Promises and Pitfalls of Mobile Money in Afghanistan: Evidence from a Randomized Control Trial

Joshua E. Blumenstock*
University of Washington
Information School
Seattle, WA
joshblum@uw.edu

Michael Callen
Harvard Kennedy School of
Government
Cambridge, MA
michael_callen@hks.harvard.edu

Tarek Ghani
U.C. Berkeley
Haas School of Business
Berkeley, CA
tarek_ghani@berkeley.edu

Lucas Koepke
University of Washington
Information School
Seattle, WA
koepkel@uw.edu

ABSTRACT

Despite substantial interest in the potential for mobile money to positively impact the lives of the poor, little empirical evidence exists to substantiate these claims. In this paper, we present the results of a field experiment in Afghanistan that was designed to increase adoption of mobile money, and determine if such adoption led to measurable changes in the lives of the adopters. The specific intervention we evaluate is a mobile salary payment program, in which a random subset of individuals of a large firm were transitioned into receiving their regular salaries in mobile money rather than in cash.

We separately analyze the impact of this transition on both the employer and the individual employees. For the employer, there were immediate and significant cost savings; in a dangerous physical environment, they were able to effectively shift the costs of managing their salary supply chain to the mobile phone operator. For individual employees, however, the results were more ambiguous. Individuals who were transitioned onto mobile salary payments were more likely to use mobile money, and there is evidence that these accounts were used to accumulate small balances that may be indicative of savings. However, we find little consistent evidence that mobile money had an immediate or significant impact on several key indicators of individual wealth or well-being. Taken together, these results suggest that while mobile salary payments may increase the efficiency and transparency of traditional systems, in the short run the benefits may be realized by those making the payments, rather than by those receiving them.

Keywords

Mobile money, Mobile payments, Mobile phones, Afghanistan, Randomized control trial, Development economics, ICTD

*Address correspondence to `joshblum@uw.edu`

1. INTRODUCTION

Over the past fifteen years, the proportion of the world's population with access to a mobile phone has increased from roughly 10 percent in 1999 to nearly 90 percent in 2014 [27]. Much of this growth has occured in developing countries, which now account for 80 percent of new subscriptions [16]. As these networks expand into rural and resource-constrained environments, they create new opportunities to provide services and applications to historically marginalized populations.

Mobile money, which generally refers to the broad set of financial services primarily accessed via mobile devices, is one area of particular promise. Of the 2.5 billion individuals worldwide without access to formal financial services, an estimated 1 billion have access to a mobile phone [26]. This creates a unique opportunity to provide basic mechanisms for savings, credit, insurance, payments, and transfers to the world's poor. Having observed the remarkable success of M-PESA, the Kenyan mobile money system that now represents more than 15 percent of Kenya's GDP and handles more transactions than Western Union [20], many mobile phone operators have tried to capitalize on this opportunity. A recent survey counted 225 worldwide mobile money deployments and 203 million registered mobile subscribers.[1] However, none have managed to reach the scope or scale of M-PESA in Kenya [21], and only 13 of these deployments have more than one million active subscribers. And, for all the excitement about mobile money, only scant empirical evidence exists on the extent to which mobile money has a positive (or negative) influence on social and economic outcomes [3, 4, 13].

In this paper, we look closely at mobile money in Afghanistan, and summarize the evidence and lessons learned from one large development organization's transition from cash to mobile money. Using a large randomized control trial in which a random subset of the organization's employees were transitioned from a cash-based salary system to one based on mobile money, we examine the impact of this transition on both the organization and on its employees. Our analysis exploits detailed financial and administrative data from the organization, roughly 2,000 face-to-face and phone-based interviews conducted by our research team with employees of the organization, as well as the complete mobile money transaction records of each employee. As we discuss in greater detail below,

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[1]Source: `https://gsmaintelligence.com/topics/3363/dashboard/`, accessed September 2014

we find that the switch to mobile money brought significant benefits to the organization, but resulted in few measurable changes in the welfare of the employees themselves, despite significant uptake of mobile money.

2. RELATED WORK

Since the early days of M-PESA's success in Kenya, a small but active group of scholars from several disciplines has examined the role of mobile money in the lives of its users. In the ethnographic literature, for instance, Morawczynski [25] shows how M-PESA in Kenya is used to maintain social networks and cope with stresses and shocks. In more theoretical work, Maurer [23] discusses how end-users shape the consumer market for mobile money, in part by repurposing the standard facets of the technology; Mbiti and Weil [24] describe several potential channels of economic impact of mobile money. These studies on mobile money contribute to a more general literature on the social role and meaning of money [22] and the financial lives of the poor (cf. [11, 19]).[2]

Our approach to studying mobile money is somewhat different than these studies, in that we attempt to measure the quantitative impact of mobile money on individuals and firms, using administrative records and data collected through a large number of structured interviews. Work in this vein is more limited, and we are aware of only a few studies that provide rigorous quantitative evidence of the social and economic impacts of mobile money. Building on the findings of [25], Jack and Suri [17] use household survey data to show that individuals with access to M-PESA in Kenya are better insured against idiosyncratic shocks. Blumenstock et al. [8] provide complementary evidence from Rwanda, showing that mobile money helps individuals send and receive money over long distances and in response to major negative shocks.

In the study closest to our own, Aker et al. [1] study the impact of moving an unconditional cash transfer program in Niger from cash to mobile money. The two contexts are very different, and ex ante there may be little reason to suspect that a government welfare program in West Africa would be comparable to a middle-class salary payment program in Afghanistan. However, the results are broadly consistent: we both find that the switch to mobile money significantly reduced the implementing agency's costs of disbursing transfers, but that there were only muted effects on the social and economic outcomes of individual recipients. Our analysis adds further depth by exploring the impact of the program on the behavioral patterns of technology use, as captured in the highly granular mobile phone and mobile money transaction records.[3]

3. MOBILE MONEY IN AFGHANISTAN

Despite noteworthy developmental progress over the past decade, Afghanistan remains one of the world's most difficult economic environments and its population is among the poorest in the world. Both Afghan and foreign firms face immense challenges to conducting their daily operations, including imperfect government control, rampant corruption, poor infrastructure and weak state institutions. Afghanistan is also at a major turning point. Currently, about 90 percent of government expenditure is comprised by foreign aid, which also makes up a major share of the formal economy. As for-
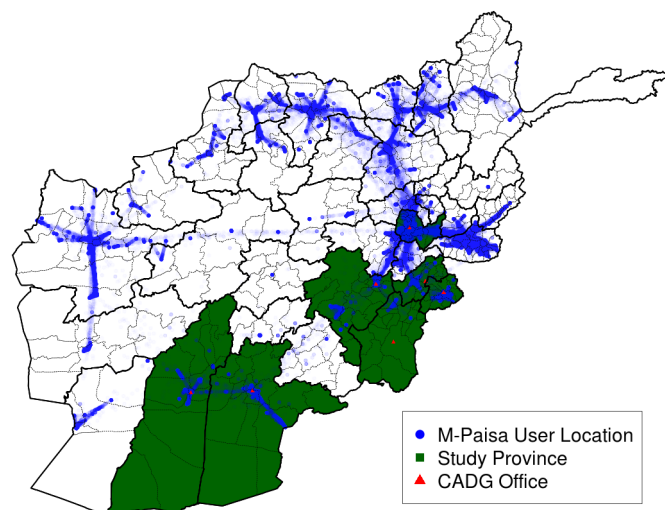

Figure 1: **Map of Afghanistan showing experimental and non-experimental populations.** Semi-transparent blue circles show approximate home locations of all active M-Paisa subscribers in Afghanistan, circa 2012, inferred using the method developed in [5]. The seven provinces in which the randomized control trial took place are highlighted in green; red dots indicate the office locations.

eign troops withdraw, most experts believe these figures will dramatically decrease and progress against poverty and persistent underdevelopment may stall. Future economic growth in Afghanistan thus depends on private sector development and the cost-effective delivery of ongoing aid programs.

For firms and other organizations operating in Afghanistan, the disbursement of employee wages poses several challenges. While the majority of Afghan firms currently pay their employees in cash, this method is plagued by problems resulting from: (i) an underdeveloped banking sector which reaches less than 5% of the population; (ii) deep distrust of formal banks; (iii) leakage and graft of employee salaries by their supervisors; and (iv) high costs of currency transport, due to unreliable transport infrastructure and concerns of physical security. The net effect of these transactional frictions has been to limit economic growth, creating demand for innovative technologies that can improve the transparency, accountability and efficiency of salary payments in Afghanistan.

Mobile phone networks, and mobile money systems in particular, have been suggested as a possible solution to several of the challenges of operating in cash. In Afghanistan, the number of mobile phones has increased from the low thousands in 2002 to over 17 million by 2013, and there are currently four private sector mobile operators and one state-owned mobile operator in the market. Roshan, the largest Afghan telecommunications operator, developed its M-Paisa mobile money platform in 2008 with the British multinational Vodafone, and now boasts over 1.2 million subscribers, though the number of active users is smaller.

In Figure 1, we provide a map that shows the geographic pattern of M-Paisa use in Afghanistan, circa 2012. We construct this map by analyzing the complete M-Paisa transaction records of all Afghan subscribers. This terabyte-scale dataset was obtained from the mobile operator, and carefully anonymized and analyzed according to strict protocols for human subject research. For each M-Paisa subscriber, we calculate the geographic "centroid" of activity in 2012, giving an approximation of the spatial distribution

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[2]Our paper also relates to a broader body of research concerned with the broader economic impacts of mobile phones in developing countries (cf. [2, 18]). Also peripheral to our study is the robust literature on the factors influence the success and failure of mobile money deployments (cf. [21, 12, 14]).

[3]For related work using mobile phone data records to model social and economic behavior in developing countries, cf. [6, 7, 15, 9].
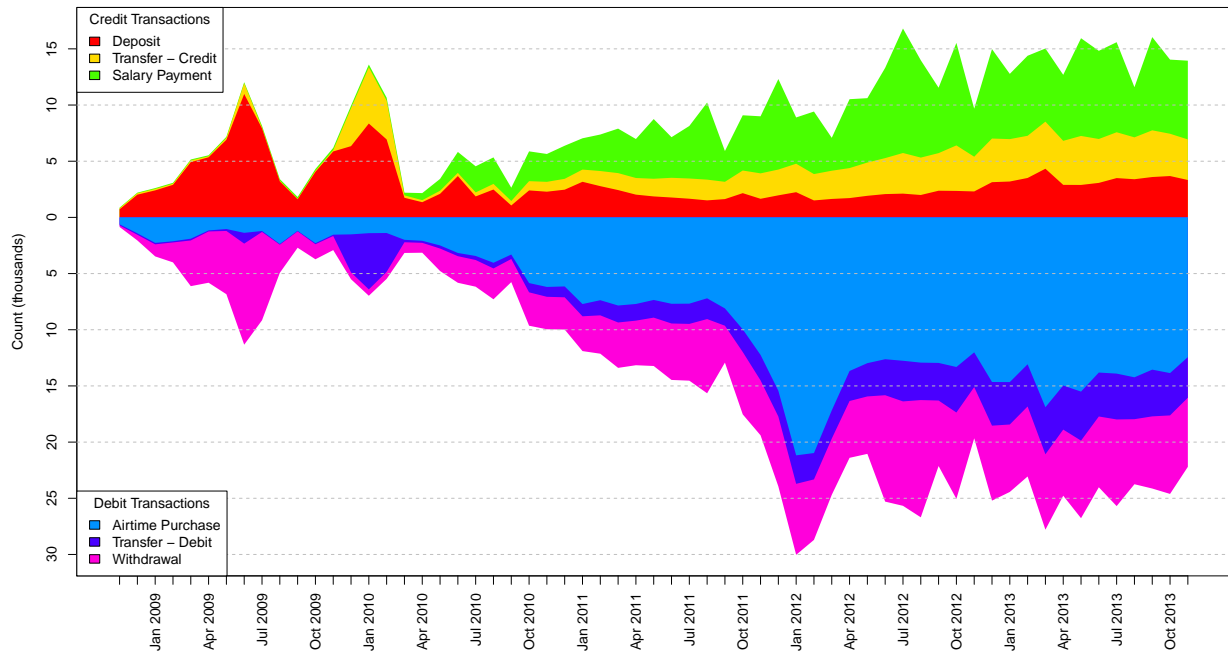
Figure 2: **Usage of M-Paisa in Afghanistan.** Initially launched in 2008, Afghanistan's primary mobile money network (M-Paisa) has seen slow but steady growth over the past several years. Salary payments, the focus of this study, represent a significant source of funds deposited into the M-Paisa system. The above figure shows the number of transactions effected per week, for the six most common transaction types.

of M-Paisa use [5]. As Figure 1 illustrates, M-Paisa use is highly concentrated in the urban and peri-urban regions of Afghanistan, as well as along major transport corridors.

In 2009, Roshan first piloted a new Mobile Salary Payment (MSP) service that enabled the central government to directly pay the salaries of Afghan National Police officers. In the MSP system, the central office authorizes payments which are then instantly credited to the employees' M-Paisa accounts. These mobile deposits could then be transferred to other mobile users, used as payment with registered vendors, or withdrawn as cash from a network of authorized agents. Anecdotal evidence suggests that this pilot project dramatically reduced leakage by reducing the incidence of "ghost" workers on the payroll, and by increasing the effective payment to participating officers by removing opportunities for diversion of funds. Similar opportunities for increased efficiency exist in the private sector, and in recent years a small number of firms in Afghanistan have begun to transition to mobile salary payments.

Figure 2 shows the evolution of the M-Paisa system since its inception in 2008, using the historical database of M-Paisa activity to highlight the most common transaction types. Initially, deposits and withdrawals were the dominant forms of M-Paisa activity, but over time salary payments and airtime purchases have become increasingly popular. Currently, salary payments are the primary means by which money enters the system, in part because the average value per transaction is much higher than for other transactions.

4. RESEARCH DESIGN

In our study, we use the Mobile Salary Payment (MSP) system as an instrument to better understand the economic impacts of mobile money. Specifically, in close partnership with a large development organization in Afghanistan, we used a randomized control trial

to transition a random subset of the organization's employees onto the MSP system from the standard cash-based method of receiving salary payments. The study was designed to provide a "random shock" to the propensity for some individuals to use mobile money, in order to isolate the causal effect of mobile money use. This research design was chosen over a non-experimental approach, as it would otherwise be very difficult to disentangle the effect of mobile money from other differences between users and non-users of the system [29]. In this section, we provide additional details on the partner organization, research design, program implementation, and data collection.

4.1 Partner Organization: CADG

Headquartered in Singapore, the Central Asia Development Group (CADG) is a private contractor that delivers engineering, aviation, agricultural services, and development assistance to remote and challenging locations. In Afghanistan, CADG's flagship development initiative has been a USAID-supported Community Development Program (CDP), primarily in the southern and eastern provinces of the country. CDP's mission is to provide labor-intensive community development projects to reduce the impact of economic vulnerability and increase support for the Afghan government. The projects undertaken by the communities involve reconstructing municipal infrastructure, irrigation systems, and public facilities such as schools and clinics. CDP's main beneficiaries are at-risk populations including unemployed men of combat age, internally displaced persons, those suffering from extreme poverty, and other marginalized segments of Afghan society.

In 2011, a small number of CADG's CDP staff in Kabul and Kandahar entered a pilot of Roshan's Mobile Salary Payment system. Each employee's monthly salary was authorized directly from CADG's Singapore headquarters, and delivered to the employee's

Figure 3: **M-Paisa training session.** All employees, including individuals in the control group, were given a mobile phone, an active M-Paisa account, and training in how to use the M-Paisa account.

	Cash Payments	Mobile Money
Bank transfer to AFG	$ 172	$ 172
Transfer Cost/fees (AFG)	$ 7,525	$ 3,570
CADG Finance Staff (AFG)	$ 1,500	$ 167
CADG Finance Staff (SIN)	$ 1,000	$ 1,200
Total	$10,197	$ 5,109
Cost per employee-month	**$ 14.57**	**$ 7.30**

Table 1: **Cost savings to the firm.** Relative cost of disbursing employee salaries in cash vs. mobile money. Calculations are based on internal financial data provided by CADG and scaled to the full payroll of 700 employees.

M-Paisa account. Employees could then use the M-Paisa balance to transfer money, purchase airtime, accrue savings, or cash out using the network of M-Paisa agents, who serve as "human ATMs" by exchanging electronic credit for Afghan currency. In 2012, in partnership with our research group and Roshan, CADG decided to scale up their pilot program, and agreed to the more ambitious research study that is the focus of this paper.

4.2   Randomized Control Trial

With technical assistance from our research team, CADG launched a randomized experiment in August 2012 involving 341 of CADG's 700 CDP employees operating in seven provinces: Kabul, Kandahar, Helmand, Ghazni, Khost, Paktia and Paktika. The sample of 341 individuals included all CDP employees who worked in office locations with Roshan mobile coverage, and excluded the CDP security staff who were being transitioned to an alternative payment system under the Afghan Public Protection Force. The location of CADG's offices in each of these provinces is represented by a red triangle in Figure 1.

Using a randomization protocol that stratified employees based on location, half (171) of the eligible employees were assigned to a treatment group and the remaining 170 were assigned to a control group.[4] Only individuals in the treatment group were enrolled in the Mobile Salary Payment system; the control group continued to be paid by CADG's existing cash-based system. Aside from the mechanism by which monthly salaries were disbursed, employees in the control group were treated as closely as possible to individuals in the treatment group. In particular, both sets of employees were given new phones and a new Roshan SIM card (described to them as a "work phone"). All employees were further given in-person training on how to use M-Paisa, including how to send, receive, deposit and withdraw funds, as well as how to purchase mobile airtime via M-Paisa (see Figure 3).

4.3   Timeline and Data Collection

Between July 2012 and April 2013, our research team conducted regular surveys with all 341 employees participating in the research study. The approximate timeline of these interviews is shown in Figure 4. We began with a very short baseline survey that was used

to perform the stratification and randomization described above. Then, immediately prior to giving each employee a phone and M-Paisa training, we conducted a longer face-to-face baseline interview to collect detailed demographic and socioeconomic information, as well as data on several outcomes related to financial activity, personal well-being, and subjective perceptions of corruption and physical security.

Following the baseline survey, all employees were given mobile phones and M-Paisa training, and were told how they would receive their salaries (i.e., we informed them of their treatment status, although we did not describe it as such). From that point forward, once a month, each employee received his or her regularly scheduled salary payment, via cash ("control") or M-Paisa ("treatment"). In addition, every month until the end of the study period, we conducted a phone interview with each employee where we asked a subset of the questions from the baseline survey. Wherever possible, at the end of the study period, we conducted a final full-length face-to-face interview.[5]

In addition to the data collected through interviews with CADG employees, our research team was given access to administrative and financial data from CADG, which we use to conduct a cost-benefit analysis to determine whether the transition to MSP resulted in net savings to CADG. The final source of data, used to construct Figures 1 and 2, came from Roshan directly. Most relevant to our study, we analyze the full set of M-Paisa transaction records for each participant in the study, in order to understand how enrollment in MSP impacted his or her use of other mobile money services. Thus, for each transaction conducted by the study participants, we observe the transaction type and value, as well as the exact time and approximate location of the transaction.

5.   RESULTS: SAVINGS TO THE FIRM

Consistent with the results from Aker et al. [1], the transition to mobile salary payments resulted in significant cost savings to CADG. As shown in Table 1, which was constructed from CADG's internal financial records, the most visible impact of MSP on CADG's operations was a significant decrease in the recurring cost of delivering salaries to CADG employees. Under CADG's existing cash-based salary system, the recurring costs associated with a salary payment were over $10 per employee per month, including bank

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[4]Randomization was conducted at the individual level, to ensure that every CADG location would have half of its employees enrolled in MSP. Randomization was further stratified by the share of monthly income transferred to a family and the level of monthly expenditures on phone airtime.

[5]In practice, due to the significant logistical challenges of travelling within Afghanistan, treatment followed a staggered rollout plan in which Kabul employees received the intervention in July 2012, followed by employees in Paktia and Paktika in August 2012, employees in Ghazni and Khost in September 2012, and employees in Helmand and Kandahar in October 2012.
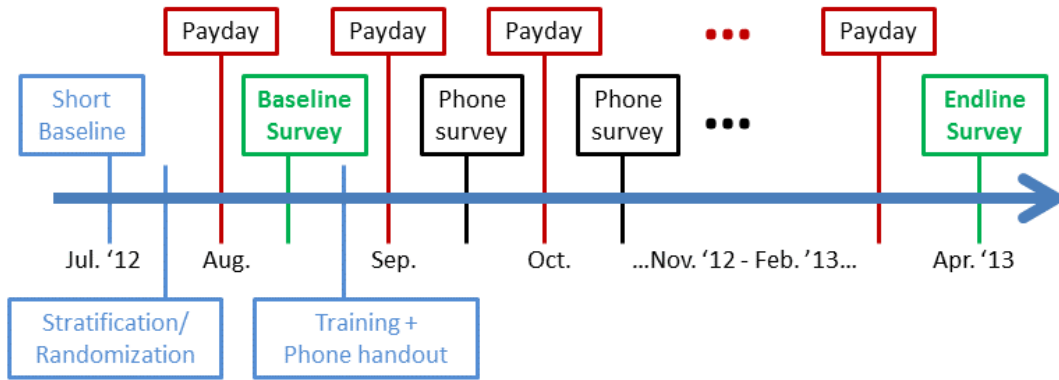
Figure 4: **Timeline of study.** A very short survey was administered in July 2012 to collect information used for stratification and randomization. Longer face-to-face baseline and endline surveys bookended shorter monthly phone surveys, which were conducted shortly after payday each month.

fees and other transportation costs associated with moving cash across the country. However, under the MSP system, the primary recurring cost was the withdrawal fee of 150 Afghanis (roughly US$3) charged by Roshan for the withdrawal. Note that while a fee is normally charged to the end-user for making an M-Paisa withdrawal, CADG paid one withdrawal fee per employee per month; on subsequent transactions employees were subject to regular M-Paisa tariffs. CADG further estimates that while the time requirements on Singapore financial staff increased by 20% under mobile salaries, the time requirements on Afghanistan financial staff decreased by over 80%, resulting in a monthly indirect cost savings of approximately US$1,000. Thus, while the conversion from cash to MSP created fixed costs of roughly $40 per employee – including the cost of registration, training, a new mobile handset, and SIM card – these fixed costs were recovered within 6 months, after which time the firm realized significant savings. Due to these substantial cost savings, shortly after the completion of our research study in March 2013, CADG announced its decision to expand mobile salary payments across its organization, at which point all of the CDP employees were transitioned to MSP.

Beyond CADG's cost reductions, there is evidence that Roshan benefited from a cross-subsidy to its mobile voice operations. As is common in many developing countries, Roshan operates on a pre-paid voice business model in which customers purchase airtime credit prior to initiating a call, and only the caller, not the called party, is charged for each call. In the CADG study, employees who were randomly assigned to the mobile salary payments group made larger and more frequent airtime purchases each month and spent more in total on airtime. On average, MSP employees increased airtime purchases by roughly 100 Afghanis (US$2) per month. This has strategic implications for the mobile operator, as it suggests a viable path forward may be to reduce M-Paisa enrollment tariffs in order to grow a larger subscriber base who then cross-subsidize voice and other product platforms.

6. RESULTS: IMPACTS ON EMPLOYEES

The results in the previous section indicate that the transition to mobile salary payments help the employer save money, and provided a cross-subsidy to the mobile operator. For the employees themselves, however, the results were equivocal. Here, we use the transaction records to analyze the impacts of the MSP program on employee use of mobile money (Section 6.1), discuss the varied experiences with mobile money reported by the employees themselves (Section 6.2), and discuss the impact of mobile money on other measures of individual welfare and well-being (Section 6.3).

6.1 Uptake and use of mobile money

Employees who were randomly selected to receive mobile salary payments were significantly more likely to use mobile money. A portion of this effect is mechanical, in the sense that each employee in the treatment group received exactly one extra mobile money deposit each month, and was thus required to make at least one withdrawal. However, the increases in mobile money use extended beyond this direct effect. The complexion of this activity is shown in Figure 5, where we plot the M-Paisa transactions made over the study period for all treated individuals in Kabul, CADG's main office. Each month, MSP (treated) employees receive a single deposit, and almost immediately afterwards most employees make a withdrawal to convert the mobile money to cash. As can be seen in the figure, however, the proportion of employees making an immediate withdrawal decreases over time. In addition, while usage of other aspects of the M-Paisa system is generally quite low in this population of employees, there is a modest increase in use of other services over the study period, and in particular in use of the Airtime Purchase service.

To examine these differences formally, we estimate a simple fixed effects model that to measure the impact of mobile salary payments on subsequent use of M-Paisa [29]:

$$Y_{it} = \alpha Treat_i + \beta Post_t + \gamma(Treat_i * Post_t) + \mu_i + \nu_t + \varepsilon_{it} \quad (1)$$

Here, Y_{it} measures employee i's use of a given M-Paisa service Y in month t. Two dummy variables $Treat_i$ and $Post_t$ indicate whether the observation is for a treated individual, and whether the observation was made post-treatment, respectively. Note that we only have one pre-treatment observation per individual, taken during the baseline. We include individual fixed effects μ_i and survey wave fixed effects ν_t to ensure that time-invariant individual factors, and temporal patterns that affect all individuals similarly, do not bias our results. Heteroskedasticity-robust standard errors are clustered at the individual level to remove the possibility that errors are correlated within a single individual between survey waves. Note that while specification (1) provides, we believe, the most rigorous means of evaluating the causal impact of the MSP treatment, similar results obtain under a variety of plausible alternative specifications, including calculating the simple difference in average outcomes between treatment and control groups from the endline survey.

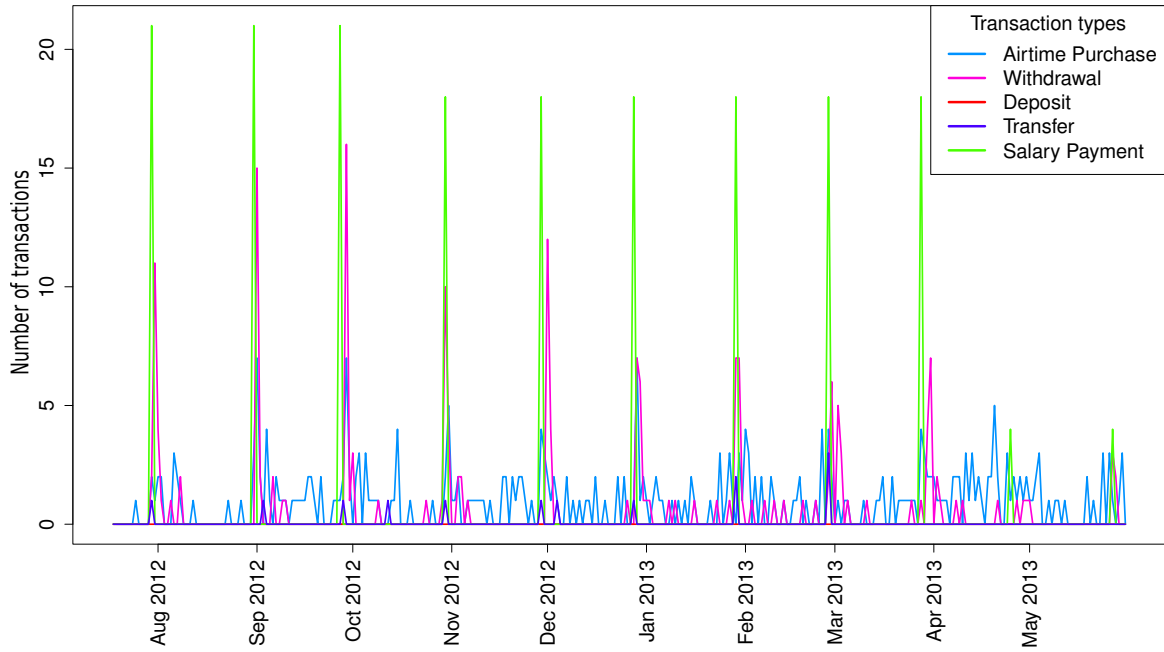The results from estimating equation (1) are presented in Table

Figure 5: **Adoption and use of M-Paisa in the MSP treatment group (Kabul province).**

	Net Balance	Cumulative Balance	Airtime (#)	Airtime (Afs)	Send Money (#)	Send Money (Afs)
Treatment effect	1579.746***	3411.278***	0.673***	96.768***	0.037***	232.949
	(456.055)	(869.933)	(0.171)	(21.850)	(0.014)	(144.709)
Constant	-34.427	-121.628	0.812***	20.630**	0.002	22.699
	(187.198)	(359.947)	(0.071)	(9.032)	(0.006)	(60.824)
# Observations	1709	1709	1709	1709	1709	1709
# Clusters	340	340	340	340	340	340

Table 2: **Effect of treatment on adoption and use of M-Paisa.** The treatment effect listed in each column indicates the average increase for each individual in each of the primary M-Paisa transactions. Units of measurement given in column headings in parenthesis. All specifications include employee and wave fixed effects to account for unobserved heterogeneity at the level of the individual and survey wave. Standard errors, clustered at the employee level, appear in parentheses under coefficients. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

2. Across several different types of M-Paisa transactions, individuals receiving the MSP are significantly more likely to use mobile money. For instance, individuals in the treatment group on average make an additional 0.67 airtime purchases per month, for an average value of 96.8 Afs (approximately US$2). Of the metrics given in Table 2, perhaps the most interesting finding relates to the use of mobile accounts for micro-savings. On average, each month each treated employee accrues an additional 1579 Afghanis (about US$30) in balance on his mobile account, or over 20% of the average monthly salary. In results not shown, we further find heterogeneity in account usage patterns, for example employees with pre-existing bank accounts maintained larger M-Paisa balances, as did employees with larger salaries and employees who represented higher shares of their household's total income. By contrast, non-heads of household were the quickest to withdraw funds from the mobile accounts following the salary transfers.

6.2 Self-reported employee experiences

While the transactional data on M-Paisa use shows that the MSP program caused treated individuals to use a variety of mobile money services, the self-reported experiences of these employees indicate that the transition to mobile payments was not entirely seamless. In the monthly surveys, we asked employees several questions about their experiences and satisfaction with the way in which they were paid. In Figure 6, we show how employees responded to the question, "Was your salary paid on time (on or before the day that it was due to be delivered)?" The figure tabulates the responses separately for the treatment (MSP) and control (cash) groups, for each monthly wave of surveys. There is a noticable and statistically significant dip in the timeliness of salary payments in the treated group in months 2-4. Overall, CADG employees receiving mobile salary payments reported about 10% of their mobile salary payments were not delivered on time, with the most common reason being agent liquidity (i.e., the nearest M-Paisa agent did not have sufficient cash on hand to allow the employee to receive the complete salary), though approximately half of these delays were caused by a single unreliable agent in Helmand province. By comparison, about 1% of CADG employees in the cash payment group reported salary delays after the study started, and 6% of all employees reported salary delays under the cash system in the baseline data before the rollout of mobile salaries. It is worth noting that, prior to our study, CADG went to great lengths to ensure the timely disbursement of
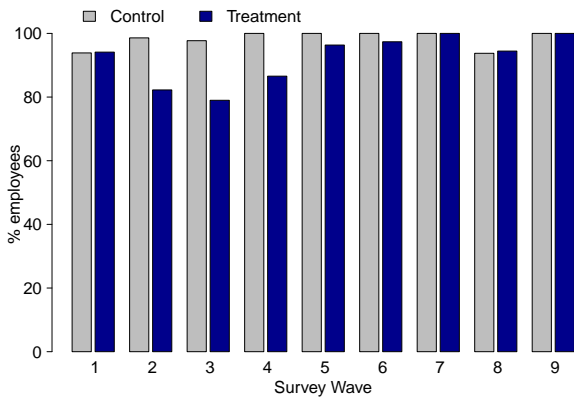
Figure 6: **"Was your salary paid on time?"** Self-reported responses are tabulated separately for individuals in the control and treatment groups for each monthly wave of surveys.

Figure 7: **"How convenient is it to access your M-Paisa agent?"** Self-reported responses are tabulated separately for individuals in the control and treatment groups, for the final wave of surveys.

cash-based salaries, so the baseline level of 94% timeliness is unusual in the Afghan context, and likely would not be sustainable for a large number of firms.

These hiccups in the deployment of mobile salary payments were resolved quickly, and over the course of the study the vast majority of employees indicated that they were either "very satisfied" or "somewhat satisfied" in response to the question, "How satisfied would you say you are with how your salary is paid by CADG?" To this question, as well as to several questions about employee job satisfaction and morale, there were no differences between the individuals in the treatment and control groups.

Panel A of Table 3 tabulates these responses and tests for statistically significant differences between the two groups. We report the average response value for the Control and Treatment groups at the endline survey (columns 1 and 2, respectively), the difference between these averages (column 3) and the p-value from a two-tailed t-test to indicate whether the difference in averages is statistically significant (column 4). In addition, columns 5 and 6 report the difference-in-difference estimates of the treatment effect and p-value, using a method statistically equivalent to specification (1). Specifically, for each individual in the study, we compute the *change* in response between the endline and baseline surveys, and then separately compute the average of these changes across all individuals in the treatment and control groups. Column 5 indicates the difference in these two averages (of endline-baseline differences), and column 6 indicates whether that difference is statistically significant. In interpreting this table, we generally conclude that the treatment had a causal effect on the outcome if columns 3 and 5 have the same sign and are both statistically significant.

6.3 Impacts on employee welfare

As discussed in the Introduction, this study was partially motivated by a desire to better understand whether the use of mobile money in general, and mobile salary payments in particular, might lead to observable changes in other aspects of how employees lived their lives. Given the relatively short window during which the study was conducted, we did not expect to see pronounced differences in key welfare indicators such as consumption, expenditures, self-reported happiness, etc. However, there were three areas in particular where previous research led us to believe the MSP treatment might have a noticeable impact.

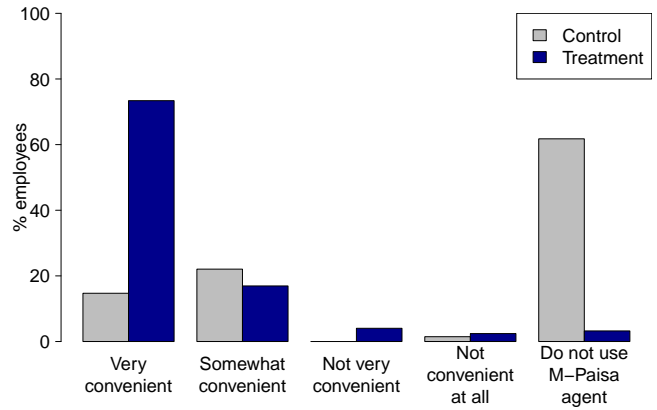First, recent research on interpersonal transfers suggests that employees who are induced to use mobile money might be more likely to send or receive transfers than individuals without access to the M-Paisa system. In particular, there is evidence that individuals in East Africa use mobile money to send funds to friends and family in times of need [8, 25], and that these transfers help recipients smooth consumption [17]. In our data, however, we find no compelling evidence that individuals in the MSP program were more likely to send or receive transfers than individuals receiving cash-based payments. These results are presented in Panel C of Table 3; if anything, it appears that treated individuals were marginally less likely to engage in transfer activity.

Second, due in part to the observation that individuals in the treatment group were more likely to accumulate mobile money balance in their accounts, it seemed possible that such differences would lead to an increase in overall savings reported by MSP recipients. Indeed, as shown in Panel D of Table 3, there were pronounced differences in how the two groups chose to save, with treated individuals more likely to use M-Paisa and control individuals more likely to use informal methods (such as "cash under the mattress"). However, the differences in *total* savings between the two groups were small and not statistically significant, indicating that treated individuals substituted M-Paisa for alternate savings mechanisms.

Third, and related to the above, we were interested to understand whether shifting the medium in which money was stored from cash to M-Paisa would impact the individual's sense of security and safety. During the study period in Afghanistan, violence was unfortunately extremely common, and close to 20 percent of the individuals in our study responded in the affirmative to the question, "Has the neighborhood in which you currently live experienced an attack in the current calendar month?" Our expectation was that the mobile money account might be perceived as a safer place to store balance, as it might be less susceptible to petty theft, extortion, or robbery (cf. [28, 25]). In Niger, for instance, Aker et al. [1] find that wives who receive government aid in the form of mobile money are better able to control how the money is spent in the household than women who receive cash transfers, with the hypothesized mechanism being that mobile money makes it harder for husbands to see and control the money in the household.

In our survey data, we find little evidence that mobile salary payments increase the respondent's subjective perception of physical security. Although there was a modest increase in the percentage

	(1) Control Avg.	(2) Treat Avg.	(3) Difference	(4) [p-val]	(5) Double Diff	(6) [p-val]
Panel A: Salary satisfaction						
Satisfied with salary	0.696	0.747	0.051	[0.313]	0.037	[0.509]
Salary paid on time	1.00	0.944	-0.056*	[0.008]	-0.065	[0.128]
Salary paid in full	1.00	0.976	-0.024*	[0.083]	-0.027*	[0.083]
Panel B: Consumption and expenditures						
Food expenditures	7021.627	9976.274	2954.647**	[0.017]	3167.227	[0.126]
Total expenditures	21037.890	26892.708	5854.818	[0.227]	14004.889	[0.132]
Panel C: Transfers						
Sent transfer	0.409	0.24	-0.169***	[0.006]	-0.175**	[0.016]
Received transfer	0.036	0.04	0.004	[0.885]	-0.021	[0.656]
Panel D: Savings						
Used private bank	0.136	0.136	0.00	[0.994]	-0.005	[0.922]
Used M-Paisa banking	0.394	0.728	0.334***	[0.00]	0.365***	[0.00]
Used informal savings	0.455	0.336	-0.119*	[0.065]	-0.11	[0.224]
Total monthly savings (Afs.)	10204.559	10351.696	147.137	[0.975]	5428.484	[0.521]
Panel E: Security and Corruption						
Feel safe to deposit 10,000 Afs.	0.824	0.871	0.047	[0.326]	0.089	[0.249]
Experienced corruption	0.009	0.016	0.007	[0.639]	0.009	[0.806]
Paid a bribe	0.011	0.027	0.017	[0.379]	-0.021	[0.684]
Bribe requested by police	0.009	0.00	.009	[0.32]	-0.018	[0.378]
Bribe requested by other	0.009	0.008	-0.001	[0.928]	-0.011	[0.505]

Table 3: **Effects of MSP treatment on individual outcomes.** Each row represents a different survey question. Columns 1 and 2 report the average (endline) survey response for Control and Treatment groups, respectively. Column 3 indicates the difference between these averages, and column 4 gives the p-value from a two-tailed t-test that this difference is zero. Columns 5 and 6 report the difference-in-difference estimates of the treatment effect and p-value, as described in the text. p-values are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1

of respondents who answered in the affirmative to the question, "Would you feel safe travelling to the bank with AFA 10,000 to deposit?", the difference is not statistically significant. More generally, for a variety of questions listed in Panel E of Table 3, there were only small differences between the two groups.

6.3.1 Interpreting the "null" result

There are several possible explanations for the fact that we observe very few differences in self-reported outcomes between the treatment and control groups. The most obvious explanation, of course, is that the mobile salary payment program indeed did not change most aspects of the employee's day to day life. While we do believe this is the most likely candidate explanation, we briefly discuss several other plausible reasons that may have led to the observed "null" result.

Short time window: Our ability to say anything conclusive about employee behavior is severely limited by the short time period over which we observe the employees. For instance, it may be that mobile money has long-term impacts on total savings, but that it takes longer than 6-8 months for those changes to materialize. As we saw in Figure 5, it was only toward the end of the study that treated individuals began to increase their use of other mobile money services. Thus, if a reasonable theory of change involves first growing comfortable with M-Paisa, then increasing savings on M-Paisa, and finally having those savings translate into observable changes in welfare (for instance through increased food expenditures), our study period is likely too short to detect such lasting impacts.

Small sample size: The statistical power of our quantitative tests is constrained by the small number of individuals who participated in the study. While a larger sample would have allowed us to detect smaller treatment effects, our study population was determined by pragmatic factors over which we had no control. Employees who worked in office locations without Roshan mobile coverage, temporary staff, and security staff paid by the Afghan Public Protection Force were all ineligible to participate. As such, even with generous assumptions about the standard errors of our estimates, our small sample limited our ability to detect anything but very large treatment effects.

Respondent honesty: Several survey questions were somewhat sensitive, and respondents may have been inclined to be conservative in their responses to questions, for instance, about their satisfaction with their current employer or bribery attempts by police officers. We did our best to assure subjects that their responses would be kept confidential, and asked ennumerators to carefully record their impressions of the respondent's honesty after each interview. However, a certain degree of noise is inevitable and would exacerbate the (traditional) measurement error in our data.

In addition to the above, there are several alternative explanations that we believe are less likely to be the source of the null result. For instance, ennumerator errors were carefully managed through rigorous training and piloting, the use of double data entry, and random spot-checks. Attrition was tightly controlled as CADG instructed each employee to set aside work time to complete the surveys. Finally, as noted above, a variety of plausible alternative empirical specifications in addition to model 1 were also tested, producing qualitatively similar results.

7. DISCUSSION

In the preceding analysis, we have highlighted several key results from our study of mobile money in Afghanistan. First, the switch from cash to mobile salary payments led to substantial cost-savings

to CADG, the partner organization. Second, this switch induced individuals enrolled in the mobile savings payments program to increase usage of the Roshan network, which indirectly benefitted the operator. Third, the transition to mobile salary payments was not seamless and at first was inconvenient to employees, but initial hiccups were resolved and did not cause long-term employee dissatisfaction. Fourth and finally, individuals receiving mobile salary payments were more likely to use M-Paisa to save money than individuals who were paid in cash, but this switch did not appear to impact other aspects of individual livelihood and well-being.

Together, these results paint a nuanced picture of mobile money in Afghanistan. While a portion of the employer's cost reductions resulted from systemic increases in efficiency, much of the savings stemmed from a shift in responsibility for cash transport costs from the employer to the employee, and to the mobile money agents employed by the phone company. While employees would normally receive cash salary transfers directly at their primary office location, under the mobile salary system it became the employee's responsibility to find a mobile money agent in order to cash out. For the employees in our study, this added transportation and opportunity costs. In addition, the reliance on third-party agents to deliver salaries involved a very salient risk, namely that the mobile money agent may not have sufficient liquidity to process all employee salaries on payday. In our study, the mobile operator was able to respond quickly and decisively to problems of this nature, but such considerations must be taken into account before mobile salary payments are scaled to a larger, and potentially more vulnerable, population. Indeed, given the lack of compelling evidence that employees benefit in other ways from mobile salary payments, it is worth ennumerating several of the lessons learned from the switch to mobile salary payments in the context of our study.

7.1 Operational lessons learned

In his introduction to Jan Chipchase's ethnographic study of mobile money in Afghanistan [10], Bill Maurer notes,

> Afghanistan's long history may hinder mobile money. The obstacles may be insurmountable. There are electricity failures and irregular bank hours. The Taliban insist that some towers be turned off at night. People withdraw their cash as soon as it registers in an account. People trust gold, and they trust the hawala networks that have endured at least since the time of Vigne to transfer their money. By contrast, most distrust the commission structure of the mobile money service; it looks like a bribe, and it's hard for people to know why they should trust an agent, or, likewise, for an agent to know why he should trust the service itself.

These obstacles to the adoption of mobile money in Afghanistan are compounded by several practical constraints. First among these is the observation that mobile network coverage and agent coverage are required before a mobile salary payment system can be implemented, a fact that limits access in remote areas. Mobile salaries only function properly in areas with both sufficient mobile network coverage and mobile money agent presence. In the CADG study, for example, the Zabul CDP office and some smaller provincial satellite offices were excluded from due to the absence of a reliable mobile signal and limits on employee travel. However in Paktia, Paktika and Helmand, where few mobile money agents existed prior to the study, Roshan agreed to onboard new mobile money agents. In practice, new agent recruitment often requires time and additional compensation in difficult areas, and may lead to early liquidity disruptions as described in the Helmand example above.

Second, agent liquidity represents a key impediment to the smooth functioning of a mobile salary payment system. While the employer may consider a transfer to be complete when it has been disbursed by their Finance department, the employee does not consider the payment received until it has been cashed out by a mobile money agent. This disjunction often comes at the employee's expense, particularly in remote areas where withdrawals are more frequent than deposits and the agents occassionally run out of cash on hand. In more robust mobile money ecosystems, services such as bill and vendor payments can help supply agents with cash, but liquidity management remains a top priority in areas where salary payments are the primary interface to the mobile money system.

Third, we believe the transition to MSP would have been more had there been local "focal points" to assist with ongoing technical concerns. For instance, there was no system in place to automatically register and train new employees, and the selection of a single employee in each office to serve as a mobile money focal point might have helped manage this process. Combined with this function could be the important role of assisting employee learning over time. Survey data suggests some CADG employees had initial misperceptions about visiting mobile money agents that were quickly resolved after one or two interactions. This confusion extended to the M-Paisa tariff structure, and in particularly the extent to which standard fees were being covered by the employer.

Finally, we note that there are an overwhelming number of pragmatic considerations that, if not handled properly, might easily derail the deployment of mobile salary payments. For instance, the bulk registration system employed by Roshan made it possible to collect photographs and biographical information in advance, which significantly reduced the time needed for on-site enrollment and verification. This provided more time for technical training and assistance (e.g. transferring contacts from one phone to another), so that each employee could confirm that his account worked properly. In this context, the M-Paisa interface based on interactive voice recognition (IVR) system, which did not require much literacy or technical proficiency, was quite popular. While such concerns may seem inconsequential, employees were understandbly extremely sensitive to any confusion or transaction cost in accessing their expected salaries.

8. CONCLUSIONS

This paper presents the results from a field experiment designed to increase the adoption of mobile money in Afghanistan. The experiment was effective, in the sense that individuals enrolled in a new mobile salary payments program were more likely to use a range of mobile money services. However, in the short run, the increased use of mobile money did not translate to meaningful changes in welfare, despite the fact that individuals in the program were more likely to save money using mobile money. For the employer and mobile operator, however, the benefits were more direct and immediate: the employer realized significant savings in salary disbursement, and the mobile operator benefited from cross-subsidies to other phone-based services.

The fact that the switch to mobile salary payments appeared to benefit the employer more than the employee may be due in part to the unusual counterfactual of our study. Prior to introducing mobile salary payments, CADG had a strong reputation with employees and had borne the entire cost of providing cash directly to each employee on payday. In other contexts, employers are less meticulous in ensuring that the employee receives the full salary each month. For instance, the employer may transfer the salary to a physical bank that is far from the employee's home or office, or the employer may entrust the employee's salary to the local manager, who may extract a small "commission" before paying the em-

ployee. In such settings, the transition to mobile salary payments may have more broadly positive implications for employee welfare.

We remain optimistic that mobile money may play an important role in fragile and conflict-affected environments like Afghanistan. Key aspects of the system hold promise for businesses, policymakers, and citizens alike: from the increased efficiency and transparency of digital transactions to the security of the mobile wallet and convenience of value-added features. However, given that the short-term benefits appear to elude the end-user, even minor hiccups with agent liquidity or the technical interface may be sufficient to deter widespread adoption. Thus, it is important that operators and firms are provided adequate incentives to first deepen capacity and then expand to more remote areas. Otherwise, the latent demand for M-Paisa will not be sufficient to trump the social and operational constraints that have thus far prevented the market-driven expansion of mobile money.

9. ACKNOWLEDGMENTS

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