com). Finally, retailers have the potential to benefit substantially from a cashless payment technology because they implement relatively many transactions per day, they are vulnerable to internal and external theft, and their growth potential may be hampered by non-transparent informal business transactions. Within the retailers category, restaurants and pharmacies are typically SMEs, and hence we decided to concentrate on measuring the impact of Lipa Na M-Pesa on adoption barriers and business outcomes in these two sub-sectors.

To draw a list of eligible firms for the study, we randomly assigned enumerators to visit specific areas in the city and requested them to list restaurants and pharmacies with one or more employees, located at a distance not less than 50 meters from the closest other business in the same sector, without a Lipa Na M-Pesa account yet, and whose owner or manager was willing to participate in a study on mobile money use by businesses.[19] Following this procedure, we listed in total 1222 SMEs, 669 restaurants and 553 pharmacies, of which about 72% were licensed. Of the 1222 firms, 607 were randomly assigned to the treatment group, and 615 to the control group. Random assignment within each sector was stratified by geographic location and firm size, measured by the number of employees.[20] Figures 3, 4 and 5 provide the geographic distribution of the sample of businesses over districts of Nairobi, by treatment and control groups.

Figures 3, 4 and 5 here

4.1.2 Experimental Intervention

The experimental intervention was conducted right after having administered the baseline survey. Firms assigned to the treatment group were informed that the researchers involved

[18]These figures are based on the World Bank database by using services value added in constant 2010 US$.

[19]We implemented the minimum distance requirement to mitigate any spillover effects between treatment and control firms, such as information dissemination, business stealing and the like.

[20]We considered a restaurant (respectively pharmacy) with more than five (respectively two) employees to be big and we used this categorization to stratify the sample. The geographic division of the area was made ad-hoc by the survey company for logistical reasons.

in this study had done research on Lipa Na M-Pesa's potential as a new cashless payment instrument, and they were interested in informing merchants about the costs and benefits of the technology.[21] After receiving this information, the merchant was asked whether she would be interested in receiving the technology, provided that the account would be opened by our research team on her behalf in addition to a know-how training that the researchers would provide on the technology.[22] The answer to this question is what constitutes the measure of willingness to adopt the technology. The timing of the events is described in the following timeline.

Timeline here

The intervention itself consisted of three components, which we describe next.

Provision of Information about the Technology

The objective of this component was to provide information on the advantages and disadvantages of Lipa Na M-Pesa compared to other payment methods. The information was provided by means of a leaflet and a video. All materials were produced by the research team in close cooperation with DDD-Kenya and a professional producer company.[23]

The leaflet consisted of concrete and easy-to-understand information on Lipa Na M-Pesa's costs and benefits. People only pay attention to that part of the provided information which they think is the most relevant to them, and hence too much information can actually limit adoption. Hanna, Mullainathan and Joshua (2014) thus recommend providing targeted as well as simplified information, and we have tried to follow that advice.

The video complemented the leaflet. It featured an interview with a fellow business owner (i.e., an owner of an SME in the same sector as the merchant) who had already adopted Lipa Na M-Pesa. We thus produced two videos, a 5.2 minute clip for the restaurant sector and a 3.2 minute clip for pharmacists, in which the interviewee summarized

[21] The interviewees were business owners or managers in charge of the business decisions.

[22] The intervention was carried out by enumerators hired and trained by DDD Kenya and by the research team. We made it very clear to the merchant that we did not have any relationship or commercial ties with Safaricom. We explicitly stated that our aim was purely academic.

[23] Neither Safaricom nor any other (marketing) company were involved.

the advantages of using Lipa Na M-Pesa as well as their own personal experience with the cashless payment technology.[24] The video was shown on the SME's premises using the enumerator's tablet. The inclusion of the video as a component of the intervention is motivated by an emerging literature highlighting the effectiveness of role models in inducing behavioral change. This literature shows that successful peers can act as role models and are particularly effective in the context of low-income households in developing countries (see, for instance, Bernard, Dercon, Orkin and Taffesse (2014) and La Ferrara (2016)).

Support for the Registration Process

In addition to lifting the information barrier, we also aimed to reduce the transaction costs associated with opening an Lipa Na M-Pesa account. We did so by offering the merchant to handle all the necessary paperwork. After the first meeting (in which the baseline survey was administered and the information on Lipa Na M-Pesa had been shared), a trained enumerator would contact those businesses that expressed their willingness to open an account to pick up the required copies of the documents from the business premises. She would subsequently do all the required paperwork, and deliver the application package to one of the Safaricom offices. When the account was approved, the enumerator would collect all the materials from Safaricom on behalf of the owner of the SME. This component is motivated by the literature pioneered by Bertrand, Mullainathan, and Shafir (2004), who argue that small situational barriers play a decisive role in preventing people to take advantage of efficient investment opportunities. The paperwork associated with opening an account can be perceived as a hassle for business owners and can prevent them from adopting the technology.

Technology Implementation Assistance

When delivering the Lipa Na M-Pesa material to the business owner, the enumerator made sure that the account would be set to the "transaction ready" mode. Specifically,

[24] As an example, the restaurant video can be accessed by clicking here.

this component of the intervention consisted of inserting the Lipa Na M-Pesa SIM-card into the mobile phone the business owner would use for her Lipa Na M-Pesa transactions and testing whether the SIM-card was functional. A short training was provided, which ended by assisting the merchant in performing a test transaction – charging our (standard) M-Pesa account for a sum of 100 KShs and completing the transaction.

4.2 Survey Measures

A key objective of our baseline survey was to measure the factors that could potentially be associated with the adoption of Lipa Na M-Pesa but which were not exogenously varied by our experimental intervention. This subsection describes these factors and the way they were measured in the survey instrument.[25]

4.2.1 Financial Transparency Aversion

Transactions made through Lipa Na M-Pesa get recorded as business activity by Safaricom. Therefore, firms that are averse to disclosing their financial activities to a third party might be reluctant to adopt the technology. These transparency concerns are difficult to measure directly, but they can be captured in an indirect way. For this purpose, we proxy transparency concerns with a dummy variable indicating the willingness of the business owner to disclose revenue and profit figures during the baseline survey interview.

Financial transparency concerns may be correlated with other variables as well. One potential candidate confounder is trust. We thus collect information on the survey respondent's propensity to trust others, measured as "trust in a person at a first-time contact". Financial transparency concerns may also be correlated with key business characteristics, such as financial sophistication, profitability, size, and holding an up-to-date business license. We therefore collected information on these variables too. In addition, we created a financial sophistication index covering, among others, formal loan use from banks and mobile money providers, and whether the SME actively kept business records.

[25]Interviewees received 500 Kenyan Shillings as a token of appreciation, both at baseline and at endline. At baseline, interviewees could earn up to 2150 Kenyan Shillings through the incentivized behavioral games to measure risk and time preferences. These preferences were not measured at endline. A copy of the baseline and endline surveys can be found here and here, respectively.

4.2.2 Behavioral Factors

Recent studies stress the importance of behavioral factors in technology adoption decisions of small enterprises. Our design is, in part, motivated by these behavioral insights, as we include role models to foster social learning and account for limited attention and seemingly small bureaucratic hassles as important potential determinants of technology adoption. However, there are other potential behavioural aspects that can affect the decision to adopt the technology. We measure these aspects in the baseline survey as follows.

First, we collect a proxy measure of each entrepreneur's cognitive function, as a plausible determinant of the ability to grasp the information on Lipa Na M-Pesa costs and benefits. We measure cognitive function by means of the *Digit Span Task* (see Daneman and Carpenter (1980 and 1983)), in which the entrepreneur is read a list of numbers and then asked to repeat these numbers in the same order. Outcomes for this task are the longest correctly remembered span, as well as overall accuracy.[26]

Second, we elicit time preferences, as well as present and future bias. The reason we are interested in these is that the decision to adopt a new technology involves planning (costs) in the present, while benefits are obtained in the future. We elicited these preferences and biases in an incentive-compatible way adopting the method used by, among others, Dupas and Robinson (2013a).[27] Merchants were asked whether they preferred receiving either 500 Ksh (US$4.93) the next day, or receiving a larger amount in 31 days. The larger the amount needed to induce the merchant to choose for the later payment, the more impatient he or she is coded to be. To measure time inconsistency, we also asked merchants to choose between Ksh 500 in 31 days and a larger amount in 61 days. A merchant is defined to be present biased if he or she is more impatient in the present than in the future, i.e. exhibits a higher discount rate between tomorrow and 31 days than between 31 days and 61 days. In contrast, a merchant that is more patient in the present than in the future is defined to be future biased.

Finally, we measure trust, as we conjecture that trust is particularly relevant in ex-

[26]This task is widely used in field experiments in economics as a proxy for cognitive ability, particularly in the context of developing countries. See Dean, Schilbach, and Schofield (2017) for a review.

[27]By *incentive-compatible* elicitation we mean that the decisions made by the entrepreneur had real monetary consequences for them.

plaining adoption of Lipa Na M-Pesa. Access to finance is quite limited in developing economies, also because trust in financial contract enforcement is weak.[28] Therefore, specially in our context, lack of trust in customers, in people met for the first time, in Safaricom, and in institutions in general, are potential important explanatory factors. We measure all these dimensions with direct survey questions.

4.2.3 Other Potential Factors

We measure additional factors that can potentially affect the decision to adopt an electronic money instrument. First, based on results from a laboratory experiment by Arifovic, Duffy, and Jiang (2017), we conjecture that merchants who have a positive previous experience with electronic money are more likely to adopt Lipa Na M-Pesa. For this purpose, we ask if the merchant uses the (standard) personal mobile money account for business purposes.

Second, we conjecture that merchants who are exposed to high risk of theft may value Lipa Na M-Pesa relatively more (see also Jack and Suri (2014) and Economides and Jeziorski (2016)). To capture this, we ask the business owner about his or her own perception of safety in the business premises, and about the frequency and magnitude of theft he or she experienced over the last six months.

Third, we also conjecture that Lipa Na M-Pesa is less appealing for businesses that frequently transfer money into saving accounts. Exchanging Lipa Na M-Pesa credits for cash is subject to a withdrawal fee, and so is sending money to a bank account (see Section 3.1). By the time our experiment was conducted, there were only two banks that provided real time cash transfer services from Lipa Na M-Pesa to business bank accounts. At other financial institutions, when business owners wanted to transfer money from Lipa Na M-pesa to their business bank accounts, they were required to use Pay-Bill or M-Pesa transfer services, which are costly and take at least 6 hours to complete the transfer. To account for this in our analysis, we ask the merchant about the use of bank accounts for business purposes to deposit cash.

Finally, we conjecture that smaller firms are expected to benefit more from a reduction in fixed adoption costs, but bigger firms are expected to benefit more from the technology

[28] See e.g. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997 and 1998).

due to higher sales, a larger pool of customers and higher likelihood of theft by employees. In our survey we proxy size with the number of employees and total sales.

4.3 Sample Characteristics

Table 1A describes the baseline characteristics of the 1222 businesses in our sample and compares the firms assigned to control and treatment groups for the full sample. Table 1B repeats the same comparison for those firms which have a business license. Online Appendix Tables OA4A and OA4B provide these comparisons separately for restaurants and pharmacies.

Tables 1A and 1B here

The average business in our sample is rather small. On average, pharmacies employ three workers and restaurants five. The average monthly sales and profits of pharmacies are about 1470 and 600 U.S dollars PPP respectively, and restaurants have about 3225 US dollars PPP in sales and 820 dollars in profits. Only 19% of the pharmacies and 36% of restaurants have made investments in their businesses in the past six months and only few businesses have received loans in the past twelve months. Moreover, 91% of the pharmacies and 54% of the restaurants in our sample have a business license.

Regarding familiarity with cashless payment technologies, almost all business owners in our sample posses a personal M-Pesa account at the time of the baseline. In addition, 43% of the restaurant owners and 31% of the pharmacy owners report mobile money to be the most frequent method of payment to suppliers, while 40% of restaurants and 25% of pharmacies have received payments from their customers through personal mobile money account of the business owner. Moreover, although none of the firms in our sample had adopted the technology at baseline, more than 90% of pharmacies and restaurants in our sample knew about the existence of Lipa Na M-pesa.

The primary reason reported for not having a Lipa Na M-Pesa account was perceived lack of net benefits. Business owners also perceived that it was too costly to open the account, that Lipa Na M-pesa transaction fees were too high, and that they did not have the time to do the registration paperwork. This pre-treatment information is enlightening

in two ways. First, it reveals that merchants had incorrect beliefs about the cost and benefits of adopting and subsequent usage of the technology, which our intervention aimed to remedy. Second, the paperwork for the registration was perceived as an impediment to opening an account, an aspect that was directly targeted by our experimental intervention.

Finally, it is important to note that no business in the sample sells its main product for more than 8500 Kenyan Shillings (about 80 US$ by the time of the baseline survey), which is the threshold amount of payment above which transferring money in a P2B transaction becomes more expensive when using a Lipa Na M-Pesa account than when using a standard M-Pesa account (Figure 1). Since surcharging is allowed, this means that all businesses in our sample could generate a transaction surplus by asking the customers to pay through the business Lipa Na M-Pesa account instead of business owners' personal M-Pesa.

Regarding the differences between businesses in the treatment and control groups, Table A1 shows that the sample is balanced in all observable characteristics except for one. In addition, we perform a test for joint orthogonality by regressing treatment status (having been assigned to the treatment or the control group) on all firm characteristics reported in Table 1A. We cannot reject the null of the coefficients of all explanatory variables being jointly zero, indicating that the two groups are well-balanced.[29] When we look at pharmacies and restaurants independently in Online Appendix Tables OA4A and OA4B, we see that the sample of restaurants is perfectly balanced between treatment and control. However, treated businesses in the pharmacy sector have higher sales and profits and also they self-signed up for a Lipa Na M-Pesa account in-between the listing and the baseline survey more often (see Table OA4A). As we document in Table OA4B, statistically significant differences in sales and profits between the pharmacies in the treatment and control groups cease to exist when we focus our analysis on those that are licensed and participate in the endline survey. Yet, to be conservative, we control for sales and Lipa Na M-Pesa self-adoption among pharmacies in our regression analyses to mitigate any possible issue associated with the perceived imbalance.

[29] An F-test for the joint significance of 23 coefficient estimates after a linear regression produces a p-value of 0.54 for all businesses.

5 Analysis and Results

We present the empirical analysis and results in two parts. In Section 5.1 we investigate the factors associated with the willingness to adopt the technology and in Section 5.2 we study the impact of our intervention on business outcomes.

5.1 Willingness to Adopt the Technology

Interest of SMEs in the Lipa Na M-Pesa technology was gauged from the response of the firms in the treatment group to our offer to open an account on their behalf. Acceptance rates were 62% among restaurants and 21% among pharmacies. These rates are high, given that at the time of the intervention the technology had been available on the market for more than a year. This means that there was a substantial "unmet demand" for the technology. It also shows that the "soft" adoption barriers we lifted were quite important in preventing adoption.

Figure 6 presents the main reasons reported by firms for not having adopted Lipa Na M-Pesa prior to our experimental intervention. Lack of perceived benefits was an important reported reason, and especially more so for the pharmacies. Additional reasons were the time costs of opening an account, and the perceived complexity of using the technology. These were precisely the three barriers that our intervention targeted.

Interesting insights are obtained when comparing the main reasons for not having adopted yet between those who ended up accepting our offer, and those who did not. Results are reported in Figures 7 and 8. As can be seen from Figure 7, our intervention increased take-up among restaurants especially because it solved the time constraint, but we did not manage to convince all respondents of the benefits of using the technology. The latter was also an issue with the pharmacies, as shown in Figure 8, and the same holds for the costs of opening the account, and of using it.

Next, we analyze what types of firms are interested in having us opening an account on their behalf. Table 2 explores in which respects firms accepting our offer differ from those that rejected it. Prior usage of mobile money, and then especially standard M-Pesa, is an important factor. In case of restaurants this holds for nearly all mobile money

usages. For pharmacies, receiving payments and storing money are the most important ones. Pharmacies that accepted our offer tend to be larger and more profitable, while restaurants that tend to invest more are also more prone to be willing to open an account.

Figures 6, 7 and 8 here

Table 2 here

Exploring in what respects adopters and non-adopters tend to differ is one approach to gauge insight into the determinants of the adoption process; using formal regression analysis is another. We specify the following generalized regression model for this purpose

$$Adopt_i = \alpha + \beta' Exposure_i + \omega' Transparency_i + \gamma' Behavior_i + \phi' Size_i + \chi_d + \mu_j + \epsilon_i, \quad (1)$$

where subscript i enumerates the business, $Adopt_i$ is a dummy variable equaling to one if business i accepts the offer to open an account, $Exposure_i$ is a vector of measures of past experience with mobile money, $Transparency_i$ is a vector of financial transparency measures, $Behavior_i$ is a vector of behavioral factors, and $Size_i$ is a vector of business size measures. Furthermore, μ_j controls for sectoral differences (pharmacies vs restaurants) and χ_d captures the enumerator-and-district fixed effects.[30]

We estimate three specifications of Equation (1). In the first specification, we use aggregated indices for exposure and transparency concerns, whereas in the second and third specifications they are replaced by the indices' individual components. Table 3A provides results from the full sample of firms, while tables 3B and 3C report results for restaurants and pharmacies separately. In all tables the variables in panel A measure standard mobile money usage. Variables in panels B and C contain the proxies for perceived safety and actual saving behavior, respectively. Variables in panel D capture transparency concerns, whereas those in panel E capture the behavioral aspects. Finally, the variables in panel F are business size indicators. Needless to say that the results we report below in this subsection should be interpreted as correlations, and not causation.

[30]Table OA1 in Online Appendix provides the full list of variables utilized in this analysis and Table OA2 provides summary statistics of the main variables.

Table 3A here

Results reported in Table 3A confirm that "pre-treatment exposure to mobile money" is significantly associated with a firm's willingness to adopt the technology, echoing recent findings from laboratory experiments from Camera, Casari, and Bortolotti (2016) and Arifovic, Duffy, and Jiang (2017). Column (1) shows that firms that use standard mobile money for business purposes are 14.2 percentage points more likely to adopt the technology compared to other businesses. The more detailed measures of prior mobile money usage indicate for example that firms that use mobile money to buy inputs are more prone to be willing to open a Lipa Na M-Pesa account. Also importantly, we observe that those businesses which do not surcharge when transacting with standard mobile money are also more eager to accept our offer to adopt the Lipa Na M-Pesa technology.

Interestingly, businesses that are non-transparent with respect to their profits and sales in the baseline interview are less likely to sign up for the technology. While other transparency aversion proxies (like not having an official business license, or measures of financial sophistication) turn out to be insignificant, all coefficient estimates have the expected signs. As far as we are aware, this is a very novel finding, which is critical both for the design of electronic financial products as well as for policies aiming to promote electronic payment usage. We will return to this important adoption channel when analyzing the outcome effects of Lipa Na M-Pesa.

The behavioral factors perform more unevenly across various specifications, though one key behavioral aspect stands out: cognitive ability of the business owner significantly correlates with adoption throughout regression specifications in Table 3A, confirming a priori expectations.

With respect to other determinants, we observe that the decision to adopt is by and large independent of (indicators of) firm size. Finally, results in Table 3 also show that businesses which save at a business bank account are less likely to adopt. This pattern holds most likely because banked firms can access payment and other financial services through their formal financial institution and also importantly because transferring funds from Lipa Na M-Pesa to a bank account is costly, as highlighted before.

Tables 3B and 3C confirm that pre-treatment use of mobile money turns out to be

important in both sectors. Also transparency aversion has negative coefficients for both pharmacies and restaurants. While this coefficient is not statistically significantly different from zero in the restaurants sub-sample, it is significant at the 5% level for pharmacies. Having a business saving account at a bank is negatively associated with the adoption of Lipa Na M-Pesa, but more so for pharmacies (see Table 3C) than for restaurants (Table 3B). Similar conclusions apply to the behavioral biases, which show up significantly for pharmacies but not for restaurants.

Tables 3B and 3C here

5.2 Adoption, Use and Impact of the Technology

Possessing an up-to-date business license is a necessary requisite imposed by Safaricom on all firms that want to open a Lipa Na M-Pesa account. For this reason, our analysis of the impact of the technology is restricted to the sub-set of those 870 firms that owned a business license at baseline. As already shown in Table 1A, treatment and control groups are balanced with respect to having a business license. Moreover, Table 1B shows that the treatment and control groups are very similar in observable characteristics, also for the subset of licensed businesses.

Since firms cannot be forced to have an account opened on their behalf, we estimate the Intention-to-Treat (ITT) effect on a given outcome Y. Using subscripts 1 and 2 to respectively capture baseline and endline values, our ANCOVA regression specification is as follows:[31]

$$Y_{i2} = \alpha + \beta' T_i + \gamma' X_{i1} + \zeta' Y_{i1} + \lambda' Controls_{i1} + \Xi_i + \epsilon_i, \tag{2}$$

where Y_{i1} and Y_{i2} respectively denote the baseline and endline values of the dependent variable of interest for business i. Next, T_i is a firm-level dummy variable which is equal to one if enterprise i was assigned to the treatment group. Since the randomization was done after stratifying by sector (pharmacies and restaurants), number of employees and geographic location (district), we follow Bruhn and McKenzie (2009) and include baseline

[31]The ANCOVA specification allows the regression model to determine the structure of the relationship between the baseline and end-line levels of the outcome, rather than imposing it by using differences. ANCOVA regression models of this kind are thus more efficient than difference-in-differences estimators in determining treatment effects with noisy outcome measures (McKenzie (2012a).

number of employees and district dummies represented by the vector X_{i1}. $Controls_{i1}$ is a vector consisting of two variables, *having a Lipa Na M-Pesa account at baseline* and *sales at baseline*. We include these two variables on the right-hand-side to mitigate any biases associated with the slight imbalances for these variables among pharmacies.[32] Finally, Ξ_i is a sector-dummy - with $\Xi_i = 1$ if the firm is a pharmacy and ϵ_i is a firm-level error term. We estimate equation (2) using ordinary least squares and report robust standard errors. When we use multiple outcomes to estimate treatment effects, we also report p-values of the estimates after correcting for multiple hypothesis testing (MHT).[33]

5.2.1 Endline Attrition

Before proceeding with the outcome analysis we present an analysis for endline attrition. Out of the initial 870 licensed businesses in the treatment and control groups, 620 took part of the endline survey – 309 in treatment, and 311 in control.[34] This implies that the endline attrition was 29%. To check whether attrition at endline is non-random, we regress "not having participated in the endline survey" on the treatment dummy as well as on other business characteristics. The estimates reported in Table 4 indicate that assignment to treatment is not significantly related to attrition, implying that endline attrition does not bias our impact estimates for the treatment.[35]

Regarding the other covariates, we observe a slightly higher attrition rate among restaurants than among pharmacies, and also that there is less attrition for establishments that were larger at baseline, experienced more external theft, received mobile loans, and are more likely to have adopted Lipa Na M-Pesa in between the baseline survey and the start of the intervention. However, when we run these regressions by treatment group, we find

[32]In a similar fashion Dupas and Robinson (2013b) include in ITT regressions baseline ROSCA control variables in a study where individuals are encouraged to adopt ROSCA saving instruments. All our impact results - with the exception of that on sales volatility - are robust to not including these two control variables on the right hand-side of the ITT regression equations. Tables OA5-OA9 in Online Appendix present ITT regressions from this robustness analysis.

[33]To correct for MHT, we use Dubey and to Armitage-Parmar approach summarized in Sankoh, Huque, and Dubey (1997). The approach uses a correction procedure that takes into account correlations among outcome variables as well the number outcome variables used to test the hypothesis.

[34]Table OA3 in Online Appendix provides summary statistics for the endline survey.

[35]As remarked by McKenzie (2012b), even if attrition is large but with equal rates for treatment and control groups, both Lee bounds and Behaghel, Crepon, Gurgand, and Le Barbanchon (2015) bounds collapse to a point estimate, and is equivalent to ignoring attrition and assuming the sample that participates in the endline is similar in both treatment and control.

no evidence of heterogeneous attrition by treatment. This implies that those firms from treatment and control groups that are not in our end-line survey share similar observable characteristics.[36]

We thus have 620 firms which we can use to estimate the effect of being assigned to treatment. As shown in Table OA2, take-up of the Lipa Na M-Pesa technology was 31% in the treatment group, and 23% in the control group. Given our usage of the ANCOVA model (equation (2)) and using the 5% significance criterion and a power of 80%, the minimum detectable effects are a 25% increase in sales, a slightly higher than 50% increase in total investments, and an 80% increase in the share of businesses taking out mobile loans. The precise estimates for the above-mentioned minimum detectable effects and also for other potential variables of interest can be found in Table OA10 of Online Appendix.

Table 4 here

5.2.2 Lipa Na M-Pesa Adoption and Usage

We first test to what extent our intervention was successful in stimulating the adoption and usage in the treatment group compared to the control. We do so for various measures of take-up: "actual registration of the Lipa Na technology", "usage of Lipa Na M-Pesa over the last 30 days", "having utilized Lipa Na M-Pesa to receive payments from the customers over the last 30 days", and "sales through Lipa Na M-Pesa over the last 30 days". The results are presented in Table 5A. The coefficients can be interpreted as percentage-point differences in actual take-up between the treatment and the control group (in columns 1-3) or as the percentage increase in take-up itself (in the fourth column).[37]

All four of the adoption measures are significantly higher in the treatment group. About 7 percentage points more businesses in the treatment group ended up having a Lipa Na M-Pesa account by the time of the endline, usage is about 8 percentage points higher among treated businesses, and the same holds for the increase in the propensity to receive payments via the new technology. According to these three measures Lipa Na M-Pesa usage was 30-35% higher in the treatment group compared to the control. As shown in column

[36]The heterogeneous attrition analyses are available upon request.

[37]For presentational purposes, the coefficients of control variables have been omitted from the Table.

4 of Table 5A, the treatment increased monthly sales via Lipa Na M-pesa by 27%, or 32 US$ (or 3256 Ksh). This amount corresponds to 15% of the average sales of an SME from our pooled sample in the endline. Overall, we conclude that our intervention was effective in significantly stimulating the Lipa Na M-Pesa uptake.

Table 5A here

Table 5B shows intention-to-treat (ITT) estimates for a split sample based on merchant's aversion towards financial transparency. Panel A shows the results for transparent firms – those that were willing to disclose their sales figures to the enumerators during the baseline interview – and Panel B for the non-transparent ones. Consistent with the findings reported in Section 5.1, the intervention was especially effective in inducing Lipa Na M-Pesa adoption among the transparent firms. These results indicate that financial transparency concerns might play an important role not only in driving the technology's adoption decision, but also of its subsequent usage.[38] This reveals potentially persistent effects of a preference for opacity in understanding the diffusion of electronic payment products.

Table 5B here

5.2.3 Business Outcomes

In Section 3.3 we hypothesized that Lipa Na M-Pesa usage may affect business outcomes, such us *perceived safety* and *access to finance*. In what follows, we report the results of the ITT regressions to assess the average treatment effect on these outcome variables as well as on sales and investment.

Business Safety

Table 6A presents ITT estimates on the impact of treatment assignment on *perceived safety*, proxied by the endline measure of "feeling more safe when conducting the business operations" - measured on a scale from 1 to 10. On average, the treatment (significantly)

[38]Note that in the baseline interview merchants were first asked to disclose their sales figures, and only then were informed of the possibility of acquiring the cashless payment technology. That means that we can rule out that these results emanate from reversed causality, i.e. the results are not likely to indicate that merchants refuse to share their sales figures because they were not interested in adopting Lipa Na M-Pesa.

increased perceived safety by 3.5%. Given that exposure to the intervention increased Lipa Na M-Pesa usage by about 40%, we document a ToT effect of just below 9% increase in perceived safety. This is an important result as it confirms the role of an electronic money instrument in raising the retail transaction safety among SMEs.

Table 6A here

In order to understand the mechanism behind the increased *perceived safety*, we split the sample by exposure to theft at baseline. Column 1 of Table 6B provides estimates for the sub-sample of firms which reported to have experienced external theft one year before the intervention, while column 2 presents estimates for those which did not experience theft. We show that the effect documented in Table 6A is caused by a substantial increase in perceived safety by firms that had experienced theft six months prior to the intervention. This finding reinforces the relevance of Lipa Na M-Pesa on business safety, as it shows that in areas where using cash is relatively more risky, safety outcome effect is stronger.

Table 6B here

Business Finance

Access to finance is an important driver of business performance. Table 3 already documents that non-banked firms are more likely to adopt Lipa Na M-Pesa. That possibly means that firms considered that having access to mobile loans is one of the advantages of having a Lipa Na M-Pesa account, because Safaricom is not just the provider of M-Pesa products but together with its partner Commercial Bank of Africa also a provider of mobile-loans, *M-Shwari*. Lipa Na M-Pesa allows Safaricom to have access to detailed information on electronic payments made to the firm, which is likely to relax hard information constraints associated with M-Shwari lending and stimulate access to external finance. We test this mechanism in tables 7A and 7B.

Table 7A reports estimates of treatment impact on formal (Panel A) and informal finance (Panel B) for business purposes. For each source of finance we report the impact of treatment assignment on the extensive margin financial inclusion (columns 1 and 3) as

well as on the intensive margin financial deepening (measured in logarithm of the borrowed amount in columns 2 and 4).[39]

A novel source of external finance that we study in Table 7A refers to mobile-loans, which exhibit the following characteristics. The dominant mobile loan provider of the country is the partnership between Safaricom and Commercial Bank of Africa (CBA). Similar to the M-Pesa service, mobile loans are made available to the borrower's mobile phone. Safaricom and CBA charge 7.5% interest on mobile loans, and the rate does not depend on the size of the loan or whether the borrower has Lipa Na M-Pesa or not. However, the loan limit is indeed determined by the history of transactions incurred by the borrower via M-Pesa and in particular through the payments received by the business owner through a Lipa Na M-Pesa account. In this respect, creditworthiness signalled through signing up for Lipa Na M-Pesa and using it in monetary transactions may help borrowers to expand credit limits.[40] Since mobile-loans are typically extended for 30 days, they are utilized to curb short-term fluctuations in business activity - and not so much for long-term investment.

Results in Table 7A show that treatment assignment significantly influenced mobile-loan usage for business purposes at the extensive margin (column 1), and also at the intensive margin (column 2).[41] Both effects are statistically significant at the 5% level and economically large. Both the financial inclusion and financial deepening effects correspond to an increase of 60% compared the control group mean. Interestingly, we do not observe a contraction in any of the other sources of external finance – neither formal nor informal. This implies that the exogenous increase in Lipa Na M-Pesa usage unambiguously increased financial access for the treated businesses.[42]

Table 7A here

Having established that Lipa Na M-pesa increases financial access, we proceed with understanding the mechanism behind this result by studying heterogeneous treatment effects

[39]Since we take log of 1+x, the interpretation of the intensive margin also includes the extensive margin.

[40]This information is highlighted on several Kenyan mobile banking web-sites, such as https://techstuffkenya.com.

[41]Intensive margin loan amounts - across different types of loans - are winsorized at 5% level.

[42]As shown in Online Appendix Tables OA6-OA9, the economically and statistically significant treatment effects on safety and access to finance remain when we exclude the two RHS variables, baseline LPN M-Pesa account and sales.

with respect to business size. If Lipa Na M-Pesa use is resolving financial opacity and implied hard information constraints, we should expect that the increase of mobile loans is bigger among small-scale establishments. We classify a business as small if its baseline number of employees is smaller than the median number of employees in the respective sector and study heterogenous treatment effects with respect to business size.[43]

Table 7B shows that the business size is an important factor affecting the mechanism via which the treatment affects financial connectedness. Specifically, as indicated by the positive and significant interaction terms associated with "Small x Treated" in Panel A, the treatment increased the probability of receiving a loan as well as the size of the loan for small firms more than for relatively larger firms: "Small x Treated" has a statistically significant effect on having a mobile loan at the 1% level, while the intensive margin effect on mobile loan size is statistically significant at the 5% level.[44]

This differential impact is consistent with the literature arguing that smaller establishments are likely to suffer from credit market exclusion because of financial opacity. For instance, the literature on relationship lending suggests that extending loans to small and non-transparent businesses requires the build-up of soft information and trust and therefore necessitates formation of long-term bank-firm relations,[45] or alternatively close monitoring of financial operations.[46] What we propose here is that an electronic payment technology, such as *Lipa Na M-Pesa*, could induce transparency, help to prove creditworthiness and thereby allow for fast and low-cost access to external finance - to compensate short-term liquidity needs.

Another interesting piece of evidence we derive from Table 7B is that our treatment also stimulated small businesses' informal finance, such as trade credit and loans from informal financial networks. Although coefficient estimates are not very significant, we see that at both extensive and intensive margins there is an overall increase in access to informal finance among treated small businesses. This result echoes the findings in the literature

[43] In the baseline median business size is 3 employees for pharmacies and 5 employees for restaurants.

[44] In all heterogeneous treatment regressions we include the dummy variable "Small" on the RHS.

[45] See Petersen and Rajan (1994), Berger and Udell (1995), Degryse and Cayseele (2000), and Beck, De Haas, Degryse and v. Horen (2018).

[46] Norden and Weber (2010) show how checking account activity and credit line usage could help bankers to monitor borrowers.

that suggest that access to formal loans (such as mobile loans in our analysis) could work as a signalling device for creditworthiness and enhance access to informal loans as well.[47]

Table 7B here

Business Sales

What is the impact of Lipa Na M-Pesa on business sales? As shown in the first column of Table 8, our treatment did not have a statistically significant impact on the overall level of sales. This outcome is unsurprising for two reasons. First, if the real performance effect of Lipa Na M-Pesa works via improved financial integration (especially by mobile loans), then this effect is expected to be relatively more present for small businesses and not so much for medium-sized establishments. Indeed in column 2 of Table 8 we observe a positive coefficient estimate for "Small x Treated" - though insignificant - in an ITT regression with sales, a finding that is consistent with what we observed in Table 7B.

Second, and more importantly, mobile loans are much more likely to help coping with cyclical shocks, such as inventory shortages, and hence with "production smoothing". As stated before, Safaricom's mobile loans are designed to cope with short-term liquidity needs and are not likely to be associated with long-term capital investments aimed at business expansion. In columns 4 and 6 of Table 8 we find evidence in support of this argument. Measuring sales volatility by the difference between the log maximum and log minimum sales over the past 12 month period (i.e., $ln(Sales_{max}) - ln(Sales_{min})$), we find that our treatment resulted in a significant reduction in volatility for small businesses.[48]

Table 8 here

The sales smoothing induced by our Lipa Na M-Pesa treatment complements the findings by Jack and Suri (2014), who show that the standard M-Pesa product smooths household consumption by allowing easy access to liquidity whenever liquid funds are needed.

[47]Such complementarities are highlighted, among others, in Demirguc-Kunt and Maksimovic (2001), Burkart and Ellingsen (2004) and Burkart, Ellingsen and Giannetti (2011).

[48]Since we have a limited number of businesses in column (3) because of missing baseline values for sales volatility, in columns 5 and 6 in Table 8 we provide a robustness check and test the sensitivity of our findings with respect to replacing those missing values using average monthly sales data.

Our research shows that an analogous effect exists for SMEs, where the cashless payment technology improves financial access and reduces sales volatility.

In addition, in Table 9 we present the impact of our treatment on total investment and the inventory investment component of total investment. Although both "Treatment" and "Small x Treated" have positive coefficient estimates for the impact of total investments (see columns 1 and 2), none of them is statistically significant. Hence, total investment, a potential determinant of overall business growth in the long-run, is not significantly affected by our treatment.

Finally, given our findings on reduced sales volatility, we study whether inventory investment increases with our treatment, specially for small firms.[49] Though the regression coefficient estimate associated with "Small x Treated" is positive and goes in the right direction (see column 4), it is not statistically significant (MHT corrected p-value of 0.21).

Table 9 here

6 Conclusion

We report the results of a field experiment aimed at (i) uncovering the factors affecting the decision to adopt a novel P2B mobile-money payment technology for small- and medium-sized merchants in Nairobi, and (ii) estimating the impact of using this technology on business outcomes. We find causal evidence that seemingly small situational barriers to adoption are decisive for the adoption of this instrument. Providing information about the product and eliminating the paperwork to open an account was enough to significantly increase the interest to adopt the technology. A second key result is that financial transparency concerns of the business owner persistently affect adoption and usage of the payment technology.

On impact, we find that treated firms feel safer and have more mobile loans sixteen months after the intervention. The impact on mobile-loan usage is especially pronounced for small-size establishments, which also experience a reduction in their sales volatility.

[49] Eichenbaum (1988) and Dynan, Elmendorf and Sichel (2006) provide theoretical and empirical arguments for the role of inventory investment in absorbing production shocks and smoothing sales over the business cycle.

We thus conclude that because it discourages the adoption of e-payments, transparency aversion is likely to be an important impediment for economic growth. Financial regulators and designers of financial instruments might need to pay attention to this novel empirical finding. Our recommendation to regulators and advocates of payment instruments is to emphasize the *benefits* of financial transparency when promoting e-payments to SMEs, which might be the most prone to non-transparent (and informal) business transactions.

We believe that the results of this study are generalizable to a wide range of settings, and especially in the context of developing countries, because we studied the adoption of a mainstream e-payment product provided by a large intermediary connecting "payment" and "lending" means of financial services spectrum. Also, we conducted this research with SMEs nearby a major urban area (Nairobi) of a fast growing developing country (Kenya). Therefore, our findings are relevant for researchers and policy makers across the globe interested in promoting both cashless transformations and financial access.

Our paper opens new avenues for future research. First, while we show that information, know-how and transaction costs are together important barriers for the adoption of the technology, it would be relevant to disentangle the relative importance of each of these three barriers. Second, we show that one explicit barrier to adopt the technology is having a business license. This paper highlights that remaining unlicensed comes with an additional cost of remaining out of the mobile credit market. A study of the preferences and potential barriers for SMEs to get a license would be an important contribution, also in light of the benefits highlighted in this paper. Third, from this research, we learn that there is some discrepancy between willingness to adopt the technology and actual adoption. Low statistical power resulting from our data does not allow us to perform an analysis to understand the main reasons of such discrepancy. We believe this is also a promising area to be explored in future research.

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Table 1A: Businesses Characteristics and Balance Test: Full Sample

	All (1)	Control (2)	Treatment (3)	Diff. (4)
Standard Mobile Money Use				
Use Mobile Money for business purposes (Yes=1; No=0)	0.51	0.49	0.53	-0.04
Use Mobile Money to receive payments (Yes=1; No=0)	0.33	0.30	0.36	-0.05*
Use Mobile Money to store money (Yes=1; No=0)	0.18	0.18	0.17	0.01
Use Mobile Money to pay bills (Yes=1; No=0)	0.32	0.32	0.32	0.01
Use Mobile Money to pay salaries (Yes=1; No=0)	0.06	0.05	0.06	-0.02
Use Mobile Money to pay inputs (Yes=1; No=0)	0.38	0.37	0.38	-0.01
Awareness of Lipa Na M-Pesa and Reasons for not Having an Account				
The business is aware of Lipa Na M-Pesa (Yes=1; No=0)	0.95	0.95	0.96	-0.00
The business has Lipa Na M-Pesa (Yes=1; No=0)	0.09	0.07	0.10	-0.03
The business does not see the benefits of Lipa Na M-Pesa (Yes=1; No=0)	0.26	0.27	0.25	0.02
The cost of opening a Lipa Na M-Pesa account is too high (Yes=1; No=0)	0.11	0.11	0.11	-0.00
The transaction fees via Lipa Na M-pesa are too high (Yes=1; No=0)	0.16	0.16	0.16	-0.00
The business owner does not have time to open an account (Yes=1; No=0)	0.12	0.12	0.11	0.01
Lipa Na M-Pesa would not increase sales (Yes=1; No=0)	0.08	0.07	0.08	-0.01
The business owner does not trust the mobile money provider (Yes=1; No=0)	0.02	0.02	0.03	-0.00
Lipa Na M-Pesa is too complex to use (Yes=1; No=0)	0.10	0.09	0.11	-0.02
Business Size				
Monthly Sales, in 1000 Ksh. (log-winsorized 5%)	5.04	5.00	5.07	-0.06
Monthly Profits, in 1000 Ksh. (log-winsorized 5%)	3.85	3.81	3.89	-0.08
Number of Employees (log)	1.44	1.44	1.44	-0.00
Investment and Access to Finance				
Investment in the past 6 months (Yes=1; No=0)	0.29	0.30	0.28	0.02
Bank loan in the past 12 months (Yes=1; No=0)	0.10	0.09	0.11	-0.02
Informal loan in the past 12 months (Yes=1; No=0)	0.04	0.03	0.04	-0.00
Mobile loan in the past 12 months (Yes=1; No=0)	0.10	0.10	0.11	-0.01
Informality				
The business has a business license (Yes=1; No=0)	0.72	0.72	0.72	0.00

Notes: This table presents summary statistics for the baseline survey data of the full sample of restaurants and pharmacies. Columns 1, 2 and 3 show mean values for the full sample, control group, and treatment group respectively. Column 4 presents p-values for equality of means tests between treatment and control groups (* p<0.1. ** p<0.05. *** p<0.01). *Monthly Sales* is the log of the total revenues in the past month; *Monthly Profits* is the log of the total income earned in the past month after paying all expenses; *Number of Employees* is the log of the total number of employees plus the owner; *Investment* is the total capital invested for business purposes; *Bank Loans = 1* if the business ever received a new loan from a commercial bank, SACCO, or other formal financial institution in the last 12 months; *Informal Loans = 1* if the the business borrowed money from any business association, moneylender, family or friend in the last 12 months; *Mobile loan = 1* if the business or business owners borrowed money from Mobile Microfinance sources like KCB -Mpesa, M-Kesha, M-Shwari over the last 12 months. The other variables are self-explanatory.

Table 1B: Business Characteristics and Balance Test: Sub-sample of Merchants with Business License

	All (1)	Control (2)	Treatment (3)	Diff. (4)
Standard Mobile Money Use				
Use Mobile Money for business purposes (Yes=1; No=0)	0.52	0.49	0.55	-0.06*
Use Mobile Money to receive payments (Yes=1; No=0)	0.35	0.3	0.4	-0.1***
Use Mobile Money to store money (Yes=1; No=0)	0.15	0.16	0.14	0.01
Use Mobile Money to pay bills (Yes=1; No=0)	0.35	0.33	0.38	-0.05
Use Mobile Money to pay salaries (Yes=1; No=0)	0.06	0.04	0.08	-0.03**
Use Mobile Money to pay inputs (Yes=1; No=0)	0.39	0.38	0.41	-0.02
Awareness of Lipa Na M-Pesa and Reasons for not Having an Account				
The business is aware of Lipa Na M-Pesa (Yes=1; No=0)	0.97	0.97	0.96	0.01
The business has Lipa Na M-Pesa (Yes=1; No=0)	0.11	0.1	0.12	-0.02
The business does not see the benefits of Lipa Na M-Pesa (Yes=1; No=0)	0.25	0.26	0.24	0.02
The cost of opening a Lipa Na M-Pesa account is too high (Yes=1; No=0)	0.13	0.13	0.13	-0.01
The transaction fees via Lipa Na M-pesa are too high (Yes=1; No=0)	0.20	0.20	0.20	0.0
The business owner does not have time to open an account (Yes=1; No=0)	0.12	0.13	0.11	0.02
Lipa Na M-Pesa would not increase sales (Yes=1; No=0)	0.09	0.07	0.1	-0.03
The business owner does not trust the mobile money provider (Yes=1; No=0)	0.03	0.03	0.03	0
Lipa Na M-Pesa is too complex to use (Yes=1; No=0)	0.1	0.09	0.11	-0.02
Business Size				
Monthly Sales, in 1000 Ksh. (log-winsorized 5%)	5.12	5.1	5.14	-0.04
Monthly Profits, in 1000 Ksh. (log-winsorized 5%)	3.99	3.95	4.03	-0.09
Number of Employees (log)	1.45	1.44	1.45	-0.01
Investment and Access to Finance				
Investment in the past 6 months (Yes=1; No=0)	0.29	0.3	0.28	0.02
Bank loan in the past 12 months (Yes=1; No=0)	0.08	0.07	0.1	-0.02
Informal loan in the past 12 months (Yes=1; No=0)	0.04	0.04	0.03	0
Mobile loan in the past 12 months (Yes=1; No=0)	0.09	0.08	0.09	-0.01
Informality				
The business has a business license (Yes=1; No=0)	1	1	1	0

Notes: This table presents summary statistics for the baseline survey data of the sub-sample of restaurants and pharmacies with business license. Columns 1 present mean, column 2 provides average values for the control group and column 3 for the treatment group. Column 4 presents p-values for equality of means tests between treatment and control groups (* p<0.1. ** p<0.05. *** p<0.01). See Table 1A notes for a description of the variables.

Table 2: Characteristics of Businesses Assigned to Treatment by Willingness to Open an Account

	Pharmacies			Restaurants		
	Willing to open an account			Willing to open an account		
	No	Yes	Diff.	No	Yes	Diff.
Standard Mobile Money Use						
Use Mobile Money for business purposes (Yes=1; No=0)	0.41	0.48	-0.07	0.52	0.68	-0.17***
Use Mobile Money to receive payments (Yes=1; No=0)	0.26	0.35	-0.09	0.33	0.48	-0.15***
Use Mobile Money to store money (Yes=1; No=0))	0.08	0.15	-0.07	0.17	0.29	-0.12***
Use Mobile Money to pay bills (Yes=1; No=0)	0.27	0.28	-0.01	0.31	0.38	-0.07
Use Mobile Money to pay salaries (Yes=1; No=0)	0.06	0.07	-0.02	0.06	0.07	-0.01
Use Mobile Money to pay inputs (Yes=1; No=0)	0.28	0.35	-0.07	0.35	0.52	-0.17***
Awareness of Lipa Na M-Pesa and Reasons for not Having an Account						
The business is aware of Lipa Na M-Pesa (Yes=1; No=0)	0.93	0.96	-0.04	0.98	0.97	0.01
The business does not see the benefits of Lipa Na M-Pesa (Yes=1; No=0)	0.30	0.13	0.16**	0.31	0.18	0.13***
The cost of opening a Lipa Na M-Pesa account is too high (Yes=1; No=0)	0.19	0.08	0.11*	0.05	0.05	0.00
The transaction fees via Lipa Na M-pesa are too high (Yes=1; No=0)	0.27	0.13	0.14**	0.10	0.09	0.00
The business owner does not have time to open an account (Yes=1; No=0)	0.06	0.13	-0.08**	0.07	0.21	-0.14***
Lipa Na M-Pesa Would not increase sales (Yes=1; No=0)	0.13	0.06	0.07	0.11	0.03	0.08***
The business owner does not trust the mobile money provider (Yes=1; No=0)	0.05	0.00	0.05*	0.03	0.01	0.02
Lipa Na M-Pesa is too complex to use (Yes=1; No=0)	0.08	0.12	-0.04	0.15	0.12	0.03
Business Size						
Monthly Sales, in 1000 Ksh. (log-winsorized 5%)	4.75	4.75	0.00	5.30	5.34	-0.04
Monthly Profits, in 1000 Ksh. (log-winsorized 5%)	3.81	3.90	-0.08	3.95	3.94	0.01
Number of Employees (log)	1.18	1.23	-0.04	1.67	1.62	0.06
Investment and Access to Finance						
Investment in the past 6 months (Yes=1; No=0)	0.19	0.24	-0.06	0.28	0.39	-0.11*
Bank loan in the past 12 months (Yes=1; No=0)	0.06	0.06	0.01	0.13	0.16	-0.03
Informal loan in the past 12 months (Yes=1; No=0)	0.02	0.02	0.00	0.06	0.04	0.02
Mobile loan in the past 12 months (Yes=1; No=0)	0.09	0.08	0.01	0.11	0.14	-0.02
Informality						
The business has a business license (Yes=1; No=0)	0.92	0.86	0.06	0.52	0.60	-0.07

Notes: This table compares businesses who answer YES to our offer to open an account of their behalf with those who answered NO. We report mean values for each business characteristic. Columns 3 and Columns 6 presents p-values for equality of means tests between businesses who want to open an account and those who do not want (* p<0.1. ** p<0.05. *** p<0.01). See Table 1A notes for a description of the variables.

Table 3A: Willingness to Open a Lipa Na M-Pesa Account: **All Businesses** Assigned to Treatment

	Variable	(1)		(2)		(3)	
		Coeff.	s.e.	Coeff.	s.e.	Coeff.	s.e.
Panel A: Standard M-Money Use	For business	0.141***	(0.044)				
	To receive payments			0.094*	(0.053)		
	To store money			0.093	(0.064)		
	To pay bills			-0.073	(0.057)		
	To pay inputs			0.123**	(0.056)		
	To pay salaries			-0.025	(0.092)		
	To save					-0.048	(0.074)
	% of utility exp. via m-money					-0.067	(0.056)
	% of input exp. via m-money					0.237***	(0.078)
	Paying wages via m-money					-0.030	(0.118)
	No increase in prices					0.201***	(0.061)
Panel B: Safety	Theft and safety	0.028	(0.024)				
	Internal theft			0.012	(0.054)	-0.007	(0.062)
	External theft			0.040	(0.079)	0.082	(0.080)
	Feeling not safe			0.008	(0.012)	0.009	(0.014)
Panel C: Saving Behavior	Savings in a bank or microfinance institution	-0.032	(0.048)				
	Savings in a personal bank account			0.029	(0.048)	0.034	(0.054)
	Savings in a business bank account			-0.189***	(0.068)	-0.195***	(0.075)
	Saving at a microfinance institution			-0.031	(0.122)	0.036	(0.137)
Panel D: Transparency	Not shared sales	-0.134*	(0.068)	-0.150**	(0.069)		
	Not shared profits					-0.214***	(0.074)
	Business license	0.042	(0.054)	0.034	(0.058)	0.089	(0.067)
	Financial Sophistication	0.021	(0.020)				
	Bank loan			0.054	(0.061)	-0.026	(0.072)
	Mobile loan			0.022	(0.075)	0.060	(0.080)
	Business records			0.083	(0.064)	0.070	(0.072)
	Sells on credit to customers	0.058	(0.042)	0.048	(0.041)	0.057	(0.046)
Panel E: Behavioral Factors	Present bias	0.025	(0.072)	0.054	(0.069)	0.046	(0.078)
	Future bias	-0.021	(0.054)	-0.000	(0.055)	-0.023	(0.057)
	Cognitive ability	0.030*	(0.017)	0.028*	(0.017)	0.039**	(0.020)
	Trust in first time	-0.024	(0.025)	-0.037	(0.025)	-0.016	(0.029)
	Trust in customers	0.018	(0.035)	0.020	(0.034)	0.009	(0.037)
	Trust in courts	-0.044*	(0.026)	-0.035	(0.028)	-0.049*	(0.029)
	Trust in mobile money company	0.042	(0.035)	0.042	(0.035)	0.029	(0.038)
Panel F: Business size	Employees (log)	0.048	(0.069)	0.097	(0.069)		
	Monthly Sales, in 1000 Ksh. (log-winsorized 5%)	0.037	(0.030)	0.056*	(0.029)		
	Monthly Profits, in 1000 Ksh. (log-winsorized 5%)					0.024	(0.031)
Enumerator, district and business type FE		Yes		Yes		Yes	
Observations		493		490		394	
R-squared		0.285		0.316		0.351	

Notes: This table shows coefficient estimates and robust standard errors (in parenthesis) resulting from estimating the following equation: $Y_i = \beta_0 + X_i^{'}\beta_1 + \epsilon_i$, where Y_i is a dummy equals to 1 if business i answered YES to our offer to open a Lipa Na M-Pesa account, and equals zero otherwise. X_i is a vector of co-variates grouped in different categories labelled in each panel. This table pools both restaurants and pharmacies. A description of each co-variate can be found in the Appendix, Tables OA1 and OA2. We report robust standard errors in parentheses. * p<0.1. ** p<0.05. *** p<0.01.

Table 3B: Willingness to Open a Lipa Na M-Pesa Account: **Restaurants** Assigned to Treatment

	Variable	(1)		(2)		(3)	
		Coeff.	s.e.	Coeff.	s.e.	Coeff.	s.e.
Panel A: Standard M-Money Use	For business	0.163**	(0.065)				
	To receive payments			0.050	(0.074)		
	To store money			0.038	(0.082)		
	To pay bills			-0.038	(0.074)		
	To pay inputs			0.198**	(0.079)		
	To pay salaries			-0.069	(0.122)		
	To save					-0.053	(0.095)
	% of utility exp. via m-money					0.029	(0.077)
	% of input exp. via m-money					0.241**	(0.099)
	Paying wages via m-money					-0.054	(0.184)
	No increase in prices					0.154**	(0.078)
Panel B: Safety	Theft and safety	0.029	(0.031)				
	Internal theft			0.029	(0.062)	0.012	(0.077)
	External theft			-0.017	(0.095)	0.042	(0.099)
	Feeling not safe			0.004	(0.017)	-0.000	(0.021)
Panel C: Saving Behavior	Savings in bank or microfinance institution	0.032	(0.067)				
	Savings in a personal bank account			0.077	(0.070)	0.122	(0.081)
	Savings in a business bank account			-0.121	(0.105)	-0.094	(0.120)
	Savings in a microfinance institution			-0.033	(0.122)	0.041	(0.173)
Panel D: Transparency	Not shared sales	-0.106	(0.128)	-0.083	(0.131)		
	Not shared profits					-0.164	(0.177)
	Business license	0.017	(0.063)	0.011	(0.071)	0.064	(0.083)
	Financial Sophistication	0.022	(0.025)				
	Bank loan			0.017	(0.081)	-0.056	(0.102)
	Mobile loan			0.064	(0.095)	0.165	(0.116)
	Business records			0.074	(0.080)	0.045	(0.093)
	Sells on credit to customers	0.093	(0.061)	0.099	(0.062)	0.082	(0.071)
Panel E: Behavioral Factors	Present bias	-0.020	(0.106)	0.015	(0.100)	0.049	(0.115)
	Future bias	0.095	(0.077)	0.113	(0.079)	0.098	(0.092)
	Cognitive ability	0.021	(0.024)	0.025	(0.024)	0.034	(0.028)
	Trust in first time	-0.048	(0.039)	-0.069*	(0.039)	-0.042	(0.048)
	Trust in customers	0.072	(0.047)	0.061	(0.048)	0.040	(0.057)
	Trust in courts	-0.060	(0.037)	-0.052	(0.039)	-0.063	(0.045)
	Trust in mobile money companies	-0.015	(0.051)	-0.010	(0.054)	-0.036	(0.059)
Panel F: Business size	Employees (log)	0.044	(0.085)	0.087	(0.086)		
	Monthly Sales, in 1000 Ksh. (log-winsorized 5%)	0.062	(0.040)	0.057	(0.040)		
	Monthly Profits, in 1000 Ksh. (log-winsorized 5%)					0.018	(0.041)
Enumerator and district FE		Yes		Yes		Yes	
Observations		277		276		216	
R-squared		0.213		0.249		0.282	

Notes: This table runs same specifications described in Table 3A but with the sub-sample of restaurants only. * p<0.1. ** p<0.05. *** p<0.01.

Table 3C: Willingness to Open a Lipa Na M-Pesa Account: **Pharmacies** Assigned to Treatment

	Variable	(1)		(2)		(3)	
Panel A: Standard M-Money Use	For business	0.115*	(0.059)				
	To receive payments			0.132	(0.084)		
	To store money			0.167	(0.144)		
	To pay bills			-0.057	(0.094)		
	To pay input			0.053	(0.091)		
	To pay salaries			0.095	(0.174)		
	To save					-0.229**	(0.088)
	% of utility exp. via m-money					-0.155*	(0.082)
	% of input exp. via m-money					0.161	(0.138)
	Paying wages via m-money					0.073	(0.201)
	No increase in prices					0.225**	(0.113)
Panel B: Safety	Theft and safety	0.021	(0.043)				
	Internal theft			-0.022	(0.124)	-0.078	(0.129)
	External theft			0.179	(0.171)	0.039	(0.150)
	Feeling not safe			0.005	(0.020)	0.035	(0.023)
Panel C: Saving Behavior	Savings in a bank or microfinance institution	-0.105	(0.075)				
	Savings in a personal bank account			-0.038	(0.080)	-0.040	(0.085)
	Savings in a business bank account			-0.237**	(0.091)	-0.192*	(0.106)
	Saving at a microfinance institution			-0.097	(0.212)	-0.099	(0.187)
Panel D: Transparency	Not shared sales	-0.173**	(0.083)	-0.221**	(0.089)		
	Not shared profits					-0.261***	(0.086)
	Business license	-0.022	(0.134)	-0.016	(0.140)	0.080	(0.168)
	Financial Sophistication	0.034	(0.038)				
	Bank loan			0.098	(0.127)	0.028	(0.121)
	Mobile loan			0.017	(0.150)	-0.126	(0.123)
	Business records			0.172**	(0.083)	0.199	(0.130)
	Sells on credit to customers	0.008	(0.061)	-0.008	(0.061)	0.038	(0.068)
Panel E: Behavioral Factors	Present bias	0.088	(0.124)	0.082	(0.119)	0.065	(0.135)
	Future bias	-0.199***	(0.075)	-0.182**	(0.079)	-0.164**	(0.076)
	Cognitive ability	0.045	(0.028)	0.040	(0.028)	0.058*	(0.031)
	Trust in first time	-0.014	(0.036)	-0.011	(0.038)	-0.010	(0.039)
	Trust in customers	-0.073	(0.063)	-0.057	(0.062)	-0.072	(0.060)
	Trust in courts	-0.036	(0.042)	-0.029	(0.044)	-0.058	(0.045)
	Trust in mobile money company	0.100*	(0.051)	0.094*	(0.052)	0.106**	(0.053)
Panel F: Business size	Employees (log)	0.134	(0.131)	0.182	(0.133)		
	Monthly Sales, in 1000 Ksh. (log-winsorized 5%)	0.026	(0.050)	0.063	(0.051)		
	Monthly Profits, in 1000 Ksh. (log-winsorized 5%)					0.064	(0.061)
Enumerator and district FE		Yes		Yes		Yes	
Observations		216		214		178	
R-squared		0.168		0.218		0.288	

Notes: This table runs same specifications described in Table 3A but with the sub-sample of pharmacies only. * p<0.1. ** p<0.05. *** p<0.01.

Table 4: Business Attrition

Baseline characteristics	(1) coef	(2) se	(3) coef	(4) se
Assigned Treatment	-0.012	(0.031)	-0.010	(0.031)
Pharmacy	-0.018	(0.031)	-0.145***	(0.044)
Has Lipa Na M-pesa account			-0.129***	(0.049)
Saves in mobile money			-0.032	(0.062)
Pays % of utility exp. via m-money			-0.029	(0.038)
% of input exp. via stand. m-money			-0.002	(0.022)
Paying wages via m-money			0.036	(0.034)
Internal theft			-0.007	(0.044)
External theft			-0.117**	(0.053)
Feeling safe			0.001	(0.009)
Saving at a pers. bank acc.			-0.059	(0.036)
Saving at a bus. bank acc.			0.014	(0.040)
Saving at a microf. inst.			0.030	(0.124)
Bank loan			0.004	(0.058)
Mobile loan			-0.100*	(0.052)
Business records			-0.102	(0.074)
Present bias			-0.050	(0.050)
Future bias			-0.069	(0.044)
Cognitive ability			-0.007	(0.012)
Trust in first time			0.030	(0.020)
Trust in customers			0.028	(0.027)
Trust in courts			0.027	(0.018)
Trust in m-money comp.			-0.033	(0.024)
# of Employees (log)			-0.136***	(0.036)
Constant	0.304***	(0.028)	0.677***	(0.174)
Observations	870		855	
R-squared	0.001		0.075	

Notes: This table shows results on the relationship between business attrition at endline and baseline business characteristics. The sample consists of businesses with a business license by the time of the baseline. We estimate $Y_i = \beta_0 + X_i^{'}\beta_1 + \epsilon_i$ through OLS for all specifications where Y_i equals 1 if business i did not participate in the endline survey. X_i is the vector of co-variates listed in column 3. we replace missing values of the co-variates with median values and control for the missing values with dummy variables. We report robust standard errors in parentheses. * p<0.1. ** p<0.05. *** p<0.01.

Table 5A: ITT Estimates for Lipa Na M-Pesa Usage

	(1)	(2)	(3)	(4)
	Opened LPN (0/1)	Used LPN (0/1)	Received payment via LPN (0/1)	LPN sales, log(1+x)
Treatment	0.07**	0.08**	0.08**	0.27**
	(0.03)	(0.03)	(0.03)	(0.11)
	[0.12]	[0.04]	[0.04]	[0.04]
Control Mean	0.23	0.21	0.20	0.63
Control StDev	0.42	0.40	0.40	1.43
N	619	618	618	618

Notes: This table shows the ITT estimates for Lipa Na M-Pesa use indicators. Dependent variables are having Lipa Na M-pesa account (0/1), using Lipa Na M-pesa for business purposes in the past 30 days, receiving payment via Lipa Na M-pesa in the past 30 days and Lipa Na M-pesa sales (log(1+x)). Control Vector in each ITT regressions are: baseline value of ln(sales-winsorized), not reporting sales in baseline, use of LPN in baseline and stratification controls. * p<0.1. ** p<0.05. *** p<0.01. p-values after correction for multiple hypothesis-testing are reported in brackets.

Table 5B: Lipa Na M-Pesa Usage for Transparent and Non-transparent Businesses

	(1)	(2)	(3)	(4)
Panel A: Transparent firms: shared sales figures in the baseline				
	Opened LPN (0/1)	Used LPN (0/1)	Received payment via LPN (0/1)	LPN sales log(1+x)
Treatment	0.08**	0.09**	0.09**	0.32**
	(0.04)	(0.04)	(0.04)	(0.12)
	[0.15]	[0.05]	[0.04]	[0.03]
Contol Mean	0.24	0.21	0.21	0.65
Contol StDev	0.43	0.41	0.22	1.45
N	488	487	487	487
Panel B: Non-transparent firms: did not share sales figures in the baseline				
	Opened LPN (0/1)	Used LPN (0/1)	Received payment via LPN (0/1)	LPN sales, log(1+x)
Treatment	0.01	0.02	0.02	0.02
	(0.08)	(0.07)	(0.07)	(0.24)
	[1.00]	[1.00]	[1.00]	[1.00]
Control Mean	0.19	0.18	0.18	0.58
Contol StDev	0.40	0.39	0.39	1.35
N	131	131	131	131

Notes: This table shows the ITT estimates for Lipa Na use indicators separately for the sub-samples of transparent and non-transparent firms. Dependent variables are having Lipa Na M-pesa account (0/1), using Lipa Na M-pesa account for business in the past 30 days, receiving payment via Lipa Na M-pesa in the past 30 days, and Lipa Na M-pesa sales (log(1+x)). Control Vector in each ITT regression: Baseline value of ln(sales-winsorized), not reporting sales in baseline, use of LPN in baseline and stratification controls. * p<0.1. ** p<0.05. *** p<0.01. p-values after correction for multiple hypothesis-testing are reported in brackets.

Table 6A: Business Safety

	Feeling safe
Treatment	0.24*
	(0.14)
Control Mean	6.88
Control StDev	1.84
N	619

Notes: This table shows the ITT estimates for business safety feeling (1 not feel safe - 10 feel safe). Control Vector: Baseline values of safety and ln(sales-winsorized), not reporting sales in baseline, use of LPN in baseline and stratification controls. * p<0.1. ** p<0.05. *** p<0.01.

Table 6B: Business Safety and Theft Exposure

	(1)	(2)
	Theft in Baseline	No Theft in Baseline
	Feeling safe	Feeling Safe
Treatment	1.16***	0.17
	(0.47)	(0.15)
Control Mean	6.36	6.96
Control StDev	1.95	1.82
N	75	543

Notes: This table shows the ITT estimates for business safety feeling (1 not feel safe - 10 feel safe) for sub-samples of firms based on theft exposure in the baseline. The first column reports the coefficient estimate for the sub-sample of businesses which reported in the baseline that they were exposed to external theft - over the last 12 months - and the second column for those which did not report any external theft in the baseline. Control Vector: Baseline values of safety and ln(sales-winsorized), not reporting sales in baseline, use of LPN in baseline and stratification controls. * p<0.1. ** p<0.05. *** p<0.01.

Table 7A: Business Finance

	(1)	(2)	(3)	(4)
Panel A: External finance (Formal)				
	Mobile loans (Yes/No)	Mobile loans (ln(Amount))	Bank loans (Yes/No)	Bank loans (ln(Amount))
Treatment	0.06**	0.47**	0.01	0.07
	(0.03)	(0.23)	(0.02)	(0.25)
	[0.07]	[0.06]	[0.67]	[0.89]
Control Group Mean	0.10	0.74	0.08	0.84
Control Group StDev	0.30	2.35	0.26	2.86
N	612	581	609	580
Panel B: External finance (Informal)				
	Trade credit (Yes/No)	Trade credit (ln(Amount))	Informal Loan (Yes/No)	Informal Loan (ln(Amount))
Treatment	-0.03	-0.46	0.01	-0.02
	(0.04)	(0.38)	(0.02)	(0.10)
	[0.54]	[0.31]	[0.87]	[0.86]
Control Group Mean	0.35	3.17	0.05	0.15
Control Group StDev	0.48	4.71	0.22	1.12
N	619	555	576	575

Notes: This table shows the ITT estimates for financial access outcomes, where ln(Amount) refers to the log of winsorized loan amounts. Control Vector: Baseline values of the outcome variable and ln(sales-winsorized), not reporting sales in baseline, use of LPN in baseline and stratification controls. * p<0.1. ** p<0.05. *** p<0.01. p-values after correction for multiple hypothesis-testing are reported in brackets.

Table 7B: Heterogeneous Treatment Effects for Business Finance

	(1)	(2)	(3)	(4)
Panel A: External finance (Formal)				
	Mobile loans (Yes/No)	Mobile loans (ln(Amount))	Bank loans (Yes/No)	Bank loans (ln(Amount))
Treatment	0.04	0.38	0.01	0.08
	(0.03)	(0.23)	(0.02)	(0.26)
	[0.22]	[0.16]	[0.68]	[0.88]
Small x Treated	0.28***	1.86**	-0.01	-0.27
	(0.11)	(0.92)	(0.11)	(0.91)
	[0.02]	[0.07]	[1.00]	[0.98]
Control Group Mean	0.10	0.74	0.08	0.84
Control Group StDev	0.30	2.35	0.26	2.86
N	612	581	609	580
Panel B: External finance (Informal)				
	Trade credit (Yes/No)	Trade credit (ln(Amount))	Informal Loan (Yes/No)	Informal Loan (ln(Amount))
Treatment	-0.04	-0.53	0.00	-0.08
	(0.04)	(0.39)	(0.02)	(0.09)
	[0.46]	[0.22]	[0.89]	[0.47]
Small x Treated	0.12	1.48	0.18*	1.03
	(0.16)	(1.60)	(0.10)	(0.69)
	[0.57]	[0.43]	[0.08]	[0.17]
Control Group Mean	0.35	3.17	0.05	0.15
Control Group StDev	0.48	4.71	0.22	1.12
N	619	555	576	575

Notes: This table shows the ITT estimates with heterogeneous treatment effects for financial access outcomes, where ln(Amount) refers to the log of winsorized loan amounts. A firm is classified as small in a respective sector if in the baseline it has # Employees<Median(# Employees). "Small x Treated" is the interaction between being a small-firm in the baseline and being assigned to the treatment group. Control Vector: Baseline values of the outcome variable and ln(sales-winsorized), a dummy for being a "small" business, not reporting sales in baseline, use of LPN in baseline and stratification controls. * p<0.1. ** p<0.05. *** p<0.01. p-values after correction for multiple hypothesis-testing are reported in brackets.

Table 8: Heterogenous Treatment Effects for Business Sales

	(1)	(2)	(3)	(4)	(5)	(6)
	ln(Sales)	ln(Sales)	Sales Volatility	Sales Volatility	Sales Volatility [robust]	Sales Volatility [robust]
Treatment	-0.03	-0.02	0.00	0.001	0.000	0.002
	(0.07)	(0.08)	(0.052)	(0.05)	(0.004)	(0.004)
	[0.69]	[0.69]	[0.80]	[0.90]	[0.98]	[0.67]
Small x Treated		0.14		-0.040**		-0.039*
		(0.35)		(0.020)		(0.020)
		[0.98]		[0.05]		[0.06]
Control Group Mean	4.90	4.90	0.72	0.72	1.062	1.062
Control Group StDev	0.95	0.95	0.59	0.59	0.043	0.043
N	539	539	436	436	515	515

Notes: This table shows the ITT estimates for sales outcomes. A firm is classified as small in a respective sector if in the baseline it has # Employees<Median(# Employees). "Small x Treated" is the interaction between being a small-firm in the baseline and being assigned to the treatment group. Sales Volatility is computed using the difference between $ln(Sales_{max})$ and $ln(Sales_{min})$, where $ln(Sales_{max})$ and $ln(Sales_{min})$ stand for the maximum and the minimum sales, respectively, during a particular month over the last 12 months. Control Vector: Baseline values of the outcome variable and ln(sales-winsorized), (in HTE regressions) a dummy for being a "small" business, not reporting sales in baseline, use of LPN in baseline and stratification controls. * p<0.1. ** p<0.05. *** p<0.01. p-values after correction for multiple hypothesis-testing are reported in brackets.

Table 9: Heterogenous Treatment Effects for Business Investment

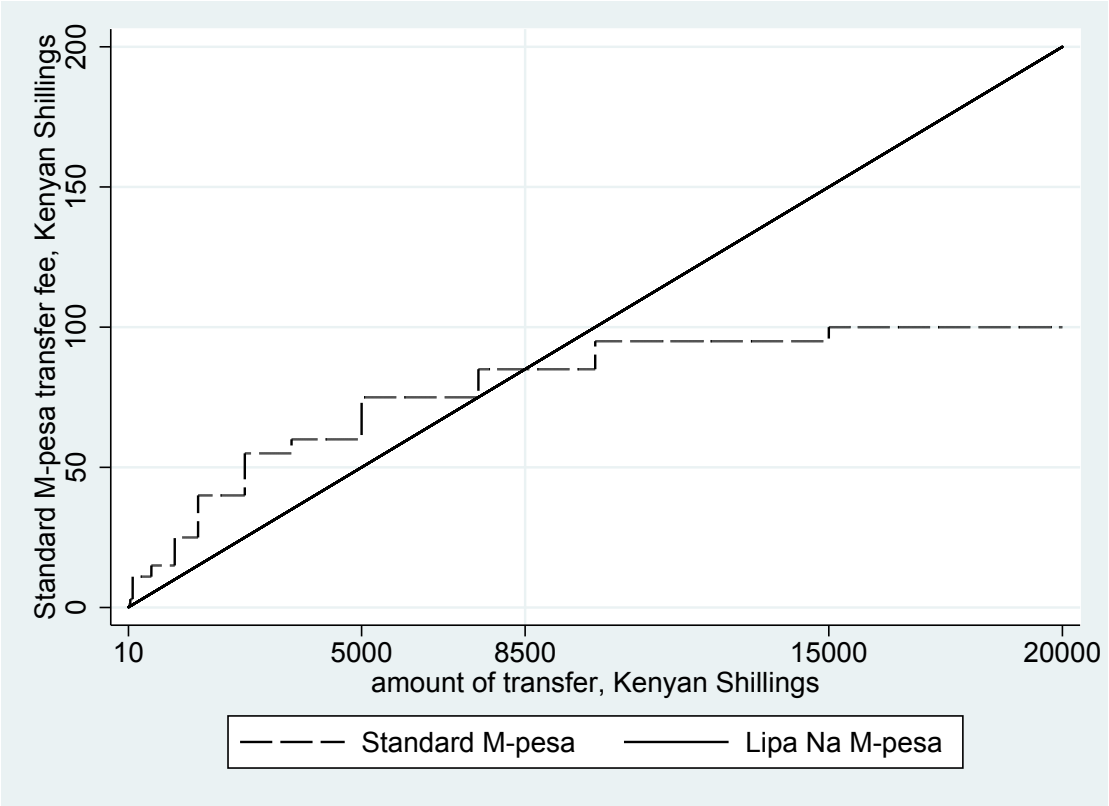
	(1)	(2)	(3)	(4)
	Total Investment	Total Investment	Inventory Investment	Inventory Investment
Treatment	5.21	4.65	1.39	0.94
	(6.73)	(6.90)	(2.63)	(2.71)
	[0.57]	[0.63]	[0.73]	[0.85]
Small x Treated		11.71		10.35
		(21.40)		(7.24)
		[0.72]		[0.21]
Control Group Mean	32.44	32.44	14.14	14.14
Control Group StDev	75.32	75.32	32.79	32.79
N	526	526	584	584

Notes: This table shows the ITT estimates for investment outcomes. A firm is classified as small in a respective sector if in the baseline it has # Employees<Median(# Employees). "Small x Treated" is the interaction between being a small-firm in the baseline and being assigned to the treatment group. Control Vector: Baseline values of the outcome variable and ln(sales-winsorized), (in HTE regressions) a dummy for being a "small" business, not reporting sales in baseline, use of LPN in baseline and stratification controls. * p<0.1. ** p<0.05. *** p<0.01. p-values after correction for multiple hypothesis-testing are reported in brackets.

Figures

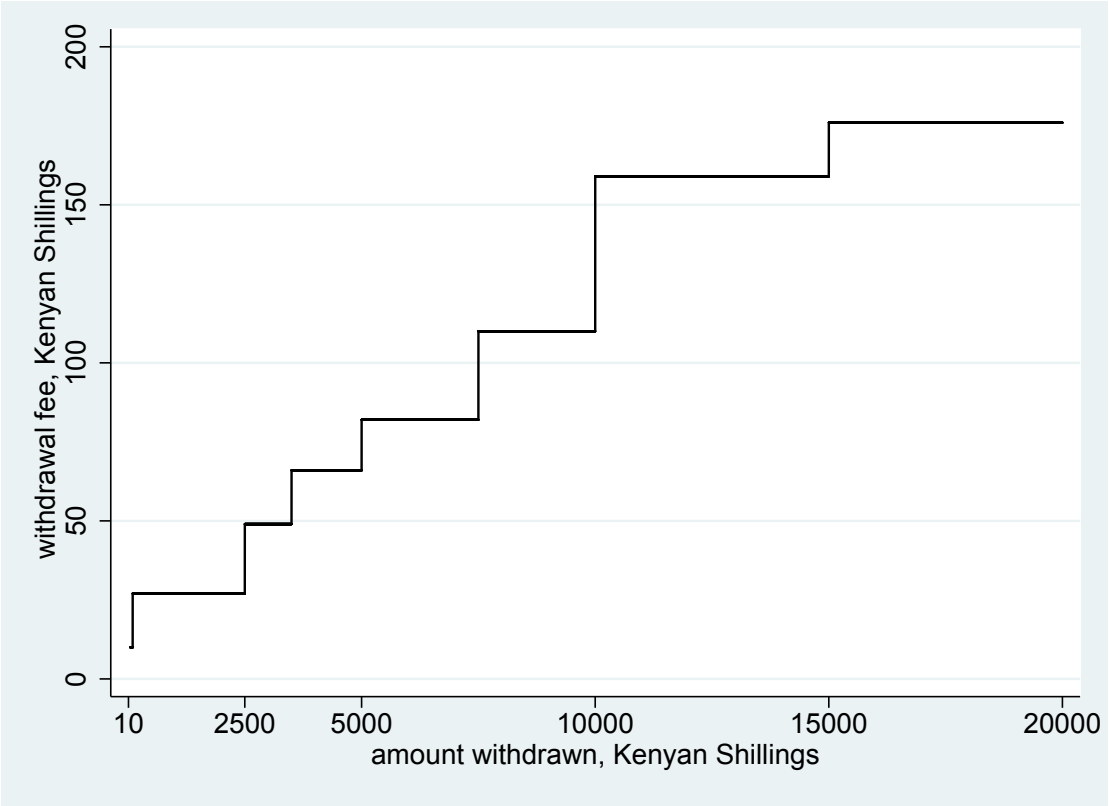
Timeline of the Field-work

Figure 1: Lipa Na M-Pesa and Standard M-Pesa: Transfers Fees



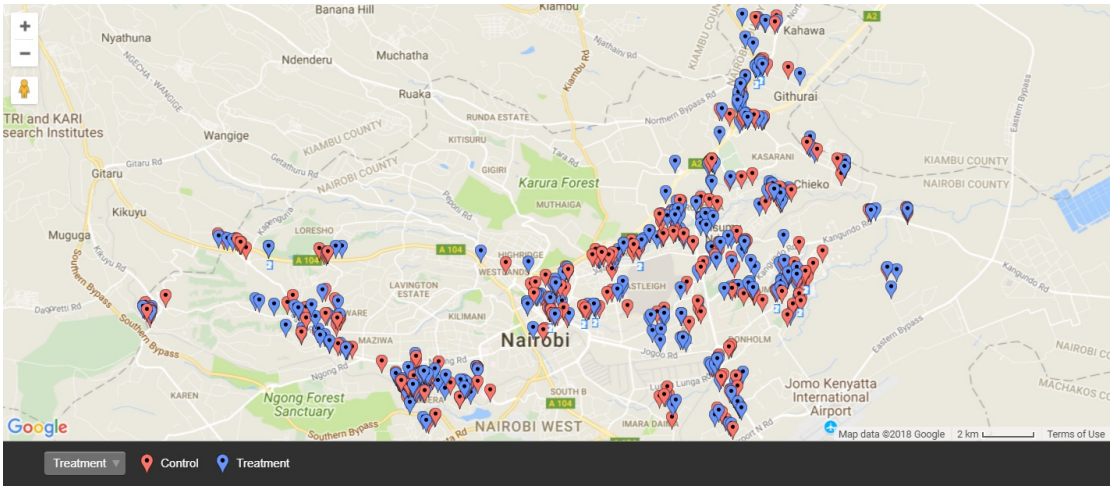
Notes: This figure depicts transfers fees charged to merchants for different amounts of transactions received with Lipa Na M-Pesa and Standard M-Pesa.

Figure 2: Lipa Na M-Pesa and Standard M-Pesa: Withdrawal Fees



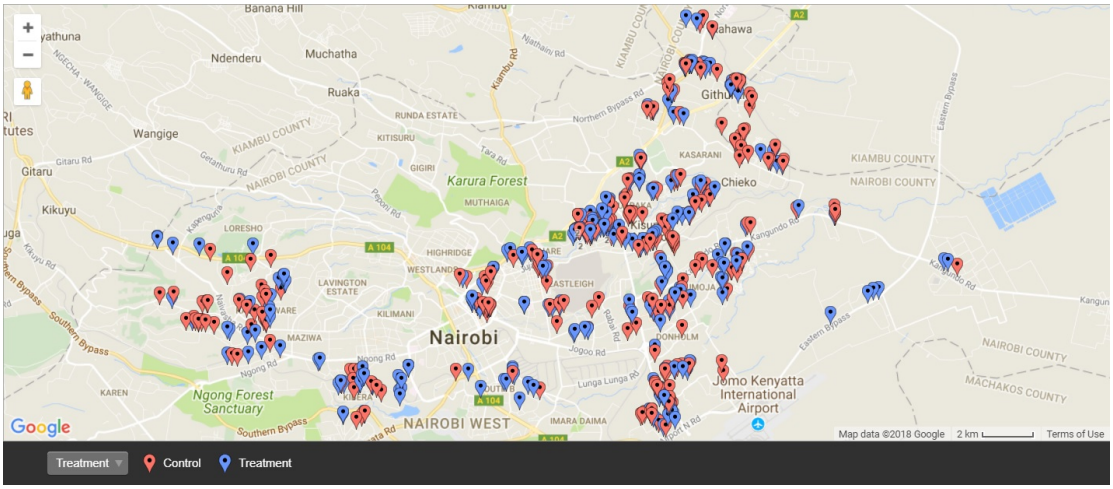
Notes: This figure depicts fees charged to M-Pesa account holders when converting M-Pesa units into cash. Same fees apply for Standard and Lipa Na M-Pesa.

Figure 3: Geographic Distribution of Restaurants



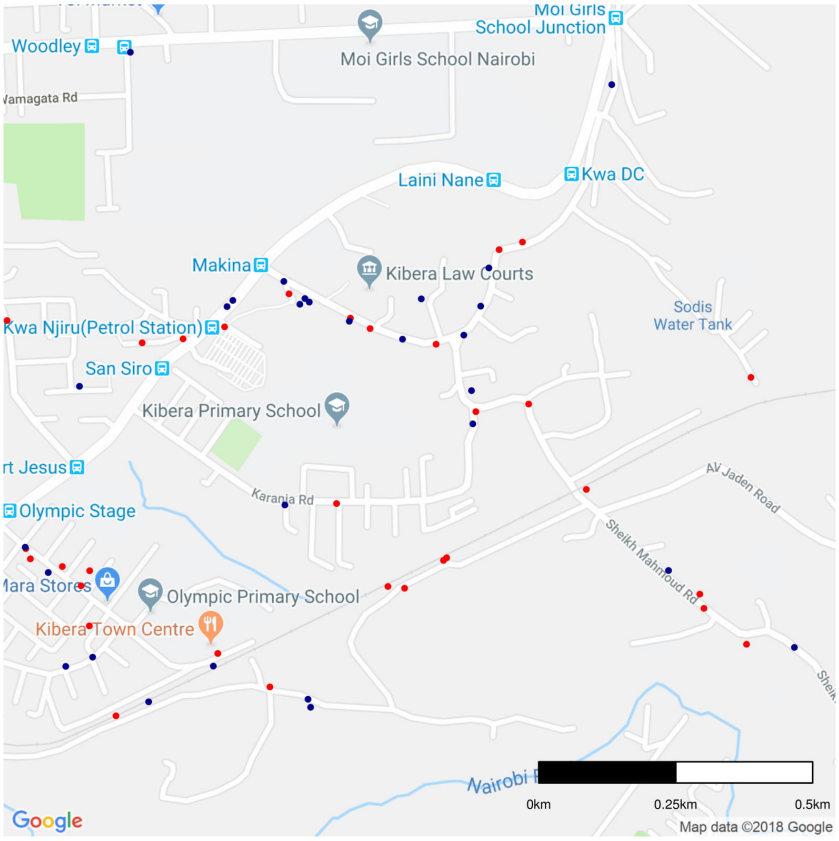
Notes: This figure shows the geographic distribution of restaurants in treatment (blue) and control (red) groups at baseline.

Figure 4: Geographic Distribution of Pharmacies



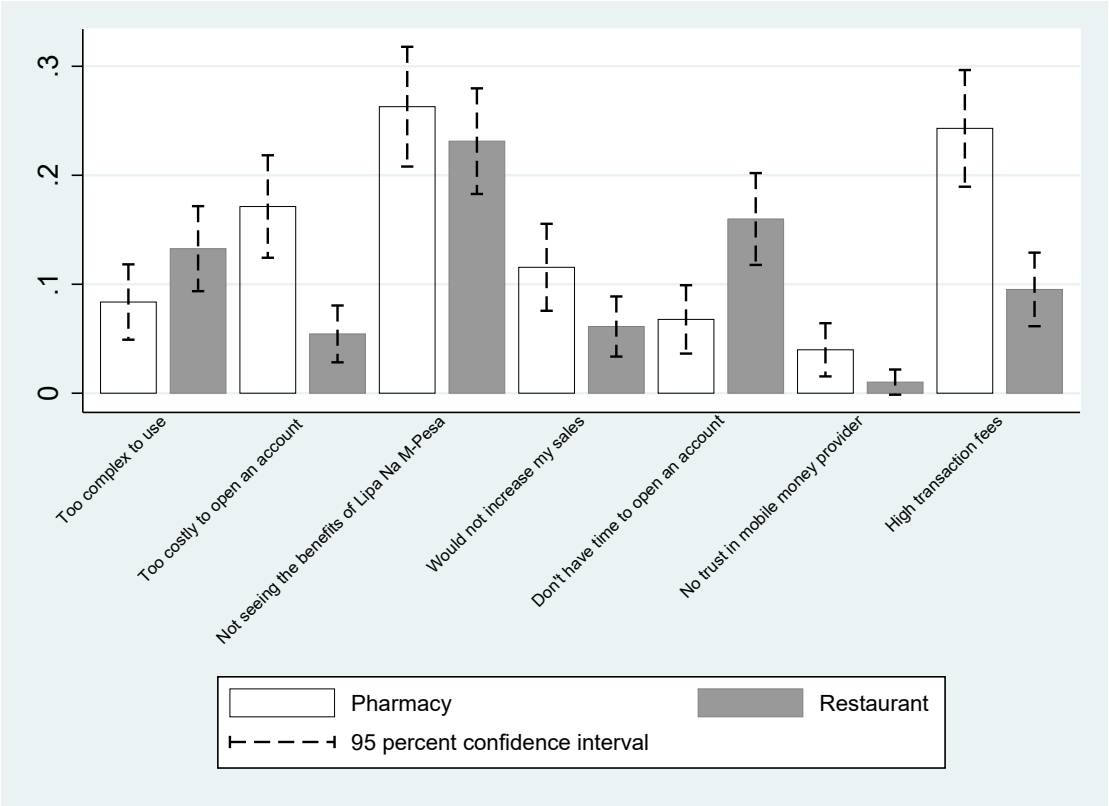
Notes: This figure shows the geographic distribution of pharmacies in treatment (blue) and control (red) groups at baseline.

Figure 5: Geographic Distribution of a Random Sub-sample of Merchants



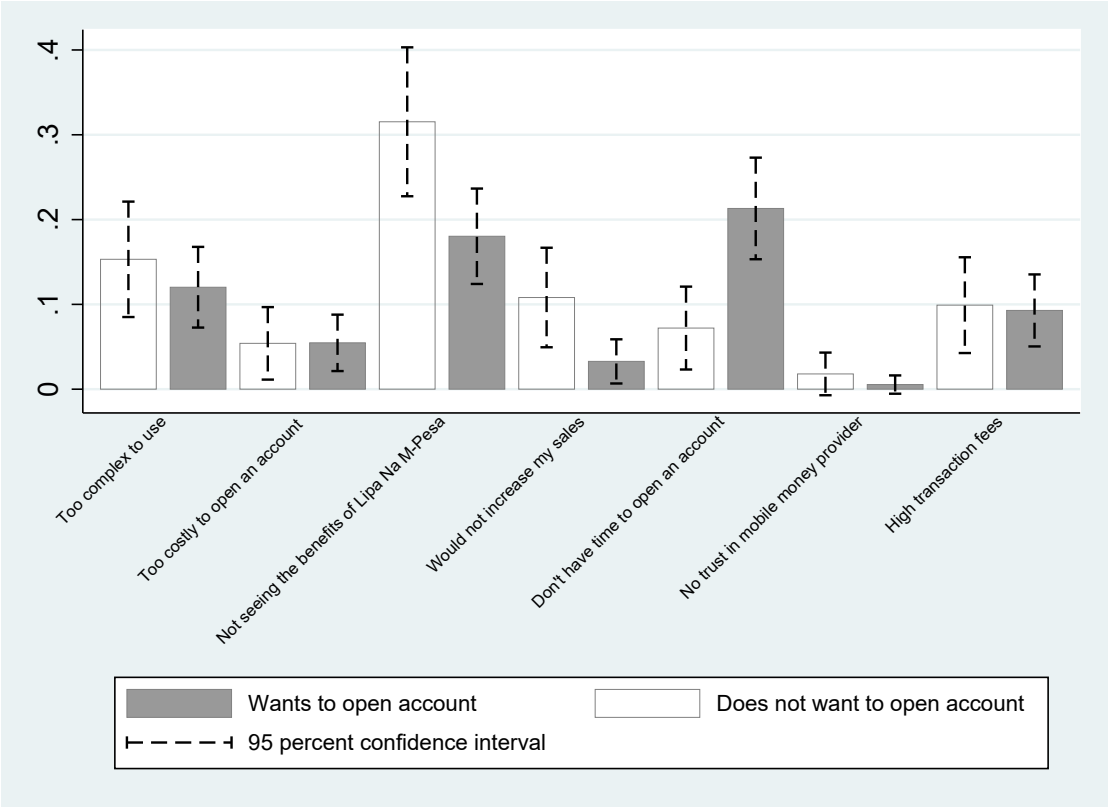
Notes: The figure shows the geographic distribution of a sub-sample of merchants in treatment (blue) and control (red) groups at baseline.

Figure 6: Reasons for not Having a Lipa Na M-Pesa Account



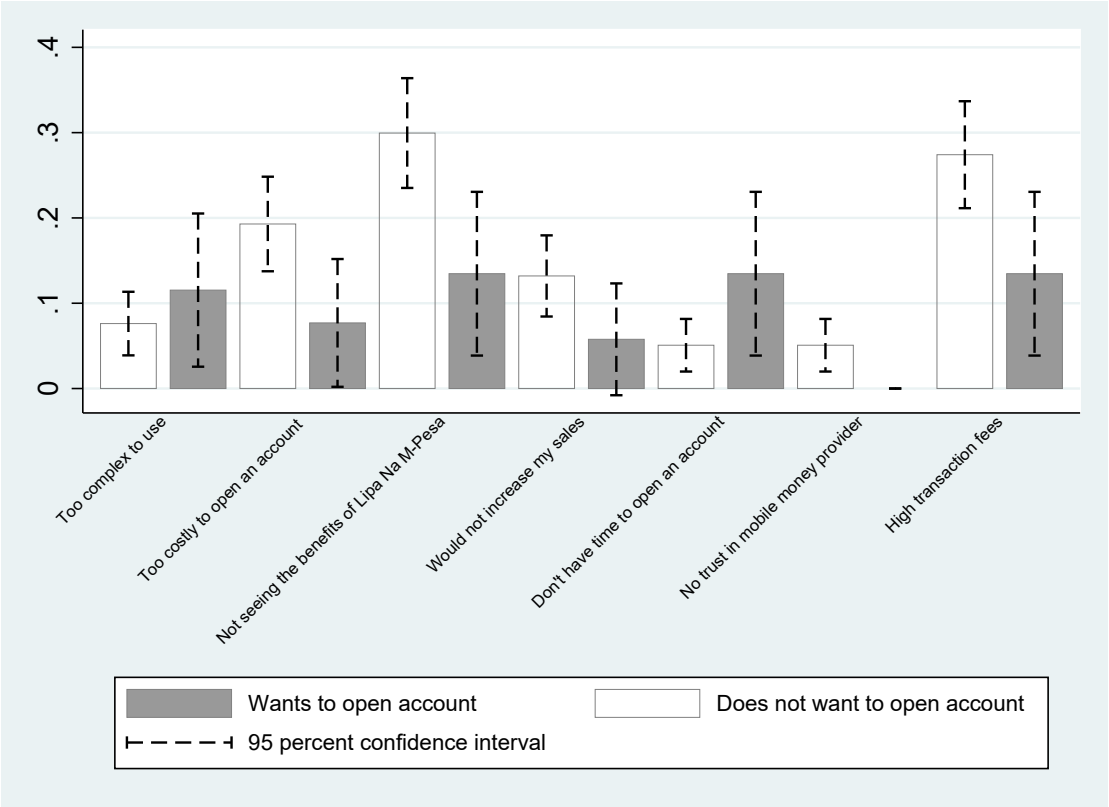
Notes: This figure shows the fraction of restaurants and pharmacies who stated a particular reason for not having a Lipa Na M-Pesa account at baseline (with 95% statistical confidence levels).

Figure 7: Reasons for not Having a Lipa Na M-Pesa Account at Baseline and Willingness to Open one after Intervention: Restaurants



Notes: This figure compares reasons for not having a Lipa Na M-Pesa account stated by restaurants who, after our intervention, want to open an account and those who do not want to open an account (see also 95% statistical confidence levels for each bar).

Figure 8: Reasons for not Having a Lipa Na M-Pesa Account at Baseline and Willingness to Open one after Intervention: Pharmacies



Notes: This figure compares reasons for not having a Lipa Na M-Pesa account stated by pharmacies who, after our intervention, want to open an account and those who do not want to open an account (see also 95% statistical confidence levels for each bar).

Online Appendix: Tables

Table OA1: Variables and their Definitions Used in the Regression Analysis

	Variable	Definiton
Panel A: Standard M-Money Use	For business	=1 if the business use standard mobile money in the last 30 days.
	To receive payments	=1 if the business receives payments to standard mobile money.
	To store money	=1 if the business store money in standard mobile money.
	To pay bills	=1 if the business pay bills via standard mobile money.
	To pay inputs	=1 if the business pay inputs via standard mobile money.
	To pay salaries	=1 if the business pay salaries via standard mobile money.
	To save	=1 if the business saves revenues in mob. money account.
	% of utility exp. via m-money	% of business utility expenses paid via standard m-money.
	% of input exp. via m-money	% of business input expenses paid via standard m-money.
	Paying wages via m-money	=1 if the business pays wages to the personal m-money accounts of workers.
	No increase in prices	=1 if the business does not increase prices when customer pays via m-money.
Panel B: Safety	Theft and safety index	Summation of internal, external theft, and feeling not safe variables, standardized.
	Internal theft	=1 if employees stole something from the business in the past 6 months.
	External theft	=1 if experienced losses as a result of theft, robbery, fire in the past 6 months.
	Feeling not safe	The safety of the area where the business is located (1 very unsafe-10 safe)
Panel C: Saving Behavior	Savings in a bank or MFI	=1 if the business saves at bank or microfinance account
	Savings in a personal bank account	=1 if the business saves at a personal bank account.
	Savings in a business bank account	=1 if the business saves at a business bank account.
	Savings in an MFI	=1 if the business saves at a microfinance account.
Panel D: Transparency	Not shared sales	=1 if the business has not shared its sales at baseline interview.
	Not shared profits	=1 if the business has not shared its profits at baseline interview.
	Business license	=1 if the business has an up-to-date government business permit.
	Financial soph. index	Summation of bank loan, mobile loan and records, standardized.
	Bank loan	=1 if the business received a bank loan in the past 12 months.
	Mobile loan	=1 if the business received a mobile loan in the past 12 months.
	Business records	=1 if the business keeps business records.
	Sells on credit to customers	=1 if the business makes sales on credit.
Panel E: Behavioral Factors	Present bias	=1 if business owner or manager is present biased.
	Future bias	=1 if business owner or manager is future biased .
	Cognitive ability	maximum number of digits remembered.
	Trust in first time	Trust in people you meet first time, 1 (not at all) -4 (completely).
	Trust in customers	Trust in customers, 1 (not at all) -4 (completely).
	Trust in courts	Trust in courts, 1 (not at all) -4 (completely).
	Trust in m-money company	Trust in mobile money companies, 1 (not at all) -4 (completely).
Panel F: Business Size	Employees (log)	Number of total employees, logarithm.
	Monthly Sales, in 1000 Ksh. (log-winsorized 5%)	Sales in the past month, 5% winsorized & in logarithm.
	Monthly Profits, in 1000 Ksh. (log-winsorized 5%)	Profits in the past month, 5% winsorized & in logarithm.

Table OA2: Descriptive Statistics of Variables Used in the Regression Estimations

		All Sample			Pharmacy			Restaurant		
	Variable	N	mean	sd	N	mean	sd	N	mean	sd
Panel A: Standard M-Money Use	For business	545	0.52	0.50	251	0.42	0.49	294	0.60	0.49
	To receive payments	543	0.34	0.47	250	0.27	0.44	293	0.40	0.49
	To store money	543	0.17	0.38	249	0.09	0.28	294	0.24	0.43
	To pay bills	544	0.30	0.46	250	0.26	0.44	294	0.33	0.47
	To pay input	544	0.37	0.48	250	0.29	0.46	294	0.43	0.50
	To Pay salaries	544	0.06	0.24	250	0.06	0.24	294	0.06	0.25
	To save	542	0.10	0.30	249	0.04	0.20	293	0.15	0.36
	% of utility exp. via m-money	474	0.33	0.45	225	0.34	0.46	249	0.31	0.45
	% of input exp. via m-money	485	0.15	0.31	224	0.14	0.28	261	0.17	0.33
	Paying wages via m-money	538	0.05	0.23	244	0.06	0.24	294	0.05	0.21
	No increase in prices	546	0.13	0.33	252	0.11	0.31	294	0.15	0.35
Panel B: Safety	Theft and safety index	537	0.00	1.00	246	-0.11	0.85	291	0.09	1.10
	Internal theft	538	0.27	0.44	247	0.07	0.26	291	0.44	0.50
	External theft	545	0.10	0.30	251	0.02	0.15	294	0.17	0.37
	Feeling safe	545	7.32	1.89	251	7.06	1.86	294	7.54	1.88
Panel C: Saving Behavior	Savings in a bank or MFI	542	0.57	0.50	249	0.53	0.50	293	0.61	0.49
	Savings in a personal bank account	542	0.37	0.48	249	0.29	0.45	293	0.45	0.50
	Savings in a business bank account	542	0.20	0.40	249	0.25	0.43	293	0.15	0.36
	Saving in an MFI	542	0.03	0.16	249	0.02	0.15	293	0.03	0.16
Panel D: Transparency	Not shared sales	546	0.14	0.35	252	0.21	0.41	294	0.09	0.28
	Not shared profits	546	0.14	0.35	252	0.21	0.41	294	0.08	0.27
	Business license	538	0.71	0.46	246	0.91	0.29	292	0.54	0.50
	Financial soph. index	515	0.00	1.00	229	0.04	0.77	286	-0.03	1.15
	Bank loan	522	0.10	0.30	234	0.06	0.25	288	0.14	0.34
	Mobile loan	517	0.10	0.31	231	0.07	0.26	286	0.13	0.34
	Business records	546	0.87	0.34	252	0.96	0.20	294	0.79	0.41
	Sells on credit to customers	545	0.51	0.50	252	0.45	0.50	293	0.57	0.50
Panel E: Behavioral Factors	Present bias	543	0.12	0.33	251	0.11	0.32	292	0.13	0.34
	Future bias	543	0.15	0.35	251	0.13	0.33	292	0.16	0.37
	Cognitive ability	545	5.21	1.50	252	5.44	1.48	293	5.02	1.49
	Trust in first time	543	2.11	0.85	251	2.15	0.89	292	2.07	0.82
	Trust in customers	544	3.42	0.65	251	3.42	0.61	293	3.41	0.69
	Trust in courts	544	2.40	0.94	252	2.37	0.98	292	2.42	0.91
	Trust in mobile money company	544	3.58	0.64	252	3.43	0.68	292	3.71	0.57
Panel F: Business Size	Employees (log)	546	1.41	0.42	252	1.19	0.27	294	1.59	0.43
	Monthly Sales, in 1000 Ksh. (log-winsorized 5%)	546	5.01	1.01	252	4.74	0.89	294	5.23	1.05
	Monthly Profits, in 1000 Ksh. (log-winsorized 5%)	546	3.84	0.96	252	3.83	0.89	294	3.85	1.02

Table OA3: Descriptive Statistics from Endline survey - All businesses with Business Licenses

Variables	Definition	All sample			Control			Treatment		
		N	Mean	Median	N	Mean	Median	N	Mean	Median
Lipa Na M-pesa use										
Have Lipa na M-pesa account (0/1)	=1 if business have a registered Lipa na M-pesa account	620	0.27	0	311	0.23	0	309	0.31	0
Used Lipa na M-pesa account for business (0/1)	=1 if business used Lipa na M-pesa account over the last 30 days	620	0.25	0	311	0.21	0	309	0.29	0
Received payment via Lipa na M-pesa (0/1)	=1 if business used Lipa na M-pesa account received payments over the last 30 days	620	0.25	0	311	0.20	0	309	0.29	0
Lipa na M-pesa sales, monthly (1000 Ksh.)	Total sales received via Lipa Na M-pesa at a typical month	620	15.50	0	311	12.47	0	309	18.54	0
Fraction of customers pay via Lipa na M-pesa	Monthly sales received via Lipa Na M-pesa divided by the sales last month	612	0.07	0	308	0.08	0	304	0.05	0
Management practices and safety										
Record keeping via mobile money (0/1)	=1 if the business keeps records via personal mobile money or Lipa Na M-pesa	620	0.11	0	311	0.10	0	309	0.12	0
Not having change (0/1)	=1 if the business experienced a foregone opportunity to sell goods due to not having change	620	0.25	0	311	0.26	0	309	0.25	0
Safety (1 not feel safe - 10 feel safe)	Safety of the area where the business is located in terms of the threats of fire, theft, robbery, etc.	620	7.03	7	311	6.89	7	309	7.18	8
		601	10.17	0	303	9.30	0	298	11.05	0
Investment and access to finance										
Capital investment, (1000 Ksh.)	Investment in the capital goods in the last 6 months	607	0.22	0	303	0.19	0	304	0.25	0
Bank loan (0/1)	=1 if the business received a loan from a bank. in the past 12 months	610	0.09	0	305	0.08	0	305	0.10	0
Informal loan (0/1)	=1 if the business received a loan from friends, relatives, etc. in the past 12 months	607	0.05	0	304	0.05	0	303	0.06	0
Mobile loan (0/1)	=1 if the business received a loan through mobile money money companies in the past 12 months	613	0.13	0	307	0.10	0	306	0.16	0
Business size										
Sales, monthly (1000 Ksh.)	Sales over the past month	539	213.07	120	267	218.27	135	272	207.96	120
Profits, monthly, (1000 Ksh.)	Profits over the past month.	531	66.91	45	266	68.67	45	265	65.14	48
Employees	Number of total permanent and temporary employees	594	4.38	3	301	4.40	3	293	4.35	3

Table OA4A: Business Characteristics and Balance Test - Pharmacies and Restaurants

	Pharmacy				Restaurant			
	All	Cont	Treat	Diff	All	Cont	Treat	Diff
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard Mobile Money Use								
Use Mobile Money for business purposes (Yes=1; No=0)	0.41	0.40	0.43	-0.03	0.59	0.57	0.62	-0.05
Use Mobile Money to receive payments (Yes=1; No=0)	0.25	0.21	0.28	-0.07*	0.40	0.38	0.42	-0.04
Use Mobile Money to store money (Yes=1; No=0)	0.09	0.09	0.10	0.00	0.25	0.26	0.24	0.02
Use Mobile Money to pay bills (Yes=1; No=0)	0.26	0.26	0.27	-0.01	0.36	0.37	0.35	0.02
Use Mobile Money to pay salaries (Yes=1; No=0)	0.04	0.02	0.06	-0.04**	0.07	0.07	0.07	0.00
Use Mobile Money to pay inputs (Yes=1; No=0)	0.31	0.32	0.29	0.03	0.43	0.41	0.45	-0.04
Awareness of Lipa Na M-Pesa and Reasons for not Having an Account								
Aware of Lipa Na M-Pesa (Yes=1; No=0)	0.94	0.95	0.93	0.02	0.96	0.95	0.97	-0.02
Has Lipa Na M-Pesa (Yes=1; No=0)	0.05	0.01	0.08	-0.06***	0.12	0.12	0.12	0.00
Does not see the benefits of LPN M-Pesa (Yes=1; No=0)	0.27	0.27	0.27	0.00	0.25	0.27	0.24	0.03
Cost of opening LPN M-Pesa is too high (Yes=1; No=0)	0.17	0.18	0.16	0.02	0.05	0.03	0.06	-0.02
High transaction fees via Lipa Na M-pesa (Yes=1; No=0)	0.25	0.25	0.24	0.01	0.09	0.08	0.09	-0.01
Doesn't have time to open an account (Yes=1; No=0)	0.09	0.11	0.07	0.04	0.14	0.14	0.15	-0.01
Would not increase my sales (Yes=1; No=0)	0.09	0.08	0.11	-0.02	0.06	0.06	0.06	0.00
No trust in mobile money provider (Yes=1; No=0)	0.03	0.03	0.04	-0.01	0.02	0.02	0.01	0.00
Too complex to use (Yes=1; No=0)	0.08	0.08	0.08	0.00	0.11	0.09	0.13	-0.03
Business size								
Monthly Sales, in 1000 Ksh. (log-winsorized 5%)	4.67	4.59	4.74	-0.16**	5.30	5.29	5.31	-0.01
Monthly Profits, in 1000 Ksh. (log-winsorized 5%)	3.74	3.65	3.83	-0.19**	3.93	3.93	3.94	-0.01
Number of Employees (log)	1.18	1.17	1.20	-0.02	1.65	1.66	1.64	0.01
Investment and access to finance								
Investment in the past 6 months (Yes=1; No=0)	0.19	0.19	0.20	-0.01	0.37	0.39	0.35	0.04
Bank loan in the past 12 months (Yes=1; No=0)	0.07	0.07	0.06	0.01	0.12	0.10	0.14	-0.04
Informal loan in the past 12 months (Yes=1; No=0)	0.03	0.03	0.02	0.00	0.04	0.04	0.05	-0.01
Mobile loan in the past 12 months (Yes=1; No=0)	0.08	0.07	0.09	-0.02	0.12	0.12	0.12	0.00
Informality								
Business license (Yes=1; No=0)	0.92	0.93	0.91	0.02	0.56	0.55	0.57	-0.01

Table OA4B: Baseline Characteristics and Balance Sample - Businesses that Participated at Endline Survey and with Business License

	Pharmacy				Restaurant			
	All	Cont	Treat	Diff	All	Cont	Treat	Diff
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard mobile money use								
Use Mobile Money for business purposes (Yes=1; No=0)	0.45	0.40	0.49	-0.09	0.67	0.65	0.68	-0.03
Use Mobile Money to receive payments (Yes=1; No=0)	0.27	0.20	0.34	-0.14***	0.49	0.48	0.50	-0.02
Use Mobile Money to store money (Yes=1; No=0)	0.12	0.11	0.13	-0.02	0.24	0.29	0.18	0.11
Use Mobile Money to pay bills (Yes=1; No=0)	0.29	0.25	0.33	-0.07	0.46	0.44	0.47	-0.03
Use Mobile Money to pay salaries (Yes=1; No=0)	0.05	0.02	0.09	-0.07***	0.09	0.09	0.10	-0.01
Use Mobile Money to pay inputs (Yes=1; No=0)	0.34	0.33	0.36	-0.02	0.50	0.50	0.50	0.00
Awareness of Lipa Na M-Pesa and Reasons for not Having an Account								
Aware of Lipa Na M-Pesa (Yes=1; No=0)	0.94	0.95	0.94	0.01	0.98	0.98	0.98	0.00
Has Lipa Na M-Pesa (Yes=1; No=0)	0.05	0.02	0.09	-0.07***	0.23	0.25	0.20	0.05
Does not see the benefits of LPN M-Pesa (Yes=1; No=0)	0.26	0.26	0.25	0.01	0.19	0.23	0.15	0.08
Cost of opening LPN M-Pesa is too high (Yes=1; No=0)	0.15	0.17	0.12	0.04	0.05	0.03	0.07	-0.04
High transaction fees via Lipa Na M-pesa (Yes=1; No=0)	0.24	0.23	0.24	-0.01	0.09	0.07	0.11	-0.04
Doesn't have time to open an account (Yes=1; No=0)	0.07	0.09	0.05	0.05	0.19	0.21	0.17	0.04
Would not increase my sales (Yes=1; No=0)	0.10	0.09	0.11	-0.02	0.08	0.07	0.08	-0.01
No trust in mobile money provider (Yes=1; No=0)	0.04	0.03	0.05	-0.02	0.02	0.03	0.01	0.02
Too complex to use (Yes=1; No=0)	0.08	0.08	0.07	0.01	0.13	0.09	0.16	-0.06
Business size								
Monthly Sales, in 1000 Ksh. (log-winsorized 5%)	4.78	4.72	4.84	-0.12	5.70	5.75	5.66	0.09
Monthly Prots, in 1000 Ksh. (log-winsorized 5%)	3.88	3.82	3.94	-0.12	4.32	4.34	4.29	0.05
Number of Employees (log)	1.21	1.20	1.22	-0.02	1.86	1.88	1.84	0.05
Investment and access to finance								
Investment in the past 6 months (Yes=1; No=0)	0.21	0.19	0.22	-0.03	0.42	0.47	0.37	0.10
Bank loan in the past 12 months (Yes=1; No=0)	0.08	0.08	0.08	0.01	0.09	0.09	0.10	-0.01
Informal loan in the past 12 months (Yes=1; No=0)	0.03	0.02	0.03	-0.01	0.04	0.04	0.05	-0.01
Mobile loan in the past 12 months (Yes=1; No=0)	0.11	0.11	0.11	0.00	0.09	0.09	0.09	0.00
Informality								
Business license (Yes=1; No=0)	1.00	1.00	1.00	0.39	1.00	1.00	1.00	0.00

Table OA5A: LPN Usage - Limited Set of Controls

	(1)	(2)	(3)	(4)
	Opened LPN (0/1)	Used LPN (0/1)	Received payment via LPN (0/1)	LPN sales, log(1+x)
Treatment	0.08**	0.10**	0.10**	0.31**
	(0.03)	(0.03)	(0.03)	(0.11)
Control Mean	0.23	0.21	0.20	0.63
Control StDev	0.42	0.40	0.40	1.43
N	619	618	618	618

Notes: This table shows the ITT estimates for Lipa Na use indicators. Dependent variables are having Lipa Na M-pesa account (0/1), using Lipa Na M-pesa account for business in the past 30 days, receiving payment via Lipa Na M-pesa in the past 30 days, and Lipa Na M-pesa sales (log(1+x)). Control Vector in each ITT regression: Stratification controls. * p<0.1. ** p<0.05. *** p<0.01.

Table OA5B: LPN Usage for Visible and Non-transparent Businesses - Limited Set of Controls

	(1)	(2)	(3)	(4)
Panel A: Transparent Firms: shared sales figures in the baseline				
Treatment	0.09**	0.11**	0.11**	0.37***
	(0.04)	(0.04)	(0.04)	(0.13)
Contol Mean	0.24	0.21	0.21	0.65
Contol StDev	0.43	0.41	0.22	1.45
N	488	487	487	487
Panel B: Non-transparent firms: did not share sales figures in the baseline				
Treatment	-0.01	0.03	0.03	0.01
	(0.08)	(0.08)	(0.08)	(0.24)
Control Mean	0.19	0.18	0.18	0.58
Contol StDev	0.40	0.39	0.39	1.35
N	131	131	131	131

Notes: This table shows the ITT estimates for Lipa Na use indicators separately for the sub- samples of transparent and non-transparent firms. Dependent variables are having Lipa Na M-pesa account (0/1), using Lipa Na M-pesa account for business in the past 30 days, receiving payment via Lipa Na M-pesa in the past 30 days, and Lipa Na M-pesa sales (log(1+x)). Control Vector in each ITT regression: Stratification controls. * p<0.1. ** p<0.05. *** p<0.01.

Table OA6A: Business Safety - Limited Set of Controls

	Feeling safe
Treatment	0.27*
	(0.14)
Control Mean	6.88
Control StDev	1.84
N	619

Notes: This table shows the ITT estimates for business safety feeling (1 not feel safe - 10 feel safe). Control Vector: Baseline value of safety and stratification controls. * p<0.1. ** p<0.05. *** p<0.01.

Table OA6B: Business Safety and Theft Exposure - Limited Set of Controls

	(1)	(2)
	Theft in Baseline	No Theft in Baseline
	Feeling safe	Feeling Safe
Treatment	1.04**	0.20
	(0.46)	(0.15)
Control Mean	6.36	6.96
Control StDev	1.95	1.82
N	75	543

Notes: This table shows the ITT estimates for business safety feeling (1 not feel safe - 10 feel safe) for sub-samples of firms based on theft exposure in the baseline. The first column reports the coefficient estimate for the sub-sample of businesses which reported in the baseline that they were exposed to external theft - over the last 12 months - and the second column for those which did not report any external theft in the baseline. Control Vector: Baseline value of safety and stratification controls. * p<0.1. ** p<0.05. *** p<0.01.

Table OA7A: Business Finance - Limited Set of Controls

	(1)	(2)	(3)	(4)
Panel A: External finance (Formal)				
	Mobile loans (Yes/No)	Mobile loans (ln(Amount))	Bank loans (Yes/No)	Bank loans (ln(Amount))
Treatment	0.06**	0.49**	0.02	0.08
	(0.03)	(0.22)	(0.02)	(0.25)
Control Group Mean	0.10	0.74	0.08	0.84
Control Group StDev	0.30	2.35	0.26	2.86
N	612	581	609	580
Panel B: External finance (Informal)				
	Trade credit (Yes/No)	Trade credit (ln(Amount))	Informal Loan (Yes/No)	Informal Loan (ln(Amount))
Treatment	-0.01	-0.42	0.01	-0.02
	(0.04)	(0.37)	(0.02)	(0.10)
Control Group Mean	0.35	3.17	0.05	0.15
Control Group StDev	0.48	4.71	0.22	1.12
N	619	564	576	575

Notes: This table shows the ITT estimates for financial access outcomes, where ln(Amount) refers to the log of winsorized loan amounts. Control Vector: Baseline value of the outcome variable and stratification controls. * p<0.1. ** p<0.05. *** p<0.01.

Table OA7B: Heterogeneous Treatment Effects for Business Finance - Limited Set of Controls

	(1)	(2)	(3)	(4)
Panel A: External Finance (Formal)				
	Mobile loans (Yes/No)	Mobile loans (ln(Amount))	Bank loans (Yes/No)	Bank loans (ln(Amount))
Treatment	0.04	0.38	0.02	0.08
	(0.03)	(0.23)	(0.02)	(0.25)
Small x Treated	0.30***	2.06**	-0.00	-0.09
	(0.11)	(0.89)	(0.10)	(1.17)
Control Group Mean	0.10	0.74	0.08	0.84
Control Group StDev	0.30	2.35	0.26	2.86
N	612	581	609	580
Panel B: External finance (Informal)				
	Trade credit (Yes/No)	Trade credit (ln(Amount))	Informal Loan (Yes/No)	Informal Loan (ln(Amount))
Treatment	-0.02	-0.51	0.00	-0.07
	(0.04)	(0.38)	(0.02)	(0.09)
Small x Treated	0.17	1.80	0.20*	1.10
	(0.15)	(1.40)	(0.10)	(0.72)
Control Group Mean	0.35	3.17	0.05	0.15
Control Group StDev	0.48	4.71	0.22	1.12
N	619	564	576	575

Notes: This table shows the ITT estimates with heterogeneous treatment effects for financial access outcomes, where ln(Amount) refers to the log of winsorized loan amounts. A firm is classified as small in a respective sector if in the baseline it has # Employees<Median(# Employees). "Small x Treated" is the interaction between being a small-firm in the baseline and being assigned to the treatment group. Control Vector: Baseline values of the outcome variable, a dummy for being a "small" business, and stratification controls. * p<0.1. ** p<0.05. *** p<0.01.

Table OA8: Heterogenous Treatment Effects for Business Sales - Limited Set of Controls

	(1)	(2)	(3)	(4)	(5)	(6)
	ln(Sales)	ln(Sales)	Sales Volatility	Sales Volatility	Sales Volatility [robust]	Sales Volatility [robust]
Treatment	-0.03	-0.03	-0.001	0.000	0.000	0.001
	(0.07)	(0.07)	(0.004)	(0.004)	(0.004)	(0.004)
Small x Treated		0.14		-0.032		-0.030
		(0.35)		(0.02)		(0.02)
Control Group Mean	4.90	4.90	0.72	0.72	1.062	1.062
Control Group StDev	0.95	0.95	0.59	0.59	0.043	0.043
N	539	539	436	436	515	515

Notes: This table shows the ITT estimates for sales outcomes. A firm is classified as small in a respective sector if in the baseline it has # Employees<Median(# Employees). "Small x Treated" is the interaction between being a small-firm in the baseline and being assigned to the treatment group. Sales Volatility is computed using the difference between $ln(Sales_{max})$ and $ln(Sales_{min})$, where $ln(Sales_{max})$ and $ln(Sales_{min})$ stand for the maximum and the minimum sales, respectively, during a particular month over the last 12 months. Control Vector: Baseline values of the outcome variable, (in HTE regressions) a dummy for being a "small" business, and stratification controls. * p<0.1. ** p<0.05. *** p<0.01.

Table OA9: Heterogenous Treatment Effects for Business Investment - Limited Set of Controls

	(1)	(2)	(3)	(4)
	Total Investment	Total Investment	Inventory Investment	Inventory Investment
Treatment	5.59	5.68	1.65	1.36
	(6.84)	(6.99)	(2.68)	(2.81)
Small x Treated		-5.20		5.96
		(22.07)		(7.31)
Control Gr Mean	32.44	32.44	14.14	14.14
Control Gr StDev	75.32	75.32	32.79	32.79
N	526	526	584	584

Notes: This table shows the ITT estimates for investment outcomes. A firm is classified as small in a respective sector if in the baseline it has # Employees<Median(# Employees). "Small x Treated" is the interaction between being a small-firm in the baseline and being assigned to the treatment group. Control Vector: Baseline value of the outcome variable, (in HTE regressions) a dummy for being a "small" business, not reporting sales in baseline, and stratification controls. * p<0.1. ** p<0.05. *** p<0.01.

Table OA10: Minimum Detectable Effect Sizes

Outcome variables	Sample size size	Control group mean (CGM)	Minimum detectable effect size (MDES)
LPN sales, log(1+x)	620	0.63	0.34
Feeling safe	620	6.89	0.41
Mobile loans (Yes/No)	613	0.10	0.08
Mobile loans, log(1+x)	582	0.74	0.62
Bank loans (Yes/No)	610	0.08	0.06
Bank loans, log(1+x)	581	0.84	0.69
Trade credit (Yes/No)	620	0.35	0.11
Trade credit (log(1+x))	565	3.17	1.06
Informal loan (Yes/No)	577	0.05	0.05
Informal Loan, log(1+x)	576	0.15	0.25
Ln(Sales)	539	4.91	0.23
Sales volatility	515	1.06	0.01
Total Investment	527	32.32	18.54
Inventory Investment	585	14.15	7.64

Notes: The table shows the minimum detectable effect (MDE) given the control group mean for each outcome variable that we test the impact of. MDEs are calculated assuming a 5% significance criterion and 80% power.