Central banks as catalysts of innovation in payments

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*The views expressed here are those of the author and may not reflect those of the Bank for International Settlements (BIS).

Roadmap for today

- Innovation in payments: why do we care?
- Macroeconomic implications of digital payments
- The challenge of crypto, decentralised finance (DeFi) and stablecoins
- A small historical detour
- Public infrastructures to support private services
- But will they work?
- Concluding remarks

- Q&A

Image source: Visit Rapid City, Cover slide source: Travel South Dakota)

Innovation in payments: why do we care?

Image Wikimedia Commons; source: BIS.

Innovation in payments: why do we care?

Image Wikimedia Commons; source: BIS.

Payments as the fundamental plumbing in the economy

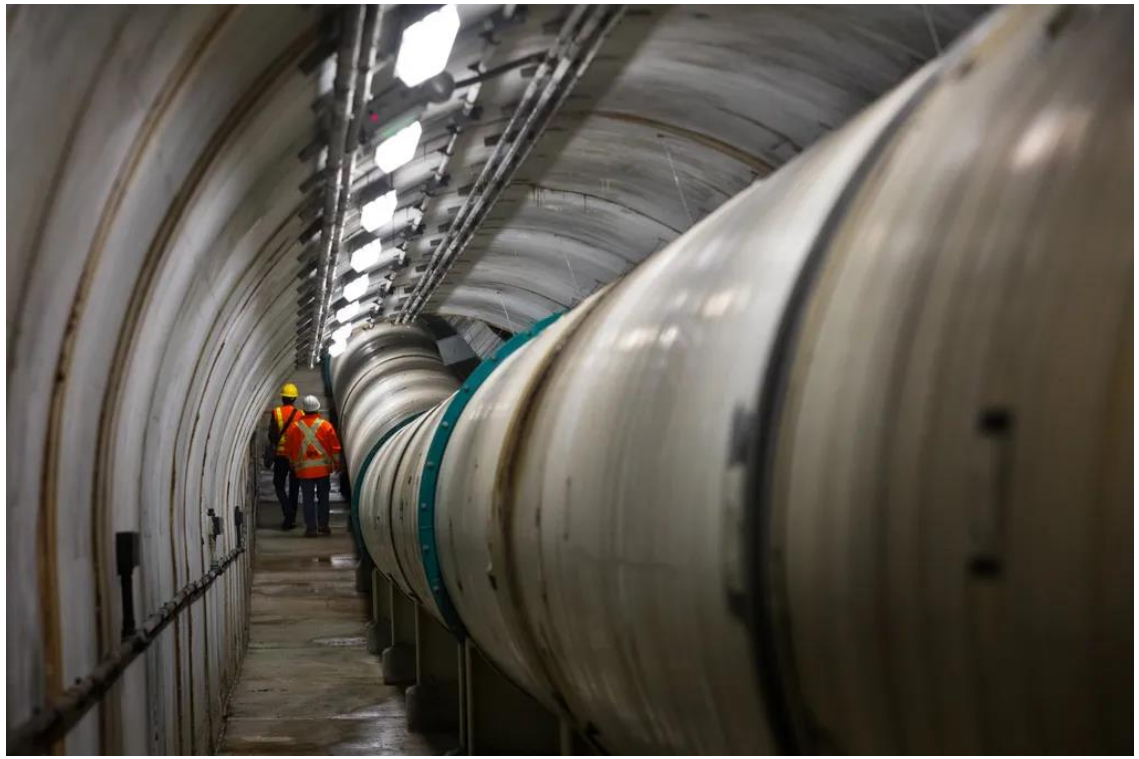
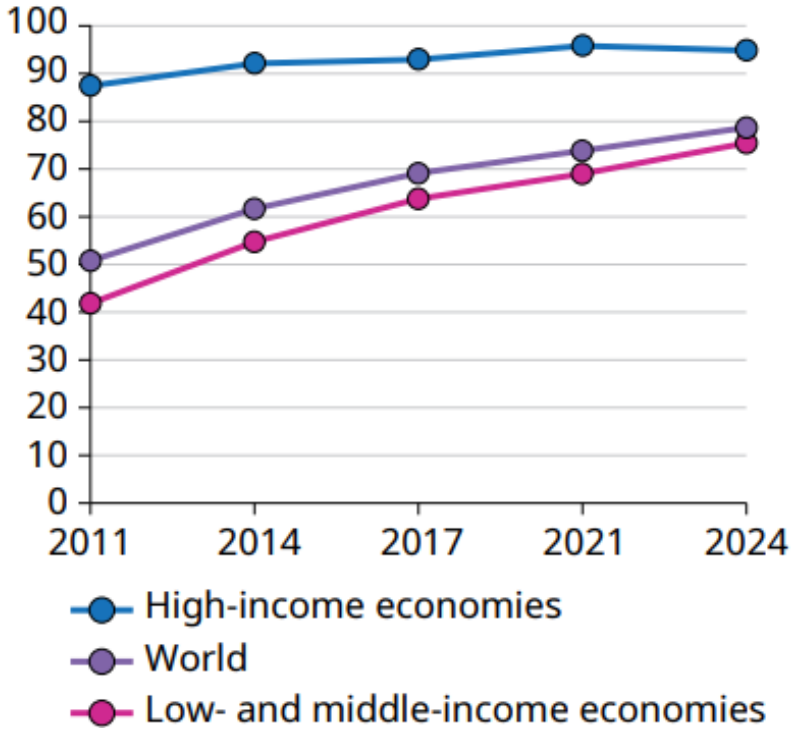


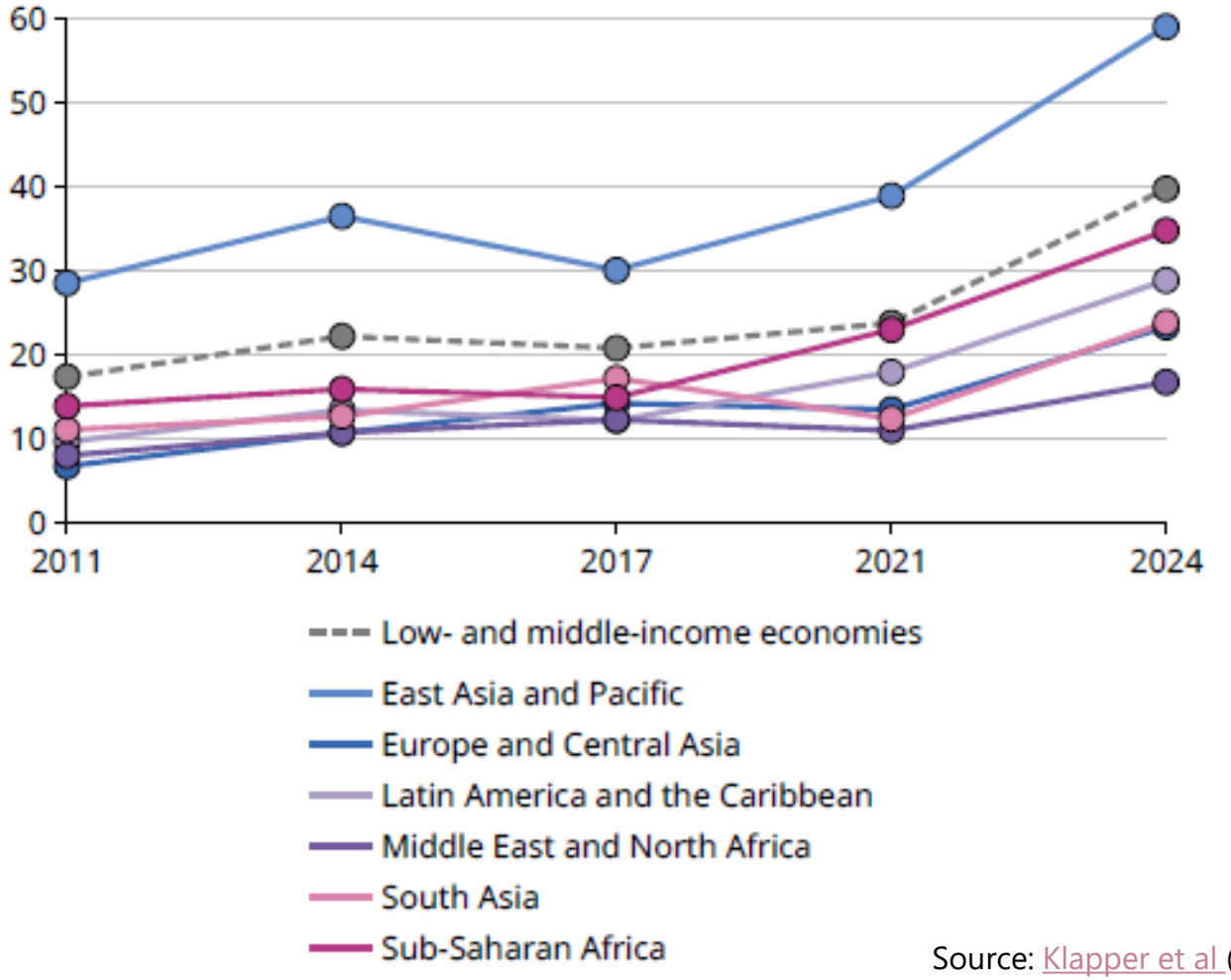
Image source: Seattle Times,

Payments as a "gateway" to other financial services – savings, credit, etc

Adults with an account (%), 2011–24



Adults saving at a bank or similar financial institution or using a mobile money account in the past year (%), 2011–24



Source: Klapper et al (2025).

Empirically, digital payments are tied to lower informality and higher growth

- A 1 percentage point (pp) rise in digital payments (DP) is associated with a 0.10pp rise in subsequent growth of GDP per capita
- This may reflect that DP fuels the expansion of demand, and expanded use of labour and capital
- DP is also tied to a 0.06pp decline in the informal employment share, and a 0.04pp rise in growth of total factor productivity

	Two-year growth rate of GDP per capita, (%)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Digital payments$_{i,t}$	0.0986***	0.0948**	0.110***	0.119***	0.0906**	0.0959**	0.0817**
	(0.0377)	(0.0375)	(0.0368)	(0.0422)	(0.0368)	(0.0374)	(0.0415)
GDP pc$_{i,t}$	-2.672**	-3.002**	-4.575**	-5.643***	-3.199***	-2.689**	-7.457***
	(1.156)	(1.193)	(1.849)	(1.419)	(1.136)	(1.153)	(2.068)
Trade openness$_{i,t}$		0.0210					0.0126
		(0.0130)					(0.0111)
Human capital$_{i,t}$			6.790				2.712
			(4.698)				(5.798)
Average hours$_{i,t}$				0.00231			-0.000134
				(0.00270)			(0.00338)
Inflation$_{i,t}$					-0.425**		-0.559**
					(0.171)		(0.217)
Population$_{i,t}$						-0.00692	-0.00808**
						(0.00437)	(0.00348)
Random effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	196	196	190	117	195	196	116
Countries	101	101	98	59	101	101	59

Standard errors clustered by country; ***/**/* indicates statistical significance at the 1/5/10% level.

Sources: Feenstra et al (2015); IMF; World Bank; authors' calculations.

Source: Aguilar et al (2024).

A vast array of retail payment innovations in the past two decades

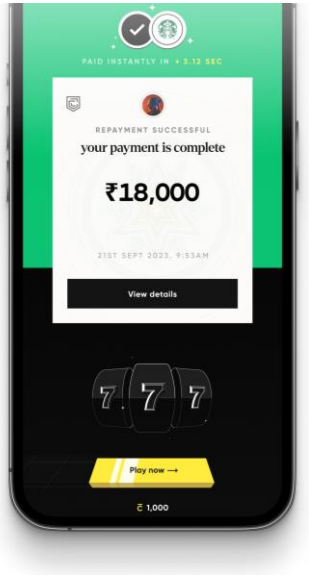


Image sources: Harris and Achora (2018), PaymentsJournal, SumUp, Google Play, CQNEWS

A new class of innovations throws down the gauntlet

Image source: Omni

Bitcoin: A Peer-to-Peer Electronic Cash System

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Abstract. A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of CPU power. As long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they'll generate the longest chain and outpace attackers. The network itself requires minimal structure. Messages are broadcast on a best effort basis, and nodes can leave and rejoin the network at will, accepting the longest proof-of-work chain as proof of what happened while they were gone.

1. Introduction

Commerce on the Internet has come to rely almost exclusively on financial institutions serving as trusted third parties to process electronic payments. While the system works well enough for most transactions, it still suffers from the inherent weaknesses of the trust based model. Completely non-reversible transactions are not really possible, since financial institutions cannot avoid mediating disputes. The cost of mediation increases transaction costs, limiting the

Image source: Bitcoin.org

Is finance becoming decentralised? And what does that mean?

- Distributed ledger technology (DLT) applications aim to provide financial services without using centralised entities – fundamentally different from traditional finance (TradFi)
- Yet in practice, DeFi platforms often have quite centralised decision making, and new forms of concentration. Some refer to a "decentralisation illusion" (Aramonte et al, 2022)

Image source: BIS

“Decentralisation” in practice

Image source: Wikimedia Commons

A “Wild West” of financial innovation?

Image source: The Telegraph

A fair comparison – in more ways than the obvious

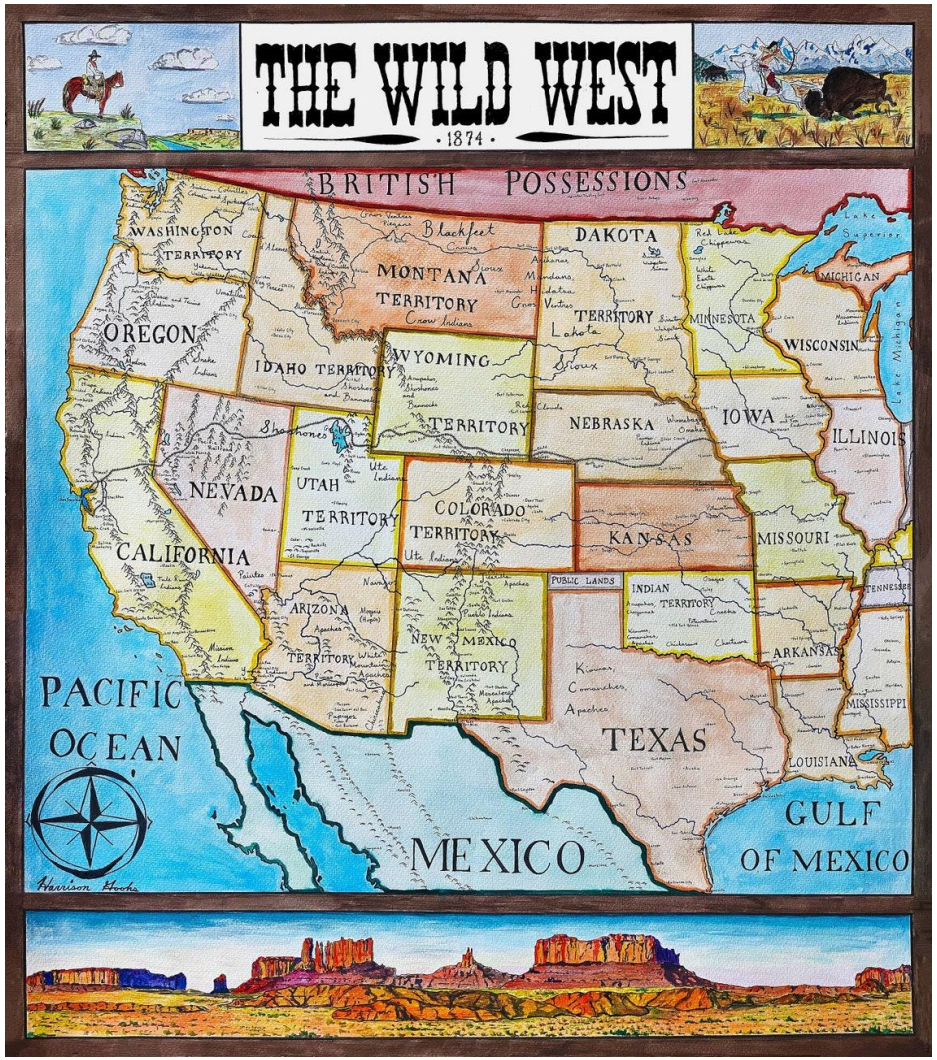


Image source: Etsy

The “real” Wild West was not always lawless, and it was not an empty wilderness

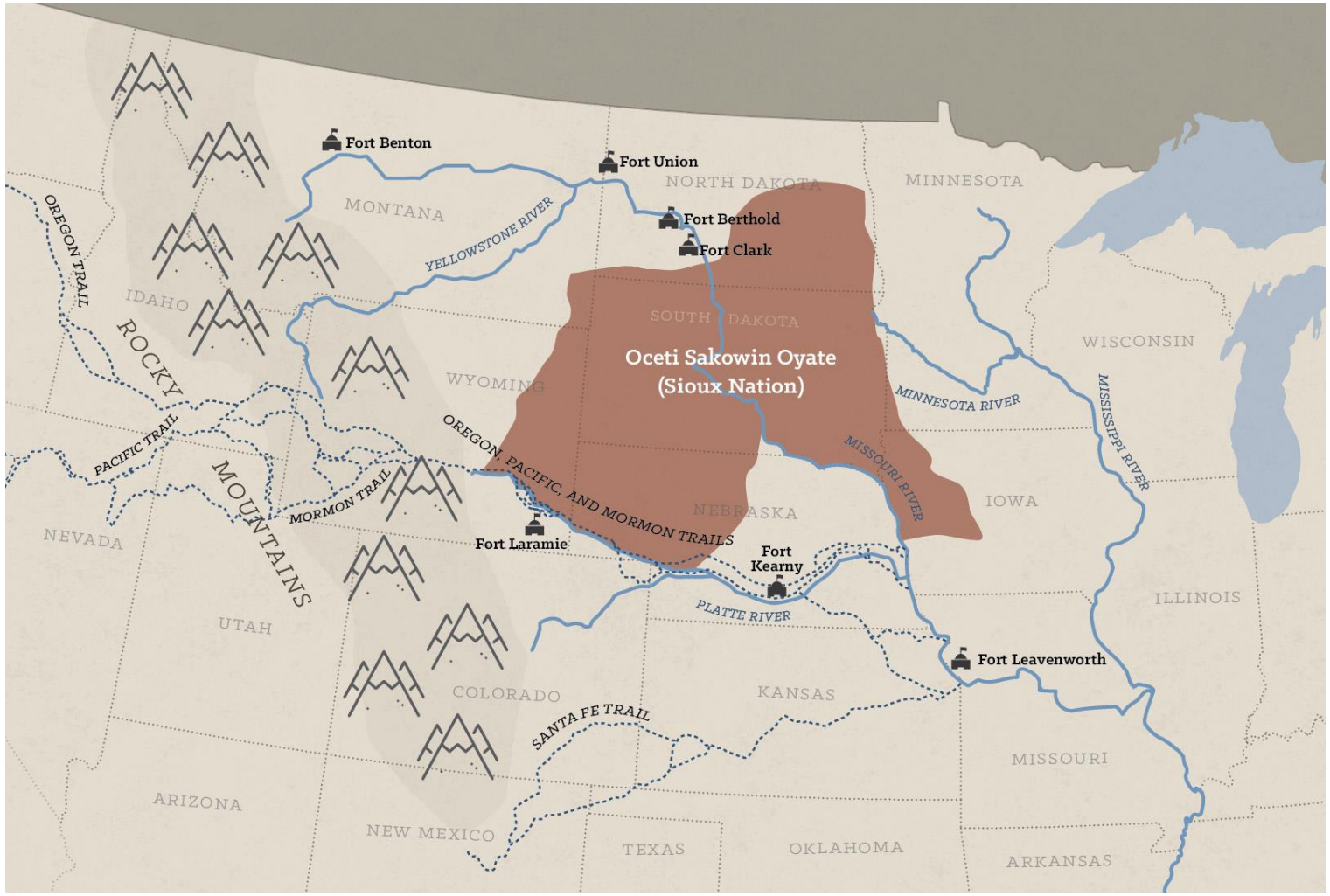


Image source: National Museum of the American Indian

A gold rush resulted in the Great Sioux War of 1876

Image source: Charles Marion Russell, Library of Congress

The frontier was populated by homesteaders – many of them from abroad

Image sources: author's family collection

Gold mining was a hugely important business

Image source: Trip Advisor

...but also a dangerous one

Image source: autor's photograph

A family tragedy underscores the dangers

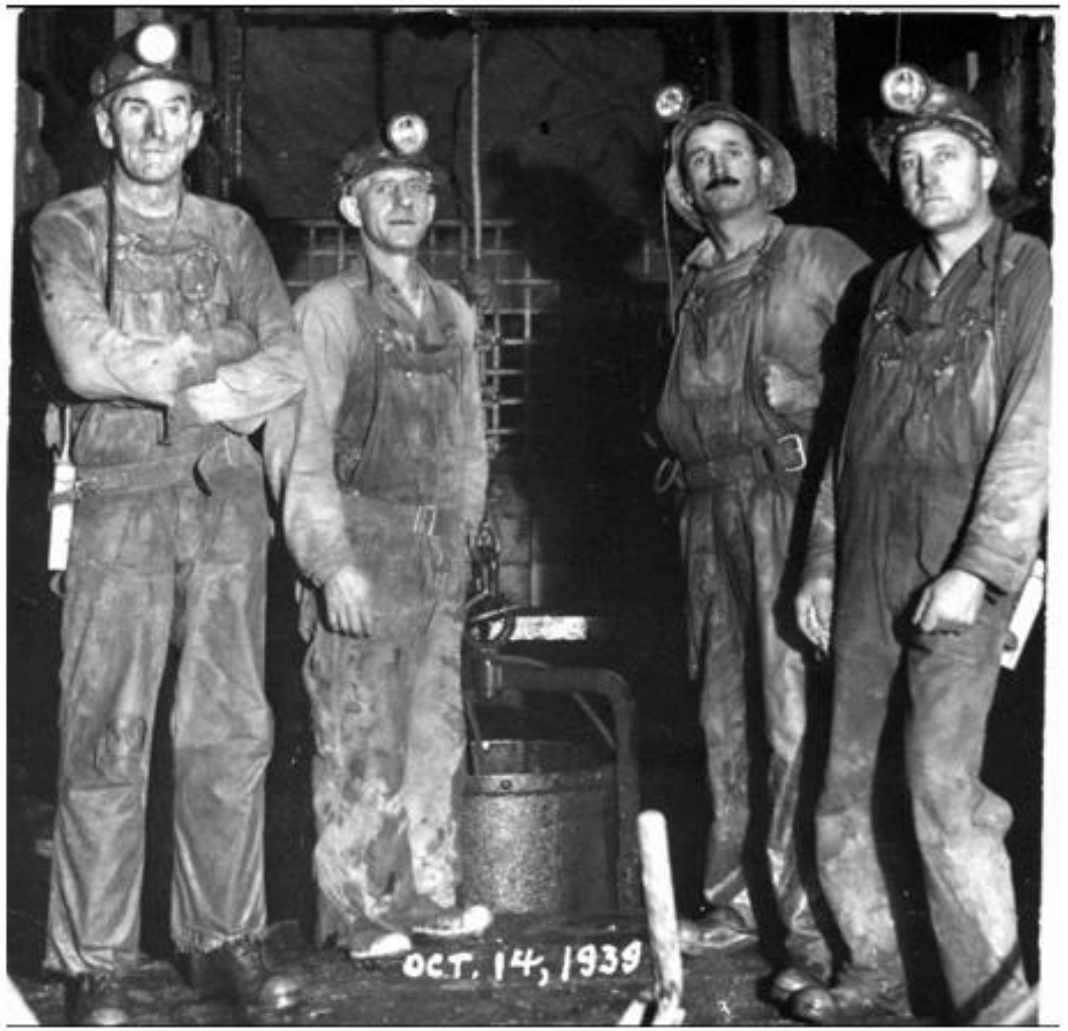


Image source: autor's family collection

But the “taming of the West” shows the constructive role of public institutions

Image source: Sanford Underground Research Facility

Some parallels to the "digital Wild West" – both positive and problematic

- Positive parallels
  - A wave of entrepreneurial talent
  - Grand ambitions to reimagine old rules
  - A streak of self-reliance and non-conformity
- Problematic parallels
  - Lawlessness – including fraud and scams (cf "bunco-steering" vs "rug pulls")
  - Hostility toward public authorities
  - "Boosterism" – overblown claims of promoters
  - Concentration of wealth in the hands of the few

When it comes to boosterism, it’s déjà vu all over again

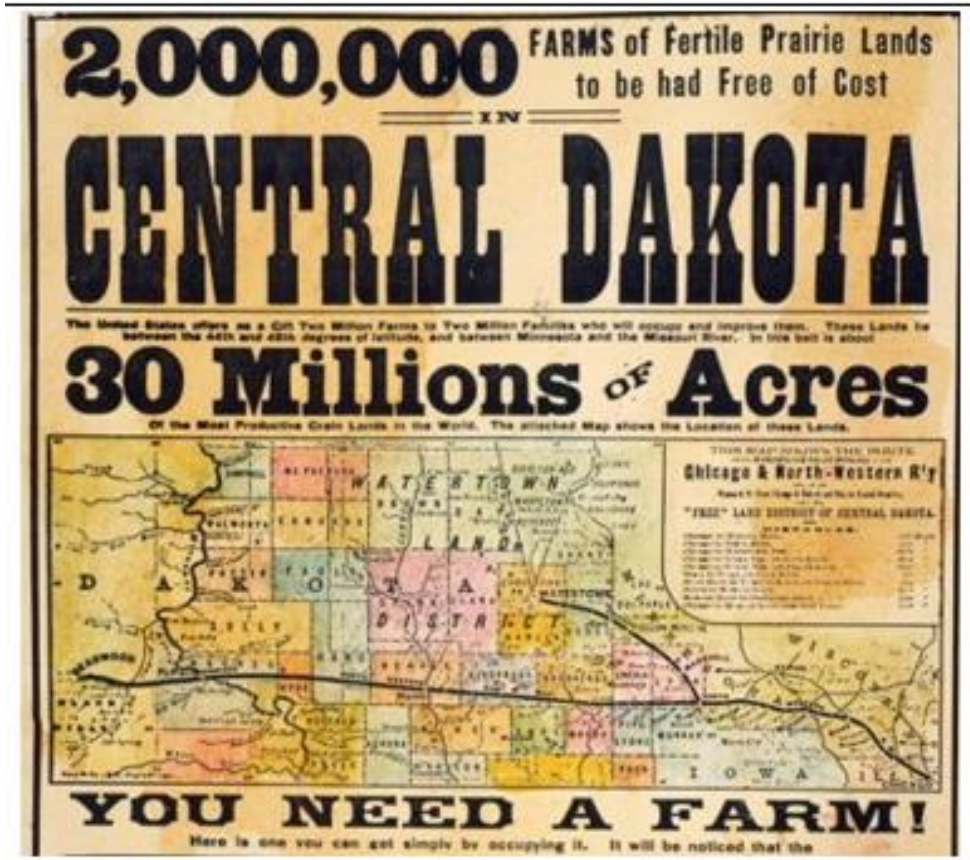


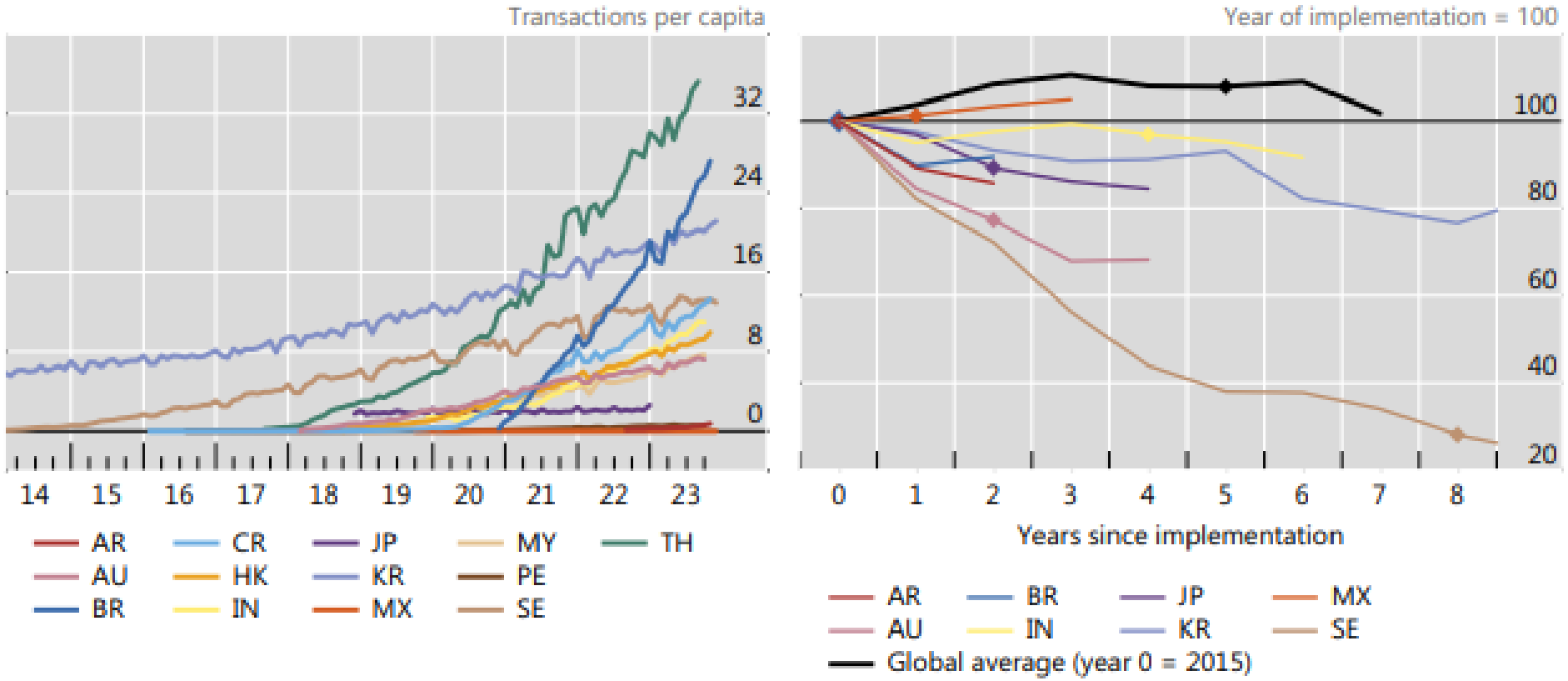
Image source: Amazon; Crypto.com

A more promising way forward: public infrastructures

Image source: OECD

Fast payment systems (FPS) can be particularly powerful

Uptake of FPS (left) has gone hand-in-hand with a reduction in cash in circulation (right)



[1] Monthly data. See technical annex for details. [2] Banknotes and coins in circulation are shown as a percentage of narrow money, except for KR for which currency in circulation/narrow money is shown. The markers indicate the year of the Covid-19 pandemic, 2020, except for KR, which shows only eight years after 2009.

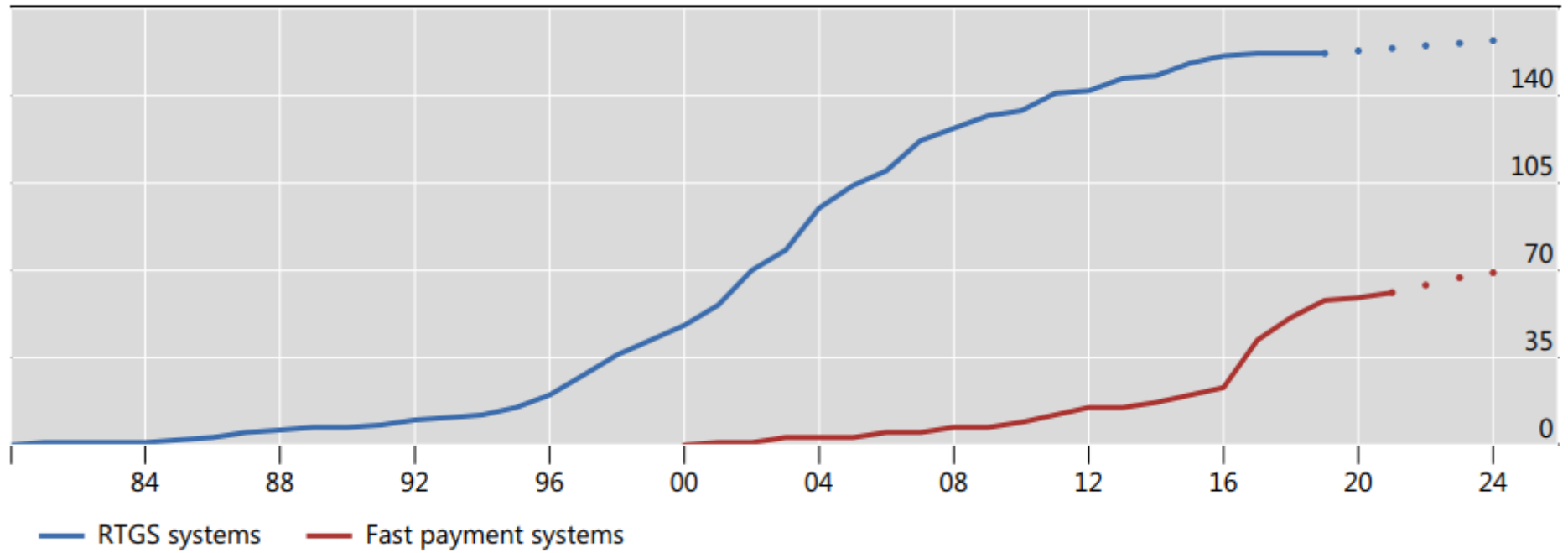
Source: Frost et al (2024).

FPS are taking off, like real-time gross settlement (RTGS) systems in the past

The adoption of RTGS and FPS systems

Number of countries

Graph 1

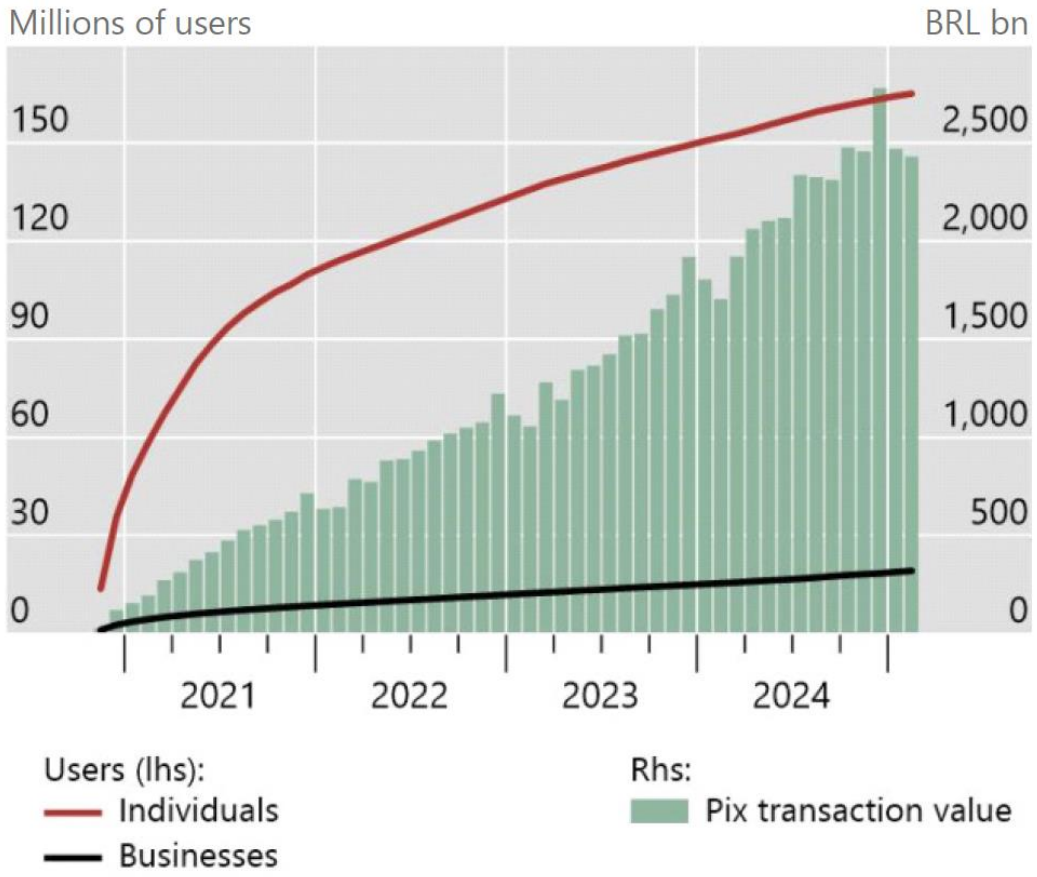


The dotted part of the line corresponds to projected implementation of both RTGS systems and FPS. Note that the number of FPS is lower than the World Bank Global Tracker, given the smaller number of jurisdictions covered.

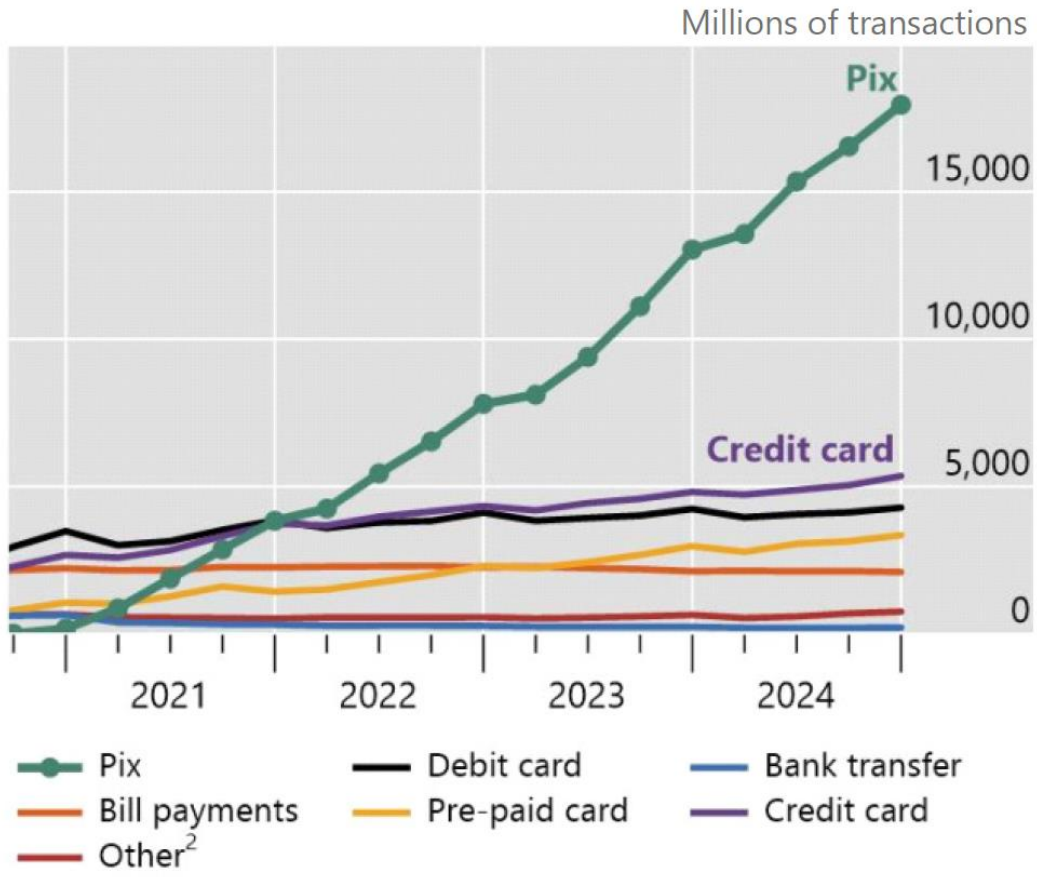
Source: Cornelli et al (2024); CPMI (2021).

In Brazil, Pix has driven a digital payments revolution…

A. Users and transaction value have risen rapidly



B. Pix is gaining market share rapidly in a growing digital payments market[1]

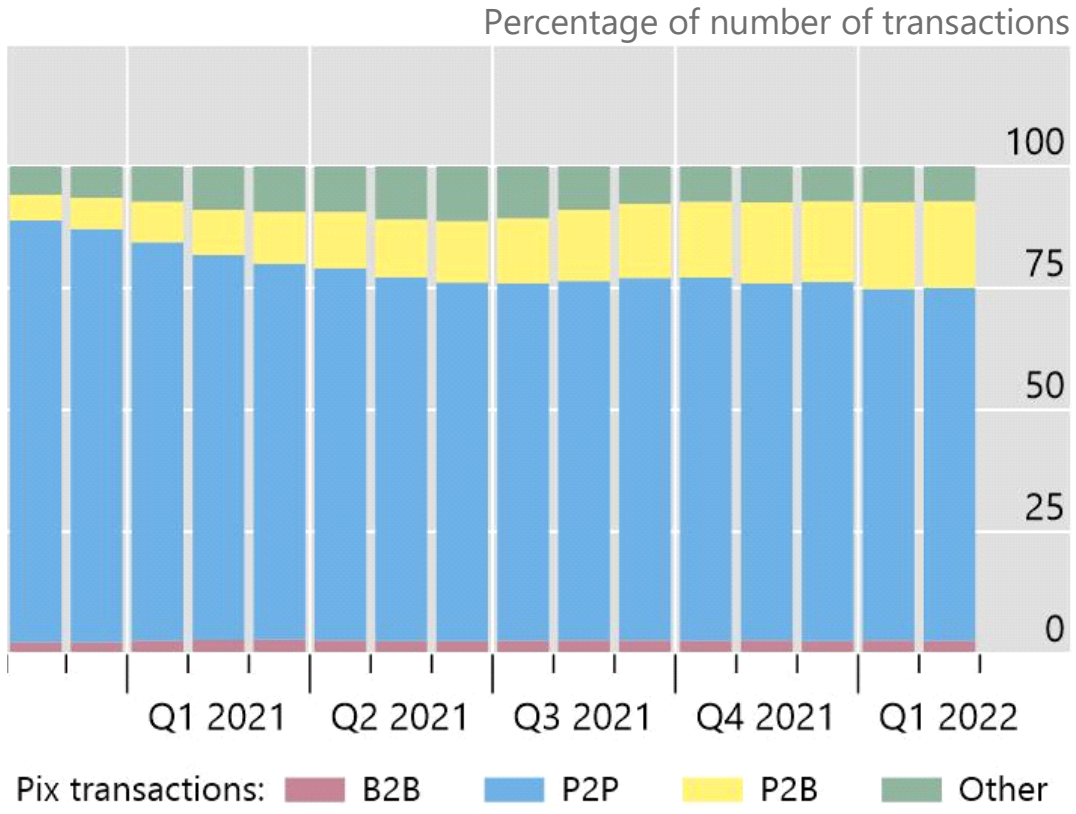


[1] Number of transactions for each payment instrument, excluding recurrent utility payments. [2] Includes cheques.

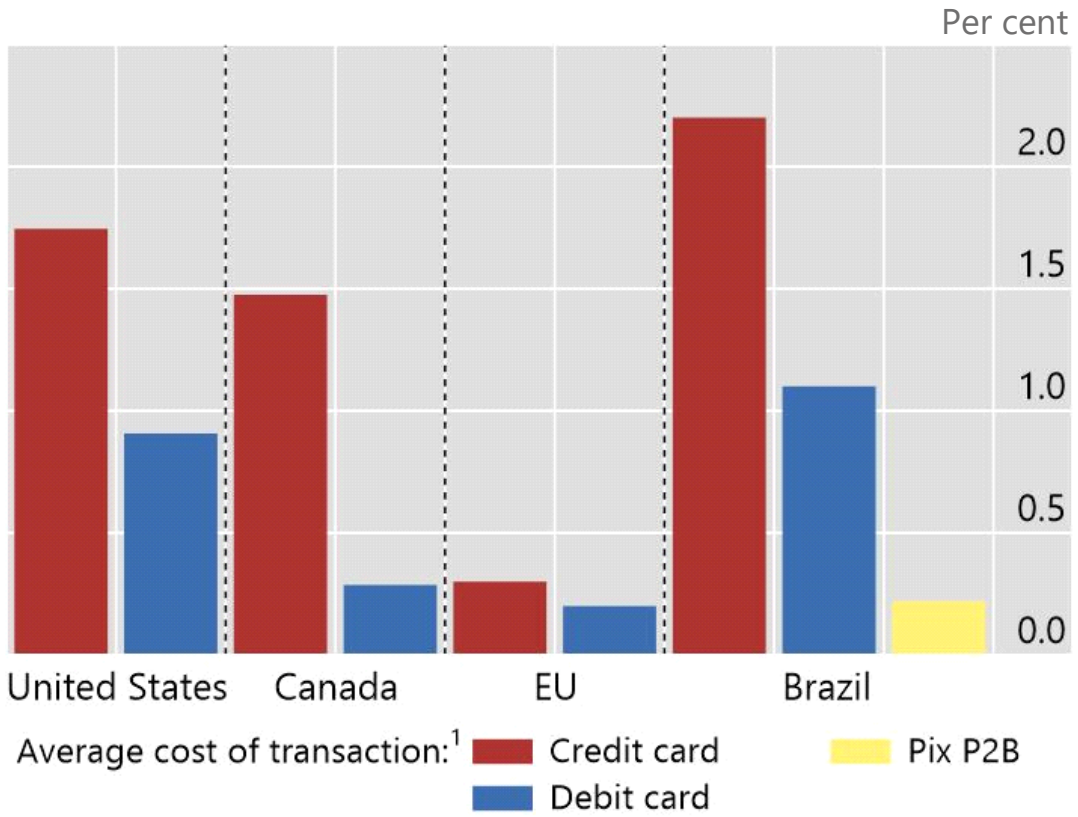
Source: Duarte et al (2022), updated as of August 2025.

…and offers dramatically lower costs for merchants

P2P payments still dominate, but P2B are growing



Average costs to merchants by payment method

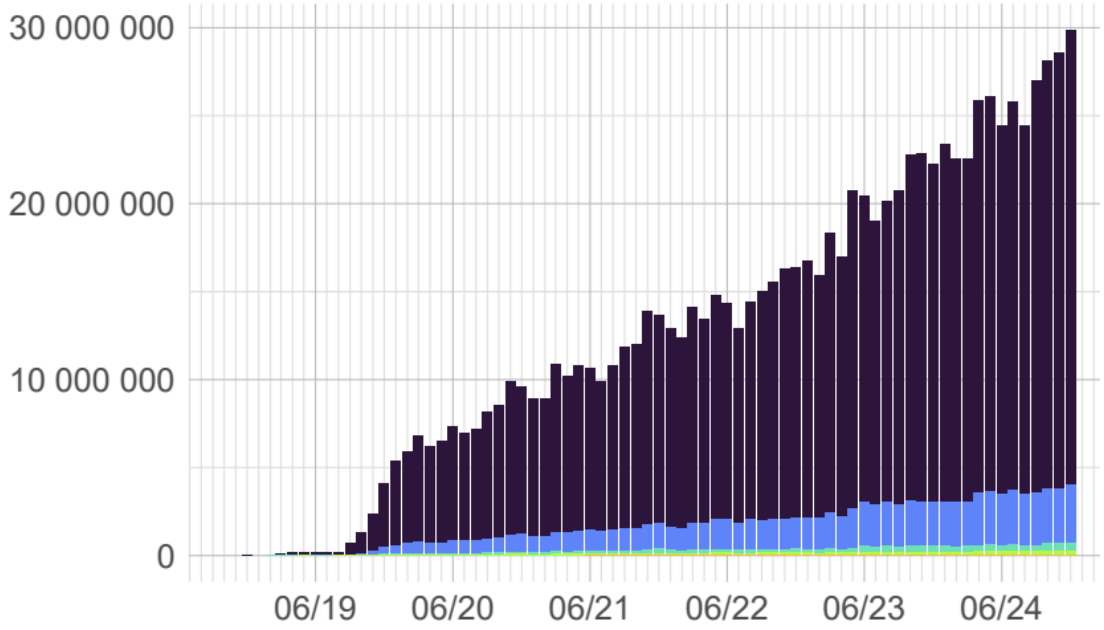


[1] For the United States, Canada and EU, average of interchange fees on credit and debit cards. Total cost to merchants may be higher.

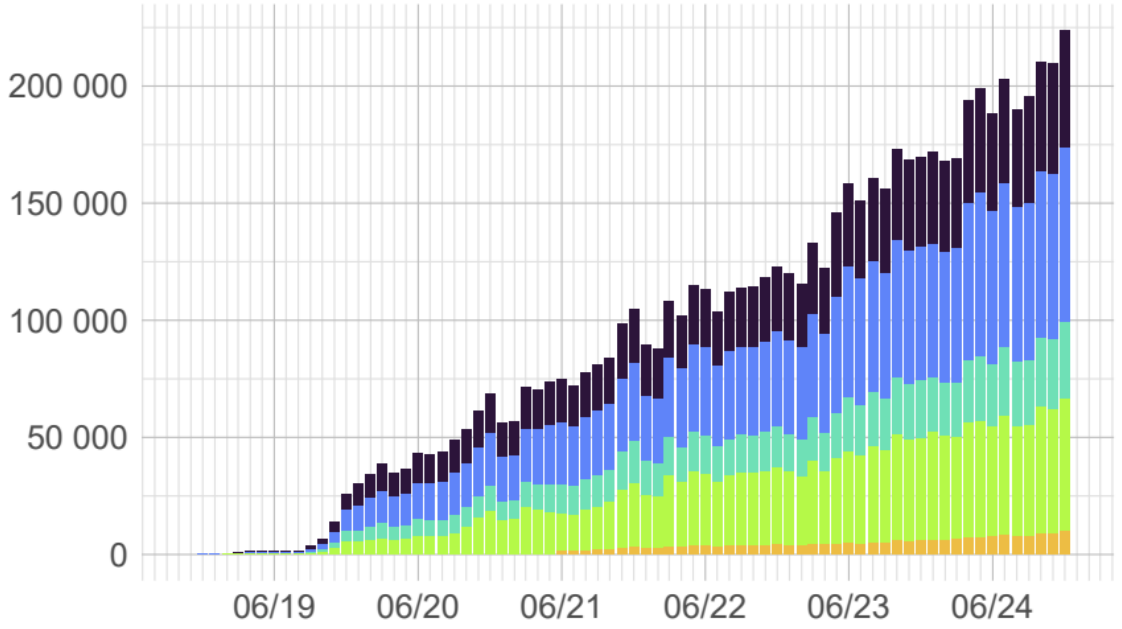
Source: Duarte et al (2022).

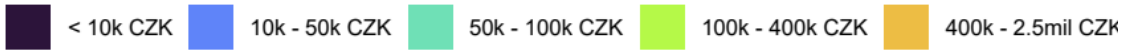
Czech Express Real Time Interbank Gross Settlement (CERTIS) is a further example

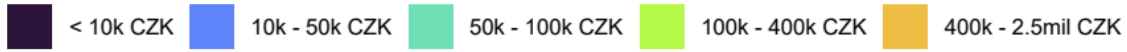
Volume of transactions



Value of transactions (CZK million)







Source: Trubelík et al (2025).

More generally, FPS as a catalyst of digital finance app adoption

Fast payment systems are associated with higher digital finance adoption — Table 2

	Downloads, % population				
	(I)	(II)	(III)	(IV)	(V)
Users, % population	0.1308***	0.1321***	0.1344***	0.1269***	0.1277***
	(0.0034)	(0.0036)	(0.0036)	(0.0045)	(0.0045)
(Users, % population)^2	–0.0244***	–0.0247***	–0.0254***	–0.0235***	–0.0238***
	(0.0010)	(0.0010)	(0.0011)	(0.0013)	(0.0013)
FPS (0/1)		0.0572***	0.0599***	0.0670***	0.0717***
		(0.0169)	(0.0168)	(0.0170)	(0.0171)
Ln(GDP per capita)		0.0000	0.0018	–0.0411***	–0.0442***
		(0.0068)	(0.0071)	(0.0149)	(0.0154)
FPS * ln(GDP per capita)		–0.0055***	–0.0058***	–0.0065***	–0.0069***
		(0.0017)	(0.0017)	(0.0017)	(0.0017)

Source: Cornelli et al (2024).

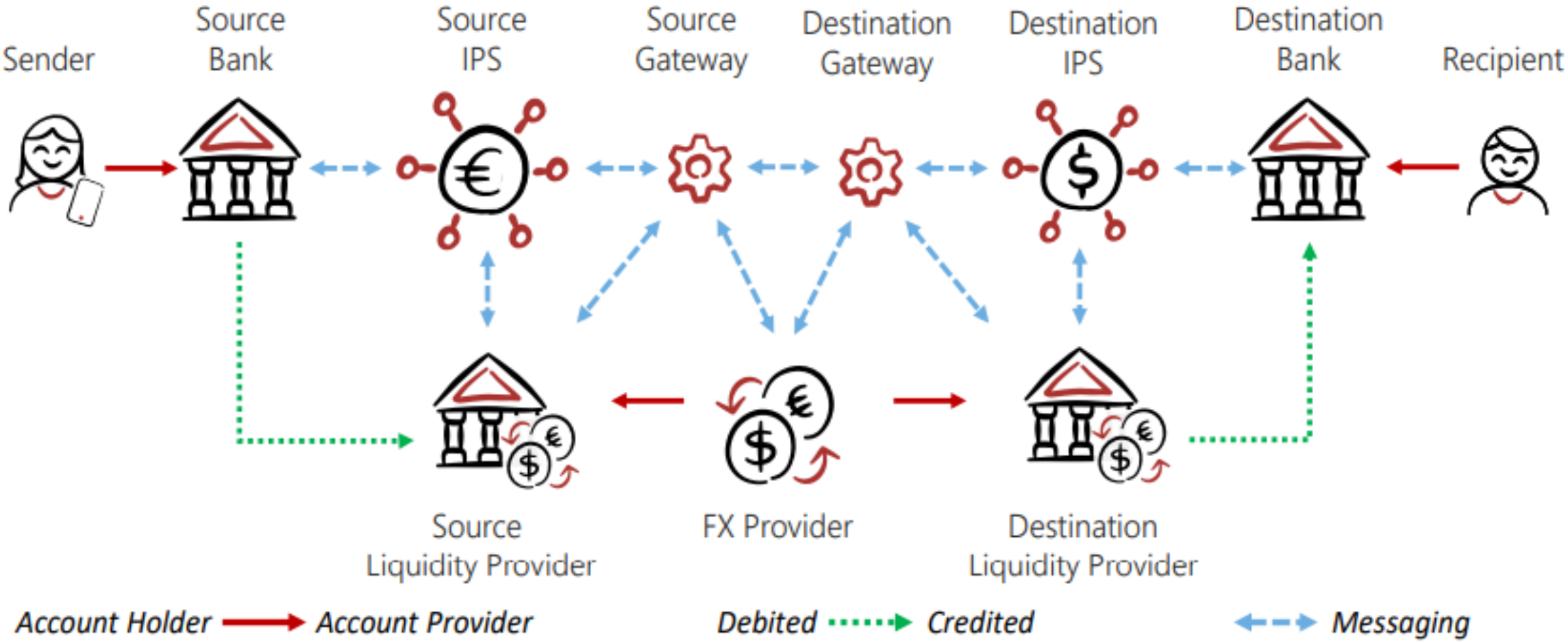
FPS that are operated by the central bank show higher uptake

FPS additional features, CPMI countries — Table 7

	Downloads, % population				
	(I)	(II)	(III)	(IV)	(V)
Users, % population	0.0854***	0.0854***	0.0854***	0.0875***	0.0765***
	(0.008645)	(0.008645)	(0.008645)	(0.001362)	(0.009390)
(Users, % population)^2	–0.0122***	–0.0122***	–0.0122***	–0.0128***	–0.0099***
	(0.002354)	(0.002354)	(0.002354)	(0.000371)	(0.002543)
FPS, managed by central bank	0.0148*	0.0148*	0.0414**		
	(0.008851)	(0.008851)	(0.017708)		
FPS, active central bank involvement				0.0159***	0.0299***
				(0.001995)	(0.011268)
FPS, intermediate central bank involvement				0.0004	0.0137
				(0.001771)	(0.009405)
FPS, open membership		0.0216*	0.0393***		0.0416***
		(0.011684)	(0.010946)		(0.011026)
FPS, real-time settlement			0.0472***		0.0368**
			(0.013538)		(0.014596)

Source: Cornelli et al (2024).

Linking FPS, as in Project Nexus, holds great promise for cross-border payments



Source: BIS Innovation Hub.

Concluding remarks

- Innovation in payments is of all times, but the recent acceleration is striking
- Digital payments can bring macroeconomic dividends, through greater growth and formality
- Crypto, DeFi and stablecoins have brought welcome competition, but many risks – and, despite the claims of decentralisation, a whole new class of intermediaries
- Historical experience underscores the constructive role of public institutions
- Public infrastructures, like fast payment systems (FPS), can form a foundation for a thriving and competitive digital payments market
- They work: as seen with evidence from FPS around the world
- Central banks can and should be catalysts for the digital payments revolution

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