

# Payment Technology Adoption by SMEs: Experimental Evidence from Kenya's Mobile Money\*

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## Abstract

What determines the use of electronic payment instruments by merchants in developing countries? Are there barriers to payment technology adoption? To shed light on these questions, we offered a randomly selected sample of merchants in Kenya the possibility to sign up for free and on their behalf, for a novel electronic-payment technology (*Lipa Na M-Pesa*), which allows an efficient mobile-money based transaction between a business and its customers. Our intervention allows us to identify the preference to adopt the payment technology, once informational and monetary barriers to adoption are resolved. We find that over a 60% (20%) of the treated restaurant (pharmacy) owners revealed their willingness to adopt the technology. This evidences an unmet latent demand for this technology. We also find that businesses with past exposure to mobile-money instruments and with lower visibility concerns are more willing to adopt the technology. Moreover, sixteen months after our interventions, we observe that business owners who adopted the technology continue using it and feel safer.

**Keywords:** P2B; Lipa Na M-Pesa; Technology Adoption; SMEs

**JEL Classification:** D22, O33, G00.

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<sup>§</sup>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.

# 1 Introduction

Technological progress is vital for economic growth. Differences in technology adoption rates help explain per-capita income differences across countries.<sup>1</sup> Understanding the constraints that firms in developing countries face to adopt productive technologies is thus of utmost importance for the design of development policies. Most of the existing literature on technology adoption has focused on agricultural technologies like fertilizers and new seeds (see e.g. Duflo, Kremer and Robinson (2004, 2008, 2011) and Foster and Rosenzweig (2010)). However, little is known about the adoption of payment technologies in the context of developing countries. This paper aims to fill this gap by studying the adoption behaviour of a mobile-money payment technology, called *Lipa Na M-Pesa*, by a groups of merchants in Nairobi, Kenya.

Since 2007, Kenyan economy has experienced a P2P (person to person) electronic-money transfer revolution caused by Safaricom, the firm who launched M-Pesa, a mobile-money technology that offers the option to transfer funds instantaneously via simple cell-phone text-messages. M-Pesa has quickly reached remarkable adoption rates among Kenyan households, and by 2016, more than 95% of the Kenyan households had an M-Pesa account associated to their mobile phones (Jack and Suri, 2016). This tremendous diffusion led many to believe that Kenya would soon transform into a cashless economy, similar to the experience of more developed financial economies over the last few decades. However, this expectation did not fully materialize yet. Despite the fact that an overwhelming majority of households have the capacity to pay via mobile-money, the use of mobile-money among Kenyan merchants remained relatively low. According to the Finaccess Business Survey (2014), less than 40% of the Kenyan SMEs reported using M-Pesa services for P2B (person-to-business) or B2B (business-to-business) purposes. Understanding why businesses did not yet catch up with the mobile-money revolution in Kenya is of great importance, as their adoption would reduce transaction frictions and the degree of anonymity in the economy.

Motivated by the success of M-Pesa - and by the lack of its up-take among SMEs, in June 2013 Safaricom introduced Lipa Na M-Pesa, an extension of M-Pesa tailored to cater the needs of SMEs. Lipa Na M-Pesa offers a payment instrument that is more efficient than standard M-Pesa, as it allows customers and merchants to settle payments at lower electronic transaction fees than M-Pesa, with additional technological possibilities. We took advantage that this technology was new in the market, and sampled 1222 restaurants and pharmacies of Nairobi that did not have the technology by then. We then randomly assigned half of the sample to an intervention that exogenously relaxed three potential barriers to adoption: information, registration costs and know-how. We provided treated merchants with a) leaflets highlighting the benefits and the costs of the technology, b) a short movie featuring the experiences of successful similar merchants who use the technology, and c) the possibility to open a Lipa Na M-Pesa account at no cost on behalf of the merchant.

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<sup>1</sup>See Caselli and Coleman (2001) and Comin and Hobijn (2004).

To the end of the component c, we informed the business owners in the treated group that the registration paperwork required to adopt the technology would be done by our research team, if the business chose to open an account.<sup>2</sup> We also offered a short training to the owner to instruct him or her on how to use the technology.

We chose restaurants and pharmacies for this study because they share a similar business structure: they have high frequency daily transactions and the payment per transaction is relatively large. This implies that adopting an electronic payment technology is expected to be particularly efficient for these businesses. In addition, cash theft – both external and internal – is an important concern for both restaurants and pharmacies, and the incidence of theft may be reduced by using Lipa Na M-Pesa.<sup>3</sup>

We find three key results. First, exogenously removing registration and information barriers uncovered a significant interest to adopt the technology: 62% of the restaurants and 20% of the pharmacies indicated that they wished to sign up. This is evidence that small registration costs and/or limited information played a decisive role in preventing businesses to take advantage of an efficient payment technology. This is line with Bertrand, Mullainathan and Shafir (2004), who argue that, in the context of poverty, small situational barriers play a decisive role in preventing people to take advantage of available technologies. Quoting from Bertrand et al. (2004) “these barriers might be a testy bus ride, challenging hours, or the reluctance to face a contemptuous [agent].” Indeed, many businesses who expressed interest in the technology reported that these small barriers were reasons for not adopting the technology prior to our intervention.

Second, we find that firms who are less worried about being visible are those that are more willing to adopt Lipa Na. Business visibility seems to be an important constraint to adoption. To open a Lipa Na account, businesses have to register the account under the name of the owner; and furthermore, the business and its customers transact using a till-number, which is also registered for the name of the business and making every Lipa Na transaction being recorded as business activity by Safaricom.<sup>4</sup> We also find that businesses that are more inclined to use mobile money and that are less future biased are more likely to want to adopt Lipa Na.

Finally, we followed the businesses in our sample 16 months after the intervention, and we see that owners who adopted the technology continue using it and feel safer than before having adopted the technology and with respect to the control group.

Overall, our study reveals two distinctive type of businesses: those who do want to adopt and use the technology but face informational and registration costs barriers, and those

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<sup>2</sup>This included filling out a registration form and handing in copies of additional required documents to Safaricom, collecting the technology from Safaricom (once the till-number is issued) and bringing it back to the shop premises with Lipa N M-Pesa advertisement flyers and posters.

<sup>3</sup>According to Global Retail Theft Barometer Survey 2014-2015 conducted in 24 countries from Asia Pacific, Europe, Latin America, and US, among retailers, pharmacies have highest rate of losses due to internal employee theft and shoplifting (external theft) (an equivalent of about 1.99% of sales).

<sup>4</sup>Standard M-Pesa transactions, even when utilized for business purposes, cannot be traced to detect business transactions.

that do not want to innovate, even when these barriers are released. Remaining relatively less visible and the lack of trust in the system seem to be key explanatory factors that keep these merchants out of the cash-less payment system.

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 experimental design and data. Sections 5.1 and 5.2 present the results on the adoption and the usage of the technology. Section 6 concludes.

## 2 Contribution to the literature

The importance of SMEs' financing constraints for economic growth has been well-documented in the literature (Beck and Demirguc-Kunt, 2006). This paper contributes to this literature by studying the barriers to SMEs' adaptation to an important, growing, and profitable financial innovation, namely M-PESA. In this respect, the paper contributes to the emerging literature on electronic money instruments and economic development. 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 help Kenyan households manage financial uncertainties caused by crop failures, droughts, or health issues. The overarching conclusion of these studies that the users of M-PESA can access a wider network of support whenever financial needs arise, and receive funds more quickly. Both studies show that by reducing the transaction costs of financial transfers, access to mobile money help households smooth consumption. Jack and Suri (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. On the business implications side of the literature, Beck, Pamuk, Ramrattan and Uras (2017) develop a dynamic general equilibrium model calibrated for firm-level data from Kenya. The authors quantify a substantial impact of M-Pesa on entrepreneurial trade credit arrangements and aggregate outcomes.

We also contribute to the literature that aims to understand the cashless transformation of societies. We particularly focus on the role of firms in stimulating electronic media of exchange. Humphrey, Pulley and Vesela (1996) document a positive association between debit card usage and the availability of ATMs. The same paper also documents a negative association between aggregate crime rates and debit card adoption. Chakravorti (2007) documents that competition could be important in determining firms' electronic payment adoption behavior. Schuh and Stavins (2010) show that technological developments in debit payments drive out checks and suggest that there are strong substitutions between comparable payment methods that differ in the degree of their efficiency. Bolt, Jonker and

v. Renselaar (2010) refer to the issue of surcharges and suggest that allowing for surcharges at retailers could be an important determinant of electronic payment adoption. Also in this literature Arifovic, Duffy and Jiang (2017) develop a game theoretic framework, which the authors bring to a laboratory environment to show that fixed adoption fees (such as the need for purchasing a till machine) could be important in inhibiting the adoption of an electronic money instrument. Similarly, Bortolotti, Camera and Casari (2016) design a laboratory experiment and show that eliminating service fees or introducing rewards can have significant implications on adoption of electronic money instruments among consumers. We contribute to the emerging literature on the impact of electronic money proliferation on economic development in low-income countries. Our study is the first to conduct a field experiment with actual businesses to understand the role of registration costs and the lack of information in explaining the adoption of a profitable payment instrument.

We also make an important contribution to the technology adoption literature in the context of developing countries. The studies that closely relate to our research are the field experiments on adoption of profitable technologies. Most studies in this literature concentrate on the agriculture sector and in particular the adoption of farming techniques, seeds and fertilizers at micro-and-small enterprises, such as the seminal papers by Duflo, Kremer and Robinson (2004, 2008, 2011) and Foster and Rosenzweig (2010). We add to this important literature by studying the financial technology upgrading decisions of SMEs (in the service sector) and understanding the barriers to adopt to this end. Importantly, several papers in this literature highlighted the role of behavioral factors on technology adoption, such as complexity of information (Hanna et al. (2014), and Drexler et al. (2014)), present bias and loss aversion. 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 risk aversion, present bias, future bias, trust and cognitive capacity.

Also relevant for our paper are the empirical studies on technology adoption, which are interested in understanding the heterogeneity in technology adoption decisions across firms, such as 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 Institutional Context: Mobile Money in Kenya**

In Kenya the most commonly utilized form of electronic money is mobile money: a cashless instrument which allows users to transfer money using cellular text messages (SMS). In

this section we provide a short overview of the essential characteristics of mobile money products in Kenya, with a particular focus on Lipa Na M-Pesa, and motivate our analysis.

### 3.1 M-Pesa

In Kenya, M-Pesa is the most commonly utilized mobile money service that allows users to send money through text messages to any mobile money user in the country.<sup>5</sup> Cash (in other words paper money) can be converted into electronic M-Pesa units at specialized agents - called *M-Pesa Kiosks* - and stored in a user's M-Pesa account. M-Pesa units deposited in a user's account can then be transferred to other mobile money account holders via simple text messages. After being introduced in 2007 by Safaricom, mobile money usage has grown rapidly. In December 2014, the total number of M-PESA Kiosks in Kenya was about 124,000 (around 20 percent of them in Nairobi (FSP interactive maps, 2013)) with approximately 25 million customers. The total number of M-PESA transactions in 2013 were 282.5 million, and the total value of money transferred was 1.9 million Kenyan shillings<sup>6</sup> - an equivalent of 40% of Kenyan GDP in 2013.<sup>7</sup> Since 2007 Kenyan households have utilized M-Pesa for not only transferring or receiving money but also for saving: according to survey evidence by Jack and Suri (2011), 85 percent of the households store some amount of money in an M-Pesa account.

Signing up for an M-Pesa account does not entail any monetary costs: all that is needed is to visit an M-Pesa Kiosk with a form of identification and a mobile phone. Once an account is opened, exchanging paper money for M-Pesa units comes for free as well. For a customer, there are two costs associated with using M-Pesa. First, sending money via SMS involves a variable cost increasing in the amount transferred, and this cost profile follows the pattern of a step function as we depict in Figure 1, with lower marginal costs of transferring M-Pesa at higher levels of transfers. In order to receive electronic money transfers - packaged in M-Pesa text messages - the recipient is also required to have a mobile phone and moreover a mobile money account (provided by Safaricom or one of its competitors). Receiving M-Pesa transfers does not entail any cost for the recipient. The second key cost component is related to the fees charged when converting M-Pesa units into cash. Converting M-Pesa into paper money at an M-Pesa Kiosk is costly - as illustrated in Figure 2.

Figures 1 and 2 here.

In addition to facilitating person to person (P2P) transfers, M-Pesa customers can also buy goods and services at retail stores or pay utility bills. There are also some mobile money

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<sup>5</sup>At the time of the study other major mobile money providers in Kenya were Airtel Money, Orange Money, Equitel, Mobikash, and Tangaza. 77% (about 21 million) of the mobile money subscribers were M-pesa users in June 2015 (Communications Authority of Kenya (2015).

<sup>6</sup>22 billion U.S dollars.

<sup>7</sup>Data used for calculating number of Nairobi M-pesa agents are from November 2013. We calculated U.S dollar equivalent of M-pesa transfers by using 2013 average of official exchange rate.

services through which businesses can pay salaries to mobile phones of their employees. P2P service is sometimes also utilized for other business related transfers (e.g. purchasing supplies, repaying informal loans) or purchasing goods and services (e.g. paying taxi fares).

Our research concerns the adoption of mobile money technology among Kenyan retailers as a payment instrument. The P2P feature of M-Pesa can be utilized to pay for goods and services at retail stores; specifically, by making transfers to the personal M-Pesa account of a business owner. However, the P2P service is not specially designed to cater the needs of retail transactions (P2B or B2B). Two caveats are important to highlight in this respect. First standard M-Pesa allows for storage to a certain extent, which a business owner - who would utilize a personal M-Pesa account to receive payments regularly - might find quite inconvenient. Second, personal M-Pesa does not feature an option that would allow for detailed account overviews, which could make record keeping difficult for a business. Potentially also because of these technological disadvantages, M-Pesa adoption by Kenyan retailers as a method to receive payments from customers did not pick up as fast as the adoption of M-Pesa as a money transfer/storage tool among Kenyan Households: in a recent survey of 1,047 Nairobi SMEs (FinAccess Business Survey, 2014), only 35 percent of firms report that they accept M-Pesa as a common method of payment vis-a-vis customers.

Since adoption of M-Pesa among retailers could significantly stimulate the overall usage of this technology throughout Kenya, in June 2013 Safaricom launched a new M-Pesa product tailored for the needs of retail stores - called *Lipa Na M-Pesa*. Lipa Na M-Pesa resolves the above mentioned two caveats for business owners and its usage comes for free for customers. Next we turn to delineating on the Lipa Na M-Pesa technology, whose adoption by retailers will constitute the core analysis in this paper.

### 3.2 Lipa Na M-Pesa

Lipa Na M-Pesa was launched by Safaricom in June 2013 with the aim to raise the usage of M-Pesa in retail transactions. As of March 2014 about 122 thousand merchants had adopted the technology. 20% of these adopters (about 24,000 merchants) had been actively using this technology according to the survey evidence provided by Katalak (2014) and the number of active users merchants rose to 46 thousand in 2015 (Safaricom, 2015). The benefits and costs of adopting this payment technology are as follows.

**Benefits of the technology.** There are five key characteristics of Lipa Na M-Pesa, which differentiate this technology from the standard M-Pesa transfer technology and promote it as an appropriate payment instrument to serve for retail transactions in-between customers and businesses.

- 1. Customers do not need not to adjust their M-Pesa account.** In order to send a payment to a business' Lipa Na M-Pesa account, the customer does not need to have access to an additional account. Any standard M-Pesa account holder can transfer

payments to a Lipa Na M-Pesa account of any business.

**2. Free of charge for customers.** Moreover, customers - when they use their personal M-Pesa accounts to transfer payments to business Lipa Na M-Pesa accounts - are not charged with transfer fees. If the retailer only has a standard M-Pesa account to receive payments instead of Lipa Na M-Pesa and a customer wanted to pay with M-Pesa, the customer would have been subject to variable transfer costs, increasing in the amount transferred to the owner's account as depicted in Figure 1.

**3. More money storage capacity.** As an important advantage for the business, Lipa Na M-Pesa's money storage capacity is higher than that of standard M-Pesa. This means a business owner does not need to cash-out too often, substantially reducing the transaction frictions and monetary cost of cash withdrawals. Moreover, M-Pesa-to-cash conversion fees (depicted in Figure 2) charged on Lipa Na M-Pesa follow the same pricing schedule charged on cash withdrawals from standard M-Pesa accounts.

**4. Record keeping.** Lipa Na M-Pesa allows the business owner to access the daily transaction records of his/her business accumulated over a six-months period for free. By sending an email to Safaricom the business can ask for a transcript of Lipa Na M-Pesa transactions for the past six months. This helps the business to keep an eye on the records of transactions at no cost.

**5. Lower marginal cost.** The variable payment fees of Lipa Na M-Pesa - which are charged to the business owner - are on average lower than the variable (P2P) transfer fees charged on transactions between two standard M-Pesa accounts. The business gets charged with a 1% Lipa Na M-Pesa usage fee, for every unit of payment made by the customer to the Lipa Na M-Pesa account of the business. However, when we compare this 1% charge against the marginal cost figures associated with the standard M-Pesa in Figure 1 (which get paid by a customer whenever a transfer is made to a standard M-Pesa account), we observe that for a very broad range of payment levels the usage of Lipa Na M-Pesa would raise the surplus generated by an economic transaction between a customer and a business. Also importantly, retailers are allowed to surcharge through Lipa Na M-Pesa, if they wanted to do so. As we will show in our descriptive statistics section below, for transaction volumes relevant for the retailers that we concentrate on, Lipa Na M-Pesa transaction fees are lower than that of standard M-Pesa transfer fees.

**Potential barriers to adopt the technology.** The above five key advantages show that there are clear efficiency gains from adopting Lipa Na M-Pesa, which make studying the adoption of the Lipa Na M-Pesa technology economically interesting. Having said this we would like to highlight that there can be three types of non-pecuniary barriers associated with adopting Lipa Na M-Pesa, to which we turn next.

**1. Lack of Information.** Business owners might lack the knowledge regarding the costs and benefits of this technology as well as the know-how about the Lipa Na M-Pesa technology-use.

**2. Registration Costs.** Business owners might lack the time they could spend in opening a Lipa Na M-Pesa account by completing the registration paperwork.

Both of these cost items could hinder efficient payment technology adoption and usage rates. This is what we are after to investigate in this paper. Specifically, as we will delineate in the next section we design an experimental intervention in order to exogenously lower adoption costs associated with (1) knowledge and know-how and (2) registration costs, and explore the adoption behavior of the Lipa Na M-Pesa technology among a sample of restaurants and pharmacies located in Nairobi, which did not have a Lipa Na M-Pesa account before our intervention.

**3. Visibility.** There is an additional potential cost of Lipa Na M-Pesa. Lipa Na M-Pesa adoption requires the registration of the product under the name of a business. Therefore, upon registration the payments made to the business in M-Pesa units get recorded as “business transactions” in Safaricom account for that particular business, similar to the advanced economy payment-instrument counterparts. On the other hand, if the personal M-Pesa account of the business owner is used for business purposes the transactions cannot be traced as business activity in the electronic environment. Also, the presence of a till-number - which the customer needs to transfer the payment - and the advertisement material makes the use of the electronic payment product highly visible to the customers and other business owners in the neighborhood. For these reasons, businesses who would like to avoid electronic transaction visibility could find the adoption of the Lipa Na M-Pesa payment technology costly. This is a cost of adoption that is not possible to experimentally vary. The same is also true for the five key advantages of Lipa Na M-Pesa listed above. Therefore, we study the role of the visibility cost of Lipa Na M-Pesa - as well as Lipa Na M-Pesa’s relative advantages across businesses exposed to mobile money products a priori to our experiment - in explaining the heterogeneous adoption behavior using the detailed structure of our survey instrument.

## 4 Experimental Design and Data

In this section we describe the sampling procedure, the randomization of firms to treatment and control groups, the design of the experimental intervention as well as key descriptive statistics for the sample of firms.

### 4.1 Sampling and Randomization

The study took place in Nairobi, in the area just outside the city’s central business district. We chose the peripheries of central Nairobi because Lipa Na M-pesa subscription was limited in those districts. We decided to focus on restaurants and pharmacies because they both share characteristics which potentiate the benefits of a cashless payment technology: they have high exposure to external and internal theft, relatively high frequency of daily

transactions and large number of customers.

To draw the sample of businesses, enumerators were assigned to specific areas in the periphery of central Nairobi and were asked to identify restaurants and pharmacies satisfying the following eligibility criteria: to have at least one employee, to not have a Lipa Na M-Pesa account already, to be located in a distance not less than 50 meters from the closest business sampled and to be willing to participate in a study about mobile money use in businesses. The restaurants were listed in May and June 2015, and the pharmacies in August and September 2015. In between the time we listed the restaurants and the pharmacies, Safaricom changed the formal requisite to open a Lipa Na account. It became a necessary requisite to have an up to date business license. That made us include this requisite in the sampling protocol for the pharmacies.<sup>8</sup>

In total we sampled 1222 firms, 669 restaurants and 553 pharmacies. Out of this sample, we randomly assigned 331 restaurants and 276 pharmacies to the treatment group and we left the rest as a control group. The randomization was stratified by number of employees and geographic location.<sup>9</sup> Figures 3 and 4 illustrate the distribution of the treatment and control businesses in the sample.

## 4.2 Lipa Na M-Pesa Intervention

We first visited the 669 restaurants in June-August of 2015 and then the 553 pharmacies in September-October 2015. During our visits, we administered a baseline survey to all firms in control and treatment groups.<sup>10</sup> In addition, in the 607 firms assigned to treatment and right after the baseline survey was completed, we introduced information about Lipa Na M-Pesa and offered to open an account on behalf of the owner and for free. Our intervention included:

1. Information on advantages of Lipa Na relative to cash and standard M-Pesa.
2. Account registration and paperwork costs.
3. Know-how about the technology usage.

### 4.2.1 Information

Our intervention increased the awareness of business owners concerning the advantages of Lipa Na M-Pesa relative to cash and standard mobile money products. We did so in two

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<sup>8</sup>The change in the business license requirement resulted in 292 restaurants which participated in our baseline survey not to be eligible to adopt the technology since they did not have a business license. 47 pharmacies stated that they had a business license in the sampling visits; however, baseline data collection revealed that they did not have one.

<sup>9</sup>We consider a restaurant (respectively pharmacy) with more than 5 (respectively 2) employees to be big and we use this categorization to stratify the sample.

<sup>10</sup>We also conducted a complementary shorter survey in April 2016 for the cases in which it was not clear that the enumerators had administered the survey to businesses managers or owners.

different ways. First we showed a video broadcasting interviews with successful restaurant (pharmacy) owners in Nairobi, who explained how they took advantage of the Lipa Na M-Pesa technology and how Lipa Na helped then increased the efficiency of monetary transactions. Importantly, the videos featured role-model business owners to disseminate the information concerning the benefits of the product.<sup>11</sup> In addition to the videos, enumerators also handed in a leaflet (in Appendix A), that listed the costs and benefits of using Lipa Na M-Pesa as a method to receive payments from customers, compared to cash or standard M-Pesa.

#### 4.2.2 Registration Costs

In addition to the information mentioned above, we provided the owner with the possibility to open a Lipa Na M-Pesa account on his or her behalf. Specifically, we offered:

- (i) to fill out the registration paperwork and delivery of the required registration material to Safaricom, and
- (ii) to pick up the SIM card including till-number (alongside advertisement material) from Safaricom and to bring this material back to the business.

Completing this procedure can constitute a substantial hassle for some businesses and our intervention released this adoption cost.

#### 4.2.3 Know-how

As part of the intervention, we promised each treated business owner to take the business to a “transaction ready” mode, should she/he be willing to adopt the technology. We offered:

- (i) to deliver the SIM-card and the till number to business;
- (ii) to insert the SIM-card to the mobile phone that was provided by a business owner to be used for Lipa Na M-pesa transactions;
- (iii) to test whether the mobile phone receives Lipa Na M-Pesa mobile signal, and the SIM card is registered on the network and functional;
- (iv) to perform a test transaction worth of 100 KShs. to show how Lipa na M-pesa is used.

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<sup>11</sup>The following two links contain the videos that we utilized as part of our intervention: <https://drive.google.com/open?id=11IEsVZwyDGuRliXMPiCiwMmkbu0nxoqh>, <https://drive.google.com/open?id=13SpxHoJRw1j7-5cP330UH3fKldAvn071>. The video for restaurants lasts 5.2 minutes and the one for pharmacies lasts 3.2 minutes)

### 4.3 Descriptive Statistics and Balance Tests

Table 1 provides the descriptive statistics of the sample of merchants as well as the tests for the sample balance between control and treatment groups.

Table 1 here.

The average business in our sample is rather small. On average, pharmacies employ three workers and restaurants employ five. The average monthly sales and profits of pharmacies are about 1470 and 600 U.S dollars PPP respectively, and of restaurants about 3225 and 820 U.S dollars PPP respectively. Only 19% of the pharmacies and 36% of restaurants invested in their businesses in the past 6 months and only few businesses have received loans in the past 12-months. Moreover, 91% of pharmacies and 54% of restaurants have a business license.<sup>12</sup> Importantly, almost all business owners in our sample possess a standard personal M-Pesa account. However, restaurant owners use their personal mobile money account significantly more for business transactions than pharmacy owners. 43% of restaurants and 31% of pharmacies report mobile money to be the most frequent method of payment to suppliers, while 40% of restaurants and 25% of pharmacies have received payment from their customers through personal mobile money account of the business owner. However, the fraction of customers paying via mobile money is limited for both restaurants and pharmacies. The average share of restaurant- (pharmacy) customers that pay through personal mobile money accounts of business owners is only 3% (2%).

A key question in our baseline survey measures the pre-treatment awareness of the Lipa Na M-Pesa technology among restaurants and pharmacies. Table 1 shows that more than 90% of pharmacies and restaurants in our sample new about the existence of Lipa Na M-pesa but chose not to adopt previous to our experimental study. We also asked about the reasons for not having adopted Lipa Na, and the primary reason reported was not seeing any benefits of the technology. Business owners and managers also thought that it was too costly to open the account, Lipa Na M-pesa transaction fees (money transfer) were too high, and they claimed not having the time to fill-out the account registration paperwork.

Finally, highly important for our analysis, no business in the sample sell their main product for more than 8500 Kenyan Shillings. This is important because this is the threshold amount of payment above which transferring money to a Lipa Na M-Pesa account becomes more expensive than transferring to a standard M-pesa account in a customer-to-business transaction (see Figure 1). Since surcharging is allowed, this means that all businesses in our sample can profit by asking the customers to pay through Lipa Na instead of paying through the standard personal M-Pesa accounts of the business owners.

Columns 4 and 8 of Table 1 report the p-values of the tests of the differences between the two groups of merchants. Overall, the sample characteristics of restaurants are balanced

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<sup>12</sup>The fraction of restaurants with business license is less than that of pharmacies due to the change from restaurant sampling strategy to pharmacy sampling strategy, as explained in Section 4.1 above.

between the treatment and control groups. Compared to the control group, the treated pharmacies have higher sales and profits and are more likely to pay salaries through the mobile money accounts of their employees. Likewise, more pharmacies in the treatment group opened a Lipa Na M-pesa account in the period between the sampling and the survey and <sup>13</sup> We control for this unbalance in the regression analysis of Section 5.2.

## 5 Results

### 5.1 Preference for Adopting the Technology

In this section we investigate the “willingness to adopt” of the Lipa Na M-Pesa technology among all treated businesses, while in 5.2 we will analyze the actual usage of the technology by concentrating on only those businesses with a valid business license. The reason why we investigate “willingness to adopt” separately from the actual take up/usage is because of the presence of a large group of restaurants in our sample without a formal business license, which - due to the policy change explained above - causes an unmet demand for the technology adoption despite for willingness to adopt. We define “willingness to adopt” through a question asked to the treatment group businesses at the end of the baseline survey on “whether the business is interested in signing up for Lipa Na M-Pesa following up on the technology information & assistance treatment provided by the research team”.

Once the main barriers to adoption are released, are the businesses willing to adopt the technology? In total, we removed informational and registration barriers for 294 restaurants and 252 pharmacies. Right after the intervention, 62% of the restaurants and 21% of the pharmacies revealed their willingness to have a Lipa Na account opened on their behalf. This indicates that the seemingly small adoption barriers that we removed with the intervention were indeed binding for an important proportion of the sample. Table 2 describes the characteristics of the businesses in this group, compared to those who express no interest for the technology. On average, the businesses who revealed a preference for the technology are more intense users of standard M-Pesa at baseline. The restaurants who prefer the technology are also more likely to receive payments, store money, and pay for inputs via personal mobile money products. Pharmacies who prefer the technology have higher sales and employ more people.

Table 2 here.

Figures 5, 6 and 7 provide a graphical illustration of the reasons the businesses stated at baseline for not adopting the technology. Among restaurants who revealed their preferences for the technology after our intervention the three most important stated reasons for not having opened a Lipa Na M-pesa account before our baseline are not having the time to

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<sup>13</sup>82 restaurants (12%) and 25 pharmacies (5%) adopted the Lipa Na M-pesa technology in the periods between listing and baseline/intervention.

open an account, not seeing any benefits of Lipa Na M-pesa and complexity of the product were. These stated preferences are consistent with their revealed preferences after our intervention, since they actually express their willingness to adopt the technology once the barriers they claimed to be binding were released. Interestingly, the non-adopter restaurants claimed that “not having enough time to fill out the registration paperwork” was a barrier, but they also stated that they don’t believe Lipa Na could increase their sales or could have any benefit to them. These results indicate that filling out the registration paperwork and opening the account on behalf of the restaurants - for free - without sacrificing the efforts of business owners or the employees might have stimulated the decision to adopt the technology.

Figure 3 here.

Among pharmacies who are willing to open a Lipa Na M-Pesa account, the reasons for not already having one is more evenly distributed. Still, not having the time to register for the Lipa Na M-Pesa account and not seeing benefits are reported as relatively important reasons by adopter pharmacies, which is in line with what we document for the case of adopter restaurants. Also consistent with our observations for the restaurant sub-sample is the significant difference between the number of adopters who report “not having the time to open the account” as an important reason for not having adopted before the treatment and the intensity of the same reason being reported by non-adopters. Non-adopter pharmacies provide user fees and not seeing any benefits of the technology as the key reasons for no-adoption.

Figures 4 and 5 here.

We next continue with a formal regressions analysis to understand the factors that could determine the willingness of a merchant to adopt Lipa Na M-Pesa. We consider three groups of factors: past exposure to mobile money in general, visibility concerns and behavioural characteristics.<sup>14</sup>

Tables 3A and 3B here.

### **5.1.1 Past Exposure to Mobile Money Technology**

A novel payment instrument, such as Lipa Na M-Pesa, is expected to intrigue an interest to adopt among businesses which value similar electronic payment technologies. This “primary adoption channel” is also highlighted in a recent experimental study by Arifovic et al. (2017). The authors show that the willingness to cover fixed technology adoption costs associated with electronic payment instruments are higher when businesses expect that customers would value paying electronically.

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<sup>14</sup>Table 3A provides the full list of variables utilized in this analysis. Table 3B provides summary statistics of the main variables.

Additionally, business owners' intrinsic valuation of electronic money is expected to be important in explaining Lipa Na M-Pesa adoption as well. We measure such valuation with the following questions: "use of owner's own mobile money account for business purposes", "total number of customers who transact using the standard mobile money technology", "the willingness of the business owner to not increase prices when transacting with mobile money", "use of mobile money as a storage device", and "paying bills, salaries, and for input purchases with mobile money".

Furthermore, theft may be an important driver of demand for electronic money instruments and those who are exposed to high risk of theft would value Lipa Na M-Pesa relatively more.<sup>15</sup> Therefore, we control for the exposure of the business to cash theft in our empirical specification as well.

To counteract the valuation items listed above, the use of Lipa Na M-pesa is less appealing when business owners are expected to frequently withdraw cash from mobile money accounts with the purpose of transferring money into saving accounts. The reason is that withdrawing cash or sending money to a bank account through any form of M-pesa involves both monetary transaction costs (withdrawal and transfer fees) and non-monetary transaction costs (such as the time spent to withdraw cash from an M-pesa kiosk and depositing it to the bank account). At the time our experiment was conducted, there was only 1 bank that provided a real time cash transfer service from Lipa Na M-pesa to business bank accounts. The cost of this service was 50 KSh per transaction. For the accounts at other banks or financial institutions, when business owners would like to transfer money from Lipa Na M-pesa accounts to their business bank accounts, they were required to use Pay-Bill or M-pesa transfer service, using which is costly as delineated before. Therefore, the frequent use of bank accounts for business purposes to deposit cash could lower the valuation of the Lipa Na M-Pesa payment product, which we will also control on the right hand side of our regressions.

Finally, firms that are larger in scale are expected to benefit more from having released fixed adoption costs. Therefore, in order to control for size effects we also include total number of customers, total employment and total sales on the right hand side of our regressions.

### **5.1.2 Cost of Lipa Na M-Pesa: Visibility**

Customer transactions through Lipa Na M-Pesa get recorded as business-activity and therefore firms that do not want public disclosure of their firm revenues might be inclined to not adopt the technology. On the other hand, the presence of a till-number in the store would make the product visible to all customers of a business as well as to its peers in the neighborhood.

The visibility related cost of Lipa Na M-Pesa adoption is difficult to measure directly.

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<sup>15</sup>See Jack and Suri (2014) and Economides and Jeziorski (2016).

However, we can capture this cost item indirectly. In this respect, the closest measure available is the willingness of the business to disclose revenue and profit figures during our survey interview. This measure, of course, could also correlate with trust of the survey respondent in the interviewer (and the research team), which we will also control as a behavioral factor in our empirical analysis using a measure for “trust in a person at a first-time contact”.

Furthermore, firms that offer their customers the option to purchase on credit and registered firms (with an up-to-date business license) are expected to have less visibility concerns. Also, financially sophisticated firms - i.e. those connected to a formal credit network as well as those that keep business records - are likely to be less worried about the visibility of electronic transactions as business activity. Finally, larger scale establishments and more profitable businesses (which of course are also indicators to capture returns to M-Pesa as highlighted above) are likely to have lower visibility worries as well.

We control on the right hand side of our regressions for variables that capture these indirect-measures in order to understand whether visibility-related concerns can explain (non-)adoption behavior of businesses.

### 5.1.3 Entrepreneurial Characteristics

Past research highlighted the role of behavioral traits for technology adoption among micro and small enterprises. Importantly, this literature suggests that the complexity of information concerning the benefits of a new technology can limit adoption. Individuals would pay attention only to the slice of the information set, which they think is the most relevant to themselves. Hanna et al. (2014) suggest that this issue could be handled with the provision of simplified information. We design our experiment with this insight in mind. We provide simplified and concrete information about the Lipa Na M-Pesa technology costs and benefits in a straightforward way (one page of bullet points in an information leaflet and an information video). Furthermore, since cognitive capacity of the potential adopter could be important in determining the ability to grasp the benefits of the technology and the realization of the actual adoption, our regressions control for the cognitive ability of the business owner/manager - measured by a digit spam test. In order to measure merchant’s short-term memory - a proxy for the cognitive ability - we use the maximum number of digits that a business owner remembers correctly from a sequence of digits (from 1 digit to 9 digits) read only once by the enumerator.<sup>16</sup>

If technology adoption requires costly experimentation, time preferences could also play a role in explaining resistance to adopt. In order to understand the relevance of time preferences for the adoption of an efficient financial technology we also measure present bias and future bias of the business owner as potential explanatory variables. We elicited

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<sup>16</sup>please see section F of the survey for details of time span test at [https://drive.google.com/file/d/1AYbZP\\_ygsjuV0Rk9o2M3mPY\\_dK-rB7G5/view?usp=sharing](https://drive.google.com/file/d/1AYbZP_ygsjuV0Rk9o2M3mPY_dK-rB7G5/view?usp=sharing)

time and risk preferences of respondents in an incentive-compatible way<sup>17</sup> To elicit time preferences merchants were asked to choose between receiving either 500 Ksh (US\$4.93) the next day, or receiving a larger amount in 31 days. To measure time consistency, we asked merchants to choose between Ksh 500 in 31 days and a larger amount in 61 days.<sup>18</sup> We calculated two individual discount factors (idf1 and idf2). To calculate idf1 - the factor that equalizes the indirect utility from receiving 500Ksh next day and or a higher amount 31days later - we check the point, at which respondents opt for the larger amount payment in 31 days instead of the 500 Ksh. the next day. To calculate idf2 - which measures the factor that equalizes the indirect utility from receiving 500Ksh in 31 days or a higher amount in 61 days we check the point, at which respondents opt for the larger amount payment in 61 days instead of the 500 Ksh. We consider the respondents are present biased if their idf1's are greater than their idf2's and future biased if their idf2's are greater than idf1's.

Furthermore, there is an additional behavioral aspect that is relevant when it comes to understanding the adoption of a technologically advanced financial instrument: trust. Finance is naturally constrained in economies, where financial counter-parties do not trust each other and/or trust in institutions which provide and support financial contracts is weak. Therefore, for our context, trust in the financial technology provider, trust in institutions as well as trust in customers could generate a resistance to adopt the Lipa Na M-Pesa payment instrument. The trust of the respondents in the research team (proxied by trust in people when met the first time) could also be important in determining the interest to adopt the technology. We control for these important dimensions of trust in our empirical analysis as well.

#### 5.1.4 Empirical Specification and Results

We regress the willingness to adopt (0,1) in the treatment group on variables that we described in sections 5.1.1-5.1.3 in addition to district fixed effects and business type fixed effect using a linear regression specification. Specifically we estimate following model by using OLS:

$$Adopt_i = \alpha + \beta'Valuation_i + \omega'Visibility_i + \gamma'Behavior_i + \phi'Size_i + \chi_i + \mu_j + \epsilon_i, \quad (1)$$

where  $i$  denotes the business.  $Valuation_i$  is the vector including valuation,  $Visibility_i$  is the vector including visibility,  $Behavior_i$  is the vector including behavioral factors, and  $Size_i$  is the vector including business size measures.  $\chi_d$  is the enumerator-and-district fixed effects and  $\mu_j$  is business type (restaurant v.s. pharmacy) fixed effects that we control for by adding enumerator dummies and business type dummies.

<sup>17</sup>To encourage truth-telling, all time preference decisions were actually paid.

<sup>18</sup>Please see section E of the survey for details of time preference experiment at [https://drive.google.com/file/d/1AYbZP\\_ygsjuVORk9o2M3mPY\\_dK-rB7G5/view?usp=sharing](https://drive.google.com/file/d/1AYbZP_ygsjuVORk9o2M3mPY_dK-rB7G5/view?usp=sharing).

In Table 4 we provide results from the full sample of firms, whereas Tables 5 and 6 report results for restaurant and pharmacy sub-samples. In all tables the variables contained in panel A measure ex-ante mobile money valuation, variables in panel B measure visibility concerns, variables in panel C are behavioral aspects and finally variables in panel D are business size indicators.

We estimate three specifications of the model. In the first specification we use aggregated valuation and visibility-concern proxies in addition to behavioral factors and business size indicators. For valuation we use a dummy variable for use of mobile money for business purposes and a dummy variable for saving at a bank or a microfinance institution for business purposes. We also include a theft index in the regression to measure safety-related willingness to adopt the technology. To the end of visibility concerns, we include the respondent's willingness to share sales & profit figures with the research team and a financial sophistication index.<sup>19</sup> In the second and third specifications we replace the aggregated indicators with detailed valuation proxies for mobile money use, detailed visibility-concern indicators, and variables that measure theft and safety concerns of the respondent.

Empirical results from the full sample analysis reveal in Table 4 that indicators for “high pre-treatment exposure to mobile money (captured by past mobile money usage variables)” have significant coefficient estimates throughout the regression specifications. Specifically, usage of owner's mobile money account for business purposes, receiving payments from customers through owner's personal mobile money account, paying for input supplies via mobile money, number of customers who are willing to transact with mobile money, the share of business expenses paid with mobile and very importantly not-increasing-prices when transacting with mobile money, all enter the “willingness to adopt” regressions with positive and statistically significant coefficient estimates. Also as expected saving through a business bank account has a negative and statistically significant coefficient estimate - indicating the potential low valuation of the product among those businesses, which cash-out and save on a regular basis.

To highlight the economic significance of the effects, for instance, businesses that use mobile money for business purposes and those who do not charge higher prices when receiving payments via mobile money are 14-15 percentage points more likely to adopt the technology compared to other businesses.

In terms of the cost of visibility measures we also obtain an interesting result. The dummy for “the respondent did not want to share sale and profit figures during the survey interview” has a statistically significant negative coefficient estimate throughout regressions. More specifically, businesses that do not share sales figures with our research team are about 13 percentage points and those who do not share profits are about 18 percentage points less likely to adopt the Lipa Na M-Pesa technology. Despite the fact that most

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<sup>19</sup>For financial sophistication, theft and safety we create two index variables: finance index - index for formal loan use from banks and mobile money providers, and keeping business records - and safety index - index of experiencing internal and external theft, and feeling not safe.

of the other visibility aversion proxies turn out to be insignificant, most coefficients have expected signs, for example having an up-to-date business permit from the government, financial sophistication, and keeping formal business records are positively related to Lipa Na M-Pesa adoption.

In the full sample analysis, in some regressions digits remembered in the memory span test have (positive) significant coefficient estimates - indicating that cognitive ability might be playing a role in adoption decisions as well. The remaining behavioral aspects do not have significant explanatory power for the adoption behavior in the full sample.

Table 4 here.

We then apply the same empirical specification to understand the adoption behavior in restaurants and in pharmacies. In Table 5 we show that pre-treatment valuation of mobile money turns out to be important for the adoption of the Lipa Na M-Pesa among restaurants. Specifically, for the case of restaurants the use of the owner's personal mobile money account for business purposes, the number of customers who like to transact via M-Pesa and paying suppliers via M-Pesa, have positive and significant coefficients. The rest of the coefficients - though mostly have consistent signs with the full sample analysis - do not enter regressions significantly.

Finally, Table 6 illustrates that for pharmacies the pre-treatment use of mobile money is significant in explaining adoption behavior as well. Different from the restaurant subsample though not-raising prices when receiving payments via M-Pesa is also a significant variable in addition to the significant negative coefficient associated with saving at a business bank account on a regular basis. Importantly, to the end of visibility concerns of the pharmacies, not sharing sales and profit figures during the survey interview is statistically significant (at 1% and 5% levels) across regression specifications. Additionally throughout all regressions future biasedness (negative) and trust in mobile money provider (positive) have significant coefficient estimates as well, while in some regressions digits remembered in the memory span test have significant explanatory power for technology adoption behavior as well.

Tables 5 and 6 here.

To summarize, our results show that the ex-ante valuation of (and exposure to) existing electronic money products at businesses is important to understand the adoption of technologically more advanced payment instruments. As discussed before, this result echoes some recent findings from lab-experiments, such as Arifovic et al. (2017) which reveal that reduction in external barriers to adopt would be better received when customers are expected to prefer electronic payment instruments in transactions. Mimicking the evidence documented by the general literature on technology adoption, we also find that behavioral factors could also be relevant for the adoption of advanced electronic payment instruments.

Finally, our research reveals that visibility concerns of business owners/managers could generate a resistance to adopt. This is a new empirical finding that policy makers might need to pay attention to when designing cashless payment instruments.

## 5.2 Use of the Technology

Utilizing information from baseline and endline surveys - on both treatment and control groups - we analyze the impact of our experimental intervention on Lipa Na M-Pesa usage and business outcome variables. To examine the effect, we choose to use only the businesses with a business license in the baseline, 868 pharmacies and restaurants. Our study's objective is to investigate the impact of our treatment on the businesses that are eligible to open and use a Lipa Na M-pesa account.

Tables 7 and 8 here.

Before we proceed with the empirical analysis, in Table 7 we present some critical descriptive statistics from the endline survey. A total of 618 businesses with the business license participated in endline data collection that we conducted in February 2017, over 16 months after baseline data collection. The rate of attrition in between the baseline and the endline is 29%. We then regress “not participating in the endline survey” on “being assigned to the treatment group” and other business characteristics to examine whether the attrition is non-random. Table 8 presents the estimates from this regression. The estimates indicate that attrition is less among pharmacies than among restaurants, and for businesses that have Lipa na M-pesa accounts and more mobile money customers, experienced external theft, received a mobile loan, trust in mobile money companies, and are with more employees. However assignment to treatment group is not significantly related to attrition, implying that attrition does not bias our impact estimates for the treatment.

In Table 9A we provide Intention-to-Treat (ITT) estimates associated with the impact of our experimental treatment on “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”. As our ITT estimates reveal, all four of the intended “usage” variables that we aimed to move with our experimental intervention got significantly influenced by the treatment. The Lipa Na-Mpesa use is about 7 percentage points higher in the treatment group than in the control group, and the treatment increased cashless payment technology usage by about 40% relative to the usage in the control group. As shown in column 4 of Table 9, the treatment enhanced the monthly Lipa Na M-pesa sales by 26%, or about 3256 Ksh. (32 US\$) additional sales via Lipa Na M-pesa and 15% of the average sales of an SME from our pooled sample in the endline.

Tables 9A and 9B here.

In Table 9B we split the sample based on the visibility measure that we developed in Section 5 through “willingness of the respondent to share sales/profits figures with the enumerator in the baseline”. Highly consistent with our findings from Section 5, in Table 9B we observe that those businesses which shared sales in the baseline ended up using Lipa Na M-Pesa significantly more when assigned to the treatment group - compared to the businesses which declined to share sales with the enumerators. These results indicate that visibility-cost concerns of the respondents associated with Lipa Na M-Pesa might be effective not only for the adoption of the technology but also for its usage.

Panel A of Table 10 presents Treatment-on-Treated regressions with entrepreneurs’ responses on “feeling more safe when conducting the business operations”, “experiencing sales loss due to not being able to provide change”, and “using mobile money accounts for record keeping” as the outcome variables. Importantly, this table shows that treated firms who picked up and utilized the technology in their transactions ended up feeling more safe based on the endline survey data.<sup>20</sup> This is an important result, as it confirms the motivational conjecture that we laid down in Section 3 on the role of an electronic money instruments in increasing the retail transaction safety among SMEs.

Table 10 here.

Finally, in Panel B of Table 10, we present Treatment-on-Treated estimates with sales, profits and employment as the outcome variables. These regressions indicate that our intervention did not have an effect on these outcome variables. We do not find this finding too surprising, because the core motivation to adopt and use Lipa Na M-Pesa is mainly associated with securing and then efficiently organizing retail transactions in-between customers and the business.

## 6 Conclusion

In this paper we analyzed the factors affecting the decision to adopt a novel profitable mobile money technology, Lipa Na M-Pesa, tailored for the needs of SMEs in Kenya and the impact of our treatment on the usage of the technology and other outcome variables. Mobile money is thought to stimulate economic growth for at least two reasons. First, it facilitates transactions as compared to cash payments, as it lowers the risk of theft and there is less need to carry small change. Second, it allows for easier book keeping. We randomly selected group of SMEs from two specific sectors and advertised the benefits

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<sup>20</sup>We use a 2SLS model to estimate the TOT. In the first stage, we use being in the treatment group and interaction of being in the treatment group and in the pharmacy sample as the instruments to predict receiving payments via Lipa Na M-pesa. Then we regress the safety, management practices safety, and the mobile loan outcome variables to the predicted value for the receiving payments via Lipa Na M-pesa variable. We control for the baseline value of the outcome variable; whether the business has a Lipa Na M-pesa in the baseline period; baseline level of the employment; the gender of the business owner; and the business type (restaurant v.s. pharmacy) and district fixed effects.

of the new technology compared to existing mobile money technologies, offered to take care of the paperwork involved in opening the Lipa Na M-Pesa account, and provided the opportunity of a training in allowing to make the most use out of the new technology.

We find causal evidence that small bureaucratic hassles and lack of information constitute a major barrier for adopting this profitable technology, in particular for restaurants. Exogenously lifting these barriers increased the interest to adopt by 62% in restaurants and by 21% in pharmacies. This result is line with the view of Bertrand, Mullainathan and Shafir (2004), who argue that, in the context of poverty, small situational barriers play a decisive role in preventing people to take advantage of profitable investment opportunities.

Further empirical results using our baseline survey instrument show that pre-treatment valuation of standard mobile money products, financial visibility concerns of the business and finally - for the case of pharmacies - future biasedness, cognitive ability and trust in mobile money provider are important determinants in explaining the payment technology adoption behavior.

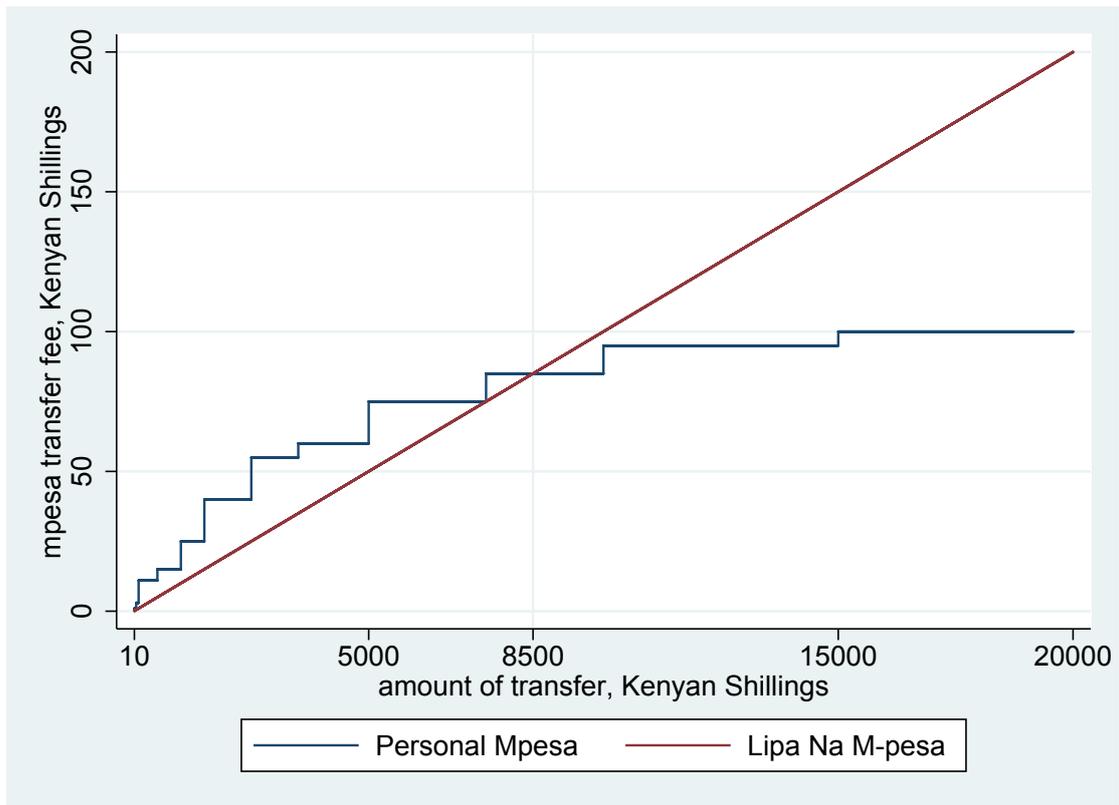
Finally, utilizing our endline survey we explore the impact of the experimental intervention on the actual adoption and usage of the technology and find that exogenously reducing information and adoption costs significantly influenced Lipa Na M-Pesa usage and induced businesses to feel safe.

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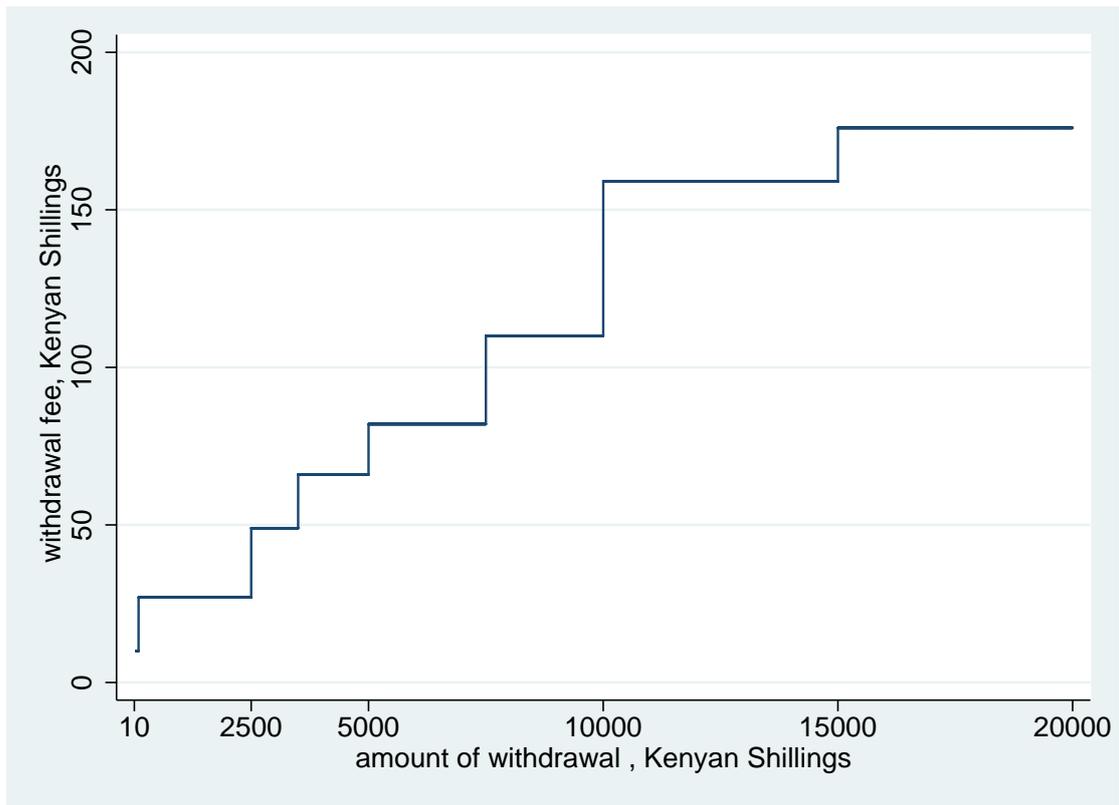
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Figure 1: Lipa Na M-Pesa vs. standard personal M-Pesa transfer fees



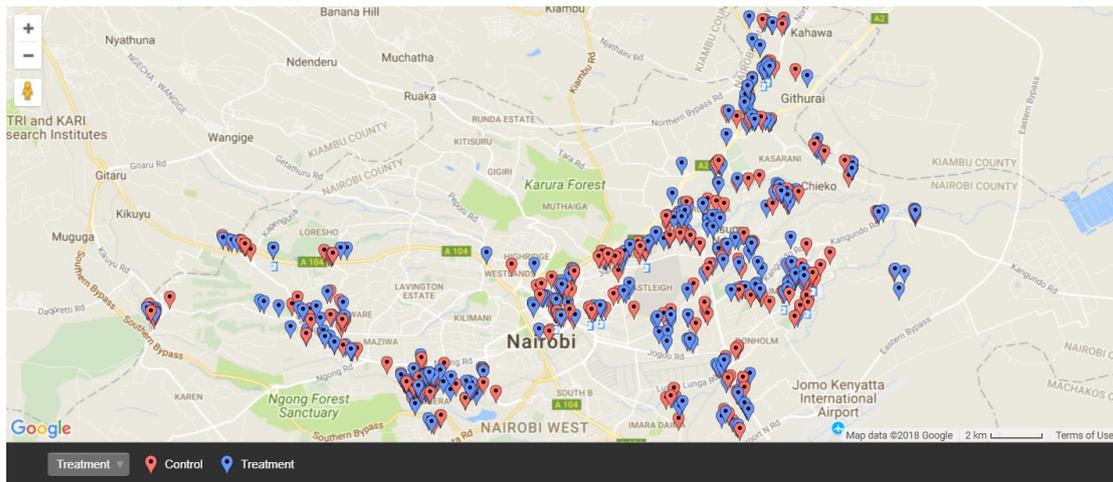
*Notes:* The figure depicts the transfer fees charged when transacting with Lipa Na M-Pesa and standard M-Pesa. The red line shows the fee that Safaricom deducts from a merchant (y-axis) for the corresponding transfer amount made by a customer (x-axis) through Lipa Na M-Pesa (the marginal cost of transaction is constant at 1% of the payment). The blue line shows the fee that Safaricom deducts from a customer (y-axis) for the corresponding amount of transfer made from a customer to the merchant (x-axis) through a standard M-Pesa account (the marginal cost of transaction is a step function).

Figure 2: M-Pesa withdrawal fees



*Notes:* The blue line depicts cash withdrawal fees (when converting M-Pesa units into cash).

Figure 3: Geographic distribution of restaurants at baseline



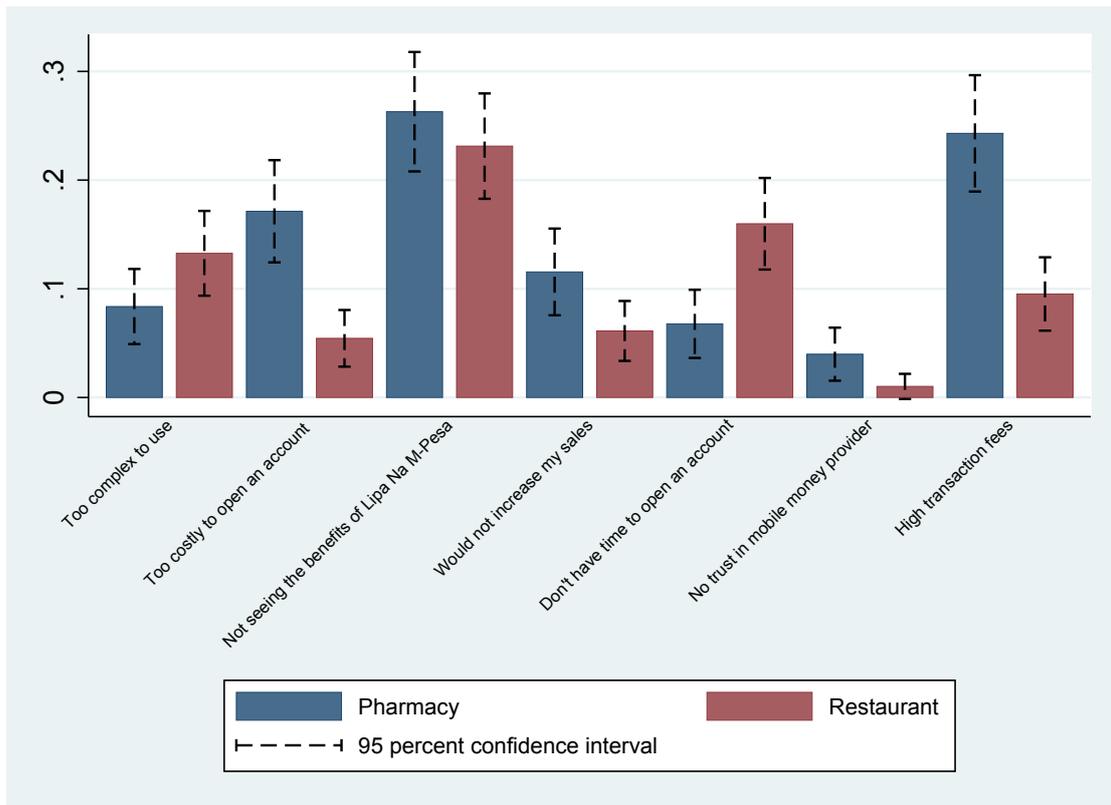
Notes: The figure shows the geographic distribution of restaurants in treatment and control group at the baseline.

Figure 4: Geographic distribution of pharmacies at baseline



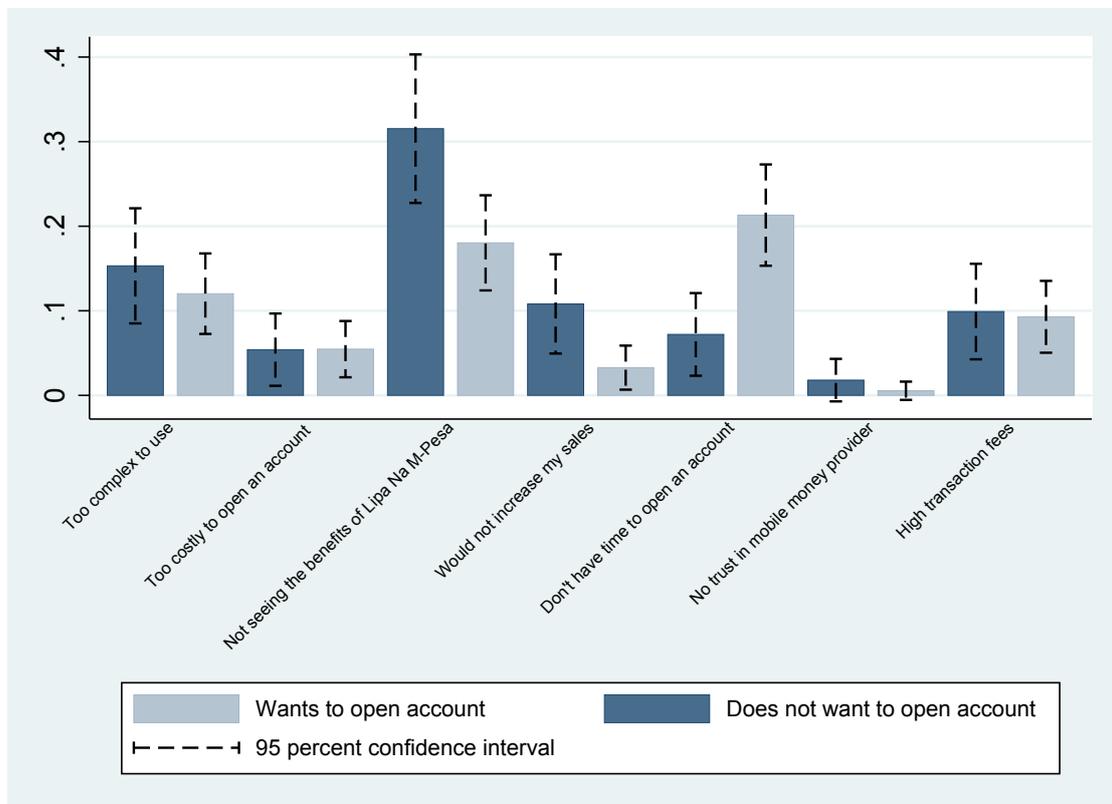
Notes: The figure shows the geographic distribution of pharmacies in treatment and control groups.

Figure 5: Stated reasons at baseline for not adopting Lipa Na: by sector



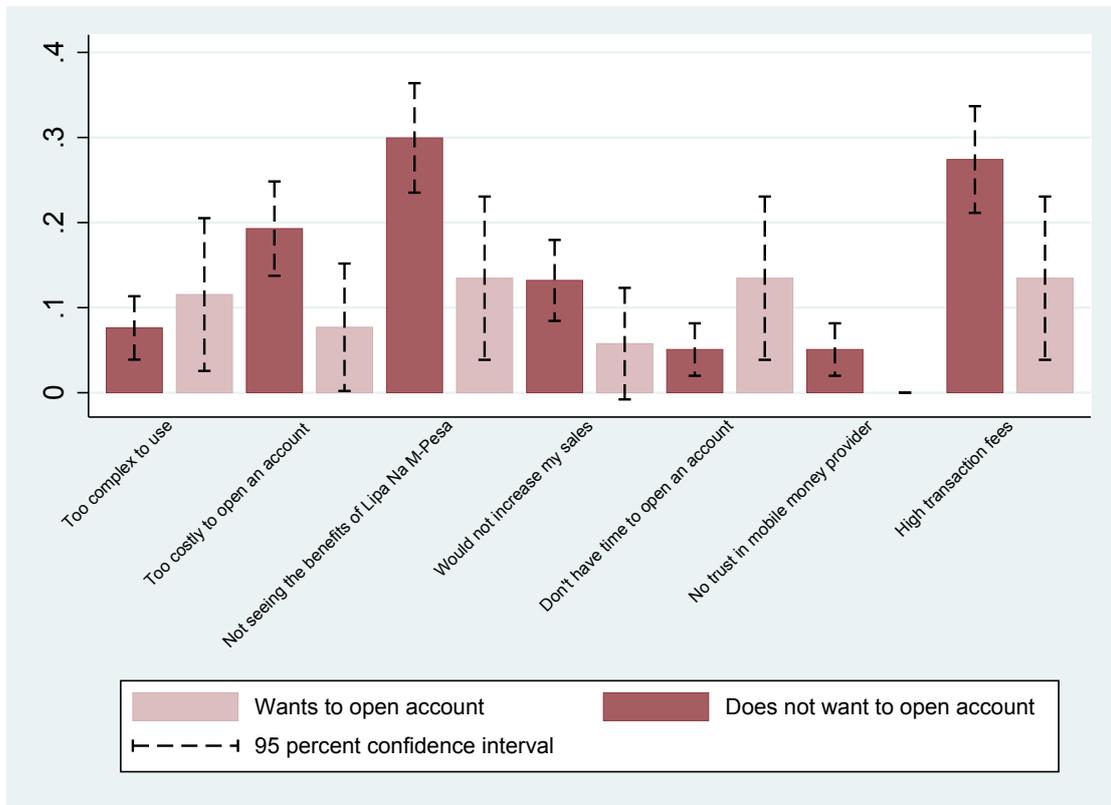
*Notes:* The figure shows the fraction of businesses (restaurants and pharmacies), who provided a particular reason for not having a Lipa Na M-Pesa account before our study. We also report 95% statistical confidence levels for each bar. Not seeing the benefits of Lipa Na M-Pesa, Too costly to open an account, High transaction fees via Lipa Na M-pesa, Don't have time to open an account, Would not increase my sales, No trust in mobile money provider, Too complex to use are reasons of not adopting the Lipa Na M-pesa before our experiment. These variables equal 1 if the business stated the corresponding reason, 0 otherwise.

Figure 6 (Restaurants): Stated reasons at baseline for not adopting Lipa Na: by adopters and non-adopters



*Notes:* The figure compares the fraction of adopters against non-adopters after the treatment - with a particular reason for not having a Lipa Na M-Pesa account before our study. We also report 95% statistical confidence levels for each bar.

Figure 7 (Pharmacies): Stated reasons at baseline for not adopting Lipa Na: by adopters and non-adopters



*Notes:* The figure compares the fraction adopters against non-adopters after the treatment - with a particular reason for not having a Lipa Na M-Pesa account before our study. We also report 95% statistical confidence levels for each bar.

Table 1: Baseline business characteristics and balance test

	Pharmacy			Restaurant			p-value (8)
	All (1)	Control (2)	Treatment (3)	All (5)	Control (6)	Treatment (3)	
	<i>Business size</i>						
Sales, monthly (1000 Ksh.), winsorized 5%	144.54	129.64	158.41	316.17	310.50	321.75	0.66
Profits, monthly, (1000 Ksh.), winsorized 5%	58.58	53.33	63.48	79.88	78.51	81.22	0.67
Employees, winsorized 5%	3.30	3.27	3.34	5.72	5.79	5.66	0.60
<i>Investment and access to finance</i>							
Investment (0/1), in the past 6 months	0.19	0.18	0.20	0.36	0.38	0.34	0.30
Bank loan (0/1), in the past 12 months	0.07	0.07	0.06	0.12	0.10	0.14	0.09
Informal loan (0/1), in the past 12 months	0.03	0.03	0.02	0.04	0.04	0.05	0.65
Mobile loan (0/1) in the past 12 months	0.08	0.07	0.09	0.12	0.12	0.12	0.96
<i>Informality</i>							
Business license (0/1)	0.91	0.92	0.91	0.56	0.55	0.57	0.70
<i>Personal mobile money use for business purposes</i>							
Using mob. money for business purposes (0/1)	0.41	0.40	0.43	0.59	0.57	0.62	0.18
Using mob. money to receive payments (0/1)	0.25	0.21	0.28	0.40	0.38	0.42	0.30
Share of mobile money customers	0.02	0.01	0.02	0.03	0.03	0.02	0.08
Using mob. money to store money (0/1)	0.09	0.09	0.10	0.25	0.26	0.24	0.52
Using mob. money to pay bills (0/1)	0.26	0.26	0.27	0.36	0.37	0.35	0.60
Using mob. money to pay salaries (0/1)	0.04	0.02	0.06	0.07	0.07	0.07	0.82
Using mob. money to pay inputs (0/1)	0.31	0.32	0.29	0.43	0.41	0.45	0.31
<i>Awareness of Lipa Na M-Pesa and reasons of not adopting</i>							
Aware of Lipa Na M-Pesa (0/1)	0.94	0.95	0.94	0.96	0.95	0.97	0.12
Have Lipa Na M-Pesa (0/1)	0.05	0.01	0.08	0.12	0.12	0.12	0.89
Not seeing the benefits of Lipa Na M-Pesa (0/1)	0.27	0.27	0.27	0.25	0.27	0.24	0.41
Too costly to open an account (0/1)	0.17	0.18	0.16	0.05	0.03	0.06	0.17
High transaction fees via Lipa Na M-pesa (0/1)	0.24	0.25	0.24	0.09	0.08	0.10	0.55
Don't have time to open an account (0/1)	0.09	0.11	0.07	0.14	0.14	0.15	0.71
Would not increase my sales (0/1)	0.09	0.08	0.11	0.06	0.06	0.06	0.86
No trust in mobile money provider (0/1)	0.03	0.03	0.04	0.02	0.02	0.01	0.74

*Notes:* This table describes the treatment and control group means for pharmacies and restaurants. Variable descriptions: Sales is the business total revenues in the past month. Profits is the total income the business earned during the past month after paying all expenses. Employees is the total number of employees plus the owner. Investment is the total capital investment for business purposes. bank equals 1 (0 otherwise) if the business ever received a new loan from a commercial bank, SACCO, or other formal financial institution over the last 12 months. Informal loan equals 1 (0 otherwise) if the business or business owners borrowed money (new loan) for business purposes from any business association, moneylender, family or friend over the last 12 months. Mobile loan equals 1 (0 otherwise) if the business or business owners borrowed money (new loan) for Mobile Microfinance sources like KCB -Mpesa, M-Kesha, M-Shwari over the last 12 months. Aware of Lipa Na M-Pesa equals 1 (0 otherwise) if the business is aware of Lipa Na M-Pesa. Business license equals 1 if the business has an up to date business license from an authority. Using mob. money for business purposes (to receive payment/store money/to pay bills/to pay salaries/to pay inputs) equals 1 (0 otherwise). Share of mobile money customer is daily number of customers that paid via mobile money divided by total number of customers for the businesses that receive payments via mobile money. Not seeing the benefits of Lipa Na M-Pesa, Too costly to open an account, High transaction fees via Lipa Na M-pesa, Don't have time to open an account, Would not increase my sales, No trust in mobile money provider, Too complex to use aer reasons of not adopting the Lipa Na M-pesa. They equal 1 (0 otherwise) if the business stated it is a reason not to adopt Lipa Na M-pesa before the treatment. p<0.1. \*\* p<0.05. \*\*\* p<0.01

Table 2: Business characteristics in the treatment group by willingness to adopt Lipa Na M-pesa

	Pharmacies			Restaurants		
	Does not want Lipa Na	Wants Lipa Na	Diff.	Does not want Lipa Na	Wants Lipa Na	Diff.
<i>Business size</i>						
Sales, monthly (1000 Ksh.)	227.42	473.02	-245.6	315.57	324.26	-8.69
Profits, monthly, (1000 Ksh.)	82.12	223.32	-141.2*	73.44	84.21	-10.77
Employees	3.34	3.71	-0.37*	5.44	5.55	-0.11
<i>Investment and access to finance</i>						
Investment (0/1), in the past 6 months	0.18	0.26	-0.08	0.23	0.38	-0.15***
Bank loan (0/1), in the past 12 months	0.07	0.06	0.01	0.12	0.14	-0.02
Informal loan (0/1), in the past 12 months	0.02	0.02	0	0.06	0.04	0.02
Mobile loan (0/1) in the past 12 months	0.07	0.08	-0.01	0.11	0.14	-0.03
<i>Informality</i>						
Business license (0/1)	0.92	0.86	0.06	0.45	0.59	-0.13**
<i>Personal mobile money use for business purposes</i>						
Using mob. money for business purposes (0/1)	0.40	0.50	-0.10	0.47	0.68	-0.21***
Using mob. money to receive payments (0/1)	0.24	0.37	-0.13*	0.29	0.47	-0.18***
Share of mobile money customers	0.06	0.07	-0.01	0.02	0.06	-0.04**
Using mob. money to store money (0/1)	0.07	0.15	-0.08*	0.16	0.29	-0.13**
Using mob. money to pay bills (0/1)	0.26	0.29	-0.03	0.26	0.37	-0.11**
Using mob. money to pay salaries (0/1)	0.06	0.08	-0.02	0.05	0.07	-0.02
Using mob. money to pay inputs (0/1)	0.27	0.37	-0.09	0.28	0.52	-0.24***
<i>Awareness of Lipa Na M-Pesa and reasons of not adopting</i>						
Aware of Lipa Na M-Pesa (0/1)	0.92	0.96	-0.04	0.97	0.97	0.01
Not seeing the benefits of Lipa Na M-Pesa (0/1)	0.3	0.13	0.16**	0.32	0.18	0.13***
Too costly to open an account (0/1)	0.19	0.08	-0.12**	0.05	0.05	0.00
High transaction fees via Lipa Na M-pesa (0/1)	0.27	0.13	0.14**	0.1	0.09	0.01
Don't have time to open an account (0/1)	0.05	0.13	-0.08**	0.07	0.21	-0.14***
Would not increase my sales (0/1)	0.13	0.06	0.07	0.11	0.03	0.08***
No trust in mobile money provider (0/1)	0.05	0	0.05*	0.02	0.01	0.01
Too complex to use (0/1)	0.08	0.12	-0.04	0.15	0.12	0.03

*Notes:* This table compares the descriptive characteristics of our sample for pharmacies and restaurants by willingness to adopt the Lipa Na M-pesa technology in our experiment. We only use treatment group businesses and businesses that do not have a Lipa Na M-Pesa account. We report mean values for each characteristic. Variable descriptions: Sales is the business total revenues in the past month. Profits is the total income the business earned during the past month after paying all expenses. Customers is the number customer visited the business in the past day. Employees is the total number of employees plus the owner. Investment is the total capital investment for business purposes. bank equals 1 (0 otherwise) if the business ever received a new loan from a commercial bank, SACCO, or other formal financial institution over the last 12 months. Informal loan equals 1 (0 otherwise) if the business or business owners borrowed money (new loan) for business purposes from any business association, moneylender, family or friend over the last 12 months. Mobile loan equals 1 (0 otherwise) if the business or business owners borrowed money (new loan) for Mobile Microfinance sources like KCB-Mpesa, M-Kesha, M-Shwari over the last 12 months. Aware of Lipa Na M-Pesa equals 1 (0 otherwise) if the business is aware of Lipa Na M-Pesa. Business license equals 1 if the business has an up to date business license from an authority. Using mob. money for business purposes (to receive payment/store money/to pay bills/to pay salaries/to pay inputs) equals 1 (0 otherwise) if the business use personal mobile account for business purposes (to receive payment/store money/to pay bills/to pay salaries/to pay inputs). Share of mobile money customer is daily number of customers that paid via mobile money divided by daily total number of customers for the businesses that receive payments via mobile money. Not seeing the benefits of Lipa Na M-Pesa, Too costly to open an account, High transaction fees via Lipa Na M-pesa, Don't have time to open an account, Would not increase my sales, No trust in mobile money provider, Too complex to use aer reasons of not adopting the Lipa Na M-pesa. They equal 1 (0 otherwise) if the business stated it is a reason not to adopt Lipa Na M-pesa. p<0.1. \*\* p<0.05. \*\*\* p<0.01

Table 3A: Variables and their definitions used in the regression analysis

	Variable	Definition
<i>Panel A: Valuation</i>	Use for business	=1 if the business use personal mob. money in the last 30 days.
	Receive payments	=1 if the business receives payments to personal mobile money.
	Store money	=1 if the business store money in personal mobile money.
	Pay bill	=1 if the business pay bills via personal mobile money.
	Pay input	=1 if the business pay inputs via personal mobile money.
	Pay salaries	=1 if the business pay salaries via personal mobile money.
	Mob. mon. customers	Daily number of customers paying via personal mobile money.
	Saving in mob. mon. account	=1 if the business save business revenues in mob. money account.
	% of utility exp. via pers. mob.	% of business utility expenses paid via personal mob. mon in utility expenses.
	% of input exp. via pers. mob.	% of business input expenses paid via personal mob. mon in input expenses.
	Paying wages via mpesa	=1 if the business pay wages to the personal M-pesa accounts of workers.
	No increase in prices	=1 if the business do not increase price when customer pay via mobile money.
	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, fire, etc.	=1 if experienced losses as a result of fire, theft, robbery, etc. in the past 6 months.
	Feeling safe	The safety of the area where the business is located (1 very unsafe-10 safe)
	<i>Panel B: Visibility</i>	Saving at a bank or micro.
Saving at a pers. bank acc.		=1 if the business save at a personal bank account.
Saving at a bus. bank acc.		=1 if the business save at a business bank account.
Saving at a microf. inst.		=1 if the business save at a microfinance account.
Business license		=1 if the business has an up to date government business permit.
Financial 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 micro money provider loan in the past 12 months.
Business records		=1 if the business keeps business records.
Sells on credit to cust.		=1 if the business save at a microfinance bank account.
<i>Panel C: Behavioral Factors</i>	Not shared sales	=1 if the business has not shared its sales.
	Not shared profits	=1 if the business has not shared its profits.
	Present bias	=1 if business owner or manager is present biased.
	Future bias	=1 if business owner or manager is future biased .
	# of digits remembered	maximum number of digits remembered from number.
	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 mob. mon. comp.	Trust in mobile money companies, 1 (not at all) -4 (completely).
	Business size	Number of total employees, in logarithms. Sales in the past month, in logarithm. Profits in the past month, in logarithm. Number of customers.

Table 3B: Descriptive statistics of the variables used in the regression estimations

	Variable	All Sample		Pharmacy		Restaurant				
		N	mean	sd	N	mean	sd	N	mean	sd
<i>Panel A: Valuation</i>	Use for business	545	0.52	0.50	251	0.42	0.49	294	0.60	0.49
	Receive payments	543	0.34	0.47	250	0.27	0.44	293	0.40	0.49
	Store money	543	0.17	0.38	249	0.09	0.28	294	0.24	0.43
	Pay bill	544	0.30	0.46	250	0.26	0.44	294	0.33	0.47
	Pay input	544	0.37	0.48	250	0.29	0.46	294	0.43	0.50
	Pay salaries	544	0.06	0.24	250	0.06	0.24	294	0.06	0.25
	Mob. mon. customers	544	1.02	3.95	251	1.17	5.32	293	0.90	2.16
	Saving in mob. mon. account	542	0.10	0.30	249	0.04	0.20	293	0.15	0.36
	% of utility exp. via pers. mob.	474	0.33	0.45	225	0.34	0.46	249	0.31	0.45
	% of input exp. via pers. mob.	485	0.15	0.31	224	0.14	0.28	261	0.17	0.33
	Paying wages via mpesa	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
	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
<i>Panel B: Visibility</i>	External theft, fire, etc.	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
	Saving at a bank or micro.	542	0.57	0.50	249	0.53	0.50	293	0.61	0.49
	Saving at a pers. bank acc.	542	0.37	0.48	249	0.29	0.45	293	0.45	0.50
	Saving at a bus. bank acc.	542	0.20	0.40	249	0.25	0.43	293	0.15	0.36
	Saving at a microf. inst.	542	0.03	0.16	249	0.02	0.15	293	0.03	0.16
	Business license	538	0.71	0.46	246	0.91	0.29	292	0.54	0.50
	Finance 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 cust.	545	0.51	0.50	252	0.45	0.50	293	0.57	0.50
	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
<i>Panel C: Behavioral Factors</i>	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
	# of digits remembered	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 mob. mon. comp.	544	3.58	0.64	252	3.43	0.68	292	3.71	0.57
	Employees	546	1.41	0.42	252	1.19	0.27	294	1.59	0.43
	Sales, in log.	546	5.01	1.01	252	4.74	0.89	294	5.23	1.05
	Profit, in log	546	3.84	0.96	252	3.83	0.89	294	3.85	1.02
	Customers	542	82.26	112.25	251	52.12	71.34	291	108.25	132.88

Notes: This table summarizes descriptive statistics for the variables for regression analysis presented in Tables 4, 5, and 6. The variable definitions are given in Table 3a.



Table 5: Regression estimates for willingness to adopt Lipa Na M-Pesa: Restaurant sample

	(1)	(2)	(3)
<i>Panel A: Valuation</i>			
Variable			
Use for business	0.165**	(0.065)	
Receive payments	0.047		(0.075)
Store money	0.034		(0.082)
Pay bill	-0.035		(0.074)
Pay input	0.199**		(0.079)
Pay salaries	-0.070		(0.122)
Mob. mon. customers			0.089* (0.047)
Mob. mon. customers <sup>2</sup>			-0.006 (0.005)
Saving in mob. mon. account			-0.083 (0.095)
% of utility exp. via pers. mob.			0.034 (0.080)
% of input exp. via pers. mob.			0.192* (0.106)
Paying wages via mpesa			-0.035 (0.177)
No increase in prices			0.096 (0.090)
Theft and safety index	0.030	(0.031)	
Internal theft			0.031 (0.062)
External theft, fire, etc.			-0.019 (0.095)
Feeling safe			-0.004 (0.018)
Saving at a bank or micro.	0.032	(0.067)	
Saving at a pers. bank acc.			0.077 (0.070)
Saving at a bus. bank acc.			-0.122 (0.105)
Saving at a microf. inst.			-0.024 (0.118)
Business license	0.014	(0.063)	
Financial sophistication	0.022	(0.026)	
Bank loan			0.016 (0.081)
Mobile loan			0.065 (0.095)
Business records			0.073 (0.080)
Sells on credit to cust.	0.091	(0.061)	
Not shared sales	-0.099	(0.127)	
Not shared profits			-0.077 (0.131)
Present bias	-0.025	(0.105)	
Future bias	0.094	(0.076)	
# of digits remembered	0.021	(0.024)	
Trust in first time	-0.049	(0.039)	
Trust in customers	0.073	(0.047)	
Trust in courts	-0.060	(0.037)	
Trust in mob. mon. comp.	-0.016	(0.051)	
Employees	0.046	(0.084)	
Sales, in log.	0.058*	(0.035)	
Profit, in log			0.003 (0.041)
Customers			0.001 (0.001)
Customers <sup>2</sup>			0.000 (0.000)
Panel D: Business size			
Enumerator and district FE	Yes	Yes	Yes
Observations	277	276	213
R-squared	0.214	0.25	0.306

Notes: This table shows the estimation result for the relationship between willingness to adopt Lipa Na M-pesa, and valuation, visibility, behavioral factors, business size for restaurant sample. We estimate  $Y_i = \beta_0 + X_i' \beta_1 + \epsilon_i$  through OLS for all specifications where  $i$  denotes the business and  $X_i$  is the vector including variables described in Tables 3a and 3b. We report coefficient estimates for  $\beta_1$  and robust standard errors in parentheses. To control for unobserved regional, enumerator factors we add enumerator and district fixed effects to all estimations. \*  $p < 0.1$ . \*\*  $p < 0.05$ . \*\*\*  $p < 0.01$ .

Table 6: Regression estimates for willingness to adopt Lipa Na M-Pesa: Pharmacy sample

	(1)	(2)	(3)
<i>Panel A: Valuation</i>			
Use for business	0.120**	(0.059)	
Receive payments	0.136	(0.085)	
Store money	0.164	(0.144)	
Pay bill	-0.056	(0.095)	
Pay input	0.054	(0.092)	
Pay salaries	0.113	(0.173)	
Mob. mon. customers			0.021 (0.016)
Mob. mon. customers <sup>2</sup>			-0.000 (0.000)
Saving in mob. mon. account			-0.146 (0.101)
% of utility exp. via pers. mob.			-0.169** (0.083)
% of input exp. via pers. mob.			0.185 (0.136)
Paying wages via mpesa			-0.020 (0.202)
No increase in prices			0.221* (0.114)
Theft	0.019	(0.043)	
Theft and safety index			
Internal theft			-0.004 (0.126)
External theft, fire, etc.			0.193 (0.176)
Feeling safe			-0.003 (0.020)
Saving at a bank or micro.	-0.095	(0.075)	
Saving at a pers. bank acc.			-0.034 (0.079)
Saving at a bus. bank acc.			-0.202** (0.091)
Saving at a microf. inst.			-0.103 (0.212)
Business license	-0.020	(0.135)	
Business license	0.032	(0.038)	
Finance index			0.075 (0.123)
Bank loan			0.011 (0.151)
Mobile loan			0.163** (0.079)
Business records			0.212 (0.134)
Sells on credit to cust.	0.005	(0.061)	
Not shared sales	-0.172**	(0.083)	
Not shared profits			-0.260*** (0.088)
Present bias	0.083	(0.125)	
Future bias	-0.201***	(0.076)	
# of digits remembered	0.046*	(0.028)	
Trust in first time	-0.011	(0.036)	
Trust in customers	-0.072	(0.063)	
Trust in courts	-0.037	(0.042)	
Trust in mob. mon. comp.	0.102**	(0.051)	
Employees	0.168	(0.142)	
Sales, in log.	-0.005	(0.043)	
Profit, in log			0.022 (0.058)
Customers			0.003 (0.003)
Customers <sup>2</sup>			-0.000 (0.000)
Enumerator and district FE	Yes	Yes	Yes
Observations	216	214	177
R-squared	0.167	0.212	0.294
<i>Panel B: Visibility</i>			
<i>Panel C: Behavioral Factors</i>			
<i>Panel D: Business size</i>			

Notes: This table shows the estimation result for the relationship between willingness to adopt Lipa Na M-pesa, and valuation, visibility, behavioral factors, business size for pharmacy sample. We estimate  $Y_i = \beta_0 + X_i' \beta_1 + \epsilon_i$  through OLS for all specifications where  $i$  denotes the business and  $X_i$  is the vector including variables described in Tables 3a and 3b. We report coefficient estimates for  $\beta_1$  and robust standard errors in parentheses. To control for unobserved regional, enumerator factors we add enumerator and district fixed effects to all estimations. \* p<0.1. \*\* p<0.05. \*\*\* p<0.01.

Table 7: Descriptive statistics from endline survey for all businesses with business licenses.

Variables	Definition	All sample			Control			Treatment		
		N	Mean	Median	N	Mean	Median	N	Mean	Median
<i>Lipa Na M-pesa use</i>										
Have Lipa na M-pesa account (0/1)	=1 if business have a registered Lipa na M-pesa account	618	0.27	0	309	0.23	0	309	0.311	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	618	0.249	0	309	0.207	0	309	0.291	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	618	0.246	0	309	0.204	0	309	0.288	0
Lipa na M-pesa sales, monthly (1000 Ksh.)	Total sales received via Lipa Na M-pesa at a typical month	618	15.55	0	309	12.56	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	610	0.066	0	306	0.078	0	304	0.054	0
<i>Management practices and safety</i>										
Record keeping via mobile money (0/1)	=1 if the business keeps records via personal mobile money or Lipa Na M-pesa	618	0.108	0	309	0.1	0	309	0.117	0
Not having change (0/1)	=1 if the business experienced a foregone opportunity to sell goods due to not having change	618	0.254	0	309	0.256	0	309	0.252	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.	618	7.026	7	309	6.874	7	309	7.178	8
<i>Investment and access to finance</i>										
Capital investment, (1000 Ksh.)	Investment in the capital goods in the last 6 months	599	10.14	0	301	9.233	0	298	11.05	0
Received loan (0/1)	=1 if the business has received a loan from informally, or through mobile a bank, or money accounts in the past 12 months	605	0.223	0	301	0.196	0	304	0.25	0
Bank loan (0/1)	=1 if the business received a loan from a bank. in the past 12 months	608	0.086	0	303	0.076	0	305	0.095	0
Informal loan (0/1)	=1 if the business received a loan from friends, relatives, etc. in the past 12 months	605	0.055	0	302	0.053	0	303	0.056	0
Mobile loan (0/1)	=1 if the business received a loan through mobile money companies in the past 12 months	611	0.133	0	305	0.102	0	306	0.163	0
<i>Business size</i>										
Sales, monthly (1000 Ksh.)	Sales over the past month	538	213.3	120	266	218.8	135	272	208	120
Profits, monthly, (1000 Ksh.)	Profits over the past month.	530	66.99	46	265	68.83	45	265	65.14	48
Employees	Number of total permanent and temporary employees	592	4.378	3	299	4.405	3	293	4.352	3

Notes: This table summarizes the descriptive statistics from endline survey for all businesses with business license. \* p<0.1. \*\* p<0.05. \*\*\* p<0.01.

Table 8: Relationship between business attrition in the endline and baseline business characteristics for all businesses with business license.

Baseline characteristics		(1)	(2)
		coef	se
Treatment	=1 if assigned to treatment group	-0.012	(0.031)
Pharmacy	=1 if business is a pharmacy	-0.161***	(0.044)
Methods of mobile money use	Have Lipa Na M-pesa account	-0.144***	(0.050)
	Mob. mon. customers	-0.005***	(0.002)
	Mob. mon. customers <sup>2</sup>	0.000***	(0.000)
	Saving in mob. mon. account	-0.014	(0.062)
	% of utility exp. via pers. mob.	-0.027	(0.040)
	% of input exp. via pers. mob.	-0.004	(0.022)
	Paying wages via mpesa	0.038	(0.062)
Theft and safety	Internal theft	-0.002	(0.044)
	External theft	-0.122**	(0.054)
	Feeling safe	0.004	(0.009)
Business saving accounts	Saving at a pers. bank acc.	-0.046	(0.036)
	Saving at a bus. bank acc.	0.025	(0.040)
	Saving at a microf. inst.	0.045	(0.121)
Financial sophistication	Bank loan	0.004	(0.058)
	Mobile loan	-0.107**	(0.052)
	Business records	-0.101	(0.074)
Present and future bias	Present bias	-0.042	(0.050)
	Future bias	-0.073*	(0.044)
Cognitive capacity	# of digits remembered	-0.007	(0.012)
Trust	Trust in first time	0.030	(0.020)
	Trust in customers	0.029	(0.027)
	Trust in courts	0.030	(0.018)
	Trust in mob. mon. comp.	-0.041*	(0.024)
Business size	Employees	-0.107***	(0.038)
	Customers	-0.000*	(0.000)
	Customers <sup>2</sup>	0.000*	(0.000)
Constant		0.659***	(0.176)
		0.000	(0.000)
Observations		853	
R-squared		0.082	

*Notes:* This table shows the estimation result for the relationship between business attrition in the endline and baseline business characteristics. We use the sample of businesses with business license in the baseline. We estimate  $Y_i = \beta_0 + X_i' \beta_1 + \epsilon_i$  through OLS for all specifications where  $i$  denotes the business and  $X_i$  is the vector including variables listed in the first column.  $Y_i$  equals 1 if the business did not participate in the baseline survey. We report coefficient estimates for  $\beta_1$  and robust standard errors in parentheses. \* p<0.1. \*\* p<0.05. \*\*\* p<0.01.

Table 9A: Intention to treat (ITT) estimates for outcome variables - business license sample.

	(1)	(2)	(3)	(4)
	Have Lipa na M-pesa account (0/1)	Used Lipa na M-pesa account for business (0/1)	Received payment via Lipa na M-pesa (0/1)	Lipa na M-pesa sales, $\log(1+x)$
Treatment	0.07** (0.03)	0.08** (0.03)	0.08** (0.03)	0.26** (0.11)
Control group mean	0.23	0.21	0.20	12560 Ksh.

*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, fraction of customers paid via Lipa Na M-pesa, and Lipa Na M-pesa sales ( $\log(1+x)$ ). \*  $p < 0.1$ . \*\*  $p < 0.05$ . \*\*\*  $p < 0.01$ .

Table 9B: Intention to treat (ITT) estimates for outcome variables for visible and non-visible businesses - business license sample.

	(1)	(2)	(3)	(4)
Panel A: Visible firms: shared sales figures in the baseline				
Treatment	0.07*	0.09**	0.09**	0.32**
	(0.04)	(0.04)	(0.04)	(0.12)
Control group mean	0.24	0.22	0.21	1397 Ksh
N	486	485	485	485
Panel B: Not visible firms: did not share sales figures in the baseline				
Treatment	0.00	0.01	0.01	0.02
	(0.08)	(0.08)	(0.08)	(0.24)
Control group mean	0.19	0.18	0.18	8285 Ksh
N	131	131	131	131

Notes: This table shows the ITT estimates for outcome variables. \* p<0.1. \*\* p<0.05. \*\*\* p<0.01.

Table 10: Treatment on treated (TOT) estimates, 2SLS - businesses with a business license.

	(1)	(2)	(3)
<i>Panel A: Management practices and safety</i>			
	Safety (1 not feel safe- 10 feel safe)	Record keeping via mobile money (0/1)	Experienced sales loss due to not having change (0/1)
Received payment via Lipa na M-pesa (0/1)	3.93* (2.38)	0.12 (0.48)	0.21 (0.32)
N	617	616	617
<i>Panel B: Business size</i>			
	Sales, monthly (1000 Ksh.)	Profits, monthly, (1000 Ksh.)	Employees
Received payment via Lipa na M-pesa (0/1)	-100.57 (254.30)	-40.36 (67.50)	-1.29 (1.69)
N	538	529	592

*Notes:* This table shows the TOT effect of receiving payments via Lipa Na M-pesa on management practices and business size. Treatment estimate variable shows the TOT We use a 2SLS model to estimate the TOT effects. In the first stage, we use being assigned to the treatment group, and the interaction of being assigned to the treatment group and being in the pharmacy sample as the instruments to predict receiving payments via Lipa Na M-pesa. Then we regress the outcome variables on the predicted value for the receiving payments via Lipa Na M-pesa variable. The Kleibergen-Paap rk Wald F statistic for the safety, the only significant estimate is, 6.4. In all regressions, we control for the baseline value of the outcome variable; whether the business has a Lipa Na M-pesa in the baseline period; baseline level of the employment; the gender of the business owner; and the business type (restaurant v.s. pharmacy) and district fixed effects. In panel A, the dependent variables are record keeping via a mobile money account, lack of change during a transaction, safety (1 not feel safe - 10 feel safe). In panel B, dependent variables are the capital investment (1000 Ksh.); receiving a bank, formal receiving, and mobile loan (0/1) in the past 6 months. In panel C, monthly sales (1000 Ksh.), profits (1000 Ksh.), and the number of employees are the dependent variables. In all regressions, we control for the baseline value of the outcome variable; whether the business has a Lipa Na M-pesa in the baseline period; baseline levels for feeling safe and employment; the gender of the business owner; and business type (restaurant v.s. pharmacy) and district fixed effects. N shows the number of observations. We report robust standard errors in parentheses. \* p<0.1. \*\* p<0.05. \*\*\* p<0.01.

## Appendix A: Information Leaflet

- Its simple and straightforward to use, both to you and your customers
- Its free to sign up; no set up costs to your business
- Its available 24/7: hence, can be used outside of core banking hours
- Other than the small transaction fee of 1%, no other operational costs for your business
- You have a USSD code to manage the flow of your balances in the merchant account.
- There are no wallet size limits to the amount of money that can be held in your Lipa Na M-PESA merchant account
- Lipa Na M-PESA minimises your costs of cash movement, e.g. cash-in-transit, insurance, etc.
- It also minimises your cost of cash handling, e.g. cash register, money counter, safe machine, etc.
- Lipa Na M-PESA minimises incidences of internal theft of money by your employees
- Lipa Na M-PESA helps you maintain good and quality record-keeping using Lipa Na M-PESA transaction statements, for future reference
- You can then use this statement to apply for credit in a financial institution, when your business needs money
- With Lipa Na M-PESA, your business has no change issues when attending to customers
- Lipa Na M-PESA gives you the option of rolling up funds from merchant till to either personal M-PESA wallet or bank account, as needed
- Lipa Na M-PESA ensures security of your business funds against external armed theft/robbery/mugging
- With Lipa Na M-PESA, there is no risk of fake/counterfeit currency from fraudulent customers
- Unlike M-PESA P2P, there is no risk of customer reversing funds, claiming they sent the money by mistake, which can inconvenience the smooth running of your business, liquidity-wise
- Most customers now have mobile handsets, and have registered for M-PESA: most Kenyans keep some money in their M-PESA wallet.
- Depending on type of business, far-away customers can still pay and goods delivered to them, hence increasing your business sales
- For long-standing relationships, your business can increase sales by offering goods on credit to clients, who then pay later using Lipa Na M-PESA.

- Lipa Na M-PESA ensures that you do not lose customers who have money in their M-PESA and not cash
- Since it is free to customers, you will have more customers coming to your business; this will increase your sales revenue
- Your customers earn Bonga (loyalty) points when they use Lipa Na M-PESA in your shop. This can encourage them to buy more, increasing your sales
- The government wants to go cashless in many sectors, therefore, the earlier you start using Lipa Na M-PESA in your business, the better!
- No stress/worry to you about the safety of your business finances since it is safely kept away in the merchant till
- No one can access the merchant till account since it is secured by a secret PIN, only known to you.
- Even if the PIN is accidentally made known to some people, the Lipa Na M-PESA merchant funds cannot be transferred to any other M-PESA personal wallet, except that which is official nominated by you or the bank account.