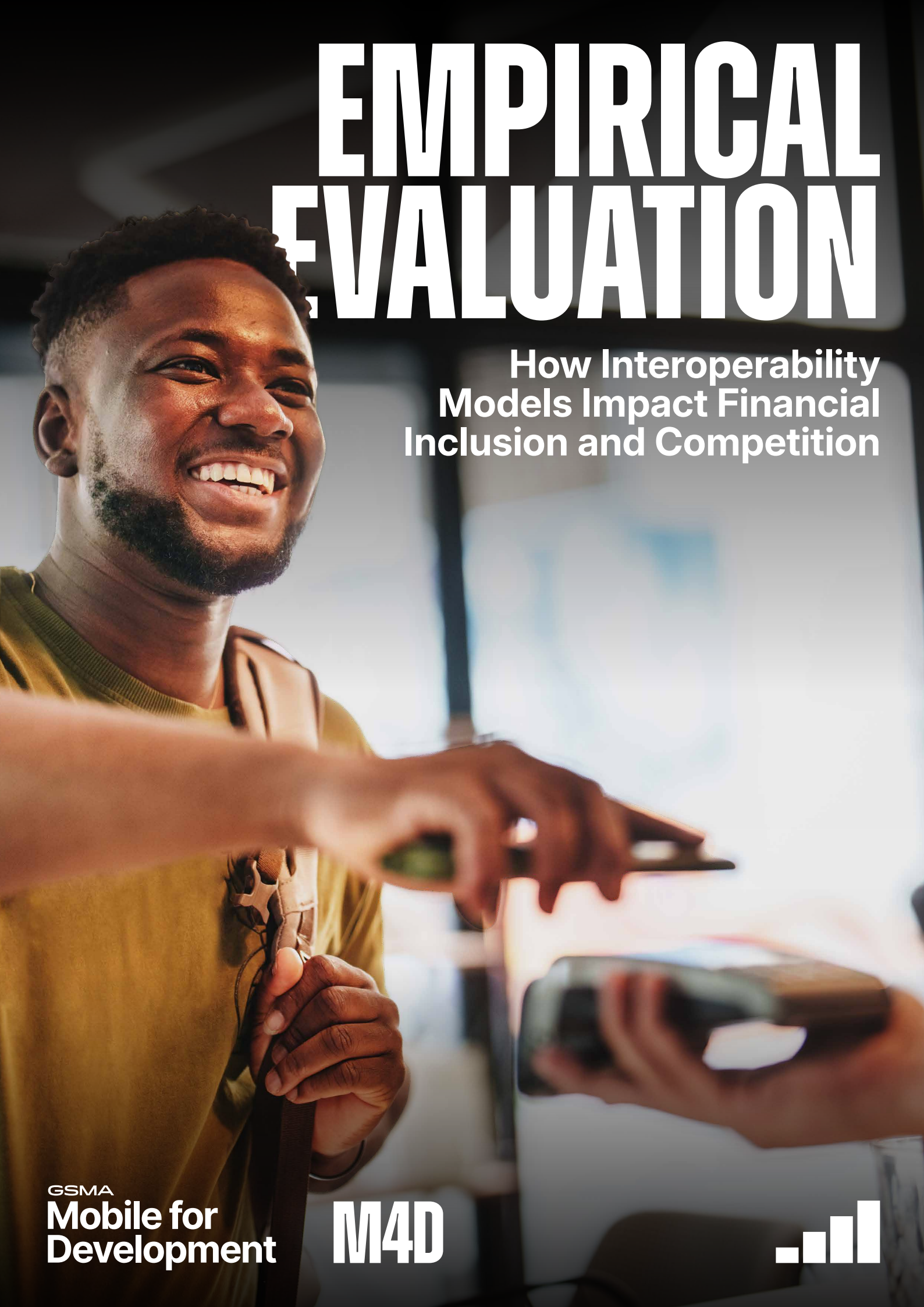
EMPIRICAL EVALUATION

How Interoperability Models Impact Financial Inclusion and Competition



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Abstract

This report empirically evaluates the impact of mobile money interoperability on adoption, usage and competition across countries. Moving beyond the traditional binary assessment of interoperability, we distinguish between policy models (market-led, regulator-led and voluntary) and explicitly account for the timing of implementation relative to market maturity. Leveraging a multi-country quarterly panel dataset, we apply modern difference-in-differences (DID) estimators designed for staggered policy adoption, enabling robust causal inference on both the type and sequencing of interoperability interventions.

Our findings show that interoperability can significantly increase mobile money adoption, but the effects on competition and transaction values depend strongly on policy design and market conditions. Market-led approaches introduced after markets reach scale deliver the best results, with adoption gains of more than 6 percentage points and an estimated 30–70 million additional active 90-day accounts in 2023. In contrast, early or rigid regulatory mandates – such as national switches – often yield neutral or negative outcomes, particularly when imposed before markets are mature, and can be associated with declines in transaction values. Quantitative estimates suggest that if countries with regulator-led interoperability had instead adopted market-led models at the appropriate stage of market development, there could have been a 40% increase in transaction value in 2023 (equivalent to around $250 billion).

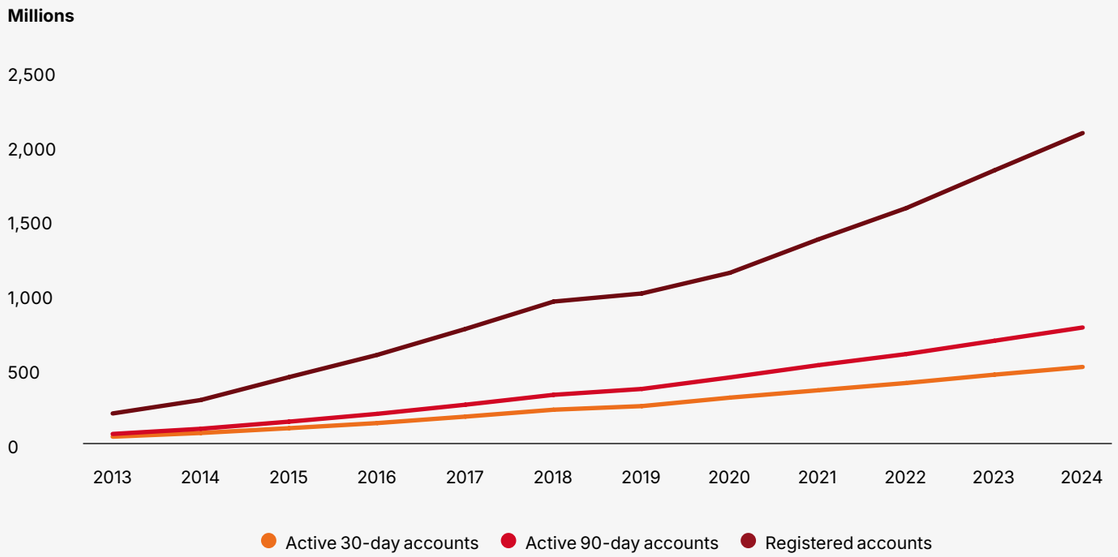
Market-led interoperability introduced after market maturity is the most effective approach. This report provides recommendations for policymakers: they should prioritise enabling conditions for scale before mandating interoperability; favour commercially viable and inclusive governance models; and design frameworks that promote innovation and competition. By integrating rigorous empirical methods and policy analysis, this study offers a comprehensive evidence base to guide future interoperability initiatives and maximise the benefits of digital financial inclusion.

1

Introduction

Interoperability describes the process of different products, services or systems working together in a way that creates value for businesses and/ consumers. It is typically achieved by exchanging information or implementing a degree of standardisation by the participating organisations. Interoperability has been applied in a wide range of sectors, and it has a long and established history in the financial sector, such as for credit cards and automatic teller machines (ATMs), and in mobile telecommunications. The topic has gained particular attention in recent years in the context of digital markets, both as an ex ante tool to promote competition and an ex post competition remedy. It is therefore unsurprising that there has also been an increased focus on interoperability in mobile money markets.

Figure 1
Total number of active and registered mobile money accounts globally



Source: GSMA Global Adoption Survey and estimates

Over the past decade, mobile money has emerged as a transformative force in financial inclusion, particularly across low- and middle-income countries (LMICs), with the number of registered accounts increasing to more than 2 billion by the end of 2024. As mobile money markets started maturing, the question of how and when to implement interoperability (i.e. allowing users to transact across different providers) became increasingly central to policy debate.

Interoperability in mobile money can apply to several dimensions, for example to the network, platform, agent or merchant.[1] The focus of this report is on horizontal platform interoperability between mobile money providers and other financial service providers, including banks. This has been the main dimension of interoperability across mobile money markets to date.

Specifically, this dimension refers to the ability of users of one mobile money service to send payments or transfers to users of another service – commonly known as account-to-account (A2A) interoperability. It is the most widespread type of interoperability in mobile money and can operate both domestically and across borders. It may involve transactions between mobile money providers or between mobile money services and other financial institutions (e.g. bank accounts). A2A interoperability can also be limited to specific payment use cases (e.g. peer to peer (P2P)) or extended to broader applications (e.g. person to business (P2B), person to government (P2G), bill payments and bulk disbursements).

Initially, interoperability was driven by market-led initiatives, with providers agreeing to enter into bilateral or multilateral agreements to enable cross-platform transactions. These arrangements were typically motivated by commercial incentives, such as expanding customer bases and enhancing user experience.

In recent years, however, governments have taken a more active role in imposing interoperability. In some cases, this has involved mandating interoperability and implementing centralised and regulated solutions (e.g. national switches). While interoperability overall can yield important benefits under specific conditions, they may also introduce trade-offs that hinder service adoption. It is therefore essential for policymakers to clearly articulate the rationale for intervention, as this will shape the design and scope of interoperability.

As highlighted in several studies, when interoperability is mandated by regulation, it should be tailored to the specific context and objectives. Policymakers must carefully weigh the costs and trade-offs associated with different forms of interoperability. These trade-offs will vary by market and depend on economic factors, including the maturity of the mobile money ecosystem – particularly whether it has achieved sufficient scale.[2]

With the continued implementation of mobile money interoperability across countries, this report aims to empirically assess its impact on three core dimensions: adoption, usage and competition. Previous studies often treat interoperability as a binary variable, either present or absent, which oversimplifies its complexity. In practice, interoperability can take multiple forms depending on how and when it is implemented, as well as the governance model under which it operates.

This report moves beyond binary classifications to evaluate the policy design and timing of interoperability initiatives. Specifically, it categorises interoperability into three distinct policy models:

- **Market-led interoperability:** This refers to markets where interoperability is mandated by regulation, but its implementation is led and driven by mobile money providers, either through bilateral or multilateral agreements.

- **Regulator-led interoperability:** This refers to markets where interoperability is mandated by regulation and it is implemented with a prescribed solution set by the regulator (typically via a national switch).

- **Voluntary interoperability:** This refers to markets with arrangements that arise from collaboration between providers without regulatory obligation.

1. For further discussion on this, see The Impact of Mobile Money Interoperability on Financial Inclusion, GSMA, 2024
2. See The impact of mobile money interoperability on financial inclusion, GSMA, 2024; Understanding mobile money interoperability: Its evolution and path to a sustainable future, GSMA, 2023; Interoperability Test Platform, GSMA, 2024; Tracking the journey towards mobile money interoperability, GSMA, 2020; and The commercial sustainability of mobile money providers in interoperability initiatives, GSMA, 2024

Case study: Tanzania

Understanding the different types of interoperability

The three different types of interoperability considered in this study can be seen in Tanzania, one of the most developed mobile money markets globally. Mobile money first launched in Tanzania in April 2008 with the introduction of Vodacom's M-Pesa service. In 2014, there was a market-led voluntary bilateral agreement for P2P established between Airtel, Tigo and Zantel. This was not mandated by the regulator, so it is an example of voluntary interoperability.

In 2015, there was a regulatory requirement for mobile money providers to facilitate P2P interoperability.[3] However, the solution was led by mobile money providers, so this is an example of mandated interoperability that is market-led (i.e. market-led interoperability). In 2016, Vodacom joined the interoperability agreement.

In 2022, all financial institutions (including mobile money providers and banks) in Tanzania were required to connect to the newly launched Tanzania Instant Payment System (TIPS). In 2023, mobile money providers completed onboarding of all approved digital channels. This is an example of mandated interoperability being implemented using a prescribed centralised and regulated solution (i.e. regulator-led interoperability).[4]

Within this context, the report assesses whether mobile money interoperability – and the policy models through which it is implemented – shapes adoption and competition patterns. It evaluates whether the presence of interoperability, and the manner of its introduction, leads to measurable differences in the uptake of mobile money across markets. The analysis considers three dimensions: (i) the extent to which interoperability enhances adoption and fosters competition; (ii) the degree to which different forms of interoperability, introduced under varying market conditions, generate distinct outcomes and indicate the relative effectiveness of alternative policy approaches; and (iii) the role of timing in conditioning the magnitude and direction of these impacts. Note that all metrics for adoption, competition (including HHI) and transaction values refer specifically to mobile money services and do not include other financial services or providers.

By addressing these topics, the report aims to provide evidence that can inform policy decisions and industry strategies, ensuring that interoperability delivers the greatest possible benefits for financial inclusion and market development.

3. NPS Act 2015: Section 6(1) A payment system that may be eligible to be licensed by the Bank shall have any of the following objects: (f) facilitation of interoperability of payment systems and services between payment systems providers and consumers. (2) For the purposes of this section, the term 'interoperability' means a seamless transfer of payment instructions or funds from an account of one payment system provider or user to another payment system provider's or user's account of a different service provider.
4. For further details on the Tanzanian case study, see The commercial sustainability of mobile money providers in interoperability initiatives, GSMA, 2024.

2

Literature review

Economics of interoperability[5,6]

There are several different elements to interoperability: the technical standards and specifications; the content and format of information exchange; the governance model; payment flows; commercial agreements; and the approach to privacy and security. There are also different degrees of interoperability, as interoperability is not binary and can instead encompass specific parts or features of a service. For example, a social media platform can establish interoperability for 'standard functionalities' such as exchange of text, images and videos with other social media platforms, but not for other functionalities.[7] In the case of mobile money, an example would be where P2P payments are interoperable but other payments (e.g. bill, bulk and merchant payments) remain exclusively on-net. Furthermore, interoperability can be one way or reciprocal between participating firms, and it can be symmetric or asymmetric.

An important distinction is between horizontal and vertical interoperability. Horizontal interoperability occurs between firms providing competing products (e.g. mobile money providers), while vertical interoperability occurs between firms that provide complementary products (e.g. between mobile app developers and app stores, or between app stores and operating systems) and allows consumers to mix and match components. An example of vertical interoperability in the mobile money market is merchant interoperability, which allows consumers to make payments to businesses irrespective of their provider. Vertical interoperability can be further distinguished between within-platform interoperability (which allows third-party providers to supply complements for a specific platform) and cross-platform interoperability (which allows third-party providers to offer services on a range of different platforms).[8] An example of cross-platform interoperability in the case of digital financial services would be between mobile money wallets and bank accounts.

Interoperability can either be market-led, regulator-led or voluntary. Below are the reasons why firms may choose to engage in interoperability:

- **Realising direct and indirect network effects:** Firms can realise the benefits of network effects by accessing another platform's customer base and creating value from new and existing products. Direct network effects occur in a market where the benefits to consumers grow with the number of users. In the case of mobile money, more users means that individuals can make more transactions and payments with each other. Direct network effects typically occur with horizontal interoperability. Indirect network effects occur when the value of a product increases with the number of users of a complementary product (e.g. a mobile app store with more users attracts more developers to develop apps for those stores, increasing their value). Indirect network effects typically occur with vertical interoperability.

5. Based on: The impact of mobile money interoperability on financial inclusion, GSMA Intelligence, 2024
6. This section provides a brief summary. For more details on the definition of interoperability and the economic theory behind it, as well as examples and policy considerations, please refer to the studies cited.
7. See Scott-Morton et al (2021)
8. For further discussion, see CERRE (2022)

- **Providing extra value to consumers:** Firms can provide extra value by enabling a more convenient and efficient platform that allows consumers to access products and services that interoperate with the platforms they use.

- **Reducing costs and increasing productive efficiency:** Firms and decrease costs and increase productive efficiency by agreeing on a set of standardised components in a production value chain.

In some markets, another solution to interoperability is the development of 'adapters' and 'converters', which ensure a product can be used on another platform.[9] In the context of mobile money, the use of over-the-counter (OTC) transactions and vouchers would be a type of 'converter'.[10]

From a public policy and regulatory perspective, governments typically enable or mandate interoperability for one or more of the following reasons:

- **Overcoming coordination problems:** Interoperability can help overcome coordination issues in cases where firms and consumers benefit from interoperability, but firms' incentives are not aligned and they are unable to agree on the form or implementation of interoperability. Two examples of addressing coordination issues include IP licensing[11] or involving standard-setting organisations to lead the agreement of technical specifications and interoperability rules. This standardisation of interoperability enables all market players to be interoperable.

- **Realising the benefits of economic externalities:** Interoperability and interconnection between mobile telephone systems, for example, enhances the economic impact of mobile as a general-purpose technology, as well as the social benefits of enabling easier communication. In the case of mobile money and digital financial services, governments may have an objective to reduce the use of cash and promote digital payments to drive financial inclusion and wider economic growth. Interoperability can help drive this if it enhances the convenience of digital payments.

- **Promoting effective competition:** Interoperability can reduce entry barriers for new firms, allowing them to share direct and indirect network effects and lowering switching costs for consumers. Depending on the market, competition concerns could be driven by market features or the conduct of specific participants. Vertical interoperability is sometimes used as a tool to mitigate the market power of digital firms that are vertically integrated, as they may have an incentive to discriminate against or foreclose complementors that compete with their downstream products. In this case, it can strengthen competition in complementary markets and foster innovation.

- **Other public policy objectives:** This includes, for example, consumer protection.

However, while there are several potential benefits of promoting interoperability, there are also trade-offs to consider, including the following:

- **Increased costs:** There is an increased cost to firms in terms of the time and resources needed to design and maintain the technical, organisational and commercial requirements of interoperability. The costs typically increase with the number of parties involved and with deeper levels of interoperability. This is because participating companies need to agree on a range of elements and then implement them, including technical specifications, the content and format of data flows, privacy and security functionalities, governance, dispute-resolution mechanisms and pricing and commercial terms.

- **Less product differentiation in the market:** Interoperability reduces product differentiation, as firms are only able to compete on certain aspects of the product that are not interoperable. This removes competition on the core platform or standards and can strengthen the position of incumbents.

- **Discouraging innovation and the potential for a disruptive new entrant:** This is particularly true if interoperability reduces the returns on investment by allowing firms to 'free ride' and benefit from other firms' investments. Some have argued that while interoperability can promote competition within the market, potentially enhancing static competition, it inhibits dynamic competition for the market. The latter has been an important driver of consumer welfare in digital markets over the past two decades, including mobile money, which has driven a significant expansion in financial inclusion in countries that previously had large populations that were unbanked and underserved by traditional institutions (particularly in Sub-Saharan Africa).[12] Conversely, in markets where innovation is slow-paced and product functionalities have been similar over a long period of time, consumers are more likely to benefit from the promotion of static competition.

- **Higher prices in the case of vertical interoperability:** Firms could have less incentive to compete on price because the benefits of reducing upstream prices can be captured by other firms in the downstream market. Vertical interoperability could also decrease the differentiation between different digital platforms because the same complementary services are available on each platform, which may soften the intensity of competition between the platforms.

- **Potential data privacy and security risks:** These are dependant on the design and implementation of the interoperability standard.

A key consideration around the need for (and impact of) interoperability is the extent of multi-homing (where consumers use multiple competing platforms). If multi-homing is costly and consumers are unable to use more than one platform, then interoperability will be more beneficial for consumers. However, if consumers can multi-home across platforms, then there can be more effective competition and contestability than if the platforms need to be interoperable. As noted in the economic literature,[13] multi-homing allows both for competition in the market and competition for the market. This is a relevant consideration for mobile money, as consumers often have multiple SIM cards on different mobile networks, allowing them access to competing mobile money providers simultaneously. At the end of 2024, the average mobile subscriber in Africa had two SIMs, with this number ranging between 1 to 3.2, depending on the market.[14] Furthermore, recent innovations around eSIM make it even easier for consumers to access multiple networks and switch between them on a single device.[15]

The timing of interoperability is also key. Firms may find it beneficial to become interoperable once they have reached a certain scale and there is sufficient value to consumers to have interoperable services. Therefore, imposing ex ante mandatory interoperability too early might lead to regulatory failure that could impede the development of both the technology and market, particularly if it is unclear as to which bottleneck interoperability is required to address. For example, imposing an interoperability solution that is costly to implement and does not align with the commercial incentives of participating mobile money providers could result in fewer providers and lower consumer adoption than would otherwise be the case. It can also take time to establish interoperability in a manner that is agreeable to all participants, who may have different business interests and incentives. At the point of agreement, the standard or solution may become outdated or redundant in a fast-moving market.

It is therefore important that policymakers are clear on the rationale for intervention, as this will drive the form of interoperability. As highlighted in several studies on interoperability,[16] to the extent that interoperability is imposed it should be focused on a specific context and objective, and policymakers should carefully consider the costs and trade-offs involved in different forms of interoperability. These trade-offs will be context-specific and will depend on the economic and technological features and maturity of the market.

9. For further discussion on this, see Kerber and Schweitzer (2017).
10. OTC is a process where a mobile money agent performs a transaction on behalf of a customer paying them in cash, often because the customer is not registered to a mobile money provider. Vouchers are a mechanism through which a text message and code are sent to a receiver, who then withdraws cash at an agent in the sender's network.
11. Examples of this include a market leader offering free access to an IP licence or through a patent pool where relevant patents can be offered and shared by all parties involved in the interoperability agreement.
12. See Demirgüç-Kunt et al (2022).
13. For example, see CERRE (2022)
14. GSMA Intelligence
15. For example, see Accelerating eSIM globally: state of the consumer market, user behaviour and adoption growth scenarios, GSMA Intelligence, 2023
16. For example, see Frontier Economics (2020)

Related literature

The literature on mobile money interoperability has expanded in recent years, reflecting its growing importance in digital financial ecosystems across LMICs. While mobile money has been widely studied for its impact on financial inclusion and household welfare, the specific role of interoperability and mobile money remains comparatively underexplored, with empirical findings that are both context-dependent and methodologically varied.

Theoretical contributions have highlighted the distinction between horizontal and vertical interoperability, as well as the implications of one-way versus reciprocal arrangements. Bourreau and Valletti (2015) argue that interoperability can promote competition in mobile money platform markets, but may also reduce incentives for differentiation and investment if implemented prematurely.[17] Kerber and Schweitzer (2017) further emphasise that mandated interoperability may inhibit dynamic competition, particularly in fast-moving digital markets.[18] These concerns are echoed in broader digital platform literature, including studies by Frontier Economics (2022) and CERRE (2022), which caution against one-size-fits-all regulatory approaches.

Empirical evidence on the impact of interoperability is mixed. Brunnermeier et al (2023) conducted a cross-country analysis of over 120 mobile operators in Africa and found that interoperability reduces transaction fees, particularly for low-value payments, but also leads to lower adoption and diminished network coverage in rural areas. This suggests that while interoperability may enhance static competition, it can weaken dynamic incentives, potentially impeding long-term investment and innovation.

A 2024 GSMA Intelligence study based on five country case studies (Kenya, Tanzania, Rwanda, Ghana and Malawi) provides further insights into the effects of different interoperability models.[19] In Kenya, Tanzania and Rwanda, market-led interoperability was associated with increased adoption and usage, particularly of advanced services such as merchant payments and international remittances. These arrangements were typically introduced after mobile money had reached significant scale, supporting the hypothesis that interoperability tends to follow financial inclusion rather than drive it. In contrast, the impact of national switches in Ghana and Malawi was inconclusive, with adoption trends largely influenced by external factors such as the Covid-19 pandemic. The timing of interoperability implementation emerges as a critical factor. In four of the five case study countries, active account penetration exceeded 50% before interoperability was introduced. This sequencing is consistent with economic theory, which posits that the benefits of interoperability – such as expanded network effects and increased transaction volumes – are more likely to be realised once a critical mass of users is in place. Ofcom (2023) similarly argues that premature mandates may disrupt market dynamics and reduce incentives for providers to invest in infrastructure and product development.

The choice of interoperability model also has significant implications. Bilateral and aggregator models tend to preserve commercial incentives and allow for flexible governance arrangements, while national switches may impose rigid technical and operational requirements. Studies by GSMA (2020) and BFA Global (2018) highlight that market-led models are more likely to result in increased adoption and usage, particularly of advanced services. Conversely, mandated models may face challenges in aligning with provider interests and sustaining innovation. Mburu and Porteous (2022) further note that the success of interoperability depends on the alignment of technical architecture, pricing structures and governance mechanisms.

Despite the growing body of evidence, significant gaps remain. Most studies rely on trend analysis or cross-sectional comparisons, limiting their ability to establish causal relationships. Arabehety et al (2016), in a 20-country scan, found no conclusive evidence linking interoperability to financial inclusion, though they observed increased off-net transactions in Tanzania following bilateral agreements. BFA Global's post-implementation review in Tanzania confirmed improvements in user experience and transaction volumes but did not establish a clear link to financial inclusion.

There is a need for more rigorous empirical research using panel data and causal inference methods to isolate the effects of different interoperability models. Negre and Cook (2021) argue that future studies should differentiate between types of interoperability, such as platform, agent, and data interoperability, and assess their respective impacts on financial inclusion and ecosystem development. Agent interoperability, for example, may improve service availability and reduce costs by allowing agents to serve multiple providers with a shared float. Data interoperability, as discussed by Bianchi et al (2023), could facilitate the development of complementary services such as credit and insurance, though it raises concerns around privacy and governance.

The broader economic implications of interoperability are also underexplored. While mobile money has been shown to contribute to GDP growth[20] through increased adoption and usage, the specific role of interoperability in amplifying these effects remains unclear. Studies suggest that mobile money interoperability can facilitate network effects and expand the reach of digital financial services, but its empirical effect on outcomes such as adoption, competition and usage has yet to be quantified.

In this context, this report makes the following contributions that, to our knowledge, have not been integrated in a single, empirical, cross-country study of mobile money interoperability:

- **Isolating effects by policy type:** Previous work has often treated interoperability as a binary feature (present or not). We explicitly distinguish policy models – market-led, regulator-led and voluntary – and estimate how their impacts differ. This allows decision-makers to move beyond 'interoperability or not' to 'which interoperability model works best under which conditions'.

- **Identifying the role of timing and market maturity:** Interoperability may deliver different outcomes depending on when it is introduced. We leverage the staggered rollout of policies across countries to examine effects when interoperability is implemented into more mature markets (with established user bases and agent networks) versus earlier-stage markets. This is crucial for policy sequencing, as the same policy can have a different impact depending on market readiness.

- **Applying robust, modern empirical methods to staggered adoption:** The report uses modern difference-in-differences (DiD) approaches that address known limitations of older methods when policies are adopted at different times. This strengthens the robustness of the results by (i) controlling for common shocks and time-invariant country characteristics, (ii) preventing bias that can arise in naïve multi-period comparisons and (iii) tracing how effects evolve after implementation (event-study dynamics).

As a result, this is the first study to isolate the effects of interoperability by both policy type and timing using robust empirical methods. For policymakers, this means clearer guidance on which interoperability models are most likely to support adoption and competition, and when they are most likely to do so, in a cross-country evidence base comparison rather than single-country experience or descriptive trends.

17. Bourreau, M., & Valletti, T. (2015). Competition and Interoperability in Mobile Money Platform Markets: What Works and What Doesn't?
18. Kerber, W., & Schweitzer, H. (2017). Interoperability in the Digital Economy. Journal of Intellectual Property, Information Technology and E-Commerce Law (JIPITEC).
19. The impact of mobile money interoperability on financial inclusion, GSMA Intelligence, 2024
20. Mobile money: How digital payments have impacted economic growth, GSMA Intelligence, 2023

3
Data

GSMA Global Adoption Survey on mobile money

The GSMA Global Adoption Survey is an annual survey designed to capture quantitative information about the performance of mobile financial services around the world. Most service providers represented in the GSMA's Mobile Money Deployment Tracker are invited to participate in the survey, and respondents supply standardised operational metrics about their services for September and December of the previous year and March and June of the current year.[21]

The survey metrics include, but are not limited to, the following: the number of registered mobile money accounts; the number of mobile money accounts active in the past 90 days; the number of mobile money accounts active in the past 30 days; the number of registered mobile money agents; and the number of mobile money agents active in the past 30 days. The survey also includes data on mobile money transaction volumes and value for the following products: airtime top-ups; bill payments; bulk disbursements; cash-ins; cash-outs; international remittances; merchant payments; bank-to-wallet; wallet-to-bank; and off-net and on-net P2P transfers.

For some countries, there are gaps in the reporting of mobile money metrics for certain providers in certain years. These are estimated using a market-sizing modelling approach. Further details of this, as well as of the Global Adoption Survey more generally, can be found in the GSMA State of Industry Report on Mobile Money.[22] The data used for this study covers 102 countries in which mobile money has been available in the 2013–2023 period.

When measuring mobile money adoption, we divide the number of accounts in each market by the country's adult population in the relevant year. We calculate the average transaction value per account by dividing total transaction values (converted to 2017 purchasing power parity (PPP) USD) by the number of mobile money accounts in the relevant year.

To assess market competition, we use the Herfindahl-Hirschman Index (HHI),[23] a widely accepted proxy for market concentration and competitive dynamics. The HHI is calculated by summing the squares of the market shares of all firms in the market, providing a single metric that reflects the degree of concentration. Using operator-level data by country and by period, we compute the market share for each mobile money adoption metric and use these to estimate the HHI. This allows us to track changes in market structure over time and evaluate the relationship between competition and mobile money outcomes.

21. See GSMA Mobile Money Metrics
22. The State of the Industry Report on Mobile Money 2025, GSMA, 2025
23. The Herfindahl-Hirschman Index (HHI) is a commonly used proxy to evaluate market concentration. It is calculated by summing the squares of the market shares of all firms in a given market, providing a single value that reflects the degree of competition. Using the available data for each provider across the relevant metrics, we computed the HHI for each case. A higher HHI value indicates a more concentrated market, suggesting less competition and potentially greater market power held by fewer providers.

Table 1
Outcome variables assessed on the empirical estimations for interoperability

Outcome category	Description
Adoption metrics	Active 30-day accounts (as a percentage of adults)
	Active 90-day accounts (as a percentage of adults)
	Registered accounts (as a percentage of adults)
Competition metrics (HHI)	HHI for active 30-day accounts
	HHI for active 90-day accounts
	HHI for registered accounts
Transaction-level metrics[24]	Value of total transactions per active 90-day account
	Value of P2P transactions per active 90-day account[25]
	Value of total off-net transactions per active 90-day account
	Share (%) of P2P transactions

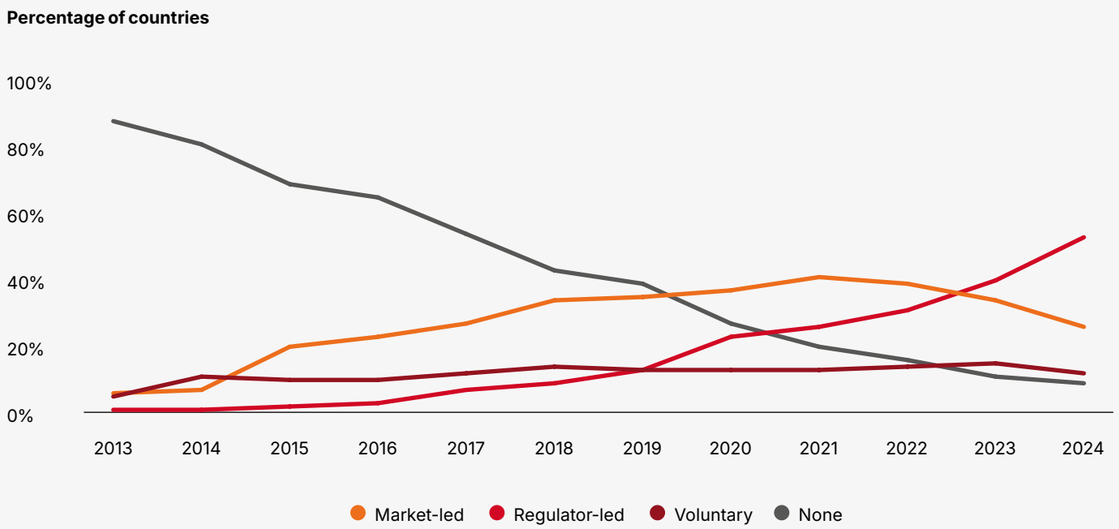
Source: GSMA Intelligence

Other data

The macroeconomic variables used in our study are gathered from the International Monetary Fund (IMF) World Economic Outlook, specifically GDP per capita, which is expressed in constant 2017 PPP USD. Data on the adult share of the total population is sourced from the World Bank's open data repository. We also use data on mobile connections and penetration from GSMA Intelligence, which is primarily sourced from mobile network operators' public reports. The definition of interoperability policy across countries was obtained from the GSMA Interoperability Policy Tracker, compiled using publicly available sources and national regulatory definitions.[26] Figure 2 shows the evolution of interoperability approaches by share of countries during the period of analysis.

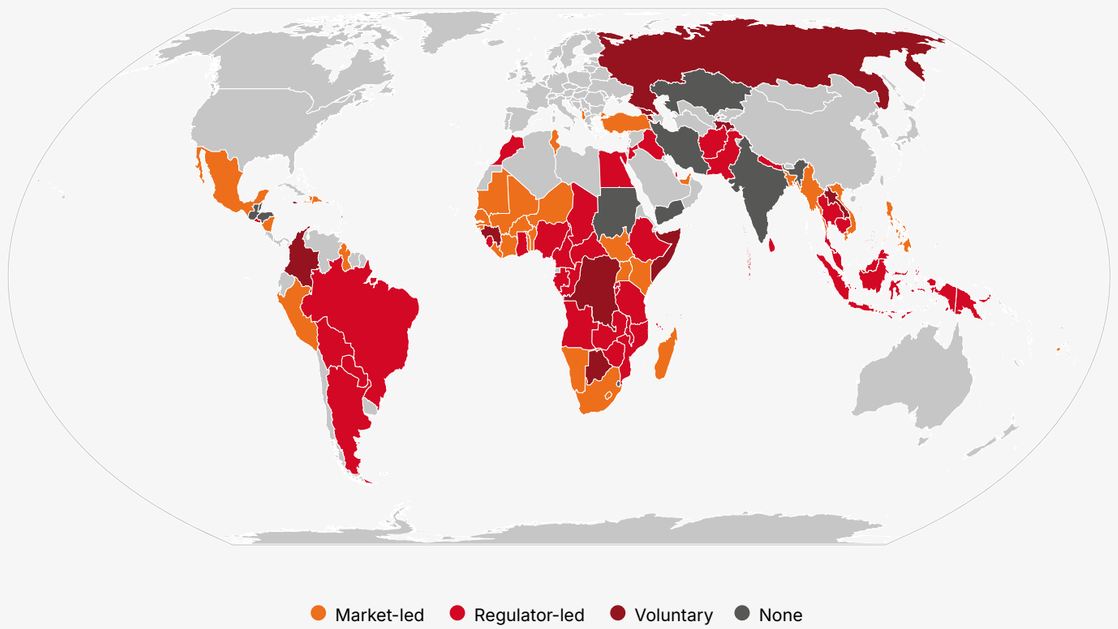
24. Mobile money transaction value aggregates the total value of transactions recorded on mobile money platforms across the following GSMA-defined categories: P2P transfer, international remittance, bill payment, merchant payment, bulk disbursement, airtime top-up, cash-in, cash-outs and bank–wallet/wallet–bank transfers. These categories and their usage in monthly value/volume reporting are set out in GSMA's Mobile Money Metrics and glossary.
25. Interoperability mainly aims to enable A2A transfers between different providers, removing 'on-net' limits and making P2P the core feature that supports wider use.
26. For example, see The Mobile Money Regulatory Index | Mobile for Development

Figure 2
Evolution of mobile money interoperability approaches



Source: GSMA Intelligence and GSMA Mobile Money

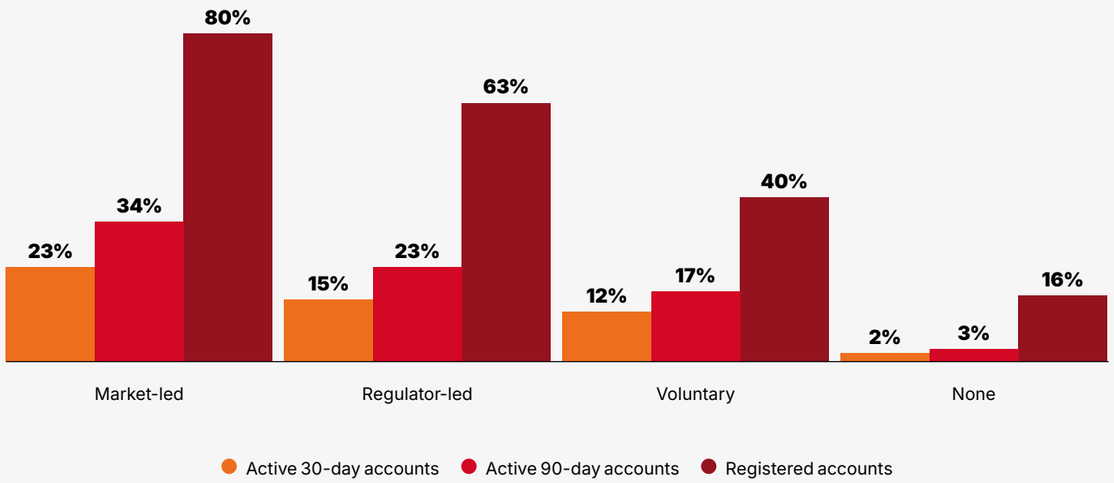
Figure 3
Mobile money interoperability approaches by country, 2024



Source: GSMA Intelligence and GSMA Mobile Money

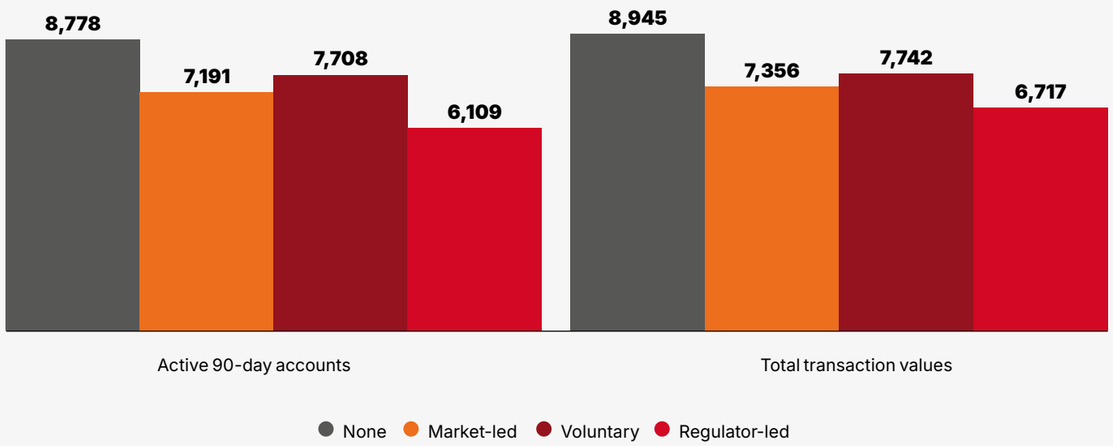
Figures 4 and 5 show that countries that have implemented mobile money interoperability exhibit significantly higher levels of adoption and competition among the total adult population compared to those without interoperability. However, the differences become even more pronounced in terms of adoption when comparing across policy approaches. Specifically, countries that adopted market-led interoperability – where providers agree to establish cross-platform connections – consistently outperform others in terms of adoption metrics.

Figure 4
Proportion of active and registered mobile money accounts by policy type, 2023

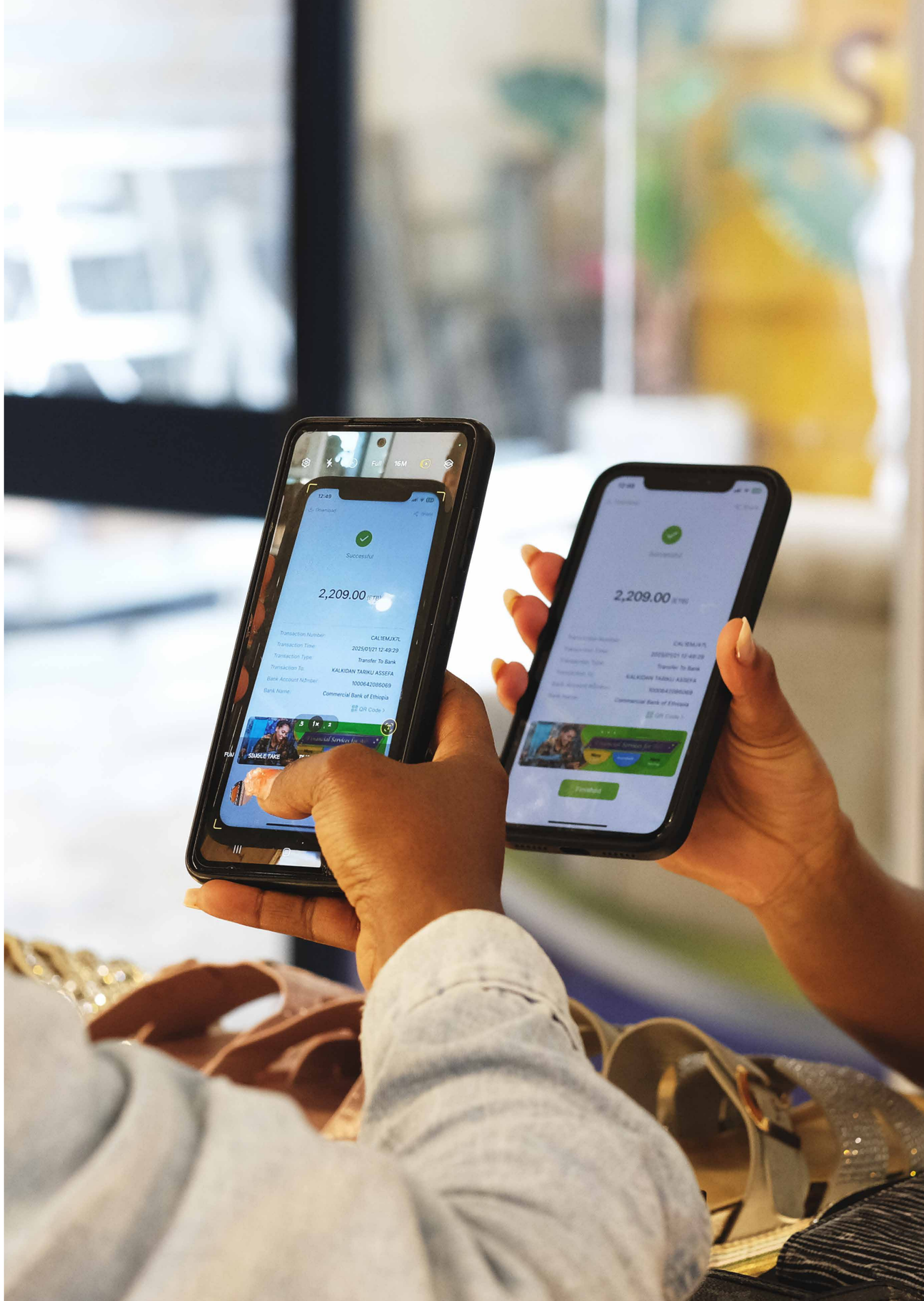


Source: GSMA Intelligence and GSMA Mobile Money

Figure 5
Average HHI for active 90-day accounts and total transaction values, 2023



Source: GSMA Intelligence and GSMA Mobile Money



4

Empirical strategy

This section focuses on the empirical methodology to estimate the causal impact of mobile money interoperability on market outcomes – specifically adoption, usage and competition – using a DiD framework adapted to staggered policy implementation. Countries introduced interoperability at different points in time and under varying policy models, including market-led, regulator-led and voluntary arrangements. This staggered rollout allows us to exploit temporal and cross-country variation to identify treatment effects.

The baseline specification follows a two-way fixed effects (TWFE) model:

$$Y_{it} = \alpha_i + \gamma_t + \delta \cdot Interoperability_{it} + \lambda X_{it} + \varepsilon_{it}$$

The outcome variables are $\boldsymbol{Y_{it}}$ (e.g. active accounts, transaction values or market concentration), while sub-indices ***i*** and ***t*** denote country and year, respectively. $\boldsymbol{\alpha_i}$ is country-level fixed effects, while $\boldsymbol{\gamma_t}$ represents year fixed effects. The treatment variable is $\boldsymbol{Interoperability_{it}}$, which is a binary or categorical indicator of whether a specific form of interoperability is in place in the country ***i*** at year ***t***. Finally, $\boldsymbol{X_{it}}$ is a vector of control variables.

While TWFE is widely used, it has well-documented limitations in staggered treatment settings. Specifically, when treatment effects vary over time or across cohorts, TWFE estimators can produce biased results due to negative weighting (Goodman-Bacon (2021)). To address this, we apply three modern DiD estimators that are robust to treatment heterogeneity and staggered adoption:

- **Sun and Abraham (2021):** This method estimates cohort-specific treatment effects using interaction-weighted estimators. It assigns non-negative weights based on the share of each cohort in the sample and the relevant post-treatment periods. The approach is robust to heterogeneous treatment effects and allows for dynamic event-study analysis, capturing how impacts evolve over time after policy implementation.

- **Borusyak, Jaravel, and Spiess (2024):** This estimator uses a two-step imputation procedure. In the first step, untreated observations are used to estimate unit and time fixed effects. These are then used to impute counterfactual untreated outcomes for treated units, allowing for the estimation of treatment effects without relying on potentially biased TWFE comparisons. The method is particularly useful when treatment timing varies and when pre-treatment trends differ across units.

- **de Chaisemartin and D'Haultfoeuille (2020):** This estimator calculates group-time average treatment effects using only comparisons between treated and untreated units at each time point. It ensures that all weights are positive and is valid under heterogeneous treatment effects. The method is well suited for policy evaluations where treatment effects may differ by cohort or evolve over time. For the purposes of this study, periods are evaluated quarterly. The analysis assesses six periods following the implementation of the policy experiment.

These estimators allow us to estimate both average and dynamic treatment effects, and to differentiate impacts by policy type and timing (e.g. whether interoperability was introduced in mature or nascent markets). They also mitigate the risk of bias from negative weighting and improve the interpretability of results in multi-period settings.

Due to missing data in some control variables, we adopt a twofold estimation strategy. First, we run specifications without controls to maximise sample size and extend the analysis period. Second, we include controls to account for confounding factors, albeit with a reduced sample. The control variables are selected based on relevance and data availability, and include GDP per capita, mobile connections per capita, smartphone penetration, rural population share and market concentration (HHI).

This empirical strategy enables us to isolate the effects of interoperability on mobile money outcomes, accounting for policy heterogeneity, timing and market conditions. It also allows us to quantify the differential impacts of market-led versus regulator-led models, and to assess whether sequencing (i.e. introducing interoperability after markets reach scale) amplifies its effectiveness.

5
Results

This section presents the main empirical findings on the impact of mobile money interoperability across three core dimensions: adoption, usage and competition. The analysis is structured around four key conclusions derived from the econometric estimations. All results are based on a multi-country panel dataset and estimated using modern DiD methodologies that account for staggered treatment timing and heterogeneous effects across countries and policy models.

Interoperability increases adoption, but competition effects are mixed

The introduction of interoperability is associated with statistically significant increases in mobile money adoption. Across all policy models, active account penetration – measured over both 30-day and 90-day windows – rises following the implementation of interoperability. This is reflected in Table 2 and Figure 6, where it is noticeable that the impact effects from the dynamic models become more significant approximately one year after the policy is introduced.

This result is consistent with the theoretical expectation that interoperability amplifies network effects by connecting previously siloed platforms. The ability to transact across providers reduces friction and enhances convenience, encouraging registration and sustained usage.

However, the impact on competition is more nuanced. While some markets experience a decline in market concentration (as measured by the HHI), others show no significant change.[27] This heterogeneity reflects differences in policy design and implementation. Market-led models tend to reduce concentration, whereas regulated schemes – particularly those introduced prematurely – may fail to generate competitive pressure due to high compliance costs and reduced incentives for differentiation.

Transaction-level indicators, such as value per active account, do not show consistent improvements.[28] This suggests that while interoperability boosts adoption, its effect on deepening usage depends on complementary factors such as pricing, agent conditions and product innovation.

27. See Table A1 in the appendix
28. Ibid

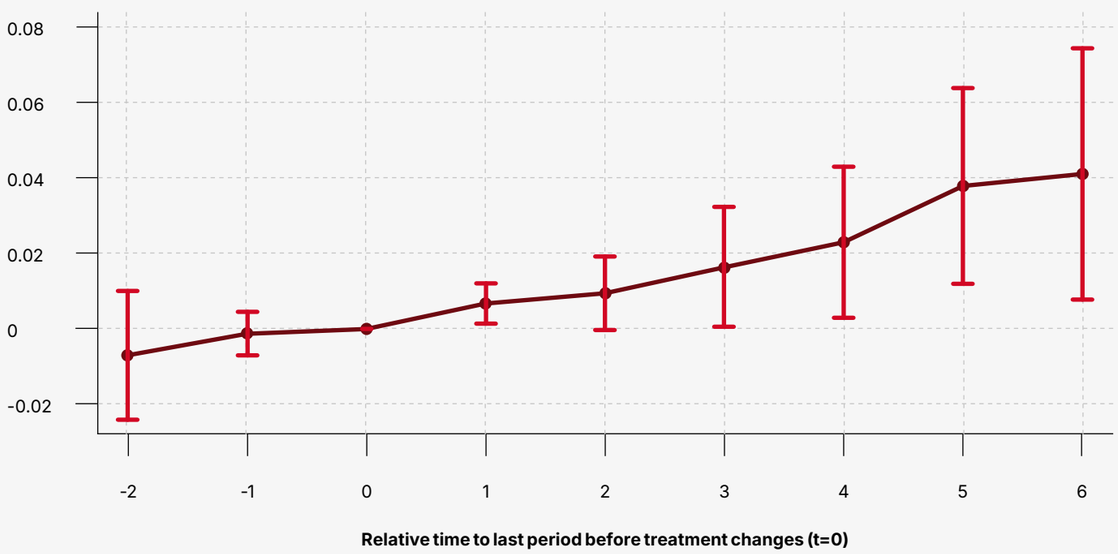
Table 2
DiD estimates of interoperability for active 30-day and 90-day account adoption

	Active 30-day account adoption			Active 90-day account adoption		
Interoperability	0.0526** [0.020]	0.118*** [0.009]	.0120 [0.007]	0.0757*** [0.02]	0.177*** [0.0598]	0.022*** [0.089]
Controls Country fixed effects Year fixed effects	No Yes Yes	Yes Yes Yes	Yes Yes Yes	No Yes Yes	Yes Yes Yes	Yes Yes Yes
Joint placebo test (Reject H_o?)	NR	No	No	NR	No	No
Estimation method	SA	B	CH	SA	B	CH
Observations	4,488	3,960	NR	4,488	3,960	NR
Sample	Global	Global	Global	Global	Global	Global

*Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors in brackets. 'SA' refers to Sun and Abraham (2021), 'B' to Borusyak et al (2024) and 'CH' to de Chaisemartin and D'Haultfoeuille (2020). 'NR' denotes not reported data. Average total effects presented for the CH estimations. Joint placebo test performed for first two pre-trends.*

Source: GSMA Intelligence

Figure 6
de Chaisemartin and D'Haultfoeuille event study of interoperability for active 90-day account adoption[29]



Source: GSMA Intelligence

29. Note: Periods refer to quarters. Period 0 marks the quarter in which the treatment begins, with negative values indicating quarters prior to treatment and positive values indicating quarters after.

Maturity must precede interoperability for the policy to be effective

The timing of interoperability implementation is critical. The analysis shows that interoperability delivers significant benefits only when introduced after markets have reached a certain level of maturity, proxied by at least 50% penetration of active 90-day accounts.

In mature markets, interoperability amplifies existing network effects, making the service more attractive and reducing frictions for frequent users. By contrast, early mandates – introduced before a critical mass of users and agents is in place – produce neutral or even negative effects on adoption and usage. In some cases, premature implementation coincides with declines in transaction values and usage depth.[30] The comparison between the two stages of maturity for the dynamic models is evidenced in Figure 6, where the effects for interoperability are positive and significant when markets reach maturity, but null in the other case

These findings support the hypothesis that interoperability is most valuable when there is something to connect. Before scale, the marginal benefit of linking small, fragmented networks is low, while the fixed costs and coordination challenges are high. After scale is reached, the benefits dominate and interoperability becomes a catalyst for further growth.

Table 3
DiD estimates of interoperability with market maturity for active 90-day accounts

	Active 90-day account adoption					
Interoperability after market maturity	0.5467*** [0.0323]	0.5652*** [0.009]	0.126*** [0.024]	0.457*** [0.052]	0.6025*** [0.0669]	0.0668*** [0.025]
Controls Country fixed effects Year fixed effects	No Yes Yes	Yes Yes Yes	Yes Yes Yes	No Yes Yes	Yes Yes Yes	Yes Yes Yes
Joint placebo test (Reject H_o?)	NR	Yes	Yes	NR	Yes	No
Estimation method	SA	B	CH	SA	B	CH
Observations	4,488	4,444	NR	2,739	2,705	NR
Sample	Global	Global	Global	Pure control	Pure control	Pure control

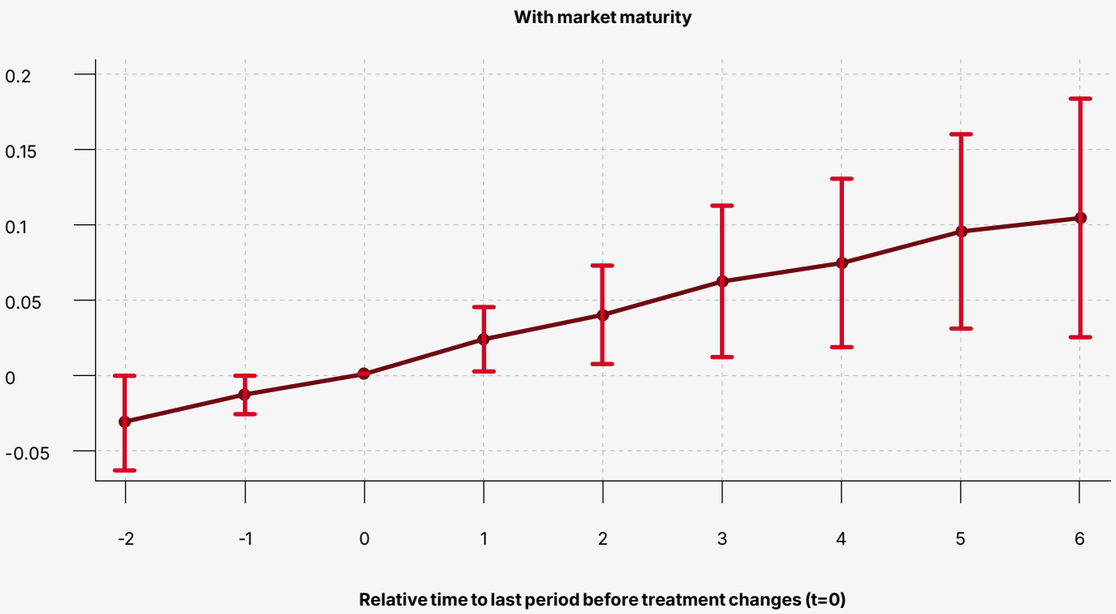
*Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors in brackets. 'SA' refers to Sun and Abraham (2021), 'B' to Borusyak et al (2024) and 'CH' to de Chaisemartin and D'Haultfoeuille (2020). 'NR' denotes not reported data. Average total effects presented for the CH estimations. Joint placebo test performed for first two pre-trends. Pure control refers to the experimental setup where the control group is restricted to observations with no interoperability and that do not meet the 50% threshold criteria.*

Source: GSMA Intelligence

30. See Table A2 in the appendix

Figure 7

de Chaisemartin and D'Haultfoeuille event study of interoperability, comparing active 90-day accounts in markets with and without maturity



Source: GSMA Intelligence

Market-led interoperability is the only approach with consistent and positive impacts

Market-led interoperability – where providers agree on technical and commercial arrangements – shows the strongest and most consistent results. Adoption increases significantly and market concentration declines, indicating a more competitive structure. Estimates suggest that this approach can increase 90-day active account adoption from 2 to 18 percentage points (pp). Importantly, there is no evidence of negative effects on transaction values or usage depth. Table 4 summarises the effects of this policy on adoption among active 90-day accounts, as well as on the HHI for this metric.

Table 4

DiD estimates of market-led Interoperability for adoption and HHI in active 90-day accounts

	Adoption for active 90-day accounts			HHI (active 90-day accounts)		
Market-led interoperability	0.090*** [0.0324]	0.176* [0.069]	0.021** [0.0093]	-0.058** [0.022]	-0.0924** [0.0337]	-0.0030 [0.014]
Controls	No	Yes	Yes	No	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Joint placebo test (Reject H_o?)	NR	No	No	NR	No	No
Estimation method	SA	B	CH	SA	B	CH
Observations	4,488	2,753	NR	2,950	2,753	NR
Sample	Global	Pure control	Global	Pure control	Pure control	Pure control

*Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors in brackets. 'SA' refers to Sun and Abraham (2021), 'B' to Borusyak et al (2024), and 'CH' to de Chaisemartin and D'Haultfoeuille (2020). 'NR' denotes not reported data. Average total effects presented for the CH estimations. Joint placebo test performed for first two pre-trends. Pure control refers to the experimental setup where the control group is restricted to observations with no interoperability of any type.*

Source: GSMA Intelligence

The reason why this particular approach works is because it combines a clear business case with shared governance and operational flexibility. Providers agree on terms that reflect their cost structures, technical standards are robust and consumer experience remains simple and affordable.[31]

Providers choose to interoperate when the business case is clear, usually after they have reached scale. This avoids 'free-rider' problems and keeps innovation incentives strong, as terms are agreed rather than imposed. In practice, shared governance and provider-led decisions ensure fees and rules match the mobile money model, while fair interchange and reasonable hub pricing protect margins and customer trust, helping usage grow. By contrast, if interoperability starts too early or on terms that favour specific or limited players, costs rise and revenues fall, reducing providers' motivation and limiting usage. When incentives are aligned, interoperability makes services easier, which drives adoption and supports more advanced use cases.[32]

31. See Tracking the journey towards mobile money interoperability: Emerging evidence from six markets, GSMA, 2020 and The commercial sustainability of mobile money providers in interoperability initiatives, GSMA, 2024

32. Idem

Prescriptive approaches to interoperability have an inconclusive impact on adoption and competition, with negative effects on usage in some cases

National switches, often introduced through regulatory mandates, do not consistently lead to improvements in adoption or competition. In several cases, transaction values per active account decline following implementation.

Table 5 summarises the empirical effects of these regulator-led or national switch approaches on transaction values. In some instances, the results suggest a negative impact of such policies on the usage of mobile money services. Empirical estimations indicate that national switch policies may be associated with reductions in transaction value higher than 30%.

Table 5
DiD estimates of mandated interoperability (national switches) on transaction values (log-transformed)

	Transaction values USD (log-transformed)					
Mandated interoperability (national switch)	-0.3185** [0.1413]	-0.367** [0.1686]	-0.095 [0.072]	-0.447** [0.1876]	-0.711*** [0.2239]	-0.103 [0.106]
Controls	No	Yes	Yes	No	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Joint placebo test (Reject H_o?)	NR	No	No	NR	Yes	No
Estimation method	SA	B	CH	SA	B	CH
Observations	4,003	3,863	NR	2,341	2,138	NR
Sample	Global	Global	Global	Pure control	Pure control	Pure control

*Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors in brackets. 'SA' refers to Sun and Abraham (2021), 'B' to Borusyak et al (2024) and 'CH' to de Chaisemartin and D'Haultfoeuille (2020). 'NR' denotes not reported data. Average total effects presented for the CH estimations. Joint placebo test performed for first two pre-trends. Pure control refers to the experimental setup where the control group is restricted to observations with no interoperability of any type.*

Source: GSMA Intelligence

This may reflect design and governance challenges: rigid schemes can impose high costs, reduce differentiation and create free-rider problems, discouraging providers from investing in product innovation or agent networks. A previous study explores these particular models of interoperability.[33] For example, in Ghana, transaction failures following the introduction of the national switch undermined customer trust and slowed usage growth. In Tanzania, the transition to a centralised hub created complexity and introduced a single point of failure, which disrupted services and negatively affected provider operations. Similarly, TIPS in West Africa,[34] while offering standardisation and a single connection to all financial service providers, has faced barriers such as transition complexity and the risks of centralised failure – issues that have harmed customer experience and increased operational risk for providers.

Mandated models can level the playing field in theory, but if introduced too early or without cost-sharing mechanisms, they risk undermining the very incentives that drive market development. On this, for example, GSMA (2020)[35] notes that governance and pricing structures matter. When mobile money providers lack representation in decision-making, or when pricing models favour banks, the result is reduced commercial viability and weaker incentives to promote interoperable services. Conversely, where governance is inclusive and pricing reflects the mobile money business model, interoperability is more likely to support adoption and usage rather than hinder it.

Market-led interoperability after market maturity represents the maximum impact for mobile money adoption

The analysis shows that the combination of market-led interoperability and implementation after markets have reached maturity produces the most significant and consistent improvements in mobile money performance. When interoperability is introduced in markets where active usage is already high, measured by at least 50% penetration of active 90-day accounts, adoption increases by more than 6 pp relative to the baseline. This is the largest effect observed across all policy models and timing scenarios. The effects are consistent across all methodologies, and in the dynamic models they are mainly reflected two quarters after the policy is implemented, as shown in Figure 8.

33. The commercial sustainability of mobile money providers in interoperability initiatives, GSMA, 2024
34. TIPS refers to the Transfert Interbancaire et de Paiement Instantané system, a regional real-time payment switch implemented by the Central Bank of West African States (BCEAO) to connect banks and mobile money providers across the West African Economic and Monetary Union (WAEMU) region.
35. Tracking the journey towards mobile money interoperability: Emerging evidence from six markets, GSMA, 2020

Table 6

DiD estimates of market-led interoperability combined with market maturity in active 90-day account adoption

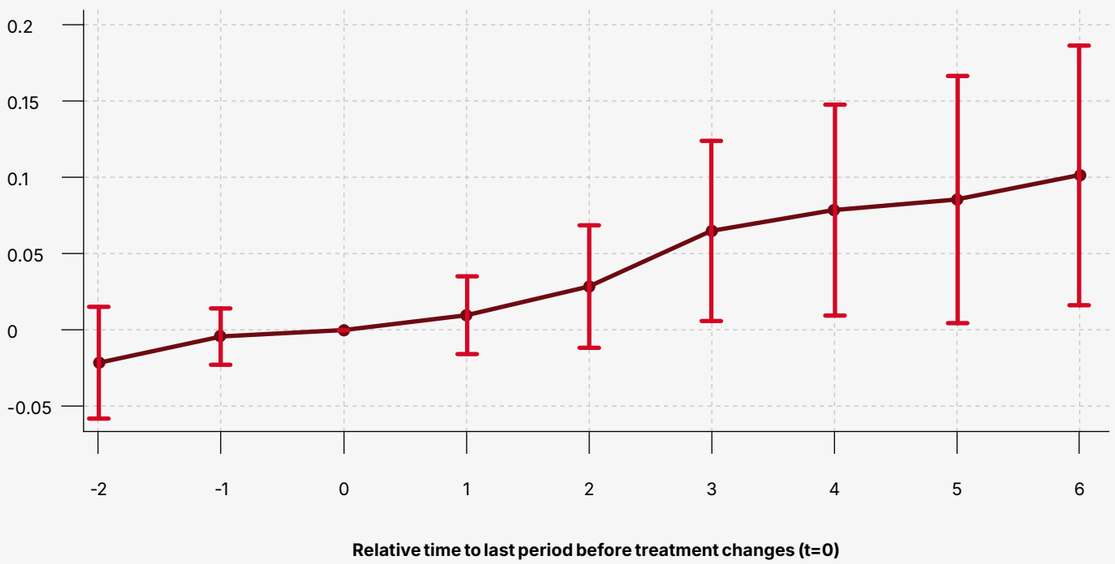
	Active 90-day account adoption					
Market-led interoperability after market maturity	0.394*** [0.0383]	0.527*** [0.034]	0.12*** [0.072]	0.463*** [0.047]	0.5862*** [0.070]	0.0603** [0.106]
Controls	No	Yes	Yes	No	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Joint placebo test (Reject H_o?)	NR	Yes	Yes	NR	Yes	No
Estimation method	SA	B	CH	SA	B	CH
Observations	4,488	4,444	NR	2,486	2,441	NR
Sample	Global	Global	Global	Pure control	Pure control	Pure control

*Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors in brackets. 'SA' refers to Sun and Abraham (2021), 'B' to Borusyak et al (2024) and 'CH' to de Chaisemartin and D'Haultfoeuille (2020). 'NR' denotes not reported data. Average total effects presented for the CH estimations. Joint placebo test performed for first two pre-trends. Pure control refers to the experimental setup where the control group is restricted to observations with no interoperability of any type.*

Source: GSMA Intelligence

Figure 8

de Chaisemartin and D'Haultfoeuille event study of market-led interoperability and market maturity on active 90-day account adoption



Source: GSMA Intelligence

Why does this combination deliver the strongest results?

The combination of market-led interoperability and implementation after markets have reached maturity delivers the most significant improvement due to a number of factors:

- **Network effects at scale:** Once a market has achieved critical mass, the value of connecting networks rises sharply. Interoperability at this stage multiplies the utility of each account by enabling transactions across the entire ecosystem of users, merchants and services.
- **Aligned incentives and sustained innovation:** Market-led models are introduced when providers recognise a commercial rationale for interoperability. This alignment ensures that integration costs are shared fairly and that providers maintain incentives to invest in product development and agent networks. Unlike rigid mandates, these arrangements preserve scope for differentiation, which supports ongoing innovation.
- **Positive impact on competition:** Evidence indicates that this combination not only accelerates adoption but also reduces market concentration, as measured by the HHI. By lowering switching costs while maintaining incentives for service improvement, market-led interoperability introduced at scale fosters a more competitive environment without undermining market sustainability.

This finding underscores the importance of sequencing and design. Introducing interoperability too early or through prescriptive models can impose costs that outweigh benefits and weaken investment incentives. In contrast, a market-led approach implemented after scale leverages existing momentum to deliver measurable gains in adoption and competition, while avoiding the risks associated with premature mandates.

Table 7

Summary of interoperability empirical impacts by policy type and market conditions[36]

Policy type/condition	Effect on adoption	Effect on competition	Effect on usage (value per active account)
Interoperability: all models combined	Increase	Neutral[37]	Neutral
Market-led	Increase	Increase	Neutral
Regulator-led	Neutral	Neutral	Decrease
Market-led after market maturity	Increase	Increase	Neutral

Source: GSMA Intelligence and GSMA Global Adoption Survey

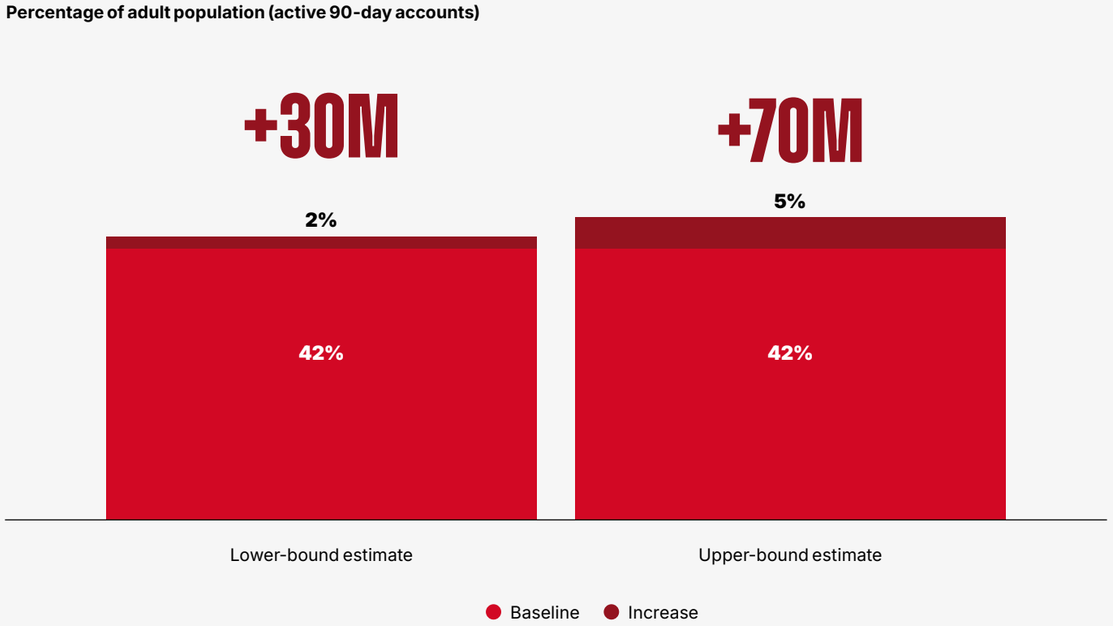
36. Due to limited variation in the sample, the analysis does not allow for a robust estimate of the impact of voluntary interoperability. Results for this category should therefore be considered inconclusive.
37. Neutral refers to cases where the results did not show a statistically significant effect or where findings were mixed across methodologies. This classification indicates that the evidence does not consistently support either a positive or negative impact.

Impact simulation of market-led interoperability after market maturity in mobile money adoption

The empirical results suggest that mobile money interoperability is more consistent and effective when it is implemented after a market reaches maturity and through market-led approaches. Figure 9 illustrates the estimated increase in active 90-day accounts under this scenario compared to a baseline without interoperability, using the most conservative policy effect estimated in Table 6, which corresponds to a treatment average effect of 6 pp under the de Chaisemartin and D'Haultfoeuille (2020) methodology.

Figure 9

Simulated impact of mobile money adoption of active 90-day accounts by interoperability under a market-led scenario after maturity, 2023



Source: GSMA Intelligence and GSMA Global Adoption Survey

The results show that in 2023, if countries had implemented market-led approaches of interoperability when the market was sufficiently mature, and avoided mandating interoperability when the market was in its early stages, there could have been between 30 to 70 million more 90-day active accounts of mobile money, equivalent to an absolute increase in adoption of 2–5 pp. This quantification highlights the policy significance of timing and model choice: when interoperability is both market-led and introduced after a market has achieved scale, it becomes a powerful driver of financial inclusion and competitive market outcomes.

6

Conclusions and policy implications

The analysis carried out in this study confirms that interoperability can significantly increase mobile money adoption. However, its impact on competition and usage depends on how and when it is implemented. Interoperability introduced after markets have reached scale and through models that align incentives and are commercially sustainable delivers measurable benefits. Conversely, early or restrictive mandates can lead to neutral or negative outcomes, particularly for transaction values.

Below are the key findings from the study:

1. Interoperability consistently supports adoption, but competition effects vary: By reducing switching costs and expanding network effects, interoperability makes mobile money more valuable to users. This drives higher adoption across markets. However, the effect on competition is mixed when all policy models are combined. While some markets show reduced concentration, others remain unchanged, reflecting differences in timing and between approaches.

2. Maturity must precede interoperability: Introducing interoperability before a market achieves sufficient scale offers limited benefits and can even harm adoption and usage. When implemented too early, integration costs and free-rider risks outweigh the gains, discouraging investment and innovation. After scale is reached, the benefits dominate and interoperability strengthens both adoption and competition.

3. Market-led models outperform alternatives: Market-led interoperability delivers the most consistent positive outcomes: adoption rises significantly and market concentration declines without negative effects on usage. These models work because they combine commercial alignment with other enablers, such as shared governance, sustainable pricing and transparent operational rules. These elements reduce risk, protect investment incentives and deliver a better user experience.

4. National switches show no measurable effect on adoption or competition and can harm usage: Empirical results indicate that mandated national switches do not produce consistent gains in adoption or competition. In several cases, they are associated with declines in transaction values per active account. This suggests that rigid, centralised models can undermine incentives for innovation and reduce service quality when introduced without regard to market readiness.

5. Market-led interoperability combined with market maturity delivers maximum impact: This combination produces the strongest and most reliable results. When interoperability is introduced after markets have reached scale, adoption increases by over 6 pp relative to the baseline and market concentration falls. This approach leverages network effects at full strength while maintaining incentives for investment and innovation.

Interoperability should be implemented in a way that maximises benefits while minimising risks. This requires the following:

- **Prioritise timing:** Interoperability should not be mandated in nascent markets. The focus should first be on enabling conditions for scale, such as agent networks, liquidity and consumer trust.
- **Favour market-led or market-informed models:** These approaches combine commercial viability with operational safeguards, reduce free-rider risks and maintain incentives for innovation. They also allow providers to shape governance and pricing frameworks, which is essential for sustainability.
- **Design governance frameworks that support competition:** Rules should ensure fair access while maintaining incentives for service improvement and product differentiation.

When implemented under these principles, interoperability becomes a strategic lever for expanding financial inclusion and fostering competition, without compromising sustainability or innovation.

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Appendix

Table A1

DiD estimates of interoperability for HHI in active 90-day accounts and transaction values

	HHI (active 90-day accounts)			Transaction values USD (log-transformed)		
Interoperability	-0.0348* [0.020]	-0.088*** [0.030]	-0.0074 [0.0114]	-0.073 [0.107]	-0.37** [0.1736]	-0.044 [0.0068]
Controls	No	Yes	Yes	No	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Joint placebo test (Reject H_o?)	NR	No	No	NR	Yes	No
Estimation method	SA	B	CH	SA	B	CH
Observations	4,009	4,180	NR	4,003	3,379	NR
Sample	Global	Global	Global	Global	Global	Global

*Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors in brackets. 'SA' refers to Sun and Abraham (2021), 'B' to Borusyak et al (2024) and 'CH' to de Chaisemartin and D'Haultfoeuille (2020). 'NR' denotes not reported data. Average total effects presented for the CH estimations. Joint placebo test performed for first two pre-trends.*

Source: GSMA Intelligence

Table A2

DiD estimates of interoperability without market maturity for active 90-day accounts and transaction values

	Active 90-day accounts share			Transaction values USD (log-transformed)		
Interoperability + no maturity	-0.24*** [0.021]	-0.0062 [0.0561]	-0.0023 [0.0105]	-0.088 [0.1009]	-0.008 [0.168]	-0.0010 [0.087]
Controls	No	Yes	Yes	No	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Joint placebo test (Reject H_o?)	NR	Yes	No	NR	No	No
Estimation method	SA	B	CH	SA	B	CH
Observations	4,488	4,136	NR	4,003	3,596	NR
Sample	Global	Global	Global	Global	Global	Global

*Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors in brackets. 'SA' refers to Sun and Abraham (2021), 'B' to Borusyak et al (2024) and 'CH' to de Chaisemartin and D'Haultfoeuille (2020). 'NR' denotes not reported data. Average total effects presented for the CH estimations. Joint placebo test performed for first two pre-trends.*

Source: GSMA Intelligence

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