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Central banks, the monetary system and public payment infrastructures: lessons from Brazil's Pix

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Central banks, the monetary system and public payment infrastructures: lessons from Brazil's Pix

Key takeaways

- *Public payment infrastructures build on the central bank's foundational role in the monetary system by promoting competition and interoperability between payment platforms. They can reduce costs for users and promote financial inclusion.*
- *Brazil's recent experience with the Pix retail instant payment system illustrates the potential gains. In little over a year since its launch in November 2020, Pix has signed up 67% of adults in Brazil, with free payments between individuals and low charges for merchants.*
- *The two key ingredients in the success of Pix are, first, the mandatory participation of large banks to kick-start network effects for users, and second, the central bank's dual role as infrastructure provider and rule setter.*

The monetary system is a crucial foundation for the economy, with the attributes of a public good. Central banks provide this public good by issuing money – the economy's unit of account. Building on this role, central banks oversee the payment system, promoting its safety, integrity and efficiency. In many economies, central banks take the additional step of providing and operating key payment infrastructure (CPSS (2003); BIS (2020; 2021); CPMI (2021)). In doing so, the central bank's objective is to promote an open, competitive payment platform on which private sector institutions can serve users more effectively.

We illustrate the central bank's role as the provider and operator of the payment platform through the recent launch and rapid adoption of Brazil's Pix instant payment system. In just over a year since its launch in November 2020, Pix has seen 114 million users, or 67% of the adult population.

Brazil's recent experience provides salient lessons – for both emerging market economies (EMEs) and advanced economies (AEs), whose payment systems still face challenges around access and user costs.

Indeed, despite rapid technological progress in information processing and digital technology in recent decades, the cost of domestic payments has remained stubbornly high. Credit and debit card fees, usually levied on merchants, exceed 1% of GDP in many economies and can be substantially higher in some cases (Alfonso et al (2020)). While these costs are not directly visible to consumers (as they are levied on merchants), they are partially passed on to consumers through higher prices at the checkout. As in the case of indirect taxation, the group that ultimately bears the tax burden may differ from the group that is formally required to pay the tax. Ultimately, these costs can act as a drag on economic activity.

Financial access is a well known problem in EMEs, but AEs are not immune to the problems associated with a lack of access to digital payments (Demirgüç-Kunt et al (2018)). In many AEs, a non-negligible share of adults does not have a bank account, payment card or payment app to transact in the digital realm and access other financial services. Many rely on high-cost financial services such as prepaid cards or payday loans that introduce substantial regressive elements into the payment system (BIS (2021)).

Progress in technology has been no panacea for the problems of payment costs and financial inclusion. The network effects inherent in payment platforms can be used to entrench market power and can often result in a lack of effective competition. Big tech payment services can quickly gain substantial market power to extract high fees and valuable data (Carstens et al (2021)). In many economies, there is also the market dominance of the major banks together with card networks that enjoy substantial rents. Some of these rents are passed back to customers, for instance through points or benefits on credit cards, but the customers who benefit are frequently the “high-value” customers who are not financially excluded.

The same technologies and network effects that lead to greater concentration and market power can equally be redirected to promote a virtuous circle of greater competition and lower costs. Central bank public infrastructures may be one such approach, through both publicly provided retail fast payment systems as well as their close cousins, central bank digital currencies (CBDCs) (BIS (2021)).

By design, these central bank payment infrastructures have an open architecture associated with data governance and technical standards that give substance to the system’s open and competitive nature. Application programming interfaces (APIs) are a key element in this regard, as they facilitate secure data exchange and interoperability between payment service providers (PSPs).¹ By directly operating such a system, the central bank can define and enforce rules that govern the platform, including on costs, use of data and other technical standards. Not least, the central bank can build on its foundational role at the centre of the monetary system to make its settlement accounts available to support the finality of payments.

The Pix instant payments system in Brazil presents a good example of these important principles.² This bulletin examines the experience and draws lessons for other countries.

Backdrop: digitalisation of Brazilian retail payments

The digitalisation of retail payments in Brazil gathered pace after the adoption of a 2013 law that gave the Central Bank of Brazil (BCB) competence to regulate retail payments according to the principles of efficiency, security, interoperability and financial inclusion. Historically, private PSPs have played an essential role in promoting the financial inclusion of households and small entrepreneurs. Pix has built on this two-tier structure. Even before the introduction of Pix, greater competition in the acquiring market and caps on interchange fees had pushed down average merchant fees on credit cards. Moreover, the share of adults with a transaction account rose from 56% in 2011 to 70% in 2017 (see online appendix).

Nevertheless, even as technology evolves, low costs and inclusion are not ensured in the absence of effective competition. Indeed, several new players have entered the payment market and offered payment services in closed-loop systems that require both payers and payees to be customers of the same institution. The use of these services can result in market concentration, as a small number of players gain monopoly power and charge high fees. By coincidence, the launch of Pix was preceded in June 2020 by the launch of a big tech payment service that proposed merchant fees of 3.99%.³ In addition, Brazil has seen rising retail investment in cryptocurrencies. While data on actual use are scarce, the volatility of large cryptocurrencies and the unregulated nature of the market raise concerns for consumer protection and potentially for financial stability.

¹ Interoperability means that users can make payments to other users that use a different provider, without having to participate in multiple systems. See Boar et al (2021).

² A further example is India’s Unified Payments Interface (UPI), launched and overseen by the Reserve Bank of India, and operated by the National Payments Corporation of India. See D’Silva et al (2019).

³ BCB and competition authority CADE moved to suspend these payments, noting that they depended on prior authorisation (BCB (2020)). In the interim, the BCB has authorised person-to-person payments by the provider on Pix. The firm is implementing changes to fulfil BCB requirements for a person-to-business payments model.

Pix: key facts and figures

The BCB decided in 2018 to launch an instant payment scheme developed, managed, operated and owned by the central bank. Pix was launched in November 2020. The goals are to enhance efficiency and competition, encourage the digitalisation of the payment market, promote financial inclusion and fill gaps in currently available payment instruments. The BCB plays two roles in Pix: it operates the system and it sets the overall rulebook. As a system operator, the BCB fully developed the infrastructure and operates the platform as a public good. As rulebook owner, the BCB sets the rules and technical specifications (eg APIs) in line with its legal mandate for retail payments. This promotes a standardised, competitive, inclusive, safe and open environment, improving the overall payment experience for end-users.

Since its launch, Pix has seen remarkable growth. By end-February 2022 (15 months after launch), 114 million individuals, or 67% of the Brazilian adult population, had either made or received a Pix transaction. Moreover, 9.1 million companies have signed up – fully 60% of firms with a relationship in the national financial system. Over 12.4 billion transactions were settled, for a total value of BRL 6.7 trillion (USD 1.2 trillion) (Graph 1, left-hand panel). Pix transactions have surpassed many instruments previously available – eg pre-paid cards – and have reached the level of credit and debit cards (Graph 1, right-hand side). Pix partly substituted for other digital payment instruments, such as bank transfers. Yet notably, the total level of digital transactions rose substantially. Using accounts from banks and non-bank fintech providers, more individuals entered the digital payment system. Indeed, Pix transfers were made by 50 million individuals (30% of the adult population) who had not made any account-to-account transfers in the 12 months prior to the launch of Pix. Thus, Pix helped to expand the universe of digital payment users.

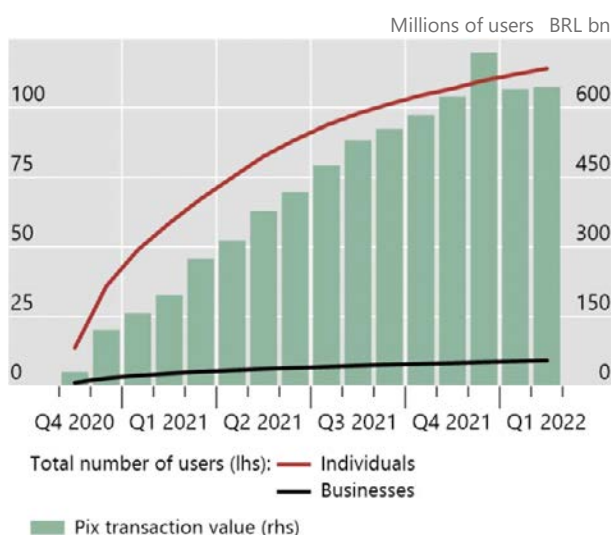
Credit transfers between individuals have been the main use case for Pix since its launch. Indeed, adoption by individuals is very straightforward. Individuals can obtain a Pix key and quick response (QR) code to initiate transfers to friends and family, or for small daily transactions. In line with its strategic agenda for financial inclusion, the BCB decided to make Pix transfers free of charge for individuals. PSPs pay a low fee (BRL 0.01 per 10 transactions) to the BCB so that the BCB can recover the cost of running the system.

To ensure access and integrity, PSPs must digitally verify the identity of users. With the existing interface and know-your-customer (KYC) processes provided by their bank or non-bank PSP, users can

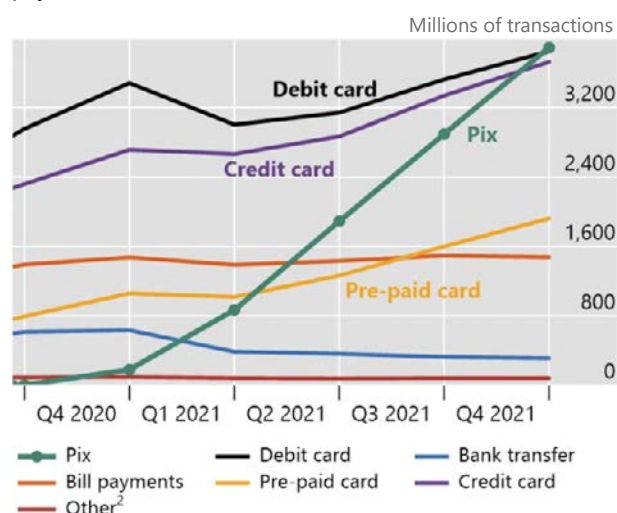
In just over a year, Pix has witnessed dramatic growth

Graph 1

Users and transaction value have risen rapidly



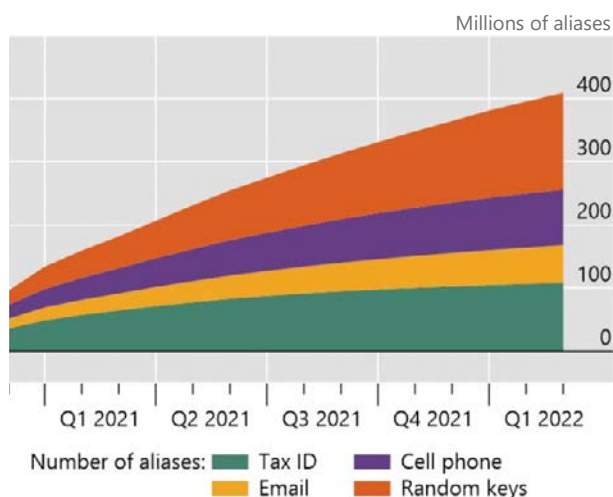
Pix is gaining market share rapidly in a growing digital payments market¹



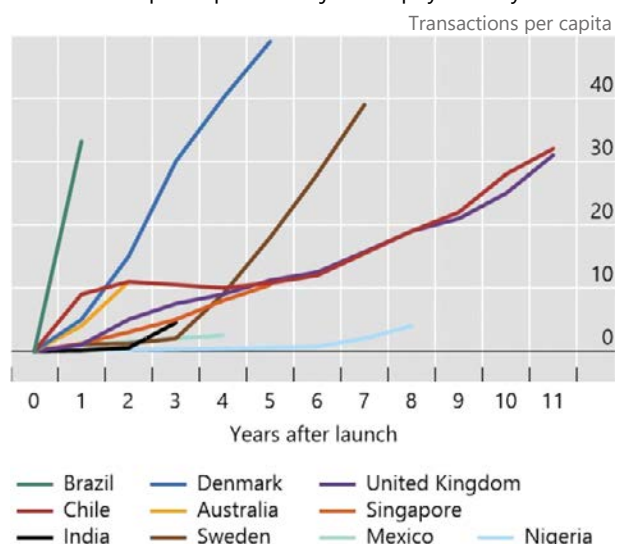
¹ Number of transactions for each payment instrument, excluding recurrent utility payments. ² Includes cheques.

Sources: Central Bank of Brazil; authors' calculations.

Distribution of aliases over time



Transactions per capita of major fast payment systems



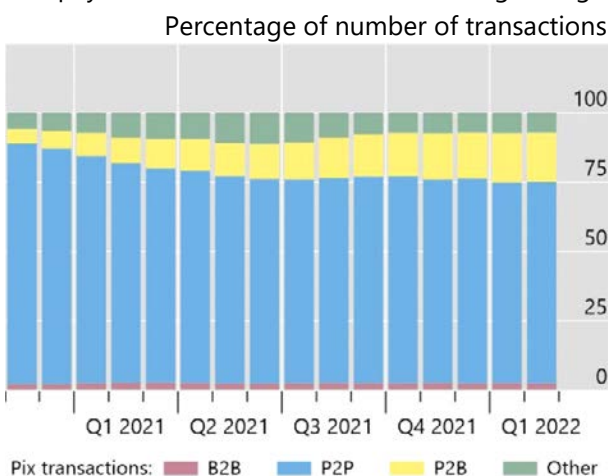
Sources: Bech et al (2020); BIS Red Book statistics; Central Bank of Brazil; authors' calculations.

have an "alias" – such as a phone number, email address or other key – which forms the basis of digital identification. The most common such aliases are randomly generated keys (eg QR codes), but phone numbers, email addresses and tax IDs are also used (Graph 2, left-hand panel). The ease of use for individuals and the multiplicity of use cases may be one reason why actual use has increased quite rapidly – to 33.2 transactions per capita, a record among peer jurisdictions (right-hand panel).

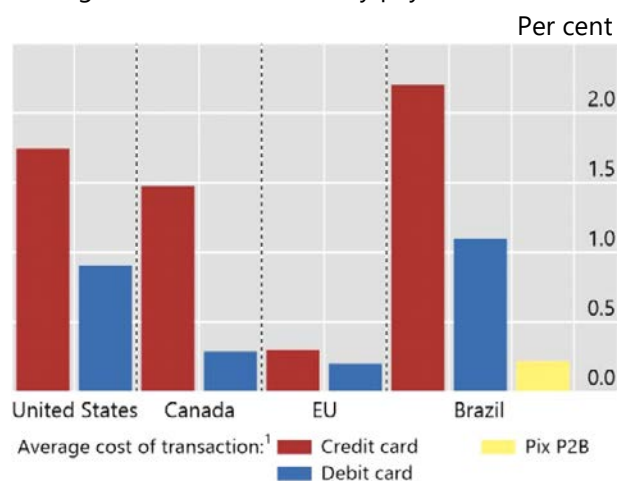
Since launch, use cases other than person-to-person payments have quickly gained ground. The share of person-to-business (P2B) payments has risen (Graph 3, left-hand panel), encompassing eg retail purchases at shops, restaurants and e-commerce sites. These, too, can use QR codes and other aliases. Stickiness in adoption by businesses is expected since this typically requires back-end systems integration. PSPs can set fees for corporate payees (for purchases) and payers (for transfers). Yet for merchants, Pix

Merchant payments are becoming more common, and are much cheaper on Pix

P2P payments still dominate, but P2B are growing



Average costs to merchants by payment method



¹ For the United States, Canada and EU, average of interchange fees on credit and debit cards. Total cost to merchants may be higher.

Sources: Hayashi and Nimmo (2021); BIS Red Book statistics; Central Bank of Brazil; authors' calculations.

payments are much cheaper than alternatives such as card payments – with an average cost to merchants of 0.22%. This compares with fees of 2.2% for credit cards in Brazil, 1.7% percent for credit cards in the United States, 1.5% in Canada and 0.3% percent in the European Union (Graph 2, right-hand panel).

A further increase in P2B usage is expected over time, as new overlay services such as direct debit and electronic bill payment are scheduled to be released in the near future.

Factors behind the success of Pix to date

Pix holds useful lessons on the ingredients for the successful launch of a public interest-oriented retail payment system. A number of factors have likely contributed to the success of Pix (see also Brandt and Lobo (2021)). Two factors particularly stand out:

- Mandatory participation of larger institutions: as a regulator, the BCB mandated participation in Pix by banks and other payment institutions with more than 500,000 transaction accounts. This created a critical mass of users and kick-started the network effects so that the open-loop payment platform could gain traction. As banks saw their competitors taking part, they were incentivised to join the network. In particular, smaller banks who were not obliged to participate saw that it was in their interest to do so. Non-bank PSPs also saw competitive incentives to enter. In total, 773 institutions joined Pix as member PSPs.⁴
- Governance arrangements to set the rules: guided by its public interest mandate, the BCB runs a central Pix rulebook. Open APIs form a key part of the rulebook, as they securely transmit only the data needed for a particular transaction (CGIDE (2020)). This includes both account information service (AIS) APIs, which transmit information between users and PSPs, and payment initiation service (PIS) APIs, which ensure the execution of payment requests. These APIs are defined and implemented by the Open Finance initiative governance body. They allow users to port their transaction history, eg to apply for credit. Meanwhile, dedicated APIs for businesses can facilitate the financial management of corporates and merchants, and allow for value added services from private technology providers.

The BCB approached Pix product development with a user-centric perspective, focusing on the concrete needs of households and businesses in their payment habits, and gaps in the current system. Working together in the Pix Forum, the BCB and private PSPs defined a range of use cases, such as P2P, P2B, electronic bill pay and deferred payments to meet specific needs. These use common standards, eg standardised user interfaces. Going forward, there are plans to roll out dual offline payments (for when the payer and payee do not have internet connectivity) and cross-border payments and remittances.

In rolling out Pix, the BCB had to respond to challenges and enact several complementary policies. For instance, to support public awareness and adoption, the BCB ran an extensive communication strategy with PSPs, individuals, businesses, media and other stakeholders. The rollout required complementary policies to increase digital literacy, particularly for the most disadvantaged and for older users, who are less comfortable making digital payments. From an infrastructure perspective, the massive adoption of Pix required additional IT resources at the BCB.

While Pix has multiple layers of security, efforts have also been necessary to prevent fraud and scams. In this light, the BCB and PSPs led an awareness campaign on social media called “The Security Week”. The BCB also developed a special refund mechanism and a precautionary blockage of funds to increase the recovery of funds from fraudsters through a standardised procedure. Finally, non-adherence to required security standards by some small PSPs allowed access by third parties to some alias data. As with other digital payment instruments, this has required further efforts by the regulator and private PSPs to adapt and ensure safety.

⁴ Of the 773 participants, 36 are mandatory, 93 are non-banks (payment institutions, direct credit societies etc) and 615 are credit unions.

Lessons from Pix

Pix has shown how central bank infrastructures can support interoperability and competition, promoting lower costs and greater financial inclusion. These features also have relevance for the possible adoption of central bank digital currencies (CBDCs). Retail CBDCs and fast payment systems can be seen as two instances in a broader continuum of payment infrastructures. Both can use digital identification, public key cryptography and APIs to guarantee privacy of payments (BIS (2021)). Both allow private sector providers to offer low-cost services through a range of interfaces. The key difference is that CBDCs would be a claim on the central bank rather than on private intermediaries, allowing for more direct settlement. CBDC systems could also allow for new functionalities such as programmability that are not currently available with bank transfers or retail fast payments. Nonetheless, the rationale for a CBDC rests on similar considerations to that of a retail fast payment system. In this respect, the success of Pix carries many important lessons.

References

Alfonso, V, A Tombini and F Zampolli (2020): "Retail payments in Latin America and the Caribbean: present and future", *BIS Quarterly Review*, December.

Bank for International Settlements (2020): "Central banks and payments in the digital era", *Annual Economic Report 2020*, Chapter III, June.

_____ (2021) "Central bank digital currencies: an opportunity for the monetary system", *Annual Economic Report 2021*, Chapter III, June.

Bech, M, J Hancock and W Zhang (2020): "Fast retail payment systems", *BIS Quarterly Review*, March, pp 28–9.

BIS Committee on Payments and Market Infrastructures (2021): *Developments in retail fast payments and implications for RTGS systems*, December.

Boar, C, S Claessens, A Kosse, R Leckow and T Rice (2021): "Interoperability between payment systems across borders", *BIS Bulletin*, no 49, December.

Brandt, C and B Lobo (2021): "Pix: the Brazilian fast payments scheme", *Journal of Payments Strategy and Systems*, vol 15, no 4, December.

Carstens, A, S Claessens, F Restoy and H S Shin (2021): "Regulating big techs in finance", *BIS Bulletin*, no 45, August.

Central Bank of Brazil (2020): "Nova solução de pagamentos depende de prévia autorização do BC" ("New payment solution depends on prior authorisation from the BCB"), press release, June.

Committee on Payment and Settlement Systems (2003): *The role of central bank money in payment systems*, August.

Consultative Group for Innovation and the Digital Economy (2020): *Enabling open finance through APIs*, December.

D'Silva, D, Z Filková, F Packer and S Tiwari (2019): "The design of digital financial infrastructure: lessons from India", *BIS Papers*, no 106, December.

Demirgüç-Kunt, A, L Klapper, D Singer, S Ansar and J Hess (2018): *The Global Findex Database 2017 – measuring financial inclusion and the fintech revolution*, World Bank Group, April.

Hayashi, F and V Nimmo (2021): "Credit and debit card interchange fees in various countries", *Federal Reserve Bank of Kansas City Payments System Research*, August.