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Evidence from a Pilot Audit Study**

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FRAUD ON MOBILE FINANCIAL MARKETS: EVIDENCE FROM A PILOT AUDIT STUDY

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Abstract

Potential fraud can limit the promise of innovative mobile financial markets like Mobile Money, yet little is known about its existence, especially among the poor. In a randomized control trial across 6 low-income communities in Ghana, I evaluate the extent of fraud—overcharged transactions—on Mobile Money and explore the mechanisms underlying the results. Trained auditors visited vendor points, seeking to make actual Mobile Money transactions: either send or receive cash. Approximately 22% of transactions go fraudulent. Additional experiments indicate that fraud is higher for large amount transactions. Consumers who are financially sophisticated are less likely to suffer fraud, but market competition appears to have no effect on this.

Key words: mobile money; financial fraud; audit study

JEL classification: O16; G21; G23; D14; G28

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“We also want you [Mobile Network Operators] to make your service affordable, we also want you [Mobile Network Operators] to put in place systems to minimize or eliminate fraud if possible and we also want you [Mobile Network Operators] to give wonderful customer service to your customers as they come to your premises to transact business. We want your system to have what it takes, to give very good audit trail of transactions.”

- **Bank of Ghana’s payments oversight office head Clarence Blay, speaking at a stakeholder conference titled *Expanding Cashless Payments Through Mobile Wallet Transactions*, 2015.**

1 Rationale and Aims

Financial access and inclusion among poor and low-income environments, historically a major challenge, have recently been transformed by the emergence of mobile financial services like Mobile Money. But, potential fraud is often hypothesized as a major barrier hindering the expansion, functioning and sustainability of these markets (e.g., CGAP 2013; Blay 2015 & 2016); yet no systematic evaluation of such market barrier is currently available. I piloted a field experiment across 6 communities in Ghana to systematically document the extent of merchant-driven² fraud on existing M-Money services using an audit study. Merchant-driven fraud is simply defined as unauthorized transaction charges that merchants impose on customers for M-Money transactions. For transactions that are *not* merchant-based e.g., peer-2-peer, M-Money providers use inbuilt technologies that automatically charge the transactions, thereby limiting the ability of merchants’ to defraud customers.³ In this study, trained auditors visited the centers of merchants seeking to make a Mobile Money transaction: either send or receive cash. The goal was to capture discrepancies in transaction tariffs compared to the provider-approved tariffs. I also ask whether fraud can be explained by price discrimination, financial sophistication/literacy or pressure from market competition.

Results have important implications for financial technology adoption and inclusion among poor societies. Such result fits into national and international policy goals like the Universal Financial Access 2020 (e.g., World Bank 2015 & IFC 2016). This work also extends the broader literatures on consumer finance and market frictions (e.g., Anagol, Cole and Sarkar 2012; Mullainathan et al. 2012; Cole et al. 2013; Gine and Mazer 2016; Annan 2017), M-Money business and financial inclusion (e.g., Demirgu-Kunt et al. 2008; Demirgu-Kunt et al. 2015), along with the burgeoning literature investigating M-Money and its revolution in development (e.g., Jack and Suri 2014; Suri

² **Mobile Money merchant** correspond to an outlet, shop, premises, channel where Mobile Money transactions can be carried out on behalf of the Mobile Money providers —i.e., joint partnerships between mobile network operators and commercial banks. The merchants register customers and act as cash in and cash out transaction points for customers. These merchants generically earn commissions on transactions and act on behalf of mobile financial service operators.

³ This is not the case for merchant-level transactions e.g., TOKEN, account/Wallet opening, peer-2-customers and many others.

and Jack 2016) and corruption in developing countries (e.g., Olken and Pande 2012). The remainder of this paper is organized as follows. Section 2 discusses the experimental environment. Section 3 presents the design and threats to its validity. The experimental results and conclusions are contained respectively in sections 4 and 5.

2 Environment

Location: The pilot study was carried out in Koforidua and 5 other surrounding villages, all located in the eastern belt of Ghana. The 6 communities include Koforidua, Nankese, Akwadum, Okorase, Jumapo and Suhyen. These selected communities differ in terms of the number of participating merchants, and are relatively low-income in nature. The former will be useful for *tests of competition* to come later, while the latter allows me to explore fraud and its dimensions in poor environments where financial access or inclusion can be critical.

Listing: I obtained the census of all M-Money merchant points across the 6 selected communities. The listing took place between February 12, 2017–February 14, 2017, yielding a total of 129 M-Money transfer vendor points. The approach used a door-to-door exercise describing the exact location of vendors using major landmarks close to the location and in most cases providing the name of merchant and operator. Whenever the merchant’s name is not publicly displayed, the listers make a small transaction to infer the name based on transactional messages auto-generated by the cash transfers system. The listers were available to provide support and answer questions about merchants’ locations, when need arises, throughout the audit experiment.

3 Experimental Design

3.1 Design

I recruited and trained 25 local residents to act as auditors.⁴ Right after recruitment, auditors were randomly assigned to different scripts and money centers. Audit trainings emphasized the provider-approved tariffs for merchant-based transactions. The auditors visited merchants to conduct M-Money transactions and immediately after complete a questionnaire about transaction charges, whether paid charges differ from the provider-approved tariffs, by how much including

⁴ Thirty persons between the ages of 20–40 years who have acquired a minimum of second cycle education were invited to participate in the pilot study. Twenty-five honored the invitation and were trained to collect data for the audit exercises.

the duration of the entire transaction.⁵ A transaction requires a one-time visit to the merchant,⁶ but multiple transactions were performed by an auditor. Auditors were not informed about the specific hypotheses that I want to test, memorized assigned scripts and used uniform language at transactional points. To avoid confusion, I was careful to assign and train a given auditor to a particular script to use for all visits; so different script-groups took turns in the training exercise. The scripts used by auditors differ along three dimensions. (1) To study the role of price discrimination, some auditors made transactions valuing either GHS50(\$12.4) or GHS1100(\$275.0)⁷, thus creating an exogenous variation in the amount of money involved when making a transaction. (2) To study the role of financial sophistication, I assigned auditors to either experienced or neophyte groups. The experienced auditors were trained to ask for the provider-approved rates at the outset of their visit, which are required to be posted at the merchant's money center.⁸ These auditors had to make this salient before the transactions took place. (3) To study the role of competition, I trained a subset of (2)'s auditors who asked whether merchant in question is aware of other nearby money centers to do transfers, in case merchant is absent. I have a sharper test for competition since the audit experiment took place across 6-villages/communities that differ in terms of the number of money centers: from as low as 1 center to as high as 20 centers. The experimental design yields a total of 6 scripts or treatments: {naive, 50GHS}, {naive, 1100GHS}, {sophisticated, 50GHS}, {sophisticated, 1100GHS}, {sophisticated, 50GHS, competition}, {sophisticated, 1100GHS, competition}. A summary of the design and randomizations are displayed in Figure A.1 of the Appendix.

3.2 Threats—Balance and Attrition

Ensuring balance across treatments groups or scripts e.g., product space; amount size space; financial sophistication is crucial for the experimental results. Before I formally evaluate fraud and the various script treatments, I ascertain balance using the demographic information of the auditors. In Table A.1 of the Appendix, I test whether the various auditor characteristics significantly differ across scripts. The results provide strong evidence in favor of balance: auditor

⁵ The auditors were eligible for financial compensation. To maximize the number of transactions and minimize the risk of losing cash resources, part of their stipend payments were directly linked to their transactions that occurred close to the end of the experiment.

⁶ There are a few cases where the merchant is either *absent* or does *not provide* the intended service. When the merchant is absent, auditors had to re-visit many times until the merchant becomes available. But when the merchant does not provide the intended service, auditors were randomly re-assigned to another vendor point.

⁷ These reflect typical transaction sizes, revealed through informal conversation with merchants and other local people. As much as possible, I mimic the M-Money market. Prevailing exchange rate: \$1.0 = GHS4.0.

⁸ Although, in practice, not all merchants adhere to the tariff-posting requirement. More exposition will be provided in sections to come.

observable characteristics are similar across script treatments, except for levels of education for scripts 3 and 5. But, all estimations will control for these characteristics. Next, attrition would be a threat to the validity of the results if it modifies the unobserved characteristics of one script group compared to another. I did not lose any auditor or merchant in the course of the audit trials, making attrition less of a problem. Besides, all estimations will include controls for baseline characteristics, which helps to overcome potential concerns about attrition and balance.

4 Experimental Results⁹

I define M-Money/financial fraud in two ways. The first, which is the main outcome of interest, captures whether or not a transaction is over-charged by comparing the charge at the vendor point with the provider-approved charge. In this case, a transaction is deemed fraudulent when the former charge exceeds the latter. The second measures the amount in difference between the vendor and provider-approved charge. Equivalently:

$$\mathbf{Fraud} \stackrel{\text{def}}{=} \frac{\mathbf{1}[\text{Charged} > \text{Approved rate}]}{||\text{Approved rate} - \text{Charged}||}$$

Figures 2a-2b report estimates of fraud and the potential underlying channels. The extent of fraud, expressed either as a share or amount of transactions is indicated in blue bars, throughout. **Figure 2a** captures fraud at the extensive margin: approach one. The results suggest substantial fraud rate of 22%, overall. This means 2 out of every 9 M-Money transactions at the merchant-level go fraudulent: overcharged. Based on this estimate, the monetary value of M-Money fraud can be derived by multiplying the fraud rate (of 22%) by the transactional amount (say x , generally). Next, I investigate how the estimated fraud varies along three dimensions: transfer amount; financial sophistication; and market competition. There is evidence of fraud across all dimensions but with notable differences. First, fraud is higher for large amount transactions. For example, in the baseline naïve group: the fraud rate is about 17% for 50GHS compared to 30% for 1100GHS. Second, financial sophistication reduces financial fraud. This is consistent with Darby and Karni (1973)’s theoretical result that consumer ignorance of services provide motivation for firms to defraud its customers. Customers who demonstrate knowledge of the transaction system, specifically charges, are less likely to suffer fraud. The experimental trials suggest about 2.5% points average reduction in fraud. Market competition should discipline participants in theory, and

⁹ To conserve space, I have omitted samples of provider approved tariff sheets used for training the auditors; several descriptive statistics about auditor characteristics; transaction volumes and features. These are available upon request.

thus may be expected to reduce financial fraud. But what is strikingly is that I find limited support for such hypothesis. Specifically, the trials suggest less role of market competition as a disciplinary mechanism in mobile financial markets: (1) fraud rates are indistinguishable between study communities that have more versus less M-Money centers. This is based on Chi-squared tests that essentially compare estimated fraud across the different study locations; (2) the extent of fraud suffered by the subset of customers or auditors in the competition group is not different from the sophisticated group.

The results displayed in **Figure 2b**, captures fraud at the intensive margin: approach two. The findings are similar to those in Figure 2a. There is evidence of substantial fraud, averaging at 0.29GHS, with significant variation across the treatment categories. Financial sophistication play some reductive role, not so for competition. Finally, **Figure 2c** asks whether M-Money fraud is different based on the type of transaction, while **Figure 2d** examines the importance of mandating merchants to post the approved tariffs at money centers. I document two results which additionally inform our thinking about how to curb fraud on M-Money. Putting or sending money to the M-Money accounts/Wallets of friends and family is a common practice in low-income settings, but I find that about 27% of such transactions go fraudulent. This estimate is however indistinguishable from the overall fraud rate of 22%. Requiring merchants to post the approved tariffs reduces M-Money fraud by 6% points. Financial fraud is substantial in low-income environments. Curbing M-Money fraud to stimulate its take-up, usage and savings on it is eminent, especially for financial inclusion. Results from this work point towards 2 immediate directions: increasing financial literacy and enforcement of tariff-posting requirements.

5 Conclusion and Policy Aspects

This pilot evaluates financial fraud in low-income environments and provides a good example of how to measure fraud on Mobile Money – via audit experiments. Estimated fraud rate is approximately 22% of typical transactional volumes. There is evidence that fraud is more concentrated on sending cash, but less for cash receiving transactions. Additional audit experiments indicate that financial sophistication or literacy is crucial in reducing fraud on M-Money, but market competition seems to have limited impact on this. More importantly, this work highlights the need for regulation and interventions meant to curb fraud and allied challenges on emerging mobile financial markets. This will ensure high value for monetary transactions and

stimulate consumer confidence and trust which can induce savings among low-income settings. The potential regulatory gains may extend to the functioning of markets and adoption of innovative financial technologies in many developing countries. I aim to extend this work in two ways: (1) Explore demand and supply side interventions—through *fraud monitoring*—that overcome fraud as a potential market imperfection and stimulate M-Money take-up, usage and savings; (2) Develop an economic model of financial fraud to show how the different channels (e.g., sophistication, competition) interact to influence fraud on mobile financial markets. Such model will also motivate the audit experiments and empirical tests.

Figures 2a-3b: FRAUD ESTIMATES AND POTENTIAL CHANNELS

Figure 2a: Extensive Margin

Figure 2b: Intensive Margin

Figure 2c: Send or receive cash?

Figure 2d: Tariff posted on-site?

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Appendix

Timeline of Pilot

Figure A.1

Design of Experiment & Randomization

NOTES: I denote by $t \in \mathbf{T}$ transaction allocations, $a \in \mathbf{A}$ 25 auditors, $m \in \mathbf{M}$ 129 census of merchants, and $s \in \mathbf{S}$ 6 script treatments. I stratify the randomizations by gender, as illustrated. Randomizations are in 2 levels. First, auditors were assigned to script treatments—fixed throughout; Second, then to vendor points for each transaction—varies. Auditors collected transaction level data from all assigned Mobile Money agents in each community. Each transactional round yields 25 transactions.

Table A.1: BALANCE ON AUDITOR CHARACTERISTICS

DV	(1) Gender	(2) Married?	(3) Age (Years)	(4) Education Level	(5) Phone has M-Money?	(6) Self Employed?	(7) Monthly Income (GHC)
Script Number=2	-0.500 (0.289)	0.250 (0.479)	-4.750 (5.588)	0.500 (0.408)	-1*** (5.27e-09)	-0.500 (0.289)	-442.5 (397.4)
Script Number=3	0.100 (0.384)	-0.250 (0.250)	0.250 (5.244)	0.800*** (0.207)	-0.200 (0.207)	-0.100 (0.384)	-262.5 (369.1)
Script Number=4	0 (0.408)	-0.250 (0.250)	-1.750 (4.837)	0.500 (0.289)	-0.250 (0.250)	-0.500 (0.289)	-362.5 (355.5)
Script Number=5	0.100 (0.384)	-0.250 (0.250)	-4.550 (4.574)	0.600** (0.253)	-0.200 (0.207)	-0.100 (0.384)	-352.5 (352.7)
Script Number=6	0.250 (0.382)	0.250 (0.382)	-0 (6.175)	0.500 (0.289)	0 (5.27e-09)	-0.250 (0.382)	-87.50 (460.0)
Constant	0.500 (0.289)	0.250 (0.250)	28.75*** (4.535)	4	1*** (5.27e-09)	0.500 (0.289)	712.5* (350.2)
Observations (N)	24	24	24	24	24	24	24
R-squared	0.136	0.325	0.133	0.250	0.406	0.163	0.151

- The table reports the results of regressing the various auditor characteristics on script treatment assignments. Each column reports the results for each observable characteristic. Script 1 is the control script. Results for auditor's previous use of M-Money are not reported, as all have used M-Money. Robust standard errors in parentheses. The following usual convention applies for statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Transaction duration?

- *Intuitive:* more time spent on large amount transactions & account/Wallet registration. This measurement serves two purposes: (1) check on the validity/conformity of information provided by the auditors and (2) investigate which transaction types that consumers will less likely engage with. All else equal, transactions that involve more wait time may attract less participation

Samples of provider approved tariff sheets, for training auditors

▪ **MTN: Mobile Money**

MTN Mobile Money Charges			
Transaction Point	Services	Transaction Limit (Ghc)	Charges (Ghc)
At Merchants/ Agents	Registration		Free
	Money Transfer (CFC)	1.00 - 50.00	2.50
		Above 50.00	3%
	Cash In	N/A	Free
	*Cash Out	1.00 - 30.00	0.50
		Above 30.00	1%
		Above 1,000.00	10.00 Flat
*On Your Mobile	Bill Payment (GDS)	N/A	1.00
	Money Transfer (P2P)	1.00 - 50.00	0.50
		Above 50.00	1%
		Above 1,000.00	10.00 Flat
	Money Transfer (A2C)	1.00 - 10.00	1.50
		Above 10.00	3%
At Merchant/ Agent Outlet/ On Your Mobile	Bill Payment - GDS	N/A	0.50
	Airtime Top Up/ Data Top Up	1.50 - 500	Free
	Bill Payment (ECG, GDS)	N/A	0.50 Flat
	Bill Payment (DSTV, MTN Postpaid)	N/A	Free
	School Fees	N/A	2.00 Flat
Account Management	Balance Enquiry	N/A	Free
	Mini Statement	N/A	0.01

*All charges are payable from your MTN Mobile Money Wallet.

Please come along a valid photo ID (Voter ID, Driver's License, Passport, SSNIT ID, National ID or NIN IC) anytime you visit the Merchant point for any transaction.

For assistance:

- Call 100 (Toll Free)
- Text 55555 (Send to shortcode 1515)
- Email mtncustomer@mtn.com
- Visit www.mtn.com.gh

▪ TIGO: Tigo Cash

Customer Fees

ACCOUNT CODE

Transaction Amount (TZS)	Withdraw Cash	Send Cash with Tigo Cash				
1.00-50	0.80	0.50	1.30	2.00	0.80	
51-100	1.50	1.00	2.50	4.00	1.50	
101-250	2.80	1.50	4.30	8.00	2.50	
251-500	4.00	2.00	6.00	17.00	3.50	
501-1000	6.00	2.50	8.50	-	-	

*FREE

- Deposit Cash
- Withdraw Cash
- Buy Airtime
- Mini Statement
- Change PIN

Send cash to 110# for Tigo Cash

Please call 100 for Tigo services or 110# for cash.
For more Tigo services, for more information
to register & to register new approved fees

tigo Live it. Love it.

tigo cash

▪ VODAFONE: Voda Cash

TARIFF TABLE

• Customer Charges

Transaction Brands (GHC)	Cash Deposit	Transfer Money (GHC)		Cash Withdrawal (GHC)
		Person to Person Transfer	Sending money to Unregistered Customer	
1 - 50	No Charge	0.50	1.50	0.50
50.01 - 75	No Charge	0.75	2.50	1.50
75.01 - 100	No Charge	1.00	2.50	1.50
100.01 - 250	No Charge	1.50	4.50	2.50
250.01 - 500	No Charge	2.00	6.00	4.00
500.01 - 1000	No Charge	2.50	10.00	6.50
1000.01 - 2000	No Charge	3.00	20.00	10.00
>2000.01	No Charge	6.00	30.00	15.00

• Other Transactions

Transaction Type	Charge
Buy Airtime for self	No charge
Buy Airtime for Others	No charge
Check Balance	No charge
Request PIN Change	No charge
Request Mini Statement	0.05p

• Bill Payment

Transaction Type	Charge
Vodafone Post Paid	No charge
Vodafone Fixed Lines	No charge
Vodafone Fixed Broadband	No charge