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How can interoperability drive investment and competition in digital payments?

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Economics for the Common Good

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Instant interoperable payment systems (IIPSs) are increasingly celebrated as a means to advance economic growth and financial consumer welfare, in low- and middle-income countries (LMICs) in particular (Arabehty et al. 2016, Croxson et al. 2023). Inspired by the sustained growth in usage of government-led IIPSs in India and Brazil, advocates suggest IIPSs will lead to more robust competition among financial service providers, reducing costs and increasing quality for consumers. However, history and research suggest that building the technology behind IIPSs is by no means sufficient. Successful adoption of IIPSs requires complex institutional design, pricing, and general policy decisions, which should reflect the unique structure of local markets. Contrary to the intentions of advocates, poorly designed and mistimed rules and regulations can have negative consequences for financial consumers and firms. This research brief draws on empirical and theoretical academic research in economics to highlight key insights for practitioners as they seek to build IIPSs. Many of these insights are counterintuitive to the conventional wisdom among advocates, rendering them all the more important.

Practitioner questions that motivate this review of the research on interoperability

This brief aims to inform practical questions from policymakers, practitioners, financial service providers, and advocates, including the following.

- When is the best time to introduce an IIPS in LMIC financial markets?
- What is the role of the government and regulation in introducing and sustaining IIPSs?
- Should participation in the IIPS be mandatory? For which institutions?
- Should the focus on IIPSs be on pricing or quality or both?
- What are potential risks in designing IIPS rules and regulations?
- What types of impacts should we expect and monitor for IIPS implementations?



Key insights to take away from the existing research

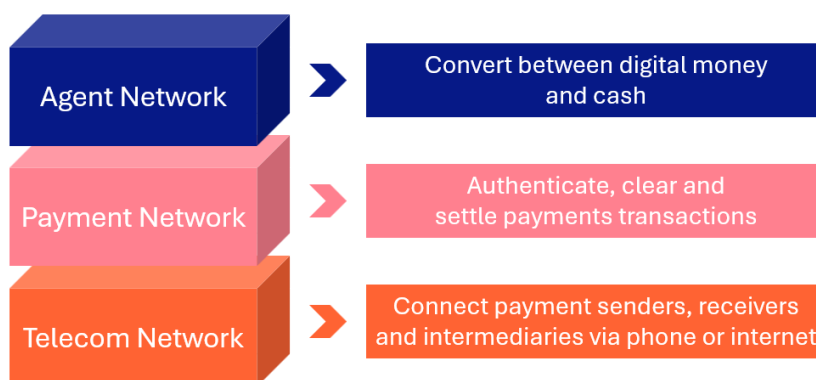
1. As with other public goods, regulation is often needed to deliver socially optimal levels of investment in digital payment infrastructure.
2. Regulators should play different roles depending on the maturity of the market for digital payments. At an early stage, regulators should focus on pricing. At later stages, regulators should focus on coordinating investment and usage.
3. Interoperability may be more beneficial in more mature markets where it is often important to mandate that all firms operate on the common IIPS. Before mandating participation, policymakers should ensure that there is sufficient regulatory capacity and authority to implement such a mandate.
4. If interoperability decreases fees, it can reduce investments in the infrastructure required to reach peripheral rural consumers. This can have detrimental effects on financial inclusion, particularly where financial and telecom services are offered by the same providers. Allowing incumbents a grace period before mandating interoperability may offer a solution.
5. The most important consumer benefits of interoperability may accrue through improved investments in financial service quality, not just through improved pricing.

Characteristics of digital financial infrastructure that motivate public intervention

A well-functioning market for digital payments requires significant investment in various types of infrastructure: A telecom infrastructure to connect the customers; a payment infrastructure to process money transfers; and an agent infrastructure to convert between digital money and cash. This infrastructure “stack” often displays notable characteristics that can help explain the complexity of IIPS policy and system design.

Use of digital payments infrastructure often displays what economists call “network externalities”; i.e., the benefit for users may increase in the number of providers and users in the same network. For example, the more people that use phones, the more useful is any given phone. The more people that have digital payment accounts to send and receive funds instantly, the more useful is any given account. This characteristic is key to the intuition that it may be socially beneficial to develop common digital payments infrastructures for all service providers.

Layers of infrastructures for digital payment transactions



Digital payments infrastructure may enable or constrain consumers’ ability to easily substitute among providers. When a handful of strong providers dominate control of a given layer of the financial infrastructure (e.g., banking oligopolies), or multiple layers (e.g., vertically integrated mobile network operators (MNOs) with mobile money businesses), they have strong incentives to make it costly for consumers to search for and/or switch to new providers. Even when no providers truly dominate the market, infrastructures may not be developed and governed to empower consumers to switch providers. For example, there may not be good technical solutions for sending funds to people with accounts at different institutions even when all consumers would benefit from such a solution. IIPs are often introduced to reduce switching costs and encourage consumer substitution as would be efficient in a competitive market. We refer to this as the “substitution effect”.

Finally, digital payments infrastructure is often what economists call “non-rival”; i.e., one provider’s use of the infrastructure does not prevent use by others. This does not mean that some providers may not be excluded from using the infrastructure. In fact, proprietary payments infrastructure managed by MNOs is often exclusive to their own clients; and, even when IIPs are functioning well with lots of participation, inevitably some smaller or less sophisticated providers will be excluded. Rather, being non-rival implies that, once built, digital payments infrastructure can support one provider practically as easily as 10; or 100 transactions as easily as 1 million. This implies that the investment in developing a shared telecom, financial, or agent network may potentially benefit several service providers if they are permitted

NETWORK AND SUBSTITUTION EFFECTS

In digital platforms, **network effects** arise when the value that each consumer derives from using the platform increases with the number of users on the same platform.

In consumer choice theory, the **substitution effect** refers to the change in the demand of a good or service that results from a change in its relative price, as compared to alternative products.

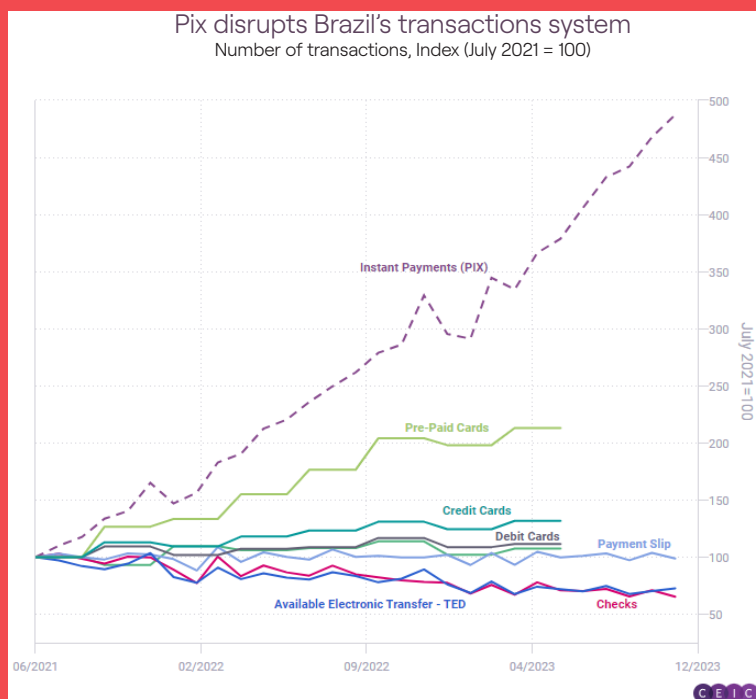
to participate. It is not hard to understand why dominant incumbents may resist being compelled to open up their proprietary infrastructure or to invest in and/or join a shared IIPS. The issue is further complicated by the fact that some providers may enter the market after the infrastructure has been developed, effectively free riding on the early investment and experiences of others.

These characteristics – regarding network externalities, consumer substitution, and non-rival infrastructure – suggest that relying solely on operators’ private incentives is often not enough to guarantee socially optimal levels of investment. Economists describe this as a problem of “public good provision in a market with network externalities”, which advocates increasingly aim to solve through the provision of “digital public infrastructure”.

SUCCESS STORIES: UPI IN INDIA AND PIX IN BRAZIL

UPI is a mobile-based, real-time payment system that enables instant personal and merchant payments. It was developed by the public-sector company National Payments Corporation of India, a joint venture between the Reserve Bank of India and the Indian Banks’ Association, and launched in April 2016 with the goal of building an efficient, inclusive, interoperable payment and settlement system in India. Today, UPI processes over 75% of the country’s retail digital payments, with more than 1 billion transactions every month.

Launched by the Central Bank of Brazil in 2020, Pix is a platform enabling instant execution of payments and transfers. Its aims were to reduce cash transactions and offer a faster and cheaper alternative to existing payment instruments. Pix quickly gained widespread popularity. Today, it is by far the most common method of transferring money among Brazilian households and merchants.



From ATMs to Pix: Compelling examples of network and substitution effects relevant to IIPs

The history of ATM networks is useful to illustrate key economic mechanisms relevant to the adoption and success of IIPs (Bianchi et al. 2023). In 1977, Citibank made a substantial investment to install ATMs across New York City. While not the first attempt to develop an ATM network, Citibank’s eventual success was aided by an extraordinary blizzard that hit New York in January 1978, forcing banks to stay closed for days and inducing a substantial increase in ATM usage. Accessible only to its own clients, the ATM network at first provided a clear comparative advantage to Citibank, which by 1981 doubled its market share for deposits. In 1985, however, six competing banks formed an alternative network of ATMs, the New York Cash Exchange (NYCE), which was larger than Citibank’s network and accessible to all clients of the six banks. In 1994, Citibank joined the NYCE.



Consumers value banks with larger ATM networks as they provide higher payment convenience; hence, banks with larger networks tend to have larger market shares and lower deposit rates

The example illustrates two key theoretical principles mentioned above. First, a network effect: consumers value banks with larger ATM networks as they provide higher payment convenience; hence, banks with larger networks tend to have larger market shares and lower deposit rates. Second, a substitution effect: when banks are grouped into a common and interoperable scheme, consumers become less sensitive to the network of a particular participating bank and they can search for banks offering higher deposit rates.

Recent evidence from the introduction of the public IIPS in Brazil (“Pix”) illustrates these effects in a contemporary context. Developed and managed by the Central Bank of Brazil, Pix now connects all major financial institutions, including large and small banks. Its introduction has reduced the comparative advantage of larger banks in offering payment services, fostered competition in the deposit market, and allowed consumers to join smaller banks and enjoy higher deposit rates. As shown by Sarkisyan (2023), these trends have resulted in substantial welfare gains for consumers. Furthermore, because clients of small banks can now easily transact with the larger population of clients at large banks, the small banks do not have to offer such high deposit rates to attract customers. In other words, Pix effectively compressed variation in interest rates across small and large providers, which Liang et al. (2024) argue improves the transmission of central bank monetary policy.

Interoperability driven voluntarily by private providers versus public mandates

Much of the relevant literature speaks convincingly about the need for regulators to take an active role in developing and sustaining an effective IIPS. However, there may be good reasons to be sceptical of governments dictating how financial service providers use and invest in infrastructure essential to their businesses. After all, governments may not be on the cutting edge of technological innovation or understanding of consumer preferences. There are numerous examples of private firms – such as card companies in select markets and private payment switch operators – building and sustainably maintaining shared payment infrastructure. If so, why might we think that the “public” nature of digital financial infrastructure is key for competition and consumer welfare?



Why might we think that the “public” nature of digital financial infrastructure is key for competition and consumer welfare?

To investigate this question about the role of government in enabling interoperability, one must think rigorously about why and how interoperability might be achieved and sustained without regulation. In other words, what are the private incentives of commercial firms to develop and sustain interoperable payment networks? Early theoretical research in “industrial organization” – the discipline of economics that investigates market structure and competition – offers some sobering insights. Work on ATM networks by Matutes and Padilla (1994) finds



that interoperability can be sustained without government regulation in three different cases, two of which are characteristic of an anti-competitive market. In the first case, interoperability functions as an anti-competitive device to deter entry of new service providers. Essentially, the network benefits to clients that participate in existing interoperable providers are so great that no new firms (e.g., future fintechs) will seek to enter the market. In the second case, consumers face large switching costs which prevent them from joining more attractive providers. The above-defined substitution effect is muted and each firm is effectively protected from competition, even in the presence of interoperability. It is only in the third case, with appropriately defined interchange and ATM withdrawal fees to which all participating firms agree, that the authors find unregulated interoperability can be developed in a way that fosters competition. As we highlight below, getting fees right is by no means a straightforward exercise.

More than just ICT: Pricing of fees and the incentives to join IIPs



Effectively developing and sustaining IIPs to the benefit of market competition and consumer welfare is clearly about more than just building shared digital infrastructure. In particular, getting pricing right – interchange fees, cash-out fees, etc. – is an essential challenge. It is hard to imagine an unregulated market effectively agreeing on fees that would sustain a virtuous form of interoperability that enabled competition. To better understand the role of fees in interoperability, let's see how both fees that are set too high and too low would discourage successful adoption of IIPs.

Consider a simplified market in which one incumbent firm decides whether to develop an interoperable network infrastructure, knowing that new firms may enter the market at a later stage. Acting as a monopolist, the incumbent tends to set access fees too high, which result in too little usage

of the network as incoming providers may prefer to operate on their own network rather than paying the high fees. Even if the incumbent did not explicitly seek to prevent competition with unreasonably high fees, the incumbent would have little incentive to develop an interoperable network if fees are too low or as low as advocates imagine can be achieved with public IIPs.

Regulators should be mostly concerned about pricing, regulating fees to balance the incentives for powerful incumbent firms to invest and the incentives for entrants to join

While this is clearly an overly simplified model of a very stylized market, these trade-offs provide intuition about the important role for regulators when the market is at an early stage of development. Here, the regulators should be mostly concerned about pricing, regulating fees to balance the incentives for powerful incumbent firms to invest and the incentives for entrants to join.

Roles for regulators in markets at different stages of maturity

We have highlighted the importance of regulating pricing to induce investment and participation in an IIPs for markets at early stages of development. But, once firms have adopted an IIPs, should regulators step back and let market forces influence outcomes at later stages of market development? Insights from both theoretical and empirical research in economics suggest a continued role for regulators. As the market develops and when several firms are operating, the regulator should switch its focus to coordinating the investment and usage of the infrastructure, making sure each firm has the incentive to operate on the common infrastructure and take full advantage of network externalities.

These arguments are formally analyzed in Bianchi and Yamashita (2024) who discuss how the key regulatory functions should evolve as the market develops. They show that regulatory interventions tend to be more effective in more mature markets where the regulator can obtain more precise information on how much consumers and firms value the common infrastructure. The benefits of waiting before intervening are greater when investment costs and uncertainties about consumers' and firms' valuations are larger.

As the market develops and when several firms are operating, the regulator should switch its focus to coordinating the investment and usage of the infrastructure, making sure each firm has the incentive to operate on the common infrastructure and take full advantage of network externalities

The authors highlight, however, that the benefits of late interventions are much lower if the regulator cannot prevent firms from building and operating on their own separate network. In fact, the research suggests that participation in the common IIPs infrastructure, whether operated by a public or private entity, should be a regulatory mandate at later stages of market development. Importantly, not all markets have the political will to institute such a mandate and advocates should be cautious in pursuing interoperability if it is unlikely to become mandated. Regulators must also have sufficient technical capacity and staff to enforce a mandate; in LMICs, this may require priority investment by domestic governments, potentially with support from international donors.

The success of the IIPS in Brazil illustrates the importance of a mandate enforced by a high-capacity regulator with authentic political will to improve competition. The Pix IIPS in Brazil was implemented after a decade-long process of reforming the banking system to reduce the dominance of a few large institutions. Brazil's central bank mandated that all the largest institutions participate in the scheme and recruited a talented team, including academic experts in the economics of competition, to implement and enforce the mandate.



The importance of sequencing policy priorities and differentiating between nascent and mature markets is further highlighted in the empirical study by Brunnermeier et al. (2024). The authors consider how mobile money fees and coverage are affected by the introduction of interoperability across 40 African countries over the period 2010-2020. They show that while interoperability tended to decrease fees, it may also have undermined investment in the core telecom infrastructure necessary to expand access to digital payment accounts in peripheral communities. This paradoxically constrained financial inclusion, contrary to the intentions of IIPS advocates, because maintaining mobile towers in remote areas involves significant variable costs and MNOs that control both telecom and mobile money businesses stop serving these regions when facing fiercer competition and smaller profit margins.

“ In markets where telecom and payments markets are vertically integrated, it may be important to allow incumbents a grace period for developing their infrastructures and reaping the benefits of their investments

Observing that these effects tend to be stronger for operators who have recently entered the market, the authors propose that interoperability could be designed to resemble patent expiration. In markets where telecom and payments markets are vertically integrated, it may be important to allow incumbents a grace period for developing their infrastructures and reaping the benefits of their investments. Interestingly, a policy along those lines was implemented in Ethiopia in 2021, where the regulator allowed state-owned Ethio Telecom to launch its mobile money service with a one-year grace period before allowing the entry of new providers. As an extension to these insights, policymakers should consider not just how interoperability impacts incentives to invest in telecom infrastructure, but also the retail agent infrastructure essential for delivering digital financial services to the world's lower-income communities.

Beyond pricing: IIPS implications for financial service quality

The aforementioned research on interoperability in Africa highlights the importance of thinking seriously not just about the impact of interoperability on pricing and competition, but also on investment in infrastructure expansion. Introducing interoperability may also affect the investments in infrastructure quality, a relatively overlooked but key dimension.

Economic theory often reduces quality in financial services to a single dimension, simplifying providers' choices to setting price and quality. When price is fixed, for example by a regulator, providers' choices are reduced to decisions about investments in quality. In reality, quality encompasses a variety of different concepts, including negative experiences with poor service, fraud, misconduct, and overcharging, as well as positive experiences of account perks, expedited service, convenience, etc. Recent research demonstrates that poor quality can be more costly to consumers than the direct pecuniary price of services. A report by IPA (2024) shows that a substantial fraction of mobile money transactions – the payment technology most relevant to many African countries – cannot be completed due to agent's unavailability, lack of liquidity, or other technical network issues. These inefficiencies lead to transaction costs that are estimated to be even more important than direct transaction fees.

Advocates often focus on how interoperability can drive down the price of payments, which IPA (2024) shows are often high in LMICs. But, as mentioned, potential impacts on financial service quality may be even more valuable to consumers than impacts on price. Bianchi et al. (2024) formally show that, in already competitive markets, interoperability may weaken competition on fees as it weakens the incentives to steal customers from other operators. At the same time, interoperability may increase each operator’s incentives to invest in network quality, as a way to differentiate and offer higher benefits to all its clients.

Potential impacts on financial service quality may be even more valuable to consumers than impacts on price

Brazil’s success in driving near universal adoption of Pix is increasingly yielding to scrutiny about growing indebtedness, fraud, and concerns about consumer “financial health”. These theoretical insights and real-world experiences highlight the need for policymakers to consider the impact of interoperability on, not just the price, but also the quality of financial services. In more mature markets, once all major providers have joined the IIPS, regulators may want to shift attention to issues of quality and even consider trade-offs between improved quality and slightly higher pricing.

We have built on empirical and theoretical economics literature to highlight some key insights for practitioners when developing IIPSs². We have highlighted some specific characteristics of digital financial infrastructures that call for regulatory interventions, while also stressing how the type of intervention should depend on the stage of market development and on the regulator’s enforcement capacity. We have also argued that while setting the right prices is a key aspect in many regulatory interventions, other aspects related to service quality should be considered as the market develops. We hope this brief can contribute to inform pressing policy debates, and to spur further academic research.

KEY POLICY INSIGHTS

Careful design and timing are crucial

- Policymakers need to ensure that IIPS implementation aligns with market maturity and local infrastructure needs.
- Early intervention may harm financial inclusion, especially in remote areas.
- Early-stage markets may need pricing regulation, while mature markets require coordination of investments.

Balance competition with investment

- Consider the trade-off between encouraging competition and incentivizing investments in digital payment infrastructure.
- To boost infrastructure investment, regulators may need to provide incentives or a phased introduction of interoperability.

Mandates should consider regulatory capacity

- In markets where regulators have limited capacity, voluntary participation in IIPS may be preferable.
- Mandates need to be backed by strong enforcement mechanisms.

Don’t forget service quality

- While it is vital to get pricing right, long-term benefits for consumers may also come from improvements in service quality.

¹ See for example, ‘Pix Gangs’ cash in on Brazil’s mobile payments boom | Reuters, Survey: 78.5% of Brazilian families are in debt | Agência Brasil (ebc.com.br), Brazil President Lula’s Debt Relief Program Struggles to Boost Consumption - Bloomberg, and Financial Inclusion in Brazil 2002 – Plano CDE.

² Our review has mostly focused on digital financial infrastructures. A broader discussion on digital payment interoperability can be found in Bianchi et al. (2023). Özyilmaz (2024) reviews recent academic evidence on the impact of IIPS on a broader set of outcomes including financial inclusion, competition, and growth.

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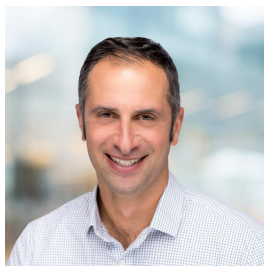


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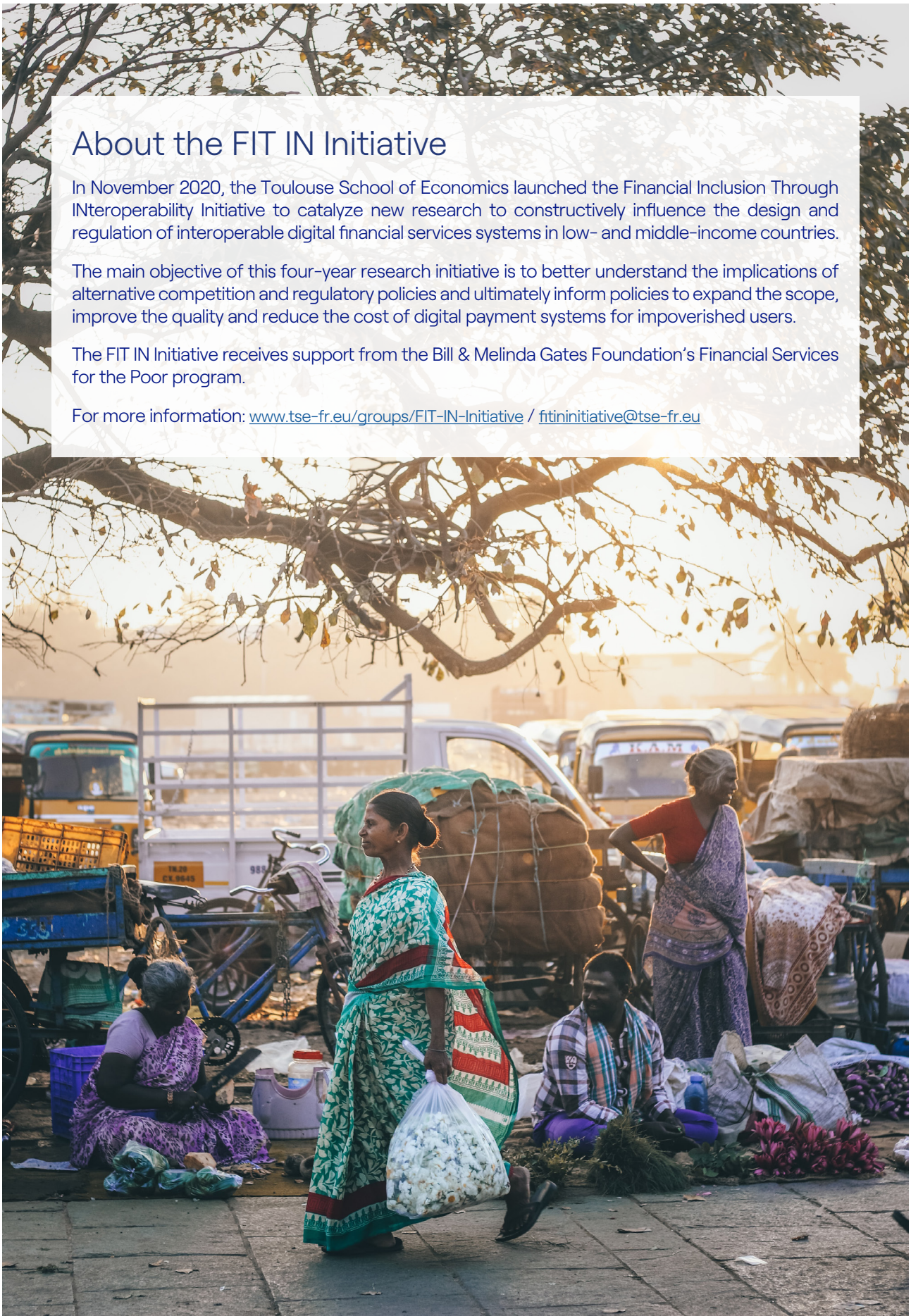
About the FIT IN Initiative

In November 2020, the Toulouse School of Economics launched the Financial Inclusion Through Interoperability Initiative to catalyze new research to constructively influence the design and regulation of interoperable digital financial services systems in low- and middle-income countries.

The main objective of this four-year research initiative is to better understand the implications of alternative competition and regulatory policies and ultimately inform policies to expand the scope, improve the quality and reduce the cost of digital payment systems for impoverished users.

The FIT IN Initiative receives support from the Bill & Melinda Gates Foundation's Financial Services for the Poor program.

For more information: www.tse-fr.eu/groups/FIT-IN-Initiative / fitininitiative@tse-fr.eu



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