BIS Working Papers
No WP1129

Big techs in finance

by Sebastian Doerr, Jon Frost, Leonardo Gambacorta, Vatsala Shreeti

Monetary and Economic Department

October 2023

JEL classification: E51, G23, O31

Keywords: big techs, financial inclusion, competition, financial stability, data privacy

This publication is available on the BIS website (www.bis.org).

ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

Big techs in finance

Sebastian Doerr, Jon Frost, Leonardo Gambacorta and Vatsala Shreeti[1]

Abstract

The entry of big tech companies into the financial services sector can bring significant benefits in terms of efficiency and financial inclusion. Yet big techs can also quickly dominate markets, engage in discriminatory behaviour, and harm data privacy. This leads to the emergence of new trade-offs between policy goals such as financial stability, competition and privacy. Regulators, both domestically and internationally, are actively working to address these trade-offs. This paper provides an overview over the state of the literature and the policy debate.

Keywords: big techs, financial inclusion, competition, financial stability, data privacy

JEL classification: E51, G23, O31

[1] Sebastian Doerr is an Economist in Innovation and the Digital Economy (IDE) at the Bank for International Settlements (BIS). Jon Frost is Head of Economics for the Americas at the BIS and is a research affiliate of the Cambridge Centre for Alternative Finance (CCAF). Leonardo Gambacorta is Head of IDE at the BIS and is a research fellow of the Centre for Economic Policy Research (CEPR). Vatsala Shreeti is an Economist in IDE at the BIS. The views expressed in the chapter are those of the authors and not necessarily of the BIS. The authors would like to thank Giulio Cornelli and the editors Allen Berger, Philip Molyneux and John Wilson for excellent comments.

This chapter will appear in *The Oxford Handbook of Banking 4th edition*, published by Oxford University Press.

1. Introduction

Large technology companies, or big techs, are increasingly venturing into finance and transforming financial markets. Owing to their business models, big techs such as Alibaba, Amazon, Meta (Facebook), Alphabet (Google) and Tencent generate a large stock of user data. Access to user data allows them to offer a range of financial services, from payments to money management, insurance and lending.

Big techs' footprint in the financial services sector is rapidly expanding, and their activities have attained macroeconomic significance in several countries. This is particularly true in countries like China, Indonesia, Kenya and Korea. In recent years, the growth rate of big tech credit in China has outpaced that of traditional bank credit. For example, between 2020 and 2021, big tech credit in China experienced an average annual growth rate of 37%, while bank credit grew at a rate of 13%. A similarly rapid expansion is seen in other regions of the world.

This paper focuses on the rise of big techs in finance and its implications.

Following this first, introductory section, the second section discusses the business model of big techs and the data-network-activity (DNA) feedback loop. It also examines the determinants of big tech credit and how its supply is affected by country-specific characteristics.

The third section analyses opportunities and challenges arising from big techs providing financial services. Big techs' networks, access to non-traditional data and use of machine learning has the potential to enhance financial inclusion, especially among the unbanked part of the population. For example, with new data and methods for credit scoring, big techs can lend to individuals and businesses who may have lacked access to bank credit. Big techs can also enhance financial inclusion by reducing the need for collateral in credit markets. However, big techs' provision of financial services can lead to regulatory challenges like market dominance, price discrimination, algorithmic discrimination and threats to user privacy.

The fourth section discusses the role of public policy in striking a balance between these opportunities and challenges. The entry of big techs into finance, driven by the DNA feedback loop, has the potential to disrupt established paradigms and requires a new and holistic regulatory approach. The section thus puts emphasis on the new trade-offs between the policy goals of financial stability, competition and privacy.

The fifth section discusses how central banks, financial regulators as well as competition and data protection authorities can work together, both domestically and across borders, to achieve public policy goals. The sixth section concludes.

2. The business model of big techs and the data-network-activity loop

Big techs are large companies whose primary activity is digital services, rather than financial services (Frost et al, 2019). Their core business is in information technology and data analytics, often across multiple business lines in different sectors. Financial services form a small but growing part of the services they offer. Big techs primarily create value as online multi-sided platforms (MSPs), enabling and catalysing direct interactions between two or more groups of users (eg buyers and sellers). Three common types of online platforms are social networks, e-commerce platforms and search engines. Big techs differ from fintech companies, which provide technology-enabled innovation in financial services as their primary activity (FSB, 2017). Thus, the services provided by big tech in finance form a part of broader wave of fintech innovation (BIS, 2019).

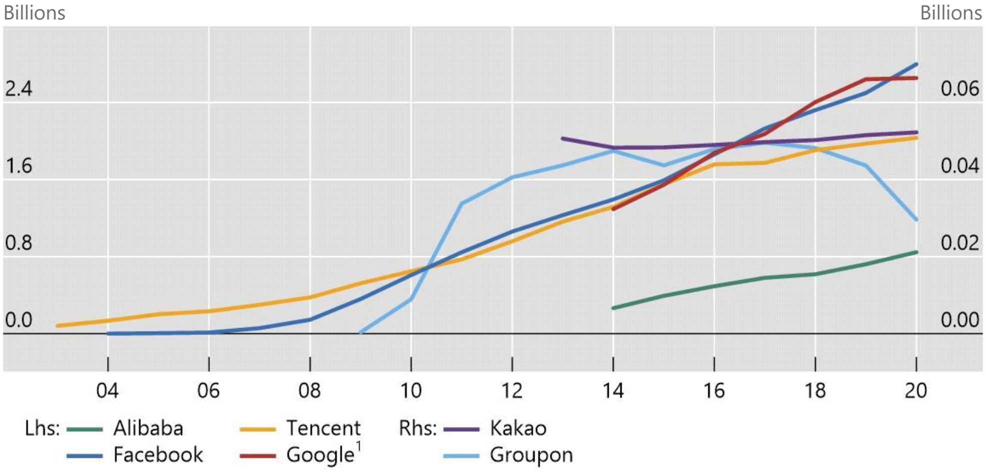
In contrast to traditional bilateral exchanges, users transact with each other *through* the platform – not *with* the platform. Social platforms, for example, allow people to connect to each other, and each member benefits from a larger community. Online shopping websites enable their users to buy and sell a wide variety of goods and services worldwide. A larger number of sellers reduces buyers' search costs, and a larger number of buyers expands sellers' business opportunities.

A typical feature of big techs is thus the presence of network externalities: the very fact that users participate on one side of the platform (eg buyers) increases users' benefits on the other side (eg sellers). One challenge is to attract users on both sides at the same time – a chicken-and-egg problem. Successful platforms solve this problem by using specific price structures, which essentially charge a lower fee to the side that creates the most network externalities – and letting the side that benefits the most from the network subsidise the other.

Once an MSP has attracted a sufficient mass of users on both sides, the emphasis is on increasing the number of users further. The hope is to reach the tipping point at which adoption rates accelerate and network effects kick in. Beyond this point, growth can be very fast. More buyers bring more sellers – and vice versa. The MSP thus enjoys increasing returns to scale: the average cost of serving a user declines with the total number of users. And users are willing to pay more for access to a bigger network. As a result, the platform's margins improve.

Figure 1 shows that big techs have become increasingly popular over the years – the number of active users of big techs like Alibaba, Tencent and others has been increasing rapidly over time. Figure 2 shows big techs' growing activity in the payments market. Payment apps provided by big techs have become especially popular in emerging market and developing economies.

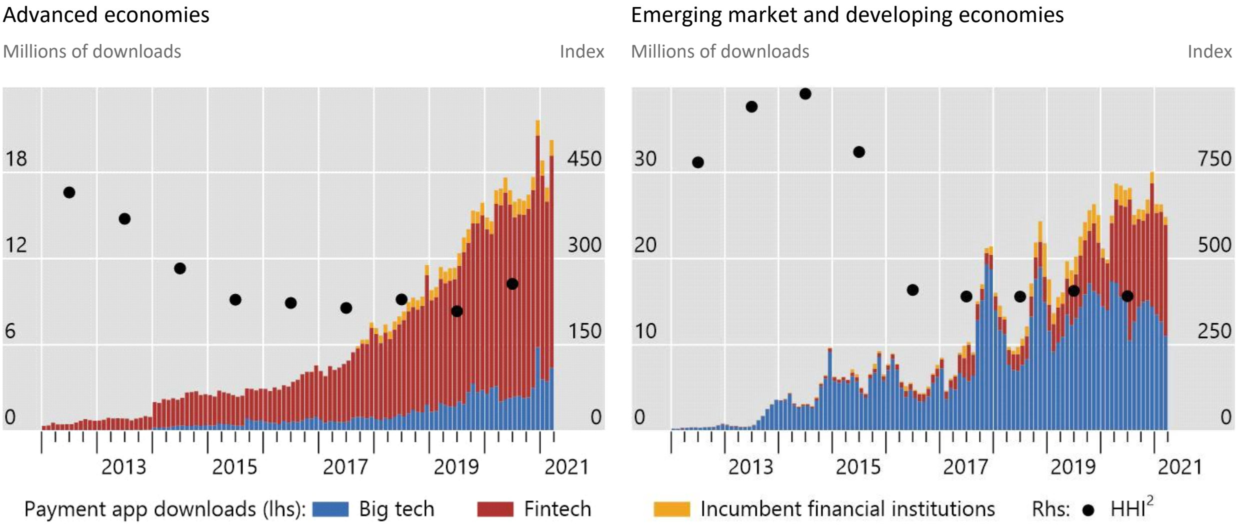
Monthly active users of selected big techs	Figure 1



[1] The number of Chrome users is used as a proxy for Google's number of active users.

Source: BIS (2019); Carstens et al (2021); Miller and Friesen (1984); S&P Capital IQ; Authors' calculations.

Downloads of payment apps by fintech firms, big tech firms and incumbents[1]	Figure 2



HHI = Herfindahl–Hirschman Index of market concentration.

[1] Downloads of all payment apps among the top 50 finance apps as classified by Sensor Tower. "Fintech" refers to apps by new entrants specialised in financial technology; "big tech" refers to apps by large technology companies whose primary activity is digital services, rather than financial services, and "incumbent financial institutions" refers to apps from commercial banks, insurers, card networks and other financial institutions. [2] Yearly average; calculated on the top 50 finance apps as classified by Sensor Tower.

Sources: Sensor Tower; authors' calculations.

2.1 Big techs as providers of financial services

Big techs are now present in the financial sector in many parts of the world. Their presence is most visible in China, with Ant Group (part of the Alibaba group) and

Tencent's WeBank providing a broad range of financial services. They are also active in a number of countries in East Africa and Egypt (Vodafone M-Pesa), India (PhonePe and Alphabet (Google)), Argentina, Brazil and Mexico (Mercado Libre), Japan (Line, NTT Docomo, Rakuten), Korea (Kakao Bank, KBank), Indonesia, Malaysia, Singapore (Go-Jek, Grab) and in the United States (Amazon, Apple, Meta (Facebook), Alphabet (Google)) (Zetsche et al, 2017; Frost et al, 2019; Cornelli et al, 2023).

The recent Covid-19 pandemic also provided a push for services and products offered by big tech companies. This included a large uptick in the use of digital payments (Auer et al, 2022), but it was certainly not limited to services and products in the financial sector.[2] E-commerce also experienced a large boost, for instance (Alfonso et al, 2021).

Big tech companies with large networks and a broad range of activities have access to extensive user data. They use such data to enter new markets such as financial services, often starting by providing payment services. Payment services provided by big techs allow settlement at delivery on e-commerce platforms and help overcome the lack of trust between buyers and sellers (BIS, 2019). Their participation in this market is especially important in jurisdictions where the penetration of other digital payment methods is low, and where mobile phone penetration is high (Boissay et al, 2021).

The market for payments can be particularly attractive for big techs as it is ripe for disruption. Traditionally, most of the revenue in this market is shared between card networks, like Visa and Mastercard, and banks, which typically have large margins. For example, in the US, Visa and Mastercard have margins as high as 50% (The Economist, 2023). This provides an opportunity for big techs to leverage their unique position as a repository of consumer data and multi-sided platform and offer payment services at lower prices than the traditional players.[3]

Once they have made inroads in providing payment services, big techs might expand into providing credit, insurance, savings and investment products, making use of the data they generated through their payment services. They provide these services both in cooperation and competition with traditional financial institutions. Often, they provide basic financial services (like payments) themselves and serve as a distribution channel for third-party providers for services like wealth management or insurance (BIS, 2019).

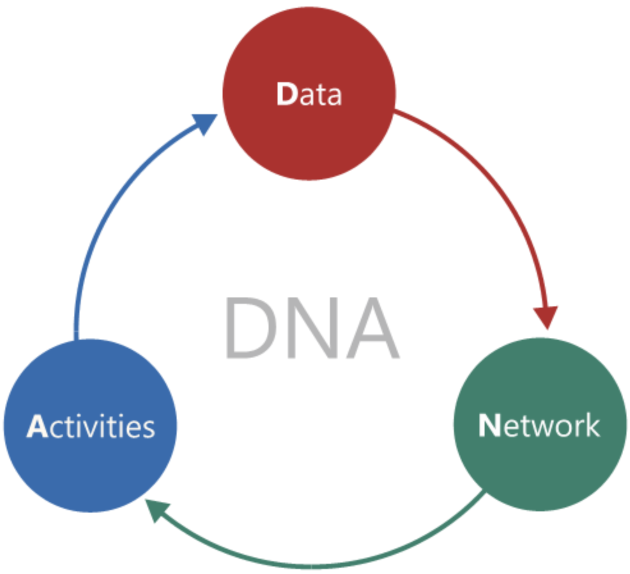
[2] Big tech companies experienced unprecedented growth in their revenues in 2020, but subsequently there have been extensive layoffs in Alphabet (Google), Meta (Facebook) and Amazon. See Ovide (2021) and Duffy (2023).

[3] It is worth noting that big techs appetite to enter different markets is driven in part by their ability to absorb losses. Unlike smaller firms, big techs typically have deep pockets, which means that they are not forced to exit the market even if some specific products fail.

2.2 The Data-Network-Activity feedback loop

Big techs' distinctive business model in finance relies on data analytics, network externalities and interwoven activities ("DNA", Figure 3). These three elements reinforce each other. Network externalities allow big techs to generate more data, the key input into data analytics. The analysis of large troves of data enhances existing services and attracts further users. More users, in turn, provide the critical mass of customers to offer a wider range of activities, which yields even more data.

Data Network Activity Loop — Figure 3



Source: BIS (2019)

Externalities are stronger on platforms that offer a broader range of services. Financial services both benefit from and fuel the DNA feedback loop. Offering financial services can complement and reinforce big techs' commercial activities. The typical example is payment services, which facilitate secure transactions on e-commerce platforms, or make it possible to send money to other users on social media platforms. Payment transactions also generate data detailing the networks between fund senders and recipients. These data can be used both to enhance existing services (eg targeted advertising) and to provide other financial services, such as credit scoring.

The source and type of data and the related DNA synergies vary across big tech platforms. Those with a dominant presence in e-commerce collect data from vendors, such as sales and profits, combining financial and consumer habit information. Big techs with a focus on social media have data on individuals and their preferences, as well as their network of connections. Big techs with search engines do not observe connections directly, but typically have a broad base of users and can infer their preferences from their online searches – in which users may divulge very personal information about their interests, preferences, geolocation and more.

The exact type of synergy between data collection and the provision of financial services varies with the nature of the data collected. Data from e-commerce platforms can be a valuable input into credit scoring models, especially for small and medium-sized enterprise (SME) and consumer loans. Big techs with a large user base in social media or internet search can use the information on users' preferences to market, distribute and price third-party financial services (eg insurance).

Banks versus big techs – competitive advantages (+) and disadvantages (–)

Table 1

	Large banks	Big techs
Data	+ Verified/reliable customer data with a long history; "soft" information from personal interactions with customers; high importance of data privacy to support customer trust.	– Mixture of verifiable and potentially less reliable data; shorter history of customer data; lower priority placed on data privacy and protection.
	– Small number of customers and limited range of non-financial activities to collect data from; transactional data often "one-sided" (eg counterparty of transactions with another bank); legacy technology limits data processing capabilities.	+ Data on a very large number of customers; technology and business model built to collect and merge data; network of customer interactions is a key data dimension.
Network	+ Large number of financial activities and services already provided.	– Need to reach a large customer base to exploit network externalities.
	– Strict regulatory limits on activities and use of data; higher marginal costs of serving additional customers.	+ Significant network externalities due to wide range of non-financial activities; captive ecosystem with potential high exit costs.
Activities	+ Advantages in high-margin and complex products requiring personal interaction (eg corporate finance, investment banking); wider range of financial services; access to large and relatively cheap funding sources; experience in risk management.	– Thus far limited or no footprint in key financial services (eg mortgages, loans to medium and large firms, insurance); funding limitations; lack of regulatory and risk management experience and expertise.
	– Legacy IT systems are a barrier to using existing data to offer new services (low economies of scope); activities limited to financial services.	+ Digital services can be provided at near-zero marginal costs; pre-existing commercial activities yield data that can be used to support new services (high economies of scope).

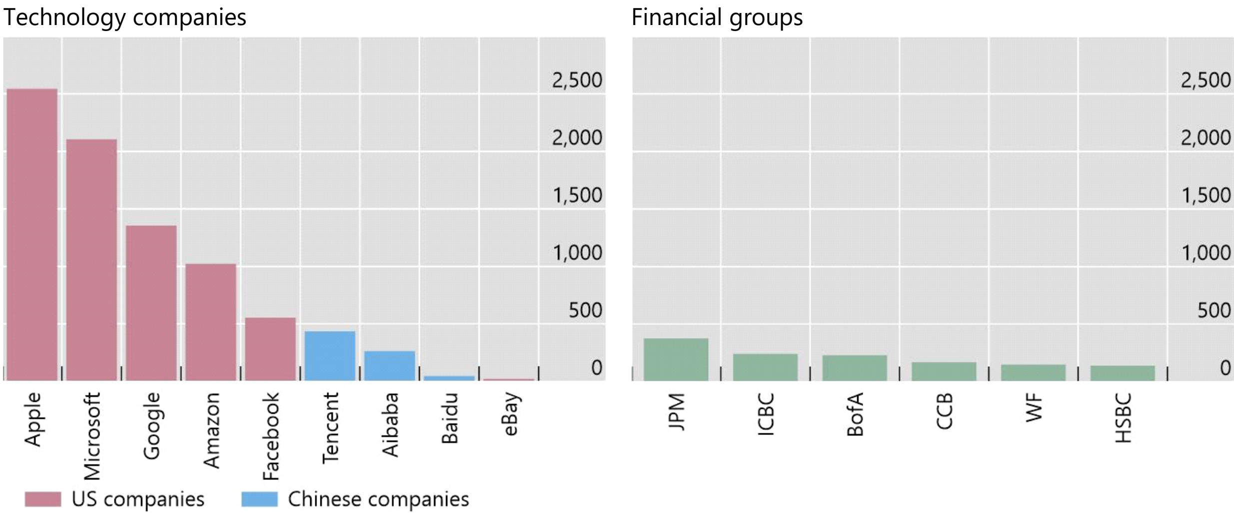
Source: BIS (2019).

Although large banks have many customers and also offer a wide range of services (eg distribution of wealth management or insurance products, mortgages), they have so far not been as effective as big techs at harnessing the DNA feedback loop (BIS, 2019). Other than payments, banks have not exploited activities with strong network externalities. One reason is the required separation of banking and commerce in most jurisdictions. As a result, banks have access mostly to account transaction data only. Moreover, legacy IT systems are not easily linked to various other services through, for instance, application programming interfaces (APIs). Combining their advanced technology with richer data and a stronger customer focus, big techs have been adept at developing and marketing new products and services. A comparison of banks and big techs comparative advantages and disadvantages is provided in Table 1.

Market capitalisation of big tech firms and major financial groups

In billions of USD

Figure 4



BofA = Bank of America; CCB = China Construction Bank; ICBC = Industrial and Commercial Bank of China; JPM = JPMorgan Chase; WF = Wells Fargo.

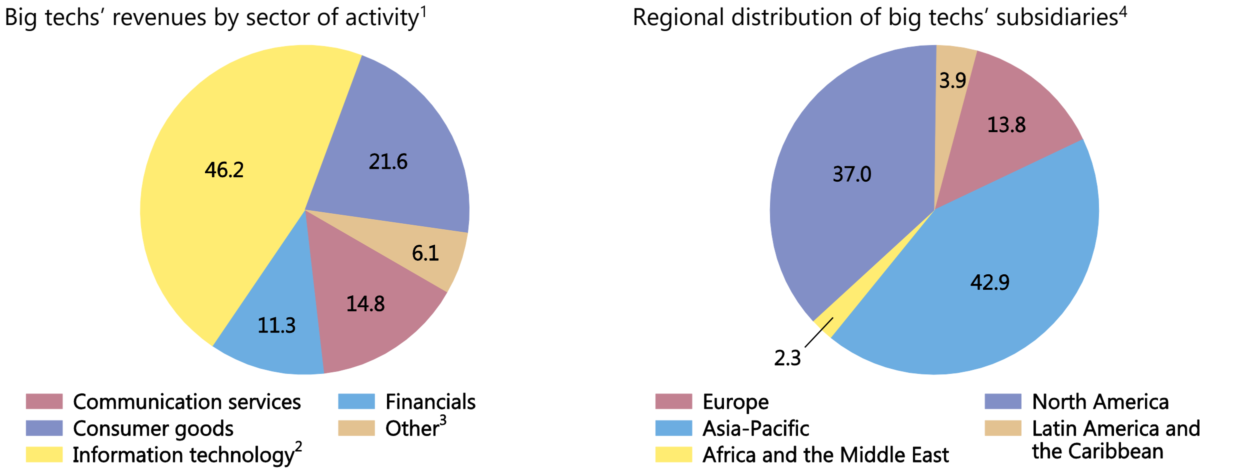
Stock market capitalisation, as of 11 April 2023.

Sources: Refinitiv Eikon; company reports.

Compared to globally systemically important banks, big tech companies are bigger in terms of market capitalisation (Figure 4). However, financial services are only a small part of the business of big techs. For instance, only 11% of big techs' revenues come from financial services (Figure 5). Moreover, big techs might face higher funding costs since they do not take deposits. To raise funding, they rely either on their own liquidity or build partnerships with banks. This limitation on raising funds might prevent big techs from scaling up their lending services, and the lack of a deposit base prevents them more flexibly providing credit to the real economy.

Financial services are a small part of big tech business

In per cent Figure 5



The sample includes Alibaba, Alphabet, Amazon, Apple, Baidu, Grab, Kakao, Mercado Libre, Meta, Rakuten, Samsung and Tencent.

[1] Shares based on 2018 total revenues, where available, as provided by S&P Capital IQ; where not available, data for 2017. Data accessed on 3 June 2019. [2] Information technology can include some financial-related business. [3] Includes health care, real estate, utilities and industrials. [4] Shares are calculated on the number of subsidiaries as classified by S&P Capital IQ. Data accessed on 3 June 2019.

Sources: BIS (2019).

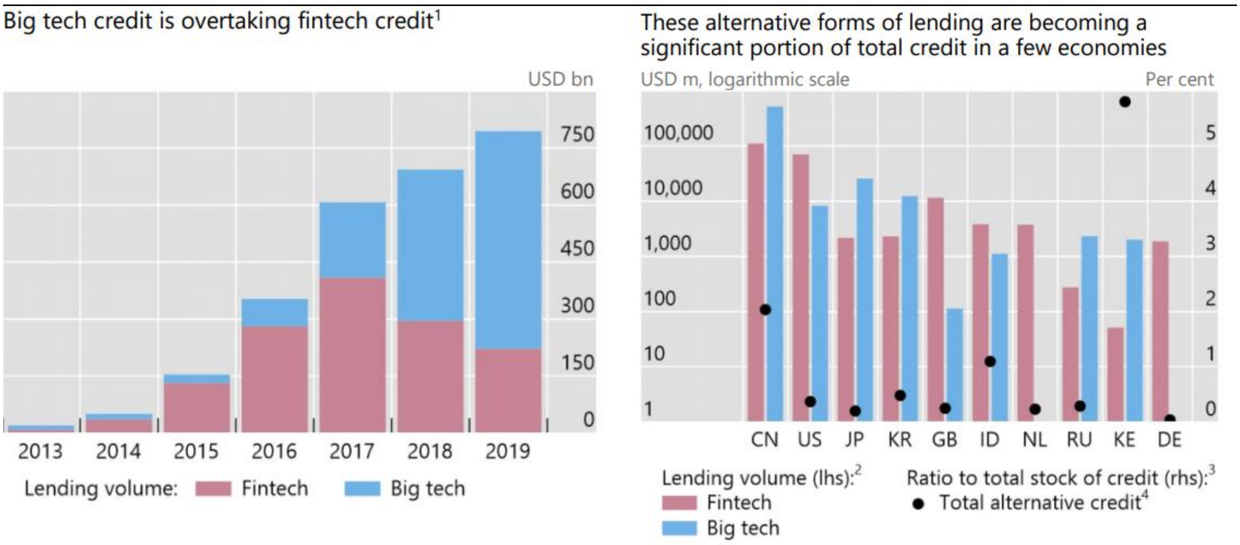
2.3 Drivers of big techs' provision of financial services

Big techs have become macroeconomically relevant in several countries, eg China, Indonesia, Kenya and Korea, especially in payments and credit. Recently, the pace of increase in big tech credit has been faster than that for bank credit (Cornelli et al, 2023). For instance, during 2020-21, big tech credit in China recorded an estimated growth rate of 37%, compared with 13% for bank credit. Still, the total size of credit made available by big tech and fintech together varies across countries: 5.8% of the total credit stock in Kenya, 2% in China, 1.1% in Indonesia and less than 1% in the US, the UK, Japan and South Korea. Figure 6 presents the growth of big tech credit globally.

Recent literature has been able to identify the demand and supply factors that explain the expansion of credit provision by big techs and more generally, fintechs.

Big tech (and fintech) credit volumes are higher wherever there is unmet credit demand and where it is more attractive for new intermediaries to offer credit (Cornelli et al, 2023). Big tech credit activity increases with the GDP per capita of a country, but at a decreasing rate (Claessens et al, 2018; Frost et al, 2019; Cornelli et al, 2023). As general economic development increases and markets become mature, both firms and consumers demand more credit. Alternate sources of credit provided by big techs and fintechs then become relevant.

Big tech credit is booming | Figure 6



The sample includes Alibaba, Alphabet, Amazon, Apple, Baidu, Grab, Kakao, Mercado Libre, Meta, Rakuten, Samsung and Tencent.

Figures include estimates. CN = China, US = United States, JP = Japan, KR = Korea, GB = United Kingdom, ID = Indonesia, NL = Netherlands, RU = Russia, KE = Kenya, DE = Germany. 1 2019 fintech lending volume figures are estimated on AU, CN, EU, GB, NZ and US. 2 Data for 2019. 3 Domestic credit provided by the financial sector. Data for 2018. 4 Total alternative credit is defined as the sum of fintech and big tech credit. Data for 2019.

Sources: IMF World Economic Outlook; World Bank; Brismo.com; Cambridge Centre for Alternative Finance and research partners; WDZJ.com; companies' reports; Cornelli et al (2023)

The level of competition in the banking sector has also shaped big tech credit activity: when banking sector margins are high (measured by the Lerner index) and there is a lack of competition, there is more room for fintech and big tech credit to develop (Cornelli et al, 2023). Several mechanisms can potentially explain this result. Big techs may provide more flexible and quicker credit than banks. Moreover, when competition is low, big techs are more likely to enter the credit market attracted by higher margins.

There are also several supply-side factors that explain big tech activity in finance in general and credit provision specifically. As mentioned, a key driver of their activity is the use big data and machine learning algorithms by big tech companies. This provides them with a technological advantage in credit provision, which can be used to improve the accuracy of credit decisions (Jagtiani and Lemieux, 2019; Berg et al., 2020; Gambacorta et al, 2020). Moreover, machine learning techniques have been shown to bring significant improvements to risk management and compliance by enabling better detection of fraud, financial crimes and regulatory violations (van Liebergen, 2017).

Another important supply-side factor that shapes big tech credit is the regulatory regime of a country. More stringent banking regulation is linked to less big tech and fintech credit activity (Barba Navaretti et al, 2020; Cornelli et al, 2023). This could be because it is easier to launch new lending products in countries with more relaxed prudential and bank licensing regimes (Cornelli et al, 2023). Yet tight regulation can also lead to regulatory arbitrage, for instance if regulations constrain traditional banks but not fintechs or big techs (Buchak et al, 2018).

Finally, there is a broad range of institutional characteristics that matter for big tech credit activity, such as the ease of doing business, disclosure rules, investor protection and the development of financial markets. For example, in the case of crowdfunding platforms, Rau (2020) finds that legal frameworks that provide transparency and accountability are crucial for fostering trust and attracting investors. More generally, a study by the World Bank (2020) finds that improving regulatory frameworks to promote transparency and accountability can help to develop capital markets, especially for SMEs that are often underserved by the banking sector.

3. Opportunities and challenges of big techs in finance

The inherent characteristics of big techs can make it easier and more affordable for them to provide financial services, leading to increased access for more people, thereby enhancing financial inclusion. However, it is important to note that the benefits of big tech in financial services may not be uniform across all types of services and may also introduce new risks and problems in the marketplace. Sections 3.1 and 3.2 describe the benefits that big techs can bring to the market for financial services, while sections 3.3 and 3.4 outline the challenges arising from their activity.

3.1 Screening and financial inclusion

Financial inclusion entails that individuals and businesses have access to a range of affordable financial products and services to meet their needs – transactions, payments, savings, credit and insurance (CPMI and World Bank, 2020). Access to a transaction account is generally a first but important step, so that individuals and businesses can make and receive payments. But it is not sufficient. After a transaction account, a key area is access to credit.

Credit extension relies on the ex-ante evaluation of credit risk and ex-post enforcement of credit repayment. For banks, the cost of providing credit depends not only on the cost of raising funds but also on the assessment of credit risk and enforcement throughout the lifetime of a loan. To price loans, banks gather information from various sources about the riskiness of their borrowers and rely on forming close relationships with them. Banks oversee borrowers or demand collateral to encourage them to repay their loans and restrict losses in the event of default. Since these procedures are time-consuming and expensive, banks require compensation in the form of fees or interest rate spreads. Big techs' access to and use of big data for screening and monitoring borrowers' activity can reduce these costs, which could improve efficiency and broaden access to financing.

In the traditional financial system, banks are unable or unwilling to serve some borrowers due to prohibitively high information costs. This puts borrowers who lack basic documentation or are difficult to reach at risk of exclusion, such as SMEs in remote areas in developing economies that lack audited financial statements. Big techs can potentially reduce these barriers to financial inclusion by decreasing information and transaction costs.

For big techs, the process of providing a loan typically involves decisions based on predictive algorithms and machine learning applied to new types of data (Frost et al, 2019). These new data can come from e-commerce platform activity or social media activity (Jagtiani and Lemieux, 2019). Depending on the nature of the big tech platform, they include: (i) data on sales volumes and average selling prices; (ii) claim ratios, handling times and complaint data; and (iii) industry-specific characteristics. Big tech companies like Mercado Libre and Ant Group often have up to 1,000 data points per borrower. On the other hand, traditional banks more often rely on the judgement of a loan officer.

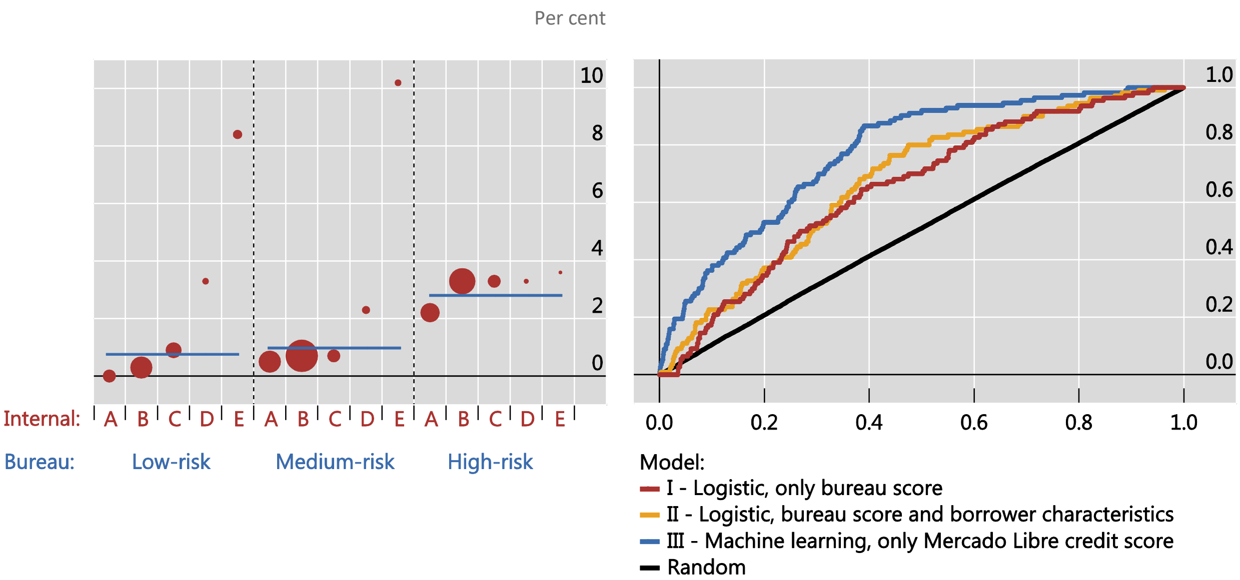
The use of machine learning techniques allows the credit provision process to be more comprehensive. It can entail faster credit risk assessment and avoidance of human bias in the decision-making process (even if it introduces the risk of algorithmic biases, which we discuss below). The use of alternative data hence promises to open the credit market to borrowers (for example SMEs) that are otherwise excluded from the traditional banking system.

In Argentina, for Mercado Libre, Frost et al (2019) find that if the screening process for credit provision was based only on the data available to the local credit bureau, 30% of the people that received credit would have been deemed "high-risk" and excluded from the program.

The different buckets are represented in the left-hand panel of Figure 9. For a given bureau rating (eg low risk), the expected loss rate is strictly monotonic with the internal rating (ie the patterns of the dots show that the internal rating orders expected loss). Conversely, given an internal rating (eg C, D or E), the loss rate is not strictly monotonic with the bank bureau risk. For example, the dot associated with internal rating D in the low-risk bureau category indicates a higher risk than the internal rating D in the medium-risk bureau category. Moreover, the internal rating has a broader range, covering losses from 0.0% to 10.2%; the bureau rating ranges from 0.7% to 2.8%. Most importantly, by using its proprietary scoring model, Mercado Libre can serve the profiles assessed as 'high risk' by the bureau. The size of the dots is proportional to the share of the firms in rating distribution. As shown, 30% of the portfolio originated by Mercado Libre would fall into the 'high risk' cluster. B.

Credit assessment and big data analytics | Figure 7

Loss rate[1] | Receiver operating characteristics (ROC) curve[2]



[1] The loss rate is the volume of loans more than 30 days past due relative to the origination volume. To date, Mercado Libre's internal rating system has proved better able to predict such losses. It segments loan originations into five different risk groups as compared with the three clusters identified by the bank bureau. The size of the dots is proportional to the share of the firms in the rating distribution. [2] True positive rates versus false positive rates for borrowers at different thresholds for a logistic model with only the credit bureau score (I), a logistic model with the bureau score and borrowers' characteristics (II), and a machine learning model with the Mercado Libre credit score (III). A random model is included for comparison purposes. The ROC curve shows that the machine learning model has superior predictive power to both the credit bureau score only and the credit bureau score with borrower characteristics.

Source: Frost el al (2019).

Moreover, the internal rating process of Mercado Libre predicts delinquency (the volume of loans past the due date by more than 30 days) better than the credit score of the local credit bureau. Mercado Libre also has a more nuanced rating process – it segments borrowers into five groups based on their risk, as opposed to only three by the credit bureau. Moreover, the relationship between the expected loss rate (based on the volume of loans overdue by more than 30 days) and the internal rating based on Mercado Libre's data is more flexible and considers non-linearities.

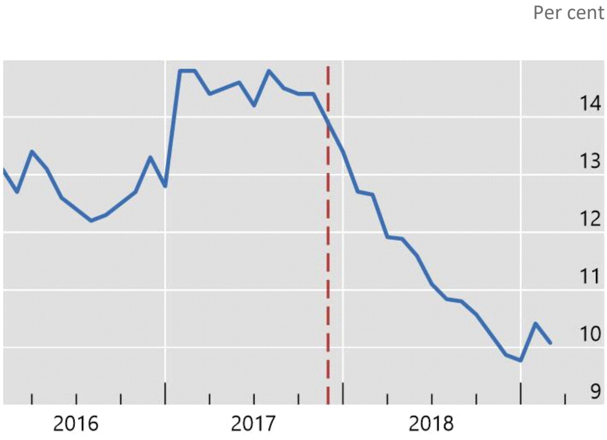
To provide further evidence of the information advantage of big techs in providing credit, the right panel of Figure 7, drawn from Frost et al (2019), shows the receiver operating characteristics (ROC) curve for the credit bureau models and the big tech model that employs machine learning and big data (based on Mercado Libre's data). The ROC curve is created by plotting the true positive rate (TPR) against the false positive rate (FPR) at various threshold settings.[4] The area under this curve ranges from 50% (for a purely random prediction, represented by the black 45-degree line) to 100% (for a perfect prediction, in the top left corner of the graph). The right panel of Figure 7 shows a logistic model with only the credit bureau credit scores (red line), a logistic model with the credit bureau credit scores and borrower specific characteristics (yellow line), and finally the machine learning model of Mercado Libre applied to data from the e-commerce platform. The figure shows that the predictive power increases substantially for the machine learning model that uses new data sources.

There is also evidence to show that big tech credit scoring exhibits greater predictive power following an economic shock, compared to traditional credit scoring methods. Gambacorta et al (2023) analyse the impact of a regulatory change on the performance of credit scoring models in China. In November 2017, the People's Bank of China issued draft guidelines to regulate shadow banking (marked by the dotted red line in left panel of Figure 8). As per these guidelines, financial institutions were prohibited from using asset management products to invest in commercial banks' credit assets or provide funding services for fintech companies to bypass regulation. As a result of this shock, the supply of loans, especially to more risky borrowers, decreased substantially (left panel of Figure 8). The rate of growth in total credit in the Chinese economy fell by 4 percentage points in less than one year after these regulatory changes. Moreover, the sudden freeze on rolling over credit lines to risky borrowers caused many small and medium enterprises to default.

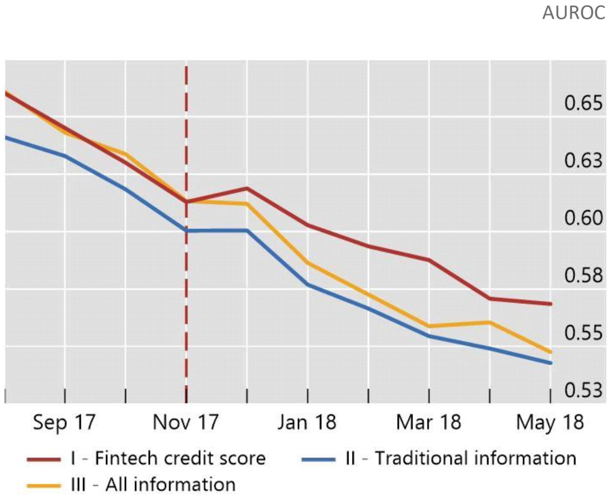
[4] True positive rate is the rate of obtaining a test result that correctly indicates the presence of a condition or characteristic. False positive rate is the rate of obtaining A test result which wrongly indicates that a particular condition or attribute is present.

Fintech credit scores show greater predictive power after a change in regulation | Figure 8

Annual growth in total credit to the Chinese economy



Predictive power of traditional vs fintech credit score[1]



The vertical dashed line indicates when the People's Bank of China (PBoC) issued specific draft guidelines to tighten regulations on shadow banking. In particular, from 17 November 2017, financial institutions have not been allowed to use asset management products to invest in commercial banks' credit assets or provide "funding services" for other institutions (such as fintech companies) to bypass regulations. The new rule has had a huge impact on fintech companies' funding sources. The PBoC set also a limit on the interest rates charged by P2P lending companies. All annualised interest rates, which include the upfront fees charged for loans, were capped at 36%. The effects of these new rules were also reinforced by the strict measures concerning online micro-lending that were imposed on December 1, 2017 by China's Internet Financial Risk Special Rectification Work Leadership Team Office.

[1] The vertical axis reports the Area Under the ROC curve (AUROC) for every model. The AUROC is a widely used metric for judging the discriminatory power of credit scores. The AUROC ranges from 50% (purely random prediction) to 100% (perfect prediction).

Source: Gambacorta et al (2023).

The right panel of Figure 8 shows the ROC curve for three models – (i) the big tech scoring model (in red), (ii) logit with traditional information (in yellow) and (iii) logit with all the information (blue). Prior to the shock, the fintech model and the logit model with traditional and non-traditional information perform similarly. However, after the regulatory shock, the fintech credit score model performs better the other models. According to Gambacorta et al (2023), one potential explanation for this might be the relative benefit of the non-linearity in machine learning models when there is a change in the external environment. Machine learning algorithms seem to adapt better to new information.

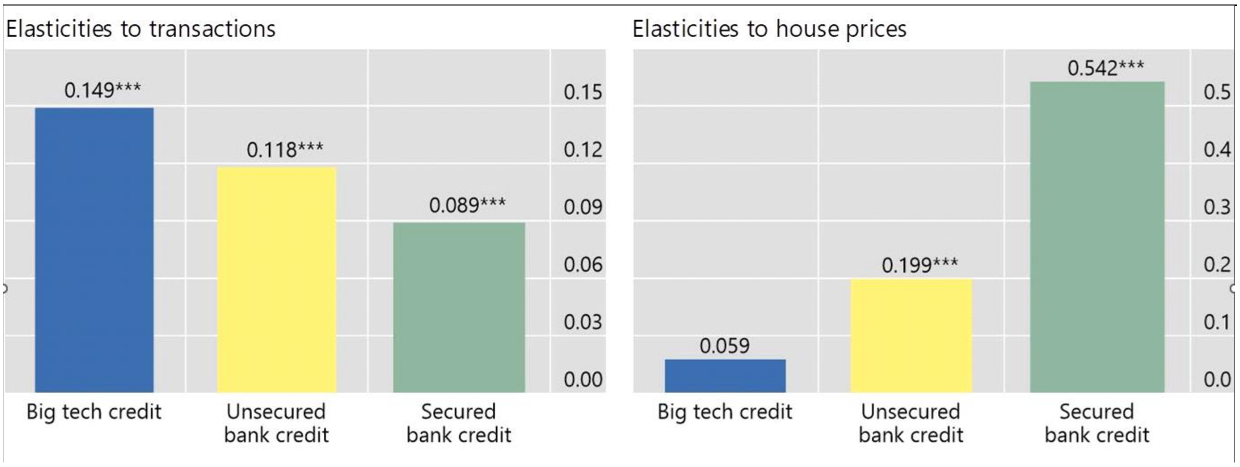
3.2 Monitoring and collateral

In addition to assessing credit risk, lenders need to incur costs to monitor borrowers and enforce loan repayments. Traditionally, banks often require tangible assets (like real estate) as collateral from borrowers to tackle enforcement problems. These assets are used to increase recovery rates in case the borrower defaults on the loan repayment. Banks also spend time and resources to monitor their clients' projects to limit the risk that borrowers implement them differently from what was agreed initially. Through this process, they can build long-term relationships with borrowers.

Big techs could monitor the repayment of loans more efficiently than banks. For example, big techs can ensure repayment of credit by threatening to exclude firms from their ecosystem, or by deducting payments from firms' revenues in the case where they provide an e-commerce platform on which the firm operates. Moreover, unlike banks, big techs do not necessarily have to rely on collateral to provide loans. They can tackle the problems arising from asymmetric information by using non-traditional data from their businesses, which banks do not have access to.

Data vs collateral: Big tech credit reacts less to changes in house prices and more to firm-specific characteristics

Figure 9



Dashed lines indicate 5th/95th percentiles. The x-axis reports the quick response (QR) code duration, that is the number of months after the firm started to use the QR code payment system. The y-axis reports the probability for a firm of having access to big tech credit.
Source: Gambacorta et al (2023).

Gambacorta et al (2023) show that data indeed replaces collateral in China. They study a random sample of more than 2 million Chinese firms that have received credit from Ant Group and traditional banks. They analyse how credit provided to these firms (big tech credit, secured bank credit or unsecured bank credit) reacts to changes in the firm-specific transaction volumes and to the general macroeconomic climate (measured by house prices).

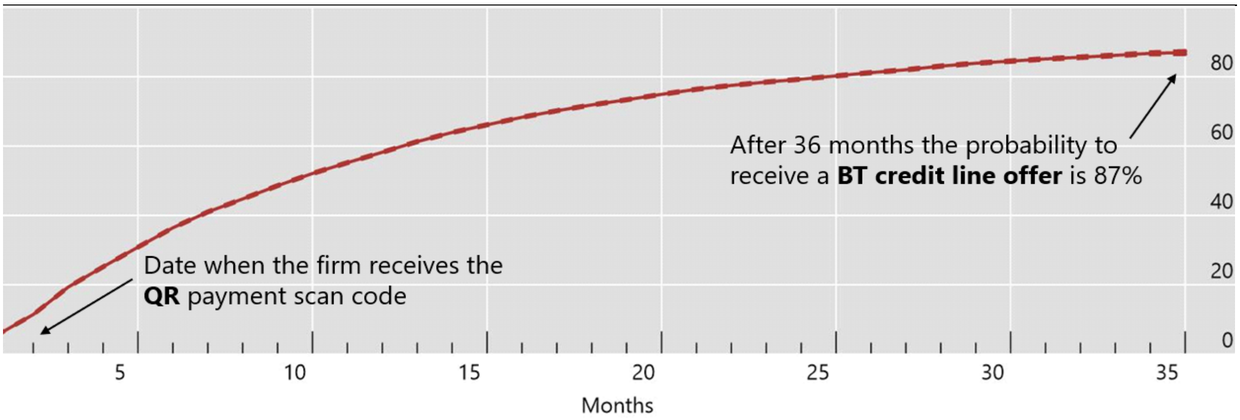
The authors find that credit provided by big techs is not correlated with local economic conditions or house prices but responds strongly to transaction volumes of the firm and firms' credit ratings. On the other hand, credit provided by banks (secured and unsecured) is significantly correlated with local economic conditions. These findings are summarised in Figure 9. Since big techs do not have to rely on collateral (like a house) to enforce repayment, big tech credit does not respond significantly to the housing cycle. This can change the monetary policy transmission mechanism: the collateral channel is weakened while big tech credit reacts more to idiosyncratic shocks to firms.

Another important feature of big tech credit is the use of data from ancillary services (like payments) to generate digital footprints for small firms that can be used to generate credit scores. In China, Ant Group provides payment services through quick response (QR) codes and provides access to offline merchants to digital payment services. It then uses the information on merchants' payment histories to provide credit to the merchants (or not). The use of QR codes for payments in China allows these merchants to access credit from not only the Ant Group itself, but also unsecured bank credit.

The use of QR code in payment allows firms to have access to big tech credit

In per cent

Figure 10



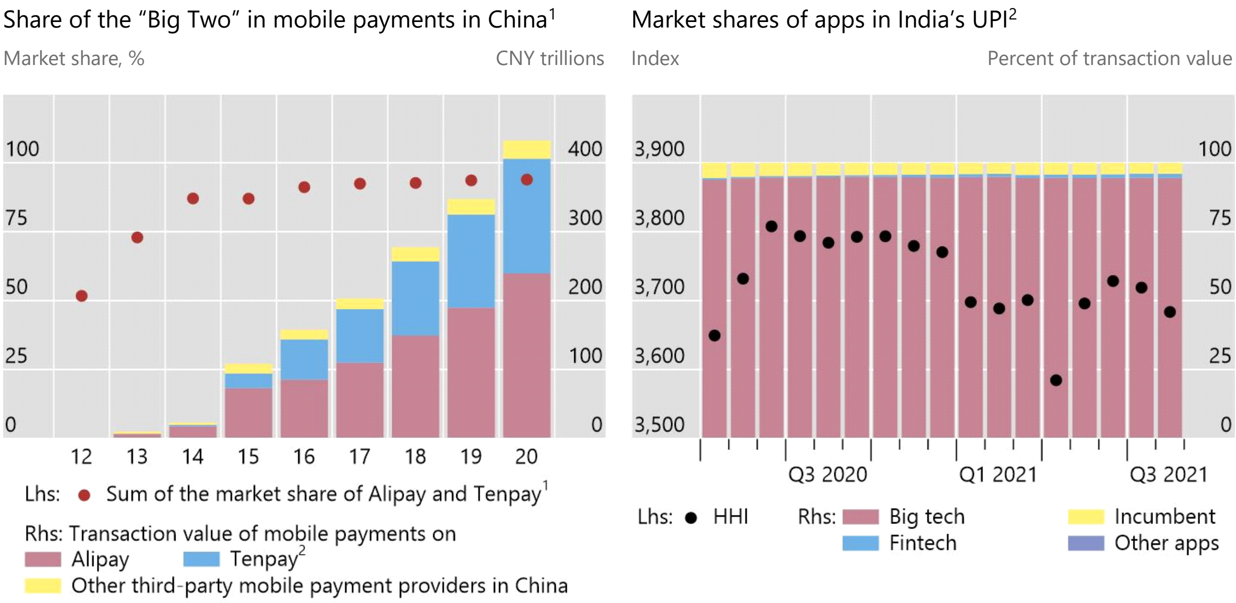
Dashed lines indicate 5th/95th percentiles. The x-axis reports the QR code duration, that is the number of months after the firm started to use the QR code payment system. The y-axis reports the probability for a firm of having access to big tech credit.
Source: Beck et al (2022)..

Figure 10 shows the probability that a firm using QR code payments receives credit. The x-axis represents the number of months since the firm starts using QR code-based payments. The y-axis represents the probability that a firm has access to big tech credit. The longer a firm uses QR code payments, the faster the likelihood of gaining access to big tech credit increases. For instance, one year after starting the use of QR code payments, the probability of having access to a big tech credit line is almost 60 per cent. This probability increases to 80 per cent after two years and to 87% after three years (Beck et al, 2022).

3.3 Market power and abuse of data

The previous sections have shown that big techs' entry into finance can bring efficiency gains and further financial inclusion. However, due to the nature of their business model, big techs can quickly attain a dominant position in the market. Once big techs have established a captive consumer base, they can abuse their dominant position in the market to prevent the entry of competitors, increase switching costs, bundle products and promote their own products at the expense of third-party sellers.

Big techs dominate digital payments in China and India | Figure 11



HHI = Herfindahl–Hirschman Index of market concentration.

[1] Market shares for 2012 are estimated based on market evidence. [2] Tenpay includes WeChat Pay and QQ Wallet. [3] Big techs are Google Pay, PhonePe, Paytm Payment Bank, Amazon Pay, Airtel Payments Bank Apps, MI Pay, Samsung Pay and WhatsApp Pay.

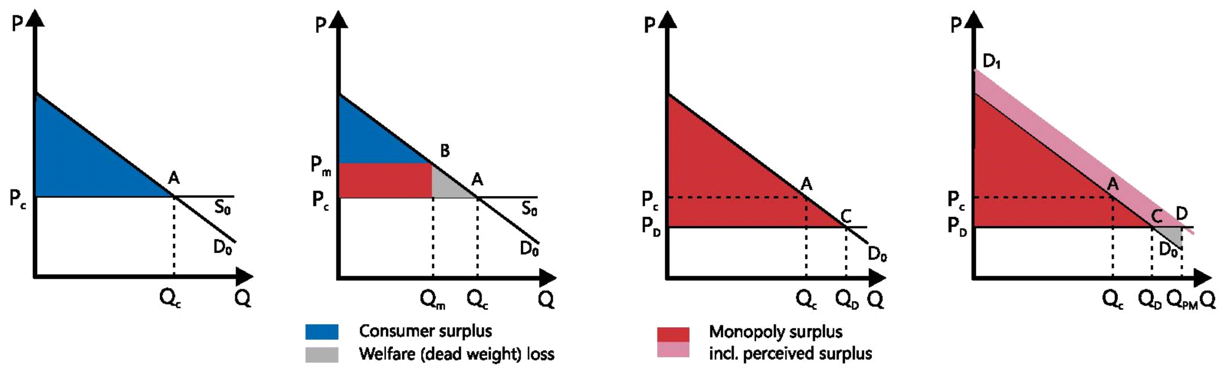
Sources: analysys.cn; Statista, Industries; National Payments Corporation of India (NPCI); A Carsten, S Claessens, F Restoy and H S Shin (2021), "Regulating big techs in finance", *BIS Bulletins*, no 45; authors' calculations.

The risk of abuse of market dominance is especially acute since big tech platforms increasingly serve as essential selling infrastructures for financial service providers but also compete with them at the same time. In Figure 11, we provide illustrative evidence on market concentration from China and India. In China, the market for mobile payments is dominated by two big techs (Alipay and Tenpay), whose services are not interoperable. In India, most of the mobile payment transactions on the Unified Payments Interface (UPI) occur through apps provided by big tech companies (though, in fairness, these services are interoperable in a shared system).

Big techs might also use the massive amounts of data that they collect to extract rent and price-discriminate among their customers. Since data are a non-rival good, it can generate both economies of scale and scope (Farboodi et al, 2019). These companies have the potential to amass significant amounts of data at minimal cost due to their size and technology. These data can be used not only to evaluate a borrower's creditworthiness but also to identify the maximum interest rate that borrowers are willing to pay for loans or the highest premium that clients would pay for insurance. Once these companies have acquired a dominant position, they may use it to engage in price discrimination and extract excessive profits. This can lead to the emergence of "digital monopolies" (BIS, 2019).

Illustrative market structures: from competition to market manipulation — Figure 12

A. Perfect competition | B. Pure monopoly | C. Digital monopoly | D. Preference manipulation



Source: Boissay et al (2021); authors' elaboration.

Figure 12 illustrates the mechanism behind the extraction of consumer surplus by big techs. Panel A is the benchmark case of perfect competition, where financial services are priced at marginal cost. Panel B presents the case of a pure monopoly, where the price paid by consumers is higher than the marginal cost, the supply of services is lower and there is a welfare loss associated with monopoly pricing (in grey). Panel C presents the case of digital monopolies (big techs) that use big data and sophisticated algorithms and are able to identify each consumer's reservation price and set a personalised price just below this. By doing this, big techs can increase the quantity sold above the competitive level (in Panel A) and eliminate the deadweight loss in Panel B. However, by doing this they also extract the entire surplus away from consumers. We see from the figure that in this case, the consumers are worse-off than they would have been under a pure monopoly.

Big techs can further exploit the behavioural biases of consumers in their favour and manipulate consumer preferences. Panel D of Figure 12 represents the case where a digital monopoly persuades its consumers to overestimate the benefits of consuming its product or service. In this case, the demand curve shifts from D0 to D1, and some consumers choose to purchase the product even though its actual value is lower than the price that they pay. Any additional consumer surplus is only perceived (pink area) and there is a loss of surplus for consumers which is even greater than under price discrimination.

3.4 Algorithmic discrimination, consumer privacy and the gender gap

There is a risk that big techs' algorithms used to process data may develop biases. Big techs' access to personal data might also lead to the exclusion of high-risk groups from socially desirable insurance markets and to algorithmic discrimination against minorities. For example, there is evidence that in the US mortgage market, Black and Hispanic borrowers were less likely to benefit from lower interest rates from machine learning based credit scoring models than other communities (Fuster et al, 2019).

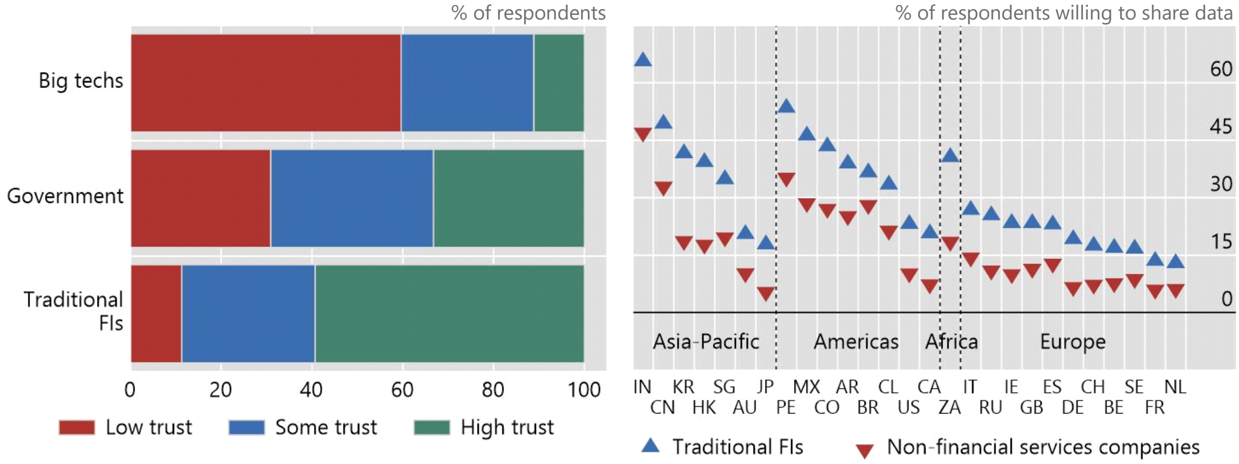
Big techs' access to and collection of extensive personal data raises concerns for consumer privacy. One instance of this is when major health websites shared individuals' personal health data with big tech companies such as Alphabet (Google), Amazon and Meta (Facebook) (Financial Times, 2019). The risks to consumer privacy are even higher when firms underinvest in data security (Carriere-Swallow and Haskar, 2019). There is a clear trade-off between data efficiency (that allows big techs to provide financial services to the underserved, for instance) and consumer privacy.

Figure 13 presents consumer attitudes towards data sharing with big tech companies and traditional financial intermediaries, obtained from Armantier et al, 2021 and Chen et al, 2023. In the US, trust in big techs to safeguard consumer data was the lowest compared with trust in the government and traditional financial intermediaries (panel A). Also globally, consumers were found to be more willing to share data with traditional financial intermediaries than non-financial services companies (panel B).

Consumers trust big techs the least to safeguard their data Figure 13

A. US consumers’ trust in counterparties to safeguard their data[1]

B. Globally, consumers are generally more willing to share data with traditional financial intermediaries (FIs)[2]



AR = Argentina; AU = Australia; BE = Belgium; BR = Brazil; CA = Canada; CH = Switzerland; CL = Chile; CN = China; CO = Colombia; DE = Germany; ES = Spain; FR = France; GB = United Kingdom; HK = Hong Kong SAR; IE = Ireland; IN = India; IT = Italy; JP = Japan; KR = Korea; MX = Mexico; NL = Netherlands; PE = Peru; RU = Russia; SE = Sweden; SG = Singapore; US = United States; ZA = South Africa.

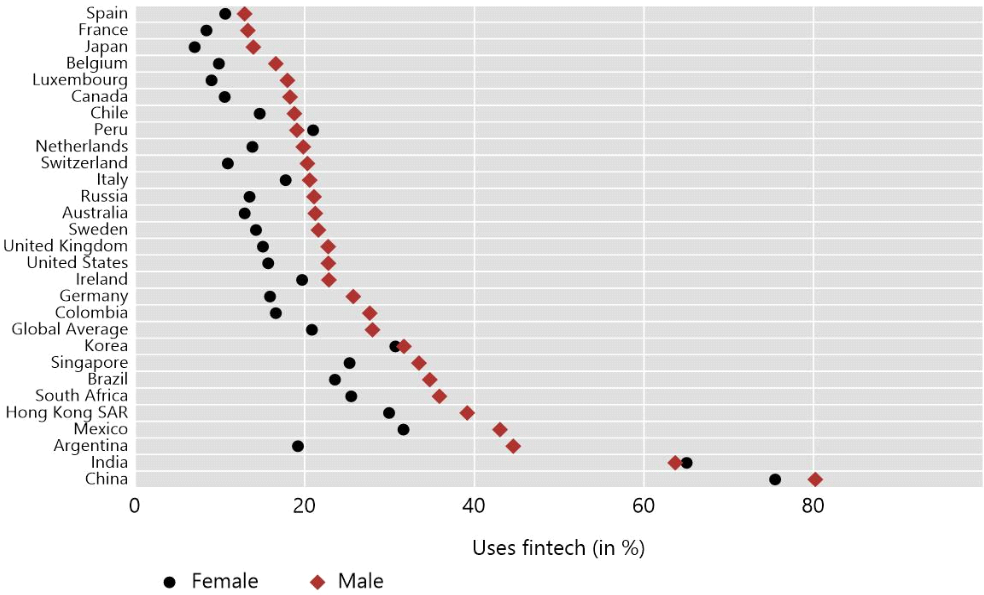
[1] Based on a representative sample of 1,361 US households, September 2020. The question reads “How much do you trust the following entities to safely store your personal data (that is, your bank transaction history, geolocation or social media data)? For each of them, please indicate your trust level on a scale from 1 (no trust at all in ability to safely store personal data) to 7 (complete trust)”. Category “low trust” corresponds to values 1 and 2, “some trust” to 3 and 4 and “high trust” to 5 or higher. [2] Based on a survey of 27,000 respondents, February–March 2019. BE includes LU. The question reads “I would be comfortable with my main bank securely sharing my financial data with other organisations if it meant that I received better offers from a) other traditional financial intermediaries, b) fintech companies, c) non-financial services companies”.

Sources: Armantier, Doerr, Frost, Fuster and Shue (2021); Chen et al (2023).

While there was hope that new financial technologies would not only enhance financial inclusion but also close the gender gap in accessing financial services, recent work provides evidence for the existence of a large and widespread fintech gender gap. Using a survey of over 27,000 adults from 28 countries, Chen et al (2023) find that that men are more likely to use fintech product services than women (27% vs 19, Figure 14). This pattern holds in almost every country and across all subcategories: payments, investment, borrowing and insurance. The gender gap remains high even when controlling for individual and country-specific characteristics. The gap persists across several categories of fintech products and across several different providers. This work shows that improvements in technology by themselves may be insufficient to close the gender gap in finance.

The rise of fintech and big tech lenders might also create new digital divides. Around the world, older generations are less likely to use digital payments and financial technology (fintech) than younger generations. This digital divide by age declines with higher income and education, implying that age disparities are particularly stark within groups who are disadvantaged in other dimensions (Doerr et al, 2022).

The fintech gender gap	Figure 14



Source: Chen et al (2023).

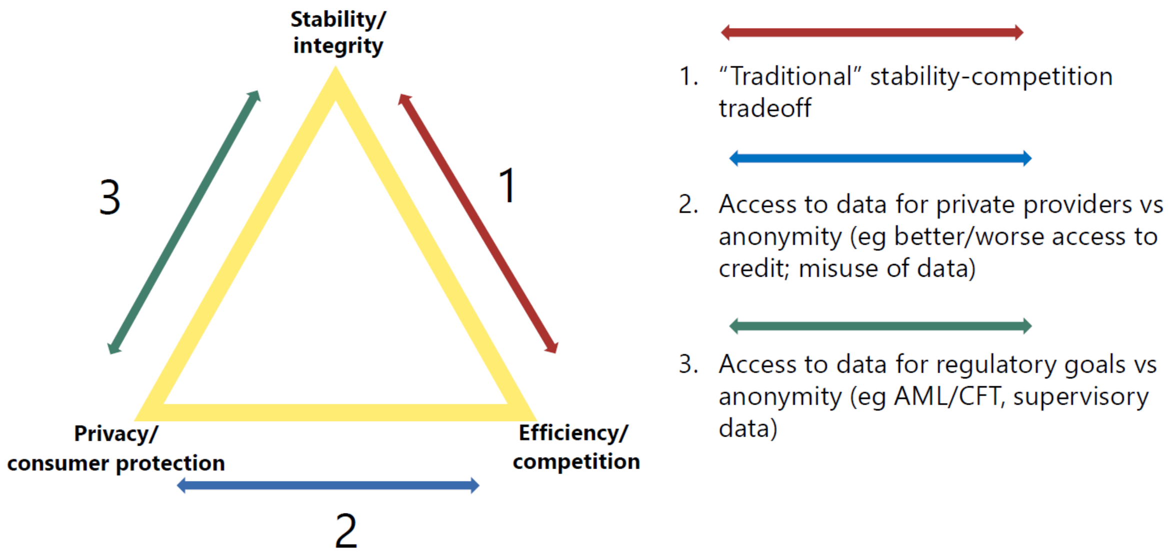
4. Big techs in finance: public policy considerations

Traditional financial regulation seeks to maintain the soundness of the financial system as a whole and ensure the solvency of financial institutions through instruments such as capital and liquidity requirements (BIS, 2019). Consumer protection goals also fall under the ambit of traditional financial regulation through regulation of conduct (BIS, 2019). The involvement of big tech companies in providing financial services leads to complex policy challenges. While the same regulatory principles should apply to big techs for activities under the scope of traditional financial regulation, big techs activity in finance also lead to new policy trade-offs.

There are two reasons that make public policy considerations complex for the case of big techs in finance (BIS, 2019). First, by the nature of their business models, big techs' activity in finance may require competition policy and data privacy regulations in addition to financial regulation. Second, any policy measures employed should consider the ultimate welfare goals, rather than solely focusing on the stated policy objectives. For big techs, the relationship between common policy tools and the resulting welfare outcomes is especially complex. For example, traditional financial regulation may encroach on the objectives of competition policy and data privacy regulation, and vice-versa (BIS, 2019).

Ultimately, this leads to new and complex public policy trade-offs between (i) financial stability and market integrity, (ii) efficiency and competition, and (iii) data privacy and consumer protection. We represent these trade-offs in Figure 15 using a policy triangle.

Policy trade-offs from digital transformation in finance — Figure 15



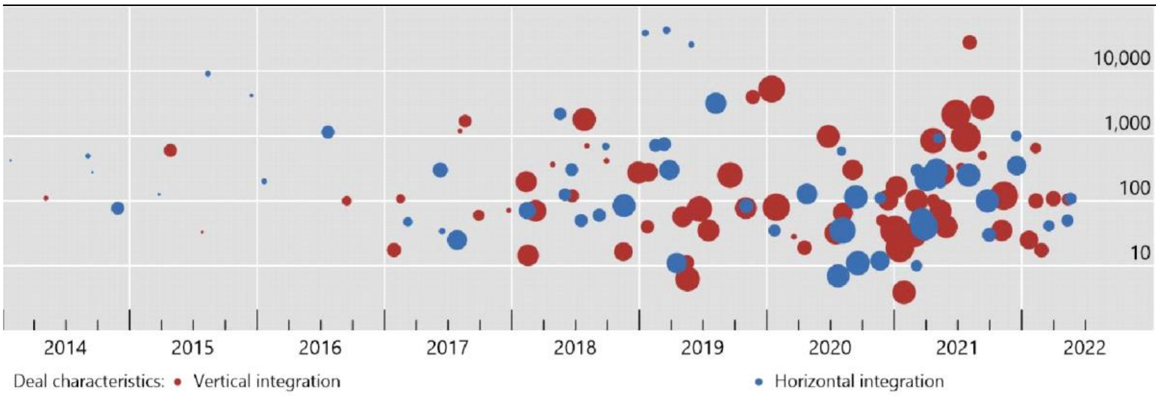
Source: Feyen et al (2021). Adapted from Petralia et al (2019) and Carletti et al (2020).

4.1 Financial stability and competition

The trade-off between financial stability and competition is not new for regulators. Traditionally, there have been two schools of thought evaluating this relationship. In the first, regulators conceived of a negative relationship between competition and financial stability: greater competition reduces banks' profits and overall franchise value, and thus may not be optimal for financial stability (Keeley, 1990; Feyen et al, 2021). More recently, a new school of thought has emerged that conceives of a positive relationship between financial stability and competition. As market entry (and therefore competition) increases in the financial sector, incumbents' market power decreases, fostering innovation and efficiency (Claessens, 2009; Feyen et al, 2021).

The entry of big techs in finance may alter these relationships because of the centrality of the Data-Network-Activity feedback loop (Feyen et al, 2021). Big techs that have market power in their primary business could also translate it into the financial services that they provide. In this case, even though there is increased entry in the financial services market, concentration and market power also increases. When big tech platforms become the primary distribution channel for their competitors, having control over the market may create conflicts of interest and the possibility of abuse of market dominance. In some jurisdictions, regulators have already recognised this challenge. In India, for example, the main e-commerce platforms are prohibited from selling products supplied by affiliated companies on their websites – including financial products – to avoid potential conflicts of interest.

Merger and acquisition (M&A) activity of payment platforms[1] Figure 16



[1] For 2022, data up to 18 May 2022. Each dot in the left-hand panel represents an M&A deal by Ant Group, Fidelity National Information Services (FIS), FISERV, Global Payments, Mastercard, PayPal, Block (formerly Square) or Visa as collected by PitchBook and Refinitiv Eikon. This excludes divestitures and intra-company operations. M&A deals are classified as "vertical" when the acquiring and the target firm operate at different stages along the same payment chain, as determined by company reports. In "horizontal" deals, the acquiring and target firm are direct competitors in at least one key business line. The size of each dot is proportional to the acquiring company market capitalisation on the day of the deal or, in the case of Ant Group, the valuation of Ant Group as of end-2018, multiplied by changes in the market capitalisation of Alibaba Holdings relative to end-2018. The same sample is used in the right-hand panel.

Sources: BIS (2020); Croxson et al (2023).

The market for payments provides evidence on how big techs are changing the competitive landscape of financial services. Figure 16 shows the merger and acquisitions (M&A) activity of global payment platforms. Mergers (horizontal integration) are denoted by the blue dots and acquisitions (vertical integration) are denoted by the red dots. The size of the dot represents the market capitalisation of acquiring companies, and the height of the dot (the y-axis) represents the size of the deal. Each dot represents a merger or acquisition deal implemented by technology companies like Ant Group, Fidelity National Information Services (FIS), FISERV, Global Payments, Mastercard, PayPal, Square, or Visa

We see that over time, the size of these dots has been increasing, indicating increasing M&A activity in the payments industry. Mergers represent direct takeover of competitors, whereas acquisitions allow for new efficiencies as new activities are performed "in-house" (Feyen et al, 2021). This figure shows that smaller payment companies are being acquired by these technology companies before they reach a critical mass of users. Further exacerbating the issue of abuse of dominance, Kamepalli et al (2020) provide evidence that the mere threat of acquisition may reduce venture capital funding for new firms. This is because investors predict that the new firms will be taken over by big tech companies even before they can build a sufficiently large user network. Cornelli et al (2021) provide similar evidence.

4.2 Competition and privacy

The next policy trade-off that we consider is between competition and privacy, represented by the blue line in Figure 15. While competition and more efficient solutions often benefit consumers, they may not always go hand in hand with data privacy protection. For example, open access to personal data can allow for identity theft, reputational damage and manipulation of behavioral biases to sell consumers products that are not in their own interests. Some of this arises from the fact that in many jurisdictions, financial services provided by big tech companies are outside the scope of consumer protection regulations.

4.3 Privacy and financial stability

The third policy trade-off that arises is between ensuring consumer privacy and financial stability. This trade-off between privacy (and consumer protection more generally) on the one hand and financial stability (and market integrity) on the other is represented by the green line in Figure 15.

Data sharing can alleviate problems of asymmetric information and thus can have benefits for financial stability. Feyen et al (2021) provide an example from the credit market to explain this point. Credit registries can reduce the asymmetric information problem between lenders and borrowers. They can further financial inclusion and increase aggregate lending activity by providing credit to borrowers that would be otherwise priced out of the market (Pagano and Jappelli, 1993). The data contained in credit registries can be accessed only with consumer content and only by licensed entities.

At the same time, access to granular data (for instance on payments) can potentially help reduce illicit activity and preserve market integrity. For example, anti-money laundering (AML) and combating the financing of terrorism (CFT) practices require the exchange of detailed information on all parts involved in a transaction.

Yet as discussed, granting sweeping access to or sharing personal data widely can pose a threat to consumer privacy, in particular as big techs record a much wider range of data (including personal data). These aspects calls for better safeguards for consumer privacy.

5. Regulating big techs

The nature of big techs activity in finance puts them under the ambit of several regulatory authorities including central banks, competition authorities and data protection authorities. This results in a complex mix of sector-specific and cross-country regulation. They key question for policy makers is whether they should consider activity-based (AB) regulation or entity-based (EB) regulation for big techs activities in financial markets. Carstens et al (2021) and Crisanto et al (2021) provide excellent introductions (for a summary of examples of AB and EB regulation see Table 2).

5.1 Activity-based versus entity-based regulation

Activity-based regulation constrains an activity on a standalone basis. It aims at directly strengthening the resilience of a systematically important activity. On the other hand, entity-based regulation concerns itself with several different activities in an entity's balance sheet, constraining a combination of activities. This helps to strengthen the resilience of activities indirectly, by reducing the probability and impact of entities' failure.

Illustrative examples of AB and EB regulation

Table 2

AB regulation	EB regulation
• Insurance scheme calibrated to a specific activity (eg collateralised lending) • CCP/bilateral margin requirements calibrated at the instrument level • LTV and DTI requirements • Operational standards for providers of a specific service (eg payments) • Retention requirements for securitisation originators • Gates triggered by market-wide developments	• Bank minimum capital and liquidity requirements, large exposure limits, CCoB, Pillar 2 add-ons • G-SIB buffer • Countercyclical Capital Buffer (CCyB) • Insurance scheme calibrated to entities' riskiness • Liquidity requirements for investment funds (eg WLA, WAM) • Gates and swing pricing at entity level • CCP default fund requirements that consider the mix of cleared derivatives • Living will requirements

Source: Borio et al (2022).

For big techs, activity-based regulation might be a good starting point (Borio et al, 2022). This would ensure that big techs would face the same financial stability regulations as other financial institutions performing the same activity. This would ensure that big techs and traditional financial institutions operate in a level-playing field, especially in cases where big techs can quickly dominate the market.

While activity-based regulation of big techs may be necessary, in most cases, it will not be sufficient. This is because big techs provide a wide range of services and generate substantial network externalities. Importantly, they also collect and use data from non-financial businesses and use it to provide financial services. In this case, financial stability regulations alone may not meet the desired public policy objectives.

Different jurisdictions have taken different approaches to regulating big techs. Some have considered adjustments to existing rules that affect big tech activities. These typically include regulations to enhance data sharing, or regulations to ensure operational resilience of firms that rely on big techs. Other jurisdictions have introduced rules specifically tailored for big techs. These include competition policies that prevent market dominance or abuse of market power (Crisanto et al, 2021).

China, the European Union (EU) and the US have been some of the most active jurisdictions looking at big tech regulation. The policy areas that these jurisdictions have focused on include: (i) competition; (ii) data protection and data-sharing; (iii) conduct of business; (iv) operational resilience; and (v) financial stability. Depending on the context and the extent of big tech activity, different jurisdictions have prioritised different areas. In China, where the participation of big techs in the payments and financial services market, regulation aims to address issue of financial stability. In the US, the focus has been more on competition policy than financial stability, as big techs have a smaller footprint in the financial services market compared to China. In the EU, regulators have developed a framework focusing on operational resilience and data protection.

5.2 Competition policy

Among the areas of potential regulatory intervention, competition authorities have been the most active. So far, most competition authorities have followed the traditional approach of ex-post enforcement to address anticompetitive practices of big techs. However, as the traditional approach is lengthy and allows for interventions only after harm to competition has occurred, many jurisdictions are considering frameworks for ex-ante entity-based rules. These could include ensuring interoperability across online platforms, equal treatment for all business users, rules against self-preferencing among others. For example, in February 2021, the State administration for Market Regulation issued "Platform antimonopoly guidelines", an ex-ante framework to regulate big techs. The Digital Markets Act and the Digital Services Act (DSA) were adopted by the EU in September 2022 to protect contestability in digital markets with gatekeepers (typically big techs). These frameworks aim to minimise harms to competition from unfair practices by big techs ex ante while also leaving room for the relevant competition authorities to intervene ex post.

5.3 Data protection and data sharing

There has also been recent regulatory activity in the domain of data protection and data-sharing. As data are the basis of big techs' operations across all their products and services, regulation of anti-competitive use of data has become a key public policy objective across many jurisdictions. In the US, several proposals related to data protection are under discussion (eg United States Consumer Data Privacy Act, Consumer Online Privacy Rights Act). Notably, the California Consumer Privacy Act (CCPA) presents a promising avenue to foster competition in the financial sector while protecting users' right to data privacy (Doerr et al, 2023). China has also implemented a new Data Security Law (DSL) and a Personal Information Protection Law (PIPL).

In the EU, the recent General Data Protection Regulation (GDPR) is one of the most comprehensive and influential legislations. Among key provisions of the GDPR are "purpose specificity" and security requirements. These are especially pertinent for big tech operations as they require that user data are collected and used only for purposes where there is explicit user consent. They also place measures to protect the integrity, confidentiality and availability of sensitive user data. Furthermore, provisions under data protection laws grant users the ability to access, change and delete their data. Finally, big techs are affected by the provisions on data portability under GDPR. Under this, users have the right to ask for their personal data and use it for their own purposes.

Finally, numerous jurisdictions have introduced open banking, which empowers consumers to share their data that usually resides with traditional financial intermediaries with newcomers. Unlike the GDPR, CCPA or DSL, open banking aims to facilitate access to data, rather than protect privacy per se.

5.4 Conduct of business and operational resilience

Crisanto et al (2021) note that there are only a few regulatory measures targeting conduct of business of big techs. EU's DSA is one such policy initiative that establishes a transparency and accountability framework for online platforms. Under the DSA, "very large online platforms" (often big techs) are obligated to conduct assessments of systemic risks arising from their business activities. Only a few other jurisdictions have similar legislation on business conduct, and regulation is more focused on consumer protection.

The EU and China also have legislations concerning operational resilience of big techs. The Digital Operational Resilience Act (DORA), an activity-based legislated, was enacted in the EU in January 2023. China, on the other hand, took an entity-based approach by designing regulations specifically for financial holding companies. The objectives of these regulations are similar even though the approach is different. Broadly stated, these legislations aim to identify the sources of operational risk for financial institutions specifically linked to information and communication technology (ICT) services. As a result of DORA, for example, big techs would need to comply with technical standards on evaluating and monitoring third-party risk (when they are users of third-party services in their financial service operations). When they are providers of "critical" third-party services like cloud computing, they are subject to additional regulatory requirements and direct supervision.

5.5 Financial stability

There has been relatively little regulatory activity directly addressing financial stability implications of big tech activity in finance. One exception is in China. In 2019, the People's Bank of China (PBC) put in place a 100% reserve requirement for user balances in big techs' payment accounts. This was followed by another set of regulations announced in 2021 that limited the ability of big tech companies to transform risk by providing credit or investing in interest bearing assets. These regulations require payment companies and big tech platforms to keep their users' money in designated bank accounts at the PBC. Additionally, the Chinese Banking and Insurance Regulatory Commission (CBIRC) has also issued new rules for online lending. Firms seeking to provide these loans must partner with banks to do so. It also imposed limitations on the amount of loans banks could provide in partnership with non-bank lenders.

5.6 Cooperation amongst regulatory bodies: domestic and international

As discussed previously, big techs offer a diverse range of services and thus, their activities fall under several different regulatory authorities. In particular, central banks and financial regulators have a mandate for the stability of the financial system, while competition and data protection authorities have a broader, cross-sectoral mandate. These institutions have not traditionally had strong interactions, and as such, it can be challenging to coordinate policy for big techs. At the domestic level, it can be necessary for new bodies to convene different authorities to discuss regulation of big techs and digital markets. For example, in the UK, the Competition and Markets Authority (CMA), Information Commissioner's Office (ICO) and Office of Communications (Ofcom) formed a Digital Regulation Cooperation Forum in July 2020, and in 2021 invited the Financial Conduct Authority (FCA) to join as a full member. This is one example of the types of institutional reforms that can help to bring authorities together – but agreeing on policy measures across the range of policy objectives may still be a challenge.

These issues can be even more complicated in a cross-border context. Big techs are headquartered in only a few countries (notably the United States, China and several emerging markets) but provide services across many different economies, both within the same region and around the world. Home authorities (ie the public authorities in the country of the big techs' headquarters) may have relatively greater insight into big techs' activities, and greater power to collect data, influence business practices, collect taxes, etc. Host authorities (ie those of other markets in which the big techs operate) may have very little traction against large foreign players for whom the respective market is very small compared to the overall business. Anecdotally, a number of host authorities worry that they cannot get access to relevant data nor stop practices judged to be detrimental to domestic policy goals, as big techs can either ignore requests or threaten to leave the local market altogether. In this context, home-host cooperation becomes much more important.

At the global level, there are relatively few policy standards or policy bodies specifically dedicated to the new policy issues and trade-offs discussed in this chapter. Certainly, policies toward big tech are an issue of discussion in bodies like the Financial Stability Board (FSB), which brings together ministries of finance, central banks and regulators of the G20 countries, and international organisations; the Global Privacy Assembly (GPA), which convenes data protection authorities from around the world; and the International Competition Network (ICN), which provides a specialised venue for competition authorities. As big techs expand further into financial services and other areas of the economy, the demand for policy coordination may yet increase.

6. Conclusion

Big techs' activities in financial services are expanding rapidly. This relates to several key economic characteristics of big techs and their business model, which is based on the data-network-activities (DNA) feedback loop. The growth of big tech credit around the globe depends on country-specific characteristics, such as GDP per capita, banks' market power, regulation, ease of doing business and investor protection. In some markets, big techs have already taken on systemic importance in the financial system.

The DNA loop introduces opportunities and challenges. The reliance on large networks, non-traditional data and machine learning can improve financial inclusion, for instance in the area of credit access. Better data can also reduce the need for collateral. At the same time, big tech business models can create new risks: they can lead to market dominance, price discrimination, algorithmic discrimination and severe privacy issues.

The rise of big techs thus brings a new and complex trade-off between the public policy objectives: financial stability, competition and privacy. The role of public policy is to strike the right balance between these opportunities and the new challenges. This calls for more coordination between national and international authorities, particularly central banks and financial regulators, as well as competition and data protection authorities.

References

Alfonso, V, C Boar, J Frost, L Gambacorta and L Jing (2021): "E-commerce in the pandemic and beyond", BIS Bulletin, no 36, January.

Armantier, O, S Doerr, J Frost, A Fuster and K Shue (2021): "Whom do consumers trust with their data? US survey evidence", BIS Bulletin No 42, May.

Auer, R, G Cornelli and J Frost (2022): "The pandemic, cash and retail payment behaviour: insights from the future of payments database", BIS Working Paper, no 1055, December.

Bank for International Settlements (BIS) (2019): "Big tech in finance: opportunities and risks", Chapter 3, Annual Economic Report, June.

--- (2020): "Central banks and payments in the digital era", Chapter 3, Annual Economic Report, June.

Barba Navaretti, G, G Calzolari, J M Mansilla-Fernandez and A F Pozzolo (2017): "FinTech and Banks: Friends or Foes?", European Economy: Banks, Regulation, and the Real Sector, 2, December.

Beck, T, L Gambacorta, Y Huang, Z Li and H Qiu (2022): "Big techs, QR code payments and financial inclusion", BIS Working Paper no. 1011, May.

Berg, V, V Burg, A Gombović and M Puri (2020): "On the rise of fintechs: Credit scoring using digital footprints", *The Review of Financial Studies*, vol 33, no 7, pp 2845–97.

Boissay, F, T Ehlers, L Gambacorta and H S Shin (2021): "Big techs in finance: on the new nexus between data privacy and competition", in R Rau, R Wardrop and L Zingales (eds), *The Palgrave Handbook of International Finance,* New York: Springer International Publishing, pp 855–75.

Borio, C, S Claessens and N Tarashev (2022): "Entity-based vs activity-based regulation: a framework and applications to traditional financial firms and big techs", SUERF Policy Brief, no 404.

Buchak, G, G Matvos, T Piskorski and A Seru (2018): "Fintech, regulatory arbitrage, and the rise of shadow banks", Journal of Financial Economics, vol 130, no 3, pp 453–83.

Buckley, R, A Sergeev, D Arner, D Zetzscheand K Charamba (2022): "Governing BigTechin Finance: Opportunities and Challenges of FinTech 4.0", *Fordham Journal of Corporate and Financial Law*.

Carletti, E, S Claessens, A Fatás and X Vives (2020): "The Bank Business Model in the Post-Covid-19 World", London: Centre for Economic Policy Research (CEPR).

Carriere-Swallow, MY and M V Haksar (2019): "The economics and implications of data: an integrated perspective", International Monetary Fund.

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

Chen S, S Doerr, J Frost, L Gambacorta and H S Shin (2023): "The fintech gender gap", *Journal of Financial Intermediation*, 54, April.

Claessens, S (2009): "Competition in the Financial Sector: Overview of Competition Policies", *The World Bank Research Observer* 24(1), 83–118.

Claessens, S, J Frost, G Turner and F Zhu (2018): "Fintech credit markets around the world: size, drivers and policy issues", BIS Quarterly Review, September.

Committee on Payments and Market Infrastructures (CPMI) and World Bank Group (2020): "Payment aspects of financial inclusion in the fintech era", April.

Cornelli, G, S Doerr, L Franco and J Frost (2021): "Funding for fintechs: patterns and drivers", BIS Quarterly Review.

Cornelli, G, J Frost, L Gambacorta, P R Rau, R Wardrop and T Ziegler (2023): "Fintech and big tech credit: drivers of the growth of digital lending", Journal of Banking and Finance, 148, March.

Crisanto, JC, J Ehrentraud, A Lawson and F Restoy (2021): "Big tech regulation: what is going on?", Bank for International Settlements, Financial Stability Institute.

De Roure, C, L Pelizzon and P Tasca (2016): "How does P2P lending fit into the consumer credit market?" Deutsche Bundesbank Discussion Papers, no 30.

Doerr, S, J Frost, L Gambacorta and H Qiu (2022): "Population ageing and the digital divide", SUERF Policy Briefs, no 270.

Doerr, S, L Gambacorta, L Guiso, M Sanchez del Villar (2023): "Privacy Regulation and Fintech Lending", BIS Working Papers, no 1103.

Duffy, C (2023): "How Big Tech's pandemic bubble burst", *CNN Business*, 22 January.

Ehrentraud, J, D Garcia Ocampo, L Garzoniand M Piccolo (2020): "Policy responses to fintech: a cross-country overview", FSI Insights, no 23, January.

Farboodi, M, R Mihet, T Philippon and L Veldkamp (2019): "Big data and firm dynamics", *AEA papers and proceedings* (Vol. 109, pp. 38-42), May.

Feyen, E, J Frost, L Gambacorta, H Natarajan and M Saal (2021): "A policy triangle for Big Techs in finance", *VoxEU.org*, October.

Financial Stability Board (FSB) (2017): "Financial stability implications from fintech: regulatory and supervisory issues that merit authorities' attention", June.

Financial Times (2019): "How top health websites are sharing sensitive data with advertisers", 13 November.

Frost, J, L Gambacorta, Y Huang, H S Shin and P Zbinden (2019): “BigTech and the changing structure of financial intermediation”, *Economic Policy*, vol 34, no 100, pp 761-799.

Fuster, A, M Plosser, P Schnabl and J Vickery (2019): “The role of technology in mortgage lending”, *The Review of Financial Studies*, vol 32, no 5, pp 1854–99.

Gambacorta, L, Y Huang, Z Li, H Qiu and S Chen (2023): “Data versus collateral”, *Review of Finance*, vol 27, no 2, pp 369–98.

Gambacorta, L, Y Huang, H Qiu and J Wang (2023): “How do machine learning and non-traditional data affect credit scoring? New evidence from a Chinese fintech firm”, *Journal of Financial Stability*, forthcoming.

Hau, H, Y Huang, H Shan and Z Sheng (2018): “Fintech credit, financial inclusion and entrepreneurial growth”, Unpublished working paper.

Jagtiani, J. and C Lemieux (2019): “The roles of alternative data and machine learning in fintech lending: evidence from the LendingClub consumer platform“, *Financial Management*, vol 48, no 4, pp 1009–29.

Kamepalli, S K, R Rajan and L Zingales (2020): "Kill zone", NBER Working Paper, no 27146.

Keeley, M (1990): “Deposit insurance, risk and market power in banking”, *American Economic Review*, vol 80, no 5, pp 1183–1200.

Ovide, S (2021), “How Big Tech Won the Pandemic”, *New York Times*, 12 October.

Pagano, M and T Jappelli (1993): “Information Sharing in Credit Markets”, *Journal of Finance*, vol 48, no 5, pp 1693–1718.

Petralia K. T Philippon, T Rice and N Veron (2019): “Banking Disrupted? Financial Intermediation in an Era of Transformational Technology, Geneva Reports on the World Economy 22, ICMB and CEPR.

Philippon, T, (2015): "Has the US Finance Industry Become Less Efficient? On the Theory and Measurement of Financial Intermediation“, *American Economic Review*, vol 105, no 4, pp 1408–38.

Rau, P. (2017): “Law, Trust, and the Development of Crowdfunding”, SSRN Electronic Journal. 10.2139/ssrn.2989056.

Restoy, F (2021): “Fintech regulation: how to achieve a level playing field”, FSI Occasional Papers, no 17.

Tang, H, (2019): “Peer-to-peer lenders versus banks: substitutes or complements?”, *The Review of Financial Studies*, vol 32, no 5, pp 1900–38.

The Economist (2023): "The old bank/card model is still entrenched in the rich world", 15 May.

US Department of Treasury (2016): "Opportunities and challenges in online marketplace lending", May.

van Liebergen, B (2017): "Machine learning: a revolution in risk management and compliance?", *The Capco Institute Journal of Financial Transformation*, vol 45, pp 60-67.

World Bank (2020): "Capital markets and SMEs in emerging markets and developing economies: can they go the distance?", January.

Zetzsche, D, R Buckley, D Arner and J Barberis, (2017): "From FinTech to TechFin: The Regulatory Challenges of Data-Driven Finance", *New York University Journal of Law and Business*.

Previous volumes in this series

1128 October 2023	The cumulant risk premium	Albert S. (Pete) Kyle and Karamfil Todorov
1127 September 2023	The impact of green investors on stock prices	Gong Cheng, Eric Jondeau, Benoit Mojon and Dimitri Vayanos
1126 September 2023	CBDC and the operational framework of monetary policy	Jorge Abad, Galo Nuño and Carlos Thomas
1125 September 2023	Banks' credit loss forecasts: lessons from supervisory data	Martin Birn, Renzo Corrias, Christian Schmieder and Nikola Tarashev
1124 September 2023	The effect of monetary policy on inflation heterogeneity along the income distribution	Miguel Ampudia, Michael Ehrmann and Georg Strasser
1123 September 2023	Global supply chain interdependence and shock amplification – evidence from Covid lockdowns	Sally Chen, Eric Tsang and Leanne (Si Ying) Zhang
1122 September 2023	gingado: a machine learning library focused on economics and finance	Douglas K G Araujo
1121 September 2023	Margins, debt capacity, and systemic risk	Sirio Aramonte, Andreas Schrimpf and Hyun Song Shin
1120 September 2023	Energy Shocks as Keynesian Supply shocks: Implications for Fiscal Policy	Enisse Kharroubi and Frank Smets
1119 September 2023	Keep calm and bank on: panic-driven bank runs and the role of public communication	Olivier Coibion, Yuriy Gorodnichenko, Francesco Grigoli and Damiano Sandri
1118 August 2023	The origins of monetary policy disagreement: the role of supply and demand shocks	Carlos Madeira, João Madeira and Paulo Santos Monteiro
1117 August 2023	An impossibility theorem on truth-telling in fully decentralized systems	Rodney Garratt and Cyril Monnet
1116 August 2023	Absolute blockchain strength? Evidence from the ABS market in China	Jing Liu, Ilhyock Shim and Yanfeng Zheng
1115 August 2023	Sharks in the dark: quantifying HFT dark pool latency arbitrage	Matteo Aquilina, Sean Foley, Peter O'Neill and Thomas Ruf

All volumes are available on our website www.bis.org.