Inclusive Instant Payment Systems

An Evidence-based Approach from Design to Impact AUGUST 2022

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1. Executive Summary

Inclusive Instant Payment System (IIPS) have the potential to transform the landscape for consumer and merchant payments in emerging markets and spur the transition from cash to digital. They do so by providing a fast back-end interface between financial service providers' (FSPs) transaction ledgers, allowing clients with different FSPs to transact (send and receive funds) near-instantly. By eliminating the risks of delayed transaction clearance, these systems enable several use cases that can increase the attractiveness of digital payment systems.

While several reports have discussed the optimal engineering, design, and regulation of these systems, relatively little has been written about implementing evidence-based policies to promote these systems. We contribute to the global discourse around IIPS by (1) showing how economic insights can help us form expectations around the potential impact of these systems, and (2) providing guidance on monitoring, evaluating, and generating evidence-based policies. We do so by:

1. Outlining a theory of change for how these systems might impact the payments economy, consumers and merchants, economic efficiency, social welfare, and the broader macro-economy;
2. Providing preliminary hypotheses on how these impacts will play out in practice;
3. Discussing unique issues that may arise when undertaking data-driven research on these systems;
4. Reviewing key policy issues around IIPS and how economic insights can help to guide policy decision-making; and
5. Providing a framework for monitoring, evaluation, research, and learning (MERL) in the context of these systems, which organizations can adapt to their own evidence needs.

The white paper is written in a modular format with largely self-contained sub-sections to enable readers to jump to topics and sections of relevance.

Why do fast, interoperable retail payment systems matter?

Cash remains the payment instrument of choice in many emerging economies, especially for low-income merchants and consumers, who value its full interoperability, privacy, instant clearance, and zero transaction costs. While mobile money and online banking applications have spread rapidly, many low-income consumers have adopted digital payments for remittances and long-distance transactions, but little else. Legacy payment rails are often still associated with a delay of hours or days to transmit funds between two different FSP accounts or wallets, which can hinder use of digital payments between merchants and suppliers. In contexts with weak identity verification and rule-of-law, the lack of capacity to manage delayed transactions and fraud risk creates significant barriers to several payments use cases.

IIPS have the potential to create a more cash-like experience in at least **three broad use areas**, while simultaneously leveraging the virtues of digital transactions: overcoming distance and enhancing security.

1. **Person-to-Person Payments (P2P):** In many countries, cross-network payments are not possible for mobile money users because telecommunications-based mobile money systems do not have access to bank-oriented payment clearing houses. Even if they do, transfers through the banking system are often slow and expensive. These off-network payment frictions generate various inefficiencies, leaving users to only transact with clients of the same FSP, or to hold accounts with multiple providers (to "multi-home").
    - IIPS can reduce the frictions to P2P off-network transfers, making payments more efficient.
2. **Peer-to-Merchant Payments (P2M):** In many emerging markets, cash is dominant for merchant payments at point-of-sale. Digitizing these transactions is difficult in the absence of interoperability, given the coordination costs merchants and consumers face in jointly adopting a new payment technology.
    - IIPS can enable convenient digital payments for merchants without requiring the payer and payee to have the same FSP. This allows for a cash-like experience through payment technologies like QR codes and smartphone payment scans, along with seamless integration with the emerging online shopping economy.
3. **Government-to-Person Payments (G2P):** Ideally, Governments would be agnostic to their citizens' financial service provider when it comes to distributing social protection transfers or bond dividends, or collecting payments from tax to public utility fees. In practice, they often need to sign and manage bilateral agreements with multiple payments providers, or mandate recipients to use one or two FSPs. This can potentially deny benefits to citizens without access to government-approved FSPs.
    - IIPS can provide the infrastructure for governments to be fully provider agnostic, maximizing the efficiency and inclusivity of digital government payments.

Expect the unexpected: hypotheses about the impacts of fast payment systems

It's difficult to make definitive statements about the impacts of IIPS. Such a fundamental change to the financial system rails is inherently complex, and simultaneously structured by and reshaping several economic, social, technological, and political factors. Keeping this in mind, to advance research and evidence-based policymaking we develop a broad Theory of Change that delineates a ***process*** of potential impact which includes: 1) switch development and launch; 2) to FSP integration and end-user uptake; 3) changes in financial behavior among consumers, merchants, and FSPs; and 4) efficiency gains and welfare effects through macro-economic change. Of course, the process could stall or outright fail anywhere along the way – e.g., low uptake for any reason would reducing downstream effects and overall impact.

What ***should*** we expect? Again, it is difficult to say definitively, as evidence on IIPS in emerging markets is scarce. We try to generate insights from payment networks that share characteristics with IIPS. For example, M-Pesa has been a highly successful closed-loop mobile money payment network in Kenya, with such widespread adoption ensuring that nearly all consumers and merchants can transact through the network, proxying an open-loop network with multiple providers. But its strength may also be its weakness – while adoption has been remarkable, M-Pesa's near-monopoly hold on the market may have weakened incentives to drive further innovation and reduce costs. Would an open-loop system with multiple competing providers overcome these limitations? The literature on payments systems in more advanced economies, particularly debit and credit card networks, also provides some lessons. Furthermore, we look to the short history (less than five years in most cases) of IIPS in emerging markets. While there have been some notable success stories, such as the catalytic effects of the Unified Payments Interface (UPI) in India, other IIPS have been slower to scale.

Overall, more research is needed. Many issues are likely to be important:

1. Individual adoption of off-net payments: This gets at traditional questions around technology adoption: e.g., pricing, information, digital and financial literacy, social learning.
2. Network effects in adoption: Off-net payments use cases, such as point-of-sale merchant payments, raise coordination challenges (known colloquially as the chicken-and-egg problem)—both consumers and merchants need to adopt simultaneously. Consumers need to be willing to hold digital wallet balances, and merchants to offer them ways to pay digitally and manage their business finances digitally.
3. Impacts: How much should we expect? On the consumer side, is it possible that reducing multihoming will only yield marginal benefits to consumers? Catalyzing the transition from cash to digital merchant payments has the potential to be transformational, but how much does the lack of interoperability matter vis-à-vis other constraints to digitization? Making government payments more efficient should reduce leakage and exclusion, but how transformative could this be?

4. Pricing: How sensitive are consumers and merchants to prices? What is the price elasticity of demand of consumers? What discount rate will merchants be willing to bear for retail payments?
5. Market structure and innovation: Interoperability has the potential to reduce network advantages of incumbent market players. Does this provide opportunities for smaller FSPs and new entrants, such as financial technology companies (Fintechs), to capture market share by offering innovative services and products? How do larger FSPs respond? Does this drive down prices, improving consumer welfare?

Key Issues for Policy

We highlight four key policy areas where economic insights and analysis can add value to the discussion around IIPS:

1. What to build and when. Interoperability can level the competitive field between FSPs. In general, more competition should be better for consumers, lowering prices and driving innovation, and for new entrants who could immediately access a large customer base. However, interoperability can act like a tax on the infrastructure of incumbent FSPs, forcing them to share mobile money agents, branches, and other payments processing infrastructure. This can reduce their incentive to expand financial inclusion; for example, , they might be less likely to build out mobile money networks in more remote areas if their agents will be processing transactions for all FSPs. Hence, policymakers need to think carefully about when and how to bring about interoperability. Too much, too soon, could weaken providers' incentives to invest in building out financial services infrastructure.
2. Spurring adoption. Once a payments switch rolls out, policymakers want to spur adoption of off-net payments and associated use cases, such as interoperable QR-based merchant payments. Is awareness-raising enough (e.g., public marketing campaigns), or is it better to focus on encouraging providers to use their resources to build out and market use cases? Leveraging the energy of the private sector requires getting the incentives right and giving them real voice in the governance of the new payments system.
3. To price or not to price? A key question for regulators is whether they should control off-net payments pricing (the fee that FSPs charge users to send a payment between two FSPs' user networks) and merchant payment fees. The consumer-centric approach seems to be to cap or even "zero price" these fees. However, by squeezing FSPs' margins, such restrictions can backfire by reducing the incentives of providers to provide and promote payments services, e.g., acquiring merchants in the P2M use case. If consumers are not too sensitive to these fees, restrictions might not even make much difference for financial inclusion. Regulators may need to consider whether they want to encourage a payments ecosystem in which FSPs derive significant revenue from processing payments, or in which low-price or free fast payments provide a platform for other value-added services.

4. Governance. How should power over switch management and development be allocated? Should it be centrally-controlled, like a public utility, or should there be strong financial services industry leadership, with the government mainly providing regulatory guardrails? The answer to this question can vary over the lifetime of a switch.

Adding to the Tool Kit: Measurement and Research Design

Research on IIPS adds additional complexities to existing research challenges around digital financial services (DFS) and the market for payments.

Researchers studying DFS are already well-acquainted with the challenges of measuring the usage of DFS. It is typically ideal to receive objective, administrative data on payments usage directly from an FSP, subject to first obtaining informed consent from the respondents. We call this ***centralized*** data access. However, it can be difficult to access such datasets due to privacy regulations and finding a willing FSP partner. Accessing centralized data can be even more challenging if researchers are provider-agnostic and hence would either need to form agreements with multiple FSPs or access data from a centralized entity that collects data from multiple providers.

Hence, we also discuss potential ***decentralized*** solutions to collect payments usage data. One approach would be to survey users about their financial transactions, but this might suffer from significant recall error. If we collect data more frequently to mitigate recall error, it is more costly and may bias users' behavior as they are reminded that their digital payments activity is being monitored. We discuss alternative, less invasive decentralized solutions like working with users to download their financial transaction records from their transaction interface, or installing passive data collection apps, though these possibilities need more field testing.

Research on off-net payments sits at a fascinating intersection of research on DFS in emerging markets, and market- and platform-level research analysis that falls under "industrial organization" (IO). We advocate for the use of the best available research methods to address causal research questions – typically impact evaluation methods like randomized controlled trials and quasi-experiments. However, we also recognize that introducing a payments switch is a financial system-level change that is not directly amenable to randomization over individual treatment units. Hence, we advocate for fruitful combinations of techniques from both toolkits. For example, using impact evaluations to tell us about behavioral responses at the individual consumer or merchant level, and then embedding those behavioral parameters into models that can help us analyze market- platform- and economy-level outcomes.

If You Don't Measure it You Can't Improve it: Monitoring, Evaluation, Research, and Learning (MERL)

We advocate for every switch implementation to include a suitable strategy to monitor and evaluate progress, learn, and make improvements. While it is easy to get consumed with engineering, onboarding, adoption, and governance challenges, we recommend that implementers take time to think through how they define success, potential red flags and early warnings of unintended consequences, and the real-world impacts they would like to achieve, and use that to develop a set of indicators that can be feasibly measured and reviewed on a regular basis. We recommend that the process of creating such a strategy gives voice to all relevant stakeholders.

We provide a template for a MERL strategy, including:

1. An overall workflow to develop the strategy, including workshops with key stakeholders;
2. Guidance on how to develop a Theory of Change;
3. Guidance on how to identify learning questions, key performance indicators, and data collection approaches;
4. While the preceding step can generate a plethora of indicators and possibilities, we recommend using the Credible, Actionable, Responsible, and Transportable (CART) approach to narrow the options;
5. Tips on developing the MERL Plan;
6. Tips on executing the MERL Plan.

Implementers should feel free to use and adapt any of this content to inspire and guide their own MERL journey.

"Woman in small shop Ghana" by Arne Hoel, World Bank (CC BY-NC-ND 2.0)

2. Introduction

In the last two decades, there has been a substantial expansion in access to information and communication technologies (ICT) globally that opens the door to build more inclusive digital financial systems. In emerging markets in particular, mobile networks have rapidly expanded access to ICT, with as many as five billion unique mobile phone users in the world and nearly five billion internet users.[1] While internet and mobile financial services have benefited the banked, expansion of ICT offers a unique opportunity to broaden financial service access in emerging markets where bank account access is far from universal, and in most cases is well below 50 percent (Demirgüç-Kunt et al. 2018). Mobile money systems, often operated by telecommunications companies (telcos) rather than banks, surpassed 1.2 billion users in 2020[2] and have accelerated user acquisition during the COVID-19 pandemic.[3] Phones also provide easier access to mobile banking and services from financial technology (fintech) providers.

However, the rapid growth in access to financial services has largely occurred through creating isolated closed loop user networks attached to individual financial service providers (FSPs). Options for clearing payments between FSPs tend to be relatively slow and expensive, often inaccessible to the many emerging mobile money, microfinance, and fintech users accessing digital wallets in low-income countries. The fact that financial inclusion in emerging markets is largely occurring through digital channels opens the door to build native digital payment systems that reduce, if not remove, the barriers between FSPs. Cutting-edge, fast,[4] interoperable, retail payments systems (IIPS)[5] that fully leverage the digital revolution and reduce barriers for the unbanked are beginning to replumb financial systems and yield new use cases. In this white paper, we present a stylized framework that captures the potential impacts of such systems on users and the broader economy as well as a research agenda for assessing these impacts that aims to inform decision making by the public and private sectors.

We focus on IIPS that aim to enhance the economic resilience and well-being of the poor in emerging markets while generating economy-wide efficiencies by interlinking fragmented financial networks and integrating new users into the financial system. Three distinguishing dimensions of these systems include:

1 DataReportal. "Digital Around the World." https://datareportal.com/global-digital-overview.

2 GSMA. "Mobile Money Accounts Grow to 1.2 Billion in 2020." Newsroom, March 24, 2021, https://www.gsma.com/newsroom/press-release/mobile-money-accounts-grow-to-1-2-billion-in-2020/

3 GSMA, "State of the Industry Report on Mobile Money 2021," March 12, 2021, https://www.gsma.com/mobilefordevelopment/blog/assessing-mobile-money-consumer-trends-in-the-wake-of-the-covid-19-pandemic/

4 Interoperable payments will be referred to as instant, although in some cases the payments are near-instant or rapid payments. Front-end payments are typically instant, while back-end settlement payments may require slightly longer processing times.

5 While interoperability can technically refer to any system allowing for payments transfers between FSPs, in this white paper we always use this term as short-hand for fast, low-cost interoperable digital payments systems.

1. Fast: Payments should be as seamless as cash—the payments technology of choice for many low-income users. Like cash, payments should be real-time, irrevocable and "push" only, with same-day settlement between users' FSPs. But better than cash, such a system enables bulk payments operated at a lower cost than batch settlement, which typically involves pull payments from payees, raising settlement risks. Same-day settlement between users' FSPs is vital; many FSPs have 100 percent reserve holding requirements so further reserves held to backup unreconciled net transaction imbalances between FSPs would raise excessive liquidity requirements if transfers are seldom cleared.
2. Interoperable: The system should be open-loop, accessible to all FSPs in a country, and leverage public international standards.
3. Retail: These systems are designed to facilitate high-volume, low-value transactions between and across consumers, merchants, FSPs, and government, building on existing real time gross settlements (RTGS) and traditional inter-bank payment clearing houses.

In addition, we are particularly interested in IIPS aligned with the Level One Principles, an initiative of the Bill & Melinda Gates Foundation, (Bill & Melinda Gates Foundation 2019) including:

1. The system should have pro-poor governance that is supported and regulated by the government and based on tiered know your customer (KYC) requirements tailored to usage.
2. The system should operate on a not-for-loss or cost-recovery-plus-investment basis, so the payments switch (or switch) itself is not-for-profit. Participating FSPs can make profits through the products and services they offer through the system.
3. FSPs should share the cost of investing in fraud detection and other scheme and platform services so that these services can be provided at low cost.

What impacts would we expect from introducing IIPS in emerging economies? While a long tradition in economics tells us that reducing barriers to transactions and trade enhances economic activity, competition, and efficiency, there are at least four reasons to consider these issues more deeply. First, a vast literature in economics tells us that the standard "***new technology and more competition are better***" predictions can go wrong, particularly in complex systems with asymmetries of power and information between parties. Second, while IIPS are characterized by a set of core dimensions, there are still a number of open questions on optimal design and implementation of such systems. For example, more in-depth research is needed on how to implement pricing rules to enable not-for-loss or cost-recovery-plus-investment economic models. Third, the successful rollout and use of IIPS among individual merchants and consumers (rather than among banking entities) raises a host of issues, such as around marketing and socialization, digital and financial literacy, user interface optimization, and product and service design, which have not been studied in the context of interoperability. Finally, it is

important to evaluate the impact of use cases to understand where they are succeeding, and where they are falling short of expectations or even creating unintended effects, to guide the allocation of resources and optimize such systems. We advocate for designing and planning payments system reforms by drawing on evidence-based insights from careful research.

The rest of the white paper is organized as follows. In the next section we briefly review the history of inter-FSP payment networks and highlight why the backbone of many payment systems has not been optimized to provide an attractive alternative to basic payment technologies like cash, particularly for lower-income users in emerging economies. We then outline a stylized framework, or Theory of Change, to illustrate the potential impact pathways of IIPS. We divide the framework into four phases: (1) backend integration to the switch by FSPs; (2) initial user integration and adoption, and the potential cost reductions as consumers and merchants transact more efficiently between FSPs; (3) subsequent market responses, including pricing, product adaptation, and innovation; and (4) dynamic market impacts arising from competition, innovation, and consolidation. Across these phases, we assess impacts on four core stakeholder groups—FSPs, merchants, households, and the government. The next section highlights potential effects of different use cases focusing on P2P (person-to-person), government-to-person (G2P) and merchant payments, before turning to regulatory considerations.

Beyond clarifying the complex and dynamic effects arising from interoperability, the Theory of Change framework helps to outline an empirical research agenda—which is essential for advancing learning on this nascent research program. Given the dearth of empirical research on IIPS to date in emerging economies, to motivate potential hypotheses, we draw on the limited available evidence from more advanced economies and from analogous technologies, such as mobile money and payment card networks. We also highlight important gaps in knowledge that would merit further research. We conclude the paper with three other critical research considerations in this field: regulatory considerations around IIPS; unique quantitative research challenges raised by payments interoperability, especially when it comes to measurement; and suggestions on how to approach monitoring and evaluation (M&E) of interoperable payment systems.

Note: Inclusive Instant Payment System (IIPS) is emerging globally as a common term to describe the systems we have in mind in this report. They offer instant payment clearance across payment networks, and they are designed with small, retail payments as one of their major use cases. They are inclusive in the sense that they process payments that are relevant to a broad range of users, including low-income users, and support financial service providers such as mobile money companies and microfinance institutions that may serve marginalized users. However, we want to emphasize that while a system may or may not be inclusive in its design, whether or not it is inclusive in practice is an issue to be evaluated. We do not mean to endorse the inclusivity of any system ex ante, in this report

3. Why Inclusive Instant Payment Systems Matter

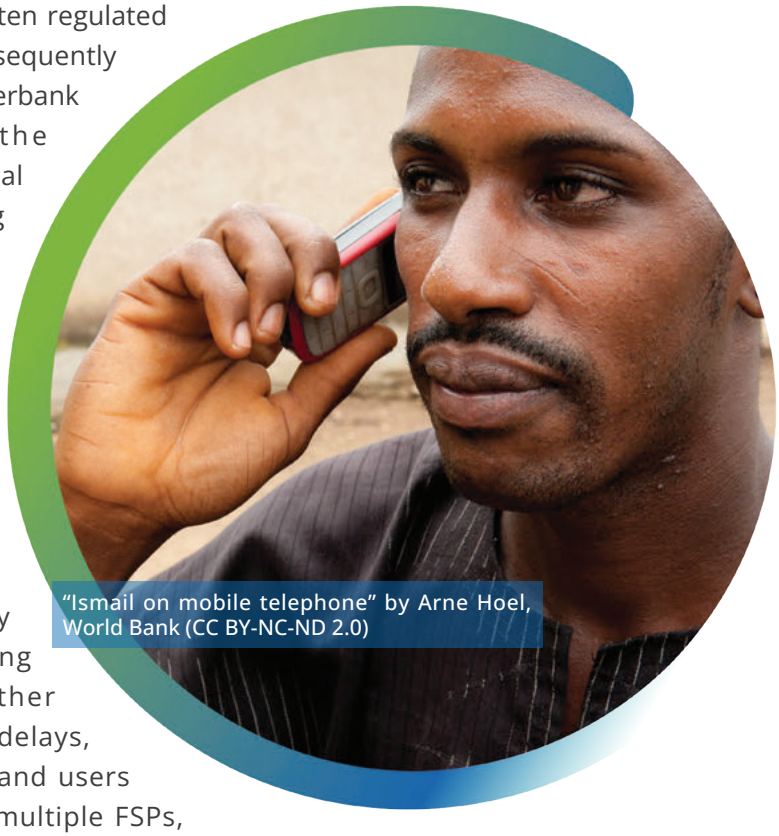
Interoperability has been a key driving force in the design of financial systems throughout history. Consider the adoption of money. It is generally accepted that the financial technology arose out of the need for a medium of exchange to overcome the problem of "the double coincidence of wants" that plagued barter economies (Jevons 1876). The invention of money proved transformative as it not only drove down transaction costs for buyers and sellers, but it widened the potential network of actors with which one could make financial transactions (Menger 1892)—two fundamental benefits we theorize follow from interoperable payments systems.

As Adam Smith (1776) averred, historically precious metals, particularly gold, served as the dominant currency of exchange due to their durability and divisibility, as well as their uniformity and limited (or slowly-growing) supply. The drawback of (heavy) physical mediums is the costs of making transactions in large amounts and over long distances. Enter banks, which originally emerged as warehouses to store physical mediums of exchange. The issue of paper receipts of deposit, which could be exchanged in the market without needing to move the physical gold, revolutionized commerce. The advent of banking further set in motion the use of financial intermediaries to make payments. In most countries, the plumbing of the banking and payments system has been retrofitted out of these technologies from the pre-digital era. Evidence from 14th century Venice shows early proto-banks hosting clients' accounts and providing transfer of value services between clients of the same bank (Boel 2019). By the 1660s, London goldsmiths, early bankers due to their capacity to safely hold deposits for clients, were creating money and an inter-bank payments network by issuing notes backed by specie (e.g., gold) deposits. The goldsmiths settled net differences in transactions between their respective clients in specie every few days (Boel 2019). As economic activity grew, a daily bilateral and then a multilateral net settlement system emerged at Bankers' Clearing House in London in 1841. This system could be cumbersome because net settlements were still traded physically which raised costs and security risks. In the first half of the 19th century, banks in the United States created the first settlement bank that would host deposits from all other banks thus initiating the first entirely paper settlement. The Bank of England adopted this multilateral net settlement function from Bankers' Clearing House in 1854 (Boel 2019). This net payment settlement framework, updated with electronic ledgers and messaging, continues to dominate much of the global banking system.

Today, most countries' retail payments transfers (by consumers and merchants) occur through automated clearing houses (ACHs) that compile batches of low-value transfers and settle them on a net basis between banks once per business day, typically overnight. A similar system governs bulk and wholesale transfers. Global bank transfers rely on ad hoc transfer networks between international banks and can take a number of days. Retail payments innovations such as the widespread use of checks, credit cards, debit cards,

and automated teller machines (ATMs) that leverage technologies like electronic funds transfer at point of sale (EFTPOS), spread rapidly in advanced economies in the second half of the 20th century and greatly facilitated retail trade by providing reliable, cash-free point-of-sale (POS) payments. However, these systems still largely rely on overnight clearance through the inter-bank transfer network and raise administrative burdens such as anti-fraud mechanisms and administration of credit oversight for credit cards. These networks are also almost exclusively accessible through banks, which generally continue to rely on physical branch networks, a fixed cost that gets passed on to customers. This has rendered these payment systems widely inaccessible in emerging markets, due to their high transaction costs and slow processing times.[6] According to the 2017 Findex survey, 63 percent of households in developing countries had access to a formal financial institution (such as an account with a bank or mobile money provider), leaving over 1.7 billion unbanked adults (Demirgüç-Kunt et al. 2018). Online payment technologies like PayPal, Venmo, Wise, and cryptocurrencies often rely on user interfaces that require bank account access or other channels that involve the use of a form of personal identification, which is a challenge for low-income users.

The financial institutions most rapidly onboarding lower-income users in emerging markets, such as mobile money companies and microfinance institutions, are often regulated separately from banks and consequently lack direct integration to the interbank payments system. Hence the structure of the current financial system, particularly in emerging markets, has evolved to require FSPs to manage separate user networks, which makes transacting between the networks very difficult due to their closed loop systems. Clients of non-bank FSPs are often unable to directly transact between user networks. These frictions have many practical implications including high transaction fees and other associated costs, transaction delays, duplication of FSP resources, and users forced to hold accounts with multiple FSPs,



"Ismail on mobile telephone" by Arne Hoel, World Bank (CC BY-NC-ND 2.0)

6 While credit, debit cards and checks allow for instantaneous payment at point-of-sale, in practice the final settlement may not actually occur for a number of days, putting account balance updating on hold and raising risks of transaction reversal. This drives up administrative and fraud-mitigation costs in the payment system.

otherwise known as multi-homing. This system also increases costs for governments. For example, to efficiently distribute social protection payments, governments need to either compel beneficiaries to acquire accounts with a select few FSPs or disburse payments across the universe of financial institutions. In terms of retail commerce, creating a user-friendly system for consumers to pay merchants at the point of sale from a digital wallet of their choice is challenging. Moreover, the current system benefits FSPs with larger user networks as they conduct a larger number of on-network transactions and amass market power. The burden of building a user network might prevent innovative financial products and services from scaling as fast as they could if the largest FSPs do not introduce them to their users.

The upshot is despite the advent of more accessible and advanced financial technologies, such as card payments and mobile money, low-income end-users continue to face formidable barriers to financial inclusion and remain dependent on cash as the interoperable payment option of choice. For example, in Mexico, it is estimated that cash payments accounted for 93 percent of retail, rent, utility, service, and public transportation transactions in 2018 compared to 26 percent and 33 percent in the United States and Canada, respectively.[7] The attributes that enabled money to replace barter thousands of years ago continue to appeal for many consumers and merchants. Cash allows for instantaneous transactions; once money changes hands the recipient can reuse it. Within a given financial system, it is universally accepted and requires no existing relationship between buyer and seller. It entails no direct transaction fees and requires no additional technological prerequisites.[8] Until a payments system rivals cash on these important dimensions it is unlikely to supplant the age-old medium of exchange.

IIPS are a next key step in the evolution of financial systems to provide a digital alternative to cash, particularly in emerging markets. Early versions of these systems emerged in some advanced economies in the latter decades of the 20th century, with early developments in emerging markets in the 2000s. Preceding the mobile phone revolution, some early systems were browser based, and hence inaccessible to many potential users, seeing relatively little take-up. The mass expansion of mobile phones and mobile money across emerging markets in the 2010s set the scene for phone-based user interfaces, and a large number of countries began to develop and launch IIPS, with many more under development and set to launch in the 2020s. In Appendix I we provide a list of IIPS across emerging markets, with additional information including their launch year, whether they offer QR-based payments, and whether they were primarily developed by a government authority rather than other parties (typically industry).

In Figure 1 we illustrate the growth of four key emerging market IIPS: CoDi (Mexico), InstaPay (Philippines), Pix (Brazil), and UPI (India), which have all launched since 2016. In

7 Federal Reserve Bank of Dallas, "Mexico Seeks to Reduce Consumers' Longstanding Reliance on Cash." Southwest Economy, First Quarter 2020, https://www.dallasfed.org/research/swe/2020/swe2001/swe2001c

8 "Cash Is King in Merchant Payments," CGAP, October 2019. https://www.cgap.org/research/publication/cash-king-merchant-payments

the top panel we display the growth of transactions going through the switch (i.e., off-net payments) in per capita terms since switch launch, while in the bottom panels we display the share of ***all*** domestic electronic transactions processed by the IIPS in the first 2 years after launch (left panel), and up to 6 years after launch (right panel). Domestic electronic transactions include on-net and off-net digital payments, including transfers between mobile wallets and bank accounts, and credit and debit card payments, excluding international transfers and remittances.

"Three mobile money agents" by Fiona Graham, WorldRemit (CC BY-SA 2.0)

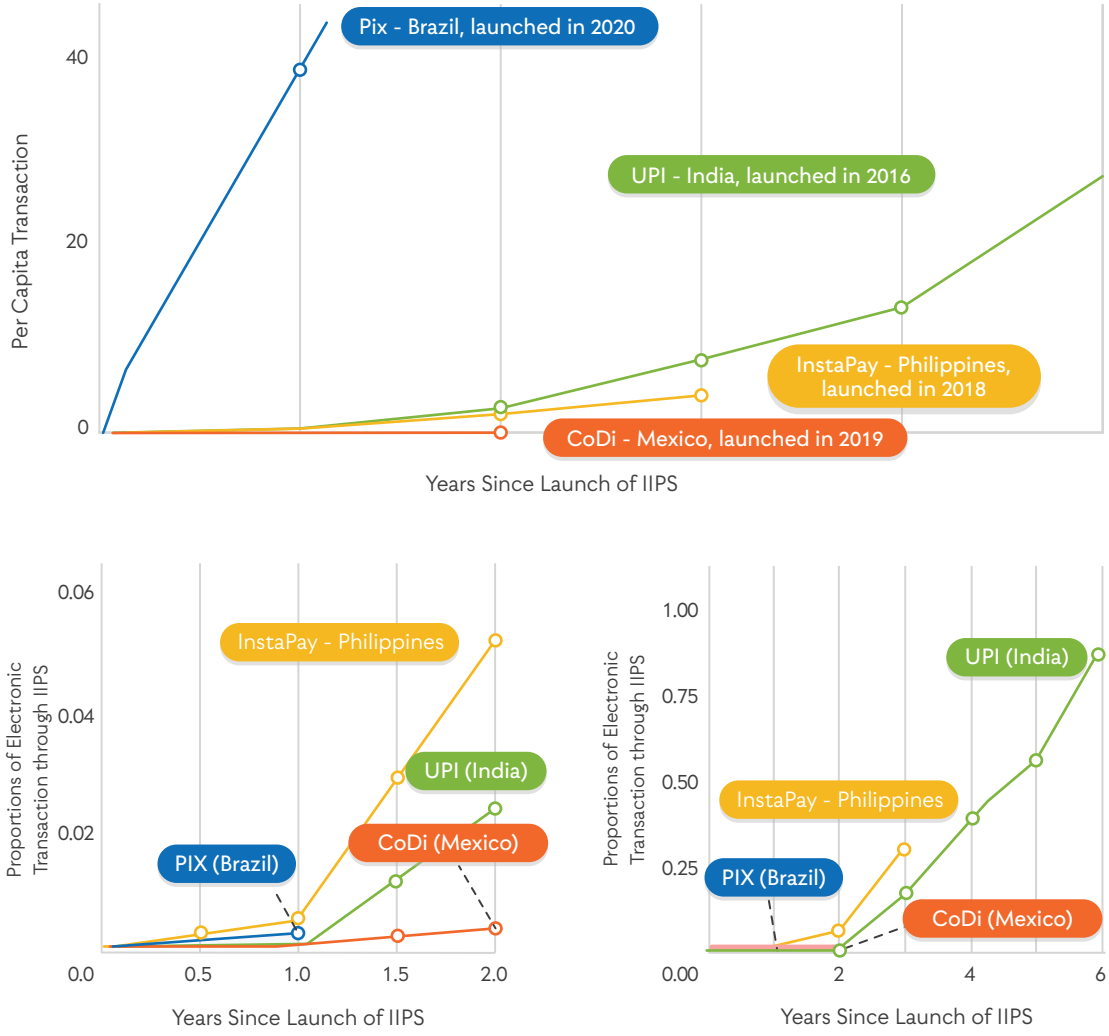


Figure 1: Per capita Transaction Volumes through various IIPS[9] [10] [11] [12] [13] (top) and the Proportion of Digital Payments through the IIPS after 2 Years[14](bottom left) and 6 Years[15] (bottom right)

9 National Payments Corporation of India (NPCI), "UPI Ecosystem Statistics" June 2022. https://www.npci.org.in/what-we-do/upi/upi-ecosystem-statistics

10 Bangko Sentral ng Pilipinas (BSP), "InstaPay Volume and Value (April 2018 – May 2022)" May 2022. https://www.bsp.gov.ph/PaymentAndSettlement/Instapay.pdf

11 Banco de México, "Operaciones realizadas a través de CoDi (CF884)" [Operations carried out through CoDi - (CF884)], May 2022. https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=21&idCuadro=CF884&accion=consultarCuadro&locale=es

12 Banco Central Do Brasil, "Detalhamento do Gráfico Pix Transactions" [Graph Detailing Pix Transactions], June 2022. https://www.bcb.gov.br/estatisticas/detalhamentoGrafico/graficospix/PixTransactionsAmount

13 World Bank, "Population, total" May 2022. https://data.worldbank.org/indicator/SP.POP.TOTL?view=chart

14 Data used in Figure 2.

15 Data used in Figure 2.

First, these figures illustrate the tremendous growth usage of IIPS in some markets – e.g., in Brazil and India there are more than 25 transactions per person per year going through the switch, which Pix achieved within its first year. Second, in the bottom panels we see how context and level of development of the payments sector matter. While Pix shows tremendous performance in the top panel, we see that within a year of launch it is well in line with the other IIPS in its overall share of electronic transactions, suggesting a much more developed electronic retail payment sector in Brazil. Third, these figures provide circumstantial evidence on the role of IIPS in driving digital payments, and perhaps financial inclusion. As we will see later, the performance of Pix in the top panel is also misleading, as Pix was launched at a time when there was already a tremendous uplift in the use of digital payments in Brazil. We see that in the Philippines, InstaPay has quickly grown to above a 25 percent market share of electronic payments, while UPI has steadily grown to take a 75 percent market share in electronic payments. Yet, UPI emerged during a period with two other groundbreaking drivers of digital payments – demonetization in late 2016, and the COVID-19 pandemic starting in 2020. While these figures hint at the impact of IIPS, they also raise a lot more questions for careful research to address.

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4. Theory of Change

Historical legacies in the development of finance in many emerging economies have bequeathed not only highly fragmented formal financial systems but deeply unequal ones that do little to service most of the population who continue to rely on cash. What might be the impact of building and deploying new open-loop financial systems? Here we provide a stylized Theory of Change to consider the impacts of IIPS.

The framework, illustrated in Figure 2, is divided into four phases: (1) onboarding—technical integration, piloting, and negotiation over rules, standards, and pricing; (2) cost reductions and efficiencies—due to initial user integration and adoption as consumers and merchants are able to transact across FSP networks; (3) behavioral and organizational change—as FSPs, merchants, consumers, and government adapt and re-optimize processes and practices in light of the new system; and (4) dynamic market impacts—due to product innovation and development, new market entrants, and potential consolidation. It is important to note in practice the impact of these pathways is highly complex and dynamic. While the preceding phases are necessary for the subsequent ones to materialize, they do not only flow in a linear direction. In many cases they operate simultaneously, creating feedback loops and reinforcing effects.

We crosscut these phases by distinguishing impacts on four core stakeholder groups along the rows of the framework: (1) FSPs; (2) merchants (from small shops to large companies); (3) households or consumers; and (4) government. The boundaries between these groups too may be blurred (e.g., a household may also operate a household microenterprise and the government could own or control an FSP).

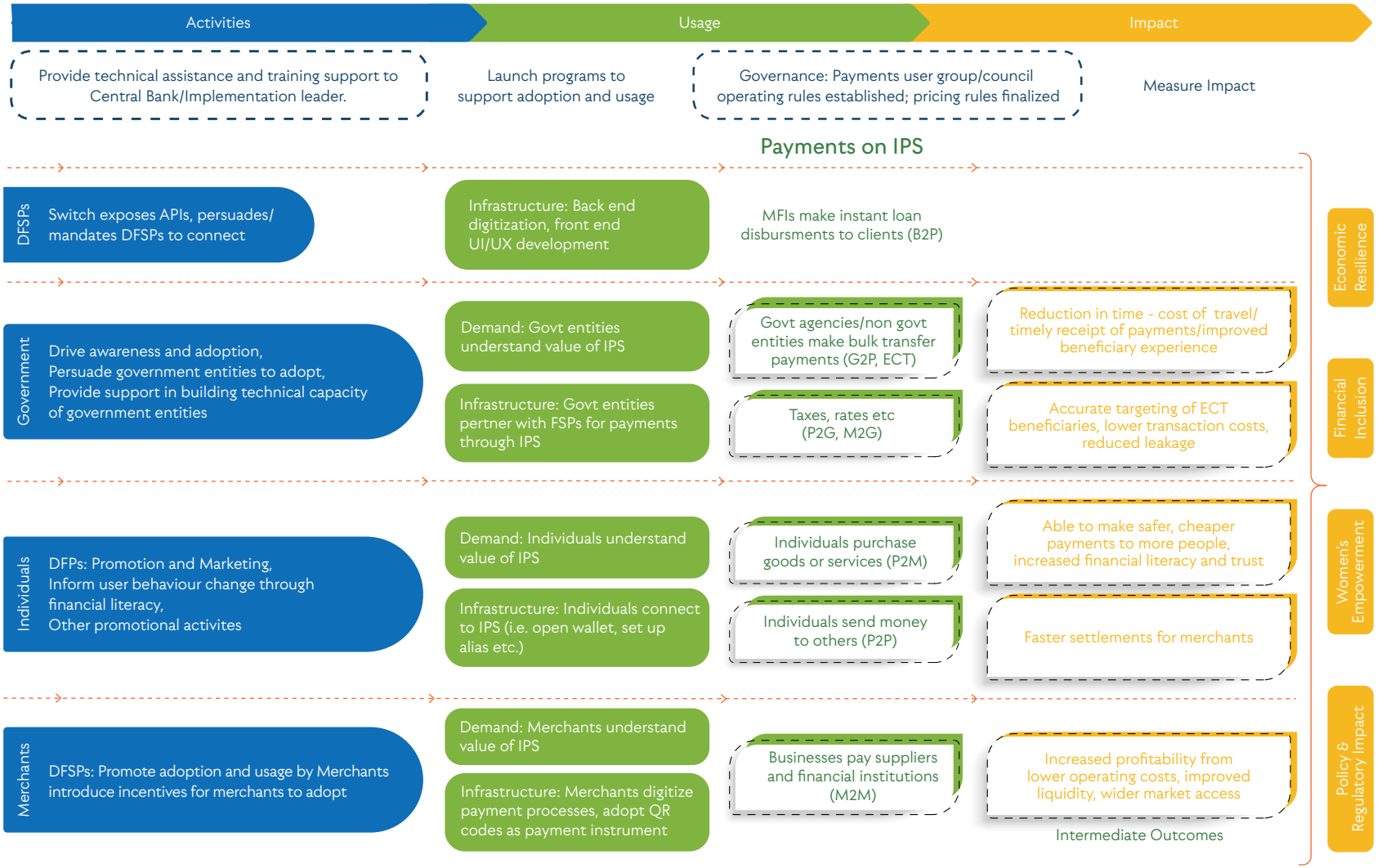

Figure 2: Theory of Change - Inclusive Instant Payment Systems

In the remainder of this section, we provide a brief discussion of the different phases of the Theory of Change with a focus on technical and economic implementation before an in-depth assessment of hypothesized impacts.

- **Onboard FSPs and users.** This initial phase encapsulates technical integration, piloting, and negotiation over rules, standards, and pricing. FSPs—usually starting with a small subset in a piloting phase—link their account ledgers and payments processing to the switch and serve as an interface between end users and interoperable payments. Onboarding may require back-end and technology adoption steps in and of itself. For example, FSPs may need to upgrade systems, digitize ledgers, and create or update their user interface to accommodate interoperable payments; merchants may need to adopt digital payments technologies; households may need to adopt digital payments through mobile phones; and governments may need to digitize and upgrade information systems for programs like social protection payments. Beyond its technical dimensions, onboarding is often a period of negotiation over standards and pricing between FSPs and the switch operator as the realities and implications of integration are no longer a theoretical proposition.

- **Cost reductions and efficiencies.** Interoperability does not represent a single intervention, but rather a suite of potential interventions built around use cases, each involving an implementation process. In different contexts, implementers may select only a subset of use cases, and may stagger the rollout of the use cases they choose to adopt. The major use cases are as follows:

  - **Person-to-Person or Peer-to-Peer Payments (P2P).** Interoperable payments systems can allow for easy and instant transfers between FSPs' user networks. This may reduce various costs and frictions in legacy systems, such as multi-homing, daily limits on off-net transactions, or the cumbersome process of entering the sender and receivers' bank account details. On this latter point, an important recent innovation in switch implementation has been the introduction of alias-based payment services, allowing users to obtain an account through a unique identifier (e.g., phone number, email address). The P2P use case can also enable other applications such as international transfers and remittances. In many emerging economies, P2P is the "default" digital retail payment mode as many merchants are hesitant to register for merchant accounts due to perceived higher transaction charges or greater tax scrutiny.

  - **Government-to-Person (G2P) and Merchant-to-Person Payments (M2P).** Governments regularly make financial transactions with their citizens, from distribution of social protection payments to collection of taxes to receipt of payments for other government services. However, managing these transactions can raise many logistical challenges—from the costs of maintaining distribution points like government offices or post offices to 'leakage' that can occur when relying on bureaucratic agents or other intermediaries with limited oversight to distribute payments. To leapfrog these problems, governments around the world are seeking to digitize payments, often relying on burgeoning FSP infrastructure throughout the

country, including in remote areas where mobile money companies and microfinance institutions (MFIs) operate. In the absence of an interoperable payments system, however, governments and citizens incur costs in coordinating on which digital channels to use for payments. For example, neither requiring all citizens to use one or two FSPs or the government remitting across the universe of unique FSPs that citizens use is an appealing option. Access to a switch can help overcome this coordination problem, potentially stimulating deeper financial inclusion. M2P bulk payments (such as, salary disbursements), or consider microfinance institutions that may distribute loans digitally and face the challenge of collecting loan repayments across multiple FSPs, give rise to an analogous challenge.

- **Person-to-Merchant (P2M) and Person-to-Government (P2G).** While the P2P payments use case enables transactions between consumers and merchants, this can be unwieldy for all but the smallest of enterprises. It precludes multiple employees from processing payments using an enterprise-specific account and increases the costs of tracking transactions across multiple SIM numbers. An interoperable payments switch can enable an efficient POS payments system for even small merchants, as well as the use of quick response (QR) codes to more efficiently exchange account details and make transactions. Other use cases also fall within this domain, such as when FSPs act as a merchant and take payments. Likewise, governments and utility services seeking to accept payments from a wider user-base with a diverse set of FSPs face similar hurdles.

- **Behavioral/organizational change.** We expect that a more efficient payments system, built on the aforementioned use cases, will lead to behavioral changes at the consumer level, and organizational adjustments for merchants, FSPs, and governments, as all of the players reoptimize based on the new system. At the consumer level, we expect that users will take advantage of the efficiencies brought about by interoperability by shedding excess accounts and transacting with a larger transfer network. Perhaps more importantly, financial inclusion may accelerate as preferences for digital payments over cash lead end-users to adopt additional digital financial services (DFS). Governments and businesses can consider a wider range of product and service offerings, for example higher-frequency collections and disbursements, and reallocating resources from distribution to other areas, such as design, production, and marketing. Digital merchant payments could enable a wider swathe of merchants to adopt digital information systems as incoming and outgoing stock can be more easily recorded digitally, allowing them to take advantage of tools such as automatic inventory management. All users might enjoy greater security from digital payment options, leading to greater openness to transactions that previously raised risks of loss from theft—one of the primary concerns that merchants have about transacting in cash. However, it is important to remain aware of potential unintended consequences of digitizing payments, including consumer protection concerns and adverse effects on those who might be excluded from the system.

- **Market effects.** Some of the most exciting potential impacts of interoperability could occur as entire market structures adjust to a much more efficient, rapid payments system, and new innovations and opportunities emerge. Due to the nature of innovation, some of these impacts are difficult to predict, but we identify a few potential trends. For example, greater competition is expected to emerge in the market for payments, potentially compressing the cost of payments—although the largest FSPs with more extensive infrastructure and greater market share would still be in an advantageous position. Greater competition may emerge in the market for financial products, principally credit, savings, and insurance. Without the need to build and service a customer network, innovative FSPs such as Fintechs, could more easily enter the market and offer innovative financial services. This should induce competitive responses from legacy financial institutions. Reliable digital payments records could also enable a larger set of product and service offerings; retailers could more easily offer customers the option to borrow on credit through regular digital payments. Online retail would likely expand, as consumers become more familiar with digital payments options and a robust payments network facilitates other services like transportation, delivery, and security. There are significant opportunities to increase aggregate market efficiency and improve overall consumer welfare, as e-commerce and mid-size merchants benefit from more seamlessly selling direct to consumers of all FSPs, presenting them with a wider and deeper product diversity at a lower cost. However, informational and regulatory frictions, distorted incentives, and bureaucratic barriers could still conspire to diminish, if not reverse, the potential impacts on some aspects of the market.

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5. Hypothesized Impacts of Inclusive Instant Payment Systems: What Might we Expect?

In this section we build on the prospective impact pathways outlined in the Theory of Change to identify how and to what extent they might transform payments, markets, and the economy more broadly. While, as noted, in-depth research on the impacts of interoperability in emerging markets is nascent, we provide tentative hypotheses on the impacts we might expect drawing on analogous technologies, such as mobile money and card payments. The heart of our synthesis focuses on the impacts stemming from cost reductions and efficiencies in payments and financial transactions, behavioral and organizational change, and dynamic market effects. But we begin with a brief consideration of the importance of back-end integration.

5.1 Back-end Integration

System integration is fundamental for any downstream effects to materialize. For FSPs, a critical prerequisite hinges on whether their internal account ledger system meets the technical standards necessary for integration. For some financial institutions, such as banks and mobile money companies, this may involve anything from relatively minor adjustments to a system upgrade. However, for other financial institutions in emerging markets, such as microfinance institutions, this may involve a large-scale upgrade of their accounts system—especially for MFIs that lack a digital accounts system altogether and continue to manually manage their accounts. Internal system upgrades can raise installation and training costs for FSPs, which may prove prohibitive for some FSPs to integrate with a payments switch in the short term, but may enable operational efficiencies in the medium to long term. Another possibility is that smaller MFIs turn to financial intermediaries who reduce the technical and financial costs of integration and compliance, as is common in settlement systems in high-income countries. While these costs and benefits of integrating with a payments switch are difficult to detect empirically, they are worth acknowledging in order to assess how payments switch rollouts proceed in practice.

5.2 Cost reductions and efficiencies: Lessons from mobile money, card payments, and digital payments

Like any payments system, the impact of interoperability flows principally from the reduction in transaction costs it brings. However, what is striking about the appeal of interoperable payment systems is the cross-sector breadth of these gains—from P2P and P2M to G2P. We review each use-case in turn. In doing so, we take adoption as given and focus on hypothesized impacts, drawing from existing research on previous technological changes in payments and finance. We revisit the issue of adoption dynamics in the section on Adoption Dynamics and Financial Inclusion.

5.2.1 P2P

Peer-to-peer or person-to-person payments entail consumers sending money from one person to another, which often covers transfers to individuals who are the sole proprietor of a business.[16] P2P payments have been a key component of financial systems throughout history, giving rise to a range of formal (e.g., wire transfers, checks, and digital and mobile transfers) and informal institutions (e.g., couriers, hawala) that have sought to reduce the costs, risks, and time of getting money from one person to another. Innovations in P2P payments often mirror broader technological changes in P2P communication that help reduce information problems between spatially separated agents (Townsend 1987). One well-known example is the advent of Western Union's money transfer service in 1871, piggybacking on its telegraph business. Some 130 years later in the Philippines, Smart Communications leveraged its mobile telecommunications service and extensive agent network to launch Smart Money, the first mobile P2P transfers.[17]

Over the past fifteen years, mobile money services have come to rival cash as the dominant mode of P2P transfers. For example, in Kenya, the birthplace of mobile money in Africa, the introduction of M-Pesahas transformed P2P payments. Prior to the launch of M-Pesa, only some 16 percent of the population had a bank account; hence, most P2P transactions were made via cash transfers among friends and relatives (more than 50 percent), through the post office (more than 20 percent) or using bus companies (more than 20 percent) (Mbiti and Weil 2016). Already by 2009, however, M-Pesa emerged as the modal method of sending and receiving money. By the end of March 2021, M-Pesa recorded 28.3 million one-month active customers—around 70 percent of its total customers—and equivalent to over 90 percent of Kenya's over-18 population.[18]

In this section we explore the potential effects of interoperability on P2P payments. Given limited empirical evidence on the welfare effects of other interoperable P2P payment technologies, such as cheques, bank transfers, or money transfers, we focus on mobile money, which has seen a surge of recent research (for a review, see Suri (2017)). Mobile money represents a useful analogue to hypothesize the effects of interoperability. For one, many interoperable payment systems see enabling payments between mobile money networks as a principal use case, and aim to replicate the low-cost and frictionless nature of on-net mobile money payments for off-net transactions and cross-FSP transactions (e.g., bank to mobile money).[19]

Mobile money has several welfare benefits that could apply to interoperability. As noted in the Kenya case, one of the principal benefits of mobile money is the qualitative

16 See Windh, Jennifer. "Peer-to-peer payments: Surveying a rapidly changing landscape." Federal Reserve Bank of Atlanta, August 15 (2011).

17 Carol Realini and Karl Mehta, "Financial Inclusion at the Bottom of the Pyramid," (FriesenPress, 2015).

18 "Safaricom PLC Results Booklet: For the Year Ended 31st March 2021," Safaricom, May 13, 2021. https://www.safaricom.co.ke/images/Downloads/FY22_Results_Booklet__12_May_2022.pdf

19 In countries with a dominant mobile money provider, such as Kenya, the system is essentially a model of an interoperable payments network.

reduction in transaction costs and corresponding efficiency gains consumers experience in the ability to send and receive money (Jack and Suri 2011)—such as forgoing the costs, risks, and delays arising from bus couriers and other modes of sending cash. Accordingly, access to mobile money is found to increase P2P remittances in a range of low-income countries specifically in Kenya (Jack, Ray, and Suri 2013), Mozambique (Batista and Vicente 2020), and Bangladesh (Lee et al. 2021). Whereas, compared to the initial transition from cash to mobile money, the marginal benefit of the deployment of interoperability is likely not as high, but still significant, especially in reducing off-net transaction costs. For example, in Uganda the cost of sending mobile money off-net is on average more than eight to nine times the cost of on-net transfers, and off-net is some 12.7 times the cost of on-net in Malawi.[20] To avoid such charges, some may use MM agents to make transfers on their behalf, send off-net vouchers that have to be cashed out at an agent of the sending mobile network operator (MNO), or possess multiple mobile money accounts ("multihoming"). The first two options require substantial travel costs for sender and receiver, respectively, whereas the third option requires managing multiple wallets. In the face of such costs, many consumers forgo off-net P2P transfers altogether. The introduction of mobile money interoperability (MMI) in Ghana demonstrates latent demand for the service. Since its introduction in May 2018, MMI transactions have increased from nearly 100,000 transactions in its first month to 8.5 million in April 2021.[21]

Another potential benefit of efficiency gains in sending money over long distances is more effective risk-sharing in the face of financial shocks. Jack and Suri (2014) find that in Kenya M-Pesa users are more likely to receive remittances when affected by a negative shock, which helps the household smooth out consumption. Riley (2018) corroborates this effect. In the face of village-wide rainfall shocks, households with mobile money access experience no decline in household consumption.[22] While it is likely that strong social ties already coordinate on the same MNO network (e.g., family and friends choosing to use the same mobile money operator), we would expect P2P interoperability to further reduce the costs of risk-sharing as one can send and receive payments among a wider network of individuals.

In addition to better access to remittances, mobile money uptake also has been found to lead to occupational change out of the farming sector (Suri and Jack 2016; Batista et

20 "Airtel Money Transaction Fees", Airtel Money, June 27, 2022, https://www.airtel.co.ug/airtelmoney/transaction_fees
"Mobile Money Tariffs" MTN, June 27, 2022, https://https://www.mtn.co.ug/insight/mobile-money-tariffs/.
"Customer Tariffs" TNM. September 19, 2021, https://www.tnmmpamba.co.mw/#/personal/customer-tariffs

21 In March 19th, 2020, the Ghana Interbank Payment and Settlement Systems Limited (GhIPSS) waived mobile money transfer fees for sums under 100 Ghanaian Cedis (~US $17) but these were reinstated on May 23, 2020. See GhIPSS, "2021 GhIPSS Annual Media Engagement." https://ghipss.net/index.php/publications?download=13:2021-ghipss-annual-media-engagement. However, individual MNOs, such as Vodafone Ghana, the number two market player, continued to waive interoperable transaction fees, although MTN, the market leader, did not. Off-net transfers represent some 2.6% of the total number of mobile money transactions.
Bank of Ghana, "Summary of Economic and Financial Data," May 2021. https://www.bog.gov.gh/wp-content/uploads/2021/05/Summary-of-Economic-and-Financial-Data-May-2021-1.pdf

22 See also Batista et al. (2018), Abiona and Koppensteiner (2020) and Ahmed and Cowan (2021).

al. 2018; De Gasperin et al. 2019; Aggarwal, Brailovskaya, and Robinson 2020; Lee et al. 2021). Several mechanisms have been suggested as to how mobile money drives labor re-allocation, including: better access to capital needed for trade, retail, or small business (Suri and Jack 2016); an instrument to more efficiently save and manage one's finances (Aggarwal, Brailovskaya, and Robinson 2020); and stronger incentives to invest in migrant labor (Batista and Lee 2018). Beyond mobile money, digital tools, such as smartphones, are found to lead to occupational change as they enable individuals to directly market one's produce or other wares and increase their consumer base (Roessler et al. 2021); mobile money interoperability thus may act as a complement to such change, facilitating small retailers to more seamlessly sell goods to a wider set of buyers. As we discuss in the next section on the merchant use case, real-time, interoperable payments may reduce small business costs, further lowering barriers to entry and leading to more efficient allocation of labor.

A final hypothesized effect of interoperability on P2P transfers is greater access to financial inclusion. Bourreau and Hoernig (2016) suggest the lack of interoperability hinders agent network penetration of underserved and marginalized areas due to low demand for each individual network. If, however, interoperability enables agents to service multiple MNOs, this may boost access into these areas—notwithstanding the other constraints to servicing rural areas (e.g., poor connectivity, under-supply of electricity, lower incomes and literacy levels).

On the whole, we would expect the adoption of interoperable payment systems to further deepen the gains individuals experience from the uptake and use of mobile money, even if the marginal benefits are lower than the effects of the initial transition from cash to mobile money. The largest gains to consumers, however, likely stem not from even greater efficiency in remittances but the promise of forgoing the steep transaction costs that many continue to incur in the continued dependence on cash for retail payments. As we discuss in the following section, despite robust P2P markets in many emerging economies, retail payments continue to be dominated by cash. Thus, many consumers tend to cash out mobile money to use for purchases. Cashing out is a costly process in terms of withdrawal fees, one's time, travel expenses, and susceptibility to overcharges levied by mobile money agents (Annan 2020). Whether interoperable payment systems can help consumers eschew these costs is a question we turn to next.

5.2.2 P2M: Moving Beyond Cash as a Payments Medium?

The staying power of cash in many economies is closely tied to its efficiency as a medium of interoperable payments. The limitations of cash dependence, however, are also clear.[23] Saving cash outside of a bank, usually in the customer's home, increases the risk of theft and insecurity, prevents others from paying to borrow the cash, and savers do not earn interest. It is inefficient and unwieldy for large purchases, long-distance exchanges, and e-commerce. Anonymity and record-less transactions cater to criminals and illicit activities, while increasing the costs of financial planning and accounting. Addressing these limitations to cash have driven financial innovations throughout history from the rise of banks to interest and credit facilities to the advent of ATMs and debit and credit cards. In high-income countries, electronic, debit, and credit payments far outpace cash payments (Khiaonarong and Humphrey 2019).

Credit and debit cards unlock interoperable payments for consumers and merchants but only on the backs of an elaborate financial infrastructure. Establishing this infrastructure entails a high set of fixed costs, including electronically linking bank issuers, card networks and merchants' banks to the adoption and distribution of card readers. Consequently, the social costs of electronic payments (including fixed costs for payments infrastructure, variable costs for labor and raw materials, and consumer transaction costs) tend to be higher than cash, especially in countries with lower levels of adoption of electronic payments (including European countries) (Hayashi and Keeton 2012).

In low- and middle-income countries with less developed financial systems, a high unbanked population, and weaker infrastructure, cash continues to dominate retail payments (World Bank 2016). One of the challenges of moving away from cash is the two-sided nature of payments that require both consumers and merchants to coordinate when adopting new systems (Rysman 2009; Higgins 2020). In other words, payment switching confronts societies once again with something approximating the "double coincidence" problem: neither side is likely to embrace a new payments system—especially one requiring significant upfront technological and financial prerequisites—until it sees the other side adopting it. Network externalities can further deepen this problem as consumers' benefits—and likelihood of adoption—depend not just on merchant uptake but on whether other consumers adopt the technology as well. As Higgins (2020) shows, however, network externalities can cut the other way and fuel adoption through supply and demand-side spillovers.[24]

The widespread adoption of mobile money outlined in the previous sub-section holds the promise of similar types of network effects leading consumers away from the use of cash to digital retail payments. However, as previously discussed, the cases of Kenya and the Philippines illustrate retail payments lagging far behind P2P transfers. In Kenya

23 On the costs and benefits of cash versus digital payments, see Bolt and Chakravorti (2012).

24 We discuss adoption dynamics further in the next subsection.

in 2017, a decade since the launch of M-PESA, more than two-thirds of Kenyans reported having ever used mobile money for P2P transfers but only 17 percent reported using the service to pay for goods from merchants.[25] P2M lagged even further behind in Tanzania—with 44 percent reporting having used P2P compared to only 4 percent using P2M.[26] In the Philippines, by 2018 only 12 percent of total person-to-business (P2B) transactions were made electronically, using cards, bank transfers, or mobile wallets.[27] The COVID-19 pandemic, however, has supercharged uptake of digital retail payments in the country; by one estimate electronic transactions now account for 40 percent of total payments, according to a consumer survey in 2021.[28] Moreover, a year after the launch of a national QR code standard for interoperable payments by the Philippines' Bangkok Sentral ng Pilipinas (BSP), there has been strong demand for the technology.

These cases point to the importance of other complementary factors in bridging the transition from P2P to P2M payments. With P2M payments largely localized—unlike P2P transfers that tend to take place across far distances[29]—consumers saw little cost-or time-savings in switching from cash to digital payments. If they do use digital for retail payments, many turn to P2P, given their familiarity with the mode of payment. Third, with many consumers still getting paid in cash, the path of least resistance is simply to shop with cash.[30] Fourth, smartphone penetration rates remain low in many low-income economies, requiring the use of unstructured supplementary service data (USSD) to make payments which can be "slow and cumbersome."[31] The importance of clearing these hurdles for P2M uptake is highlighted in the case of China (see Box 1).

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25 Merchant payment covers "paid for goods or services at a grocery store, clothing shop or any other store/shop." Bill payment, defined as "paid a bill for medical expenses, housing, rent or utilities, such as electricity, water, solar, satellite TV or cable TV," was a more prevalent with 23 percent reporting they had used mobile money service for such transactions. Based on authors' analysis of Financial Inclusion Insights (FII) Tracker Survey, Kenya Wave 5 conducted in June-July 2017. Financial Inclusion Insights Program, InterMedia. Similar patterns are documented through 2019 in Kenya in which 90 percent of respondents in a nationally representative survey report using cash for daily expenses. Central Bank of Kenya. 2019. "FinAccess Household Survey." https://www.centralbank.go.ke/uploads/financial_inclusion/1035460079_2019%20FinAcces%20Report%20(web).pdf

26 Based on authors' analysis of Financial Inclusion Insights (FII) Tracker Survey, Tanzania Wave 5 conducted in July-August 2017. Financial Inclusion Insights Program, InterMedia.

27 "The State of Digital Payments in the Philippines," Better than Cash Alliance, December, 2019, https://www.betterthancash.org/alliance-reports/country-diagnostic-the-philippines-2019-edition

28 "Fintech in ASEAN 2021: Digital takes flight," UoB, November 2021, https://www.uobgroup.com/techecosystem/news-insights-fintech-in-asean-2021.html

29 Jack and Suri (2014), find that the average distance of M-PESA remittances was, on average, some 200-300 km in 2008 and 2010.

30 Flood, Z. 'Zimbabwe and Kenya lead the way in Africa's dash from cash', The Guardian, February 22, 2018. https://www.theguardian.com/world/2018/feb/22/kenya-leads-way-mobile-money-africa-shifts-towards-cash-free-living

31 As the report summarized: "Speed at till is slow because either the customer or merchant must unlock the phone, dial a USSD short code, and then navigate multiple levels of a terse text-based menu that is often not user friendly. Timeouts and broken sessions that require restarting the transaction are fairly common." "Acceptance Technologies for Merchant Payments," CGAP, October 2019. https://www.cgap.org/research/publication/acceptance-technologies-merchant-payments

Box 1: The Endogenous Rise of Digital Payments in China but without Interoperability

The most dramatic transformation in terms of digital retail payments in an emerging market has been China. Over the course of 10 years, the country has gone from almost the exclusive use of cash in retail payments to the ubiquity of digital payments. The pendulum has swung so far in favor of the latter that the People's Bank of China (PBOC) in 2018 issued a circular stating it was illegal for merchants and businesses to refuse or discriminate against cash payments.[32] While debit cards issued by UnionPay enjoy wide circulation in the country today (and indeed UnionPay has come to command market share in total card payments in the world), within China it was overtaken by mobile payments providers AliPay and WeChat Pay—which account for 53 percent and 39 percent of mobile payments market share, respectively.[33] The two payment providers leveraged large existing customer bases, brand awareness, and organic demand for digital payments in their underlying businesses of e-commerce and messaging to expand into the payment space. Both use QR code technology and digital wallets, often linked to bank accounts, to enable consumers and merchants to seamlessly make transactions. AliPay and WeChat Pay spurred adoption by charging zero-price fees for consumers and low processing fees for merchants (0.55 percent and 0.6 percent respectively). The former made a calculated bet to win the loyalty of consumers through free payment transactions and then offered investment products, loans, and insurance, which represents a sizable share of AliPay's revenue. While AliPay and WeChat Pay grew out of distinct businesses to meet the needs of customers for e-commerce and messaging, over time strategic competition has led them to converge in the services they offer. Nonetheless, the duopoly has necessitated merchants and consumers to each adopt separate QR codes and wallets if they want to use both systems. China's central bank has called for greater QR code payment interoperability, most notably in its 2019 two-year plan for the country's fintech industry. In line with this regulatory pressure, by the end of 2021, both WeChat Pay and Alipay agreed to accept QR code payments from UnionPay customers.[34]

32 In January 2021 the PBOC fined 16 merchants and institutions "for posting 'no cash' signs or simply refusing to take cash as payment." See "China punishes 16 institutions, merchants for refusing cash payments," Xinhua, January 21, 2021. http://www.xinhuanet.com/english/2021-01/21/c_139687310.htm

33 Aaron Klein, "China's Digital Payments Revolution," Brookings, April 2020, https://www.brookings.edu/wp-content/uploads/2020/04/FP_20200427_china_digital_payments_klein.pdf

34 Zeyi Yang, "WeChat and UnionPay will recognize each other's QR codes," Protocol, August 23, 2021. Available at https://www.protocol.com/bulletins/china-qr-codes-merge. Liao Shumin, "Alipay, UnionPay Achieve Interoperability of QR Payment Codes Across China," YiCai Global, December 2, 2021. https://www.yicaiglobal.com/news/alipay-unionpay-achieve-interoperability-of-qr-payment-codes-across-china

What explains the takeoff of digital retail payments in China? Many attribute it to the following conditions: a high banked population (due to the growth of the financial sector in the early part of the 20th century—the so-called Golden Age of Chinese banking—and the Chinese government's use of bank accounts to send benefits); the high levels of smartphone penetration; an under-developed credit card industry; and the take-off of e-commerce and social media in a favorable regulatory environment.[35]

Whereas the China case reveals the potential for a meteoric increase in digital payments when supply-side and demand-side factors align, in many emerging economies coordination problems between merchants and consumers continue to hinder a transition away from cash. This is particularly likely if merchants face high set-up costs (e.g., the required paperwork and lack of technical expertise to integrate and learn how to use payment platforms) and need to adopt multiple payment operators due to a fragmented payment marketplace.36 But even in the absence of such barriers, low demand may forestall further digitization. This is seen in India prior to widespread integration with the Unified Payments Interface (UPI). (See Box 2 on the transformative impacts of UPI.) Drawing from a survey of some 1,000 small-scale fixed store merchants fielded in Jaipur, India in 2017, Ligon et al. (2019) find, despite most merchants in their sample possessing the skills (e.g., digital literacy), tools (e.g., own smartphones), infrastructure (e.g., bank accounts) and resources (e.g., fees on platforms are affordable) to accept digital payments, almost 80 percent of their transactions were in cash. Merchants suggested perceived lack of customer demand for digital payments was one factor, but the authors also found heterogeneous differences based on tax registration (with merchants without a valid tax ID significantly less likely to use digital payments). One interpretation of the latter result is that informal, unregistered merchants feared digital records may increase their tax liability.

In the face of these enduring coordination problems, despite the growing ubiquity of mobile money and smartphones, some governments, such as Pakistan and Tanzania, are implementing national interoperable payment systems with the goal, among many, of enhancing retail payments. As merchants are encouraged to link with these systems and adopt QR codes to speed-up transaction times, this has the potential to encourage

35 Martin Chorzempa, "How China Leapfrogged Ahead of the United States in the Fintech Race," Peterson Institute for International Economics, January 9, 2018, https://www.piie.com/blogs/china-economic-watch/beijings-grip-internet-finance- tightening. Aaron Klein, "China's Digital Payments Revolution," Global China: Brookings Institution, April 2020. https://www.brookings.edu/wp-content/uploads/2020/04/FP_20200427_china_digital_payments_klein.pdf

36 Francesco Pasti and Anant Nautiyal, "Mobile Money for Enterprise Customers: Addressing the financial services needs of MSMEs in Sub-Saharan Africa," GSMA, February 2019. https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/02/GSMA-Mobile-Money-for-Enterprise-Customers.pdf

businesses to go the last mile and adopt digital payments. In turn, integration is expected to increase demand as each of these systems enable low- cost, real-time interoperable payments—three of the factors regularly cited as underpinning demand for cash.[37] The case of India reveals the potential coordinating role that IIPS can play in catalyzing a qualitative shift among consumers and merchants away from cash to digital payments.

Box 2: An Indian Interoperable Case Study: UPI's Success Story

Unified Payments Interface (UPI) was launched in 2016 by the National Payments Corporation of India (NPCI), which operates retail payments and settlement systems in India under a public-private partnership. UPI was designed to allow instant inter-bank payments through mobile applications. A new UPI user had to register at least one bank account, and then could subsequently link additional accounts, digital wallets, or other payment channels through a UPI-linked app.

A non-bank mobile payments Fintech, PhonePe, gained access to UPI by partnering with a UPI member bank, Yes Bank, launching its UPI integrated app in August 2016. In late November 2016, The State Bank of India and the HDFC Bank, two leading banks, became UPI members, just weeks after India's major demonetization event.[38] In spite of the bank-centric approach, by January 2017 PhonePe accounted for 40% of transactions through UPI, which had begun to see exponential growth in usage in the wake of demonetization.[39]

Other mobile tech companies, like Google, later used a similar strategy as PhonePe and partnered with UPI member banks; e.g., Google launched Tez in 2017, which was later rebranded to Google Pay. A mobile wallet company that had existed many years before UPI's launch, called Paytm, gained access to UPI directly in August 2017, by applying to become a bank (as opposed to continuing to operate, as it did before, as a non-bank mobile money company).

37 "Digitizing Merchant Payments: Why and How," CGAP, October 2019, https://www.cgap.org/research/publication/digitizing-merchant-payments-why-and-how

38 Demonetization of two of the largest bills happened on the 8th of November 2016, overnight and without prior warning. There were cash shortages in the aftermath of demonetization. This might have been a driver for these large banks to have joined UPI. It is plausible that demonetization was also a key factor in early PhonePe given UPI took off after demonetization. PhonePe was, in fact, marketed by its then-owner Flipkart as a solution to ATM queues post-demonetization. To quote: "Demonetization blues? ATM queues? Kiss them goodbye and say hello to PhonePe, Flipkart's mobile payments app based on the government-backed Unified Payment Interface (UPI) platform. It's cool, convenient and hassle-free. And, even better, it's free!", see: Team Flipkart Stories. January 2, 2017. "7 things you must know about the PhonePe app from Flipkart" https://stories.flipkart.com/phonepe-app-flipkart/

39 IANS, "Flipkart forms group with its subsidiaries, makes co-founder Binny Bansal CEO," The News Minute, January 10, 2017, https://www.thenewsminute.com/article/flipkart-forms-group-its-subsidiaries-makes-co-founder-binny-bansal-ceo-55501

By 2022, UPI dominates small value, mobile-based transactions in India, making up 90 percent of the volume of all mobile app-based transactions and 64 percent of all of the digital transaction volume. As of April 2022, there were 65 payment applications connected to UPI, with 5.7 billion transactions processed in that month only (almost all of which were processed by the three market leaders). In spite of the initial bank-centric approach, the early Fintech movers quickly came to dominate the system.[40] In 2022, Google Pay, PhonePe and Paytm make up over 95 percent of the transaction volume through UPI.

What factors might have been important in UPI's take-off?

Different experts emphasize different parts of UPI's story. As this white paper outlines, there are many factors that can play a role in increasing the chances of success of a IIPS.

Local Factors (Comparing UPI with an Instant, Low-Value Card-Based System)

India's previous push in creating a national (biometric) ID meant it already had the infrastructure in place to document individuals who otherwise would find it hard to meet stringent KYC requirements to create a bank account. Demonetization in late 2016, accompanied by a push to open "low-frill" bank accounts (a bank account was required to use UPI until very recently) gave UPI a boost in the year it was launched. NPCI, the body responsible for UPI, has a relatively innovative culture and regulatory structure, which likely contributed to lower fees and better designed technology (Cook and Raman 2019). These India-specific, contextual factors raise the question of how easily UPI's take-off can be replicated by other countries.

Yet the phone-based interface may have also been pivotal. A low-value transaction, card-based interoperable payment system, Rupay, launched in 2012 with a similar value-proposition to UPI, has not succeeded nearly to the same extent that UPI has. Figure 3 shows how card transactions, which include Rupay, have largely flatlined while mobile payments, which are dominated by payments made through the UPI system (mobile payments exclude payments made with cards even if the card payment was made on a mobile phone). We also see that market concentration (market shares of largest banks) generally decreases for all payment instruments during this period, but especially mobile payments.

40 First-mover advantage might have been important to gain networks. Other big players did try and enter a little later like Amazon, see: Choudhury, K. April 13, 2017. "Amazon to take on Paytm, Flipkart's PhonePe with its digital wallet licence" Business Standard. https://www.business-standard.com/article/companies/amazon-to-take-on-paytm-flipkart-s-phonepe-with-its-digital-wallet-licence-117041201146_1.html
Apple announced that Apple Pay was going to be launched in India and was going to be UPI based but then has since denounced this, Apple does not currently plan to launch Apple Pay in India, and there is speculation that the current market domination of the major players (Google Pay, PhonePe and Paytm) is the reason they are not intending to enter, see: Verma, S. May 10, 2022. "Explained: Why Apple Pay Is Not Available in India?" Cashify. https://www.cashify.in/why-apple-pay-is-not-available-in-india

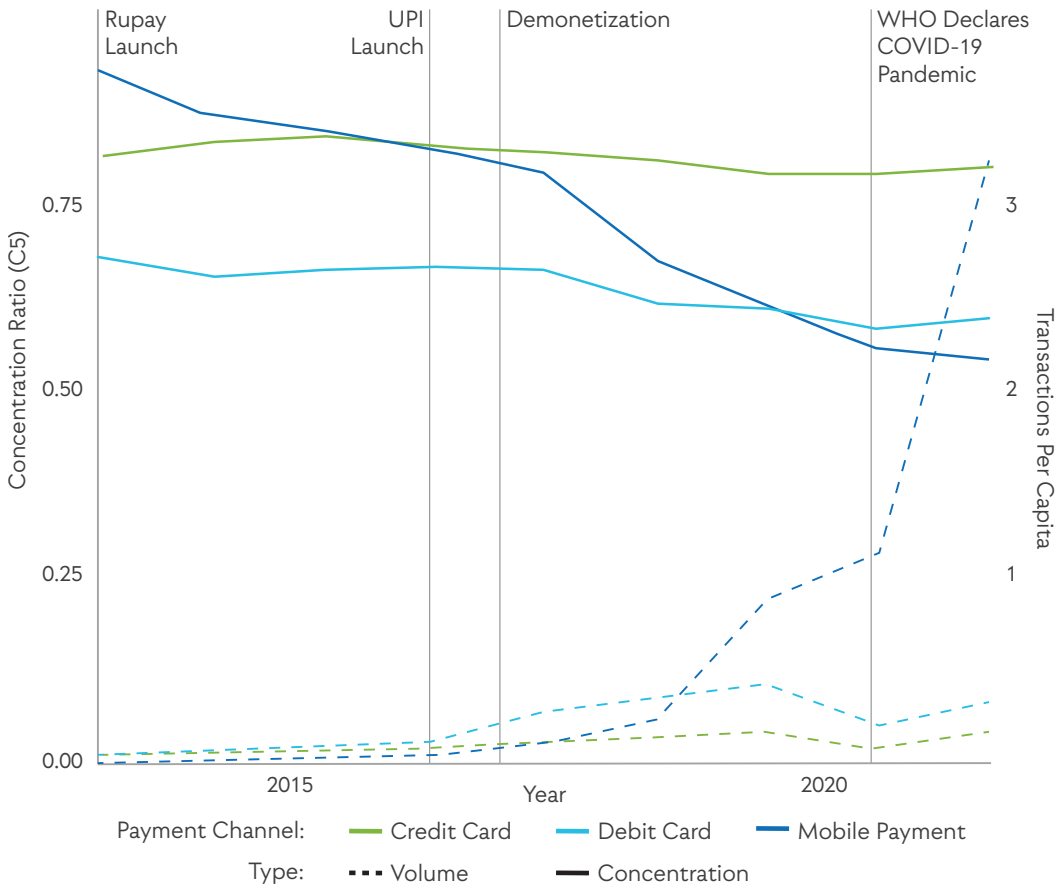


Figure 3: Market concentration (market share of top-5 banks) by transaction volume of banks for cards and mobile payments (solid lines, left y-axis); transaction volume per capita through each channel (dotted lines; right y-axis).

Similarly, the QR code-based payment system associated with UPI, UPI QR, which launched in 2020, has had much more success than a QR system launched a few years prior, Bharat QR, despite Bharat QR servicing both UPI and Rupay.

Hence local conditions seem insufficient to explain UPI's success, given that systems with similar features in the same country available at the same time have not taken off to the same extent UPI has.

India versus China (the role of third-party providers)

Unlike in China, India's IIPS was driven by regulators and started with a bank-centric model. However, like in the China case, private technology companies still ended up playing a major role in UPI's success. As third-party providers, the Fintechs, mobile money companies and e-commerce platforms that integrated UPI into their mobile applications drove most of the transaction volume early on and still dominate the UPI ecosystem. However, regulation that makes it easier and more appealing for such companies to participate in the instant payment system might still have been a significant part of UPI's success. It is possible that if there had been more consultation with non-bank FSPs from the outset, UPI would have had a faster take-off. On the other hand, it is also possible that if NPCI had not focused on getting the banks on board first, that there would have been no interoperable system with banks or mobile money at all, given the additional complexity of satisfying the interests of a larger pool of stakeholders.

5.2.3 How might interoperability accelerate the P2M use case

UPI points to how interoperability might accelerate the P2M use case. For merchants, an interoperable payment system has the potential of not only reducing payment frictions without the use of additional technological prerequisites beyond a smartphone (e.g., no need for point-of-sale terminals), but it also makes it easier to trade with a broad consumer base irrespective of the FSPs their clientele use. These gains may lead to increased sales and profitability. But they also have the benefit of improving liquidity and working capital, while also helping merchants better track sales and inventory and digitize procurement. For example, in India a number of companies (Paytm, Google, PhonePe), building on their success in facilitating payments via UPI, have offered merchants value added services to improve their business and sales, such as accounting analytics, invoicing, bank settlement, and collateral-free loans.[41] As we discuss below, this might generate broader market effects as more merchants are able to access loans or other financial services due to improved legibility of their financial transaction history and portfolios to creditors.

For consumers, one of the most significant benefits following greater accessibility of interoperable retail payments is the ability to undertake a more complete range of payments digitally from P2P to P2M. This flexibility will reduce the need for cashing out, which, as noted, entails a number of costs. An extensive body of research points to the costs that the unbanked face in cashing out or paying with cash in increasingly digitized economies in both low and high-income countries (Barr 2004; Solo 2008).

41 "India: A Testing Ground for Digital Merchant Payments," CGAP, October 2019, https://www.cgap.org/research/publication/india-testing-ground-digital-merchant-payments

5.3 How interoperability might lead to behavioral and organizational change

Interoperability represents a systematic change in the payments ecosystem. As use cases come online, we expect to see that markets start to adjust; as users, in turn, adopt, demand and supply pressures induce pricing changes for payment services; and, concurrently, FSPs should begin to invest in and offer new product mixes. In this section we consider these behavioral and organizational changes and their impacts.

5.3.1 Adoption Dynamics and Financial Inclusion

Interoperability could make DFS more attractive to existing and potential users due to its cash-like characteristics, while allowing for more secure transactions and value-added services. P2P interoperability has generated higher digital transaction volumes based on early indications from MMI in Tanzania where four major mobile money providers linked together on a concerted basis starting from 2015-16.[42] On this regulatory model see the discussion on Governance in the section on Regulatory Considerations. As noted above, however, evidence from other markets such as Ghana suggests that certain interoperable payments are still a modest fraction of digital payments overall. One reason for the modest adoption may be that Ghana's market is less competitive. What else might increase adoption? We discuss individual-level and network-level effects.

5.3.1.1 Individual Characteristics Driving Adoption

In considering adoption, it is again informative to consider the mobile money use case, given the similar properties with interoperability. Randomized evaluations that vary access to mobile money at the community level find that early mobile money adopters tend to be better educated and are more likely to already hold a bank account (e.g., Batista and Vicente 2020; Wieser et al. 2019). At the individual-level, literacy is a strong predictor of accepting a mobile money transfer versus cash among new mobile phone owners (Roessler et al. 2021). It is possible that the tendency to take advantage of interoperability could be similar, as more digitally and financially literate users, who also understand the benefit of being able to transfer funds between multiple FSPs, drive early adoption. A randomized evaluation conducted amongst microentrepreneurs has found that assistance in opening a mobile money account, training on how to perform transactions, and withdrawal fee waivers are successful in driving significant uptake increases (Aggarwal et al. 2020). FSPs could consider the impact of interoperability ambassadors and, perhaps, other more indirect forms of social learning to drive adoption.

42 Lara Gilman, "The impact of mobile money interoperability in Tanzania: Early data and market perspectives on account-to-account interoperability," GSMA, September, 2016, https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2016/10/2016_GSMA_The-impact-of-mobile-money-interoperability-in-Tanzania.pdf

Social and network dynamics in technology adoption: Consumers, Merchants, and FSPs

Beyond individual-level factors, the adoption of DFS is also likely affected by the actions of others. Accordingly, we expect a curvilinear adoption curve as demand percolates among early adopters before increasing sharply as information about the value of the new technology spreads throughout the population (Foster and Rosenzweig 2010). Moreover, because interoperability is a network good, like telecoms or the internet, which gains in value as it attracts more users, we would expect adoption of interoperability to be stimulated not just by word-of-mouth and demonstration effects, but also from strategic complementarities that arise as more users make off-net transactions.[43]

Along this line, there has been empirical evidence of increased adoption for both merchants and consumers in DFS due to transaction externalities.[44] In Mexico, when there was a large positive exogenous shock in consumer debit card adoption, many small retailers invested in POS terminals to accept card payments. This subsequently led to an increase in other consumers adopting debit cards due to the increased benefit of card adoption, creating a positive feedback loop (Higgins 2019). Learning externalities can encourage adoption of certain payment modes as well. In the financial services context, Banerjee et al. (2013) conducted a study in rural Indian villages finding that both those who have knowledge of a microfinance program and those who participate in it help to spread awareness about the program. Eventual participation in the microfinance program was higher in villages where the first group of people to be informed were more central to the social networks of that village. This pattern will likely be similar for interoperability as early adopters increase broader awareness of the benefits of the technology, but with the strongest diffusion effects among those in their money transfer networks.

Merchants face tradeoffs in channeling adoption externalities. Acceptance of digital payments might draw in new customers that merchants might be willing to accept, even if it leads to a lower profit per transaction relative to cash, particularly during the initial adoption phase. However, as the technology becomes more familiar, it is likely that merchants will begin to pass on the cost of transactions to consumers through across the board higher prices for goods and services. Thus, some of the cost of the new payment technology is borne precisely by the consumers who do not use it (i.e., those who pay in cash) (Rochet & Tirole 2006). Additionally, merchants might eschew expensive digital payment methods and accept only those with more favorable merchant fee structures, which could exert a negative externality on consumers as they are directed towards payment methods with higher consumer fees (Rochet and Tirole 2006). This pattern is observed in research on the role of network externalities in driving payment

43 For an analogous market, see the dynamics of technology and network externalities in payment cards adoption (Chakravorti, 2010).

44 Bhaskar Chakravorti, "Finding Competitive Advantage in Adversity," Harvard Business Review, November, 2010, https://hbr.org/2010/11/finding-competitive-advantage-in-adversity

network adoption such as around the Automated Clearing House (ACH) (Ackerberg and Gowrisankaran 2006), and Automated Teller Machine (ATM) networks (Saloner and Shephard 1995).

Network effects also have important implications for FSPs. Despite the potential for network externalities to increase financial inclusion, FSPs might have incentives to oppose interoperability. In particular, FSPs with good reputations or large existing user networks might be opposed to integration as it reduces demand for consumers to join their particular network. Even if these FSPs are forced to join an interoperable system through regulation, they may not invest sufficiently into the project, limiting the benefits experienced by users. Meanwhile, FSPs with small networks or weak reputations likely are inclined to support interoperability, even when society isn't necessarily made better off by integration (Katz and Shapiro 1985). Network integration thus raises coordination challenges between FSPs, which are likely compounded by the large up-front costs needed to build and govern a payments switch and that may necessitate outside intervention (e.g., government regulation) to resolve. As previously noted, an additional barrier to adoption is related to the "chicken-and-egg" problem in moving to a new payments equilibrium—whereby consumers value digital payment methods only to the extent that merchants accept them, and merchants adopt these methods only when enough consumers want to use them. This leaves neither consumers nor merchants willing to invest in the digital payment method until the other party does (Crowe et al. 2010)—or again without some type of outside intervention. The Mexico case analyzed by Higgins (2019) is again illuminating. The exogeneous increase in debit cards and merchant acceptance of card payments was stimulated by the Mexican government disbursement of about one million debit cards as the new payment method for Prospera, its conditional cash transfer program. We revisit the role of government in stimulating payments adoption in the section on regulation.

In sum, existing research offers much insight into the various types of externalities and coordination problems in network integration. To date, however, empirical work lacks evidence drawn from network effects induced by randomization.

5.3.2 Pricing

Interoperable payments systems raise two core and interrelated pricing issues: (1) the business model for maintaining and developing the payments switch; and (2) the prices that FSPs charge to users. The first issue is the financial model for maintaining the switch and developing new use cases. While in principle a government, donor or other entity could cover upfront and maintenance costs, it is more likely that these expenses will be funded through a user-pay model. The Level One Principles advocate for a not-for-loss or cost-recovery-plus-investment basis for the pricing model. The second issue concerns off-net transaction fees that FSPs charge. In a number of cases the regulator sets constraints on the amount FSPs can charge users, by capping prices, limiting price increases, or dictating a specific price, such as when some regulators set inter-FSP transfer prices to zero during the early months of the COVID-19 pandemic.

The two pricing issues—the switch business model and transaction fees charged by FSPs—are likely to be interdependent. This is an example of platform economics, in which a platform acts as an interface between enterprises and customers. If the FSP is obligated to cover the cost of their portion of switch maintenance, then they will likely try to cover this expense through an increase in user fees. However, given that FSPs provide a package of financial services with payments potentially one among many sources of revenue, they may also be willing to accept lower profits. This could even be true to the extent that the FSP becomes a loss leader, offering payment amounts at below cost to encourage consumer adoption and loyalty to the FSP network, to sell them other value-added services in the future. However, given that payments are in continuous demand, FSPs may want to recover their costs and avoid confusing users by varying payments pricing over time; accordingly, what FSPs charge users for access to the payments network may align with the cost of providing such access (Bolt and Chakravorti 2008). Existing empirical work on other interoperable payments systems like credit cards suggests that network usage fees are passed onto consumers and merchants by FSPs (Chang et al. 2005). If FSPs are mandated to contribute to the costs of the switch and are allowed to charge transaction fees, it is likely they will try to charge users enough in transaction fees to cover this amount. For example, in the Philippines, the switch charges FSPs the equivalent of about 5 US cents for each off-net transaction, then FSPs charge about 18 to 45 US cents per transaction to users, inclusive of the switch fee and their own margin.

In the rest of this section, we focus on issue 2—the prices that FSPs charge to users, taking cost sharing and regulatory models as given. Pricing regulation raises several complex issues from a governance perspective that we will address in the section on Regulatory Considerations. We hone in on cases where FSPs have a degree of latitude in setting transfer prices and pricing can be subject to competition—even if within constraints set by regulators (e.g., setting price floors or ceilings, such as for low-value transactions that are more likely to be sent/received by low-income users). In this context interoperability is likely to change the flow of payments through the financial system, raising opportunities for some FSPs, and creating challenges for others.

While analysis of the effects of pricing of interoperable payments itself is scant, pricing in payment card networks provides a relevant comparison. In payment card systems, Visa and MasterCard act as a switch and charge banks assessment fees. Banks then decide what to charge for both consumers (typically zero fees) and merchants (i.e., merchant discount rates (MDR)) for use of payment cards. First, the prices charged by FSPs, to some extent, will depend on the extent of the competition they face and the extent to which consumers and merchants multi-home versus join only one FSP network.[45] Also, greater market competition may encourage providers to innovate more and create products

45 Rysman, (2007) shows that consumers in the U.S. generally concentrate their spending on a single payment network (single-homing), although many maintain unused cards that allow the ability to use multiple networks (multi-homing).

and services that improve the efficiency of the interoperable system, reducing costs and enabling FSPs to charge users lower prices. While we typically expect competition to cause a decrease in prices, there are a number of potential mechanisms for increased competition between FSPs that lead to an unexpected increase in prices and have adverse impacts on other dimensions of societal welfare. Guthrie and Wright (2007) show that more competition between FSPs can increase or decrease prices in payments networks, depending for instance on the characteristics of consumers. Tan and Zhou (2021) show theoretically how increased competition could generate unexpected effects; in the presence of cross-subsidization and externalities, standard competition effects could be reversed, so that prices for consumers increase, users' surplus decreases, while platform profits increase. Moreover, large FSPs might exhibit market power when payments are bundled with other financial services, as larger institutions may be able to provide some services more efficiently. This market power could allow large FSPs to charge a higher price even when faced with competition. Weiner and Wright (2005) provide empirical evidence in support of this possibility in the context of credit card networks, finding a positive correlation between the level of network usage fees and the market share of card providers. Moreover, payment processing exhibits economies of scale due to high up-front costs of investment, facilities, and operations (Beijnen and Bolt 2009), meaning that larger FSPs might have a lower marginal cost when providing payments services.

If a positive network externality is present, whereby the value of joining the payments network increases with the number of other users doing so, then FSPs might charge a lower payment fee to price-sensitive users to not only draw them in but also increase benefits for less price-sensitive users (Bolt and Tieman 2008). The extreme case would be the merchant-pays model, i.e., setting the user price to zero, which maximizes consumer adoption, particularly if a large number of merchants are already on the interoperable payments network (Bourreau and Verdier 2013). Whether we expect the consumer or merchant to incur a larger portion of the fee[46] in practice depends on factors such as end users' cost of multi-homing, platform differentiation, the platform's ability to use volume-based pricing, the extent to which consumers or merchants are attracted to the network as a function of the number of users in the same category (e.g., same-side network effect), and whether platforms could deter multi-homing (Rochet and Tirole 2003).

Finally, as noted, prices may change over time as FSPs respond to adoption dynamics and subsequent use. Li et al. (2020) find that a high fixed cost of adoption and a low marginal cost of use can explain the increasing merchant fees and decreasing consumer fees over time observed in the card payment networks in the United States. It is also important to note that prices might vary based on several features of the transaction itself. Economides and Jeziorski (2017) show empirically that an FSP differentially priced mobile

46 A number of common economic models allow, for example, that even if merchants are technically charged the usage fee, they could pass on the cost of the fee to consumers by raising the price they charge on goods on services. Their scope to do so depends on the extent of their market power.

money in Tanzania based on a consumer's location, the type of service, and distance between transaction origin and destination, which increased welfare for everyone on the network. We also note that in the interoperable payment system that accommodates cards, FSPs might charge additional fees for card usage as they incur interchange fees when consumers use cards.[47]

5.3.3 Product Updating

FSPs will likely need to update the products they offer based on interoperability. One potential adjustment would be for FSPs to modify their user interface (UI) to accommodate interoperability on phones or other devices. Depending on if the payment switch is integrated in the front-end or back-end, the UI will need to include the national switch as an option in the menu for users to make push payments or, otherwise, notify users that payments are being transmitted on a switch to a user affiliated with a different FSP. More substantively, they might offer services that were more technically challenging without interoperability. For example, they could allow users to pay utility bills, taxes, or make merchant payments, with features like programming payments to automatically initiate conditional on a user-chosen schedule. Also, FSPs might offer users who sign up to receive their salaries as direct deposit with default savings accounts for retirement (Blumenstock et al. 2018). Finally, at the enterprise-level, FSPs might offer an expanded suite of financial management and payments tracking services to small businesses.

5.4 Market Effects

As discussed, interoperability provides a new platform for competition between FSPs. This can lead to dynamic effects. It can induce significant shifts in market share—giving an advantage to some FSP vis-à-vis others, providing opportunities for new entrants, and causing others to exit the market altogether. Likewise, the new platform and competitive marketplace creates strong incentives for FSPs to create new products and services leveraging interoperability. Through these two respective channels—competition and innovation—these changes in the financial sector can also impact the broader economy. These processes are most closely connected to the furthest downstream phase of our Theory of Change, though we reemphasize that once underway the phases occur in parallel, creating feedback loops and reinforcing effects.

5.4.1 Timing of Launch of Interoperability

An important potential factor both in the success of a IIPS, and its impacts, is the timing of its launch. On the one hand, timing can matter for the success of a IIPS. Suppose the financial sector is relatively underdeveloped, with relatively low penetration of electronic payments, and/or a relatively underdeveloped mobile money sector lacking high agent

47 For example, topping up to Paytm in India using credit card incurs 2 percent fee.

density. Large, powerful FSPs are likely to push back politically on a IIPS, because interoperability allows competitors to access their payments infrastructure, and may therefore attempt to influence its design in the interests of FSPs rather than the broader public. On the other hand, interoperability acts like a tax on payments infrastructure investments, because the benefit from new investments are shared by the investing FSP with its competitors. This can reduce their incentive to make the investments needed to offer these financial services; e.g., they might be less likely to build out mobile money networks in more remote areas if their agents will be processing transactions for all FSPs. This could mean that in a market where a IIPS launches early in the development of the sector, the future development of the sector may be impeded. Yet, an early IIPS launch might also encourage FSPs to develop based on business models that do not rely on leveraging closed-loop network effects.

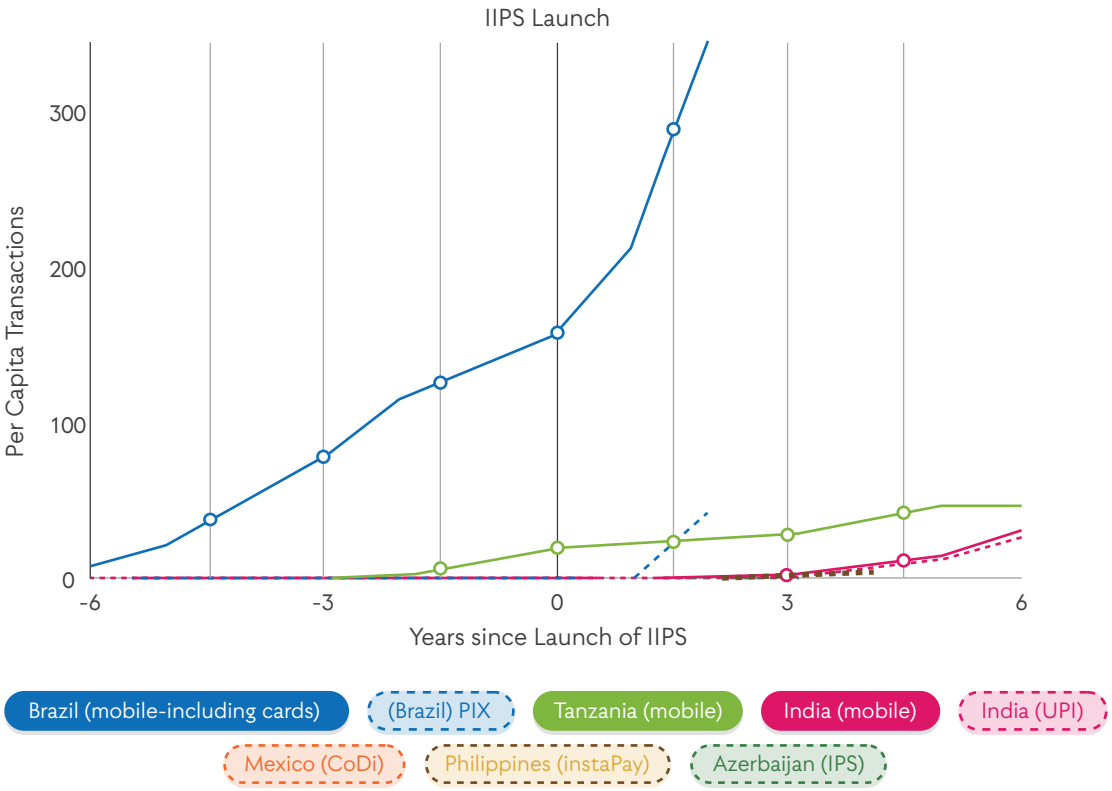
If a IIPS launches at a later stage of the development of a financial system, it carries the prospect of leveling the competitive playing field between FSPs in a setting with better-developed payments infrastructure. In general, more competition should be better for consumers, lowering prices and driving innovation, including by new entrants who could immediately access a large customer base. However, in such a case, the political resistance from the financial sector could be more formidable as they face the prospect of being forced into more intense competition, and potentially significant restructuring to re-optimize their operations to the new financial sector playing field. If FSPs do not embrace the IIPS and only join by force, they might not invest in its success or be incentivized to develop and market use cases to consumers. In two-sided market settings, market structures that encourage fierce competition on the supply side can sound attractive for consumers but may be less likely to succeed.

We provide preliminary evidence on the timing of launch of interoperability in the following figure, which displays transactions per capita for six key emerging market IIPS, including the four that were first illustrated in Figure 1. The bottom panel simply re-states the top panel in log terms, making it easier to compare between the different IIPS. The solid line depicts all domestic mobile payments, i.e., processed through mobile phones either on digital wallets or other mobile apps including mobile banking, while the dotted line depicts transactions processed through the IIPS. We provide an analogous figure (figure 12) in Appendix II which displays transactions through the IIPS against all domestic electronic transactions.

First, we see the tremendous level of development of electronic payments in Brazil, which dwarfs the others, even just in terms of mobile transactions (this gap is even more dramatic for all electronic payments, as seen in Appendix II). Second, we see that the early growth of Pix is misleading – mobile payments were growing rapidly in Brazil even prior to the launch of Pix. We see a further increase in the growth rate of mobile payments around the launch of Pix, though this also coincided with the COVID-19 pandemic, which spurred digital payments globally. Third, relatedly, we see that in markets like Brazil and Tanzania, greater prior digital and mobile payment adoption might have made adoption of a IIPS easier.

Indeed, the IIPS in Tanzania implicit in this graph was created by a private agreement between the major mobile money players. Unfortunately, the data parsing out off-net payments on this private switch is not publicly available, however it is still interesting to observe the evolution of total mobile payments (essentially all on-net and off-net payments by the major mobile money operators) preceding and following their agreement. Fourth, however, in markets where digital payments were relatively less developed at the time of launch (e.g., India, Philippines), the launch of a IIPS may have helped in driving greater digital and mobile payment adoption. Finally, we see that success is not guaranteed, as the Azerbaijani and Mexican switches have seen relatively slow adoption in their early years. All the same we commend the relevant parties for making this data publicly available, and would urge other switch managers to making similar datasets, ideally parsing on-net, off-net, and other digital and electronic transactions, publicly available so that systematic, cross-country knowledge can be created.

"Muslim market, Shanghai" by LezlieN (CC BY-NC-ND 2.0)



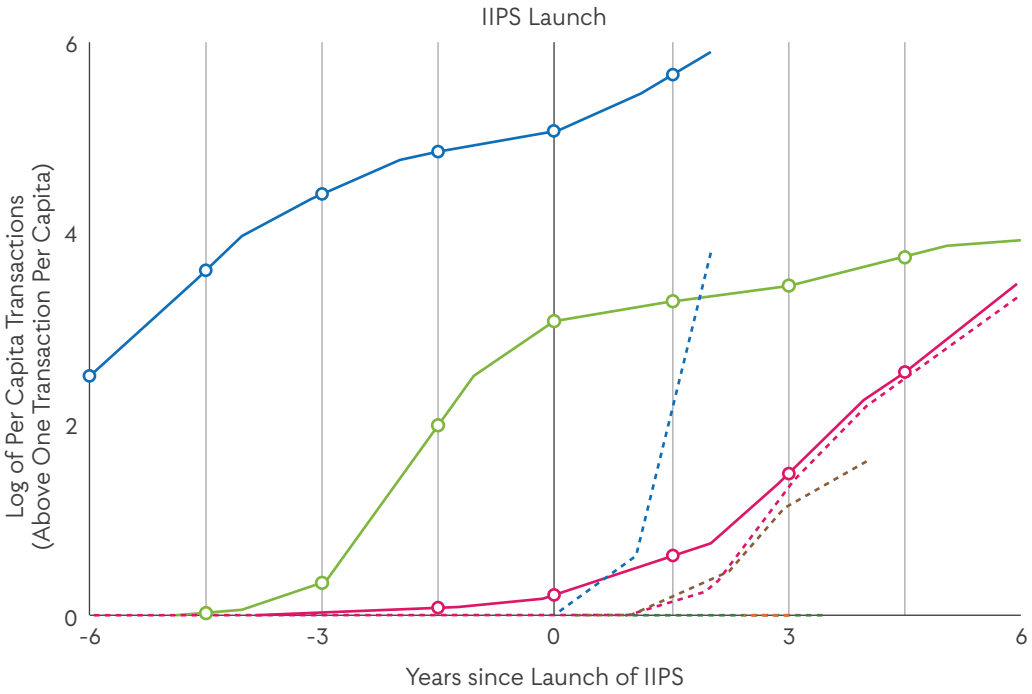


Figure 4: IIPS and Mobile Transactions per Capita (top: standard, bottom: log)

5.4.2 Competition Channel: FSPs and Merchants

The introduction of low-cost, rapid interoperable payments significantly reduces barriers to payments transfers between FSPs' user networks (consumers and merchants), particularly for users who do not have access to the interbank payments network through a formal bank account and for lower-value transfers.[48] This reduction in transaction barriers could lead to increased competition between FSPs, which can benefit users in a few different ways. First, customers who previously held multiple accounts in closed-loop networks with multiple FSPs could reduce the number of accounts they use to potentially one primary account. Second, account holders who on the margin were drawn to FSPs primarily for network factors (e.g., because more of their friends and family were with that FSP or it had a larger network in general) might start to prioritize value-added services. Finally, and potentially most importantly, interoperability can lower the barriers for FSPs to offer financial services outside their home user network. This can level the playing field for FSPs with smaller user networks and increase incentives for financial innovation.

The most comparable case to rapid interoperable payments that has been closely studied is that of payment card networks (Chakravorti 2010). Payment card networks such as Visa and MasterCard facilitate interoperable payments between users aligned with different FSPs within the network. Hence, from the perspective of a card-holding user, a card network is analogous to an FSP's closed-loop client network in terms of providing payments interoperability. Without interoperability, a user might need to use several FSPs in order to make transactions to users in their networks. Interoperability allows consumers to easily connect to other user networks affiliated with other FSPs, even if they only use one FSP.

The current economics literature does not give clear guidance on how interoperability would affect competition between FSPs, and empirical evidence is scant. One possibility is that interoperability could reduce the user's need to multi-home; with interoperability, FSPs might compete for a greater volume of business and attract the users to use their services only. Another possibility is that smaller FSPs benefit from interoperability because it allows them to access a larger user base, which was previously enjoyed by larger FSPs without interoperability (Katz and Shapiro 1985).

There is also a lack of clear guidance from the economics literature on the consequences of network competition for users. The standard analysis of competition in economics says that competition between service providers like FSPs is good for consumers and merchants: prices fall, hence the economic gains for users (surplus) should increase, and FSPs' profits decrease. However, it has been shown theoretically that under certain conditions, network competition may not lead to more efficient prices (Rochet and Tirole 2003; Chakravorti and Roson 2006; Guthrie and Wright 2007) when competing networks

48 Particularly in LMICs the distinction between consumers and merchants may not be so clear. For example, someone operating a micro or small enterprise, particularly in the informal sector, may use a single, personal mobile money account to manage business and household transactions.

attract end-users who tend to single-home but their networks are not able to capture the extra economic surplus that users gain from maintaining an account with a particular network.[49] Nonetheless, the welfare gain from more competition is usually larger than the welfare loss from less efficient prices. There is little evidence of such possibilities in the context of financial networks, however there is evidence from other network competition settings. For example, Björkegren (2022) conducted a study on the development of the Rwandan mobile phone network, showing that it matters when new telecom players enter the market. When competitors enter early, the extra competition has positive effects, leading to lower user prices while maintaining incentives for telecoms to invest in building out their network coverage. However, later competitor entry has more mixed effects.

Besides network competition, interoperability may also facilitate competition between merchants. Interoperability makes digital payments more attractive for consumers. Thus, merchants might lose business to their competitors if they do not accept digital payments even though the payments could include a fee for merchants. Unfortunately, the burden of adopting a new payment technology is likely to affect less advanced merchants the most, who are likely from lower-income households. The rollout of payments solutions leveraging interoperability, such as QR code-based payments, would only exacerbate these pressures. In general, consumers are most likely to benefit from merchant competition, as it would increase the efficiency of merchants leading to lower prices or better-quality goods and services for consumers. It is possible that in the fragmented markets of the developing world, a payments solution that drives some (generally smaller) merchants out of business could leave the remaining merchants with greater market power, which could have adverse effects on consumers in the medium to long term. Nevertheless, the market with increased merchant competition through interoperability should be more favorable to consumers.

The pricing of payments, discussed at length in the previous section, could also be a channel to reduce consumer welfare. If FSPs are largely free to set the fees for payments transfers, they may be able to take advantage of competition between merchants to set fees that are higher than socially optimal. Again, the payments card literature may be instructive. Rochet and Tirole (2002) find that merchants may be willing to pay higher fees for digital payment technology in order to stay competitive and attract customers who are interested in using the technology. However, this comes at the cost of driving up the price of the service, making society as a whole worse off. As suggested by Wright (2004), when merchant competition is meaningful, the transfer fee that is optimal for society can depend on a number of factors, including how much consumers and merchants value the payment technology, and the costs underlying the retail business model. One implication is that competition between merchants can lead FSPs to set sub-optimally high transfer fees that drive down payment transactions.

49 This is quite possible if networks are not able to price discriminate by offering different prices to users with different relative valuations of their services.

We highlight several reasons why the literature on networked industries would benefit from more empirical research, particularly leveraging experimentally-generated data (Rysman and Wright 2012). First, most of the work in this area is theoretical. Hypotheses-testing is critical for assessing, refining, and extending theoretical arguments. For example, how competition between FSPs affects transfer prices is theoretically ambiguous but can be tested empirically. Likewise, many assumptions of existing models could be empirically validated. For example, we lack strong evidence on the extent to which network externalities are present (i.e., the extent to which user growth itself attracts more users to platform), and whether merchants have the ability to surcharge. Third, outcome predictions under existing models are built based on several hypothetical parameters such as the level of interchange fees (Guthrie and Wright 2007). Leveraging real-world data, we could realistically calibrate or estimate these models. Lastly, empirical research in this field mostly relies on approaches that require relatively strong assumptions, such as the instrumental variable approach. Research that uses experimental variation would provide more convincing evidence.

5.4.3 Impact on Innovation

One of the most important justifications for promoting interoperable payment systems is that they will allow any FSP to rapidly reach a large consumer base. In turn, this might stimulate innovation in financial products and services, for example, new savings, credit, insurance, or payments products. We are not aware of any empirical evidence on how interoperability could affect innovation in the economics literature, perhaps partly because new interoperable payments systems have not been in place long enough to lead to measurable downstream effects. The broader literature on innovation has found that the extent of innovation importantly depends on the market structure, which influences market participants' innovation incentives (see Aghion et al. (2005) and Goettler and Gordon (2011)). For example, if an industry has several neck-and-neck competing firms, they might have an incentive to innovate, as their profit gained from innovation is high, especially if they can maintain exclusive access to the innovation.

Pricing structures have also been shown to have important effects on the extent of innovation. Pricing raises an important tradeoff: higher prices for users lower their incentive to adopt innovations but increases FSPs' incentives to innovate. Bourreau and Verdier (2013) showed that, in the context of payment cards, unless consumer adoption exhibits strong network externalities for merchants (meaning that user adoption could be deterred if banks pass on high fees to users), high interchange fees give banks greater incentives to innovate. Evans (2011) demonstrated that whether merchants or consumers pay the interchange fee affects the extent of innovation. The merchant-pays model resulted in a higher level of innovation and benefited merchants and consumers. On the other hand, because the profit obtained from the consumer side is less than that obtained from the merchant side, switching to a consumer-pays model is predicted to lead to a decline in the amount of innovation and investment in payments, which will hinder new payment systems.

5.4.4 Impact on Investment

Another important outcome to understand is how interoperability might affect investment, particularly for the growth of mobile money networks. Interoperability between wallets may, for instance, incentivize investments in products and services to retain money in the system. In addition, interoperable payment systems may also facilitate interoperability on the agent level, and thus might discourage investment in agent network development, as FSPs might not be able to prevent competitors' free riding and recoup the expenses of investing in their agent network. As noted, Björkegren (2022) showed in his empirical study on Rwandan telecoms that incentives to invest in a network industry depend on the timing of interoperability, the level of competition, and types of investments (i.e., investments that expand the market or induce dispersed network spillovers). Having a competitor earlier would have reduced prices and increased incentives to invest in rural towers.

5.4.5 Broad Market Impacts

Beyond competition and innovation, we should expect broader impacts of interoperable payments as changes to the financial sector flow into the broader economy. The introduction of interoperable payments provides both interoperability and an expanded market for DFS. As described earlier in the section on Cost reductions and efficiencies, the expansion of DFS has been shown to have a range of largely positive impacts on households and firms, such as in improving resilience, reducing poverty, and expanding economic activity. Whether interoperability might amplify or reduce these impacts of DFS is not well documented in the literature, but it is expected that interoperability could enhance the broader impacts of DFS by making the payments network more interconnected and enhancing access and innovation. The case of UPI in India, however, underscores that benefits are likely to disproportionately accrue to those most likely to be digitally connected and active in their usage of DFS. UPI access has predominantly been through smartphone apps, as UPI's SMS-based system failed to gain traction and accounts for a miniscule proportion of the transaction volume (RBI, June, 2022). Yet, unlike in China, as of 2018, only 32% of Indians owned or shared smartphones (compared to 51% who owned or shared a basic or feature phone) (Silver et al. 2019).

Evidence on the broader economic impacts of interoperability is currently lacking. However, several papers provide macro-level empirical evidence and demonstrate a positive relationship between the use of electronic payments and economic growth, trade, and consumption (Hasan et al. 2012; Oyewole et al. 2013; Zandi et al. 2016). However, Tee and Ong's (2016) research cautions that the impact of DFS on economic growth might only be observed in the long run, as it takes time for systems to build a large enough user base and volume of use to be detectable at the macroeconomic level. Furthermore, many of the users of DFS in low- to middle- income countries (LMIC) are in the informal sector, and hence their economic contributions may not be measured in government statistics.

DFS and interoperability could also affect consumers' consumption behavior, especially as it promotes digital payments as a more viable alternative to cash. Interoperability may make payments more convenient for consumers, especially when visiting small merchants, and for payees who need to travel considerable distances to make payments for necessities such as utilities. This could change where and how much consumers spend. Agarwal et al. (2019) show that electronic payments increase overall spending. In Mexico, the adoption of widespread point-of-sale (POS) terminals to accept card payments caused a partial shift in richer households' consumption from large to small retailers (Higgins 2019). Some research also finds that electronic payments could substitute for other types of cashless payment, e.g., check payments (Tee and Ong 2016), and that there might be spillover effects to cashless payment, e.g., credit cards (Agarwal et al. 2019), as the ease of use of interoperability leads to an overall move away from cash payments. Additionally, interoperability could promote new consumption channels such as online shopping. If interoperability stimulates innovation in financial services like credit, insurance, and savings, then this may also change the productive and savings choices of households. Once again, empirical evidence on these possibilities is scant.

If interoperability leads to an increase in economic activity, then merchant sales are likely to increase as a result of higher consumer spending. However, there are likely to be distributional impacts. If merchants can take advantage of new payments opportunities, then sales growth could be particularly large for small and entrepreneurial firms (Agarwal et al. 2019). Agarwal et al. (2020) found that the introduction of mobile payment technology leads to a higher growth rate of business creation in business-to-consumer (B2C) industries relative to business-to-business (B2B) industries, with the effect being largest in small firms and in industries with a higher cost of cash handling. If FSPs further provide new products and services, there could be smaller sales volatility (Chen et al. 2021) and sales growth due to the relaxing of credit constraints (Hau et al. 2021). However, the least advanced firms may face barriers to taking advantage of new payments channels and lose out as a result.

Interoperability can also have important implications for the role of government in the economy. While the role of government policies in managing interoperability will be addressed more thoroughly in the Regulatory Considerations section below, some potential aggregate impacts are highlighted here. First, interoperability can facilitate government payments, making them more efficient. This could have broad welfare impacts, particularly benefiting the poor, such as in reducing "leakage" in government programs and improving targeting (Muralidharan et al. 2016). Second, in many LMICs, a large percentage of the economy operates in the informal sector. Whether interoperability will increase or reduce informality partly depends on whether and how governments choose to leverage digital payments data. Digital payments result in a clear electronic trail of payments, which governments could attempt to leverage to increase tax revenue (Zandi et al. 2016). Governments could attempt to introduce interventions, such as requiring merchants to formally register. The extent of the impact on tax revenue depends on merchants' willingness to adopt vis-à-vis their tax evasion incentives. In the

extreme case, an intervention that attempts to force users to make their transactions more transparent could backfire, as few merchants register and they are more reluctant to adopt the new digital payments channel. Ulyssea (2020) argues that the most effective way to increase formality is through increasing enforcement to incentivize firms to formally register (e.g., as opposed to lowering the costs of formality such as through lowering tax rates). Perhaps if digital payments are associated with formal registration, it could make it easier to observe formality status, and hence lower the cost of enforcement.

"Mobile money kiosk in rural Ghana" by Fiona Graham, WorldRemit (CC BY-SA 2.0)

6. Regulatory Considerations

Governments have been confronted with a number of trade-offs in how to regulate interoperable payment systems to optimize efficiency and welfare gains. In order for the system to function effectively, a delicate balance between regulatory intervention, private sector self-governance, and market forces is needed. The adoption and timing of interoperability is also an option for regulation. For example, the government may consider mandating all licensed FSPs to integrate with the switch. This would ensure the interoperability among all FSPs and increase the network size. It is also relevant for regulators to consider the optimal timing and approach to encourage interoperability depending on a country's level of financial system development.

In this section we highlight several key considerations. First, we discuss issues around the regulation of pricing, both whether and how much FSPs contribute to the switch, and what FSPs charge to users. We consider alternative models to recoup switch costs, and the effects of pricing on user adoption and innovation by FSPs. We also provide an overview of regulatory issues in merchant payments pricing. We then discuss the issue of switch governance, and consider some additional key issues including economic formalization, privacy, and digital inclusion.

6.1 Pricing Regulation: Adoption, Timing, and Merchant Payments

As covered in previous sections, the near-instant interoperability of the payments ecosystem represents a systemic change. Pricing is an important, yet subtle area for regulation: low fees can drive user adoption, however they can also stunt incentives for FSPs to promote adoption, and innovate. As consumers continue to adopt certain use cases and markets begin to adjust, user fee policy-making will affect the ongoing adoption and usage levels of the system. We initially have more of a focus on pricing in the context of P2P transfers. We then provide a dedicated discussion on the regulation of merchant payments under IIPS, beginning with a motivation of electronic merchant payments from first principles, and contrasting IIPS-based merchant payments with other merchant pricing models. We close with a brief discussion on how optimal pricing regulation might evolve over time.

6.1.1 The Regulation of Pricing

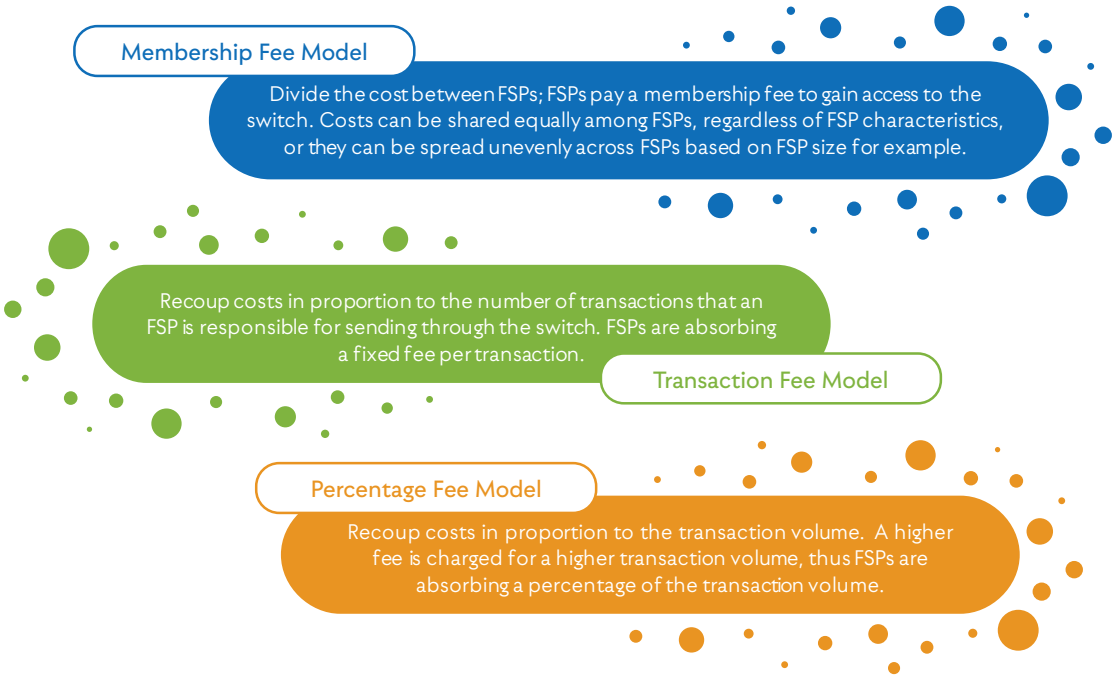
Pricing is an important area for regulation. The switch owner or regulator needs to decide how to cover the costs of maintaining and further developing the switch and its use cases as well as whether and how to regulate what fees FSPs charge to individual users. In some cases, government or donor budgets may be used to cover the setup costs of the switch or certain use cases. While switch maintenance and development costs could be covered from a central budget or endowment, in most cases, switch owners intend for the cost to be recouped through fees incurred by the FSPs for using the payments switch. The Level One Principles recommend that "the system should operate on a not-

for-loss or cost-recovery-plus-investment basis;" how to structure FSP pricing is actively debated in switch implementations around the world, without a widely-held consensus. The advantages and disadvantages of some of these approaches are reviewed below.

Different pricing rules would directly affect FSPs' operating costs and lead to different market outcomes. Many considerations go into price regulation, which affects a range of outcomes, from distributional consequences between FSPs, user adoption, to innovation and investment. Regulators might also consider optimal timing (e.g., pricing regulations that are optimal for a nascent switch might not be optimal for a more mature one). The actual impact of the pricing rules might also vary depending on certain market features such as the existing financial market structure (e.g., whether the industry is relatively competitive and dynamic, or dominated by a small number of incumbents). Regulators might consider these consequences when deciding on the pricing rules to implement, and whether to modify them over time as circumstances evolve.

6.1.2 Pricing Regulation Approaches

There are a few potential models for regulators or switch operators to pass on the cost of the development and maintenance of the switch to the FSPs. The following descriptions assume that the policy will follow the Level One Principles and seek to collect fees solely to cover these costs:



Membership fees would probably facilitate greater cost certainty for FSPs, as the contributions could all be predicted quite accurately in advance. However, if the costs are spread evenly among FSPs, the marginal cost per transaction would be higher for smaller FSPs, which process fewer transactions but pay the same fee as larger FSPs. Under this

model, larger FSPs likely gain a higher profit from interoperable payments; competition among FSPs would be lower under the membership fee model than the other two models.

For FSPs that tend to handle larger transactions, like commercial banks, the transaction fee model leads to a lower marginal cost per dollar of transaction value as compared to the percentage fee model. On the other hand, charging a fixed fee per transaction would cause a higher marginal cost for FSPs that handle smaller transactions as compared to the percentage fee model. Suppose larger FSPs process mostly large transactions; the transaction fee model would favor these large FSPs and lead to lower competition among FSPs. In contrast, the percentage fee model would benefit small FSPs and result in more competition overall.

A richer version of these models could distinguish between size or type of FSP, assigning larger shares to larger institutions, potentially as a dynamic function of switch use in a previous time period (e.g., last fiscal year). A combination of the three models could also be considered: e.g., FSPs pay a membership fee every fiscal year and pay a transaction or percentage fee for each transaction made.

The pricing scheme directly affects FSPs' marginal cost and their profits. A higher price charged to FSPs acts like a tax, decreasing their incentive to innovate as they expect to earn lower profits in the future (Bourreau and Verdier 2013; Evans 2011). Moreover, the FSPs' innovation (e.g., Aghion et al. 2005) and investment incentives (e.g. Björkegren 2022) depend on the market structure, which is shaped by the pricing scheme. A pricing scheme that encourages excessively high or low competition levels might lead to lower innovation or investment, as FSPs are less incentivized to compete to survive. The effect on innovation is further elaborated on later in this section.

6.1.3 Pricing Policy and User Adoption

While the pricing rules for switch maintenance and development directly affect FSPs, they can also affect users indirectly. Therefore, it is important to consider the impact of these pricing rules on users through the pass-through of fees from FSPs to users. Consumer-centric regulators might have incentives to require that FSPs bear most costs and help users enjoy the services at a lower price. However, without regulations on user fees in addition to the pricing schemes, FSPs could simply pass their costs on to users by charging a higher user fee. Even with regulations on user fees, FPSs may ultimately charge higher loan rates or cash-out charges to recoup the cost. There is also a diversity of ways for FSPs to charge user fees and practices between countries differ.[50] The regulator should also consider the price of off-net payments relative to on-net, i.e., if these fees

50 For example, in Philippines, different providers have different fee structures. Most providers charge a fixed fee per transaction, ranging from PESO0.00 to PESO250. In Nigeria, providers charge a minimum of ₦50 subject to 1.5 percent of transaction value or ₦500, whichever is lower. In India, the UPI payment system has no charges.

are quite different it could lead to distortions and incentivize costly work-arounds. If FSPs oppose interoperability they may set high off-net fees as much to discourage customers from transferring funds off their user network, as to drive revenues, analogous to tariffs in the context of international trade.

User fee policy-making affects the adoption of a system; more users will adopt a system when the cost is low. The regulator should consider the benefits and costs of restricting the user fee. If there is an adoption externality (i.e., a user's adoption could attract other users to also adopt the system or use the system more frequently), charging users the full marginal cost of a transaction early in the life of a switch might not lead to rapid user growth because this dampens the rate and extent of adoption. Charging a fee lower than marginal cost early in the life of the switch might be optimal when user surplus driven by the adoption externality dominates the cost of lowering the fees. The system owner or regulator may even temporarily reduce or remove fees, or even provide incentives like cash transfers or assistance with setting up a new wallet, in order to incentivize users to adopt and use the new technology. Note that in the context of a participant-owned infrastructure, the transaction fee is the allocation of costs among participants, and the industry will ultimately bear these costs. Hence, charging a lower fee early in the life of the switch might result in a higher fee later on.

Some regulators intervene by restricting fees, while others tend to leave it to the FSPs and the market to determine the prices. Interbank transfer fees were one of the key policy instruments used by regulators to encourage digital payments early in the COVID-19 pandemic. A number of regulators, including in the Philippines, Pakistan, and Rwanda, mandated zero pricing of inter-FSP transfers in April 2020. Later, throughout 2020 and 2021, some regulators began to roll back these restrictions. However, these well-meaning policies may have had some unintended consequences. For example, the Pakistan government has mandated FSPs to charge zero for off-net transfers since April, 2020. However, leading mobile money providers claimed that they have been suffering financial losses because of this regulation. Users holding both bank accounts and mobile accounts, about half of mobile money customers, could use mobile money agents to process deposits to their bank account for free, essentially forcing the mobile money companies to digitize cash on behalf of the banking sector, without generating any revenue. The zero-fee mandate in Pakistan had not been rolled back as of mid-2022.

At the same time, it might not always be optimal to charge all users the same fee due to user heterogeneity. For example, a common pricing strategy in two-sided markets is to charge different prices to merchants and consumers. Since a transaction requires both adoption and usage by the merchant and consumer, a price charged to consumers would indirectly affect merchants, by preventing their customer base from growing as fast as it otherwise would have. Depending on the relative price elasticities between the merchant and the consumer (i.e., how relatively price sensitive they are, as well as their interdependencies) the regulator might consider mandating different fees for merchants and consumers. Furthermore, each merchant may have a different price elasticity and

interdependence, hence it could be beneficial to charge different prices for small and large merchants or to consider other dimensions of heterogeneity.

6.1.4 New regulation regimes for merchant payments under IIPS?

What is the most efficient way for a consumer to pay a merchant? A consumer wants to give a merchant an exact amount of money, in return for a good or service. Cash provides an interoperable means to transact, but it is impractical to rely on cash, given security risks of storing and transporting cash, and the inconvenience of transacting exact amounts in cash. The consumer can make a promise to pay, like in written form like a check, but this requires trust and doesn't work well for remote or online payments. Hence, we're drawn to secure electronic payment instruments that make it easy to pay quickly in exact amounts with both parties being confident about what they paid or will receive.

6.1.4.1 Essentials of an electronic payment chain

What are the essential elements of an electronic payment chain? The payments are going to be linked to electronic accounts of the consumer and the merchant, respectively, whether with a bank, e-wallet, etc. There needs to be an interface where the consumer can securely confirm they want to release an exact amount from one of their own accounts, at point of sale (physically in-person or online), in return for a good or service from a merchant, who can be confident that the agreed amount will arrive in their own account within a reasonable period of time.

Thus we need:

- An issuer of the electronic payment instrument to the consumer. It makes sense that the consumer's FSP that custodies their account would issue the electronic payment instrument to them. That FSP has oversight on their account, and conducts KYC, so is best placed to take responsibility for a payment they initiate. The issuer is also well-placed to provide credit in the case of delayed payment if the system allows.
- An acquirer of merchant payees. It correspondingly makes sense that the merchant would work with an FSP that provides their merchant account and associated supporting services, such as payment interfaces or terminals, training in payments acceptance practices, and a line of credit to manage payment gaps.

It turns out that the market economics behind who pays what, and when – between consumer, merchant, issuer, acquirer – comes down significantly to the network economics of who is willing to pay, or needs to be incentivized, to adopt and utilize electronic payment instruments. Electronic payment instruments are a network good – consumers value them more if more merchants accept, and the merchants value them more if more of their customers are willing to pay with them, especially if it makes them willing to spend higher, and often.

In most electronic payment networks – e.g., debit and credit cards, some newer fintech models – the tilt of the economics has been to charge merchants and reward consumers, indicating a balance of economic incentives where merchants particularly benefit from having issuers push for widespread electronic payment usage amongst consumers. While some countries largely leave the attendant fees to market forces, some regulators have tried to limit these fees. Will the streamlined, cash-like payment models enabled by IIPS change the underlying economics, and hence the optimal regulatory responses? With IIPS making digital payments more accessible to lower-income consumers and informal-sector merchants in emerging markets, will we see new approaches emerge around the regulation of fees?

6.1.4.2 Closed-loop systems

In closed-loop merchant payment systems the issuer and acquirer are one and the same – a payment provider facilitates payments between its own clients, potentially through payment instruments like cards and POS terminals or QR codes. Having the provider directly serve both sides of the market provides certain advantages in terms of oversight and efficiency, but raises the challenge that it has to both recruit consumers and acquire merchants onto its platform. Hence closed-loop credit and debit card providers like American Express and Discover tend to focus on a smaller set of wealthier clients with larger average transaction sizes. Paypal and Square are examples of a closed-loop fintech payment models. In emerging markets there are numerous examples of closed-loop merchant payment systems provided by large banks or mobile money companies.

In these closed-loop models the payment providers tend to charge a MDR on each payment, deducted from the sticker price and hence officially charged to the merchant (rather than the consumer). On the consumer side, while debit and some fintech payments clear near-instantly, credit card models allow the provider, also registered as a bank, to offer a line of credit to the consumer so they can pay later, allowing the provider to earn interest. There may however be other consumer fees (e.g., annual card maintenance fee).

6.1.4.3 Open-loop systems

In an open-loop system, we open the possibility for at least two FSPs to be involved, one as issuer (of the electronic payment instrument to the consumer, and potentially other services like credit), and one as merchant acquirer. We need a way to bridge payments between the two, which adds an additional function:

- **Provider of interoperability.** The means of bridging payments between two FSPs.

If payments don't instantly clear, the issuer take responsibility for payments with instruments they issued. The acquirer typically deposits payments received on behalf of merchants in batches, and may provide credit to cover gaps in payment. Issuers and

acquirers need to cover fraud risk on either side of the payment, and take responsibility for other risks around the transaction such as payment default by the consumer or business dissolution by the merchant.

In the context of credit and debit cards, companies like Visa and Mastercard provide secure payments interoperability between FSPs, with issuers providing consumers with cards tied to the respective payment networks. In these networks the economics are again tilted toward consumers such that typically an MDR is charged, usually lower than in a closed-loop network,[51] with open-loop card companies focusing more on total number of transactions than average transaction size. The merchant again pays the MDR on the sticker price, part of which is kept by the merchant's acquiring bank, but most (around 70%) of which is transferred to the consumer's card-issuing bank in the form of the "interchange fee," to cover the latter's risk of prospectively approving the payment, and other customer service costs. Since this risk is lower in the case of debit card payments, which withdraw the payment from existing funds, the interchange rate is typically much lower for debit than credit card payments.[52] The merchant's acquiring bank usually has to further pay the credit card company a scheme fee, or switch fee, for access to its payment network. The issuer provides the line of credit to its clients if it offers a line of credit under the credit card, and consumers are often encouraged to use payment cards, such as through additional bonus and reward programs.

6.1.4.4 What does this mean for regulation of merchant payments under IIPS?

To forecast how these payment economics might evolve under IIPS, it's important to still keep in mind that we expect merchants to continue to adopt, offer new payments options in an inclusive way to a broad swathe of merchants, and incur the associated fees for them, if the expected benefit of doing so over time exceeds the cost—and likewise for consumers, in terms of their willingness to use these instruments.

Under an open-loop IIPS, the provider of interoperability is the fast payment switch, which may be privately or publicly run. Running it more like a public utility could lead to lower fees, though there tends to be one switch per country, rather than multiple competing card or fintech platforms, so monopolistic pricing is still possible. Instant payments clearance reduces a lot of risk in the system, mitigating fraud and credit risk, and reducing or eliminating funding periods—thus potentially helping to negate the primary purpose of the MDR. This is analogous to how debit card MDR is typically much lower than credit card MDR. Moreover, customers may need less encouragement to adopt highly-convenient, phone-based payment options, reducing the need for consumer-friendly pricing structures. An objective of IIPS merchant payments may also be inclusivity

51 MDRs in open-loop networks tend to be 0.5-2.5% of the sticker price of the good or service, while in closed-loop networks 2.5-3.5% is more typical. Some countries have attempted to regulate the MDRs and/or the embedded interchange fee, and it has been a subject of anti-trust litigation in the United States.

52 https://higherstandards.net/debit-cards-vs-credit-cards-which-should-merchants-prefer/

of small merchants, who may transact mainly in cash and hence are not accustomed to paying an MDR. All of these factors point to the potential for more merchant-friendly pricing, in terms of lower percentage fees, zero fees, or even consumer-pays models[53]—and for regulators to intervene to achieve those outcomes. In particular, if a high MDR discourages small merchants from adopting electronic payments, it might create a competitive advantage for large merchants, which a regulator might want to mitigate, potentially creating both more competition and better distributional outcomes.

On the other hand, there is still significant room for innovation in payment technologies and practices, whether in person or online. Merchants may still need training, access to technology, and support. It's probably relatively less profitable to provide digital payment services to informal sector merchants, who may need more training and support, may be more costly to service (e.g., less convenient locations), and may generate less revenue for an acquirer. Who will provide these services, if not an acquirer? While some consumers may be willing to adopt IIPS-linked payment methods, others may still need more encouragement, marketing, training, and incentives. These factors push back on aggressively trying to reduce or eliminate MDR.

The regulatory game is changing in the context of IIPS. Greater public involvement in creating and managing IIPS may create a sense that regulators should ensure that fees are as low as possible. Regulators have arguably been more interventionist in merchant payments on IIPS than in other payments use-cases, by taking actions such as eliminating interchange (e.g., Brazil, Singapore), setting the market-level fee structures (Jordan), or even eliminating fees all together (India, Mexico) (Cook et al. 2022). However, some of these moves have been controversial, and led to concerns about reduced investment and innovation in the payments industry. If providers genuinely still face meaningful costs, and can't recoup them directly due to a capped MDR, it may distort the market by forcing them to generate revenue from consumer payments or in adjacent business lines like credit provision (of course, this may also be an explicit objective for some policymakers, to push new value-added business models outside of payments clearance). Or acquirers may simply ignore informal-sector merchants who offer lower net returns. Regulators and financial-sector policymakers have options to streamline payments and reduce acquiring costs, e.g., allowing for tiered KYC that onboards smaller merchants on lower-frills merchant payment accounts, or encouraging efficient, even remote, digital onboarding processes (Cook et al. 2022).

53 We already have real-world examples of consumer-pay models, e.g., Pochi La Biashara from Safaricom in Kenya and MoMoPay from MTN in Ghana, https://www.safaricom.co.ke/personal/m-pesa/lipa-na-m-pesa/pochi-la-biashara

Timing of price setting

The optimal pricing regime might change over time depending on several factors; a pricing regime might be optimal for a limited time before the market matures with more users and competitors and a different market structure. In addition, while a government might use temporary pricing incentives or mandates to influence the rate of a system's adoption, it might also wish to consistently restrict user fees. If there is a long-term price restriction, however, the government needs to consider the impact on FSPs in the long run and potentially provide a subsidy; restricting user fees places a cap on FSPs' revenues, which could affect their profitability and reduce their incentive to delve into research and development systems and other investments that would increase user utility.

6.2 Innovation

As we highlighted elsewhere in the white paper, interoperability has tremendous potential to usher in new financial services use cases amongst existing providers, and encourage the entry of new providers. While this process ultimately depends on market forces and entrepreneurial energy, it will be shaped by the framework that regulators and switch governors provide.

One aspect of switch governance is research and development. Uses cases typically require sustained investment and development in order to build the features of the switch platform. The switch cost recovery and investment model, and how those resources are deployed, will help determine the set of innovation opportunities. Second, regulators typically have broad scope to determine which FSPs can offer what specific services. Regulators may take an assertive role (e.g., encouraging and shaping the direction of innovation) or a passive role (e.g., only considering which applications come in). A common approach for financial services innovation is to create a regulatory sandbox: providing a space for FSPs to run controlled pilots of new services under closer scrutiny from the regulator, which is an important platform to nurture innovation while managing the risk of broad-scale rollouts of financial services that might raise risks for consumer protection, fraud, and over-indebtedness.

Regulators manage the licensing and scope of new FSPs. Interoperability carries the possibility for nimble new FSPs to enter the market and build on the client networks and financial services infrastructure of existing FSPs. This is analogous to settings in which telecommunication companies license out their infrastructure to other mobile phone or internet service providers. Incumbent FSPs have strong incentives to lobby against an open-access approach. While free competition can be favorable for consumers, there is also a risk that the companies that have already invested in the existing financial services infrastructure become much more reluctant to do so if they know others will be able to use the technology they invested in for free. It is possible for regulators to carefully

balance these factors, e.g., Bauer and Gerdes (2012) focus on the transition from paper to electronic processing of checks, concluding that regulations and policies designed can encourage technology adoption by correctly aligning banks' incentives.

6.3 Timing of adoption of interoperability

A potentially important policy question is the timing of adoption of interoperability. As we have discussed previously in the section on Timing of Launch of Interoperability, the success and impacts of a IIPS could vary as a function of the level of development of the financial sector, and other factors. If policymakers are to lead or co-lead the development and launch of a switch, it may be worth considering the timing question in the preliminary stages of assessing a switch project, and varying the approach based on key contextual factors. For example, a more-developed financial system may have more politically-savvy, large FSPs, which might be more resistant to the competitive effects of a switch and its implications for well-developed business models. An excessively heavy-handed approach could stunt the growth of the payments system, if it disrupts the activities of FSPs that are otherwise eager to continue investing in the sector. Ideally a switch would enable efficiencies and innovation, so that the private sector is incentivized to build out use cases and market them, rather than relying on top-down directives.

The allocation of power in the governance process for the switch might have to vary depending on the incentives of key stakeholders. This may also have implications for whether a government-led switch development project sees it initially as more of a public-utility or a private good, and hence whether the regulator plays a relatively hands-off, framework-setting role, or directly manages the switch, at least for a period of time. In a less-developed financial system, there may also be questions about whether the necessary technical capacity is available locally to lead a formidable project like switch development and integration of FSPs with the switch, or whether it is best to involve or outsource some of the work to foreign or international partners.

There is relatively limited systematic evidence thus far on what works and what doesn't for switch development, and of course each country context is unique. Governance relationships are often opaque, and many key discussions and debates are held in private. The irony is that in an environment with significant uncertainty around what works, the perceived risks of open governance are higher, which slows down knowledge-sharing globally.

6.4 Governance

Interoperability hinges on interconnectedness between FSPs. How this is achieved and how the system is subsequently governed raises several critical questions. In most countries the formal authority that creates and governs a switch is some combination of the government or the private sector, with the latter acting within the framework of existing laws and government approvals. Government and private sector actors may

also be supported and advised by partners such as international organizations, non-governmental organizations (NGOs), or industry organizations. In some cases, a para-governmental organization may play a strong technical and policy role in developing and launching the switch. In practice, the impetus to launch a switch could come from FSPs. In other cases, government institutions may provide a strong incentive to launch a switch in the face of resistance from the private sector for reasons that we have discussed earlier.

Once the switch is active, the governance approach is critical, for ongoing decisions, such as the funding model for the switch, how those funds are allocated to switch maintenance, fraud and consumer protection, government engagement, and switch development (e.g., onboarding new technologies and developing new use cases). Sometimes, the switch will be fully centrally-managed by a government entity, however, most experts advocate for a more participatory model, involving representatives from some combination of government, the private sector, consumer advocacy groups, and other organizations. Participatory approaches have the potential to unlock a synergistic collaboration between the various interest groups and maximize the societal benefits of the switch, although, the size and composition of a governing committee and how to delegate powers require careful consideration to find the right balance between societal interests and private sector profitability and innovation.

In 2015 in Tanzania, an industry-led solution to MMI emerged from bilateral negotiations between two of the country's leading MNOs, Airtel and Tigo, facilitated by the International Finance Corporation.[54] By 2016, bilateral agreements were forged with Zantel and Vodacom, the dominant market players. The nimble structure, which did not entail the creation of an autonomous entity to manage the scheme, was instead based on bilateral application programming interface (API) connections and interparty fee agreements (Cook et al. 2021). This enabled the rapid deployment of MMI, which many consumers were eager to use given the dynamic but fragmented market and the prevalence of work-around solutions, such as sending of off-net vouchers (Bourreau and Hoernig 2016). Within two years of its initiation, off-net mobile money transfers accounted for 30 percent of all P2P transactions (Cook 2018).[55]

This case demonstrates the benefits of an industry-based solution to interoperability governance. Tapping into latent demand, MNOs deployed a quick, light-touch governance system that added value for consumers and members, enabling them to overcome initial hesitancy from the dominant market player. At the same time, however, the arrangements essentially created a closed loop system exclusive to MNOs and that required new entrants to forge bilateral connections with each existing member to join.

54 "Achieving Interoperability in Mobile Financial Services: Tanzania Case Study," IFC, 2015, https://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/financial+institutions/resources/achieving+interoperability+in+mobile+financial+services+tanzania+case+study

55 William Cook, "Interoperability in East Africa Dispatches from the Home of Mobile Money," CGAP, May, 2018, https://www.cgap.org/sites/default/files/publications/slidedeck/2018_05-Slidedeck-Interoperability-in-East-Africa-Dispatches-from-the-Home-of-Mobile-Money.pdf

For example, although MNO Halotel entered the Tanzania market in 2015, they did not achieve interoperability until 2018. Thus, while successful at underwriting MMI, the system was not capable of supporting a broader transformation of the financial services sector (Cook et al. 2021).

The prospect of MMI, however, galvanized the Bank of Tanzania to build a new open-loop national payment system, the Tanzania Instant Payment System (TIPS), that enabled real-time payments between all FSPs including banks, MNOs, and MFIs. The system allows consumers to ***potentially*** make low-cost P2P payments to any other registered user no matter their FSP account. Rather than a web of bilateral connections, the TIPS scheme, regulated and managed by the Bank of Tanzania, operates via a hub-and-spoke model. Each FSP integrates to TIPS and the TIPS switch, developed by the Bank of Tanzania using the Mojaloop open-source platform for interoperability (Mojaloop), allowing consumers from one FSP to push credit payments through the hub to another consumer or merchant anywhere on the wheel.

Whereas TIPS constitutes a much more inclusive payments system, it also represents a significant shift from a lightweight industry-led approach to a state-led, centralized solution to the challenge of FSP inter-connectedness. The system also has much more expansive goals, from security and efficiency of digital financial transactions and accelerating the country's transition to a cash-lite economy to strengthening the government's regulatory capabilities, especially tax collection, through transaction visibility, as stated by the Bank of Tanzania's National Payment System Director.[56]

The launch of RAAST in Pakistan in 2021 is another example of a state-led interoperable payment system. This may presage a trend of public initiatives to incubate national payment schemes. But it is worth noting that one of the early state-led systems, Jordan Mobile Payment (JoMoPay), eventually transferred scheme ownership to a separate public/private entity, the Jordan Payments and Clearing Company (JoPACC). Other prominent payment initiatives, from Australia's New Payments Platform (NPP) to Philippines' InstaPay to India's UPI, represent industry-led models. The state provides oversight and was catalytic in getting the system off the ground, however, the scheme itself is managed by a consortium of private companies.(Cook et al. 2021).

Formalization

One principal objective many governments have for investing in interoperable payment systems is strengthening their taxation capabilities. For example, at the launch of RAAST, Pakistan's Prime Minister, Imran Khan, bemoaned the country's narrow tax base describing it as the lowest in the world, which he attributed to the country's "big informal economy." He lauded RAAST for the promise it held in reducing Pakistan's cash "addiction," boosting the formal economy, and increasing the revenue the government

56 "BoT launches single payment system," The Citizen, February 14, 2019, https://www.thecitizen.co.tz/News/BoT-launches-singlepayment-system/1840340-4981752-d3ybfbz/index.html

needs to modernize infrastructure and services.[57] Interoperability, however, may not have uniform positive effects on formalization and taxation. On the one hand, the launch of interoperable payment systems may encourage informal businesses to register with tax authorities to gain access and enable the digitization of tax payments, which in some economies has led firms to increase the sales they report to tax authorities (Das et al. 2022) and may increase taxation rates (Klapper, Miller, and Hess 2019). At the same time, as national switches reduce the costs governments face in monitoring financial transactions, they may increase business and citizens' concerns regarding higher tax scrutiny and deter them from using the platform altogether, further disincentivizing formalization.

Existing research on the types of firms that dominate the informal sector in emerging economies underscores the policy dilemma governments face in this respect (Ulyssea 2020). Drawing on data from Brazil, Ulyssea (2018) classifies almost 49 percent of firms as eschewing formalization out of necessity; as low-skill individuals, their productivity levels are too minimal to warrant formalization and if forced to formalize, they would likely exit. On the other hand, almost 42 percent avoid formalization out of choice; they are productive enough to compete in the formal sector but "choose to remain informal to earn higher profits from the cost advantages of not complying with taxes and regulations" (Ulyssea 2020). Consequently, requiring formal tax registration as a prerequisite for using interoperable payment switches may prove effective with the latter set of firms but with adverse consequences for the former. A more optimal policy may be to allow informal firms to integrate with the switch first (e.g., acquire settlement accounts without a formal tax numbers), realizing the potential productivity boost that comes with interoperability as detailed above, and then enforce formalization after a few years. Tax rates on the most vulnerable firms could be minimal.

6.4.1 Privacy

Interoperability also raises important questions about data ownership and access. Interoperable payments immediately extend the shared database of between-FSP transactions, and the switch generates a database of all off-net transactions. Various models are possible for ownership and management of these databases including a limited access model in which no one can access the database other than for functional purposes like running diagnostics and error-checking. Access could be extended to one or more government entities, which may be used for purposes like tax collection and monitoring on illegal activities, such as money laundering or terrorist financing. Furthermore, access may be provided to the entity governing the switch, for example to monitor switch activity through key performance indicators (KPIs) or, even more broadly, controlled access might be provided for other financial services applications, such as a credit bureau. And finally, access could be provided to selected researchers to conduct important studies on switch activity while protecting the privacy of individual users.

57 Rizwan Shehzad, "PM rolls out 'Raast' initiative to move to cashless economy," The Express Tribune, 11 January 2021. https://tribune.com.pk/story/2279540/pm-rolls-out-raast-initiative-to-move-to-cashless-economy

6.4.2 Digital Inclusion

Much of the infrastructure of interoperable payment systems is predicated upon existing access to digital technology, especially for consumers, mobile phones and mobile money accounts. Over the last 15 years, enormous gains have been made in terms of mobile phone ownership, exponentially increasing access to financial services. Important gaps remain, however, in which women, rural residents, and low-income households have been significantly less likely to own smartphones and use the internet and access digital financial services. Moreover, turnover in mobile phone ownership among low-income consumers is high, leaving these individuals disconnected for substantial stretches at a time (Roessler et al. 2021). One fundamental concern is that the development of new technological systems, such as interoperability or digital IDs, widen and deepen digital inequality; existing users become more connected and integrated and late adopters fall further behind, which creates new sources of social and economic exclusion (Muralidharan, Niehaus, and Sukhtankar 2020).

However, interoperability presents opportunities for governments to deepen digital inclusion through efficiency gains in G2P payments. In Indonesia, receipt of government benefits is correlated with financial inclusion especially for women (Moorena et al. 2020). However, many do not understand the full functionality of their accounts; one survey estimates that 85 percent of cash transfer program recipients thought that they could only make withdrawals with their savings account.[58] Interoperable payment systems may deepen financial inclusion through more efficient use of G2P payments, but the value of complementary informational and digital literacy campaigns to ensure customer uptake is vital.

Another important dimension of digital inclusion reflects who is accessing the national switch. In many low-income countries, rural citizens have come to rely on MFIs or micro-banks for access to basic banking services with incremental use of mobile money at best. Interoperable payment systems hold the promise of serving as a gateway to the broader financial services ecosystem if these MFIs can integrate to the switch. But this is not a given due to high connection costs and technical barriers. MFIs and rural banks may remain excluded depending on importance of the role of switch integrators to leverage price discrimination in order to assist smaller, less-digitized FSPs in connecting to the payments switch.

58 Sophie Theis et al., "Delivering on the Potential of Digitized G2P: Driving Women's Financial Inclusion and Empowerment through Indonesia's Program Keluarga Harapan," Women's World Banking, Technical report, 2020.

7. Quantitative Research Methods for Interoperability

In this section we highlight unique issues that arise when conducting empirical research on interoperable payment systems. While research on interoperability will significantly overlap with existing research on financial inclusion and financial systems, there are a few key issues that are less familiar with the existing literature that are detailed here. In particular, we focus on: (1) measurement of interoperability; (2) using experimental and other impact evaluation methods to identify the impacts of access to interoperable payments at the level of individual economic units (e.g., individuals, households, enterprises, and villages); (3) methods to quantify the impacts of interoperability on the broader economy. For simplicity this section ignores the distinction between use cases (e.g., P2P, P2M, G2P), however, in practice, these insights could be applied separately by use case and we could expect the valuation of interoperability to vary by use case.

7.1 Data Collection Approaches

7.1.1 Surveying about IIPS

In some cases, we might want to ask users about their awareness, interest in, and opinions about cross-network transfers, including:

- Workarounds they employ in absence of access to convenient cross-network transfers (e.g., multi-homing)
- Their demand for convenient cross-network transfers
- Their awareness and use of cross-network payment switches in general, and specific switches
- Their awareness and demand for other use cases and technologies like QR code payments

In Appendix III we provide a set of sample survey questions on these topics that could be adapted to various research contexts, including for monitoring and evaluation purposes, a representative survey on financial inclusion, or a specific research study that touches on cross-network payments.

7.1.2 Data Collection on Transactions

In some research contexts we need to accurately measure interoperable payments in order to address research questions such as whether an intervention increases the utilization of interoperable payments or the impacts of interoperable payments on users and the broader economy. We can divide all digital transactions into two categories:

1. **On-net:** Transactions within an FSP's user network.
2. **Off-net:** Transactions, or interoperable payments, between users of two different FSPs.

In some cases, researchers would seek to monitor off-net transactions only. In other cases, they would need to observe all digital transactions, distinguishing between off-net and on-net, given that the intervention could impact both the total number of digital transactions, and the composition of transactions between on-net and off-net.

Additionally, it is important to identify the minimal level of granularity needed to monitor transactions, which varies according to research study objectives. Some studies may call for data at the level of individual transactions, particularly in studies that assess an intervention meant to interact with interoperable payments activity that is highly localized, like at the individual, household, or enterprise level. On the other hand, if the study conducts analysis at a more aggregated level, it may be sufficient to access data that are aggregated across groups of households, enterprises, or across time (e.g., studying how interoperability might increase economic activity at a regional level the study could focus on transactions data aggregated at the region-by-month level or the total number of transactions or total value of transactions for the region within that month).

7.1.3 Potential Variables

The level of detail needed about transactions also varies by application:

- **Transaction occurrence and timing:** By month, day, hour, or minute;
- **Transaction amount**: Transfer amount and transaction fees or other costs such as the cost of sending or receiving a digital payment, and any separate fees for off-net transactions;
- **Transaction type**: type of transaction between each use case (i.e., P2P, P2M, G2P);
- **Sender and/or the receiver details:**
  - Location(s);
  - Nature of transactions between the sender/receiver: one-off or regular transactions; and
  - Broader characteristics of sender and/or receiver: age, gender, socio-economic characteristics, type (e.g., individual, merchant, business, government) etc.

In the next section we assess practicalities of measurement: how to gather data around interoperable payments and research protocols to manage ethical and privacy concerns in regards to the sharing of more granular data.

7.1.4 Centralized Data Collection

The most accurate data collection approach from a measurement perspective is to obtain direct access to transaction-level, administrative data on payments from the source (i.e.,

datasets that FSPs, other payments providers, and payment switches carefully collect and manage). However, each of these entities may be restricted in their ability or willingness to provide access to data due to regulatory reasons (e.g., privacy) or competitive concerns. Some switch regulators have pre-committed to make all switch data private and inaccessible to government or public entities. Even when switch data are held in a database it is likely to be highly protected. FSPs may be more open to data sharing if there are benefits such as in generating insights that would be useful for their business or to improve public relations. However, individual FSPs may have limited visibility on transaction activity beyond what they can see from the side of their own customers, which could constrain the available variables, or only generate a selected sample of the larger payments user network.

One potential downside to this approach is that it may be challenging to conduct follow-up surveys to capture information not contained in the administrative data because the caretakers of administrative data may be unwilling or unable to share relevant information or the contact details of potential respondents.[59] Another issue is that this approach targets existing digital finance users and excludes potential users; if the goal of the study is partly to understand impacts of bringing users into the digital payments ecosystem by giving them access to interoperable payments then researchers would need to identify a baseline of potential users. A possible solution to this issue is to obtain data from the Central Bank, but this may mean less complete data and further difficulties in obtaining additional information beyond the administrative datasets.

7.1.5 Decentralized Data Collection

While centralized data collection is attractive from a data quality perspective, barriers to data access may be insurmountable in some contexts. Decentralized approaches to data collection attempt to collect data on interoperable payments directly from users, thus providing an alternative channel to access data. One disadvantage to this method is that a research team would typically have to recruit prospective study participants individually, unless there is an existing sample available. Also, if the researchers are interested in targeting digital payments users for a study, they will likely need to carry out a preliminary sample frame identification step.[60] It would be even more challenging to recruit users if the research question concerned network-level samples regarding the network of transaction relationships between large groups of users, as network sampling and recruitment can be very expensive.

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59 There are at least two salient reasons why they might be unable. First, there may be privacy concerns with sharing respondents' contact details in absence of informed consent. The partner might need to take the lead on obtaining informed consent from willing study participants, before releasing contact details to the researchers. Second, in many mobile money networks, KYC requirements can be very weak for low-volume users. For example, an introductory account capping transaction sizes at 50-100 USD might not have any requirements at all to provide personal details; an individual can simply sign up for a digital wallet with their mobile phone number. In this case the mobile money company simply will not have its clients' details available.

60 This would typically be done through conducting a very short, preliminary survey with a larger set of prospective respondents, screening based on their digital payments' usage status. Prospective participants can be identified through random digit dialing, door-to-door visits, an existing sampling frame or listing, etc.

Nonetheless, a few possibilities for decentralized data collection are detailed below:

- Surveys: The research team can survey respondents online, by phone, or in person, to ask them about their transaction activity. This approach raises two serious concerns; (1) measurement error given that participants may not recall their transaction history very well and the researchers have no way to directly verify it. In some payments systems users may have limited visibility on whether a payment was on-net or off-net. The respondent could be asked to access their transaction history to confirm their memory (e.g., using a mobile app), however, this may be challenging for users who are less digitally literate, though an enumerator could assist the respondent; (2) salience and demand effects given that the act of collecting data brings payment activity front of mind for the respondent. Depending on the study design, this could lead to bias, as the respondent might change their behavior if payments are front-of-mind, or they might alter their responses to what they think the surveyor wants to hear.

- Manual extraction of transaction record: Many providers give users access to a record of transactions (e.g., users may be able to download a PDF document summarizing their transactions over a certain time period and share it with the research team). This may be less accessible for less tech savvy users, but again, enumerators may be able to assist, and respondents could be provided small bonuses in return for their time and effort in extracting and sending such records. While this approach could still create salience or demand bias, if the respondent is not asked to directly report on their records and instead simply shares a file, or such data collection is infrequent or only occurs after an intervention has concluded, it would likely reduce the potential bias.

- Automated data reporting: This approach involves automating the data extraction process. For example, suppose when a user initiates or receives a digital payment they also receive an automatic SMS notification, which contains enough information on the on-net or off-net status of the payment and additional details such as timing and amount. A sensor could be installed on the user's phone that tracks SMS communication and could export the information to a database maintained by the research team. Alternatively, as payment detail reporting is required in certain markets, data that is already being distributed to the authorities or regulators, such as the Tax and Telecom authorities in Tanzania, can be collected from these bodies.

The effectiveness of each of these decentralized approaches is largely an open question. Directly asking respondents about their transaction behavior might influence their future behavior or may have little effect. Manual extraction might raise a plethora of logistical challenges when working with populations who are less technologically literate. More methodological research is needed in order to better understand which methods work best and under what circumstances.

7.1.6 Legal and Privacy Concerns

Accessing data on individual transactions or groups of transactions by individual users raises ethical and privacy concerns. Academic researchers are typically governed by Institutional Review Boards or similar entities, which need to sign off in advance on research projects that involve human subjects, and enforce standards in areas such as data protection, privacy, safe storage, and informed consent of the respondent sharing data. As research using administrative data becomes more common, researchers continue to improve methods for safely accessing, storing, and analyzing sensitive data.

There are a number of methods available to reduce risks to study participants, including:

- Sharing data in encrypted formats only;
- Analyzing anonymized versions of datasets, i.e., with information that could possibly identify individuals[61] removed, a step which could potentially be carried out by the entity that owns the data before it is released to the research team;
- The owner of the data may not be willing to release the raw data outside their premises. Options in this case include:
    - Writing data analysis code that could be shared with the data management team of the data owner.
    - Receive permission to conduct the analysis on-site at the premises of the data owner, whether an FSP or a government institution. This analysis could be completed more informally, or if more structure is necessary, some institutions such as the United States Census have developed sophisticated methods for secure data access (e.g., pre-screening prospective data analysts) and providing secure facilities for data analysis to be carried out.
    - Differential Privacy (DP) tools make aggregated data available while generating very low individual privacy risk. OpenDP provides an open-source platform for differential privacy. Incorporating this into a research reporting tool that could be studied and approved by the regulator (or other central data collector) might provide a viable way to make highly private data available to a large number of researchers, especially for research on large population aggregates.

Transaction-level data are one of the most sensitive forms of individual data, but there are several approaches available to balance the need to strictly protect privacy of users, while leveraging rich data to drive valuable insights that can broadly benefit users and society.

61 Sometimes referred to as Personally-Identifiable Information.

Research Approaches to Evaluate the Impacts of Interoperability

One of the key research questions in the study of interoperable payment systems is how access and use of interoperability impacts broader outcomes for individuals, enterprises, and society. We advocate for the use of experimental methods (i.e., randomization in the context of randomized evaluations or A/B trials), or research designs that most closely approximate experiments, sometimes called quasi-experiments, whenever feasible.

The main objective of an impact evaluation is to precisely quantify the effect of a treatment (an intervention, a program, or a policy) on a set of key outcomes. This is challenging to do in the typical context where allocation of a treatment is organic (e.g., if recipients choose to take up the treatment, and/or providers decide who to allocate it to). Given that potential recipients can have different characteristics, it's possible that certain characteristics make potential recipients more likely to take up the treatment, but also more likely to have certain outcomes. In such cases, it would be naïve to simply compare recipients and non-recipients and interpret differences in outcomes as differences in the impact of the treatment. Hence this is called the problem of "selection bias," because differential selection into taking up the treatment based on characteristics can bias how we interpret the impact of a treatment.

For example, suppose that an FSP is rolling out QR code-based merchant payments (the treatment), and it uses the same marketing campaign for all its merchant clients. Suppose that the merchants who are more likely to initially adopt and offer this payment option to consumers are more ambitious, entrepreneurial merchants, who would have had stronger performance outcomes (e.g., sales growth, revenue growth, customer satisfaction) even in absence of the QR code-based payments. Then if researchers naively compare adopters and non-adopters of the QR code-based payments one year after the initial rollout, they would very likely ***overestimate*** the true effect of the QR code-based payments. They might find that QR code-adopting merchants have stronger sales growth, revenue growth, and customer satisfaction then non-adopters, however they could not be sure ***how much*** of this gap is due to the true impact of the QR payment technology, and how much is due to the gap in these outcomes that would have occurred even in the absence of QR-based payments.

In modern quantitative social science, it is broadly accepted that the best way to tackle selection bias is through research design. Attempting to measure and control for the sources of selection bias is generally considered a fool's errand, an approach that requires unacceptably strong assumptions about our ability to measure and control for the drivers of this bias. The drivers could be ambition, entrepreneurialism, social connectivity, raw IQ, private information, or any number of other things that are typically impossible to correctly measure. This applies to the study of interoperable payment systems as well as any other area of social science inquiry.

The ideal research design to study the impacts of access to interoperability would be an evaluation that randomizes an eligible sample population into at least two groups:[62]

- Comparison Group: Group that proceeds with normal access only to on-net transactions
- Treatment Group: Group that gains access to off-net transactions

then compares the two groups later based on a set of outcomes of interest.

One challenge with implementing this design is how to vary access to off-net transactions. The ideal approach would be to work with an FSP that can control which of its clients have access to on-net versus off-net transactions, which is likely to be most feasible in the context of a new rollout of interoperability. However, it may be difficult to vary access to a switch at the individual client level, or the FSP might be reluctant to risk confusing its clients (e.g., the FSP could be running ongoing public marketing campaign for new payments use case in tandem to the study). The treatment group would need to be informed about interoperability at individual level rather than being exposed through a broader marketing campaign that might also reach the comparison group.

An alternative to centrally controlling switch access would be an "encouragement design," which involves randomizing informing clients about the treatment. So essentially, a marketing campaign that is only targeted at a randomly-chosen subset of clients. This study can be completed without working with an FSP, by taking advantage of the novelty of the technology and opportunity to nudge some users into more rapid uptake. As long as the encouragement design and treatment is sufficiently effective in driving more rapid uptake of interoperable payments, it is possible to detect a treatment effect through this more decentralized research design.

Another drawback to working with an individual FSP is that it only allows us to detect the impacts of interoperable payments on existing users of digital payments. However, some people who might benefit from interoperability might be infrequent users of digital payments or not using digital payments at all, and hence not be connected to an FSP. An intervention to nudge such potential users to utilize interoperability might simultaneously inform them about digital payments in general or encourage more frequent use. Then any treatment effect observed would be measuring the combination of enhancing digital payments uptake in general ***and*** interoperability. To isolate the effect of access to interoperability, researchers could include an additional placebo treatment group that is provided similar information on digital payments, without including information about, or access to, interoperability. There is also potential for study designs with multiple user types (e.g., working with existing digital payments users to infer their demand for interoperability, working with current non-users to first induce their uptake of digital payments, and then isolating their subsequent demand for interoperability).

62 For example, we could use a random number generator to assign a value between zero and one to each member of a list of eligible participants. Members of the list that receive a value above 0.5 would be in the treatment group, while those receiving a number below 0.5 would be in the comparison group.

Estimating Demand: The Value of Interoperability

The experimental approaches described in the previous section provide a best-case approach to identify the effects of interoperability on a set of outcomes for individual economic units such as households and enterprises (e.g., income, time savings, empowerment, business profits, etc.). However, researchers may be interested in an all-encompassing monetary measure of the value of access to interoperability on an individual, household, or organizational level, relative to the best alternative. Additionally, researchers could be interested in higher levels of aggregation such as the economy of a country (e.g., access to rapid interoperable payments added 18 million USD in value to the economy of "Country X" in 2022). Finally, researchers may want to disaggregate these effects on different user subgroups in order to identify which users benefit most or to identify groups that might unexpectedly be losing out. Instead of trying to identify all the possible impact channels in a design as described in the previous section, the aggregate gain can be inferred in consumer welfare[63] or producer surplus from accessing interoperability, through methods to first estimate the demand for interoperability.

Figure 5 illustrates a way to measure the potential demand for interoperability by observing usage of interoperable payments at three prices (*A, B, and C*).[64] Assuming that consumers act consistently within these three particular price points, the green demand line shows how they would behave at other price points that have not been observed (e.g., any prices other than *A, B, or C*).

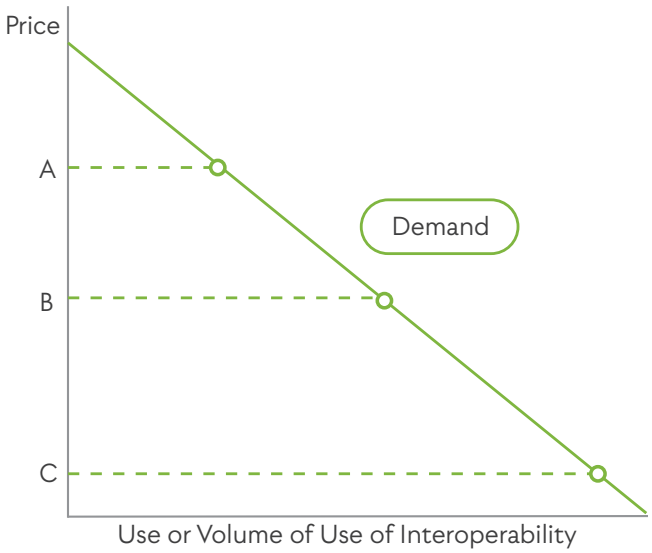

Figure 5: Illustrating off-net payment Demand

63 When economists use the term "welfare" in this context, they are referring to the aggregate well-being or "utility" generated by an intervention, not a social welfare program.

64 The three dots may not line up, and instead there is a demand curve. The graph is limited to a straight line for simplicity of exposition, but in practice researchers would need to accommodate more general cases.

Demand estimation would be feasible in any market where interoperable payments are available, but is more accurately studied with more experienced users in a mature market due to their great familiarity with the product.

There are a few research approaches to estimating demand:

- Survey units of interest (i.e., individuals, enterprise) on their subjective valuation of interoperability by asking what they are willing to pay for access to interoperable payments compared to only having access to closed-loop systems. The challenge with these methods is that users may struggle to find a valuation and even experienced or a reliable estimate.
- Collect data on the time and cost of travel for deposit/withdrawal of merchant proceeds; cost of cash leakage; supply chain friction due to physical proximity payments; and cost or other penalty of late payments that could not be made remotely. Aggregating these data points can create a picture of the price/demand curve independent of users' subjective valuations.
- The typical approach by research economists to quantify aggregate consumer and producer welfare comes from the sub-field of economics called "industrial organization." Researchers leverage observational market data and a reasonable model of the market in question to infer the market demand curve from that the aggregate gains in consumer and producer welfare from the product. This approach is feasible in a wide range of settings, however, the results critically rely on the selection of the underlying model of the market. It can also involve fairly strong assumptions to identify aggregate welfare estimates (e.g., the method relies on observing how usage varies with price but price-setters might also be setting prices based on their perception of user demand, i.e., in response to user demand), which could lead to biased demand estimates.
- Employing a randomized evaluation could be very beneficial to researchers by randomizing the price that individuals pay for access to interoperability or more realistically for individual interoperable payment transactions.65 This would allow researchers to observe how otherwise equivalent users respond to different price levels under real-world conditions to more reliably infer their demand for interoperable payments. Combining a randomized evaluation with an economic industry model allows researchers to infer aggregate benefits, but in a setting with more reliable inferences on individual demand (an example of how to structure this approach is provided in Appendix IV). To implement randomization, researchers could work directly with an entity that has direct control over pricing and can adjust pricing at the point of purchase (e.g., offering different prices to three randomly-selected groups of users, such as what is illustrated in Figure 5).

65 For example, there could be two to three treatment arms, each receiving a different price, (e.g., one very low price (near zero), one moderate price, and one higher price).

- Alternatively, if partnering with a centralized entity such as an FSP is not possible, researchers could attempt to implement a decentralized model where users receive small subsidies in conjunction with their usage of interoperable payments, to effectively implement the same prices.66 This latter approach removes the reliance on an institutional partner, but raises questions about whether incentives can be deployed at time of purchase, and if not, whether it would be observed as a distorted behavioral response. For example, researchers could study if users would respond different to a subsidy billed monthly for interoperable payments versus an instant interoperable payment with the subsidy baked into the cost.

The randomization approach, while most rigorous, also raises similar issues explored in the previous section; if users have little or no experience with off-net payments, offering them price incentives may increase their confusion about off-net payments. There may be a "nocebo effect," whereby exposure to some information about mobile payments only motivates them to use the existing payment options that they are already familiar with, even if they are more expensive or less convenient.

66 There are settings where digital payments are "zero priced" at baseline. In such settings we might try to provide subsidies for the use of interoperable payments (i.e., users would receive a small positive amount, rather than being charged a smaller or larger fee), to attempt to estimate demand. However, it is an open research question whether positive subsidies act symmetrically to fees, so whether we gain as much knowledge from a study utilizing positive subsidies, as we do from varying how much of a fee users need to pay.

Untitled by Kay McGowan, USAID (CC BY-ND 2.0)

8. Monitoring, Evaluation, Research, and Learning Approach

Developing, launching, and governing a IIPS is a complex, multi-year process involving a large number of stakeholders, potential sources of uncertainty, and challenges. Such systems often require a significant up-front investment that could be absorbed by the government, donors, and/or the private sector. Balancing government and donor objectives of creating economic efficiencies and positive welfare impacts of interoperability for users, with the objectives of FSPs, can be pivotal. A monitoring, evaluation, research, and learning (MERL) approach can help the funders to ensure impacts envisaged from a substantive investment are realized. With the lack of empirical evidence on what works in payment system design, research and learning play a fundamental role in allowing funders to adjust, alter and modify the design of the system to best suit the objectives of the respective stakeholders.

A MERL framework with robust tools and methodologies provides an important tool to efficiently operate the payments system and allow the relevant stakeholders to monitor the performance of and measure the intended outputs and outcomes of the platform. The activity of developing the MERL framework can also play an important role in clarifying impact pathways and coordinating expectations between stakeholders. In our background research on IIPS in emerging markets (e.g., see Table 3 in Appendix I), we found that many IIPS do not even have basic indicators that are publicly-available, e.g., monthly transaction volumes processed by the switch, much less comparable data on other electronic transactions (e.g., on-net, credit, debit), or breakdowns of off-net transactions by types of financial institution. This kind of aggregated data provides an excellent starting point, but a well-designed MERL strategy can go well beyond baseline statistics in providing insights on the system.

IPA's experience suggests that a participatory (co-creation) approach should be utilized in developing a MERL framework for an interoperable payments system. This is because the technical and design aspects of these complex systems are best understood by experts involved in its implementation. Each system will have different technical and design specifications, and therefore any MERL framework may have to be tailored to the specific system. Developing MERL frameworks for these complex implementations must be through a workshop-based approach, where technical on-ground implementers (i.e., who have a comprehensive understanding of the system), participants of the system, funders (e.g., donors or government agencies), are involved. A mix of expertise, supported with MERL experts, can result in the construction of a robust MERL framework. Figure 6 below illustrates IPA's approach in developing a MERL framework through a workshop-based approach.

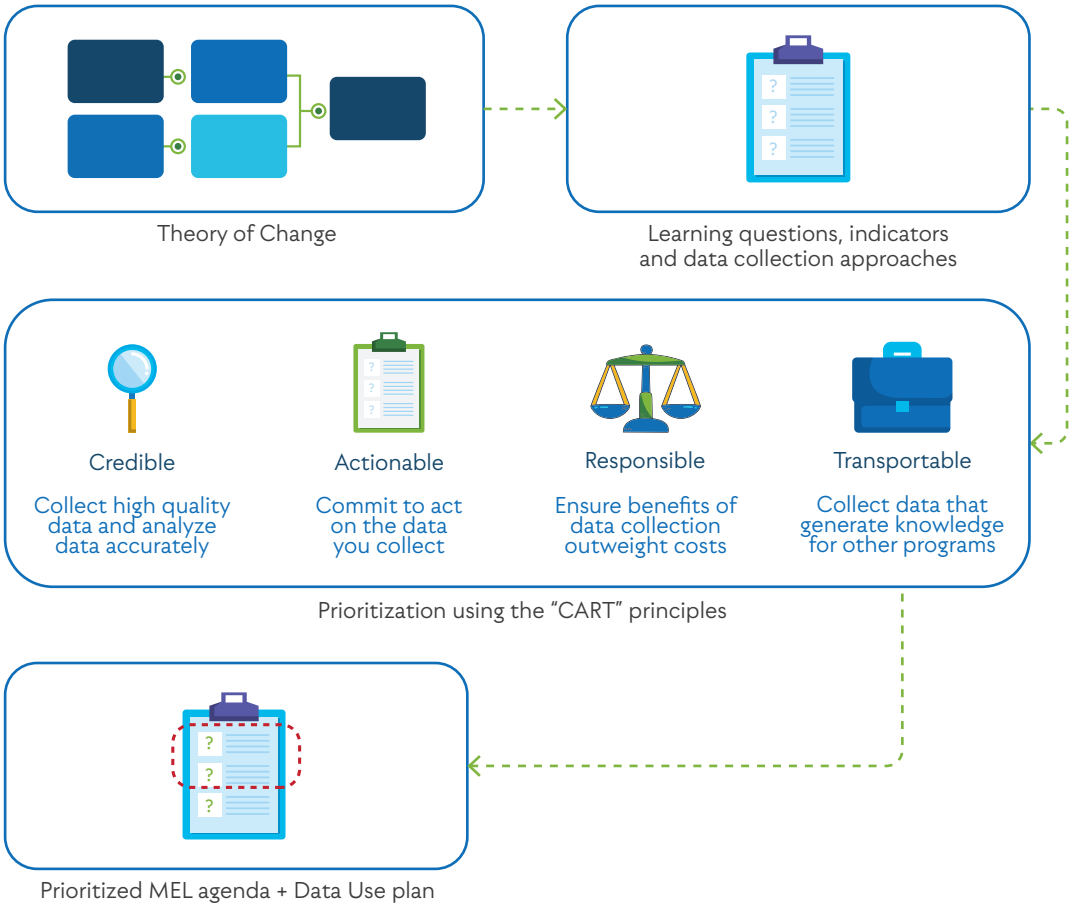

Figure 6: Proposed sequence of right-fit MEL workshops

The sequence of activities is further explored below:

1. **Theory of Change:** Developing a theory of change for the implementation of an interoperable payment system allows stakeholders to map out critical impact / causal change pathways, such as drawing out how relevant stakeholders will onboard to the platform, adapt practices and experience broader financial inclusion and social welfare impacts. The Theory of Change will also define how each major activity relates to others and highlight the importance of each activity. For a comprehensive MERL strategy covering all aspects of switch implementation, the Theory of Change is broken down into three distinct stages, including: activities (actions required by funders, implementers, or FSPs), usage (how system actors respond to a payments system), and impacts of the overall system. See Figure 7 below:

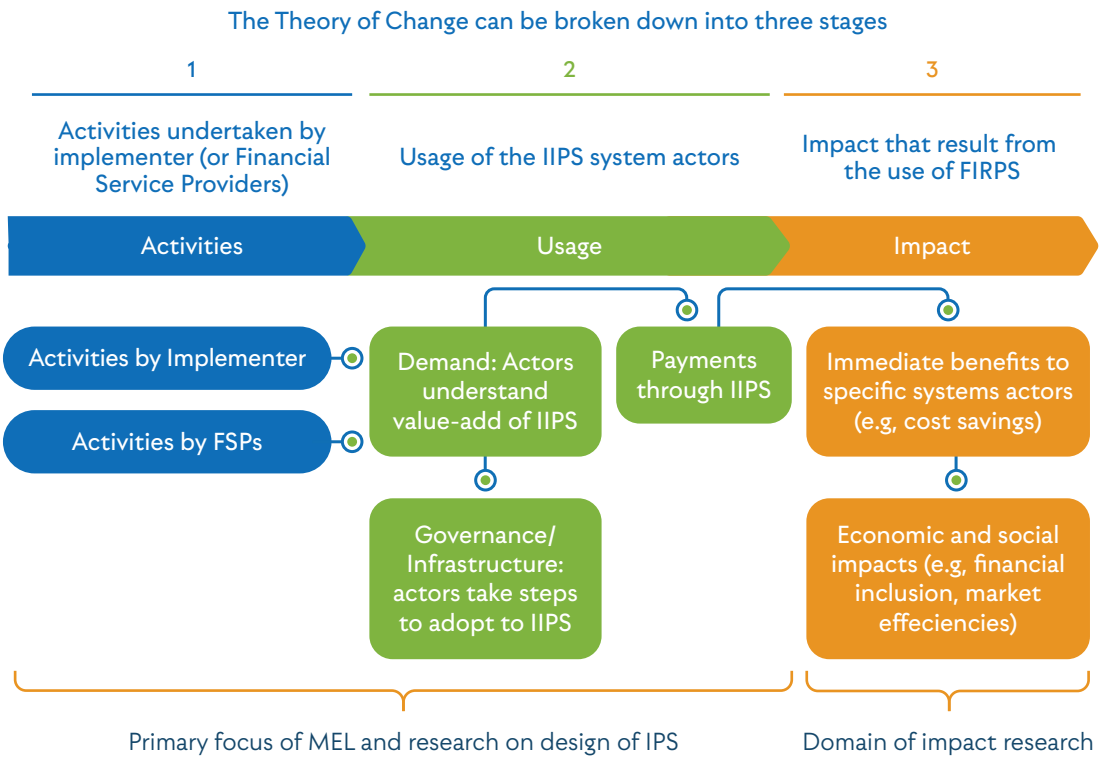

Figure 7: MERL - Theory of Change (Breakdown)

A more detailed breakdown of the Theory of Change is shown in Figure 8 below. This section outlines the activities that are required by implementers, governments, and FSPs to enable technical implementation. It also illustrates the process of onboarding of participants and non-participants and adjusting user and merchant behavior, for each party to effectively integrate with and use the interoperable payments system, as well as theories of impacts that can be generated through active usage of interoperability.

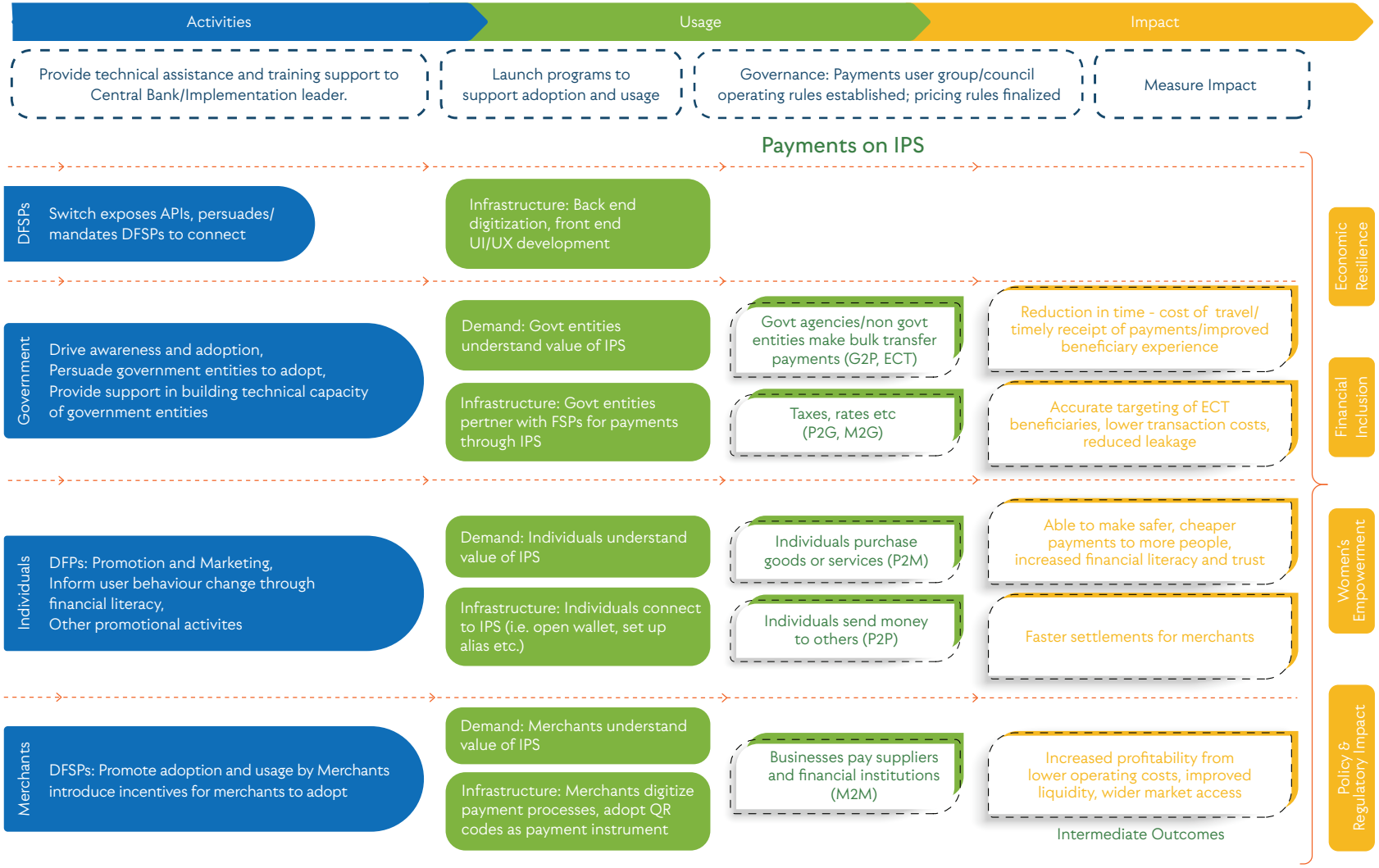

Figure 8: MERL - Theory of Change (Detailed)

2. **Identification of KPIs:** Once a theory of change has been drafted, the next key step is to develop KPIs that can comprehensively and accurately measure the implementation of the project. For identification of KPIs researchers must segregate impact on all beneficiaries of the system (e.g., individuals, merchants, social protection beneficiaries, and other G2P recipients). The beneficiaries of any system are likely to be different depending on the context and the objective of the payment system being implemented. Employing a critical impact pathway approach allows funders and implementers to ascertain if there are gaps in implementation, enabling them to trace these gaps to either usage or activities, specific to a certain outcome. The indicators in this approach are divided between output and outcome indicators. This allows measurement to be either quantitative and/or qualitative at output level and at output/outcome level. See Figure 9 below as a reference:

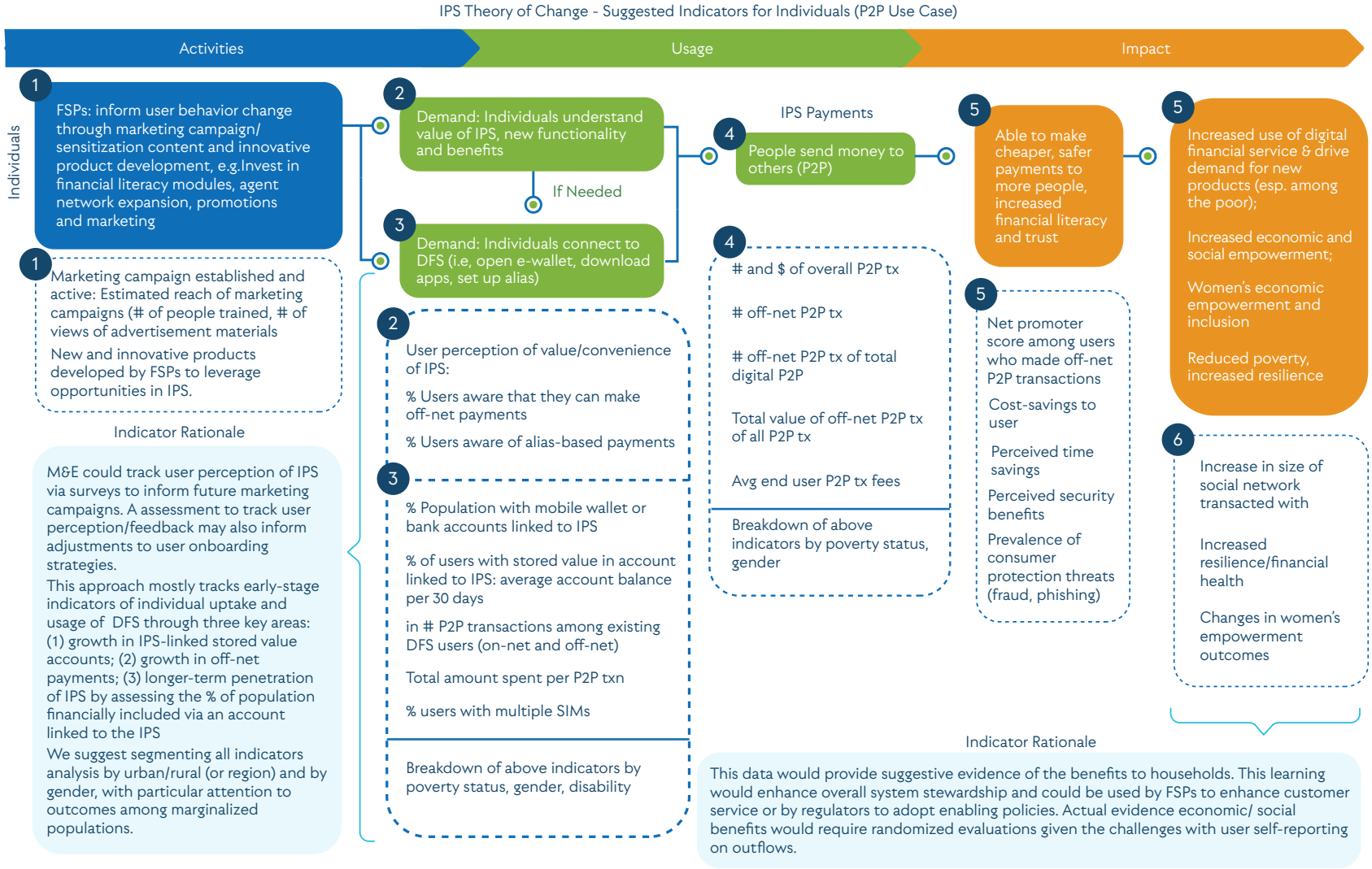

Figure 9: MERL - Indicators for P2P use case

3. **Indicator Prioritization and identification of Evaluation Approaches:** Once a list of indicators has been developed through a workshop-based approach, the next step is to identify a prioritized list of indicators that have the best value for money in terms of learning, and can be feasibly and accurately measured through a framework, as shown in Figure 10 below:

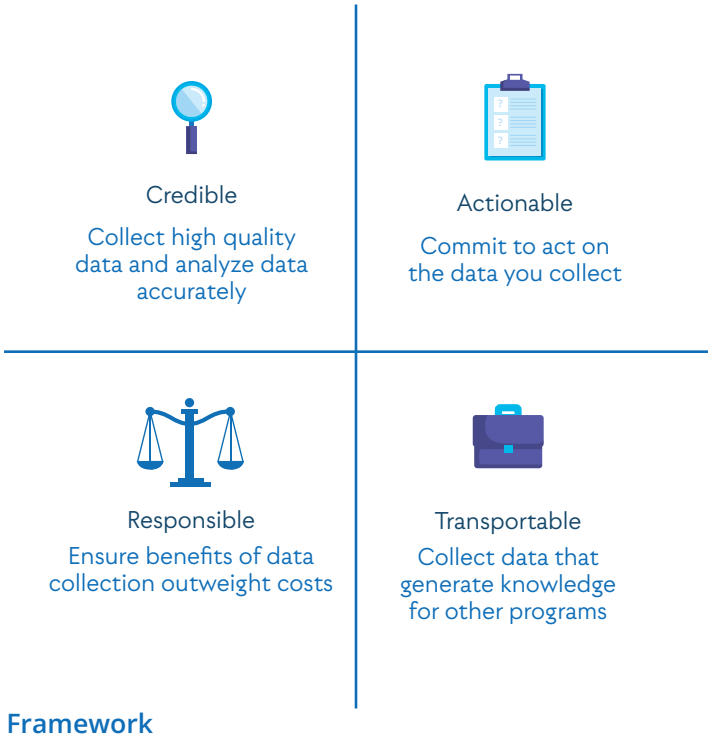

Figure 10: CART Framework

Applying this criterion to the list of indicators developed can help identify a prioritized list, which can be captured in the short term. Using a scoring mechanism allows researchers to identify indicators with a high Credible, Actionable, Responsible, and Transportable (CART) score and thus become eligible as prioritized indicators. See Table 1 below:

Table 1: Prioritizing Indicators with CART Framework[67]

Activity/ Output/ Outcome	Description	Learning Question	Suggested Indicator(s)	Credible (0-3; 3 is most credible)	Actionable (0-3; 3 is most actionable)	Responsible (0-3; 3 is most responsible)	Overall CAR score (product of CAR ratings)
Activities: to Onboard Participants to IIPS	Donor provides technical assistance and training support to implementer for implementation of IIPS; support implementer to mandate adoption by supervised entities	Are the most effective onboarding activities being implemented?	Percent of all FSPs onboarded	2	3	2	12
Outputs: Changes in Governance and Infrastructure for Direct and Indirect Participants to Join IIPS	Governance: Payments user group/ council operating rules established; group manages scheme under IIPS	Is the scheme council's governance structure maturing as anticipated?	Governance arrangements established	3	2	3	18
Outputs: Changes in user demand/ awareness of IPS	Users understand the value of IPS after being exposed to marketing/ training schemes implemented by FSPs	Are FSPs implementing the right marketing/ training schemes that help improve user demand for IPS?	Percent of users aware that they can retrieve loans/make repayments via IPS	3	3	3	27

67 All elements of a CART framework will not always be applicable to a MERL framework. In this framework, Transportable element is not applicable and thus not incorporated.

4. Developing a MERL Plan: A MERL plan enables transparency, accountability, and monitoring of timely implementation. A MERL plan for an interoperable payment system implementation allows prioritized indicators to be measured through relevant research methodologies (both qualitative and quantitative). At this step, the prioritized indicators are converted into a logical framework, that incorporates targets, frequency of data collection and data sources for each indicator. Learning questions are also identified in the MERL framework, which can enable continuous learning throughout the lifecycle of the implementation as illustrated in Table 2 below:

Table 2: MERL Plan for IPS

Suggested Indicator(s)	Quant/ Qual	Method of Collection	Overall CAR score (product of CAR ratings)	Baseline	Target (2023)	Target (2024)	Target (2025)
Percent of all FSPs onboarded	Quant	Existing/ Secondary	12	FSPs not onboarded	25% onboarded	50% onboarded	100% onboarded
Governance arrangements established	Qual	Collation/ Admin	18	Payments Council has been set up		Rules established	
Percent of users aware that they can retrieve loans/make repayments via IIPS	Quant	Survey	27	Customers are not aware	30% of FSP users are aware of IIPS	60% FSP users are aware of IIPS	90% FSP users are aware of IIPS

5. Executing a MERL strategy: Clearly defining a plan for executing a MERL strategy is as important as constructing a MERL strategy; identifying the roles and responsibilities of the actors involved, timelines under which planning and execution should take place, and especially, how a continuous cycle of learning is followed.

Roles and Responsibilities:

- **Defining the owner of the MERL strategy is essential.** Based on other similar engagements, we have learned that it is important to identify one actor out of the wide array of stakeholders involved in a payments system as the owner of the MERL framework. This actor would be responsible for populating the targets through launching timely and accurate data collection exercises, in addition to readjusting the indicators through review exercises, if required. This actor must be recognized by primary participants (e.g., scheme council) for undertaking this review and measurement work, to allow for easy accessibility of data, individuals and systems. Usually, this actor is the sponsor of the payments system, (i.e., the government, donor, an association or a private sector entity).

- **Key actor responsible should have significant monitoring and evaluation (M&E) experience.** It is also important that the owner of the MERL framework has sufficient M&E resource capacity for efficient and accurate execution of the strategy. While donor agencies will have dedicated M&E resources, government agencies or private sector entities may not possess sufficient understanding of M&E required to evaluate a complex payments system. At the same time, M&E resources, where present, may not be fully equipped with the technical understanding of payments system to be able to independently implement the M&E strategy. As a result, IPA recommends a co-creation exercise where M&E and technical resources are involved in designing, launching, and executing a complete strategy.

Timelines:

- **The timeline for implementing a MERL strategy can be vital to its usefulness.** Developing a strategy before the design components are finalized (i.e., fee structures, governance models) or after (e.g., when the payment system is operating at business as usual) can lead to either inaccuracy of the strategy itself or unmeasured initial impacts; a MERL strategy should be constructed and implemented after design components of the payments system have been finalized. This can allow for recording impacts form the onset of the launch of the payments system.

- While IPA has not come across other examples of IIPS M&E and the period during which impact is surfaced and thus should be captured, typical IIPS become operational in one to two years and are able to foster adoption in two to three years after launch. As a result, the MERL framework can measure outputs and outcomes over a three-year period using the original framework. After a three-year period, where several assumptions will have been either annulled or established, a new framework may have to be developed to represent the theory of change more accurately after launch.

Adaptive Management:

IPA's MERL process focuses on actionability, meaning that all data collected should be used for the purpose of informing the design and ultimately improving the effectiveness of a IIPS. The core outputs of the MERL framework are tied together through the following cycle of adaptive management illustrated in Figure 11. The outputs are dynamic, meaning that they are continuously refined based on the data generated from MERL activities.

Figure 11: Adaptive MERL Process

Ultimately, the responsibility of adaptive management also sits with the owner of the MERL framework. This would however involve an open and a collaborative process where technical and M&E resources are able to adapt the system using data driven insights.

"Mobile money in Tanzania" by Fiona Graham, WorldRemit (CC BY-SA 2.0)

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10. Glossary of Key Terms

Administrative data: Data collected by an organization or entity. Data is typically collected automatically or in the course of normal operations. E.g., data collecting for account set up, individual transaction data.

Alias-based payment services: Payment services that allow users to link a unique identifier other than their personal identity to their payment account (e.g., phone number or email).

Application Programming Interface (API): A software intermediary that allows two software applications to communicate with each other.

Closed loop payment system: A payment system where payments are processed within the user network of a single FSP. Closed loop contrasts with open loop.

Double coincidence of wants: To transact without money, we need to match parties that each have an item(s) the other wants. Given the improbability of these matches in practice, we see money emerge as a medium of exchange even in small-scale economies.

Cost-Recovery-Plus-Investment: A way of fixing the revenue for a not-for-profit entity like a payments switch, to just cover operational costs plus an agreed-upon additional amount for new investment.

Encouragement design: A randomized control trial research design in which both treatment and comparison groups have access to the intervention, but some individuals or groups are randomly assigned to receive encouragement to take up the program. Commonly used when evaluating an intervention or program that is rolled out at national or regional level, but lack of familiarity might lead many potential recipients not to take up the intervention in absence of encouragement.

Externality: an indirect cost or benefit to an uninvolved third party that arises as an effect of another party's (or parties') activities. Can be positive or negative. For example, a negative externality could occur for consumers, if merchants adopt payment platforms that provide less favorable fee structures for consumers. On the other hand, a positive externality occurs if a user adopts a payments platform that someone they send/receive money with, is already on the platform.

Findex survey: The Global Findex database is the world's most comprehensive data set on how adults save, borrow, make payments, and manage risk. Launched with funding from the Bill & Melinda Gates Foundation, the database has been published every three years since 2011.

Hawala transfer: Hawala is an informal method of transferring money without any physical money actually moving. Hawala is used today as an alternative remittance channel that exists outside of traditional banking systems.

Hub-and-spoke model: The hub and spoke model refers to a distribution method in which a centralized hub exists; every transaction either originates in the hub or is sent to the hub for distribution to consumers.

On-net transfers: Transfers between two users within an FSP's client network.

Loss leader payments: When a merchant intentionally sells a product below its market cost as part of its overall pricing strategy. Loss leader pricing is typically used to stimulate sales of more profitable products or services.

Multi-home or multi-homing: When consumers maintain accounts with multiple FSPs' digital wallets. They might do so to be able to transact in multiple closed loop payment networks, in a non-interoperable payment system.

Off-net transfers: Transfers between two users in different FSPs' client networks.

Open loop payment system: A payment system where payments are processed between the user networks of multiple FSPs. Open loop contrasts with closed loop.

Pass-through: The idea that even if a user is not explicitly charged a fee, they may still effectively pay part of the fee by transacting with a merchant that is explicitly charged a fee. For example, if merchants have to pay taxes or payments network user fees, they might in turn increase the price they charge for goods and services, leading consumers to have these fees "passed through" to them by the merchant.

Payments switch (switch): A back-end payments technology that allows for off-net transfers between the user networks of multiple FSPs, by interacting between their digital ledgers, typically through APIs. A prominent example is the Mojaloop technology.

Platform economics: A domain of economic theory and analysis concerned with the economics of platforms, i.e., entities that connect two or more sets of users, typically merchants and consumers. Amazon.com, EBay, Uber, and AirBnB are all examples of platforms. Because platforms involve network effects (the value of the platform rises in the number of users on each side of the market), they raise complex pricing challenges.

Pro-Poor Growth: If economic growth reduces poverty or increases the income of the poor.

Pull Payment: Pull payment transaction that is triggered by the payee. For example, a direct debit is a pull payment.

Push payment: Push payments are payment transactions that are triggered by the payer.

Regulatory sandbox: A regulatory approach that allows live, time-bound testing of innovations under a regulator's oversight.

Same-side network effect: Same-side network effects refer to the increase in value that occurs for users on the same side of a platform with the addition of users on that side. For example, social media networks like Facebook, or mobile money networks, are more valuable to you if more of your friends are also on the platform.

Single-home: When consumers maintain an account with a single FSP's digital wallet.

Zero pricing: When a regulator mandates that the fee for a good or service should be set to zero. For example, some regulators have mandated that FSPs should not charge an additional fee for off-net transfer (beyond what they would charge for on-net transfers).

"Mobile money transaction at agent's office in Uganda" by Fiona Graham, WorldRemit (CC BY-SA 2.0)

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"A row of shops in the Hanoi old quarter" by shankar s. (CC BY-NC-ND 2.0)

Acronyms

ACHs	Automated clearing houses
API	Application programming interface
ATMs	Automated teller machines
B2B	Business-to-business
B2C	Business-to-consumer
BSP	Bangko Sentral ng Pilipinas
CART	Credible, Actionable, Responsible, and Transportable
CS	Consumer Surplus
DFS	Digital financial services
EFTPOS	Electronic funds transfer at point of sale
IIPS	Fast, interoperable retail payment system
FSP	Financial service providers
G2P	Government-to-person
ICT	Information and communication technologies
IFC	International Finance Corporation
IPA	Innovations for Poverty Action
JoMo	Pay Jordan Mobile Payment
JoPACC	Jordan Payments and Clearing Company
KPI	Key performance indicator
KYC	Know your customer
LMIC	Low- and middle- income countries
M2P	Merchant-to-Person
M&E	Monitoring and Evaluation
MDR	Merchant discount rate
MERL	Monitoring, evaluation, research and learning
MFI	Mobile financial institution
MNO	Mobile network operator
MMI	Mobile money interoperability
NPP	New Payments Platform
P2B	Person-to-business
P2M	Person-to-merchant
P2P	Person-to-person
PBOC	People's Bank of China
POS	Point-of-sale
QR	Quick response
TIPS	Tanzania Instant Payment System
UI	User interface
UPI	Unified payments interface
U.S.	United States
USSD	Unstructured supplementary service data

Appendix I: Instant Payment Switches in Emerging Markets

Table 3 below provides a list of Instant Payment Systems (IPS) that have been launched as of the writing of this report, in emerging markets (countries classified by the World Bank as Upper Middle Income or below). We do not claim that this list is necessarily fully comprehensive of all switches that have launched in emerging markets. The accuracy of the information is subject to the sources provided.

Table 3:Some Existing Instant and QR Payment Systems in Emerging Economies

System Name	Country	Instant Payment System (IPS)?[68]	QR Payments?[69]	Launch Year	Government led or co-led development?
3.0 Transfers[70]	Argentina	✓	✓	2020	✓
MODO[71]	Argentina	✓[72]	✓	2022 or earlier	
PEI[73] [74]	Argentina	✓		2016	✓
IPS[75]	Azerbaijan	✓	Since 2020[76]	2018	✓

68 We consider a switch to be a IIPS if it is described as such in public materials, i.e., terms such as "instant," "real-time," "fast," or "near instant" are used to describe the switch, it involves at least three FSPs, and consumers are among the intended primary users.However, as noted earlier in the report 'we emphasize that while a system may be inclusive in its design, whether or not it is inclusive in practice is an issue to be evaluated. We do not mean to endorse the inclusivity of any system ex ante, in this report'

69 Customers can scan QR codes of this QR payment system to make payments that are processed through a IIPS.

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73 Banco Central de la República Argentina (BCRA). June 16, 2017. "Pagos Electrónicos Inmediatos (PEI) |POS Móvil, Botón de Pago y Billetera Electrónica" [Immediate Electronic Payments (PEI) | Mobile POS, Payment Button and Electronic Wallet] http://www.bcra.gob.ar/Noticias/PEI.asp

74 Banco Central de la República Argentina (BCRA). 2021. "Immediate Electronic Payment (PEI)" https://www.bcra.gob.ar/MediosPago/Politica_Pagos-i.asp#c

75 Central Bank of the Republic of Azerbaijan. 2022. "The Instant Payment System (IPS)" https://www.cbar.az/page-479/instant-payments-system-ips

76 The Europe Times. February 23, 2022. "Azerbaijan unveils transactions through "QR-codes" within Instant Payments System" https://theeuropetimes.eu/azerbaijan-unveils-transactions-through-qr-codes-within-instant-payments-system/

System Name	Country	Instant Payment System (IPS)?	QR Payments?	Launch Year	Government led or co-led development?
Pix[77]	Brazil	✓	✓	2020	✓
Retail Pay[78]	Cambodia	✓	✓	2021	✓
Alipay, UnionPay, WeChat Operator Agreement[79] [80]	China		✓	2021	Private agreement made to comply with regulation on QR interoperability.
Transfiya[81] [82]	Colombia	✓	✓	2019	✗
GhanaPay[83]	Ghana	✓		2022	✓
GhIPSS[84]	Ghana	✓		2007	✓[85]
Bharat QR[86]	India	✗	✓	2017	✓
UPI87	India	✓	Compatible with UPI QR and Bharat QR	2016	✓[88]

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87 National Payments Corporation of India (NPCI). 2022. "Unified Payments Interface (UPI)" https://www.npci.org.in/what-we-do/upi/product-overview

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System Name	Country	Instant Payment System (IPS)?	QR Payments?	Launch Year	Government led or co-led development?
UPI QR[89]	India	✗	✓	2020	✓
BI-FAST[90]	Indonesia	✓		2021	✓
CliQ[91]	Jordan	✓	✓	2020	✓[92]
JoMoPay[93]	Jordan	✓		2014	✓
PesaLink[94]	Kenya	✓		2016	✓
DuitNow[95] [96]	Malaysia	✓	✓	2022	✓[97]
CoDi[98]	Mexico	✓	✓	2019	✓
NQR Payment[99]	Nigeria	✓	✓	2021	✓
MPClear (MPCSS)[100]	Oman	✓	Compatible with private QR code systems[101] [102]	2017	✓
Raast[103]	Pakistan	✓	Compatible with Standardized QR Code System[104]	2021	✓
PLIN[105]	Peru	✓	✓	2020	

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System Name	Country	Instant Payment System (IPS)?	QR Payments?	Launch Year	Government led or co-led development?
InstaPay[106]	Philippines	✓	Compatible with QR Ph	2018	✓
QR Ph[107]	Philippines	✗	✓	2019	✓
FPS[108]	Russia	✓		2019	✓
LankaPay[109]	Sri Lanka	✓	Compatible with LANKAQR	2017	✓
LANKAQR[110]	Sri Lanka	✗	✓	2020	✓
Mobile Network Operator Private Agreement111	Tanzania	✓	Compatible with Masterpass QR[112] [113]	2014	✗
TIPS[114]	Tanzania	✓	✓	2022	✓
PromptPay[115] [116]	Thailand	✓	✓	2016	✓
Napas247 Quick Money Transfer service [117][118]	Vietnam	✓	Compatible with VietQR	2016	✓
VietQR[119]	Vietnam		✓	2022	✓

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117 National Payment Corporation of Vietnam. 2022. "24/7 QUICK Interbank Funds Transfer Service" https://napas.com.vn/en-us/for%20customers/for-banks-and-finance-companies/24-7-quick-interbank-funds-transfer-service-1-2.html

118 National Payment Corporation of Vietnam. 2022. "Milestones, Achievements" https://napas.com.vn/en-us/milestones.aspx

119 Bizhub. January 10, 2022. "NAPAS launches VietQR code payment on National Public Service Portal" http://bizhub.vn/banking/napas-launchesvietqr-code-payment-on-national-public-service-portal_330526.html

Appendix II: Per Capita Electronic and Off-net Transactions Relative to Launch of IIPS

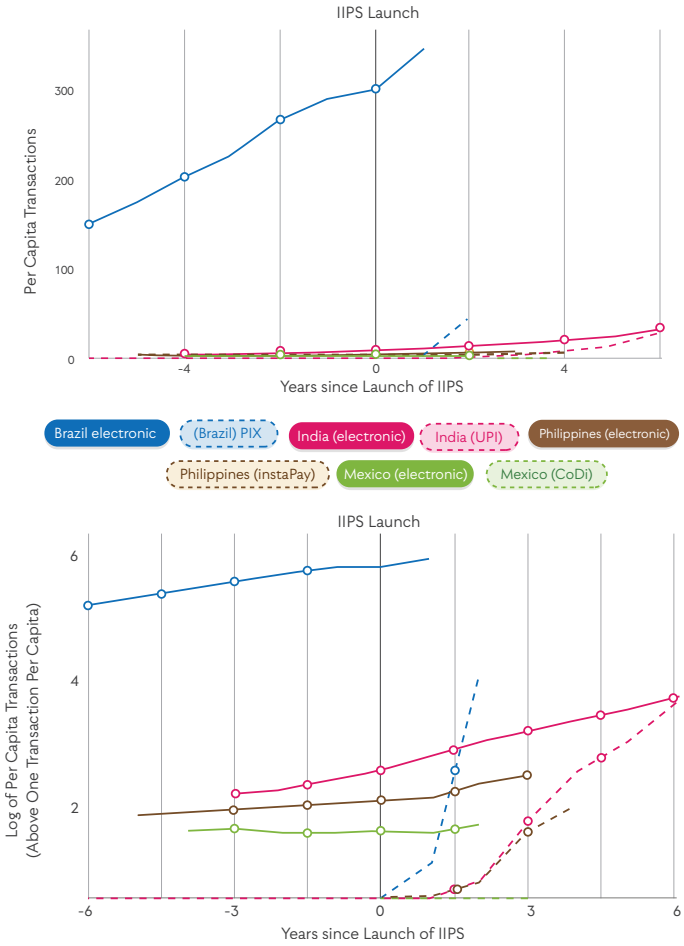

Figure 12: IIPS and Electronic Transactions per Capita (top: standard, bottom: log)[120 121 122 123 124]

120 Reserve Bank of India (RBI), "Payment System Indicators" June 2022. https://www.rbi.org.in/Scripts/PSIUserView.aspx

121 Estioko, R., Mesina-Romero, B.R., Masangkay, M.C, Sivalingam, I., Better Than Cash Alliance and Bangko Sentral Ng Pilipinas, "Highlights Report: State of Digital Payments In The Philippines 2019 Update and 2020 Preview", 2021. https://www.bsp.gov.ph/PaymentAndSettlement/State_of_Digital_Payments_in_the_Philippines_(2021_Edition).pdf

122 Massally, K., Ricart, R., Bambawale, M., Totapally, S., & Bhandari, V. 2019. "The State of Digital Payments in The Philippines." Better Than Cash Alliance. https://btca-prod. s3. amazonaws. com/documents/435/english_attachments/The_State_of_Digital_Payments_in_the_ Philippines_ExecSummary. pdf 1577119411

123 Banco de México, "Transfers - (CF258)", May 2022. https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=5&accion=consultarCuadro&idCuadro=CF258&locale=en

124 Banco Central Do Brasil, "Estatísticas de Meios de Pagamentos" [Means of Payment Statistics], June 2022. https://www.bcb.gov.br/estatisticas/spbadendos

Appendix III: Sample Questions to Measure IIPS for Consumers and Merchants

In this section we provide a set of sample questions that could be used to create a module on interoperable payments in individual, household, and/or merchant surveys, financial inclusion surveys, or other survey instruments. We recommend that readers looking to adapt these questions carefully consider their own survey context and the financial and digital literacy level of their respondents.

Comments to reader [in square brackets]

Comments to survey enumerators in ALL CAPS

Workarounds to enable cross-network transfers

1. Do you use more than one of the same type of financial account (mobile money, bank, etc)?

   Options:

- Yes
- No

[The use of more than one of the same type of financial account is called "multihoming" however we do not recommend using this technical term.

A survey on financial inclusion might have specific questions on which accounts a respondent holds. In that case Q1 might not be necessary as multihoming could be deduced from the reported account holding (e.g., if the respondent has two mobile money accounts, then they are multihoming for mobile money). In that case Q2 would not have the condition "If Yes to Q1" but rather be asked conditional on the response to preceding questions about account holding.

2. [If Yes to Q1] Why do you use more than one financial account of the same type? CAN SELECT MORE THAN ONE OPTION

   Options:

- Because I want to be able to transact with people or organizations that have accounts (mobile wallets, bank accounts, etc) with different financial institutions.
- To take advantage of promotions that are available from different financial service providers.
- To take advantage of payment or other financial services that are available from different financial providers.
- To overcome restrictions on the volume of transactions I can conduct on financial accounts within a fixed time period.

  Other.

- I don't know.

3. [If Yes to option a. of Q2] Have you ever used the financial account of an intermediary, like a friend or mobile money agent, in order to transfer funds to a financial institution that is different from the financial institution that you have an account with?

   Options

- No.
- Yes; I do so daily.
- Yes; I do so weekly.
- Yes; I do so monthly.
- Yes; I do so annually.
- I don't know.

Demand for cross-network transfers

4. As per your knowledge, what do you think the fee is for sending [small amount in the local currency, e.g., the equivalent of an average hourly wage] between two financial accounts that are from the same financial institution?

   Options:

- [create 4-5 reasonable bins in the local currency]

5. Do you think it is possible to send money from a financial account that is registered with a different financial service provider?

   Options:

- Yes
- No

6. [If Yes to Q5] As per your knowledge, what do you think the fee is for sending [small amount in the local currency, e.g., the equivalent of an average hourly wage] between two financial accounts that is registered with a different financial institution?

   Options:

- [create 4-5 reasonable bins in the local currency]

7. [If Yes to Q5] If you have to send [small amount in the local currency, e.g., the equivalent of an average hourly wage] from your own financial account to the financial account of a different financial institution, then what is the maximum you would be willing to pay for such a transaction in terms of fees?

   Options:

- [create 4-5 reasonable bins in the local currency]

8. Would you be interested in being able to receive payments to your financial account just by providing the payer with an alias such as your national ID number, email address, or phone number?

   Options:

- Yes
- No
- I don't know

Awareness and use of cross-network payment switches

9. Have you ever made a direct transfer from one mobile wallet to a different mobile wallet, for any reason (to send money to friends/family, to pay a merchant, to pay a bill, etc)?

   Options:

- Yes
- No
- I don't know

10. Have you ever used your mobile wallet or bank account, to make a direct transfer to or receive funds from a mobile wallet or bank account of a different financial institution (e.g., bank, mobile money provider)?

    Options:

- Yes
- No
- I don't know

11. [If Yes to Q9 or Q10] As you said that you make transfers to recipients who have financial accounts (mobile money wallet or bank) in different financial institutions, what is the main reason for you doing so?

Options:

- To send money home to my family.
- To pay a merchant.
- To pay an employee.
- To pay school fees.
- To pay another government fee.
- Other.
- I don't know.
- I don't send money, I only receive it.

12. [If Yes to Q9 or Q10] As you said that you make transfers to recipients who have financial accounts (mobile money wallet or bank) in different financial institutions, what is the average size of such transactions?

Options:

- [create 4-5 reasonable bins in the local currency]

13. Do you intend to make a transfer from one mobile wallet or bank account, to a mobile wallet or bank account with a different financial institution, in the future?

Options:

- Yes
- No
- I don't know

Awareness of specific payment switches

[Ask the following questions for each payment switch of interest in the survey.]

14. Have you ever heard of [payment switch]?

Options:

- Yes
- No
- I don't know

15. Do you recognize this symbol? (SHOW CARD WITH [payment switch] logo)

Options:

- Yes
- No
- I don't know

16. [If Yes to Q14] How did you first hear about [payment switch]?

Options:

- Radio advertisement.
- TV advertisement.
- Newspaper or magazine advertisement.
- Mobile money app.
- Family members in the household.
- Family members in a different household.
- Friends or neighbors.
- Mobile money agents.
- Merchants.
- SMS message from mobile money service , banks, etc.
- Social Media.
- Other: _____
- I don't know.

17. How frequently do you get advertisements about [payment switch] when you are accessing your financial account through your smart phone?

Options:

- Never.
- Daily.
- Weekly.
- Monthly.
- Annually.
- I don't know.

18. [If Yes to Q14] What do you know about [payment switch]?

Options (SELECT ALL THAT APPLY):

- It is a payments system.
- It is run by the government.
- It is used for interoperable payments.
- It ensures faster payments.
- It ensures cheaper payments.
- It ensures more secure payments.
- Other, specify _____
- I don't know.

IF No to Q14 OR I don't know to Q18, PLEASE EXPLAIN THE FOLLOWING: [insert a simple explanation of the payment switch]

19. Do you think [payment switch] could benefit you?

Options:

- Yes
- No
- I don't know

20. Have you ever used [payment switch]?

Options:

- Yes
- No
- I don't know

21. [If Yes to Q20] What were the reasons for which you used [payment switch]?

- To make speedy payments.
- To receive speedy payments.
- It is convenient.
- It is safe.
- It is cheaper compared to alternatives.
- It allows for sending money across platforms.
- I trust it more because the Government runs it.
- Other, specify _____
- I don't know.

22. Do you intend to use [payment switch] in the future?

Options:

- Yes
- No
- I don't know

23. [If Yes to Q22] . Tell me the reasons you intend to use [payment switch] in the future for?

- To make speedy payments.
- To receive speedy payments.
- It is convenient.
- It is safe.
- It is cheaper compared to alternatives.
- It allows for sending money across platforms.
- I trust it more because the Government runs it.
- Other, specify _____
- I don't know.

Demand for QR code payments

[This type of questions could be used for any use case or technology built on a IIPS]

[Questions about QR codes could be conditional on smartphone ownership]

24. Do you know what a QR code is?

Options:

- Yes
- No
- I don't know

25. This is what a QR code looks like, do you recognize it? SHOW CARD WITH A SAMPLE QR CODE Have you ever made a payment by using QR scanning through your smartphone?

Options:

- Yes
- No
- I don't know

26. [If Yes to Q25] How frequently do you make payments by QR code scan on your smartphone?

Options:

- Daily.
- Weekly.
- Monthly.
- Yearly.
- I don't know.

27. Do you intend to make payments by QR code tap on your smartphone in the future?

Options:

- Yes
- No
- I don't know

28. [If Yes to Q27] Why do you intend to make payments by QR code tap on your smartphone in the future? CAN PICK MULTIPLE

Options

- It is more convenient than paying in cash.
- It is more secure than carrying cash.
- I transact with merchants that prefer QR code payments.
- I get discounts or incentives for using QR code payments.
- Other.
- I don’t know.

29. [If No to Q27] Why do you not intend to make payments by QR code tap on your smartphone in the future? CAN PICK MULTIPLE

Options:

- I don’t understand this QR technology.
- I prefer to use cash for payments.
- I don’t know a merchant that would accept this form of payment.
- I prefer to use a bank card (credit, debit) for payment.
- I don’t trust QR code technology.
- I’m worried the Government could track me if I use this technology.
- The associated fees are too high.
- Other _____
- I don’t know.

Appendix IV: Quantitative Research Methods for Interoperability

Estimating Demand for Interoperability

Suppose we run an experiment like the one described in the Research Methods section. We identify a set of eligible users of interoperability and randomly allocate them to three groups, with each group receiving price *A*, *B*, or *C*, respectively, for a fixed period of time. *A* might be the prevailing off-net transfer price, so *B* and *C* represent discounts on this fee level. Suppose that we calculate the average usage in each group at each price point and generate a figure like the left panel of Figure 13[125]:

Figure 13: Estimating Demand for Interoperability

Economists assume that incentivized choices like this can be modeled through a "demand curve" that coherently applies to all of the prices they could potentially face (not just the three chosen for our experiment). A plot like the left panel hints at what kind of demand curve would fit through these points. Using basic econometric techniques to estimate a demand curve that best fits these points, as in the right panel or by fitting a regression equation such as the following to our experimental data:

$$price_i = a + b_1 quantity_i + b_2 * quantity_i^2 + b_3 * quantity_i^3 + \varepsilon$$

where and are the price faced by user and the corresponding usage by useruser i, a, b_1, b_2, and b_3 are parameters chosen to best fit the curve to the points, and is the regression error term.

125 Ideally, we would run a regression like

$$Quantity = a + b_1 * price_A + b_2 * price_B + b_3 * price_C + \varepsilon$$

where $price_P$ takes a value 1 if an individual is in the treatment group receiving price P and 0 otherwise, which could also include controls. The coefficients b_i could each be plotted to generate a similar figure.

This fitted curve illustrates:

- What users' demand would be at unobserved prices (e.g., other than *A*, *B*, and *C*) assuming that individuals tend to have coherent preferences.
- The elasticity of demand at different points on the demand curve: how sensitive users are to price (, on average, and how much their demand for interoperability were to change if we were to change the price.
- How much users value interoperability as it captures preferences in monetary terms. The curve implies how many monetary units (e.g., dollars) a user would give up for an interoperable payment, in lieu of everything else they could spend those monetary units on in the economy.

This latter feature of the demand curve can be powerfully leveraged to broadly show how much consumer welfare interoperability generates for the economy discussed further below.

Converting Estimated Demand into Estimating the Aggregate Value of Interoperability

With the estimated demand curve, researchers are able to quantify the aggregate welfare effect of accessing interoperability for consumers. Consumer surplus is the amount a consumer is willing to spend for the use of interoperability minus the amount the consumer pays. Consumer surplus is measured as the area below the demand curve and above the price of the interoperability, as the shaded area marked in Figure 14. Suppose the demand curve is , the area of consumer surplus (CS) can be written as:

$$CS = \int_0^Q p(q)\,dq - P \times Q$$

where P is the market price and

$$Q = a + b_1 * P + b_2 * P^2 + b_3 * P^3$$

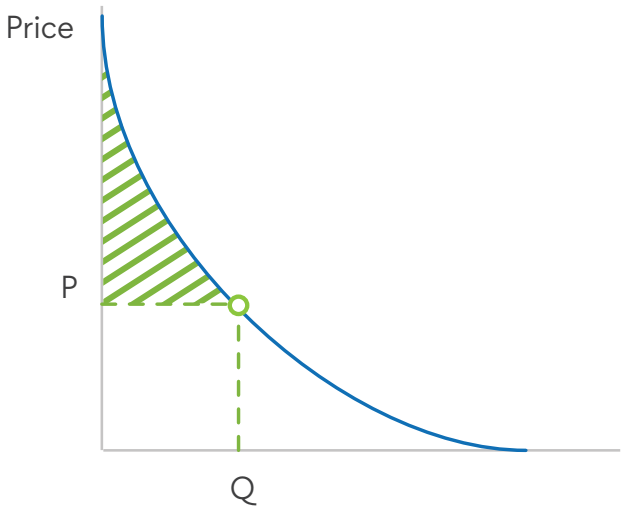

Figure 14: Converting Demand into Aggregrate Value

The area measures consumer surplus, which represents the consumers' welfare gain in monetary value from the use of interoperability and can be directly computed once we have estimated the shape of the demand curve.


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