

WORKING PAPERS

N° 15

2024

“Designing Interoperable Platforms and Welfare Effects”

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AUGUST 2024

DESIGNING INTEROPERABLE PLATFORMS AND WELFARE EFFECTS

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August 24, 2024

Abstract

Digital financial services (DFS), particularly mobile money, have been instrumental in reducing poverty and improving welfare. The implementation of interoperability, which enables transactions between different networks, has been a significant innovation in the DFS market. Our study will analyze the effects of interoperability using transaction data collected in collaboration with the Central Bank of Ghana from January 2017 to date, encompassing various mobile money providers and financial institutions. We aim to examine the impact of different commercial pricing models (such as sender-pay versus recipient-pay) on (1) market concentration and (2) DFS prices. Second, we will investigate the implications of strategic responses by established players and new entrants such as G-Money and the merger effects of Tigo and Airtel. Our results seek to build evidence for what works and explore how the Central Bank can use this to develop workable regulations in the DFS marketplace.

Keywords: Mobile Money Interoperability, Commercial Pricing Models, Merger, Competition

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INTRODUCTION

Markets for digital financial services (DFS)—particularly mobile money—reduce poverty and improve welfare (Annan, 2022; Bill & Melinda Gates Foundation, 2021; Suri & Jack, 2016). Several digitization and interoperability initiatives are transforming the DFS marketplace. Interoperability is a major innovation in digital finance and payment markets that enables users to conduct off-platform transactions. The Central Bank launched its first interoperability program in Ghana on May 10, 2018. This important interoperable policy experiment in sub-Saharan Africa introduces unique possibilities for learning about interoperability in payment markets as a first-order policy issue.

Despite its importance, very little is known about the potential effects of interoperability in mobile money markets for competition and welfare. This is interesting for at least two reasons. First, platform interoperability has the potential to incentivize commercial providers to endogenously change their pricing models (including their infrastructure and coverage). Second, the effect of interoperability on market concentration and prices is theoretically ambiguous. Interoperability may reduce or increase market concentration, depending on the transaction pattern within and across provider networks. The transaction pattern depends not only on consumer demographics (gender, income, location) for the different providers but is also affected by prices set for within- and across-network transactions.

With this in mind, we aim to address the following policy and academically relevant questions in Ghana—an environment in which cashless payments and digital banking are important subjects in the financial access and banking discourse:

- 1) Is interoperability *competition-proof*?
- 2) What are the effects, if any, of interoperability on market concentration, welfare, and prices?
- 3) Do different commercial pricing models for interoperability (e.g., sender-pay versus recipient-pay versus decreased fees to match Peer-to-peer (P2P) fees) matter, and if so, how?

We plan to partner with Ghana's Central Bank to assemble *firm-level* monthly transaction data from before and after the 2018 interoperability policy, ideally from January 2017 to present. Firms will cover all specific providers or electronic money issuers (EMIs) (e.g., MTN Mobile Money, AirtelTigo, VodaCash, and G-Money), commercial banks, and financial institutions that

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directly report monthly data to the Bank of Ghana (via Ghana Interbank Payment and Settlement Systems [GhIPSS]). This will provide high-frequency industry data across all relevant specific firms to carefully explore the impacts of the May 2018 interoperability policy and changes in its commercial pricing models on market concentration and DFS prices. We will explore the effects of G-Money entering the DF market in January 2020 and examine the merger effects of Tigo and Airtel. From a policy standpoint, our goal is to build evidence on what works and explore how the Central Bank can use this to develop workable regulations in the DFS marketplace.

INTEROPERABILITY AND PRICING MODELS ACROSS SUB-SAHARAN AFRICA

Is interoperability *competition-proof*? Whether interoperability can withstand (i.e., competition-proof) or succumb to competitive pressure is ambiguous. When interoperability withstands competitive pressure, there is no change in market concentration and prices. In such instances, consumers do not exhibit multi-sim behavior (i.e., there is no need for them to own multiple sims) because certain service aspects are standardized, which potentially diminishes the importance of competition around previous differentiators, such as transaction ease and reach. In addition, it reduces the exposure of consumers to alternative providers because transactions are processed in a similar manner with similar fees, and consumers may be less aware of which provider offers potentially better service or value. This promotes either customer loyalty or inertia, with loyalty being defined as a customer's ongoing commitment to a brand due to positive experiences and perceived value and inertia referring to a customer's continuation with a service or product out of habit or convenience rather than satisfaction.

On the other hand, interoperability among mobile network providers can result in competitive pressure by incentivizing commercial providers to endogenously change their pricing models, providing customers with the option to select a provider based on unique services or products. It also facilitates easier switching between services without any penalties or inconvenience for the customers. This also means that interoperability lowers the barriers to entry for new players, intensifying competition. New entrants can plug into an existing interoperable framework without needing to build a large proprietary network of their own. This can increase the number of players and force all providers to compete more aggressively on price, quality, and innovation. The question of whether interoperability is competition-proof remains uncertain, as evidenced by mobile network operators like Vodacom and MTN Ghana, which have maintained their market shares in Tanzania and Ghana, respectively, after adopting interoperability GSMA (2020). This observation underscores the relevance of our research question and motivates our second question: *What are the effects, if any, of interoperability on market concentration, welfare, and prices?*

To further understand the effects of interoperability, it is important to note that it has five components: (1) connection, (2) settlement, (3) governance, (4) pricing and business model, and (5) dispute resolution system (GSMA, 2020; GSMA, 2024). According to the GSMA (2020b) report, connection refers to the mechanism allowing different providers to interconnect,

exchange information, and initiate and receive transactions. This can be bilateral, where each provider has a dedicated connection, or through a hub that connects providers. It is worth mentioning that some countries have transitioned from bilateral agreements to national switches. Tanzania, for example, initially had bilateral interoperability and eventually transitioned to a national switch (GSMA, 2024). Sometimes, interoperability is in the form of a third party that has already integrated with the market players. In such cases, the mobile money provider has less control over it (GSMA, 2020). This form of interoperability was seen in Ghana from 2016 to 2017 when mobile money network providers were only able to connect with each other through third-party aggregators, such as IT Consortium and Nsano. This changed in 2018 when they officially launched mobile money interoperability.

Settlement, the process enabling the flow of real money between participants, can occur through pre-funding-based models where transactions are only allowed after sufficient funds are deposited or clearing-based models where transactions are permitted before funds are received, which is secured by a reliable third party like a bank or central bank (GSMA, 2020). Pricing and business models play crucial roles in ensuring the profitability and sustainability of interoperability solutions. The model typically includes processing fees charged for each transaction by the central entity managing the interoperable transactions, interchange fees (i.e., fees paid between participants; either the sender or receiver, as agreed), and client surcharges that are applied when transactions across different networks incur higher fees for end-users than those within the same network.

Governance of interoperability can be either full or partial for the mobile money service provider. The government of Ghana, for instance, has full control because it owns the national switch and requires mobile money service providers to connect to the hub to enable interoperability.

The dispute resolution system boosts consumer confidence in sending money across the network by providing a reliable channel for addressing their complaints (GSMA, 2020). In this study, our focus is on the pricing model, specifically on the impacts of the interchange fees that participants pay. The interchange is essentially a payment made between providers to help balance out the economic discrepancies during interoperable transactions (Niehaus & Cook, 2018).

Interchange fees can include (1) no fee charged to either the sender or receiver in a transaction (i.e., a no-interchange model), (2) the receiver paying the interparty fee, and (3) the sender paying an interparty fee.

In the no-interchange model, no fees are exchanged between the mobile money providers involved in a transaction. This model often leads to the service provider charging end-users higher fees to compensate for the lack of revenue sharing between institutions through off-net surcharges (Niehaus & Cook, 2018).

In the sender-pays model, the mobile money provider (MMP) initiating the transaction bears the transaction costs, often passed on to the sender by their mobile money service provider to recover the cost of using another party's infrastructure (Niehaus & Cook, 2018). This model can discourage senders from initiating transactions, especially if the fees are high, as it makes sending money more expensive.

In the receiver-pays model, the receiving MMP compensates the sending provider for liquidities leaving its network (GSMA, 2020c). These fees cover the expenses of bringing the funds to the network and the operational costs of the sender's side of the business (Niehaus & Cook, 2018). While this model can encourage sending transactions (since senders do not bear the costs), it may discourage receivers, particularly merchants, from accepting certain forms of payment due to the fees, which can reduce their net revenue from sales. Ghana has adopted the receiver-pay model to allow for comparable prices of on-network (P2P transfer) and off-network person-to-person transactions.

Recently (post-2018), all mobile money services have been integrated into cross-domain Instant Payment Systems (IPS)³. Cross-domain IPS allows all-to-all interoperability, including banks and non-banks, where switching, clearing, and instrument exchanges are contained within one overarching system (SIIPS, 2023). Table 1 below displays various African countries and their details regarding mobile money interoperability.

³ The total number of mobile money IPS is seven (SIIPS, 2023). Instant payments are transactions where the payment message and final fund availability to the payee happen almost instantly with continuous availability (24/7/365) (Cook et al., 2018).

Table 1: African countries with their details on mobile money interoperability.

No.	Country	Launch date	Connection	Interchange/ Interparty model	MNO/Bank-led	Source
1	Uganda	2018	Aggregator and bilateral	Receiver MMP pays	MNO-led	Cook (2018); GSMA (2020c)
2	Ghana	2018	National switch (GhIPSS Instant Payment)	Receiver MMP pays	MNO-led	GSMA (2020c); GSMA (2024)
3	Tanzania	2014	Bilateral agreements	Receiver MMP pays	MNO-led	GSMA (2020c)
4	Chad	2020	BEAC and commercial banks	N/A	Bank-led	AfricaNenda ⁴
5	Cameroon	2020	BEAC and commercial banks	N/A	Bank-led	AfricaNenda
6	Central African Republic	2020	BEAC and commercial banks	N/A	Bank-led	AfricaNenda
7	Equatorial Guinea	2020	BEAC and commercial banks	N/A	Bank-led	AfricaNenda
8	Gabon	2020	BEAC and commercial banks	N/A	Bank-led	AfricaNenda
9	Republic of Congo	2020	BEAC and commercial banks	N/A	Bank-led	AfricaNenda
10	Egypt	2017	Egyptian Banks Company	N/A	Bank-led	AfricaNenda
11	Kenya	2018	Bilateral agreements	No interparty fee	MNO-led	Cook (2018)
12	Malawi	2020	National Switch (NatSwitch)	N/A	Bank-led	GSMA (2024)
13	Morocco	2018	Bank Al-Maghrib	N/A	Bank-led	AfricaNenda Brunnermeier et al. (2023)
14	Nigeria	2013	Central Bank of Nigeria and Nigerian Communications Commission	N/A	Bank-led	AfricaNenda
15	Zambia	2019	Zambia Electronic Clearing House Limited	N/A	Bank-led	AfricaNenda
16	Madagascar	2016	Bilateral agreements	No interchange fee	MNO-led	AfricaNenda
17	Rwanda	2022	National switch (eKash)	N/A	Bank-led	AfricaNenda

Notes: Bank of Central African States (BEAC); N/A means interoperability interchange model not used; MMP stands for mobile money provider

⁴ All AfricaNenda information are retrieved from <https://www.africanenda.org/en/map>

GHANA EXPERIMENT

Mobile money interoperability in Ghana was officially launched on May 10, 2018, by the GhIPSS, a subsidiary of the Central Bank of Ghana. From 2016 to 2017, mobile network providers were only able to connect with each other through third-party aggregators such as IT Consortium and Nsano (this changed in 2018). However, with the introduction of interoperability, these services were consolidated under the GhIPSS platform. The push for interoperability was strongly supported by specific regulatory frameworks, as noted in the GSMA 2020 report, which indicated that legislation played a crucial role in promoting this integration.

Moreover, preceding laws, such as the 2008 Branchless Banking Guidelines and the 2015 Guidelines for Electronic Money Issuers, laid a strong foundation for interoperability. While the former law mandated mobile network providers to connect with at least three banks and share agents, the latter outlined the operational rules for e-money issuers using retail agents as alternative delivery channels outside traditional bank settings.

Since its inception, mobile money interoperability has significantly boosted financial transactions in Ghana. In the first six months post-launch, the volume of transactions soared, reflecting an approximately 85-fold increase in value, from 96,907 to 8.31 million Ghanaian cedis (Bank of Ghana, 2018). This upward trend continued, with a 400% increase in interoperable transactions recorded between 2019 and 2020, growing from 2.5 million to 13.6 million transactions⁵.

⁵ <https://www.adfi.org/news/ghana-mobile-money-interoperability-transactions-rise-400-six-months>, accessed August 9, 2023.

REDUCED FORM AND POLICY COUNTERFACTUALS

We will start by discussing the nature of the data we are collecting, which will inform us of the possibility of developing reduced form estimates and running policy counterfactuals. We plan to partner with Ghana's Central Bank to gather detailed, firm-level transaction data both before and after the implementation of the 2018 interoperability policy, spanning from January 2017 to the present. This data collection will encompass all specific providers and EMIs, such as MTN Mobile Money, AirtelTigo, VodaCash, and G-Money, as well as commercial banks and financial institutions that report monthly data to the Bank of Ghana through its subsidiary, GhIPSS. Our objective is to acquire high-frequency industry data from all relevant firms to thoroughly analyze the impacts of the May 2018 interoperability policy and the changes in its *commercial pricing models* on market concentration and DFS pricing.

During our conversations with the Central Bank, we gained insights into the available data. The data will include transaction volumes, values, and fees (processing fees, interchange fees, and consumer surcharges) across different payment platforms owned by GhIPSS (i.e., gh-link, e-zwich, GhIPSS Instant Payment, and Mobile Money Interoperability System). We will also track the initiator and type of each transaction, distinguishing between business (Business-to-Business, Business-to-Consumer, Business-to-Government) and consumer (Consumer-to-Business, Consumer-to-Consumer, Consumer-to-Government) transactions, along with the adoption of related DFS, such as digital loans.

Since the introduction of interoperability, there have been two pricing models. The first model, implemented in 2018, had higher fees for interoperable transactions compared to in-network P2P transactions. This was due to additional fees charged to the sender for out-of-network transactions and was later changed to a recipient-pay model, aligning the cost with in-network P2P transactions. Due to this change, we can measure consumer welfare via consumer surplus because we observe the difference between prices that consumers were willing to pay (when they perhaps faced higher fees for cross-network transactions) before interoperability and what they actually paid after interoperability was introduced. We will also consider the implications of fee waivers provided by mobile money operators like Vodafone Ghana⁶, which

⁶ <https://www.myjoyonline.com/vodafone-waives-charges-money-transfers-to-all-networks-from-vodafone-cash/>, accessed August 1, 2024.

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waived transfer charges across networks during the COVID-19 pandemic, and MTN Ghana, which waived fees for P2P transactions up to 100 Ghanaian Cedis across all networks (GSMA, 2020a).

In addition, since G-Money entered the DF market in January 2020, we plan to explore the impact of new entrants. Moreover, we will examine the merger effects of Tigo and Airtel in 2017.

From a policy perspective, our research aims to generate evidence-based insights into effective strategies and help the Central Bank develop practical regulations for the DFS market. Based on the extensive data we will be collecting, including transaction volumes, fees, the introduction of interoperability, and changes in commercial pricing models and mergers, we can effectively develop reduced-form models that estimate the impacts of the May 2018 interoperability policy and structural models that simulate different policy scenarios assessing the potential impacts of the different *commercial pricing models*.

LITERATURE REVIEW

Mobile money markets are inherently two-sided, thriving on network effects that enhance their value as more participants join the platform (Bourreau & Valletti, 2015; Bianchi et al., 2023). Therefore, the lack of interconnection between different networks could lead to dominant networks monopolizing the market due to positive network externalities and coordination failures (Annan et al., 2014; Bourreau & Valletti, 2015). The former suggests that larger networks could stifle competition by continuously attracting more users (Bourreau & Valletti, 2015). This could also prevent new entrants from attracting new customers. Coordination failures could also happen because consumers who are ready to make transactions must be using the same service provider to successfully complete their transactions.

Interoperability, therefore, is seen as a beneficial remedy to market monopoly (Morton & Kades, 2021) in mobile money markets because it facilitates connections between different mobile money platforms, thereby allowing new entrants a fair chance to compete and enabling consumers to enjoy broader network benefits. This leads to potentially lower costs and the expansion of services, which, in turn, increases the adoption and usage of mobile money services (Anderson & Reynolds, 2015; Donovan, 2012). To realize the full benefits of mobile money interoperability, Di Castri (2013) suggests that the timing of interoperability is critical. Interoperability tends to yield more significant advantages in well-established mobile money systems with a strong network of agents and an active customer base. Drawing from the product life cycle, introducing interoperability in the maturity phase will be beneficial to market players (Levitt, 1965; Moon, 2005). In the maturity phase, mobile money markets would have reached widespread acceptance and stability, which, in turn, create greater value for both customers and providers. Introducing interoperability at this stage is analogous to introducing new features or extensions in a traditional product life cycle to rejuvenate the product's appeal and extend its life. In addition, interoperability can help the platform stay competitive and meet broader customer needs by facilitating broader network use and utility.

The empirical research on interoperability within the mobile money sector is expanding. Brunnermeier et al. (2023) use a staggered difference-in-difference methodology to evaluate the effects of interoperability by analyzing data from 129 operators across 42 African countries from 2010 to 2020. Their findings indicate that interoperability tends to lower mobile money fees for users. Despite these benefits, there are drawbacks, such as reduced mobile tower presence and

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network coverage, which disproportionately affect rural and economically disadvantaged areas, potentially hindering financial inclusion. Gutierrez and Singh (2013) studied the effects of regulatory reforms on mobile money usage based on datasets from the World Bank for 35 countries. By employing fixed effects regressions, the authors find that a sound legal and supporting regulatory framework increases mobile money usage among the general population and the under-served populations. Additionally, they find that a regulatory framework facilitating interoperability is linked to higher usage.

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