



FINTECH

NOTES

The Rise and Impact of Fintech in Latin America

Bas B. Bakker, Beatriz Garcia-Nunes, Weicheng Lian, Yang Liu,
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Abstract	In the past decade, fintech has shaken up the financial sector in Latin America providing innovations in lending, payments, insurance, and regulation and compliance. This paper examines this development by focusing on both fintech services and regulation. Exploring fintech's macro-critical impact using country- and bank-level data, we find that booming financial technologies in Latin America have helped boost competition in the banking sector and inclusion. Additionally, we demonstrate that fintech firms in Latin America experienced robust growth even during the pandemic supported by external funding. Finally, we discuss how regulators are addressing the risks associated with financial technologies and how they are leveraging fintech tools in their supervisory activities.

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Glossary

- **Alternative finance** consists of financial channels and instruments that have emerged outside of the traditional finance system such as regulated banks and capital markets.¹
- **Alternative lending** is a form of alternative financing.² Fintech lending, or online lending, refers to newer forms of nonbank lending that bypass traditional intermediaries and are made possible due to technological innovation. Online lending has become a popular financing option for small businesses compared with obtaining a loan from a bank.
- **Artificial intelligence (AI)** is the application of computational tools to address tasks traditionally requiring human sophistication.³
- **Digital banks** include neobanks (see below) and challenger banks (fintech startups that have banking licenses).
- **Digital payments** use technology (computer, smartphone, or a card) to substitute/avoid the use of cash. They are executed through digital or online modes to transfer payments between parties—individuals or businesses.⁴ For example, a payment on a website for an online transaction is a digital payment, as is a payment of a utility bill through a bank account.
- **Fintech** refers to the use of technology to deliver financial services and products. It encompasses a wide range of innovations and business models that aim to improve and automate financial processes, such as payments, money transfers, investments, insurance, and lending. Fintech companies leverage technology to create more efficient, convenient, and accessible financial services, often challenging traditional financial institutions.
- **Fintech vertical** refers to a specific area or segment within the broader financial technology (fintech) industry.
- **Insurtech**⁵ brings technological innovations to the traditional insurance industry. It may involve offering tailor-made policies, smart contracts, and use of alternative data to judge insurability and solvency; it may also apply dynamic pricing for the potential clients as well as management techniques using technological advances.
- **Innovation hub** is a dedicated space inside the regulator’s office that promotes an open and informal dialogue between innovator companies and the regulator. It enables regulators to understand and monitor new business models and technologies and to identify regulatory and supervisory challenges associated with fintech risks and opportunities.

¹ Cantú and Ulloa (2020), p. 32.

² “What Is Alternative Lending?” (2020).

³ Financial Stability Board (2017), p. 3.

⁴ Khaitan and Joshi (2022).

⁵ According to Hargrave (2022). See also Catlin and others (2017).

- **Machine learning** (ML) is a subcategory of AI, a method of designing a sequence of actions to solve a problem, which optimize automatically through experience and with limited or no human intervention.⁶
- **Neobanks** are banks that rely exclusively on digital technologies to deliver services. Neobanks exist only in the online space—they forsake physical presence, such as branches or ATMs. This lack of physical location helps minimize costs of operations. They might offer fewer services than traditional banks and might in fact not be licensed to operate as banks—that is, to accept deposits, benefit from the deposit insurance schemes, or be regulated on the same level as licensed banks.
- **Regulatory sandboxes** aim at encouraging fintech experimentation by enabling the testing of new products, services, and platforms in a production environment through the application of appropriate safeguards. Typically, sandboxes involve some elements of temporary regulatory forbearance or alleviation from full regulatory requirements to participating firms.
- **Regtech** is the use of innovative technology (big data or artificial intelligence) by institutions to meet their regulatory requirements.
- **Suptech** is the use of innovative technology (big data or artificial intelligence) by financial authorities to support their work in providing market oversight, conduct supervision and prudential supervision. Suptech tools can be used by financial authorities in the whole range of activities—from data collection, including data management, to data analytics.

⁶ Financial Stability Board (2017), p. 4.

Introduction and Executive Summary

In the past decade, fintech⁷ has shaken up the financial sector in Latin America. Digital payment systems have grown rapidly, digital banks have grown large, and alternative finance and insurtech have started to blossom. In 2021 there were more than 300 million users of digital payments and more than 30 million users of digital banks, mostly concentrated in Brazil and Mexico. One of the largest digital banks in the world is in Brazil. Alternative finance and insurtech are not as big yet but are growing rapidly.

Fintech is innovation. Financial transactions that took days now can be completed instantaneously on Mexico's CoDi, Costa Rica's SINPE Móvil or Brazil's Pix payment systems. Bank services such as opening an account or getting a loan that were previously available only at a bank's brick-and-mortar branches can now be done online at digital banks. Digital wallets (financial transaction applications that run on mobile devices) are nearly as ubiquitous as cellphones.

Fintech is boosting competition. The proliferation of new financial technology and digital banks is associated with a reduction in lending spreads. This is important as lending spreads have traditionally been high in Latin America. But fintech companies do not just compete with banks and insurance companies; they also provide banks and insurance companies with new technologies and services. Indeed, the line between traditional financial companies and fintech companies has already begun to blur.

Fintech has increased inclusion. About three-quarters of digital banks' customers are previously unbanked and underbanked consumers and small and medium enterprises (SMEs). A higher level of fintech adoption is associated with lower income inequality. Alternative finance has boosted access to finance for micro, small, and medium enterprises—sectors that have been underserved by the traditional banking system.

Fintech helped the region weather the COVID-19 shock. While lending by traditional banks slowed significantly in 2020–21, fintech lending, digital payments, and digital banks' transactions continued their strong growth. The use of mobile technologies helped people and companies maintain operations despite mobility restrictions. Given this advantage, investors significantly increased funding for fintech companies during the pandemic to finance fintech expansion.

Fintech also brings risks such as these:

- Financial stability risks. Fintech companies may not be fully equipped to handle market volatility, which could result in losses for their customers. Technology that facilitates instantaneous bank transfers and withdrawals may also boost the speed of bank runs. Fintech companies often collaborate and share information with other financial institutions, which could spread the impact of any failure or disruption. If they operate on a large scale, their failure could result in a widespread disruption to the financial system.
- Financial integrity risks. Fintech platforms could facilitate cross-border fraud, theft, and money laundering.

⁷ This paper focuses on digital payment systems, digital banks, alternative finance, bigtech, insurtech, and regulatory innovations that help unlock fintech potential while controlling risks such as supotech, sandboxes, and open banking. For discussions on the developments in digital currencies in Latin America, see Appendino and others (2023).

- Regulatory risks. Because fintech is a relatively new industry, there may be regulatory gaps or inconsistencies that could negatively affect its stability.
- Market integrity risk. These risks emerge from companies such as bigtechs located in other jurisdictions and with core businesses in nonfinancial sectors (for example, e-commerce).
- Cybersecurity risk. Fintech companies are vulnerable to cyberattacks, which could result in significant financial losses and damage to their reputation.
- Data privacy risk. Fintech companies often handle sensitive financial and personal information, making them a prime target for cybercriminals.

Fintech also provides tools to help manage these risks. Financial authorities and their supervisees increasingly use technology (regtech and suptech) to manage regulatory compliance and collect and process data.

Policymakers are supporting fintech development. Many countries are using innovation hubs and regulatory sandboxes to test new solutions before their operationalization. Open banking and open finance may further boost innovation but should be matched with a developing regulatory environment—so far only Brazil and Mexico have it in place.

This paper is guided by the Bali Fintech Agenda,⁸ a set of 12 policy elements aimed at helping IMF member countries to harness the benefits and opportunities of rapid advances in financial technology that are transforming the provision of financial services while managing the inherent risks.⁹

⁸ IMF (2018).

⁹ This paper explores developments in financial technology in Latin America regarding the following BFA principles: (1) embrace the promise of fintech; (2) enable new technologies to enhance financial service provision; (3) reinforce competition and commitment to open, free, and contestable markets; (4) foster fintech to promote financial inclusion and develop financial markets; (5) monitor developments closely and deepen understanding of evolving financial systems; (6) adapt regulatory framework and supervisory practices for orderly development and stability of the financial system; (7) modernize legal frameworks to provide an enabling legal landscape; (8) ensure the stability of domestic monetary and financial systems.

I. Fintech Verticals: Trends and Funding

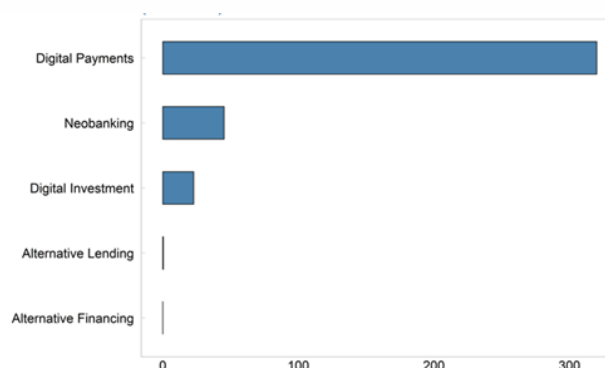
Fintech penetration in Latin America and the Caribbean (LAC) varies across sectors. In terms of users and transaction volumes, digital payments and digital banking are the largest fintech subsectors in LAC. Two other important fintech verticals¹⁰, insurtech and alternative finance, although still relatively small in terms of users or capitalization, are growing fast and create important innovations. The wider use of data technologies allows insurtech companies to improve risk assessment and create new targeted insurance products, potentially boosting insurance penetration in the region. Alternative finance platforms provide new solutions to limited access to finance, as they allow clients to bypass intermediaries and directly lend to a company or a person or invest in unlisted companies.

Since the last stock-taking exercise that used data ending in 2017,¹¹ the Latin American fintech sectors have all grown exponentially.¹²

- Digital payments grew from \$89 billion in 2017 to \$215 billion in 2021¹³ (see next section) and the number of users of digital payment services exceeded 300 million in 2021 (Figure 1).
- The transaction volume of fully online digital banks in LA6¹⁴ grew from \$17 billion in 2017 to \$123 billion in 2021.¹⁵ Digital banks had more than 30 million users in 2021, mostly concentrated in Brazil and Mexico.
- Alternative finance lending, financial modes that emerged outside the traditional financial system, expanded from \$0.7 billion in 2017 to \$6 billion in 2020.

Providing customized insurance policies, insurtech's penetration increased and the number of insurtech companies operating in Latin America reached 352 in 2021.¹⁶

Figure 1. LAC: Number of Fintech Users by Segment, 2021 (In millions)



Source: Statista (2022).

Note: LAC countries include Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.

¹⁰ Within the fintech framework are many areas, also called verticals, including digital payments, alternative financing, insurtech, and digital banks.

¹¹ Berkmen and others (2019).

¹² The IMF Financial Access Survey (2022) also documents rapid progress in terms of access to and use of financial services in the region, including in the use of mobile money and electronic forms of payment.

¹³ Statista (2022) for all countries in Latin America and Caribbean (LAC) for which data are available.

¹⁴ LA6: Argentina, Brazil, Chile, Colombia, Mexico, Peru.

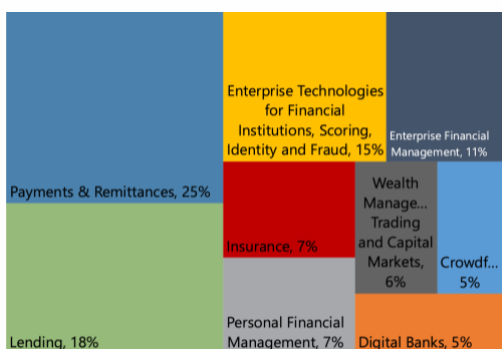
¹⁵ Statista (2022); digital banks' transactions include all transactions: transfers, payment, loans, deposits, and so on.

¹⁶ Digital Insurance Latam (2021).

In 2021, a quarter of fintech startups in the region focused on digital payments and remittances, followed by about a fifth focusing on alternative financing (lending) platforms, and about a sixth providing services related to enterprise technologies for financial institutions including scoring, identity services, and fraud detection (Figure 2). The share of digital banks among startups is now relatively small, as several digital banks have become very big. In terms of assets, digital banks have seen the fastest growth among fintech startups between 2017 and 2021.

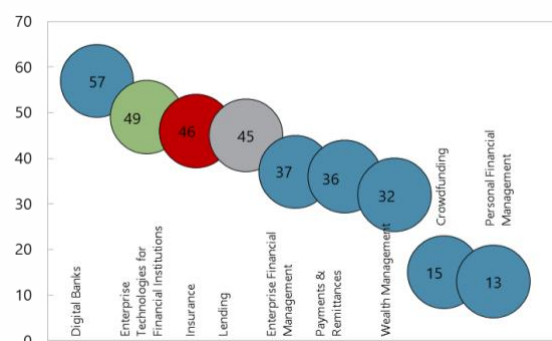
Figure 2. Fintech Startups

1. Fintech Startups by Sector, 2021



Source: IDB (2022).

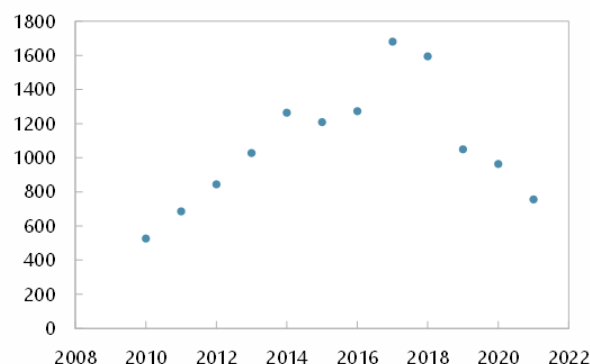
2. Fintech Startups' Average Annual Growth, 2017–21 (Percent)



Business-to-business (B2B) fintech startups providing technological solutions to existing financial institutions on average grew annually by almost 50 percent between 2017 and 2021 (Figure 2, panel 2). About half of their revenue comes from digital banks. Digital infrastructure solutions and smart contracts generate 20 and 10 percent of their revenue, respectively. The rest comes from data processing, Know Your Customer (KYC) services, and chatbots.¹⁷

The overall number of fintech startups in LAC, however, peaked in 2017 and has since been declining. This trend likely reflects the increased maturity of the sector and implies that activities are getting concentrated among fintech incumbents (Figure 3).

Figure 3. Fintech Firms Founded in a Given Year (Number of firms)



Source: Crunchbase and IMF staff calculations.

¹⁷ IDB (2022), p. 35.

Main Fintech Verticals

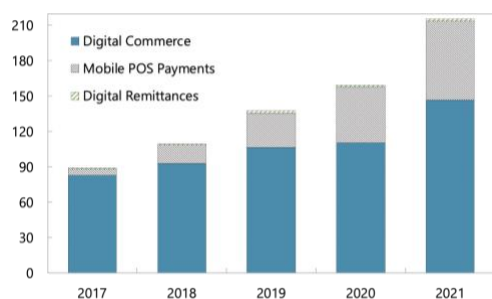
Digital Payments

Digital payments include any transaction where money transfers from one account to another electronically.¹⁸ They include the following:

- Purchases paid for through mobile wallets (cell phones and smartwatches)
- Money transfers through mobile payment service apps and QR codes (such as PayPal, Venmo, Zelle)
- Online-based purchases (such as browsers or apps)
- Crypto payments

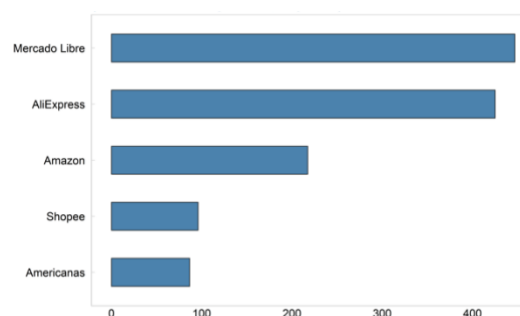
Figure 4. Digital Payments

1. LAC: Transaction Value by Segment (In billions of USD)

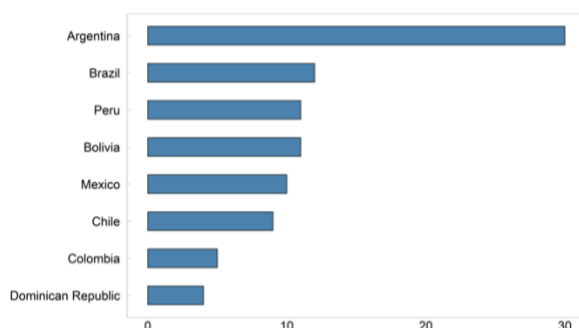


2. Leading Online Marketplaces in Latin America

(In millions of monthly visitors, July 2022)



3. Share of E-Commerce Spending Made through Digital Wallets, 2021 (Percent)



Source: Statista (2022).

¹⁸ Blakely-Gray (2021).

Digital payments are mostly used for digital commerce (online-based purchases) and mobile point-of-sale-payments¹⁹ (Figure 4). Cross-border digital remittances are growing fast but are still relatively small.

The pandemic triggered rapid growth in digital payments—transactions increased by 50 percent between 2019 and 2021. By July 2022, leading online marketplace Mercado Libre registered more than 400 million monthly visitors. More than 10 percent of e-commerce spending is made using digital wallets.²⁰ The combination of increased cell phone and internet usage and expensive and not-widespread traditional payment systems set the stage for a boom in digital payments. The launch by the central banks of low-value (or retail) payment systems in Brazil (Pix), Mexico (CoDi), and Costa Rica (SINPE Móvil) improved access to retail payments:

- Pix²¹ is the payment scheme created and regulated by the Central Bank of Brazil. It started operating in 2020 and, as of December 2022, had about 145 million users and 2,890 million transactions per month, mostly (66 percent) peer-to-peer payments. Transactions take place 24/7 in contrast to previously available payment systems in Brazil. The average cost to merchants is about 0.2 percent vis-à-vis credit card fees of 2.2 percent (Duarte and others, 2022). A person or a company can make a payment by using their regular accounts at one of the nearly 800 payment service providers that participates in Pix (banks and nonbanks). Technology companies account for about 10 percent of companies that provide financial services through Pix.²²
- The CoDi²³ platform, Mexico's central bank electronic payment platform, uses QR codes and near-field communication technology (NFC) enabling communication between devices when they are next to each other. CoDi was launched in 2019 and by 2022 had 12 million accounts. Only licensed financial institutions can access the system. To use CoDi, users must have an account with a participating institution and a mobile device with CoDi application capable of reading QR codes. The payments are processed instantly, any time, without fees.
- Costa Rica's immediate payment system SINPE Móvil has existed since late 2015 and requires a mobile phone number and an open account at one of financial entities that support this service. In 2022, SINPE Móvil had about 3.4 million active users vis-à-vis Costa Rica's population of slightly more than 5 million people.

¹⁹ A point-of-sale system is a computerized system used to manage transactions in a retail or hospitality environment.

²⁰ A digital wallet (or electronic wallet) is a financial transaction application that runs on mobile devices. It securely stores your payment information and passwords. These applications allow you to pay when shopping using your device so you don't need to carry your cards. You enter and store your credit card, debit card, or bank account information and can then use your device to pay for purchases. See Kagan (2022).

²¹ "Pix Frequently Asked Questions" (2020).

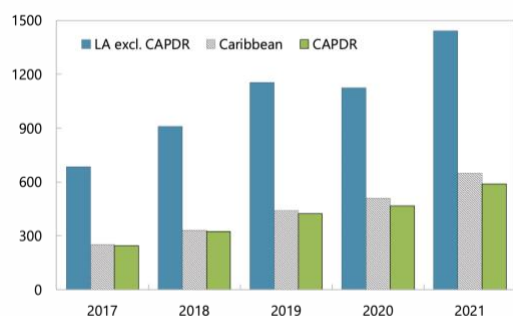
²² IDB (2022) reports that nearly 800 companies, including 75 fintechs, provide services through Pix.

²³ "CoDi es para todos" (n.d.).

Figure 5. Digital Remittances in the Caribbean and Central America

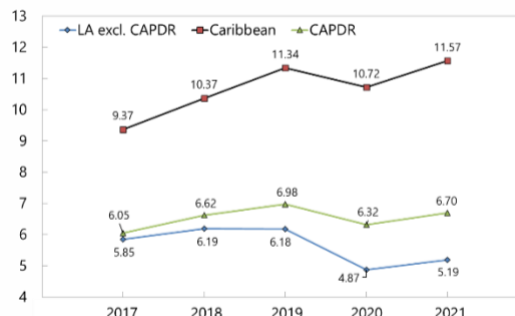
1. Transaction Value

(In millions of dollars)



2. Average Transaction Value per User

(In thousands of dollars)



Source: Statista (2022).

Digital remittances grew almost threefold in the Caribbean and Central America and twofold in South America despite a fall in the average transaction value between 2017 and 2021 (Figure 5). Due to convenience and despite a limited impact on fees (Bersch and others, 2021), digital remittances are becoming more popular in the Caribbean and Central America. Most digital remittances are sent using e-money or existing infrastructure. The use of blockchain infrastructure and crypto assets to send remittances is limited—see Carare and others (2022) for more information.

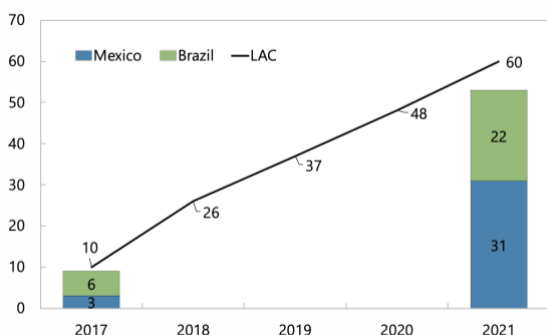
Digital Banks

A digital bank operates online, has no physical presence, and provides services that were previously available only at a bank branch. For example, a client can open an account or obtain a loan online.

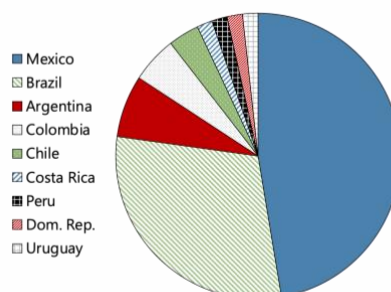
Digital banking has expanded rapidly. There are now 60 digital banks in the region (up from 10 in 2017), 55 of which are in Mexico and Brazil (Figure 6). About three-quarters of digital banks’ customers are unbanked and underbanked consumers and SMEs (Figure 6, panel 4).

Figure 6. Digital Banks in LAC

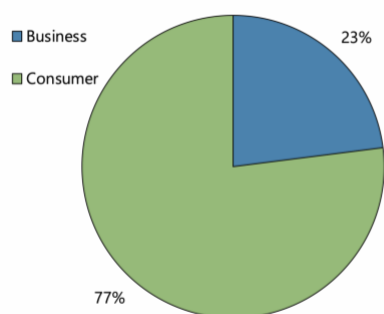
1. LAC: Number of Digital Banks



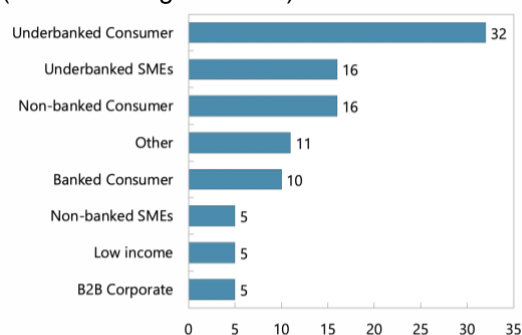
2. LAC: Country Share of Digital Banks, 2020



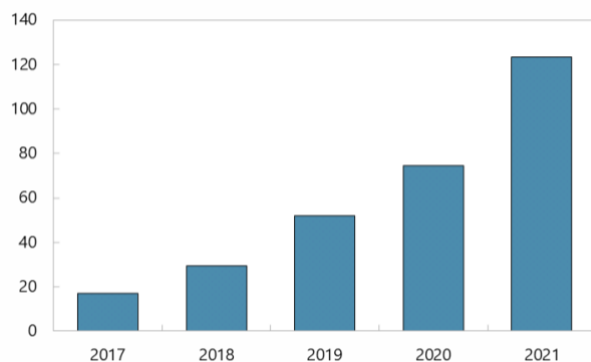
3. LAC: Orientation of Digital Banks (Percent)



4. LAC: Markets Served by Digital Banks (Percent of digital banks)



5. LA6: Digital Bank Transaction Value (In billions of dollars)



Sources: IDB (2022); and Statista (2022).

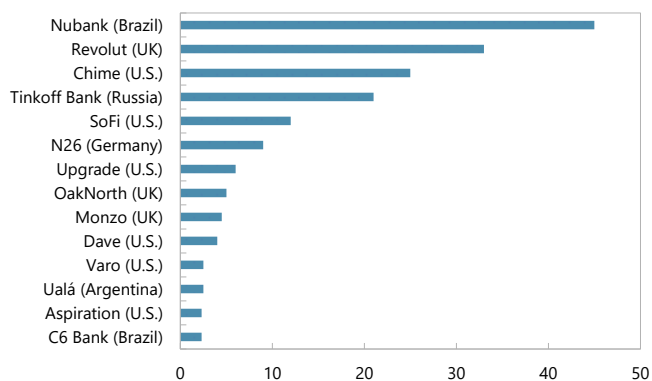
Note: LAC countries include Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.

While the rapid expansion of digital banks has improved financial inclusion, it may also have increased stability risks. The loan portfolios of digital banks increased rapidly when global interest rates were low, and it remains to be seen how credit quality will hold up now that global interest rates have increased. It is also not yet clear how vulnerable digital banks would be to liquidity shocks in an environment of increased market volatility. New digital banks and traditional banks that have employed technology that facilitates instantaneous bank transfers and withdrawals may be at higher risk of faster bank runs.

One of the largest digital banks in the world—Nubank—is in Brazil (Figure 7). Nubank was established in 2013 and now serves 70 million customers in Brazil, Mexico, and Colombia, including more than 5 million first-time credit card or bank account owners and 2 million small businesses. Nubank completed an IPO in December 2021 valued at \$41 billion in addition to raising \$3.9 billion since its inception. However, in terms of total assets, Nubank is still small relative to the largest banks of Brazil. Its total assets were at about \$19.8 billion in 2021 vis-à-vis the largest bank's total assets of \$389 billion.

Neon is another large digital bank in Brazil that was founded in 2016 to offer digital accounts and a virtual credit card. Between 2017 and 2021 its client base increased 50-fold to 10 million. Neon processes about \$1.1 billion transactions a month.

**Figure 7. Most Valued Independent Digital Banks, 2021
(In billions of USD)**



Source: Statista.

Alternative Finance by Fintech

Though still small compared with traditional banks, the alternative finance industry is developing rapidly. This industry comprises (1) debt-based platforms, such as peer-to-peer lending platforms; (2) equity-based platforms that allow investment in unlisted shares; and (3) reward-based or donation-based crowdfunding.²⁴

Between 2017 and 2020, the *volume* of alternative finance in Latin America and the Caribbean has expanded ninefold to about \$6 billion. The number of alternative finance providers more than quadrupled between 2017 and 2022 (Figures 8 and 9). Lending platforms accounted for most of this growth, while capital-raising platforms remained small (Table 1). Brazil is a clear leader in alternative finance accounting for about two-thirds of the volume followed by Chile and Mexico.²⁵

²⁴ See alternative finance taxonomy in Ziegler and others (2022); Digital Vertical identifies a segment of the fintech market.

²⁵ This ranking is reflected in the proprietary fintech league tables, which rank (as of 2022) Brazil 14 of 83 countries rated, Uruguay 17, Mexico 32, Peru 62, and the only Caribbean country present is Belize at 67. The ranking includes

Table 1. Capital Provided by Alternative Finance Providers in LAC, 2013–2020

Date	Total	Capital raising	Lending
	(In billions of dollars)	(Percent of total)	
2013	0.0	34	66
2014	0.1	24	76
2015	0.1	31	69
2016	0.5	9	91
2017	0.7	16	84
2018	1.8	5	95
2019	5.2	2	98
2020	6.0	2	98

Source: Cambridge Centre for Alternative Finance (CCAF) data provided to the IMF in June 2022.

Note: LAC countries include Antigua and Barbuda, Argentina, The Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Curacao, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Northern Mariana Islands, Panama, Paraguay, Peru, St. Kitts and Nevis, St. Lucia, Suriname, Trinidad and Tobago, Uruguay, and Venezuela.

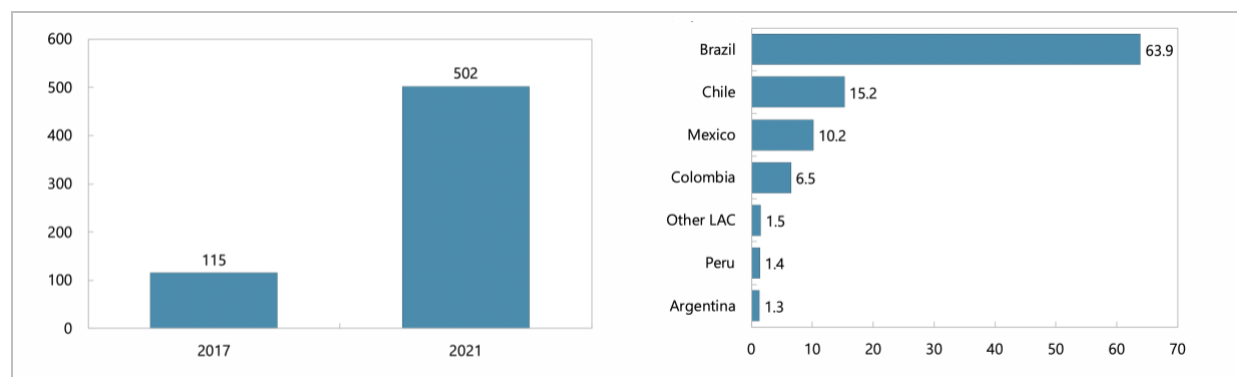
Alternative finance is important for boosting access to finance. For some Latin American countries, micro, small, and medium enterprise (MSME) loans on P2P platforms have been the only available financing source. Ziegler and others (2022) shows that the use of alternative finance is associated with improvements in MSMEs' financial health and productivity. Borrowing via alternative lending platforms also resulted in an increased use of savings and checking accounts.

Figure 8. LAC Alternative Finance: Number of Firms and Country Shares

1. Startups in Alternative Finance
(Number of firms)

2. Alternative Finance: Country Shares, 2020
(Percent)

11 LAC countries, 11 African countries, 11 Asian and Pacific countries, 18 Eastern European countries, 7 Middle Eastern countries, and 26 advanced economies. The US is rated first and Ethiopia last. See "The Global Fintech Index" (n.d.) Ecosystem Rankings of Countries. Note that this ranking is a third-party ranking based on a proprietary methodology and that application of a different methodology may provide an altered ranking. The interpretation of the ranking should be done with due caution.



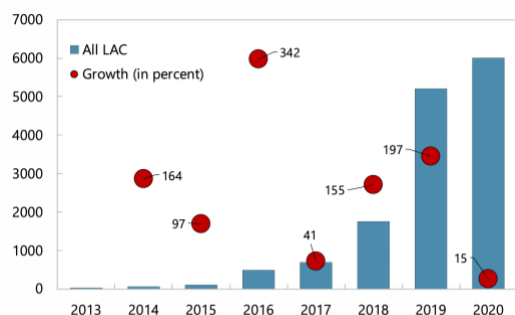
Sources: IDB (2022), pp. 30, 31; and Ziegler and others (2021).

Note: LAC countries include Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.

Figure 9. LAC Alternative Finance: Value and Transactions

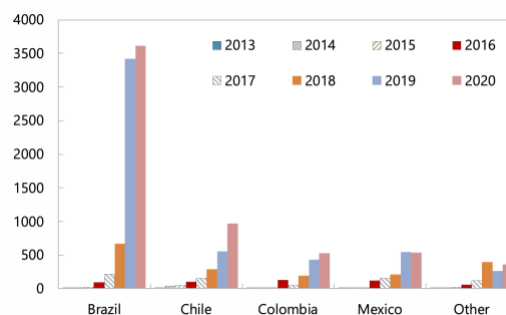
1. Total Value of Alternative Finance Transactions

(In millions of dollars, unless otherwise indicated)



2. Alternative Finance Transactions by Country

(In millions of dollars)



Source: CCAF data provided to IMF in June 2022.

Note: LAC countries include Antigua and Barbuda, Argentina, The Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Curacao, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Northern Mariana Islands, Panama, Paraguay, Peru, St. Kitts and Nevis, St. Lucia, Suriname, Trinidad and Tobago, Uruguay, and Venezuela.

Insurtech

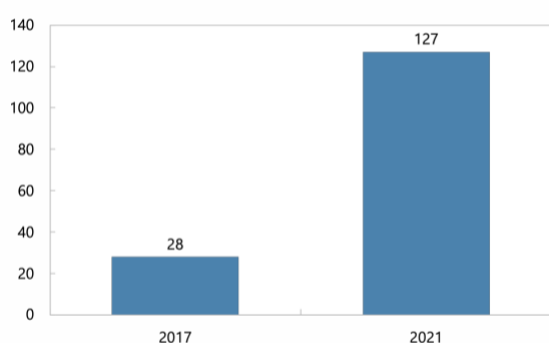
The insurtech market in Latin America and the Caribbean has a strong potential for expansion. Insurance penetration in the region is significantly lower than in Organisation for Economic Co-operation and Development (OECD) countries: from 1 percent of GDP in Venezuela to about 4 percent in Chile vis-à-vis 9.4 percent in OECD countries. Most people in Latin America do not have life insurance, and 70 percent of cars operate without insurance. The insurtech industry can foster advancement in these areas with its focus on targeted products, process efficiency, alternative data usage, and accessibility via digital means.

Fueled by funding rounds (Table 2) and targeting market gaps, the insurtech sector is expanding quickly. The number of startups in this subsector increased from 28 in 2017 to 127 in 2021 (Figure 10). According to the industry report, 352 insurtech companies were in Latin America in 2021.²⁶ About half of insurtech companies' clients are small and medium enterprises and low-income consumers. Insurtech companies also provide technological solutions to a quarter of all traditional insurance companies.

Figure 10. LAC's Insurtechs

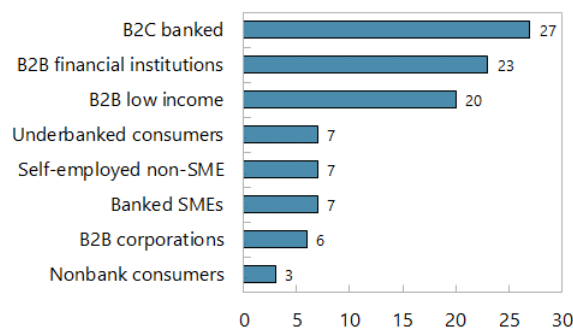
1. Start-ups in Insurtech

(Number of firms)



2. Business Models and Markets Served, 2021

(Percent)



Source: IDB (2022), pp. 22, 118.

Notes:

- LAC countries include Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.
- B2C stands for Business to Consumer; B2B stands for Business to Business; and SMEs stands for Small and Medium Enterprises.

²⁶ Digital Insurance Latam (2021).

Table 2. Insurtech Deals in Latin America

Country	Deals		Rank	Funding	
	(In number of deals)			(In millions of dollars)	
	2012–21	2022 Q1		2012–21	2022 Q1
Brazil	27	0	12	305	...
Chile	14	4	15	123	158
Mexico	13	1	18	24	1
Argentina	2	2	25	3	10
Colombia	2	0	27	2	...
Peru	1	0	28	2	...
El Salvador	0	1	28	0	2
Memorandum items					
US	1,124	67	1	26,500	970
Canada	46	3	7	219	100

Bigtech

Bigtech companies are large technology conglomerates with extensive customer networks and core business across markets, such as in social media, internet search, and e-commerce. Examples include Google, Apple, Facebook, Amazon, Alibaba, and Mercado Libre.

Bigtech companies have also expanded to financial services. Their access to the vast user data, combined with advanced analytical technologies such as AI and machine learning, gives bigtech companies opportunities to provide innovative services. Their business models differ from those of fintech companies. Fintech startups usually have been characterized by the unbundling and decentralization of financial services using technology to participate in a few activities, such as payments or lending. Bigtechs, on the other hand, have access to large proprietary data sets and use technology and talent to reverse the unbundling, providing a wide range of financial services within one group (Bains and others 2022).

Bigtech companies have increased their presence and market share in financial services in the region. According to a paper by the FSB,²⁷ the expansion of bigtech firms into financial services in emerging market and developing economies has generally been more rapid and broad-based than that in advanced economies. An example is Alipay (established in 2004)—a payment service of Alibaba Group and a digital wallet in China that has more than a billion active users worldwide. Other examples include KakaoPay (2014), a South Korean mobile payment and digital wallet service; M-Pesa Safaricom, launched by Vodafone and Safaricom in 2007, the largest mobile network operator in Kenya and now operating globally; and WeChat Pay (2013), the main competitor of AliPay.

In the region, companies such as Rappi and MercadoLibre, which started as e-commerce platforms, now offer payment services as well as credit cards to their clients. They also offer savings accounts to their customers through a partnership with a local bank. The rapid expansion of credit and the increased interconnectedness with financial institutions have benefits such as higher access to formal credit but can also create systemic risks (Bains and others 2022).

Funding of Fintech

There has been a shift in fintech funding from angel investors and family and friends to risk capital and accelerators and incubators (Figure 11). This shift likely reflects the maturing of the fintech sector.

Venture capital and private equity funding of fintech companies increased steadily before the pandemic. Average monthly funding rose from \$38 million in 2015 to \$90 million in 2019 (Figure 12).²⁸ Annex III shows a breakdown of venture capital into series A, B, and C using the Crunchbase database.²⁹

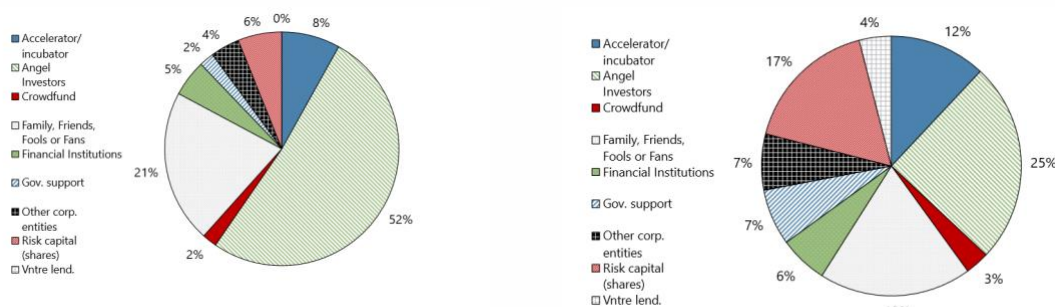
There was a surge in venture capital and private equity funding during the pandemic (see the section “Weathering Shocks”).

²⁷ Financial Stability Board(2020).

²⁸ In 2019, on average, the fintech companies received one-third of financing deals as venture capital funding and one-quarter as incubator/accelerator deals (Cornelli and others 2020). In the most mature markets—Brazil and Mexico—venture capital provided most of the funding; in Chile, Colombia, and Argentina, nearly half of the fintech startups received venture capital financing. Funding with an incubator/accelerator was very important in Peru, where some two-thirds of all firms benefited from financing by accelerators/incubators.

²⁹ Series A is the first round of venture capital funding, series B the second, and series C the third. Before series A, external investors may be involved in helping the business get off the ground through angel investment.

Figure 11. Latin America: Sources of Funds for Fintech, 2018 versus 2020 (Percent of total funding)



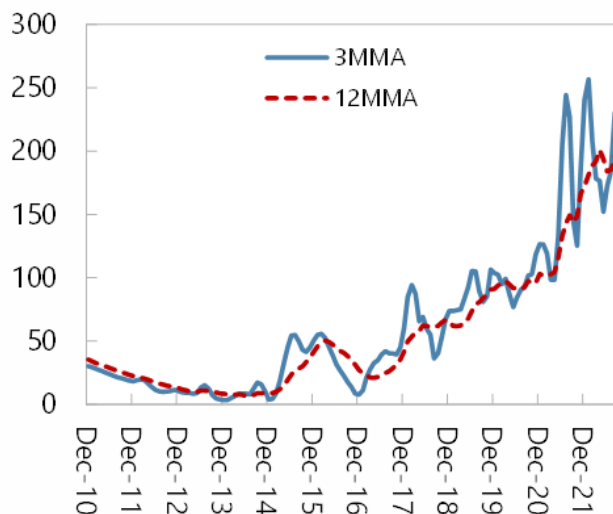
Source: IDB (2022), p. 58.

Note: LAC countries include Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.

Foreign financing is important. Among fintechs analyzed in the Inter-American Development Bank (IDB) 2022 study, about two-thirds reported receiving external support (compared with half in 2018), and about a quarter relied on local funds. According to a report by the Association for Private Capital Investment in Latin America (LAVCA 2022), in 2021 there was \$6.1 billion in external investments in Latin American fintech across 258 transactions. Unsurprisingly, the biggest markets attract the most external interest.

In 2021, consumer finance and banks attracted most of the total capital invested in fintech.³⁰ Two-thirds of those investing in fintech invest less than \$0.5 million, about a third of investors invest between \$0.5 and \$5 million, and about 10 percent of investors invest more than \$5 million.

Figure 12. LAC: Venture Capital and Private Equity Funding Raised for Fintech (In millions of USD)



Source: Crunchbase; IMF Staff Calculations.

Note: MMA=modified moving average.

³⁰ About 4 times more than in 2020 (LAVCA 2022).

II. Causes and Impact of the Fintech Boom

Factors Fueling the Fintech Boom

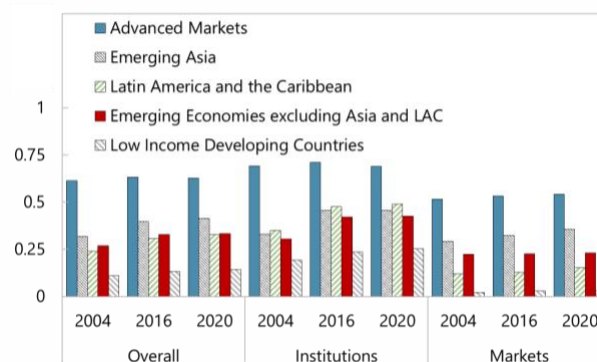
Three key factors seem to have fueled the fintech boom in Latin America: (1) limited access to finance from banks and insufficient competition among banks, (2) improvements in digital infrastructure, and (3) access to venture capital.

Access to finance from regular banks remains limited. Between 2016 and 2019, Latin America and the Caribbean caught up with emerging market economies in terms of financial development but remained behind emerging Asia (Figure 13). At the same time, high interest rate margins (the difference between loan and deposit interest rates) indicated a limited access to finance. The high margins most likely reflected high costs of operations, high perceived risk of lending, and limited competition among banks. The limited access to finance is a macro-critical problem: the SMEs’ financing gap reached \$1 trillion by 2020.³¹

Internet access has become ubiquitous, with 74 percent of the population using the internet in 2019, compared with 34 percent in 2010 (Figure 14).

The IDB’s 2021 report calls the locally owned technology-based private companies founded in the region “tecnolatinas.” These comprise 1,005 companies and by 2021 had created \$221 billion of value alongside 245,000 jobs and raised \$28 billion in capital. Brazil, Argentina, Mexico, Colombia, Chile, and Uruguay are identified in the report as the countries with the strongest tecnolatinas ecosystems. Fintech and e-commerce account for nearly three-quarters of the ecosystems’ value. One in five tecnolatinas works in fintech and collectively these companies raised one-third of the \$28 billion in capital.

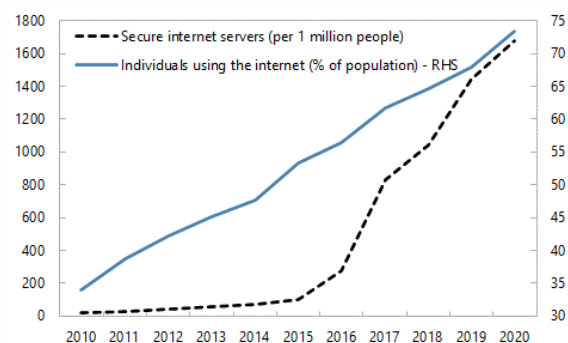
Figure 13. Financial Development Index: World Rankings (Index from 0 to 1)



Sources: IMF Financial Development Index Database; and IMF staff calculations.

Note: The Financial Development Index is a summary index, which covers the depth, access, and efficiency of both financial institutions and markets. For a detailed methodology on the index and country groupings, please see the referenced source. Country groupings conform to *World Economic Outlook* definitions. LAC = Latin America and the Caribbean.

Figure 14. LAC: Internet Use and Secure Server Count



Sources: World Bank, World Development Indicators, and Groupe Speciale Mobile Association (GSMA) Foundation.

Note: Country groupings conform to World Economic Outlook definitions. LAC = Latin America and the Caribbean.

³¹ World Bank (2020).

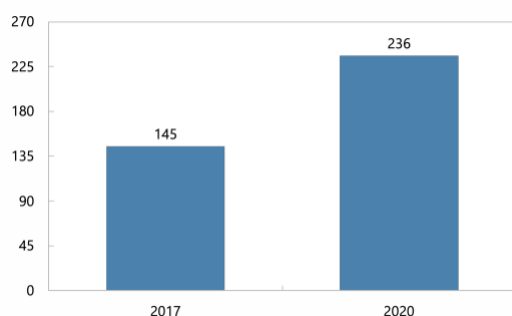
Fintech’s Macro-Critical Impact

Long-standing obstacles prevent many people in Latin America from using traditional financial services. World Bank (2014, 2022)³² list the following reasons for lack of a bank account: insufficient income, use of a relative’s account, unaffordability, distance, documentation requirements, lack of trust, and religious reasons. UNCTAD (2021) stresses that barriers to financial inclusion disproportionately affect the poor, women, youth, rural populations, informal workers, and migrants. Fintech can address these obstacles on its own or in cooperation with existing financial service providers.

Figure 15. LAC: Financial Inclusion Is Progressing

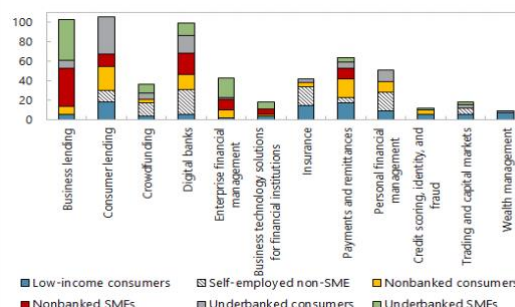
1. Startups Focused on Underserved Markets

(Number of firms)



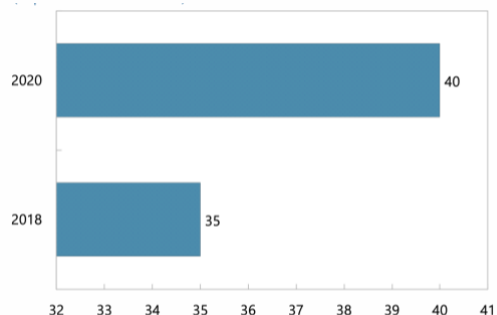
2. Fintech Services Directed at Underserved Markets, 2021

(Percent of services provided)



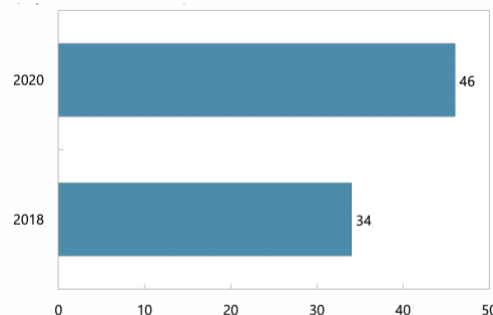
3. Fintechs with Female Funders or Cofunders

(Percent of fintech firms)



4. Fintechs with Gender Parity Among Customers

(Percent of fintech firms)



Source: IDB (2022).

Note: LAC countries include Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela. SME = small and medium enterprises.

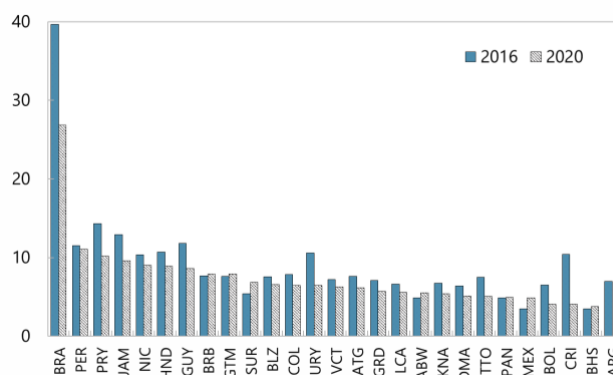
³² World Bank (2014), pp. 34–5; World Bank (2022), p. 4. The authors state, “Lack of money, distance to the nearest financial institution, and insufficient documentation were consistently cited by the 1.4 billion unbanked adults as some of the primary reasons they did not have an account.”

Fintech is revolutionizing the traditional financial sector by simplifying access to financial services (Figure 15). Two-thirds of digital banks’ loans go to under- and nonbanked consumers and SMEs. The number of startups focused on financially underserved markets has been growing at an average annual rate of 19.3 percent since 2017 (IDB, 2022). More than one-third of all fintech companies in LAC serve those excluded from the formal financial system. Figure 15 shows that the three fintech segments most focused on previously unbanked clients are lenders to enterprises, lenders to consumers, and digital banking. Fintech is also addressing obstacles to participation in the financial sector, especially financial education and health. In 2021, two-thirds of fintech companies reportedly offered tools for financial education, evaluation, and improvement to their clients. Finally, gender parity in the demand and supply of fintech finances continues to improve. The share of fintech startups with female funders/cofounders has increased by a seventh while the share of female fintech customers was up by approximately a third (Figure 16, panels 3 and 4). There is also progress in relation to female labor participation in fintech companies. Since the last IDB study in 2018, the share of fintech companies with equal gender parity more than doubled from about 6 to 15 percent, while the share of fintech companies with no females among the labor force shrunk by 4 percentage points to 12 percent.

We find that fintech startups boost traditional banks’ competition directly and indirectly (Annex I). A direct impact comes from competition between incumbents and fintech lending institutions. Indirectly, fintech startups provide incentives and opportunities for incumbents to invest in new financial technologies. According to the estimates presented in Annex I, an increase in the ratio between digital banks’ transactions and total banks’ loans by 1 percentage point in emerging market and developing economies (EMDEs) and Latin America and the Caribbean is associated with a reduction in net interest margin by 0.2 to 1.9 percentage points. Between 2017 and 2020, interest rate margins have declined by about 13 percentage points in Brazil (Figure 16)—a country with large digital banks. Using coefficients for the EMDEs sample, the model suggests that an increase in digital banks’ activity reduced interest rate margins in Brazil by 3 percentage points.

We also find that fintech is associated with reduced income inequality (Annex II). A higher level of fintech adoption is associated with a lower income share of the top 10 percent and a lower Gini coefficient. Fintech adoption is also associated with a higher level of female employment.

Figure 16. LAC: Interest Rate Spread, 2016 and 2020 (Lending rate less deposit rate; percentage points)



Sources: IMF and International Financial Statistics

III. Weathering Shocks: COVID-19

The COVID-19 pandemic posed some challenges but also provided a lot of opportunities for the fintech sector. While lending from traditional banks slowed down, fintech lending continued its exponential growth. Following a global credit crunch in the early months of the pandemic, a funding glut boosted fintech growth in the second half of 2020–21. The pandemic also nudged regulators to prioritize fintech and employ new technological solutions in their regulatory work.

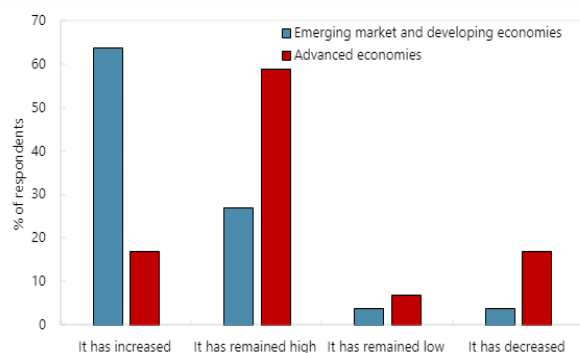
Regulatory Response to the Pandemic

During the COVID-19 pandemic, regulators in emerging market economies increased their focus on fintech. According to the World Bank-CCAF survey, COVID-19 has generally increased the prioritization of fintech for regulators.³³ As shown in Figure 17, around two-thirds or regulators in emerging market and developing economies consider that the priority of fintech has increased, while 60 percent in advanced economies indicated that fintech remains a high priority.

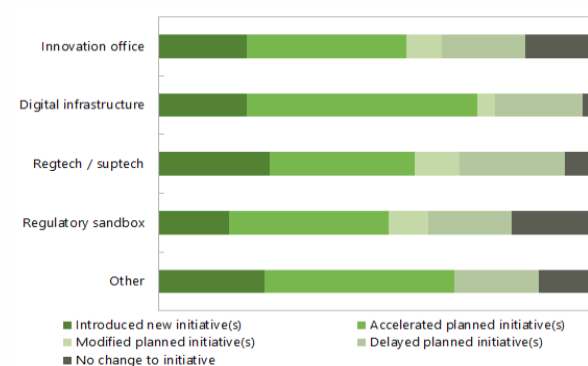
The challenges brought to regulation and supervision during the pandemic led to an increased interest in technology-based solutions. Working remotely and coordinating with other agencies as well as ensuring access to timely data proved challenging during COVID-19, particularly in jurisdictions where stringency measures were tight. Against this background, some regulatory changes were introduced and others accelerated, including the introduction of innovation offices, regulatory sandbox initiatives (including the exploration of digital sandboxes), and digital infrastructure. Regtech and supotech were also given a fillip because of the support they provide to a range of core regulatory activities at a time of crisis, helping to reduce and streamline processes.

Figure 17: The Impact of the Pandemic

1. Priority of Fintech within Regulators in Light of COVID-19



2. Impact of COVID-19 on Regulatory Innovation Initiatives



Source: IDB (2022), World Bank, and CCAF.

³³ World Bank and CCAF (2020).

To boost the use of fintech during the pandemic, half of the regulators took measures to facilitate the implementation of some anti-money laundering and combating the financing of terrorism (AML/CFT) requirements using digital tools. Examples of this included facilitating or permitting electronic KYC (eKYC). Other measures included the facilitation of digital onboarding.

Specific measures for fintech during the pandemic were related to digital payments and remittances. About one-third of regulators undertook at least one measure, most often related to digital payments and remittances. The types of measures include the temporary waiving of transaction fees (partially or wholly) for payments and remittances and the increase of transaction limits/thresholds. Examples include increases in daily maximum account balance and wallet limits and increases in contactless payment and mobile money limits. Fintech companies were involved in supporting the governments in emerging markets in providing COVID-19 relief, particularly in the digital disbursement of payments and remittances, health care, and the delivery of government relief and stimulus funding (Table 3).

Table 3. Examples of New or Updated Products Launched in Response to COVID-19

Model	Change to existing/ new or updated	Example from the field
Digital lending	Credit or microcredit facility	A digital lending platform and a food delivery service collaborated to offer a loan facility to restaurants in Mexico.
Digital lending	New products and services	Two Brazilian platforms joined the governments' program to aid SMEs during the pandemic; both companies will be the intermediary and facilitators to deliver the loans.
Insurtech	New products and services	An insurtech from Chile introduced a new product, insurance per kilometer, to address the changing mobility habits of citizens in Chile during COVID-19.
Digital custody	Participation in COVID-19 relief measures	The governments of Colombia and Paraguay partnered with digital wallets to distribute COVID-19-related stimulus.
Digital payments	New products and services	A digital payment firm greatly increased remote delivery of digital payment accounts, which link to personal loans and money market savings funds. They are not, however, permitted to take deposits or receive customers' salaries or state benefits directly into the account.
Source: CCAF and others (2020).		

Did Fintech Help Weather the COVID-19 Shock?

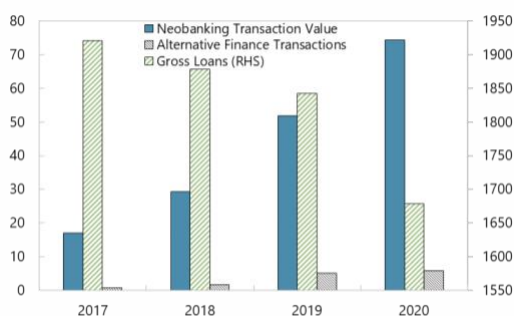
Strong growth throughout the pandemic in digital payments, digital banks' transactions, and alternative lending confirms that fintech companies continued to support economic activity in Latin America and the Caribbean. Figure 18 shows that banks' loans slowed significantly in 2020 while fintech lending continued its rapid growth.

Several of fintech's features helped boost its operations during the pandemic. The use of mobile technologies helped people and companies maintain operations despite mobility restrictions. Given this advantage, investors significantly increased funding to finance fintech expansion. New fintech companies also were less vulnerable to shocks than long-standing institutions, as they were growing new portfolios.

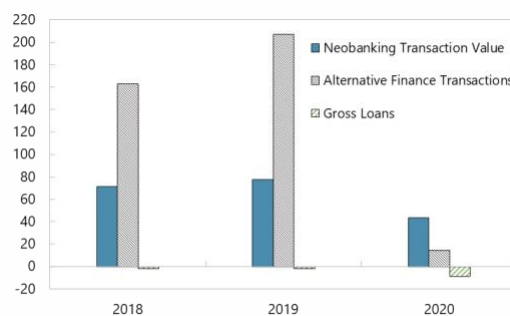
As discussed previously, fintech startups in Latin America affect banks by directly competing with them and by providing new technologies. Thus, in addition to providing loans and insurance policies to people and companies, fintech companies provided technologies and incentivized traditional insurance companies and banks to invest in new technologies.

Figure 18. LA6: Alternative Finance vs. Bank Loans

1. In billions of dollars



2. Year-on-year percent change



Sources: Statista, CCAF data provided to IMF in June 2022, and IMF FSIs.

Fintech’s Access to Funding

After a short slowdown in funding deals at the outset of the COVID-19 pandemic, funding to fintech startups accelerated sharply between the second quarter of 2020 and the end of 2021.³⁴ The trend in equity capital raised by fintech startups has followed the global liquidity cycle: a quick and forceful liquidity crunch in early 2020 turned into a liquidity boom that was followed by global liquidity tightening starting in 2022.

A surge in venture capital and private equity funding occurred during the pandemic. The size of the surge is best illustrated by the three-month moving average of total monthly funding (Figure 13). In the early stage of the pandemic, the financing declined from \$104 million in December 2019 to \$77 million in May 2020. It then had a surge, with a peak of \$257 million in January 2022. Thereafter it eased to \$152 million in May 2022 but rebounded to \$222 million in October 2022.

Annex III includes more details on the breakdown of the dynamics into young and mature startups, as well as a machine learning analysis, which shows that young fintech startups benefited more from the financing boom than mature ones.

³⁴ See FT Partners Quarterly Fintech Insights and Annual Almanac reports available at <https://www.ftpartners.com/fintech-research/almanac>.

IV. Good Policies: Controlling Risks and Enabling Growth

Policymakers play two major roles supporting fintech development. First, they set the regulation for digital sandboxes, digital ID, and open banking and developing innovation facilitators (see the root section in Figure 19). Second, they address risks stemming from the application of fintech, which arise primarily in six areas: (1) financial stability, (2) financial integrity, (3) cybersecurity, (4) consumer and data protection, (5) data provision, and (6) market integrity.

Figure 19. Fintech Tree

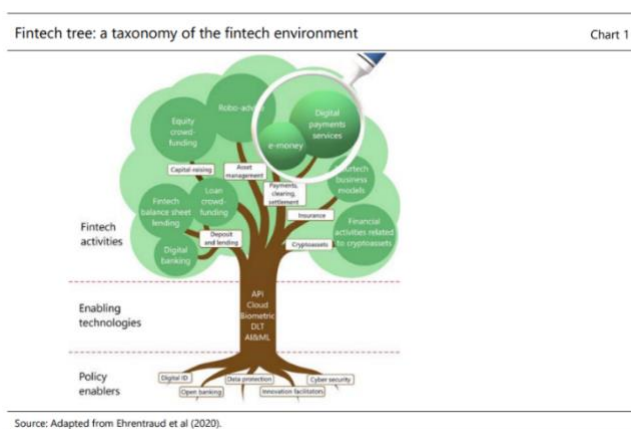
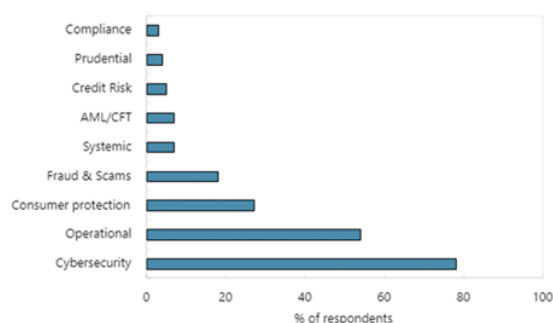


Figure 20. Impact of the Pandemic on Fintech Risks



Sources: World Bank and CCAF survey.

Note: AML/CFT = anti-money laundering and combating the financing of terrorism.

The acceleration of digital financial services during the COVID-19 pandemic has led to a further heightening of risks. Results from the World Bank and Cambridge Centre for Alternative Finance Survey³⁵ show that the perceived risk that increased the most during the pandemic was cybersecurity (78 percent), followed by operational risks (54 percent), consumer protection (27 percent), and fraud and scams (18 percent) (Figure 20).

The expansion of fintech in Latin America has also increased systemic risks, creating challenges for both regulation and supervision. While some of the risks are particular to fintech, many others are linked to underlying products and institutions similar to those faced by the traditional financial system. In particular, fintech can heighten operational risks and those related to data and consumer protection.

³⁵ World Bank and CCAF (2020), p. 29.

Approaches to Fintech Regulation in the Region

Various approaches exist in fintech regulation. When choosing the regulatory framework, authorities have four possible options. The first one is *wait and see*, which occurs when no concrete action is taken (either for an existing regulation or to adopt a new regulation). The second option is *test and learn*, where tools such as innovation hubs and sandboxes are used to understand new developments and make regulatory changes based on the outcomes. The third option is expanding the perimeter by adopting new rules to regulate fintech companies, including by the adaptation of existing norms. The fourth one is *bespoke regulation*, which recognizes the particularities of fintech and creates new regulations for each innovation.³⁶

In Latin America, fintech tends to be regulated most often by the type of *activity* of firms rather than by type of firms providing services. Mexico is the only jurisdiction that applies entity-based regulation to fintech, as licenses are granted to financial technology institutions. Other jurisdictions apply an activity-based approach where existing regulation is being adapted to fintech activities. For instance, Argentina, Brazil, and Colombia have published acts or amendments specific to credit and payments and crowdfunding (Cantú and Ulloa 2020).

Broader Regulatory Issues

Nonbank Payment Service Providers

The rapid growth of nonbank payment service providers (NBSP) has increased risks. Aside from those common to other fintech technologies, the provision of payments by nonbanks has potential risks in protection of funds in transit or storage, digital exclusion, and market concentration that need to be addressed by regulators.³⁷

Regulatory requirements for payment services that are applied in a differentiated manner include licensing, minimum capital, safeguards and interoperability. Other regulatory requirements that are applied across the board include AML/CFT, risk management and cyber security, data protection and consumer protection.³⁸

Countries like Brazil have a general license framework, whereas Mexico has a limited (payment) license. In Brazil, Chile and Mexico, nonbank institutions can issue e-money, including in foreign currency in the case of Mexico. Capital requirements usually are a percentage of e-money transactions. In Colombia, it is 2 percent of total payments or transfers in the past 12 months. Brazil requires interoperability for e-money issuance, acquiring of payment transactions and payment initiation services. This allows customers to transact with any other customer, irrespective of the service provider.

³⁶ Bains and others (2022).

³⁷ See FSI Insights (2021), Executive Summary.

³⁸ According to the FSI Insights (2021), the number of regulatory requirements for services such as acquiring payment transactions, e-wallets, and e-money issuance are higher in emerging market and developing economies than in advanced economies.

Open Banking and Open Finance

Open banking and open finance will further boost innovation and inclusion.³⁹ Under open banking, consumers can share their transaction and account data from bank accounts to regulated third parties for specific purposes. Open finance also utilizes consumer-permissioned data, but from financial accounts rather than typical bank deposit accounts. Examples include investment accounts, small business accounts, crypto wallets, or fintech apps. Open finance provides benefits to financial institutions stemming from the use of technology to gather and analyze customer information and can help consumers to search and compare financial products and services.

Open banking and open finance require regulation of three principles: data access and data sharing, data portability, and data interoperability. The EU was the pioneer of the open banking regulation through the payment service directive, which regulates two types of services: the payment initiation services and the account information services. The payment initiation services help to initiate a payment from the consumer's account to the merchant's account by creating an interface to bridge both accounts, filling in the information needed and informing the store of the transaction. The account information services include the collection and storage of information from a customer's different accounts in a single place.

Brazil and Mexico are the only countries in the region with open finance regulation. Both countries have mandatory models for sharing information with the consent of the client. In Mexico, open finance was included in the Fintech Law, which established the principles for data access and data sharing. Subsequently, in 2020, it was regulated by the Central Bank and the National Banking and Securities Commission (CNBV), for aspects such as interoperability and authentication mechanisms for application programming interfaces. In Brazil, the open finance model has been developed in stages, with the objective of promoting innovation, competition and efficiency in the financial sector and the payment system. The Central Bank has the responsibility of regulating and supervising open finance, including the implementation of the model. In 2020, the regulation on open finance was issued, establishing the main rules regarding several aspects, such as mandatory participants, scope of data and services, requirements for sharing data and services, governance structure. Open finance has been included as a priority in the first cycle of the regulatory sandbox of the Central Bank. Both Chile and Colombia are currently finalizing the regulations for open finance. In the case of Colombia, the authorities plan to make the system voluntary, in contrast to the mandatory nature of Chile's proposal and the systems in place in Brazil and Mexico.

³⁹ See "Open Banking vs. Open Finance." Finicity. April 7, 2022. <https://tinyurl.com/5n994r4z>.

Crowdfunding

Crowdfunding regulation in the region has also advanced. Regulation has focused on two models of crowdfunding: debt and equity. According to the World Bank,⁴⁰ regulation for crowdfunding currently exists in 16 out of 37 jurisdictions in the region. Countries such as Brazil have a specific regulation for each subcategory, while Mexico and others have an overarching regulation for both equity and debt. The typical regulatory requirements are minimum capital, maximum investment, and subscription, which may vary by country. Minimum capital requirement ranges from \$179,000 in Brazil to \$234,000 in Chile. Colombia imposes no minimum capital requirement, but companies have strong requirements for asset management, and for managing operational and infrastructure risks. The maximum investment possible for nonqualified investors also varies, from \$200 in Argentina to \$2,700 in Brazil, whereas in Colombia the limit is established as 20 percent of the annual revenue or capital. The maximum subscription is also different across countries. Additional requirements usually exist for information disclosure to investors, minimum liquidity, and insurance.

Bigtech

Existing fintech regulation has enabled the expansion of bigtech in the region. According to an FSB⁴¹ survey, which included regulators in seven Latin American countries, the financial regulation was supportive of the provision of financial services by bigtech companies. Examples of regulation adopted during the pandemic include the development of faster payments systems supported by the central banks in Brazil and Mexico and the open banking initiatives, which allow for data sharing between banks and third parties. In April 2021, the Central Bank of the Republic of Argentina published a collection of guidelines for the proper response and recovery when cyber-incidents occur. Innovation facilitators like sandboxes have also been reported as enabling bigtech activities in financial services (FSB, 2020). But even with these advancements, there are still regulatory gaps. The rapid growth of lending by bigtech, particularly to individuals and small business who previously had limited or no access to credit, could result in excessive debt. Data gaps are also an important concern, given that bigtech activities may not be captured by existing reporting requirements in payments, credit, insurance, and wealth management. Concentration risks are also a potential vulnerability, particularly in areas such as cloud services, where just four bigtechs provide around two-thirds of global cloud services.

The expansion of bigtech into financial services brings risks from (1) carrying out several activities in parallel, (2) interconnecting operationally and financially with incumbents, and (3) providing single systemically important activities like the cloud or systemic payment infrastructures. Additional regulatory challenges are linked to the cross-border nature of bigtech companies. Given the complex risks associated with bigtech, the principles of the Bali Fintech Agenda suggest a two-step approach. In the short term, bigtechs should develop codes of conduct that address the spillover risks from unregulated parts of the business to the financial sector. In the long-term, there should be a hybrid regulation approach, where home supervisors establish entity-based regulation to cover bigtechs as a group while host supervisors apply activity-based regulations.

⁴⁰ See “Global Fintech-Enabling Regulations Database.” The World Bank. November 16, 2021. <https://www.worldbank.org/en/topic/fintech/brief/global-fintech-enabling-regulations-database>.

⁴¹ “Global Fintech-Enabling Regulations Database,” p 11.

Making Regulation Work

Using Technology for Managing Regulatory Compliance

Both fintech firms and supervisors increasingly use technology to help manage regulatory compliance.

Financial firms use regtech—innovative technology tools for managing regulatory compliance. The use of regtech could improve compliance outcomes, enhance risk management capabilities, and generate new insights into the business for improved decision-making. Companies invest in regtech to save time and money, freeing up resources that were once devoted to regulatory compliance.⁴²

Financial authorities use suptech. Suptech is the use of innovative technology solutions designed to help financial supervisory agencies fulfill certain regulatory tasks.

Regtech and suptech help automate some compliance and oversight processes and to match data meaningful to both regulators and firms. Regtech and suptech are usually cloud based and use application programming interfaces to enable more efficient data management, facilitating compliance workflow, decision-making, and reporting. Some examples of regtech adoption include AML/CFT and customer due diligence. For both authorities and regulated institutions, regtech and suptech can bring gains related to efficiency and effectiveness and possible improvement in quality arising from automation of previously manual processes. Mexico has been the leader in regtech in the region. As part of the National Strategy for Financial Inclusion, the authorities adjusted their KYC requirements to facilitate opening new bank accounts.

The Financial Superintendency of Colombia launched an initiative to promote the local development of regtech. The project is part of their Fintech division, in collaboration with third parties, with a particular focus on technology that helps distribute and clarify information about regulation changes.

Examples of regtech companies in the region are (1) Brazilian OriginalMy and Idwall, focusing on fraud and identity verification; (2) Chilean Ceptinel, specializing in fraud prevention and regulatory compliance; and (3) Colombian Pronus, providing risk and compliance management services for companies in the financial, legal, mining, and infrastructure sectors.

Examples of suptech tools to help financial authorities can be found in Mexico and Brazil. In Mexico, the CNBV partnered with the Regtech for Regulators Accelerator⁴³ in 2017 to develop a new regulatory framework to digitize compliance reporting, increase the quantity and quality of data, organize archival data, and improve data analysis. The CNBV uses a combination of innovative tools to detect suspicious patterns in granular transactional and account-level data. It is also experimenting with an NLP tool that flags selected names and companies from news related to money-laundering schemes and links these to other data sources. For AML and anti-fraud purposes, the Bank of Mexico uses a combination of web-scraping and text mining to audit promotional materials, prospectuses, or financial advice documents disseminated by financial institutions.

⁴² See Stafford (2016).

⁴³ Regtech for Regulators Accelerator is a nonprofit, donor-funded accelerator program administered by BFA Global that aims to help financial authorities in emerging market and developing economies explore specific suptech solutions by providing support in building prototypes.

In Brazil, the Central Bank developed ADAM, a machine learning tool to examine the entire credit portfolio of a supervised firm and identify credit exposures with inadequately recognized expected losses. ADAM can analyze 3 million exposures to customers in just 24 hours, while a team of 10 experienced inspectors would take 30 years to do the same. ADAM was first used by nonbanking supervision teams and then increasingly for banking supervision. The Central Bank also developed EVE, a tool to conduct automated end-to-end inspections without human interference. In particular, the tool automates the creation of working papers (that is, internal reports containing all supervisory analyses) and the drafting of communications to firms. Simulations showed that the tool can do the job 200 times faster than inspection teams. It was piloted in 2020 by supervisors in charge of fintech firms, but since then has been made available to other supervisors.

But even if suptech tools can bring significant benefits, implementation challenges may hamper wider adoption and acceptance. A key issue is the limited data science skills of supervisors. In addition, the pandemic highlighted the need for continued improvements in information technology infrastructure and data collection practices, which can support ongoing exploration of new suptech tools (FSB 2020).

Collection and Processing of Data

The financial sector increasingly gathers data not just for business purposes but also to satisfy regulatory requirements. Personal data can be used to comply with regulatory requirements to identify customers, to detect suspicious activities, and to perform due diligence procedures such as customer identification and transactions and customer monitoring. The appropriate data framework should aim to attain different objectives including privacy, innovation, competition, consumer protection, financial integrity, and financial stability and requires cooperation among many agencies. Data sharing with regulatory purposes should be governed by a careful balance between protecting privacy and attaining public policy objectives, such as facilitating criminal law enforcement activities (Haksar and others 2021).

Innovation Hubs and Regulatory Sandboxes

Authorities have increasingly adopted innovation hubs and regulatory sandboxes.

- An innovation hub is a dedicated space inside the regulator's office to promote an open and informal dialogue between innovator companies and the regulator.
- A sandbox is an experimental space that allows companies to operate temporarily under certain rules to test their product under the supervision of the regulator. Sandboxes have the potential to reduce asymmetric information and regulatory costs. They are more resource intensive and take a longer time to launch compared to innovation hubs. They also have potential reputational risks, because if implemented incorrectly, regulatory standards can be lower.

Innovation hubs are useful where the fintech ecosystem is growing at rapid pace and authorities need to get a better understanding of how fintech might impact regulatory frameworks. In these instances, the use of regulatory touchpoints like innovation hubs are a sensible step for strengthening surveillance and providing feedback to firms. However, successful innovation hubs require feasibility studies, clear objectives, and strong organizational buy-in. They can be costly and could divert resources from other priority areas. These new structures cannot fix inherent issues in existing supervisory structures and could potentially amplify existing weaknesses (Bains and Wu 2023).

A sandbox allows for live testing of new products or services in a controlled environment under the supervision of the regulator. They are resource-intensive, hypothesis-led initiatives that allow firms to test innovative propositions with real consumers. Where resources are available and fintech developments have a considerable impact on existing regulation, sandboxes allow authorities to monitor developments closely and can help them get comfortable with new technologies and business models. However, sandboxes are expensive, diverse in design, and require significant resources dedicated to a small number of firms. There are currently eight innovative hubs and nine sandboxes in the region (Tables 4 and 5).

One example of an innovation hub is the Brazilian Laboratório de Inovação Financeira e Tecnológica (LIFT). [LIFT](#) ecosystem is managed by the National Federation of Associations of Central Bank Employees (Fenasbac) and the Central Bank of Brazil and is comprised of three major groups of initiatives. First, LIFT Labs, with annual edition since 2018, focused on projects at an intermediate Technology Readiness Level (TRL), in order to accelerate innovation, promote the creation of new products and facilitate the entry of new market participants. Second, LIFT Learning, promoted in partnership with Brazilian universities, designed to engage the academic community in the development of projects at an initial TRL, in order to discuss longer-term needs of the Brazilian financial market and to prepare the workforce to tackle those needs. Finally, LIFT Challenge, focus on specific “challenges” faced by the financial sector, brings together market participants interested in developing minimally viable products (MVP) that meet the objective of the challenge and proposes innovative solutions to it.

Mexico and Colombia have also experimented with sandboxes. In Mexico, the National Commission of Banking and Securities organized the Sandbox Challenge, where 6 (out of 166) projects were approved in areas like fiduciary, capital markets, and crypto assets. Colombia has had two waves: The first (Supervisor Sandbox) started in 2019 and was limited to companies under the supervision of the Financial Superintendency of Colombia. It had a total of 18 pilot projects, of which 8 were in tryout in early 2022. The second one (Regulatory Sandbox) was expanded to nonsupervised companies and has 9 pilot projects.

According to the IDB-Finnovista survey, fintech companies perceive sandboxes as a useful and needed tool for regulation, both in countries that already have them, such as Brazil and Colombia, as well as in those that do not, such as Panama and Honduras. Fintech companies in credit scoring, payments and remittances, asset management, digital banking, and corporate lending give a high relevance to regulatory sandboxes.⁴⁴

Participating in a sandbox can also help firms to attract financing. Sandboxes are relatively new even in advanced economies, and the assessment of their effectiveness is relatively limited. A BIS paper finds that firms entering the United Kingdom's regulatory sandbox have a higher probability of raising funding and an increase of about 15 percent in the average amount of funding raised relative to firms that do not enter. Results suggest that sandboxes improve access to funding through two channels: reducing information asymmetries and lowering regulatory costs.⁴⁵

⁴⁴ IDB (2020).

⁴⁵ Cornelli and others (2020).

Table 4. Innovation Hubs in Latin America and the Caribbean

Country	Promoters	Year
Argentina	National Securities Commission	2022
The Bahamas	Securities Commission of the Bahamas	2019
Brazil	Securities and Exchange Commission	2016
Colombia	Financial Superintendency	2020
Costa Rica	CONASSIF, SUGESE, SUGEVAL, SUPEN, SUGEF, Central Bank	2022
El Salvador	Financial Superintendency	2021
Guatemala	Banks Superintendency	2019
Dominican Republic	Central Bank, Bank Superintendency, Capital Markets Superintendency, Pensions Superintendency, and Insurance Superintendency	2022

Source: IDB (2022).

Table 5. Sandboxes in Latin America and the Caribbean

Country	Promoters	Year
Barbados	Central Bank of Barbados and Financial Service Commission	2018
Brazil	Central Bank of Brazil	2020
Brazil	Private Insurance Superintendency	2020
Brazil	Securities and Exchange Commission	2020
Colombia	Financial Superintendency	2020
Jamaica	Bank of Jamaica	2020
Mexico	National Commission of Banking and Securities	2018
Peru	Banks and Insurance Superintendency	2021
Trinidad and Tobago	Central Bank, Financial Intelligence Unit, and Securities Exchange Commission	2021

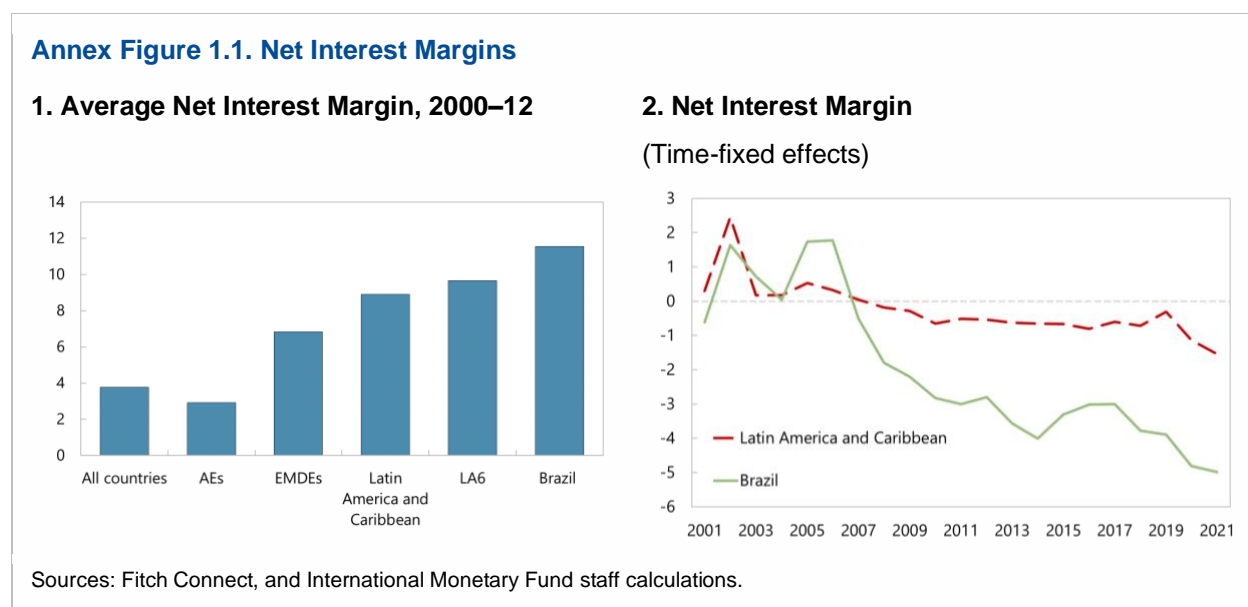
Source: IDB (2022).

Annex I. Fintech and Competition Among Banks

Fintech companies are addressing a long-standing growth constraint that Latin America has been facing for decades: limited access to finance. Fintech companies compete with banks, providing loans directly to individuals and firms. They also provide opportunity and incentives to banks to acquire new technologies. Individual banks have visibly different responses to the emergence of fintech: smaller banks tend to compete by price and reduce interest margins, whereas larger banks seem to be more reluctant to reduce interest margins and instead increase investment in technologies.

Financing has been limited and expensive in emerging market and developing economies (EMDEs) and especially in Latin America. While the average net interest margin in advanced economies between 2000 and 2012 was at 3 percent, it was at almost 7 percent in EMDEs and 9 percent in Latin America and the Caribbean.⁴⁶

Although still high, net interest margins have been declining since the 2000s. The decline continued during the fintech boom that started in Latin America and the Caribbean around 2012. Annex Figure 1.1 (panel 2) shows time variation in net interest margins estimated using time-fixed effects and controlling for banks' fixed effects.



Simplifying access to financial services, fintech companies have expanded rapidly in the past 10 years. The transaction volume of fully online digital banks in LA6⁴⁷ reached \$123 billion in 2021,⁴⁸ and

⁴⁶ Net interest margin is defined as the accounting value of a bank's net interest revenue as a share of its average interest-bearing (total earning) assets. See World Bank (2023).

⁴⁷ LA6: Argentina, Brazil, Chile, Colombia, Mexico, Peru.

⁴⁸ Statista(2022); digital banks' transactions include all transactions: transfers, payment, loans, deposits, and so on.

digital banks had more than 30 million users, mostly concentrated in Brazil and Mexico. The alternative finance industry expanded to \$6 billion in 2020.

We find that fintech startups' activities improve competition among banks directly and indirectly. A direct impact comes from competition between incumbents and fintech lending institutions. Indirectly, fintech companies provide incentives and opportunities for incumbents to invest in new financial technologies.

To estimate the effects of fintech activities on banks' competition, we use the following model:

$$NIM_{ict} = \alpha_i + \beta_t + \delta X_{ict} + \theta Z_{ct} + \gamma FT_{ct} + \varepsilon_{ict},$$

where NIM is a net interest margin, α_i and β_t are bank-level and time-fixed effects, X_{ict} is a vector of bank-specific characteristics (Annex Table 1.1), Z_{ct} is a vector of country-specific macroeconomic variables, and FT_{ct} is a country-specific fintech variable. In the main specification presented here, we use digital banks' transactions (such as transfers, deposits, loans) data provided by Statista. To check for robustness, we also used country-level alternative finance transactions collected by the Cambridge Centre for Alternative Finance.

Annex Table 1.1. Data and Data Sources

Variables	Scale/units	Obs.	Median	Std. dev.
Net interest income/average earning assets	Ratio, in percent	244584	3.13	2.59
Net fees and commissions/average earning assets	Ratio, in percent	244584	0.87	3.53
Personnel expenses/average earning assets	Ratio, in percent	244584	1.76	2.49
Other operating expenses/average earning assets	Ratio, in percent	244584	2.19	5.30
Liquid assets/total assets	Ratio, in percent	244530	18.15	26.05
Equity/total assets	Ratio, in percent	244582	12.03	29.95
Bank's loans/Total banking system's loans	Ratio, in percent	243142	1.46	6.68
Impaired loans (NPLs)/gross loans	Ratio, in percent	185473	4.60	52.05
Gross domestic product, constant prices, percent change	Percent	243295	1.98	3.20
Consumer prices, period average, percent change	Percent	243109	3.86	240.21
Real policy rate	Percent	148305	2.70	5.32
Emerging Markets Bond Global Index Spread	Basis Points	39757	369.13	502.23
Share of foreign banks in loans (gross)	Percent	240110	0.11	0.15
Herfindahl-Hirschman Index (HHI) with market share as a percentage of assets	Index	243423	787.41	797.12
Total loans (gross) held in all banks in given country in a given year divided by GDP	Ratio	243305	89.26	797.32
Alternative finance (loans) to total banks' loans	Ratio, in percent	119443	0.10	0.23
Digital banks' transactions to total banks' loans	Ratio, in percent	55445	1.18	1.43

Sources: Cambridge Centre for Alternative Finance, Fitch Connect, International Financial Statistics, World Economic Outlook, Statista, International Monetary Fund staff calculations.

Digital banks' transactions have a statistically and economically significant positive effect on competition among banks (Annex Table 1.2). An increase in digital banks' transactions by one standard deviation is associated with a reduction in net interest margin in EMDEs and Latin America and the Caribbean by 0.2 to 2.7 percentage points. The results are robust to changes in samples and specifications, including the use of the fintech variable in levels, growth rates, and lag.

Annex Table 1.2. Regressions

	Advanced economies	Emerging market and developing economies	Latin America and Caribbean
	b/se	b/se	b/se
Fees	-0.316 (0.20)	-0.160 (0.22)	-0.478 (0.31)
Personnel costs	0.055 (0.05)	0.368 (0.32)	-0.073 (0.37)
Operating costs	0.130** (0.06)	0.690*** (0.21)	1.006*** (0.29)
NPL/gross loans	-0.000* (0.00)	0.014 (0.01)	0.057 (0.05)
Equity/assets	0.034** (0.01)	0.051** (0.02)	0.036 (0.05)
Liquidity ratio	-0.014*** (0.00)	0.000 (0.01)	-0.004 (0.02)
Bank's share	-0.150*** (0.04)	0.050 (0.03)	-0.206 (0.18)
HHI (banks' assets)	0.000 (0.00)	0.000 (0.00)	-0.005* (0.00)
Share of total assets	-21.528*** (8.15)	3.643** (1.50)	3.439 (7.97)
GDP growth	0.008 (0.01)	-0.050*** (0.02)	0.040 (0.05)
Inflation	-0.090*** (0.01)	0.211*** (0.04)	0.296*** (0.08)
Policy rate	0.203*** (0.02)	0.017 (0.03)	0.013 (0.04)
Total lending (%GDP)	-0.003*** (0.00)	0.000 (0.00)	0.001 (0.00)
Digital banks' transactions (%total bank loans)	-0.057*** (0.02)	-0.162*** (0.06)	-1.862*** (0.55)
Year fixed effect	Yes	Yes	Yes
Bank fixed effect	Yes	Yes	Yes
N	29880	5704	1322

Annex II. Fintech and Inclusion: Evidence from Latin America

While there seems to be much hope that new technology in finance, which quickly spreads across the world, will unlock great potential for economic growth and social welfare like any other form of innovation, the distributional consequences of fintech are not yet well understood or researched.

This annex uses cross-country data to shed light on the nexus between fintech and inclusion in Latin America. Specifically, we focus on the effect of fintech adoption on gender inequality⁴⁹ and income inequality in the region. The model is specified as follows:

$$Inequality_{i,t} = \beta_0 + \beta_1 Fintech_{i,t-1} + \beta_2 X_{i,t-1} + \mu_t + \varepsilon_{i,t}$$

where $Inequality_{i,t}$ refers to the level of income/gender inequality of country i in year t . $Fintech_{i,t}$ captures the fintech development of country i in year t , measured by the volume of alternative finance. $X_{i,t-1}$ is a vector of country-level controls, including the natural logarithm of per capita GDP, inflation, trade openness, debt level, and institutional quality. All explanatory variables are lagged by one year to mitigate endogeneity concerns. The sample period is from 2010 to 2019.

We find that fintech development is associated with lower income inequality, which is robust in various model specifications and different inequality measures. In model 1, we use the Gini index as the dependent variable and find a negative correlation between fintech and the Gini coefficient. The results also indicate that GDP per capita, trade openness, and institutional quality also have a significant impact on inequality variables.

To examine the effect of fintech adoption on income segments, we replace the Gini index with variables of top 1 percent income share, top 10 percent income share, and bottom 50 percent income share in models 2 to 4, respectively. A higher level of fintech adoption is associated with a reduction in top income share and an increase in bottom income share, suggesting that fintech disproportionately benefits lower-income populations. The coefficient on the quadratic term is statistically significant, indicating that the relationship between fintech development and income inequality is nonlinear.

Our results show that fintech adoption is associated with a higher level of female employment. More specifically, a 1 percent increase in the scale of fintech usage is associated with a 1.1 percentage point increase in the number of female workers during the sample period. The economic magnitude is large, given that the sample average percentage of female employees is 51 percent. The coefficient on male employment is also significant but smaller in magnitude than that of female employment.

Taken together, our findings indicate a significant equalizing effect and are consistent with the literature. Using a sample of 93 countries, Asongu and Nwachukwu (2018) conclude that the use of mobile phones to pay bills or to send and receive money is significantly and negatively associated with income inequality but only in upper-middle income countries. More recently, Chinoda and Mashamba (2021) analyze the interaction between financial technology, financial inclusion, and income inequality in

⁴⁹Khera and others (2022) find that while digital financial services have made access to finance easier, faster, and less costly, thereby broadening digital financial inclusion, its impact on gender gaps varies across countries.

a panel of 25 African countries over the periods 2011, 2014, and 2017. They find that financial inclusion mediates the financial technology–income inequality relationship, thus playing a fundamental role in reducing income inequality in Africa. Loko and Yang (2022) focus on the effects of fintech on gender inequality. Using large-scale firm-level data, they show that fintech improves female employment, particularly in small firms and firms headed by females. We add to the literature by presenting novel evidence on the Latin American and the Caribbean region (Annex Table 2.1).

Annex Table 2.1. Fintech and Inclusion

Variables	Gini coefficient	Top 1% income share	Top 10% income share	Bottom 50% income share	Female employment
	(1)	(2)	(3)	(4)	(5)
Fintech	-2.100***	-0.021***	-0.033***	0.009***	1.049***
	(0.688)	(0.005)	(0.007)	(0.003)	(0.400)
Fintech squared	0.083***	0.001***	0.001***	-0.000***	-0.042***
	(0.025)	(0.000)	(0.000)	(0.000)	(0.015)
Ln GDP per capita	2.445**	0.008	-0.001	0.002	-1.703
	(1.209)	(0.008)	(0.010)	(0.004)	(2.578)
Inflation	-0.050	0.000	0.000**	-0.000	-0.008
	(0.044)	(0.000)	(0.000)	(0.000)	(0.041)
Trade openness	7.074***	0.045***	0.047***	-0.025***	-1.854
	(1.940)	(0.011)	(0.014)	(0.007)	(4.736)
Debt level	0.541	0.000	0.000	-0.000	1.400
	(1.106)	(0.000)	(0.000)	(0.000)	(4.656)
Institutional quality	-3.593***	-0.012	-0.000	0.004	0.737
	(1.255)	(0.010)	(0.015)	(0.007)	(1.974)
Constant	33.167***	0.231**	0.700***	0.070	59.703**
	(11.404)	(0.092)	(0.106)	(0.043)	(25.002)
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	150	155	155	155	154
R-squared	0.239	0.351	0.345	0.238	0.269

Sources: IMF staff estimates.

Notes:

1. Fintech data are from Cambridge Center for Alternative Finance. Female employment, Gini coefficient, and institutional quality data are from the World Bank. Income shares are from the World Inequality Database. Other control variables are from the IMF.
2. Robust standard errors in parentheses.
3. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Annex III. How Were Venture Capital and Private Equity Funding of Fintech in the Western Hemisphere Affected by the COVID-19 Pandemic? A Firm-Level Analysis

How were venture capital and private equity funding of fintech companies affected by the COVID-19 pandemic? This annex tries to answer this question through a firm-level analysis that uses the Crunchbase data set.⁵⁰

We show that venture capital and private equity funding of fintech companies surged in the second half of 2020 and 2021 and peaked in the first half of 2022. The total amount of funding increased, as did the funding for Series A, Series B, and Series C.⁵¹

We argue that the fintech financing surge was not just the result of a global funding boom but also reflected fintech-specific factors. A machine learning analysis shows that in 2021 and 2022, fintech firms had a higher probability of receiving financing, even after controlling for proxies of financial conditions. This higher probability was likely the result of optimism in the prospects of the fintech sector.

Financing Boom during the COVID-19 Pandemic

In the years preceding the pandemic, venture capital and private equity funding of fintech firms increased gradually. Average monthly funding (the sum of Series A, B, and C) increased from \$38 million in 2015 to \$90 million in 2019 (Annex Figure 3.1).

The size of funding surged during the pandemic.⁵² The magnitude is best illustrated by the three-month moving average of total monthly funding (Annex Figure 3.1). In the early stage of the pandemic, financing declined from \$104 million in December 2019 to \$77 million in May 2020. It then surged, with a peak of \$257 million in January 2022. Thereafter it eased to \$152 million in May 2022, but this level rebounded to \$236 million in September 2022.⁵³

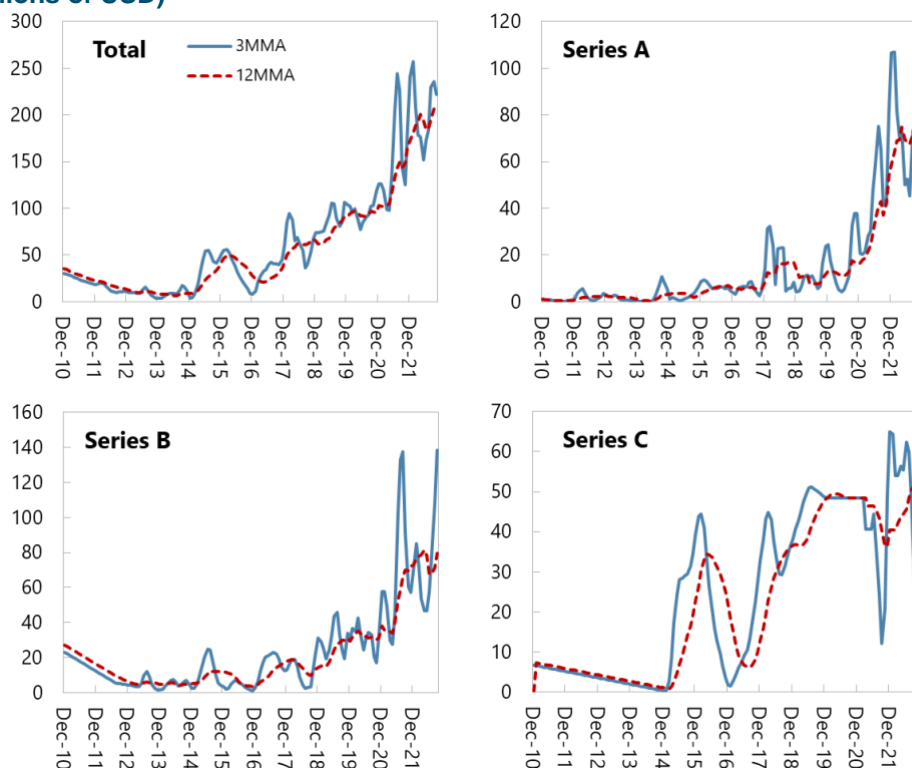
⁵⁰ The Crunchbase data set provides information for assessing the financing of fintech startups. Its information includes investment and funding information, founding members and individuals in leadership positions, mergers and acquisitions, news, and industry trends.

⁵¹ Series A is a stage in which investors not only further confirm the business idea to be good but also look for a strong strategy to turn the idea into a profitable enterprise. Series B and C help startups reach a larger scale, develop new products, and acquire other companies. Before series A, external investors may be involved in helping the business get off the ground through angel investment.

⁵² The surge highlighted here is consistent with a report by Johansson (2022).

⁵³ The analysis stops in September 2022, as the snapshot of the Crunchbase was taken in October 2022.

Annex Figure 3.1. LAC: Monthly Venture Capital and Private Equity Amount Raised for Fintech (In millions of USD)



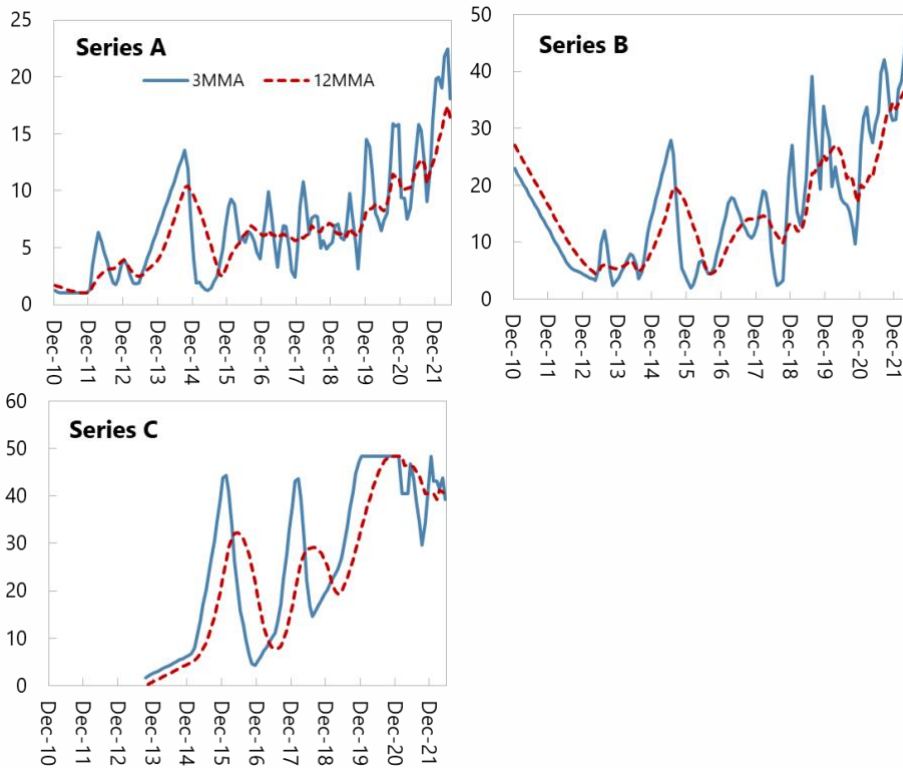
Sources: Crunchbase; and IMF Staff Calculations.

Note: 3MMA = three month moving average; 12MMA = twelve month moving average.

The surge occurred for Series A, B, and C (Annex Figure 3.1). It was strongest for Series A. The average deal size increased as well, most strongly for series A (Annex Figure 3.2).

The boom for fintech funding was stronger than for nonfintech (Annex Figure 3.3), although this pattern also reflects the fact that nonfintech firms do not rely on venture capital and private equity as the main financing source. The total funding for series A increased by 344 percent from 2019 to 2021 and by 495 percent from 2019 to 2022 (up to September) for fintech, compared with 304 percent and 245 percent, respectively, for nonfintech.

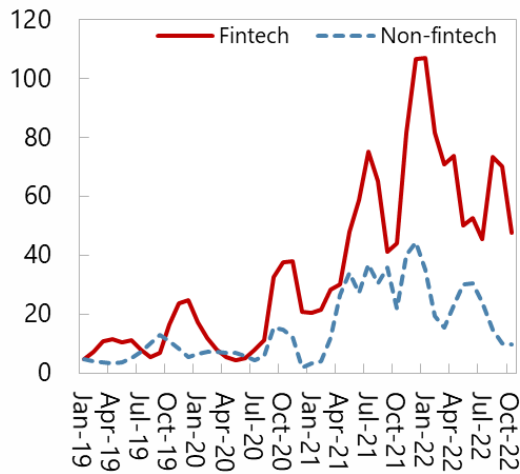
Annex Figure 3.2. LAC: Average Deal Size for Fintech by Stage of Financing (In millions of USD)



Source: Crunchbase; and IMF staff calculations.

Note: 3MMA = three month moving average; 12MMA = twelve month moving average.

Annex Figure 3.3. LAC: Total Amount Raised for Fintech in Series A (USD million)



Sources: Crunchbase; and IMF staff calculations.

Note: Total financing of nonfintech firms reported by Crunchbase is shown, with the caveat that their main financing source should not be venture capital or private equity.

A Machine Learning Analysis

This section uses machine learning (ML) tools to further reveal patterns of the financing boom during the pandemic. The reason for using ML tools here rather than conventional econometric methods is that the relationship between financing of startups and its determinants can be highly nonlinear, especially during the COVID-19 pandemic.

Data, Sample, and Variable Definitions

The analysis uses the Crunchbase data set, which provides critical information for assessing the financing of fintech startups. The Crunchbase is “a platform for finding business information about private and public companies,” and its information includes “investments and funding information, founding members and individuals in leadership positions, mergers and acquisitions, news, and industry trends.” “Originally built to track startups, the Crunchbase website contains information on public and private companies on a global scale.”⁵⁴

The Crunchbase database provides the year when a firm was founded and the time of occurrence and the amount raised for each financing deal. A Crunchbase vintage provides a snapshot of self-reported values from firms regarding their characteristics; most variables lack a time dimension. But the funding information is an exception.

The sample is restricted to fintech companies; a company’s self-identified industries include one of the following keywords: fintech, big data, peer to peer, virtual currency, crowdfunding, payments, insurtech, bitcoin, blockchain, cybersecurity, machine learning. The analysis is conducted for countries in Latin America and the Caribbean, and most of the findings are robust to expanding it to a global sample. The sample period is between 2010 and 2022.

Empirical Methodology

Machine learning (ML) is becoming popular in economics and policy evaluation.⁵⁵ The ML analysis here uses XGBoost, a tool widely employed in economic studies.⁵⁶ An ML analysis consists of (1) selection of features, (2) treatment of the sample, and (3) tuning of hyperparameters. We chose popular tree models given that the data-set structure under the classification task is traditional; we leave exercises based on neural networks and other ML tools for future research.

We use ML to predict whether a firm receives financing. Regarding the selection of features, we use 55 indicators as explanatory variables or so-called features in the analysis. They include (1) firm-level characteristics from the Crunchbase data set, (2) country-level variables from the World Bank Economic Development Indicators, and (3) year dummies. Firm-level characteristics include age, industry dummies, and total financing that has been raised; country-level indicators include GDP growth, inflation, change in currency value, changes of the Federal Reserve System and the European Central Bank balance sheets

⁵⁴ The quotes are from Wikipedia (<https://en.wikipedia.org/wiki/Crunchbase>).

⁵⁵ See Athey and Imbens (2017, 2019) and Mullainathan and Spiess (2017).

⁵⁶ XGBoost is a supervised machine learning method based on gradient boosting trees in the form of an ensemble of weak prediction decision trees. XGBoost provides a parallel tree boosting that solves classification and regression problems in a fast and accurate way; one example is Chen and Guestrin (2016).

based on their period averages, policy rate, domestic credit in US dollars, and multiple financial condition indicators.⁵⁷

Treatment of the Sample

Following the standard practice, 80 percent of the sample is used for a training set and the remaining for a testing set. Observations are randomly assigned to two groups. Because the sample is highly unbalanced (only 20 percent of firm-year pairs had a financing deal), the training set is adjusted to be more balanced, while the testing test is left as it is.

Tuning of Hyperparameters

Hyperparameter tuning is done using fivefold cross validation (Kohavi 1995) and Bayesian optimization (Snoek and others 2012).^{58,59} The tuned hyperparameters of XGBoost are listed in Annex Table 3.1, which includes L1 regularization term, L2 regularization term, learning rate, minimum loss reduction (required to make a further partition on a leaf node of the tree), max depth, and the number of estimators. The two regularization terms are part of the loss function to deal with model overfitting. L1 penalizes a large sum of the absolute value of coefficients and L2 a large sum of the square of coefficients. A lower learning rate prevents training from overshooting—a cause of the process being unstable. Minimum loss reduction, max depth, and number of estimators are chosen to strike a balance between model complexity and overfitting.

⁵⁷ Industry dummies include those indicating whether the firm belongs to 10 fintech industries and whether the firm is involved in lending business. Financial condition indicators come from the World Bank Development Indicator Database. The selected indicators are (1) bank accounts per 1,000 adults; (2) firms with a bank loan or line of credit (percent); (3) small firms with a bank loan or line of credit (percent); (4) financial institution account (percent age 15+); (5) saved at financial institution, (6) borrowed from a financial institution; (7) nonbank financial institutions' assets to GDP (percent); (8) stock market capitalization to GDP (percent); (9) stock market total value traded to GDP (percent); (10) gross portfolio equity and investment fund shares liabilities to GDP (percent); (11) gross portfolio and investment fund shares assets to GDP (percent); (12) credit flows by fintech and bigtech companies to GDP (percent); (13) bank overhead costs to total assets (percent); (14) bank nonperforming loans to gross loans (percent); (15) bank concentration (percent); (16) five-bank asset concentration; (17) foreign bank assets among total bank assets (percent); (18) banking crisis dummy (1 = banking crisis, 0 = none); (19) number of listed companies per 1,000,000 people; (20) total alternative financing volume across all subsectors; (21) total business financing volume across all subsectors.

⁵⁸ That is, we randomly partition the training data set into five equal-sized subsamples. Of the five subsamples, a single subsample is retained as the validation data for testing the model (F1 score), and the remaining four subsamples are used to train the model. The cross-validation process is then repeated five times, with each of the five subsamples used exactly once as the validation data. The five results can then be averaged to produce a single estimation.

⁵⁹ Hyperparameter tuning consists of maximizing out-of-sample performance over hyperparameters. It is difficult to calculate the derivatives of this objective function. The Bayesian approach constructs a probabilistic model (usually Gaussian processes) for the objective function and then exploits this model to make decisions about where to next evaluate the function.

Annex Table 3.1 Hyperparameter Tuning Outcomes

XGBoost Hyperparameters	
Alpha (L1 regularization term)	0
Lambda (L2 regularization term)	0.79
Eta (Learning rate)	0.066
Gamma (minimum loss reduction required to make a further partition on a leaf node of the tree)	0.83
Max depth	6
Number of estimators	100

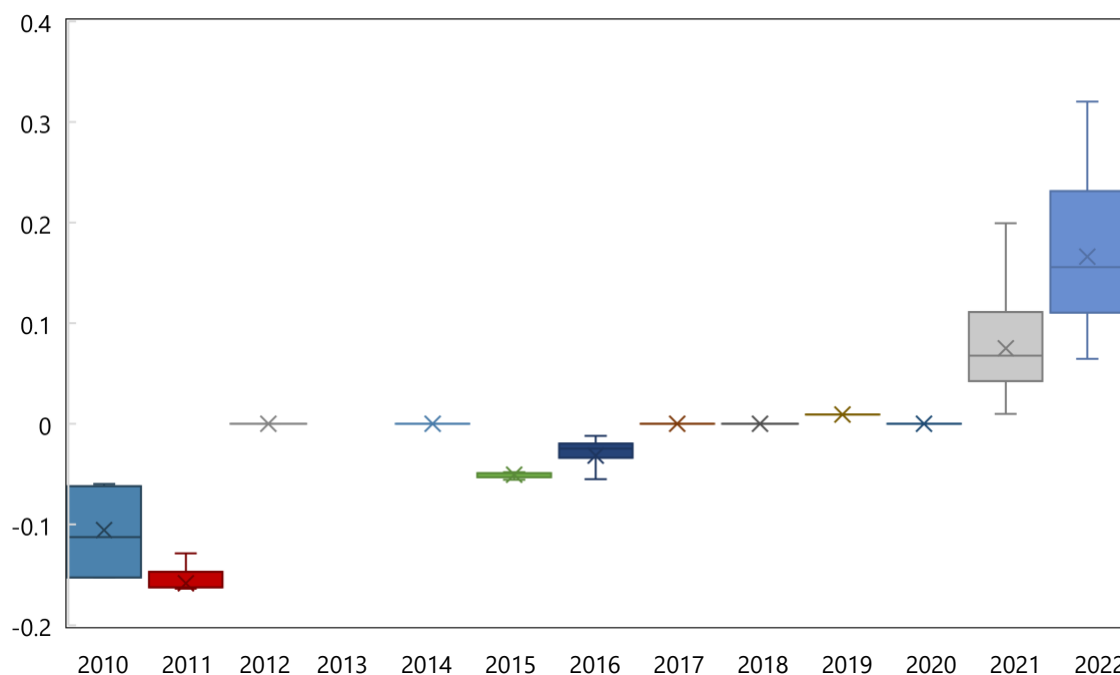
Source: IMF staff calculations.

We use SHAP values (SHapley Additive exPlanations) developed by Lundberg and Lee (2017) to interpret the model. Their framework, based on Shapley values, attributes to each feature the change in the expected model prediction when conditioning on that feature. Higher SHAP values make it more likely for the model to predict the firm would receive funding.

Quantitative Results

The ML analysis suggests that firms had a higher probability of receiving financing in 2021 and 2022 than in other years, after controlling for firm characteristics and macroconditions. Annex Figure 3.4 reports SHAP values for year dummies.⁶⁰ SHAP values of 2021 and 2022 are larger than those of other years. The low values of 2010 and 2011 likely reflect the impact of the global financial crisis.

⁶⁰ SHAP values are proposed by Lundberg and Lee (2017) to capture the impact of a feature's value on the outcome. The SHAP framework is based on Shapley values.

Annex Figure 3.4. SHAP Values for Year Dummies

Sources: Crunchbase, World Bank Development Indicators; and IMF staff calculations.

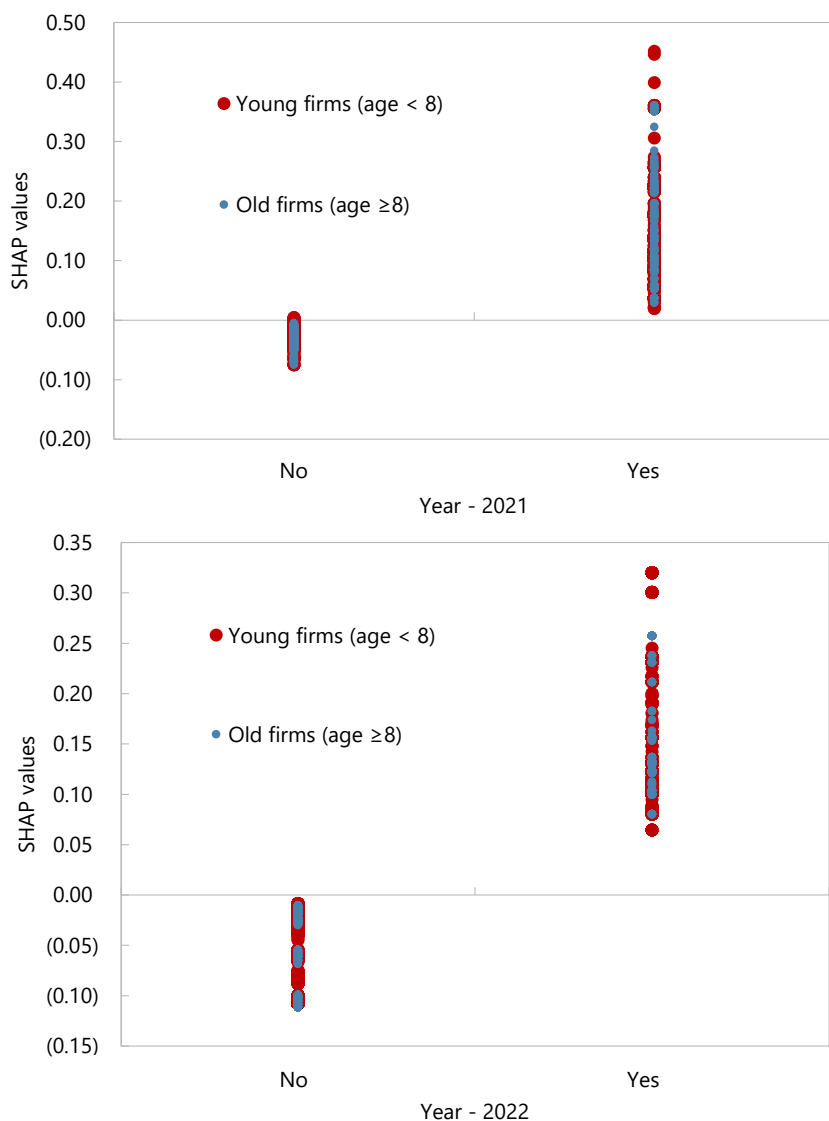
Note: A higher SHAP value indicates a higher probability of receiving financing. The pattern suggests that compared with an average year, firms had a larger probability of receiving financing in 2021 and 2022. For each year, mean, median, interquartile range, and 10th and 90th percentiles of SHAP values are shown.

The analysis also suggests that some young firms benefited more than other firms from the financing boom in 2021 and 2022. Annex Figure 3.5 shows SHAP values of year dummies for firms in different age groups. For the 2021 dummy, firms of lower ages (those below 8) have more dispersed SHAP values, and this pattern continues to hold for 2022. In both years, the firms with the highest probability of receiving financing are young firms.

Finally, fintech firms had a higher probability of receiving financing in 2021 and 2022 than in other years, after controlling for proxies of financial condition. It is interesting to note that after controlling them, the boom was still stronger in 2022 than in 2021 (Annex Figure 3.6). As global funding liquidity to emerging markets appeared to weaken in 2022 compared with 2021, as is suggested by BIS global liquidity indicators, the pattern in Annex Figure 3.6 supports our argument that, in addition to a global funding boom that benefited all firms, fintech-specific factors played a role in the 2021–22 fintech financing surge.⁶¹

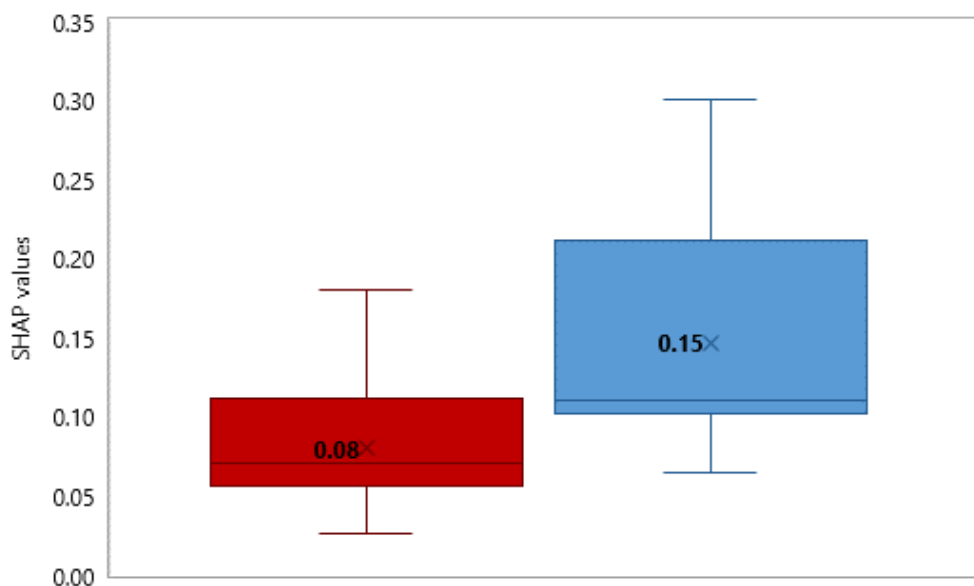
⁶¹ As we conjecture in the note for Annex Figure 3.6, selection bias could create an upward bias for the boom of venture capital/private equity financing for nonfintech firms reported by Crunchbase. If so, the stronger surge of VC/PE financing for fintech firms in 2021–22 than for nonfintech firms shown in Annex Figure 3.3 is also evidence for the role of fintech-specific factors in driving up funding during this episode.

Annex Figure 3.5. SHAP Values of Year Dummies: Age Groups



Sources: Crunchbase, World Bank Development Indicators; and IMF staff calculations.

Note: A higher SHAP value indicates a larger probability of receiving financing. The figure suggests that before 2021 the dispersion of the probability was similar for old and young firms. In 2021 and 2022 the dispersion was higher for young firms; the firms with the highest probability were young firms.

Annex Figure 3.6. SHAP Values of Year Dummies: Fintech Firms

Sources: Crunchbase; and IMF staff calculations.

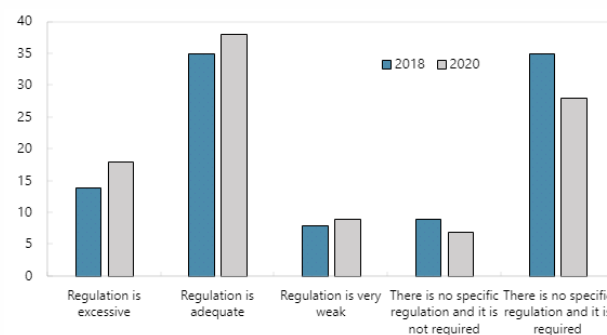
Note: A higher SHAP value indicates a higher probability of receiving financing. The figure shows the distributions of SHAP values for fintech firms for 2021 and 2022 year dummies. Given the main source of funding of nonfintech firms is not venture capital or private equity, the exercise of this figure serves as a robustness test. The pattern suggests that the positive SHAP values of 2021 and 2022 shown in Annex Figure 3.4 are not driven by nonfintech firms (whose SHAP values can be harder to interpret given the impact of selection bias—firms may show up in the Crunchbase database only because they received a funding deal during the pandemic, creating an upward bias in the role of being a nonfintech firm in receiving financing). The markers show the mean of the distributions.

Annex IV. Views of Fintech Companies of Regulation

Surveys of fintech companies show that regulation still has room to improve, even in countries with a high presence of fintech (IDB 2022).⁶² Two-thirds of Brazilian companies consider that regulation is adequate; the perception in Argentina and Mexico is close to the region’s average; and in Colombia and Chile, it is below average. In less mature fintech markets the proportion of companies that perceive regulation as adequate is lower, except for Uruguay. Regulation is better perceived by companies providing services in personal finance, insurance, consumer lending, crowdfunding, and digital banking. The perception about regulatory adequacy by companies in trading, asset management, wealth management, and corporate lending businesses is less favorable.

More than half of companies think that regulators have a weak openness to dialogue. Results vary by country: Brazil, Mexico, and Colombia show a more positive perception than Argentina and Chile. In markets with an emerging fintech industry, the general perception is that openness to dialogue is weak, except for in the Dominican Republic.

Annex Figure 4.1. Perception of the Regulatory Environment for Fintech Companies in Latin America



Source: IDB (2022).

⁶² IDB (2022).

Annex Table 4.1. Perception of the Quality of the Dialogue with Regulators of the Fintech Ecosystem

Country	Strong openness to dialogue	Weak openness to dialogue	No openness to dialogue
All	41.5	53.3	5.3
Main markets			
Argentina	22.6	71.0	6.5
Brazil	61.9	32.0	6.2
Chile	13.7	78.4	7.8
Colombia	51.2	46.3	2.4
Mexico	45.2	52.3	2.8
Emerging markets			
Dominican Republic	79.0	15.8	5.3
Peru	26.0	70.0	4.0
Costa Rica	28.6	57.1	14.3
Ecuador	14.3	64.3	21.4
Uruguay	20.0	70.0	10.0

Source: IDB (2022).

Annex V. Recent Regulatory Changes in Brazil and Colombia

Brazil

In March 2022, the Central Bank announced that financial conglomerates led by payment institutions (such as Nubank) will need to comply with the same capital requirements of traditional banks. The Central Bank considered it necessary to update the regulation, first issued in 2013, given the fast growth and sophistication of fintech companies. The new regulation, which will take effect in January 2023 and will be gradually implemented over the next eighteen months until January 2025, will extend the regulatory requirements currently used for conglomerates led by financial institutions to conglomerates led by payment institutions (IPs), varying according to their size and complexity. Under the new approach, IPs should gradually increase their amount of capital and exclude assets with a low capacity to absorb capital losses in times of stress, as is already the case with banks.

The new regulation mainly affects payment institutions with strong growth in recent years, such as Nubank. The regulation aims to keep simplified rules for new fintech companies entering the market. Following the announcement by the central bank, the shares of Nubank and other publicly traded Brazilian fintechs dropped significantly, as the new capital requirements will likely make operations more costly in the long term.

Brazil is a pioneer of open banking and open finance regulation in the region. The central bank had discussions with the industry about open banking initiatives in early 2019 as part of a broader financial system modernization, and the regulation was approved by the National Monetary Council and the Central Bank in early 2020. The project was initially scheduled to start in November 2020 with phase 1, but complexities in the process of standardizing data and difficulties faced by the participants institutions due to the pandemic delayed its implementation, which ended up taking effect in February 2021. In March 2022, the project that started as open banking was updated to open finance, considering the widening of its scope to encompass other products, such as investment, foreign exchange and insurance. Open finance is compulsory for some institutions (such as large banks) and voluntary for others. Clients are able to choose if they want their information shared or not.

The open finance ecosystem entered into operation in February 2021. The implementation has four phases:

Phase 1 was launched in February 2021, allowing participating institutions to provide standardized information about their service channels and the characteristics of traditional banking products available to the public such as deposits, savings accounts, and credit.

Phase 2, which started in August 2021, allowed the sharing of customer's registry and transactional data concerning the same traditional banking services covered in Phase 1 (account, credit card and credit operations).

Phase 3, launched in October 2021, allowed institutions to initiate payments, starting with Pix, and to make personalized credit proposals to clients that voluntarily shared their information (even if the person was not currently a client of the bank or IP).

During Phase 4, which began in December 2021, established that participants had to provide standardized information on data on non-traditional banking services like insurance, open pension funds, investment and foreign exchange, evolving to allow the sharing of transaction data on those services.

Colombia

In 2021, the government launched a regulatory sandbox for fintech companies. The sandbox defines the rules, requirements, proceedings, and conditions under which fintech projects or development programs can be tested. The goals are to promote innovation for financial products, channels, and services; protect financial consumers; encourage compliance with all laws and requirements intended to protect the stability of the financial system; and prevent regulatory arbitrage in new financial services and products. The sandbox is available both to companies already under control and supervision of the Finance Superintendence and to new companies. The trial period can extend up to two years, after which each participant will need to decide whether to obtain a permanent license and satisfy all the requirements for the activity or conclude the trial.

The regulation of open finance is at an early stage, and the model will be voluntary. In addition to facilitating the sharing of banking data through application programming interfaces (as proposed by open banking), the Colombian model contemplates the inclusion of data from other financial institutions. At the end of 2021, the government issued two documents that outline the foundations for the open finance model:

- A technical document from the Financial Regulation Unit (URF) that describes the general rules to implement open finance in the country and suggests a regulatory intervention.
- A draft decree from the Ministry of Finance and Public Credit on open finance (which was approved in July 2022), specifies the rules around the transfer of consumer data between financial entities. The document emphasized that entities supervised by the Financial Superintendence may commercialize the use, storage, and circulation of personal data, provided they have the express authorization from the data owner. It also stated that supervised entities may offer products and services of third parties in their virtual and face-to-face channels, with a previous authorization in their connection operations.

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