

Digital payments

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We are grateful to Matthew Bird (discussant), one anonymous referee, and the editors for their insightful comments.

Abstract

Despite the rapid growth in digital payments (DP) adoption and its positive socio-economic impacts in low-income countries, a large portion of the population remains disconnected from DP. At the same time, usage of DP conditional on adoption is low, highlighting the unexplored potential for financial inclusion and economic advancement. This paper reviews the burgeoning academic literature on DP and categorizes both macro-level adoption barriers (extensive margin) and micro-level usage challenges (intensive margin). We draw on the Transaction Cost Index, a new comprehensive database encompassing 16 low-income countries, to shed light on major themes in markets for DP. We conclude by outlining potential avenues for future research in this area.

Keywords: digital payments, technology adoption, consumer protection, financial intermediation

JEL classification: D18, G20, G50, O12, O16

1. Introduction

In the past decade, digital payments have increased substantially worldwide (Demirgüç-Kunt *et al.*, 2021). From 2014 to 2021, the percentage of respondents engaging in digital transactions surged from 44 to 64 per cent.¹ This average increase (in levels and growth rate), however, conceals important disparities between high- and low-income countries. In affluent countries, this percentage increased from 88 to 95 per cent, resulting in an 8 per cent growth. In low-income countries, the increase is more pronounced, from a mere 12 per cent to 35 per cent or a staggering 192 per cent growth. We attribute this differential growth to innovations in digital payments (DP) that thrived in poorer regions due to the limited banking infrastructure.² The rapid penetration and proliferation of DP in low-income countries has led to the introduction of cheaper and better tailored financial products that have improved various socio-economic outcomes, including the ability to smooth consumption despite income fluctuations, poverty reduction, improved labour outcomes, and faster ways of sending remittances and making cross-border transactions.³ Despite these promising developments, 65 per cent of respondents of the World Bank's Global Findex Database in low-income countries report not using any form of digital payment. This suggests that DP have yet to reach their full potential to increase financial access, fulfil clients' needs, lower transaction costs, and promote economic growth in these regions.

This chapter explores the barriers to broader adoption and usage of DP in low-income countries and suggests avenues for research to reach universal adoption. We define DP as the set of cashless payments through digital channels such as mobile phones, the internet, or other digital devices. This broad definition of DP encompasses

¹ These are respondents who have used mobile money, debit or credit cards, or a mobile phone for payments, or those who have used the internet for bill payments or online purchases in the past year.

² According to the 2021 IMF Financial Access Survey, the number of commercial bank branches per 100,000 adults in the US was 28.26, whereas in Kenya, this figure was merely 4.39. In contrast, as of 2019, the reach of mobile money agents in emerging markets is 20 times that of bank branches (GSMA, 2020a).

³ For impacts of mobile money please see the research brief titled 'The Impact of Mobile Money on Poverty' published by the Bill and Melinda Gates Foundation in 2021.

all non-cash payments leaving a digital footprint and serves two purposes: it aligns with the World Bank's definition, and it underscores the potential transition from a cash-based economy to a non-cash, or digital, economy. Following our definition, DP include digital payments through point-of-sale devices and QR codes, online banking, mobile money, and e-wallets, among others.^{4,5}

We classify drivers of DP into adoption (extensive margin) and usage (intensive margin), but we acknowledge that many constraints to adoption might also reduce usage by existing DP users, and vice versa. Our classification is guided by the observation that adoption barriers are typically macro-level challenges, often outside the purview of individual consumers or agents. The adoption barriers that we discuss are cash availability, coordination failure, social capital, and supply-side constraints. On the other hand, usage barriers are more micro-level, often addressable by individual actions. We discuss the quality of service, monetary costs and fraud, non-monetary costs, privacy, and homophily. Thus, while adoption barriers may render digital payments altogether unviable, usage barriers typically reduce its desirability compared to cash, assuming both options are available. In our classification, we also identify cross-cutting factors, such as trust, that appear in both adoption and usage barriers. [Table 1](#) provides a comprehensive summary of these constraints, citing the studies we reference, their respective country of focus, and whether trust can play a role as a cross-cutting factor.

Throughout the article, we draw on our own research on mobile money markets consisting of a desk review in 16 low-income countries across Sub-Saharan Africa and Asia and audit studies in Uganda, Tanzania, and Bangladesh reported in the Transaction Cost Index ([Annan et al., 2023](#); TCI henceforth) to provide some descriptive evidence on factors that impede DP adoption and usage. The desk review in TCI (2023) collected data from 33 major DP providers on the pricing of various services (e.g. cash-in, cash-out, on-network transfers, and off-network transfers), including a breakdown of taxes and fees charged, and on price transparency (availability of official fee schedules). To account for costs beyond official fees, such as informal extra fees charged by agents and non-monetary expenses, TCI (2023) conducted audit studies with around 400 agents across both rural and urban areas in each country. Data collection in each agent location compared three different methods: professional mystery shopping, where hired enumerators carried out the actual transactions; consumer intercept surveys, where actual consumers were interviewed near the agent after conducting a transaction; and local mystery shopping where respondents of the consumer intercept survey were enlisted and trained to carry out mystery shopping visits.

Our paper contributes to the literature in two distinct ways. First, we expand DP beyond mobile money and include other payment systems.⁶ For a comprehensive overview of mobile money, readers can refer to [Suri \(2017\)](#) and [Suri et al. \(2023\)](#). Second, we focus on the causes, rather than the consequences, of DP expansion. Given the scarcity of academic reviews on the effects of DP, we direct readers to a parallel World Bank policy report by [Pazarbasioglu et al. \(2020\)](#), which draws from industry knowledge. Additionally, the [International Finance Corporation's 2021](#) Digital Financial Services market research series provides an in-depth exploration of how digital payments counteract the negative repercussions of the Covid-19 pandemic in 12 African countries.

II. Adoption of digital payments

Digital payments adoption depends on the stakeholder. For consumers, it involves the downloading of a mobile banking app, the linking of a savings account to a fast payment system such as Pix in Brazil or e-wallet in India, the opening of a mobile money account, or the acquisition of a debit or credit card. For businesses, adoption refers to accepting cashless payments through point-of-sale machines or QR codes, including mobile money merchant accounts to facilitate retail payments. For governments, DP adoption relates to accepting the cashless payment of

⁴ Given the companion article in this issue by [Burlando, Kuhn, and Prina \(2023\)](#) on digital credit, we focus this article on digital payments and not on broader digital financial services such as digital credit.

⁵ Point-of-sale (POS) devices are card-reading machines where customers can swipe, insert, or tap their credit or debit cards to make a payment. A QR (quick response) code is a barcode that can be scanned using a smartphone. A merchant can display a QR code that represents their payment details, and customers can scan this code using their smartphone to initiate and complete a payment. This method eliminates the need for physical cards or cash, making the transaction process faster and more convenient. Following the Transaction Cost Index (2023), to be described in greater detail below, our definition of mobile money expands on the IMF definition to include bank-led DP providers. It is defined as a pay-as-you-go digital medium of exchange and store of value that uses mobile money accounts and is facilitated by a network of mobile money agents. The service does not require a bank account and only requires a basic mobile phone. Modern POS devices could be programmed to directly accept mobile money payments, beyond traditional credit or debit cards.

⁶ World Bank's Global Findex Database shows that in low-income countries, mobile money account ownership (defined as personally using a mobile money service to make payments, buy things, or to send or receive money in the past year) increased from 20 per cent in 2014 to 27 per cent in 2021.

Table 1: Constraints affecting DP adoption and usage: a review of key studies, their geographical focus, and the relevance of trust as a cross-cutting factor

	Constraint	Geographical focus and study	Trust
Adoption	Cash availability	– India (Chodorow-Reich et al., 2020)	×
		– Brazil (Mariani et al., 2023)	×
		– Mexico (Alvarez and Argente, 2020)	×
	Coordination failure	– Costa Rica (Alvarez et al., 2023)	×
		– India (Crouzet et al., forthcoming)	×
		– Mexico (Higgins, 2022)	×
	Network interoperability	– Theory (Bianchi et al., 2023)	×
		– 42 African countries (Brunnermeier et al., 2023)	×
	Social capital	– Italy (Guiso et al., 2004)	✓
		– Mexico (Gertler et al., 2023)	✓
Usage	Supply-side constraints	– 16 countries across Sub-Saharan Africa and Asia (TCI, 2023)	✓
		– Low and middle-income countries (ReFind Research Initiative, 2022)	✓
	Quality of services	– Bangladesh, Uganda, and Philippines (Wright, 2015)	✓
		– Bangladesh, Uganda, and Tanzania (TCI, 2023)	×
		– Turkey (Alan et al., 2018)	✓
		– Indonesia (Deserranno et al., 2023)	✓
	Monetary costs and frauds	– Ghana and Tanzania (GSMA, 2020b)	×
		– Bangladesh, Uganda, and Tanzania (TCI, 2023)	✓
		– Ghana (Annan, forthcoming)	✓
	Non-monetary costs	– Mexico (Bachas et al., 2018)	×
		– Senegal (Giné et al., forthcoming)	×
	Privacy	– Senegal (Giné et al., forthcoming)	✓
		– Low- and middle-income countries (Blumenstock and Kohli, 2023)	✓
	Homophily	– Democratic Republic of Congo (Chamboko et al., 2021)	✓

taxes and other government services as well as cashless transfer payments linked to social protection programmes that were previously made in cash.

This section draws on recent studies to describe different factors that constrain adoption. These include the ease with which cash is available, the potential for coordination failure in the presence of network externalities, the role of social capital, and supply-side constraints such as entry capital requirements to become an agent and low density in remote communities. By understanding the constraints that limit DP adoption, we can identify strategies and interventions that can help overcome these barriers and accelerate the uptake of DP.

(i) Cash availability

Since digital payments are a substitute for cash, in settings where cash is easily accessible, the adoption of DP tends to slow down. [Chodorow-Reich et al. \(2020\)](#) study India's demonetization in 2016. On 8 November 2016, the Indian government announced unexpectedly that the two notes with the largest denominations (accounting for 86 per cent of cash in circulation) were voided with immediate effect. The study documents how shortage of cash led to a doubling of e-wallet transactions, and a six-fold increase in POS transactions in the 3 months following the demonetization.^{7,8}

Similarly, [Mariani et al. \(2023\)](#) find that the presence of physical bank branches slows down the diffusion of Pix, the instant payment technology in Brazil.⁹ The authors exploit the temporary shutdown of bank branches

⁷ [Crouzet et al. \(forthcoming\)](#) also document adoption of an alternative payment technology in response to India's demonetization. The ease with which individuals switch from cash to cashless payment technologies depends on the elasticity of substitution. Aiming to quantify the welfare effects of demonetization, [Chodorow-Reich et al. \(2020\)](#) assume a constant elasticity of substitution while [Crouzet et al. \(forthcoming\)](#) relax this assumption by endogenizing it.

⁸ The e-wallet provider offers a mobile service that facilitates transactions between individuals and businesses. For instance, after downloading the app and linking their bank account, customers can pay merchants via a unique QR code. Merchants receive payments in a mobile wallet, which can be transferred to their bank account. Notably, the company provides a toll-free number for payments, eliminating the need for a smartphone or internet.

⁹ Pix, launched in Brazil in 2020, is a 24/7 real-time online payment system allowing transfers from any bank account or payment institution account. Users can make transactions using email, ID, phone number, or QR code, eliminating the need for detailed bank account information.

due to hit-and-run raids by sophisticated, non-local criminal groups. To steal the cash inventory of a branch, the criminals detonate explosives, rendering the branch inoperable for several weeks. During this period, the costs of handling cash increase sharply as cash inventory drops significantly, reducing its appeal as a means of payment. [Mariani et al. \(2023\)](#) shows that the use of Pix increases, but deposits are not significantly affected. After a robbery the number and value of Pix transactions as well as the number of users (both consumers and businesses) increase. The authors also find important spillover effects to other municipalities not affected by the robberies and to other non-robbed banks in municipalities affected by these crimes.

Although the quasi-experimental setting in India and Brazil cannot be generalized to other countries, a negative relationship between cash availability and DP adoption is likely to emerge provided that a robust digital ecosystem exists to support DP adoption. This ecosystem becomes crucial where cash is unavailable, whether because of deliberate policy decisions, as in India, or unexpected circumstances, as in Brazil. Supporting this notion, the Consultative Group to Assist the Poor (CGAP)'s research has found that it is only in places where digital ecosystems are advanced enough that one sees a decline in the use of cash and in cash-in/cash-out (CICO) transactions more broadly. Many countries, including advanced economies with high levels of financial inclusion, are still growing CICO transactions or remaining steady. In the US, for example, during the Covid-19 pandemic the number of automated teller machine (ATM) transactions declined, but average withdrawals were significantly larger, suggesting that individuals were making fewer trips for larger values.

Indeed, policies that phase out cash must be carefully designed as they can have large, negative, and regressive impacts on consumers. [Alvarez and Argente \(2020\)](#) use data from three field experiments and estimate a structural model to assess the effects of banning cash to pay for Uber rides in Mexico. They show that riders who typically pay in cash (instead of a credit card) spend about 50 per cent less on trips compared to before the ban. In terms of distributional impact, their findings indicate that the burden of a cash ban is primarily borne by the least-advantaged households, who rely more heavily on cash and have limited access to other payment alternatives.

(ii) Coordination failures

Digital payments are an example of a two-sided market in which two groups interact with each other, each affecting the outcomes of the other. In this type of market, adoption decisions are complementary across groups, but can be subject to coordination failure ([Rysman, 2009](#)), even when strategic complementarities are present.¹⁰

[Alvarez et al. \(2023\)](#) develop a model that demonstrates how strategic complementarities can lead to suboptimal outcomes and multiple equilibrium paths in the adoption process, highlighting the importance of understanding the dynamics of adoption processes. They find that strategic complementarities in person-to-person (P2P) digital payments can lead to slow adoption rates, a form of coordination failure as individuals choose to wait for others to adopt before doing so themselves. Consistent with their model, the authors analyse transaction-level data on the use of an electronic P2P payment app developed by the Central Bank of Costa Rica.¹¹ They find that changes in the share of members in the network (i.e. neighbours or co-workers) that adopt the technology are associated with changes in the intensity with which users in that network use the app. They also find that early adopters of the app are more intense users, are more skilled, and earn higher wages compared to individuals that adopted later. These findings suggest that individuals are heterogeneous and that selection at entry can play a significant role in the adoption process.

[Crouzet et al. \(forthcoming\)](#) and [Higgins \(2022\)](#) offer additional support for the role of coordination failure in the adoption of digital payments. Complementing [Chodorow-Reich et al. \(2020\)](#) discussed earlier, [Crouzet et al. \(forthcoming\)](#) examine network externalities in the adoption of digital payments using India's demonetization, which induced an indirect positive demand shock for digital payments due to the decline in the supply of cash. The authors find that the large but temporary cash contraction led to a persistent increase in the rate of adoption of mobile-based payment wallets and suggest that complementarities account for almost half of the adoption.

Targeted policy interventions can be implemented to mitigate coordination failures and instead encourage early adopters to kickstart the adoption process. For instance, [Higgins \(2022\)](#) highlights the government's role in promoting digital payments adoption. He investigates the positive spillover effect of a large-scale government programme that distributed one million debit cards to poor households in Mexico—a direct positive DP demand shock—on both the demand and supply sides of the market. He finds that small retail firms on the

¹⁰ Strategic complementarities, sometimes referred to as positive network effects, occur when the benefits of adopting a technology increase as more people adopt it.

¹¹ The P2P payment app is a digital payment platform launched in 2015 that enables users to transfer money via mobile phones. To use the app, users need a bank account linked to their mobile number. Aimed at reducing cash usage, the app primarily targets small, fee-free transfers within a daily limit.

supply side adopted point-of-sale terminals to accept card payments, which in turn trigger a positive knock-on response in card adoption among consumers on the demand side that were not beneficiaries of the government programme.

(iii) Network interoperability

Lack of network interoperability, i.e. the inability to make a payment or transfer from one account to another if accounts are issued by different mobile money services or financial providers, can exacerbate coordination failures as individuals willing to transact with one another need to use the same provider. According to TCI (2023), consumers in nine of the 16 sample countries were unable to carry out off-network transactions, i.e. transfers where the providers of the sender and receiver are in different networks. Out of the 33 providers assessed, only 14 offered off-network P2P transfer services. Additionally, only six out of the 16 countries had mobile money providers that allowed the transfer of funds from a mobile money wallet to a bank account.

Drawing from the behavioural and industrial organization fields, [Bianchi *et al.* \(2023\)](#) provide a theoretical perspective on why interoperability might yield varied, and at times negative, effects depending on consumer types.¹² [Brunnermeier *et al.* \(2023\)](#) use a staggered difference-in-difference approach to assess the impact of interoperability, which arguably central banks introduced exogenously. Analysing 129 operators across 42 African countries from 2010 onward, they find that interoperability policies have a pro-competitive effect resulting in reduced ‘official’ fees by operators. However, this comes at a cost: the decrease in monopoly profits prompts operators to withdraw from less lucrative markets, typically rural and poorer districts. In general, however, interoperability may not be an important barrier to adoption of digital payments for two main reasons. First, in more monopolistic markets like Kenya and Ghana (with a dominant provider), the need to transact with different providers is lower and so is the need for interoperability. Second, absent interoperability, customers use workarounds such as SIM swapping/porting, multiple SIMs, and over the counter (OTC) transactions with agents that can transact with multiple services. In Pakistan, for example, while there is essentially a duopoly, more than 90 per cent of the agents can use both services.

(iv) Social capital

Social capital has traditionally played a role in financial development. While they are not strictly ‘digital’, [Guiso *et al.* \(2004\)](#) find that in areas of Italy with higher social capital, households were more likely to use cheques as a payment method and hold less cash as a share of wealth. The analysis of heterogeneity suggests that the findings are particularly pronounced in areas characterized by weak law enforcement and low education levels, which are defining features of many developing countries. Although trust evolves slowly, the results suggest that policy interventions that improve the regulatory framework and increase consumer education could be effective substitutes for social networks.

While [Guiso *et al.* \(2004\)](#) focus on generalized trust as a proxy for social capital, [Gertler *et al.* \(2023\)](#) examine actual trust in a FinTech provider in Mexico.¹³ The authors randomly offered firms using the FinTech’s payment service lower transaction fees for payments received from customers for 6 months and find that take-up of the offer was 25 per cent (relative to 0 per cent in the control group that did not receive the offer). Receiving a reminder about the offer increases take-up by 18 per cent and if the reminder was anticipated, take-up increased an additional 7 per cent. The study suggests that trust is the mechanism behind the additional effect of the anticipated reminder, as it built credibility and allayed suspicions about the offer’s credibility. Furthermore, the study finds that the treatment effect is stronger for firms with the lowest level of trust in the advertised offer, who also happened to have the least experience with the digital payment technology.

(v) Supply-side constraints

CICO transactions (i.e. deposits and withdrawals) are made using a network of agents (i.e. human ATMs). Agents are trusted local retailers that double as lower-cost alternatives to financial providers. Because of the convenience associated with their closer proximity to typically underserved market segments (both physical and social), agents

¹² [Bianchi *et al.* \(2023\)](#) employ a terminology that differs from ours. They label what we refer to as ‘network interoperability’, as ‘platform interoperability’. In their definition, ‘network interoperability’ refers to the capability of clients from one mobile service operator to access payment services offered by another mobile service operator.

¹³ The FinTech company offers a POS device and an accompanying app for accepting debit and credit card payments. After registration and bank account linkage, merchants can process electronic payments. The company charges a merchant fee, as a percentage of each transaction, regardless of the card network. Compared to bank-issued POS devices, the FinTech’s POS device is more affordable and has no monthly fee. However, they charge a higher percentage as a transaction fee for each payment.

may find it easier to reach poorer customers living further from bank branches, and thus can deepen financial inclusion more cost-effectively than the traditional banking model. According to the 2021 Global Findex Database, however, 27 per cent of respondents in low-income countries claim they do not have a mobile money account due to the absence of nearby mobile money agents. Two key factors contribute to lack of agents: documentation and clearance procedures (ReFinD Research Initiative, 2022) and high start-up capital requirements. In Ghana, for example, agents need at least 4,000 GHS (approximately \$700) to start their retail operations. Since illiteracy is prevalent among potential customers in low-income countries, lack of agents results in low adoption as illiterate customers rely on agents for transactions and a broader set of digital financial products. According to TCI (2023), one-third of consumers are unable to independently execute transfers and must rely on agents for assistance. Consequently, the growth of retail agent networks and digital payments tend to go hand-in-hand. As the number of customers expands, agents assume additional responsibilities beyond CICO transactions, assisting customers with other transactions, including over-the-counter (OTC) payments like bill payments, P2P off-network transactions, and airtime top-ups.

We note that different digital payment services require varying levels of consumer experience or trust, with consumers typically beginning with simpler and more intuitive services such as CICO. Policy-makers in countries like Rwanda, Armenia, and Jordan have attempted policies that downplay the development of CICO agent networks, aiming to ‘leapfrog’ into more advanced services that eliminate the need for cash. These attempts, however, have unintentionally backfired and impeded adoption, as the crucial ‘on-ramps’ to more advanced services are absent.

III. Usage of digital payments

One limitation of focusing solely on adoption without considering usage to proxy for financial inclusion is the potential for dormant accounts—accounts that have been opened but never used. Karlan *et al.* (2014) analyse several studies on saving products and services and find that the treatment effect on usage rates is often less than half that of take-up, consistent with a large number of accounts with little or no usage. Furthermore, they report that even initial users tend to become inactive after about 6 months. In the context of mobile money, GSMA’s 2023 report reveals that the growth rate for both registered and active accounts (in the past 90 days) was 13 per cent in 2022. The number of active accounts at 586 million, however, accounts for only 36 per cent of the 1.6 billion registered accounts. Conversely, the number of active agents was 7.2 million, which represents just 41 per cent of the 17.4 million registered agents. To get a more comprehensive picture of access to digital payments, in this subsection we examine the level of usage, conditional on adoption.

Recent literature suggests that repeated use of digital payments builds experience over time which in turn can lead to better-informed customers. Breza *et al.* (2020) document that individuals with more experience rely less on agents and are charged lower transaction fees. The authors conducted a field experiment in Bangladesh that introduced payroll accounts to unbanked factory workers, with one group receiving monthly wage payments into a bank or mobile money account, and a control group continuing to receive cash wages. They show that exposure to payroll accounts increased account use, consumer learning, and reduced illicit fees. The study uses data-driven machine-learning methods to examine the heterogeneous treatment effects on increased consumer knowledge. It finds that the benefits of learning-by-doing are greater for individuals with prior financial access and higher education levels. This implies that alternative interventions are needed to support disadvantaged users. In line with the market’s two-sided nature, the treatment has market-level externality on the supply side: an additional audit study finds that mobile money agents were less likely to overcharge inexperienced customers in areas with higher levels of payroll account adoption, suggesting important equilibrium effects at scale. Giné and Goldberg (2022) provide another example of experience leading to better financial decisions. The study examines the cost–benefit analysis performed by users when deciding whether to switch from their current higher-fee account to a new lower-fee account offered by the same bank. Exogenous variation in the frequency of past transactions, due to a randomized intervention, causally increases the likelihood of subjects making the switch. This was attributed to increased trust in the bank and knowledge of the features of the account. However, randomly sponsoring the cost of visiting the bank branch for a subset of participants did not affect their switching decision. These papers share a common finding: more-experienced consumers are better informed and are charged lower fees, highlighting the importance of encouraging usage and building experience.

There are, however, a variety of factors that affect the use of digital payments and the accumulation of experience. In this section we focus on the quality of service, monetary and non-monetary costs, privacy concerns, and homophily between agents and consumers.

(i) Quality of service

Usage can be affected by the quality of service offered. Citing survey data from Bangladesh, Uganda, and the Philippines, [Wright \(2015\)](#) highlights three key consumer service issues: downtime, illiquidity, and lack of transparency.

Service downtime is commonplace and typically caused by poor cell phone coverage. A related problem is that of agents not being present during business hours. According to TCI (2023), mobile money agents in Uganda, Bangladesh, and Tanzania were present in 83 per cent of the visits. This figure, however, masks a significant urban–rural divide, with urban agents significantly more likely to be present than their rural counterparts: 7 percentage points more likely in Bangladesh, 15 percentage points in Tanzania, and 12 percentage points in Uganda. When downtime happens (or the agent is not present), transactions cannot be completed, not only disrupting customers who are unable to access their funds but also eroding trust in the system. In addition, downtime can result in customers leaving their money with agents to complete the transaction when the system is back online, further creating opportunities for fraud.

Provided that an agent is available, about 86 per cent of transactions in the TCI (2023) sample are carried out successfully. Agents report liquidity constraints as the main reason for incomplete transactions, leading to increased transaction fees and extended transaction times.¹⁴

Finally, price transparency can also affect trust and use of digital payments. Consumer intercept and mystery shopping data from TCI (2023) reveal two key factors related to pricing transparency and suggest significant room for improvement. First, although regulations in all three countries mandate that agents display their official fees, compliance differs notably across these countries: 99 per cent of agents in Bangladesh display the official price list, compared to 82 per cent in Tanzania and 59 per cent in Uganda. Second, agents typically do not inform customers of the transaction fee verbally, with only 4 per cent doing so in Bangladesh, 7 per cent in Tanzania, and 12 per cent in Uganda. [Alan et al. \(2018\)](#) underscore the significance of price transparency in a study that experimentally examines the usage of an expensive add-on overdraft credit (60 per cent APR) associated with a free checking account in Turkey. The authors find that a substantial discount on overdraft fees paradoxically reduced overdraft usage, whereas messages highlighting the availability of overdraft without mentioning the price led to an increase in usage. This suggests that explicitly stating prices can remind customers about the high cost of overdrafts, consistent with behavioural models that posit that consumers often underestimate and neglect overdraft costs. Transparency interventions, however, can backfire if they are not well designed. [Deserranno et al. \(2023\)](#) demonstrate that offering bank retail agents in Indonesia higher commissions for acquiring new customers is only effective when the incentive payments are unknown to prospective clients. When these incentives are disclosed to the public, they have no effect on take-up, despite greater agent effort.

(ii) Monetary costs and frauds

Usage is highly sensitive to prices. Evidence from Ghana and Tanzania shows that the introduction of digital taxes led to a significant 40 per cent decline in mobile money usage ([GSMA, 2020b](#)). Given this high demand elasticity, it is essential to understand the actual prices that consumers pay, which may differ from the official prices set by financial institutions.

The lack of transparency in digital payments mentioned before can also lead agents to overcharge customers when official fees are not properly displayed. In the TCI sample, 15 per cent of successful transactions reportedly involved overcharging, with cash-out transactions being more susceptible to overcharging than cash-in transactions. Among the countries studied, shopper visits to Uganda had the highest rate of overcharging, more than 10 percentage points higher than Bangladesh and Tanzania. On average, the amount overcharged, calculated as a percentage of the transaction value, stood at 5 per cent. The fact that users are often poorly informed exacerbates agent exploitation. In Ghana, for example, while agents are fully aware of prices, 60 per cent of consumers do not know the official prices. This lack of knowledge can lead to widespread distrust in agents and underuse of digital payments due to fear of exploitation.

Focusing on rural Ghana, [Annan \(forthcoming\)](#) examines the impact on digital financial services of consumer exploitation by retail agents in delivering mobile money services. The study finds that most retail agents overcharge for services, with approximately 20 per cent of transactions incurring unexpected fees. He designs a market-level intervention that reduces illegal overcharging by exogenously informing both users and retail agents about official prices and how to report illegal overpricing behaviour. The intervention reduced overpricing by 40–70 per cent,

¹⁴ Contrary to expectations, urban agents are more likely than rural agents to attribute transaction failures to liquidity issues: 37 per cent of urban agents cited this as a reason for failure, as opposed to 24 per cent of rural agents.

increased the usage of services by 40 per cent, and increased profits for retailers who set prices to the *ex ante* official lower prices. The study also found massive spillovers, such as decreases in overpricing by untreated agents in treated local markets, increases in other non-mobile money services offered at retail outlets, and astounding benefits to consumer welfare, including increased usage of digital finance and non-digital finance and shock mitigation. Overall, the study shows that retail agent misconduct is welfare-reducing.

(iii) Non-monetary costs

Digital financial services (including digital payments) can be accessed from anywhere, anytime using a mobile phone, or by visiting a vast network of agents, usually small-scale merchants, such as convenience stores, gas stations, and supermarkets. In this sense, they have a significant edge over traditional branch banking. While agents do not provide the full range of services that traditional branches offer, the services they do offer are adequate for most consumer needs. Furthermore, they are often more accessible to consumers geographically and can cater to untapped market segments that are not large enough to support a fully-fledged traditional branch.

[Bachas et al. \(2018\)](#) find that for beneficiaries of Mexico's Oportunidades cash transfer programme, using debit cards significantly reduces the median road distance needed to access savings and transfers from 4.8 to 1.3 kilometres, as they could use any bank's ATM and make purchases at point-of-sale terminals. As a result, beneficiaries were less likely to have to sacrifice important activities such as childcare and work to withdraw their transfer. Furthermore, account holders who were closer to an ATM experienced a greater increase in both the number of withdrawals and savings balances.

[Giné et al. \(forthcoming\)](#) conducted a randomized controlled trial in Senegal to compare the benefits of agent banking and branch banking beyond physical proximity. Participants were given information about a savings account at the same financial institution, with half being encouraged to open the account at the nearest agent and the other half encouraged to do so at the nearest branch. The study finds that agent banking reduced transaction costs for consumers, not only by being physically closer, but also by reducing the time required for visits due to shorter waiting times. Compared to subjects sent to branches, those sent to agents also made a greater number of overall deposits and withdrawals. These findings suggest that agent banking could be a valuable option for delivering financial services, even in areas with convenient physical access to traditional banking branches.

(iv) Privacy

[Giné et al. \(forthcoming\)](#) also address the issue of privacy concerns associated with agent banking, which may explain why branch banking continues to be used despite higher transaction costs. Through focus groups with long-time account holders of the financial institution who did not participate in the study, the study documents that clients were concerned about making large transactions with an agent due to a lack of privacy, since the transaction occurs in the presence of other customers who may be part of their social network. Clients may worry that at an agent, information about the transaction could reach their family and friends, leading to pressure to share their cash holdings. In contrast, transactions at branches are confidential and only witnessed by the teller and the client.

While [Giné et al. \(forthcoming\)](#) focus on privacy concerns between consumers and members of their network, a broader privacy issue involves the relationship between consumers and providers. In the context of the US, [Bian et al. \(2023\)](#) use a difference-in-difference approach to evaluate the effects of Apple's App Tracking Transparency policy, which limits user tracking across iOS apps. Their findings suggest that this policy reduces financial fraud complaints associated with data security and privacy. While we speculate that data security concerns are equally relevant in low-income countries, we observe that research in this area has not kept pace with public interest. In the white paper by [Blumenstock and Kohli \(2023\)](#), the authors argue that big data innovations that exploit new data sources such as mobile phone calling data and social media data to create alternative credit scores, has allowed loans to be granted to hundreds of millions of people previously excluded from traditional banking services. However, overlooking data privacy may destabilize FinTech and financial services industries in emerging markets, impeding innovation. Therefore, the white paper advocates for a coordinated research agenda to gain a deeper understanding of big data privacy challenges, in order to promote a more responsible and customer-focused approach to big data innovation within financial services.

(v) Homophily

Using data from FINCA DRC, one of the largest microfinance institutions in the Democratic Republic of Congo, [Chamboko et al. \(2021\)](#) find that customers are more likely to transact with agents of their own gender. Women, in particular, are significantly more likely to transact with female agents. This preference for gender homophily could explain the gender gap in financial access and utilization among women since they are underrepresented in

the agent network. The study suggests that trust plays a role in gender assortative matching, with women seeking out agents they trust not to disclose their financial information to others. The findings suggest that increasing the representation of female agents could improve financial access and utilization for women, which could be achieved by recruiting more female agents and providing training and support to existing female agents.

IV. Future direction

Despite the significant progress and positive impacts of digital payments, several areas require further research and attention to unlock their full potential.

1. While drivers of digital payments—prices, quality, transparency, experience, consumer trust, among others—depend on the underlying market structure, how market structure affects the use of digital payments remains an open question (Annan, 2023). The evolving landscape of digital payments presents an opportunity to examine market structure and its impact on consumer demand and trust. Previous studies have examined the impact of changes in the demand side, such as debit card adoption resulting from government welfare programmes (Higgins, 2022) and the effects of India's demonetization (Crouzet *et al.*, forthcoming). However, there is a dearth of evidence on the supply side. While the entry of new digital financial service agents can have a substantial influence on market competition, the process of market reorganization in response to entry is still poorly understood. To shed light on this topic, several key questions should be addressed. First, what dimensions, both in terms of price and non-price factors (such as agent availability, quality, or transparency), do mobile money agents compete on? Second, what are the overall impacts of competition on incumbents and other market players? Third, can retail payments unlock the potential of neighbouring small business retailers by incorporating digital payments as an additional line of business? Finally, how and when does increased competition affect consumer demand and trust in digital payments? Answers to these crucial questions can enhance our understanding of market structure in digital payments and its implications.

Another aspect that merits attention in market structure research is the identification of form and structure of adoption externalities, particularly horizontal and vertical externalities. For instance, the general equilibrium effects of digitizing business payments along the supply chain (vertical externalities) and its impact on neighbouring businesses (horizontal externalities) have been relatively understudied. Exploring these externalities can provide valuable insights into the broader effects of digital payments adoption and shed light on potential spillover impacts across different sectors and market participants.

2. To better understand the quality of digital payments, it is necessary to measure 'hard to observe' outcomes beyond those provided by administrative data or standard survey questions. This can be achieved through innovative measures such as audit studies and consumer intercept surveys, as highlighted in TCI (2023), including other forensic measurements. Social media and machine-learning-based methods offer an alternative data source. With increasing number of consumers sharing their experiences and raising concerns on social media platforms, these platforms become valuable sources of data regarding consumer complaints and the responsiveness of digital payments providers. IPA Consumer Protection (2021) exemplifies this approach by investigating consumer-protection-related content on platforms such as Twitter, Facebook Public Pages, and Google Play Store Reviews in Kenya, Nigeria, and Uganda. The study successfully identifies transaction errors as the most commonly reported operational failures and highlights long waiting times and lack of responsiveness in customer care as frequent complaints. This methodology demonstrates the potential of using social media data to monitor consumer protection and obtain actionable information for improving digital payments. Leveraging such data sources can stimulate research that evaluates programmes promoting transparency, accountability, and reputation-building mechanisms.
3. With the focus of research primarily on P2P transactions as the most prevalent digital payments, it is essential to broaden the scope to encompass transactions between different actors, such as governments and businesses, and examine both the determinants and impacts of these transactions. One area of investigation is the impact of consumer experience on their willingness to engage in different transaction types, such as person-to-business (P2B) and person-to-government (P2G). As the market matures and consumers gain trust, they may become more receptive to maintaining savings balances (Breza *et al.*, 2020; Giné and Goldberg, 2022). The World Bank's Global Findex Database also reports that savings into mobile money accounts are becoming the most common method in Sub-Saharan Africa. Increased savings can facilitate the adoption of these less-used services and the design of more tailored financial products. Understanding the spillover effects from

accumulated consumer experience into new transaction types and financial products is an important avenue for future research. This has broader implications on how to improve consumer decision-making, including how to educate or inform consumers about their own behaviour.

Regarding government-to-person (G2P) transactions, the introduction of secure payment infrastructure has shown promising results. For instance, [Muralidharan et al. \(2016\)](#) study the implementation of biometric Smartcards in employment and pension programmes in India and find that the enhanced payment system significantly improves the efficiency, predictability, and integrity of the pay-outs. In the context of government-to-business (G2B) transactions, state and local governments often outsource development projects to small and medium enterprises (SMEs). The integration of digital financial technology can streamline bureaucratic decision-making processes, leading to improved government capacity and reduced frictions in project processing and payments to SMEs ([Annan and Gupta, 2022](#)). These advancements might have significant implications for increasing firm productivity and improving project outcomes, by ensuring timely processing and payments for projects to SMEs. These underscore the significance of studying various types of digital transactions beyond P2P interactions, as they have the potential to yield positive outcomes and further research is needed to explore their full impact.

4. Despite the existing evidence suggesting positive impacts of digital payments, there is a pressing need for more rigorous cost-and-benefit analyses, given the significant investment in promoting these services. To accurately quantify the welfare benefits associated with digital payments, researchers must adopt a structural approach. A critical component of such analyses is the estimation of elasticities, which capture the sensitivity of relying on digital payments when payment prices change—an essential parameter currently lacking in the literature. Although not directly addressing this demand elasticity, the study described above by [Alvarez and Argente \(2020\)](#) on the substitution between cash and non-cash payment modes following Uber's cash ban in Mexico exemplifies how elasticities related to digital payments can be estimated. Moving forward, more research employing such a structural approach is essential to enhance our understanding of the welfare implications of digital payments and inform evidence-based policy-making in this important domain.

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