

Finance, Competitiveness, and Innovation Global Practice, World Bank  
Financial Institutions Group, International Finance Corporation

---

# Fintech and the Digital Transformation of Financial Services: Implications for Market Structure and Public Policy

---

Fintech and the Future of Finance Flagship Technical Note

Public Disclosure Authorized

Public Disclosure Authorized

Public Disclosure Authorized

Public Disclosure Authorized



---

# Fintech and the Digital Transformation of Financial Services: Implications for Market Structure and Public Policy

---

Fintech and the Future of Finance Flagship Technical Note

© 2022 International Bank for Reconstruction and Development / The World Bank  
1818 H Street NW,  
Washington DC 20433  
Telephone: 202-473-1000;  
Internet: [www.worldbank.org](http://www.worldbank.org)

This work is a product of the staff of The World Bank with external contributions. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of The World Bank, its Board of Executive Directors, or the governments they represent.

The World Bank does not guarantee the accuracy, completeness, or currency of the data included in this work and does not assume responsibility for any errors, omissions, or discrepancies in the information, or liability with respect to the use of or failure to use the information, methods, processes, or conclusions set forth. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Nothing herein shall constitute or be construed or considered to be a limitation upon or waiver of the privileges and immunities of The World Bank, all of which are specifically reserved.



### **Rights and Permissions**

The material in this work is subject to copyright. Because The World Bank encourages dissemination of its knowledge, this work may be reproduced, in whole or in part, for noncommercial purposes as long as full attribution to this work is given.

Any queries on rights and licenses, including subsidiary rights, should be addressed to World Bank Publications, The World Bank Group, 1818 H Street NW, Washington, DC 20433, USA; fax: 202-522-2625; e-mail: [pubrights@worldbank.org](mailto:pubrights@worldbank.org).

---

# Contents

---

<b>Authors and Contributors</b>	<b>vii</b>
<b>Acronyms</b>	<b>viii</b>
<b>Executive Summary</b>	<b>1</b>
<b>1. Introduction</b>	<b>3</b>
<b>2. Economic Frictions and Forces in Financial Services</b>	<b>5</b>
2.1 The Impact of Digital Innovation on Key Economic Frictions	6
2.1.1 Technology advances in connectivity, data processing, and storage	7
2.1.2 Data, networks, and new business models	9
2.1.3 Impact on transaction costs, information asymmetries, and market gaps	11
2.2 Consequences for Financial Services Firms	14
3.1 Implications for Market Entry	18
<b>3. Implications for the Industrial Organization of the Financial Sector</b>	<b>18</b>
3.2 Shifting Economies of Scale and Scope	19
3.3 Impact on Financial Services Providers	20
3.3.1 Incumbents	21
3.3.2 Fintech firms	22
3.3.3 Big tech firms	23
3.3.4 Individuals as financial services providers	24
3.4 Impact on Sector Composition, Competition, Concentration	26
4.1 Implications for the Regulatory Perimeter and Supervisory Practices	31
<b>4. Policy Implications and New Trade-offs</b>	<b>31</b>
4.2 Implications for Competition Policy	33
4.3 New Dimensions to Financial Regulation Policy Trade-offs	36
4.3.1 Efficiency and competition vs. financial stability and integrity	36

4.3.2	Efficiency and competition vs. privacy and consumer protection	39
4.3.3	Privacy and consumer protection vs. financial stability and integrity	41
<b>5.</b>	<b>Conclusions</b>	<b>43</b>
	<b>Bibliography</b>	<b>45</b>

## List of Figures

Figure 1.	Mobile and mobile wallet growth worldwide	7
Figure 2.	Costs of storage have declined as global data volumes have surged	8
Figure 3.	Enterprises using cloud storage in Europe rose sharply over 2014–18	9
Figure 4.	Investment in CloudTech and DevOps companies	10
Figure B1.	Elasticity of big-tech credit to asset prices	13
Figure 5.	Specialist providers challenging the services of large banks	16
Figure 6.	Average spread of active bonds to benchmark government bonds at issuance	20
Figure 7.	Fintech product offerings have expanded over time	23
Figure B2.	Global big tech credit is booming, overtaking fintech credit	25
Figure 8.	Corner solutions of scale vs. atomization	29
Figure 9.	Potential barbell financial services market (illustrative)	30
Figure 10.	Market share of leading firms in the cloud infrastructure-as-a-service (IaaS) market, across all industries (Q4 2019)	33
Figure 11.	Interplay of ex ante sectoral regulations and ex post interventions by competition authority	34
Figure 12.	Policy trade-offs from digital transformation in finance	37
Figure 13.	Winners and losers of machine-learning credit scoring and the fintech gender gap	42

## List of Boxes

Box 1.	Data and collateral	13
Box 2.	The data-network-activity feedback loop may explain the rapid growth of big tech credit	25
Box 3.	Competition in digital payments: the case of Kenya	35

---

## Authors and Contributors

This technical note is part of a series of technical notes developed for the “Fintech and the Future of Finance” report, a joint effort by the World Bank and the International Financial Corporation (IFC). This note has been co-authored by the staff of the World Bank and the Bank for International Settlements (BIS).

This project was led by Erik Feyen and Harish Natarajan (both World Bank) and Matthew Saal (IFC) under the overall guidance of Jean Pesme, Mahesh Uttamchandani, and Anderson Caputo Silva (all World Bank) and Paulo de Bolle and Martin Holtmann (both IFC). Alfonso Garcia Mora (IFC, formerly World Bank) provided guidance at inception and during earlier stages of the report.

This note was prepared by Erik Feyen (World Bank), Jon Frost (Bank for International Settlements (BIS) and Cambridge Centre for Alternative Finance (CCAF)), Leonardo Gambacorta (BIS and Centre for Economic Policy Research (CEPR)), Harish Natarajan (World Bank), and Matthew Saal (International Finance Corporation (IFC)).

The team thanks Stijn Claessens, Miquel Dijkman, Sebastian Doerr, Sara Nyman, Jean Pesme, Beniamino Savonitto, Ghiath Shabsigh and Davide Strusani for comments. The team thanks Giulio Cornelli for excellent research assistance.

The team thanks Machimanda A. Deviah (World Bank) for editorial assistance, Maria Lopez (World Bank) and Sensical Design for design and layout, Elizabeth Price, Melissa Knutson and Nandita Roy (all World Bank) and Henry Pulizzi and Elena Gox (both IFC) for communications support, and Michael Geller and Arpita Sarkar (both World Bank) for overall coordination.

---

---

# Acronyms

---

<b>AML</b>	Anti-Money Laundering
<b>AI</b>	Artificial Intelligence
<b>BaaS</b>	Banking-as-a-Service
<b>CI/CO</b>	Cash-in/Cash-out
<b>CBDC</b>	Central Bank Digital Currency
<b>CFT</b>	Combating the Financing of Terrorism
<b>CR</b>	Credit Registries
<b>DNA</b>	Data-Network-Activities
<b>DLT</b>	Distributed Ledger Technology
<b>EMDE</b>	Emerging Markets and Developing Economies
<b>EU</b>	European Union
<b>KYC</b>	Know-Your-Customer
<b>ML</b>	Machine Learning
<b>P2P</b>	Peer-to-Peer
<b>POS</b>	Point of Sale
<b>Regtech</b>	regulatory technology
<b>SaaS</b>	Software-as-a-Service
<b>Suptech</b>	supervisory technology



---

# Executive Summary

---

**Financial intermediaries, such as banks and insurance companies, act as the middleman, linking together participants in financial transactions.** Economic frictions in the form of information asymmetries and economic forces, such as economies of scale and scope, give rise to financial intermediaries and shape financial markets. While technological advances are not new to finance, digital innovation has brought major improvements in connectivity of systems, in computing power and cost, and in newly created and usable data. This digital innovation is shaking up financial intermediaries and the markets in which they operate.

**Digital improvements have alleviated transaction costs and given rise to new business models and new entrants.** As technology has increased information exchange and reduced transaction costs, the production of financial services could be disaggregated. Specialized players have unbundled financial services, allowing consumers to find and assemble their preferred suites of products.

Digital technologies are reshaping payments, lending, insurance, and wealth management—a process that the COVID19 pandemic has accelerated. While this is making financial services in many economies more diverse, competitive, efficient, and inclusive, it may also increase concentration in markets. Economies of scale and scope, and network effects are present in many aspects of financial services production, including customer acquisition, funding, compliance activities, data and capital (including trust capital). Despite advances in technology, the costs of consumer search and assembly remain significant. These forces encourage re-bundling, and confer advantages to large multi-product providers, including technology (big tech) firms expanding into financial services from adjacent markets.

**Moreover, new risks may arise to a range of key public policy goals.** This note draws on the underlying economics of financial services and their industrial organization to examine—with recent empirical evidence—the implications of digital innovation for market structure and attendant policies, including financial and competition regulation.

The organizing framework for the discussion is built around how economic frictions and economic forces, mentioned above, are driving market changes. For example, mobile phone use has surged globally; social and economic activity has shifted online—often to platform-based businesses—and new technologies like cloud computing have been widely adopted.

**These improvements have alleviated frictions, blurred firm and industry boundaries, and given rise to new business models.** New and often smaller and more specialized financial technology (fintech) players have unbundled services (see definitions). Economies of scale and network effects are strong in digital platforms and cloud computing. These scale effects, alongside economies of scope, encourage re-bundling, and allow large technology (big tech) firms and other new players to deepen inroads into core financial product markets. Available evidence shows that big-tech firms are rapidly expanding their footprint in finance and can use Big Data in ways that reduce the need for collateral. Meanwhile, incumbent financial institutions have adapted by adopting new technologies and by disaggregating their production of financial services to improve efficiency.

**Digital innovation could drive a range of industrial organization outcomes.** On the one hand, digital technology enables niche providers to reach a target customer base and be economically viable. On the other, customer acquisition, funding, “assembly,” and switching costs tend to favour larger providers. One possibility is a “barbell” shaped market,

composed of a few large players and many niche players. The large, multi-product players could include traditional financial institutions, fintech and big tech firms—both incumbents and new entrants. Small players may include product, geographic or sector-focused fintech firms and incumbents.

**While a “barbell” is not the only potential outcome, it is a central case, given the economic forces at work.** It is a potential steady-state market structure as some participants leverage scale economies and network effects to grow larger, while innovation continues to result in new entrants. Market forces will push players to either hyper-focus or to aim for the large, multi-product type of service offering. However, atomization—the reduction of services to their most basic parts—may continue and re-aggregation could stall, leading to a market of more small players. Then again, limits on entry could result in a completely different market configuration. It's difficult to predict.

This analysis gives rise to important policy issues regarding competition, regulatory perimeters, and ensuring a level playing field. Concentration risks may increase in the provision of financial services to end-users, and in the provision of infrastructure to financial institutions. Market structures that concentrate data and supercharge network effects could reduce intermediation costs and broaden inclusion. In many markets, however, the resulting market power might be detrimental. Competition regulators will have to strike a balance appropriate to the needs of their markets, since different societies will attach different preferences to market structure outcomes.

**At the same time, financial regulatory authorities are working to manage policy trade-offs between stability and integrity, competition and efficiency, and consumer protection and privacy.** The barbell outcome, for example, could present challenges in terms of stability with respect to both large and small payers. Widespread access to data raises privacy concerns. Regulators need to balance the innovation and efficiency brought by new entrants with the potential challenges for oversight, enforcement, and consumer protection. Emerging policy approaches—such as new anti-trust rules for the digital era, data mobility requirements, and data protection laws—may help mitigate the policy trade-offs. Yet the responsibility for these changes generally lies with different public authorities, and with legislatures.

**Financial services are undergoing a profound transformation.** To navigate this new territory effectively, and to balance the necessary policy goals, authorities will need to collaborate. This will need to occur both domestically—with cooperation between central banks, financial sector regulators, other industry regulators, and competition and data protection authorities—and across borders. Such collaboration can help to ensure regulatory consistency and peer learning within and between countries, and ultimately better development outcomes for the country.

---

# 1. Introduction

---

**Digital innovation is transforming financial services.** Innovations in financial technology such as mobile money, peer-to-peer (P2P) or marketplace lending, robo-advice, insurance technology (insurtech) and crypto-assets have emerged around the world.<sup>1</sup> In the past decade, fintech has already driven greater convenience and access to financial services for retail users. Artificial intelligence (AI), cloud services, and distributed ledger technology (DLT) are transforming wholesale markets in areas as diverse as financial market trading and regulatory and supervisory technology (regtech and suptech). A host of new firms have sprung up to apply new technologies to meet customer demand and most incumbents indicate that digital transformation is a strategic priority (Feyen et al. 2021). Indeed, leading banks are rapidly closing gaps in digitization of internal processes and customer offerings, to compete with fintech and large technology (big tech) firms that have also entered the fray (BIS 2019; Frost et al. 2019).

**These developments have the potential to make markets more diverse, competitive, efficient, and inclusive, but could also increase concentration.** Innovation has introduced competition and increased inclusion, particularly in emerging markets and developing economies (Pazarbasioglu et al. 2020; Frost et al. 2021). Fintech seems to have thrived particularly in markets where the financial system had been less developed (FSB 2020; Didier et al. 2021). However, the underlying economics of intermediation combined with new technology may lead to concentration among both traditional and new financial services providers. Monopolistic or anti-competitive behaviours by big technology platforms are already being scrutinized. As financial services move towards similar technology-driven configurations, regulators are grappling with questions around how best to regulate and supervise a landscape that is increasingly characterized by new players and business models; and to address potential challenges to financial stability, financial integrity, fair competition, and consumer protection (including data privacy).

**The COVID-19 pandemic has accelerated digital transformation.** In particular, the need for digital connectivity to replace physical interactions between consumers and providers, and in the processes that produce financial services, will be even more important as economies, financial services providers, businesses and individuals navigate the pandemic and the eventual post-COVID-19 world. For instance, the pandemic has already accelerated the shift to digital payments (Auer et al. 2020a). It has also intensified e-commerce (BIS 2020; Alfonso et al. 2021), which may benefit big-tech firms and their activities in finance. Countries with more stringent COVID-19 policies and lower community mobility experienced a larger increase in financial app downloads in the wake of the outbreak (Didier et al. 2021). Finally, it may be speeding up work on central bank digital currencies (CBDCs) (Auer et al. 2020b).

**This note examines the implications of digital innovation for market structure and attendant policies, including financial and competition regulation.** There have been a number of surveys of regulatory responses. This note takes a step back, to look at what the economic theory of banking and financial intermediation can tell us about how technology may drive industrial organization in the sector, and how that might inform further policy responses. The paper roots the impact of the digital transformation of finance in innovations that have enabled providers to address long-standing challenges of financial intermediation—including asymmetric information, uncertainty, incomplete markets, and fixed and variable costs of production. The paper describes how digital innovation affects these key economic frictions in finance, and alters the financial services value chain and industrial organization. The forces driving these changes, and potential outcomes in terms of industry structure, lead to insights for policy makers on how to harness the benefits of fintech,

---

1. FSB (2017) and IMF and World Bank Group (2019) give overviews.

while mitigating some of the risks, particularly around competition and market structure. The focus is on economic and technological forces that apply broadly across financial services. It recognizes that the sector encompasses a wide range of different products and services, and is composed of numerous sub-markets that might use different technologies or have different economic structures. These may thus diverge in market structure and competition outcomes.

---

## 2. Economic Frictions and Forces in Financial Services

---

**Fundamentally, financial firms, like other firms, owe their existence to transaction costs** (Baltensperger 1980). In the absence of complete trust between parties, market interactions on the production side and the customer side are characterized by risks, for example, due to principal-agent challenges and incomplete or asymmetric information. Solving these to reduce risk and create trust imposes costs on both institutions and consumers, including contracting, search, and verification costs. For example, lending is characterized by information asymmetries *ex ante*, as lenders need to determine the risk profile of potential borrowers, and *ex post*, as they need to monitor the repayment capacity of borrowers (Dewatripoint and Tirole, 1994). A fundamental feature of payment markets is the need to keep track of payment obligations, and to verify the identity of account holders or the veracity of payment tokens (Kahn and Roberds, 2009). Different actors in the payment processing chain must trust that the other links will not expose them to fraud or liability, and customers require trustworthy counterparties with which to lodge funds and reliable processes for their delivery. Financial market investment and insurance are subject to uncertainty around future outcomes, adverse selection, and moral hazard. Those creating investment products rely on sound underwriting and execution services to be able to offer a quality product to their customers. Customers, in turn, must be able to trust the soundness of the investments and of the operations that underlie their ability to buy and sell.

**As in other industries, internalization of activities within a single financial services firm overcomes principal-agent and asymmetric information challenges to align interests and monitor actions.** This ensures trusted interactions across teams. Linking deposit-taking to lending enables close coordination of asset and liability management. Combining payments execution with account management allows the provider to confirm availability of funds before transfer instructions are carried out. Linking underwriting, trading, and sales allows firms to design new investment products in line with market conditions and investor preferences.

**Uncertainty about future outcomes, for example, whether a borrower will go bankrupt, adds further frictions.** Because it is difficult to define a contract for all potential future states of the world—and the resulting solvency status of the borrower—markets are not complete in the Arrow-Debreu (1954) sense. As a result, resource allocations may be inefficient: some borrowers will have to pay higher interest rates to compensate the lender for expected (but not necessarily realized) losses, costly insurance may be required, or some loans will not be made at all. More generally, the difficulty of tailoring products to the precise circumstances of different customers, due either to asymmetric information or uncertainty about outcomes, means that pricing, maturity, or other terms will inevitably be less than perfectly suited to the circumstances of some clients. They may decline the offer, or the intermediary may deem certain segments unviable commercially. Either way, some customers will not be served.

**Financial services companies are structured to address particular information gaps and frictions related to intermediation.** Banks developed to address the maturity transformation challenge resulting from incomplete information about future liquidity needs of depositors. They also address the transactional costs and risk-management needs of intermediating investments across individuals who lack direct knowledge of other counterparties or information about economic activities taking place elsewhere. Banks diversify across large numbers of borrowers to better manage uncertainty of outcomes. Exchanges and brokers address the search and transaction costs of individual issuers and investors, reducing information asymmetries through listing requirements and publishing prices, and providing infrastructure and

services to match and enable transactions between buyers and sellers who don't know each other. Because so much of the intermediation process is not readily visible to customers, and risks may only be realized after an extended period of time, the consumer need for trusted providers manifests more than in other industries. A provider that gains customer trust with one product can leverage that trust to offer other services.

**Providing these services requires not only information and *financial resources*, but also *real resources*.** These include the labour, equipment, and premises to produce financial contracts, manage accounts, and process customer transactions. The mix of labour, physical capital, financial capital, and trust capital will vary by business type, and has been rapidly changing. Nevertheless, financial services production is subject, in varying degrees, to the same frictions that affect production in other industries, including real resource indivisibility and fixed costs. Thus, while financial intermediation is subject to unique information and transaction frictions, as an industry it is also subject to familiar economic forces observed across sectors.

**Basic economic forces are at play across both the financial and real resources deployed by financial firms.** These include:

- **Economies of scale.** On the supply side, traditional financial firms have had large fixed cost investment needs for the creation and maintenance of back-office systems and physical distribution networks to connect to the consumer. There may also be fixed costs of minimum capital requirements and regulatory compliance operations. As in any industry with fixed costs, economies of scale emerge when a larger producer can amortize those costs over a larger customer base. Scale also permits the development of a diversified balance sheet to better manage liquidity and credit risk. Scale can reduce the marginal cost of risk-taking (Mester, 2010), allow better pricing, and increase ability to serve a wider range of customers.
- **Economies of scope.** Also on the supply side, financial intermediaries enjoy economies of scope by bundling interdependent financial services that can be delivered through the same physical customer interfaces and leverage the same balance sheet. Cross-selling loan products and insurance, and offering both asset and liability products, can create synergies and reduce costs. Economies of scope are further enforced by the demand side as many customers prefer a conveniently offered suite of products. This also reinforces the institution's role of gatekeeper to the customer.
- **Network effects.** On the demand side, network effects (or "externalities") are significant in financial services such as payments, where the value of the network to all users (both payers and payees) increases when the number of connected users increases. A bank serving a business, as well as its suppliers and customers could more efficiently connect counterparties to quickly transfer payments and provide working capital.

**Given the available technology and prevailing regulation, these forces have historically conferred advantages to "first movers" and large, vertically and horizontally integrated players.** This has been particularly true for capital-intensive products such as lending, for institutions that put consumers' savings at risk such as deposit taking, and for capital and network-intensive areas such as payments.

---

## 2.1 The Impact of Digital Innovation on Key Economic Frictions

---

**The adoption of technology is not new in the financial sector, but a number of constraints had until recently defined the operating environment.** In the late 20th century, the industry was already characterized by a relatively high degree of computerization since most financial services were dematerialized.<sup>2</sup> Only payments frequently required physical cash or a check. Onboarding for new products and services often required in-person or paper-based processes.

---

2. This included data centres, front and back-office connectivity to core banking systems, branch automation, and interoperable payments networks connecting financial firms, including wire services, automated clearing houses (ACH), and ATM networks.

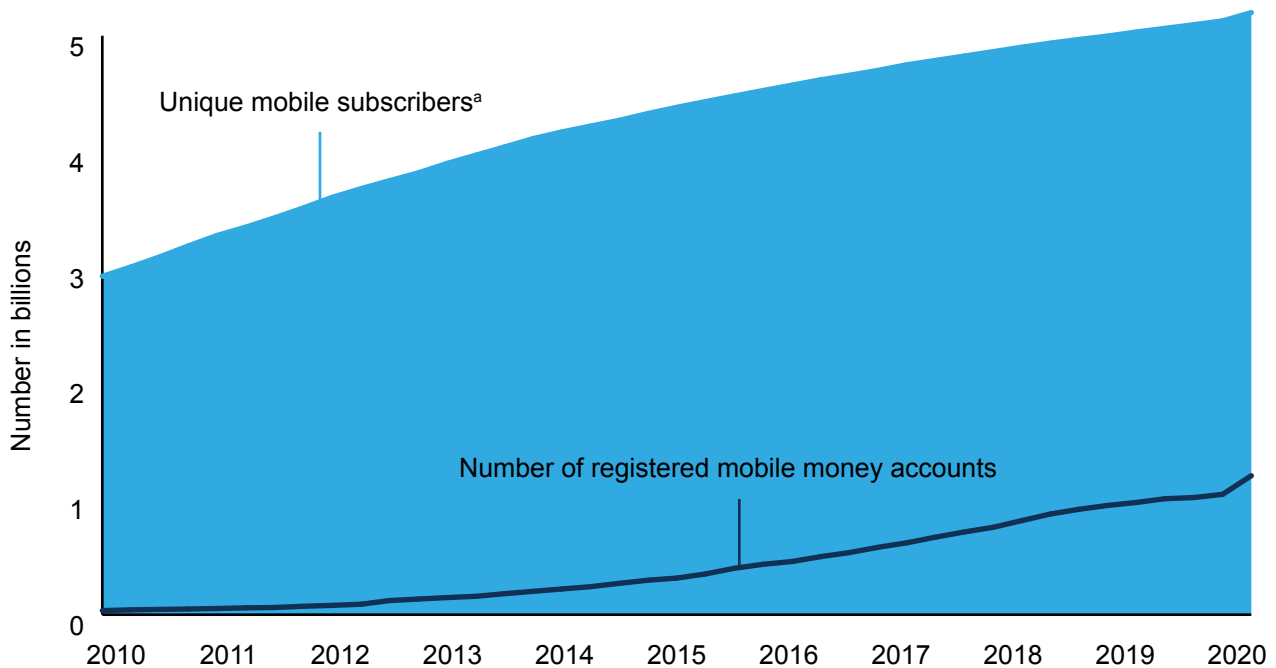
Still, reaching and connecting to customers routinely required physical infrastructure such as branches and automated teller machines (ATMs). Customers wishing to transact with counterparties using other banks had to use expensive and sometimes slow or risky processes such as wire transfers. Even after the advent of digital payment systems and the dematerialization of securities, connectivity remained a barrier to entry—an institution typically had to be licensed and part of the consortium of banks or brokerage houses to participate in a transactional network. Further, data processing and storage were expensive, requiring the operation of bespoke mainframes and data centres. This limited the volume of information that could be gathered, stored, analyzed, and exchanged to improve efficiency, better price risk, and tailor products to customer needs.

### 2.1.1 Technology advances in connectivity, data processing, and storage

Significant technology advances in two key areas have contributed to the current wave of technology-based finance:

- Increased connectivity:** Internet, and mobile technology have rapidly increased the ability to transfer information and interact remotely, both between businesses and directly to the consumer. Through mobile and smartphones, which are near-ubiquitous, technology has increased access to, and the efficiency of, direct delivery channels and promises lower-cost, tailored financial services. As of late 2020, GSMA estimated that there were more than 5 billion mobile subscriptions worldwide. Building on this user base, there were more than one billion registered mobile money accounts (figure 1). In principle, most financial services can be now delivered directly and digitally, vastly increasing access to finance. An emerging class of services and assets could in principle even be delivered without the need for an intermediary. At the same time, the rapid increase in connectivity has enabled large network effects and strengthened the position of established intermediaries offering mobile networks and subscriptions, such as

Figure 1. Mobile and mobile wallet growth worldwide



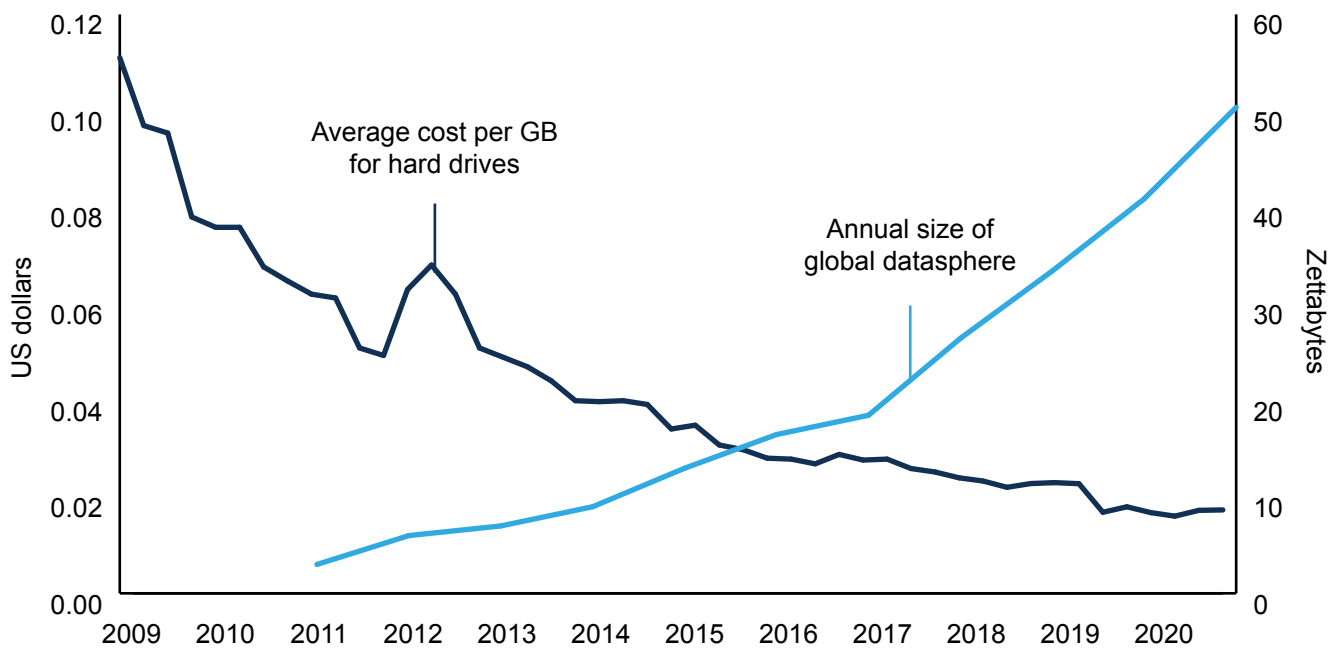
a. Defined by GSMA Intelligence as individual person that can account for multiple 'mobile connections' (that is, SIM cards).

Source: GSMA Intelligence.

telecom companies, particularly in some emerging market and developing economies (EMDEs). Furthermore, the development of widely used applications and services like social media, search, and social communication has enabled more peer-to-peer casual interactions. These are increasingly being tapped for economic interactions, as well. This has strengthened the position of the companies providing these services.

- Low-cost computing and data storage:** Computing efficiency has risen exponentially, as the cost of data storage has rapidly declined. The Cray-1 was the world’s fastest “supercomputer” from 1976 to 1982, operating at 80 MHz, weighing 5.5 tons, and costing \$10 million.<sup>3</sup> The A11 chip powering an iPhone X runs at a speed of 2.39 GHz—30 times faster—and at a small fraction of the size and cost.<sup>4</sup> Data that required a room full of tape or hard drives in 1980 can fit on a micro secure digital (SD) card today. As the cost of data storage has fallen, from \$0.11 per gigabyte in 2009 to \$0.02 in 2020, the volume of data being generated globally has increased exponentially—to an estimated 48 zettabytes (48 trillion gigabytes) in 2020 (figure 2). The ability to process such data rapidly has also risen with advances in artificial intelligence (AI) and machine learning (FSB 2017). Digital technologies like smartphones, and activities like social media and e-commerce generate a wealth of new data. Much of the new data relates to individuals (“personal data”) or firms, and can be processed automatically to identify the characteristics of existing or potential clients and offer the financial services that best fit them.

**Figure 2. Costs of storage have declined as global data volumes have surged**



From Sep 2017, data extrapolated using the growth rate in price per MB from <http://www.jcmit.net/diskprice.htm>. The increase in 2012 is explained by flooding in Thailand, where one-third of hard drives were produced globally. One zettabyte is one trillion gigabytes.

Source: BACKBLAZE; [jcmit.net/diskprice](http://jcmit.net/diskprice); SEAGATE (2018), *The digitization of the world from edge to core*, November.

3. See <https://www.computerhistory.org/revolution/supercomputers/10/7>.  
 4. See <https://igotoffer.com/blog/iphone-x-sum-technologies>.

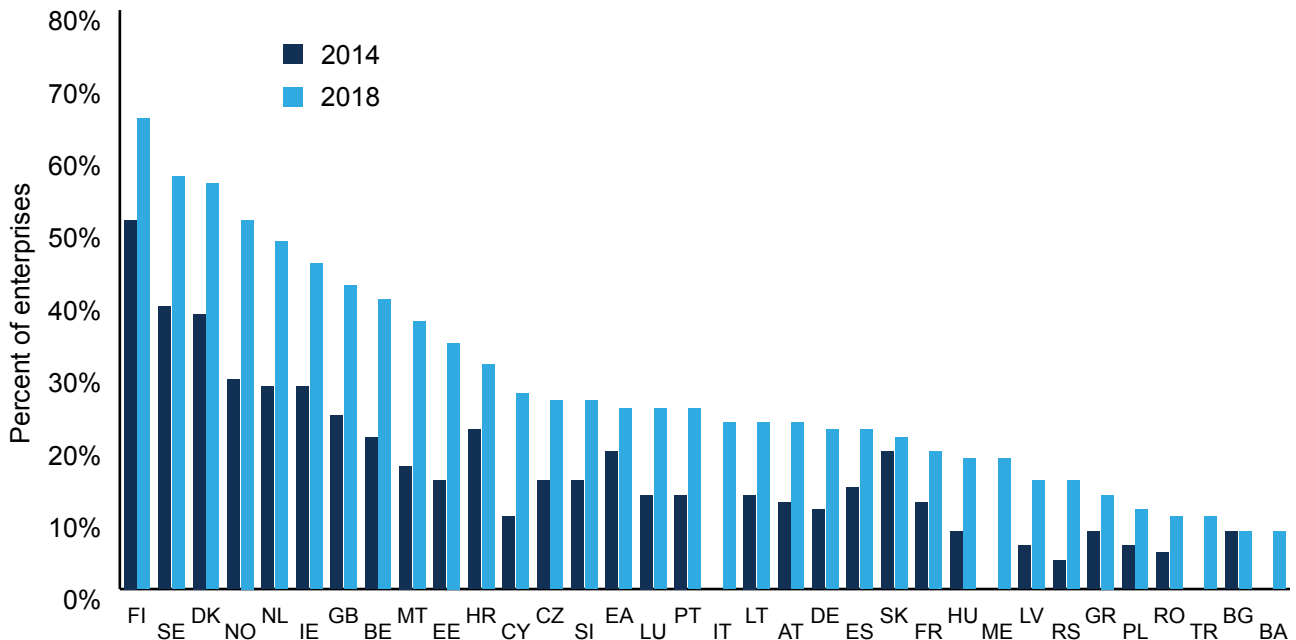


### 2.1.2 Data, networks, and new business models

These advances have enabled the creation of huge amounts of capturable data, new tools to analyze those data, and new business models leveraging insights from the analysis. Connectivity generates and captures a variety of data, and digitization of more activities generates higher volumes of data at an even greater velocity. Storage and processing capacity allows data to be organized, validated, and analyzed, including through computationally intensive techniques such as AI, including machine learning applications on vast troves of data. Digitally “native” data with high volume, variety, velocity and veracity are referred to as “Big Data.”<sup>5</sup> These characteristics mean that not only did Big Data *emerge* due to increased digitization of activities (including those facilitated by connectivity), but Big Data also *requires* low-cost storage and high-capacity computing power to be useful. Big Data emerges from a variety of sources, including the location and usage data from mobile phones, the contact information from social networks, the delivery information from logistics companies, and the sales data from retail outlets and payments networks. Big Data is being used in a wide range of traditional financial services and new types of businesses to improve credit analysis, process efficiency, risk management, product design, customer service and other areas. Examples include Trusting Social, which uses call records to develop credit scores, and Tenda Pago, which uses retailers’ consumer goods order information as a basis for working capital loans. Data can be an important resource for, and driver of, economic development (World Bank 2021).

These advances also enable a number of new business models for the provision of technology, one of which is cloud-based computing. This combines the ability of an enterprise or individual to connect to externally operated and managed data centers with low-cost computing power and storage. The result is an ability to obtain infrastructure on demand and reduce the fixed cost barrier to entry to offer financial services. Surveys show that cloud adoption has

Figure 3. Enterprises using cloud storage in Europe rose sharply over 2014–18



Source: Eurostat.

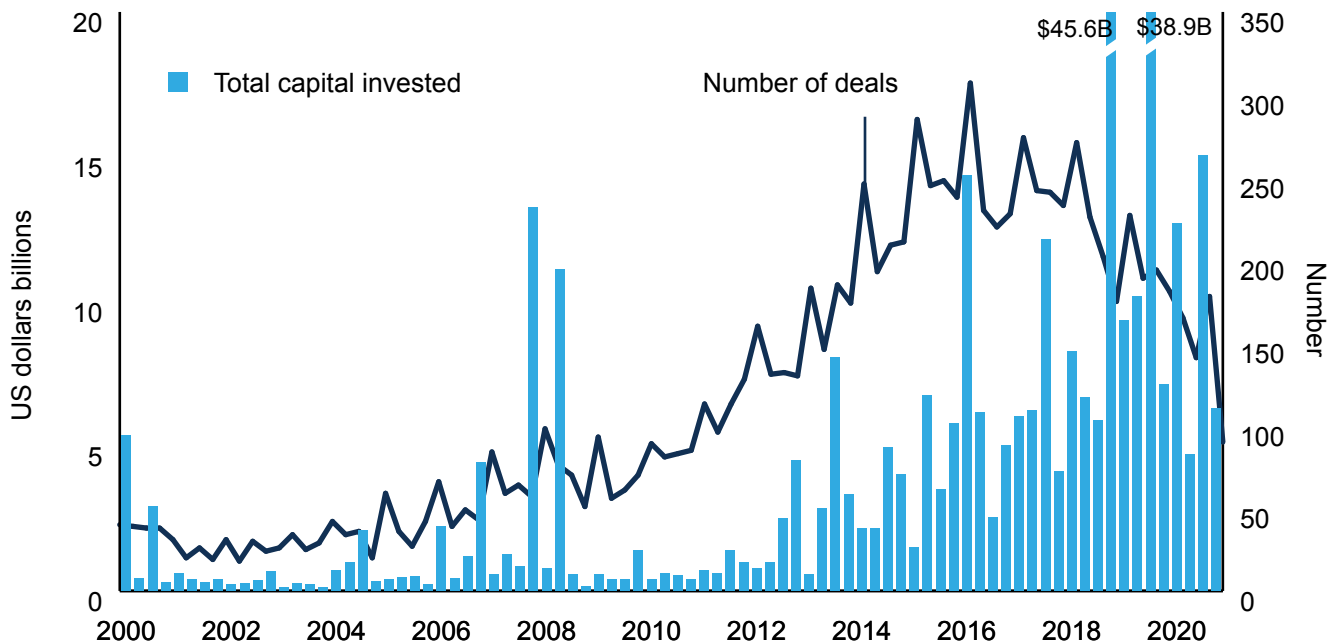
5. Earlier versions used the first three Vs, with veracity added as a characteristic necessary to make the data truly useful (Lukoianova and Rubin, 2014). Some add a fifth V, value (BBVA 2020).

proceeded rapidly. For instance, in Europe, Eurostat estimates that over half of enterprises in the Nordic countries used cloud storage in 2018, while firms in the Netherlands, Ireland, the UK, and Malta have also seen rapid adoption (figure 3). Recent evidence suggests that cloud adoption has even accelerated during the COVID-19 pandemic (McKinsey 2020). For instance, a recent survey of IT leaders from 250 mid-sized companies around the world found that 82 percent of respondents increased cloud usage as a result of the COVID-19 pandemic and 91 percent are planning a more strategic use of cloud in the near future (Snow 2020). Innovation in cloud services is proceeding apace, as growing volumes of venture capital and private equity funding have flown into new applications of cloud technology and development operations (DevOps) over the past three years (figure 4).

**Another result of the technology advances described above has been the wide emergence of platform-based business models.** Fintech firms, big tech firms, and even some incumbents have moved increasingly to a role as “match-makers” between different users and providers on their platforms (Croxson et al. 2021). These businesses leverage the connectivity of individuals and businesses, and the ability to quickly and easily collaborate, discover counterparties, and package and deliver a range of digital and physical goods and services. Platforms are two-sided or multi-sided markets, and benefit from network effects that create more value for each participant with increased numbers of other participants.

**The platform provider also benefits from the network effects that attract more users, transaction volumes from which to earn revenues, and data that in turn enables the provider to target users with more goods or services.** The ability to connect large numbers of users to a wide array of services has led to the rise of so-called ‘super apps’ such as WeChat, AliPay, and (perhaps) Facebook. These and other technology companies operating platforms with large customer bases are often referred to as big tech firms (Frost et al. 2019). For this analysis, almost any large company that has or can leverage Big Data against a large customer base could become a big tech. Examples include telecom providers like Vodafone MPesa, and retailers such as Walmart, which is already a substantial e-commerce player and in early 2021 announced intentions to create a fintech operation. It could also include business-to-business (B2B) players

Figure 4. Investment in CloudTech and DevOps companies<sup>a</sup>



a. As classified by PitchBook. CloudTech and development operations (DevOps) include companies that help organizations develop, operationalize and monitor software applications at scale. Data accessed on November 18, 2020.

Source: PitchBook Data Inc.

such as consumer goods manufacturers and distributors. Among other features, platform operators can leverage digital delivery channels and application programming interfaces (APIs) to seamlessly “embed” financial services, such as payments or loans, into non-financial services such as e-commerce or social media.

**Network effects in these business models can lead to market concentration and competition concerns.** The effect of adding users on one side of a platform market (ride-hailing drivers, for example), creating more value to users on the other side (riders), and therefore becoming more attractive to users on the first side (drivers), can result in a positive growth spiral and a *winner-takes-all* or *winner-takes-most* outcome, where all market participants want to be on the same platform. There is the risk that a platform that builds a dominant market position would extract rents from its massive data and networks (Croxson et al. 2021). The multi-sided nature of the market, however, makes it difficult to define the relevant market interactions, such as product tying (i.e., where the use of one product or service is tied to the purchase of another product or service), for competition analysis. Furthermore, multi-sided markets are characterized by complex pricing structures, including asymmetric pricing that more finely divides the consumer surplus amongst participants. Pricing practices that could be considered anti-competitive in one-sided markets might be pro-competitive in a multi-sided market by attracting more participants and increasing welfare-enhancing network effects (White et al. 2018). The implications of these aspects for financial services delivered through fintech or big tech platforms will be explored further below.

### 2.1.3 Impact on transaction costs, information asymmetries, and market gaps

**Through the advances in connectivity and computing, digital innovation helps to alleviate transaction costs and enable a wide range of new financial services business models.** Adoption cuts across traditional and new providers. Digital technologies can help reduce the costs of collecting, storing, processing, and exchanging information—including search costs, replication costs, tracking costs, and verification costs (Goldfarb and Tucker 2019). In finance, this can help borrowers to more quickly find a suitable offer on loans, or help savers to find investment products that suit their specific needs. Technologies can also help parties to automate verification of events, enabling the creation of a wider range of state-contingent products. For instance, an insurance client may use a phone camera or other remote device to document damage that results in an insurance claim, or a drone may verify that a field has been planted to enable disbursement of an agricultural loan. Blockchain technologies take these a level further by providing a set of underlying capabilities making it easier for individuals and businesses to interact on a peer-to-peer basis even when they do not know each other beforehand (trustless context). At the limit, such advances may obviate the need for intermediation, by enabling individuals or firms—such as the lenders and borrowers in P2P and private credit markets—to interact directly without the need for a bank to aggregate funds, assess credit, and provide ongoing monitoring and servicing functions.

**Incumbents, fintech entrants, and big tech firms are leveraging technology to address economic frictions.** They can close information gaps (asymmetric information, uncertainty), and cut costs by:

- **Reducing information asymmetries.** Classic theories of intermediation describe how banks address information asymmetries between borrowers and lenders (Aghion and Bolton, 1997; Holmström and Tirole, 1997). They also discuss how residual gaps increase credit costs or restrict the supply of credit, both in terms of interest rates and the costs of ancillary activities such as attaching collateral. Better information, for example, leveraging consumer data and analytics, could improve risk assessment and reduce the need for collateral as an indicator of creditworthiness in lending (Gambacorta et al. 2020; see box 1). The use of vast troves of data enables the provision of financial services to individuals and small businesses with no or limited traditional credit history, thereby promoting financial inclusion. More information and greater transparency tend to increase trust, enabling providers and users of funds to work with a wider range of counterparties. With enough transparency between users of finance and providers of funds, intermediation itself may not be necessary. For example, fintech credit models such as P2P or marketplace lending seek to directly link investors and borrowers (Claessens et al. 2018).

- **Enabling customization of financial services to construct more complete markets.** Data and automation facilitate the execution and monitoring of complex contracts and creation of more complete markets. This could bring financial services closer to the stylized general equilibrium of the classic Arrow-Debreu (1954) model. Traditional core banking systems and marketing channels were built around standardized products, and did not facilitate a fully consumer-centric approach to product development and marketing. More tailored services, such as loans, investment advice, or retirement planning structured to account for individual circumstances of the borrower across different outcomes and states of the world, required highly trained and expensive experts. In contrast, fintech-enabled automation of processes reduces set-up costs for customized products and can track different contingencies across a wide range of outcomes. Digital marketing systems enable specialized products to find a sufficient customer base. The increased availability of data and computing power makes it possible to better price risk, tailor a product or service to the needs of the consumer, and potentially construct a range of state-contingent products, executed and monitored through smart contracts or other emerging technologies.
- **Reducing fixed and marginal costs of producing financial services.** Technology has reduced the costs of, and the need for, much of the traditional physical infrastructure that drove fixed costs for the direct financial services provider. An early example that has been particularly important in EMDEs is mobile money. Mobile money has reduced the need for traditional bank branches and payments acceptance infrastructure, for example, point of sale (POS) terminals, and has become a widely used alternative to bank accounts in some countries. Cloud-based infrastructure, including banking-as-a-service (BaaS), provides computing power, data storage, and even compliance services. A niche financial services provider can connect to these services and purchase as much capacity as it requires on demand without the need to build data centres and other back-office infrastructure (or, in the case of BaaS, a license).<sup>6</sup> Financial intermediaries can reduce marginal costs through technology-enabled automation and “straight-through” processing, which are accelerating with the expanded use of data and AI-based processes. Digital innovation can also help to overcome spatial (geographical) barriers, and even to bridge differences across legal jurisdictions (akin to processes discussed by Bodie and Merton, 2005). The increased use of digital tools and platforms for a range of economic activities makes it possible to embed tailored financial products into non-financial activities, drastically reducing customer acquisition costs and risks. Contextualized finance will be discussed further below.
- **Reducing search and switching costs for consumers.** Advances in connectivity and online search mean finding and using a financial services provider in the next state or province—or across the globe—can be as easy as finding one in the same city. On the consumer side, the marginal cost of using multiple financial service providers is also reduced. Technologies have become increasingly plug-and-play, from the advent of common internet communications protocols and mark-up languages, to “open banking” and standardized APIs that facilitate data access and exchange. Increased access to information about remote providers and their products and prices reduces search costs for users. The reduction in search and switching costs thus applies both to providers and individual customers. For example, a customer can now choose a start-up remittance service provider, offering lower fees and ready connectivity to the customer’s bank account, or an established social media company that already has the customer’s trust and connectivity to friends and family to whom remittances are sent. Reduced search costs could eventually enable those who need finance to connect directly to those with excess funds to invest, with smart loan contracts replacing the monitoring provided by intermediaries. Lower search, onboarding, and switching costs could make markets more competitive.

**Despite reduced costs, increased efficiency, and all the new data and computing power available, fintech remains subject to the same risks traditionally present in finance.** Credit, liquidity, market, and operational risks can be reduced or transferred, but not eliminated completely. Market failures can result in financial instability, speculative bubbles, domino effects and, potentially, systemic risks (Frost 2020). In most markets, digital finance has not reached levels at which it presents systemic risk, but as fintech and big-tech finance grow, and traditional banks use similar

6. While branch fixed costs may be eliminated by direct connectivity to customers, technology fixed cost has been variabilized at the level of the financial services provider but remains a high fixed cost offering from the technology provider(s). The relevant market for tech infrastructure shifts from financial services to IT/cloud services. The resulting market concentration issues are addressed below.

**Box 1. Data and collateral**

Banks usually require borrowers to pledge tangible assets, such as real estate, to help offset asymmetric information problems. Collateral performs several functions: it can indicate creditworthiness, to the extent that having accumulated the means to possess a tangible asset signals something about ability to repay a loan; it provides an alternative means to recover the loan in case the borrower becomes unable to repay; and it aligns interests because the potential loss of the collateral would be costly for a borrower, who becomes unwilling to repay. By contrast, big tech firms can use Big Data to better assess firms' creditworthiness. They can link repayment performance to other sources of value, such as access to new inventory or to an e-commerce platform to sell goods. These capabilities could help to reduce the importance of collateral in solving asymmetric information problems and maintaining alignment of interests.

Gambacorta et al. (2020) compare how credit from a big tech firm (Ant Group) and traditional bank lending correlate with local economic activity, house prices, and firm-specific characteristics. Using a unique random sample of more than two million Chinese firms, the paper finds that big tech credit does not correlate with local business conditions and house prices when controlling for demand factors.

Figure B1 indicates the unconditional elasticity between the different credit forms and house price. The dots in the figures indicate the average logarithm credit use (y-axis) and the average logarithm of housing price (x-axis) at the city-year level. The left-hand panel plots big-tech credit, the middle panel plots bank-secured credit (mortgages), and the right-hand panel plots bank-unsecured credit. Linear trend lines are reported in each graph, together with 95 percent confidence bands. The (unconditional) elasticity of big-tech credit with respect to house prices is 0.09, while that of unsecured bank credit is twice as high (0.184). That of secured bank credit is five times higher (0.488). A greater use of big-tech credit could therefore have macroeconomic implications, weakening the relevance of the collateral channel.

**Figure B1. Elasticity of big-tech credit to asset prices**



Based on a 100,000 random sample of firms served by both MYbank (Ant Group) and traditional Chinese banks. The dots in the figures indicate the average logarithm credit use (y-axis) and the average logarithm of housing price (x-axis) at the city-year level. Growth rates are approximated using first differences of log values. The left-hand panel plots big tech credit, the middle panel plots bank-secured credit and the right-hand panel plots bank-unsecured credit. Linear trend lines are reported in each graph, together with 95-percent confidence bands. Standard errors in brackets.

Source: Gambacorta et al. 2020.

technologies to a greater degree, that will shift. P2P lending in China reached significant volumes before the regulatory crackdown began in 2017. This culminated in the November 2019 requirement that all platforms close or convert to regulated small loan providers within two years. P2P lending in China and the more recent Wirecard failure in Germany offer lessons on the need for appropriate regulation and supervision of fintech. Big-tech firms may already have reached the level of systemic importance (too-big-to-fail) in some economies, notably in China. Authorities are actively formulating appropriate regulatory responses to these risks (see section 4).

**The digital transformation of finance also introduces—or heightens—cyber risks. Cybersecurity is an issue for all sectors and for traditional financial services providers as well as fintech firms and big tech firms.** The attack surface is broadening, however, as interconnectivity increases and the disaggregation of services introduces more links to each product chain and user interface. These factors can also increase operational risks as a greater number of distinct entities may be involved in the provision of a single product or service, creating complex webs of operational dependency. These risks may have increased further during the COVID-19 pandemic (Aldasoro et al. 2021). At the same time, certain core services have become more concentrated (for example, provision of cloud services), creating the potential that single points of failure could result in systemic disruption.

**Finally, there are new risks to privacy and consumer protection.** The proliferation of providers and tailored services, reaching new customers and embedding financial products into other activities, increase the risks of compromising privacy, abusive practices, or errors by unaware consumers. Consumer protection and regulation of risks arising from fintech and digital transformation are addressed in other papers in the Fintech and the Future of Finance series.

---

## 2.2 Consequences for Financial Services Firms

---

**The financial services value chain consists of four broad components: customer interface, back-office functions, infrastructure, and balance sheet.** The operations that ‘manufacture’ financial services involve the first three of these. The theory of the firm in economics highlights transactions costs as a key determinant of whether a given process or interaction will be mediated through the market or within a firm (Coase 1937; Williamson 1971). Prior to the advent of fintech, the combination of transactions costs and economies of scale and scope resulted in large financial intermediaries that tended to be vertically and horizontally integrated, providing all four components (and multitudes of subcomponents) internally.

- i. **Customer interface.** This consists of physical networks such as branches, ATMs, and points-of-sale to distribute core financial products and services. In the past, customers needed to be physically present to conduct activities such as opening an account, buying a product, making a transaction, and getting advice. In many cases, these activities were paper-based and cumbersome. Although the advent of the internet gave rise to online and mobile banking, these were again owned and operated by a particular financial institution. As a result, financial institutions largely remained as *gatekeepers* to the consumer with a basic bank account being the pre-condition to participate in the economy and acquire additional financial services. As a result, financial institutions were also able to tap into a highly regulated, but sticky and cheap source of funding: retail deposits.
- ii. **Back and middle office.** This consists of all the departments, processes, and internal systems to operate the bank’s products and balance sheets. These functions include risk management, regulatory compliance, credit decisions, fraud detection, call centres, trade reconciliation, technology operations, and record keeping. Prior to the advent of fintech, these processes involved manual and paper-based intervention and required cross-departmental coordination. Organizational complexity and siloed legacy IT systems further increased transaction costs, left customer data unexploited, impeded the ability to innovate, and degraded customer experiences.
- iii. **Infrastructure.** This connects individual financial sector participants (including the central bank) to collectively comprise the financial system. This includes payment and settlement systems (retail and wholesale) as well as other financial infrastructures such as credit information bureaus and arrangements that facilitate transactions across

borders. Many of these infrastructures still face inefficiencies due to, for example, limited operating hours and interoperability constraints. Further, until recently, non-banks typically could not access these infrastructures directly and were therefore reliant on banks.

- iv. **Balance sheet.** Deploying customer deposits (or other sources of funds) into productive loans (and other uses of funds) through balance sheet intermediation is one of the oldest functions in finance. A modern balance sheet serves more complex functions and is optimized to attract a mix of retail and wholesale funds, to match assets and liabilities across multiple dimensions (tenor, currency, etc.) and to maintain adequate capital and liquidity levels. Balance sheets of regulated financial institutions are subject to a variety of requirements and constraints. Certain types of financial institutions—for example, payment service providers, mutual fund managers, and more recently P2P or marketplace lenders—do not create customer liabilities and assets on their own balance sheets. Nevertheless, balance-sheet finance remains dominant in most EMDEs. Even in advanced economies, assets that are ultimately funded through capital markets are often originated on-balance sheet before being securitized or sold to a ‘shadow bank.’

**As technology has reduced transaction costs, the boundaries of the firm have changed and the production chain for financial services could be more disaggregated (vertical disintegration).** This has been taking place for decades; an example is the use of third-party ATM and card networks to process banking withdrawals or payments transactions. First, the ATM moved the transaction outside the bank branch. Then, connectivity and information transfer technologies enabled different companies to provide elements of the transaction value chain—an issuing bank, a merchant processor operating a POS terminal, and a network operator. As a result, the customer-facing bank could focus on its core competencies and customers. With advances in technology, this process has accelerated. There is an increasing array of products and services that can be sourced from multiple different providers, combined, and offered to the customer as an integrated whole. The customer-facing provider might incorporate features and functions from external vendors, outsourcing providers, or partners. Examples include using third-party sales agents or internet marketplace originators, external credit scoring services, outsourced card issuer processing, and white-label integration of fintech services.

**Advances in information and connectivity have also led to an unbundling of financial services consumption (horizontal disintegration).** Customers now have more information about different providers and an increased ability to interact across providers, so they can choose different providers for the different financial products they use. Similarly, providers have more access to information about new or potential customers, can market to them better, and can offer services directly. The availability of data also makes it easier for providers to underwrite a customer without having had a prior relationship, so the inherent competitive advantage of a single provider in offering additional products is diminished. Services that were once consumed from one financial institution can be offered by a wide range of specialized firms. Examples in both personal and business banking underscore this unbundling (figure 5). However, even as the consumer’s need for a horizontally integrated provider has been reduced, providers can now integrate more products from different providers. The outcome in terms of horizontal disintegration depends on individual preferences, views on convenience, and costs to search and assemble product sets. All of these are affected by changing access modes, for example, from branch to internet, agent, or mobile app.

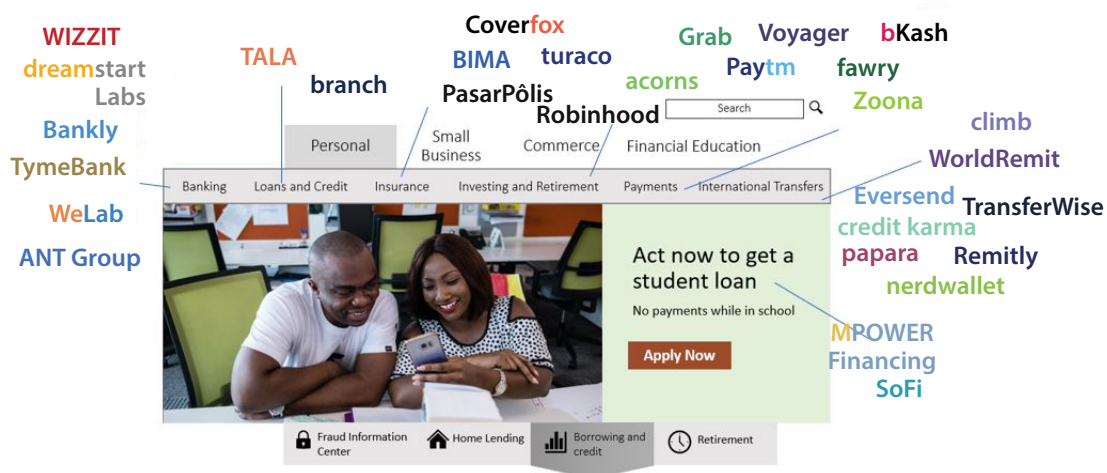
**Consumer interfaces are changing from physical branches to convenient digital access from anywhere.** Digital consumer interfaces (for example, web, mobile) enable new players to directly reach consumers both near and far. By using apps from different competitors, consumers can build their own complete bank and gain more personalized services. This has likely reduced the value of legacy physical networks and the incumbent’s grip on the customer, who can easily shift funds to different providers to access preferred services (Shevlin, 2019). For example, the innovation of mobile money was a network-based account ledger provided by non-bank players and mobile network operators, leveraging already ubiquitous mobile-network connectivity infrastructure. This was combined with a new ecosystem of low-cost agents for the customer interface, and a high degree of automation to eliminate most back-office processes. Mobile money ecosystems deliver low value/high volume transactions cost effectively, making this a viable offering for low income inclusive finance segments. Similarly, fintech payment aggregators (for example, Square and Stripe) offer convenient payment services to merchants without the need for them to set up a merchant account with a processing

bank. The aggregators act as the ‘merchant of record’ taking responsibility for compliance vis-à-vis network and bank requirements. A related development is that the customer interface could be with institutions outside the jurisdictional boundaries of the customer. On the internet, it does not matter to the consumer if the provider is in Kansas or Kathmandu (although it may matter to the regulator). Services have adapted accordingly.

**Non-financial companies can also leverage customer connectivity and data to offer financial services, altering the competitive landscape and blurring industry boundaries.** As mobile applications and the internet have become a dominant way through which consumers live their lives and businesses operate, e-commerce, telecom, online search, logistics/transportation, and social media platforms have become the new gatekeepers to the customer. Digital platforms and big tech firms in particular are well placed to directly tap into their vast customer networks and data (BIS 2019). They are able to offer contextually relevant financial services to their user bases to enhance customer experience or increase sales of their core product. For example, e-commerce, ride-hailing, and social media platforms have integrated seamless

**Figure 5. Specialist providers challenging the services of large banks**

**Unbundling of personal banking**



**Unbundling of business banking**



Source: World Bank; authors' elaboration after Barrett (2018).



payment services to strengthen the value proposition in their core markets. Micro-insurance has been embedded into mobile money and the sale of consumer products. Users do not desire most financial services in and of themselves, but see them as a means to another activity (for example, pay a driver to reach a destination, take out a working capital loan to obtain inventory). As such, embedding the financial service directly into that core activity can be attractive to the customer. It can even make the customer more aware of services about which they otherwise might not have known, or to which they might not have had access. Banks have used customer relationships to cross-sell financial services since the beginning of banking; now an increasing range of non-bank actors are doing the same thing.

**The back and middle office are being revamped—or eliminated entirely.** Technology has reduced the costs of, and need for, much of the traditional back-office infrastructure, from paper processing to data centres. The back office is being revamped to lower costs and improve communication. Process automation and upgrades to software and IT systems are causing a restructuring of financial institutions and a reduction of full-time employees. Middle-office functions such as reconciliations are increasingly unnecessary. Entire processes, and many of the skills that previously had to be hired, can be replaced with automation or expert systems. This has also given room for third parties to step in, such as cloud service providers and fintech firms with specialized capabilities that sell their software-as-a-service (SaaS) to banks (for example, data processing, credit scoring, electronic know-your-customer or e-KYC). Thus, for example, a bank can work with a credit-scoring company that leverages unique data and scoring expertise to provide a seamless customer experience.

**Unencumbered by legacy systems, some new entrants have built new software platforms to handle their core banking activities, while others rent.** Cloud-based infrastructure and BaaS providers allow smaller banks to outsource technology operations and leverage the latest systems to compete alongside larger banks. They enable small start-ups to purchase not only data processing and storage capacity, but also entry points into regulated infrastructure and regulatory compliance. Thus, smaller players can grow capacity in tandem with their customer base, without the initial setup costs and step-function cost curves previously required.

**Technology has also accelerated the internationalization of back-office functions.** For several decades there has been a trend of offshoring back-office functions. Many financial firms first shifted call centres and customer service to lower-cost environments; they later shifted application processing and IT operations. This trend is accelerated by the advent of cloud computing. Entire IT systems, including core banking systems, can now be hosted anywhere in the world. In regions with common regulatory frameworks, even the entire provision of some products and services could be outside the boundaries of the customer's country. For example, a digital bank domiciled in Lithuania can bundle products and services from elsewhere in the European Union (EU) and offer them to customers over the entire EU. On the other hand, in jurisdictions where the use of cloud-based infrastructure and/or overseas data processing and storage have been restricted (due to data localization or other policies), efficiencies and entry may be limited. This is particularly true if the market is too small to support its own localized infrastructure. The shift of back-office functions—and associated processes and customer data—to other jurisdictions can raise a new set of supervisory challenges.

**Supporting infrastructures are changing.** Much of the traditional infrastructure, which was both a cost and source of competitive advantage for incumbents, can be reduced or replaced, or must be shared. Digital identity (ID) and know your customer (KYC) registries are implemented in many countries and can help redefine the onboarding and authentication process that has long required in-person verification at a branch (D'Silva et al. 2019). New infrastructures such as API platforms for payments or lending, and distributed ledger systems that can support crypto-assets or stablecoins, could produce large network effects and change the role of, or even disintermediate, certain players (Arner et al. 2020). Open banking initiatives require banks to share customer data with fintech firms. In some jurisdictions banks must initiate transactions introduced by fintech firms upon customer request, further eroding the traditional incumbent-customer relationship. At the same time, public payment system innovations have allowed access to non-banks. On the one hand, open banking APIs enable non-banks to offer payment initiation services, without them having to participate in any of the payment systems themselves. On the other, central banks are requiring transparent and risk-based access criteria for payment and settlement systems, replacing earlier restrictions of access to only banks.

---

## 3. Implications for the Industrial Organization of the Financial Sector

---

### 3.1 Implications for Market Entry

---

**Digital innovation has reduced cost barriers, allowing new and smaller players to enter.** The elimination of many fixed costs and a reduction in variable and switching costs makes it possible for low-cost providers to enter the market, subject to local regulation. Although a trusted reputation must still be developed, small providers are more likely than in the past to be economically viable. Such new providers may strip away particular customer segments and revenue bases from traditional providers, or broaden access to finance for previously underserved segments, without needing to achieve large scale and scope. Apps and cloud-based computing and software platforms have enabled entrepreneurs to quickly bootstrap without the need to raise huge amounts of capital to finance massive upfront investments. APIs and open banking initiatives have the potential to further accelerate this trend, since a new service need not wrench the customer completely away from the incumbent, and can therefore build trust by layering a service on top of the safety net provided by legacy institutions.

**Infrastructure connectivity and a reduced need for physical branches allow established companies from other sectors to offer financial services as well.** These entrants can deploy automated processes in lieu of hiring a specialized workforce, connect to the financial transactions infrastructure, and leverage cloud-based infrastructures to reduce the cost of cross-market entry. For many of these new providers, such as digital platform companies and some telecoms, consumer trust and a customer base are already established in their core markets and potentially transferable to the financial sector (Oliver Wyman 2019). Some are able to combine financial services with other products or core capabilities as part of a platform offering. This is particularly relevant in EMDEs where the financial system is less developed and access to financial services is more limited. This affords fintech and big tech firms more room to expand their financial activities and compete with incumbents (FSB 2020).

**Entry into financial services is accelerated by the ability to turn regulatory compliance into a technology integration process.** Several banks have built BaaS platforms to serve fintech firms and even other banks. They can connect these clients to the payment system or a bank balance sheet, thus reducing the need to deal with the complexities of licensing, regulation, and developing their own core banking systems. Leveraging BaaS, new entrants can tap into existing—and already regulated—financial transactions and balance sheet providers. Where open banking is in force, they can also leverage the data, and sometimes functionality, of existing financial accounts. This allows a wider range of use cases into which finance can be embedded; in particular, a range of commercial platforms or transactional situations can layer on a financial service from a BaaS provider without much of the systems and compliance overhead previously required. While increasing competition, this multi-faceted and multi-tiered access to the regulated banking sector introduces new challenges for regulators and supervisors, as discussed below.

## 3.2 Shifting Economies of Scale and Scope

**However, basic economic forces remain relevant.** Economies of scale and scope remain, even as the minimum efficient scale for service delivery is lower for the individual user and for most financial services providers. That has been accomplished in part by shifting the scale effects to the infrastructure providers; scale remains highly relevant in areas of cloud computing and data processing and software platforms. In fact, new forms of scale have emerged in connectivity and computing, along with previously present economies of scale in capital, including reputation, or “trust capital.”

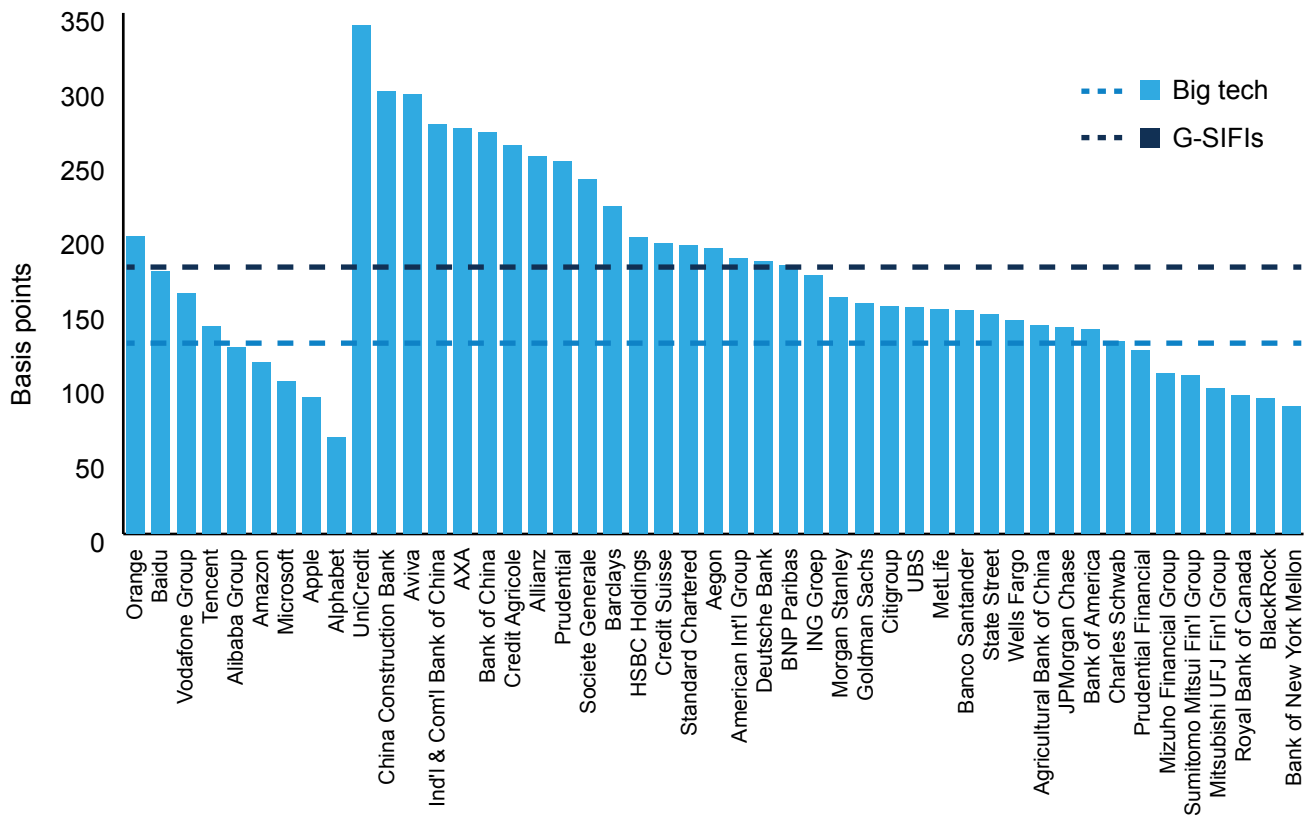
**In the digital finance era, economic frictions have not disappeared, but take on new forms.** The costs of services have been reduced in many cases, but certainly not eliminated. Financial services providers, particularly new non-bank providers, face two important costs in the unbundled marketplace:

- **Customer acquisition costs.** Customer acquisition costs, comprising marketing, onboarding, KYC, and initial credit assessment, remain significant relative to revenues, especially for retail financial services. This is partly due to regulatory requirements, but marketing and other onboarding costs remain pertinent even when remote interactions are possible (for example, leveraging e-KYC). While technology has made it easy to directly reach users digitally, the cost to acquire new customers remains high because of user inertia, which is particularly present in retail and SME business lines. Customer acquisition costs are also significant for wholesale customers, as systems integration and business process changes may be cumbersome, and initial credit assessment is more complex. Amortizing these and other fixed costs across more customers and products allows for economies of scale and scope. This naturally puts larger incumbents and big tech firms at an advantage.
- **Funding costs.** As noted above, some products have natural complementarities that reduce the cost of providing one or the other product if offered in tandem. Most clearly, offering loans is more economical if there is a cheap source of funding in the form of deposits. There are other complementarities in derivatives, stock lending, insurance, etc. Size, and the diversification it brings, can provide a funding advantage due to lower risk, and greater liquidity of traded funding instruments (bonds, shares) issued at scale. In general, big tech firms have a higher overall cost of funding than global systemically important financial institutions (G-SIFIs) because they use more equity and have no deposits. However, when analyzing similar funding components (that is, bonds) big tech firms tend to have a lower cost at issuance (figure 6).

Consumers and other users also experience frictions in the unbundled financial services marketplace. As consumers balance choice and convenience, they may favour firms offering broader scope:

- **Assembly costs.** Simplicity and convenience have significant value, often resulting in preferences for a single provider that offers an integrated suite of financial products and services, even if each individual product may be less convenient or well-designed, or marginally more expensive, than those of alternative niche providers. For many consumers, there is a cost to the time, effort, and potential confusion of assembling fragmented services from unbundled providers and moving funds between them. Thus, most savers still use intermediaries or platforms to deploy their savings instead of searching out individual borrowers. Similarly, “contextualized finance” embeds the financial service into the actual economic activity the customer is seeking to perform (for example, pay for a trip on a ride-hailing platform, take out a loan on an e-commerce platform). This can provide the service exactly when it is needed. Where the customer is already using a platform provider or big tech, onboarding costs are reduced, and convenience for the user creates economies of scope for the provider. The rise of “super apps” such as WeChat, AliPay, Yandex, and Grab, and contenders such as Rappi and Revolut, which add multiple services, is testament to the value consumers place on being able to go to a single source for multiple services.
- **Switching costs.** For consumers, business users and financial services providers considering a change of vendor, there are barriers in the form of effort, inertia, inconvenience, and the difficulty of disentangling a service that has been linked to multiple activities and systems. Switching costs can also result from intentional technical design.

Figure 6. Average spread of active bonds to benchmark government bonds at issuance



The dashed horizontal lines indicate the simple average.

Average spread of active bonds over the respective benchmark government bond at issuance as collected by the Bloomberg SRCH function. Terminal accessed on Sept. 3, 2020. Filters used: Corporates, Active Bonds, Issue Date >01/01/2013 and Issuer Name as listed in the graph.

Source: Cornelli et al. (2020b); Bloomberg.

Consumers may flock to digital platforms with large customer bases to benefit from network effects. Yet once they become large, platforms may seek to increase switching costs. If a service has been integrated into multiple activities or workflows, or has accumulated significant user data, it may also be able to provide better or more tailored services that a new provider would not be able to match. Where proprietary protocols are in place, or historical data are difficult to share, connectivity across different providers might be hindered.

### 3.3 Impact on Financial Services Providers

**Reduced economic frictions, the ability to reconfigure the value chain, new opportunities for entry, and shifting economies of scale and scope will affect different financial services providers differently.** The impact will depend on their current market positions and ability to leverage technology. Incumbents start with advantages in trust capital and regulatory position. Fintech firms are proving nimble at leveraging data, connectivity, and improved processing capacity, and at converting regulatory barriers into solvable technology challenges. Big tech firms compound the advantages of fintech firms with large existing customer bases for non-financial business lines, associated customer data, and high

levels of brand trust (Stulz, 2020; OECD 2020).<sup>7</sup> Individuals play a limited role as financial service providers today, interacting largely via intermediaries. In a future of increased connectivity and decentralized finance, individuals may be further empowered as direct providers of financial services.

### 3.3.1 Incumbents

**Although there is increasing competition, the continued relevance of basic economic forces enables incumbent financial institutions with integrated product offerings to maintain—at least for now—significant market share.** Incumbents have an advantage in having already overcome some of the information asymmetries that form a barrier to trust: they are regulated and have been in the market and demonstrated their reliability over time. Multi-product incumbents ameliorate customer switching and assembly costs. Incumbents benefit from economies of scale in financial capital, and the diversification benefits inherent in larger scale and broader scope. Incumbents also have economies of scale in customer data, which they are beginning to better leverage, and customers often have higher trust in incumbents to safeguard their data (Armantier et al. 2021).

**Unbundling could reduce the cross-subsidies that are inherent in the integrated banking model.** Free use of a current account is often funded by the use of the balances to lend to other customers, or by the value created in providing other products to the account holder. While product tying is often considered an anti-competitive practice, in most markets traditional banking products have explicit exemption from anti-tying rules (see, for example, OCC 1995). Disaggregation can disrupt this business model, potentially stripping away the more profitable products and services that have standalone profitability (for example, remittances), and leaving traditional providers with an embedded cost base and products with low margins or that the market expects to get for free. Open banking regulations that require banks to offer access to their customers' accounts to third parties could accelerate this process.

**Incumbents are innovating and upgrading across each component of the value chain.** Indeed, a recent World Bank survey finds that digital transformation is a strategic priority for the overwhelming majority of incumbents. They aim to shed overhead costs and employees, improve products, and compete for consumer relationships (Feyen et al. 2021). Many expect further growth in digital customer interactions and transactions, which will intensify competition. The largest institutions can leverage their scale, customer base, regulatory expertise, and capacity to update their technology stacks and manage large balance sheets to effectively compete with big-tech entrants. Smaller institutions can take advantage of on-demand infrastructure and external service providers to undertake a rapid and less costly digital transformation. Incumbents that are not able to adapt in time may perish or be acquired.

**Some incumbents have built distribution platforms to enrich their own product offering by allowing fintech firms to offer their products directly to the incumbent's users.** In essence, these incumbents have become marketplaces and leverage network effects.<sup>8</sup> Innovations in infrastructure such as APIs can facilitate these partnerships, which benefit from both the fintech firms' need to achieve scale, and banks' continued role as the central financial services provider for many of their customers. As long as customers remain tethered to bank accounts directly or through fintech firms, banks can continue to benefit from their own economies of scale in capital, connectivity, and high-fidelity consumer financial data.

**Banks continue to have deep expertise in regulation and compliance and have already passed key regulatory hurdles ahead of new entrants.** Many fintech and big tech firms offer their financial services in close direct or indirect collaboration with banks to access the regulated financial system at the back office or infrastructure layers. B2B fintech and big tech firms offer their services to incumbents in the form of partnerships or SaaS engagements. This is also the

7. Surveys of the most trusted consumer brands globally and in the US continue to place big tech firms well above financial institutions. See Morning Consult (2021). On the other hand, Armantier et al. (2021) find that US consumers trust big tech firms the least to safeguard their personal data, and have more trust in banks, followed by fintech firms and the government. The difference may be explained in part by the difference in overall brand trust versus trust to safeguard personal data.

8. See EY 2020 and Croxson et al. 2021.

main level where banks engage with big tech firms to procure state-of-the-art cloud-computing and data-processing services, which require deep expertise and economies of scale. Business-to-consumer (B2C) fintech and big tech firms that compete directly at the customer interface level often still rely on banks themselves to store value (for example, the so-called float, or deposited funds, of mobile money operators). They also use banks to access the payment system, or use other core banking system functions that are difficult to build in-house (for example, by using BaaS). Moreover, depending on the regulatory environment and the business model choices fintech firms make, their customers often need to have an account with a financial institution to use the fintech firms' services, driving continued demand for at least some incumbents' services.

**Incumbents also have a comparative advantage in managing complex, large balance sheets and navigating compliance with evolving regulations.** This is critical since finance is one of the most highly regulated sectors. As such, many fintech and big tech firms may be reluctant to become full-fledged regulated financial institutions, which can be a slow, costly, and uncertain process. However, regtech solutions could erode part of this comparative advantage of incumbents (Auer 2019). As another example, lending platforms also rely on incumbents and institutional investors to purchase the loans originated on the platform.

**The main challenge for incumbents is that they are encumbered by legacy systems, networks, and cultures; not all will be able to adapt and survive.** Legacy, fixed-cost infrastructure cannot be easily scaled back at the same rate as it becomes obsolete. Financial institutions (and regulators) are also mindful of the need to maintain minimum services for non-digitized customer segments, especially in more remote locations where alternatives are limited. Incumbents bear regulatory and compliance requirements that may not apply to new competitors or that can be evaded via regulatory arbitrage. Incumbents may also have service obligations not imposed on fintech or big-tech players. These regulatory and social obligations can present competitive disadvantages if steps are not taken to level the playing field.

---

### 3.3.2 Fintech firms

---

**After driving the unbundling of financial services, many fintech firms have begun to re-bundle.** Fintech firms have been adding new products to their offerings, by themselves or via partnerships and platform approaches. This allows them to cross-sell to existing customers and make themselves more attractive to new ones. Some examples are shown in figure 7. For some, this is the result of opportunities to provide a better customer experience and increase revenue. For others, it is a matter of necessity. Since scale and scope economies still matter, fintech firms that focus on a limited range of products may not be able to achieve funding synergies or amortize customer acquisition costs, regulatory compliance costs, and investments in brand recognition across a sufficiently large revenue base to be able to generate profits or fully compete on price with incumbents. It will be interesting to observe how these newly re-bundled product sets evolve. Newer companies building up a set of services for a particular customer base in today's environment, leveraging high-quality data on market needs and customer profitability, will doubtless arrive at a different product set than was developed by universal banks through agglomeration of products over a long period, from the 18th to the 20th centuries.

**New entrants initially stayed away from financial activities that carry large licensing, capital, and regulatory burdens.** Most new players focused on activities such as payments, cards and financial advice, and avoided highly regulated, capital-intensive activities such as on-balance sheet lending and securities underwriting. Indeed, the rapid rise of fintech firms was facilitated in many markets by regulatory gaps that allowed new service providers to enter and operate with minimal regulatory burden. As regulators caught up, fintech strategies shifted; in some markets they were forced to seek licenses.

**Some fintech firms have chosen a regulated status as part of their evolving product strategies.** For example, alternative finance platforms initially focused on matching supply and demand of capital, avoiding the regulatory burden of intermediation. However, in the process of re-bundling, some fintech firms have sought full banking licenses. In particular, lending platforms have faced challenges to fund their operations in wholesale markets or using a pure P2P

funding model. As a result, they have become more reliant on incumbents for funding, or have sought their own banking licenses. For example, Grab and SoFi have sought banking licenses, while GoJek and MoneyTap partner with banks (the latter also has a non-bank financial company license). Other fintech firms prefer to avoid a higher regulatory burden by expanding across borders to reach scale with their existing product offering. The COVID-19 pandemic and resulting economic dislocations have exacerbated the challenges of relying on crowdfunding, capital markets, or bank partners for balance sheet capacity. As a result, two prominent early fintech lenders, OnDeck and Kabbage, were sold to other companies in July and August 2020.

### 3.3.3 Big tech firms

**Basic economic forces such as scale and scope economies, along with network effects, also play to the fundamental strengths of big tech companies.** Big tech firms already enjoy an active customer base, creating economies of scale and scope and network effects in their core markets; they are increasingly able to leverage these to exert market power in the financial sector (BIS 2019; Frost et al. 2019). Agility in systems development and creating easy-to-use customer interfaces are relative strengths of tech companies compared to traditional financial institutions, and big tech firms’ access to customer data and understanding of customer behaviours may equal or exceed those of financial institutions. Big tech firms can bundle financial services to reinforce the value proposition of the ecosystem in their core markets, such as e-commerce and social media, or offer financial services as a new product line cross-sold to the existing customer base. This phenomenon is manifest in developed and emerging markets, often led by the latter. Alibaba was a leader in layering payments onto e-commerce with AliPay. It then developed a broad range of financial services. (By contrast, eBay’s integration of the original incarnation of PayPal did not go as far). Marketplaces from Amazon to Gojek, Grab, Jumia, Lazada, and Mercado Libre are integrating merchant loans into their offerings. Because financial services are layered over other cash generating activities, these companies can subsidize financial services. For instance, WeChat Pay, WhatsApp Pay and other providers allow users to send money to each other for free—though fees may be higher

Figure 7. Fintech product offerings have expanded over time

#### Product Add-ons



(formerly TransferWise)  
International Remittances  
+ Debit Card  
+ Multicurrency Account



Merchant Digital Services  
+ Lending



Small Business Loans  
+ Checking Account



Prepaid Card Account  
+ Business Services  
+ Stock Trading



Merchant Acceptance  
+ Card Issuance  
+ Merchant Loans



Student Loans  
+ Personal Loans, Home Loans  
+ SoFi Money, SoFi Invest



Payments and Card Acceptance  
+ Small Business Lending



Consumer Loans  
+ Checking  
+ Credit Monitoring  
+ Investment

#### Partnerships



Money  
Dashboard  
TransferWise



Money  
Dashboard  
moneybox  
PensionBee

#### Platforms



Source: Authors’ elaborations.

for merchants and business users. In some cases, the value a big tech can generate from customer data by driving traffic to its core business may be higher than the financial service fee income.

**Big tech firms have already amassed vast troves of relevant alternative customer data, which traditional financial institutions lack.** Combined with their ability to process these data for insights, this has enabled big tech firms to offer tailored financial services such as insurance or working capital loans to merchants on their platforms, who traditionally lack collateral or strong credit histories. This has uprooted the notion of traditional “relationship banking” in which banks have superior proprietary hard and soft information about their clients thus keeping them captive. Big tech firms also often choose to partner with incumbent financial institutions to offer these services so they can focus on their core markets. Regardless, bundling of services sets in motion a “data-network-activities (DNA)” feedback loop (see box B) where big tech ecosystems become more valuable to users. This begets new users, higher user engagement, and more user data. This in turn boosts network effects and economies of scale and scope, which enable big tech firms to increase the value of their ecosystems.

**Big tech firms can leverage unique market power in providing contextual finance—the bundling of financial services with core activities.** In addition to the data-network-activity feedback loop described above, “contextualized finance” may result in improved operational efficiency and portfolio performance relative to traditional financial institutions. A ride-hailing service that is financing the driver’s automobile can monitor usage, maintenance patterns, and cash flows. A distribution platform offering working capital credit to retailers purchasing inventory could cut off the supply of goods if the retailer is late in repaying; similarly, an e-commerce platform providing logistics and financing to merchants could seize inventory. Given network effects and high switching costs, big tech firms could enforce loan repayments by the simple threat of a downgrade or exclusion from their ecosystem in case of default. Their position as customer gatekeepers in their core businesses helps establish roles as gatekeepers and potentially enforcers for financial services as well. Although research has shown that fintech and big tech credit tends to complement, rather than replace, other forms of credit (see box 2), some big tech firms have explored becoming a full-fledged deposit-taking financial institution. Big tech firms active in EMDEs, with lower levels of financial development and inclusion and more permissive regulatory environments, have had more scope to venture on this path. Other jurisdictions impose limits to the span of activities of regulated financial institutions, with the result that big tech firms have not taken on a regulatory status that might restrict their ability to continue their other activities.

---

### 3.3.4 Individuals as financial services providers

---

**Technology will enable individuals to move beyond providing finance via intermediaries.** Today, individual savers provide the deposits that banks use to lend, and equity capital via investment and pension funds. There is the occasional direct family loan, or high net worth angel investor providing direct finance. Technology could allow this to be much more pervasive. P2P was an initial step in that direction.

**Reduction of the frictions that give rise to intermediation raises the prospect of radical disintermediation such that individuals become financial services providers directly.** The core of financial services is the transfer of resources between individuals directly and over time. New technologies could decentralize decision-making, risk-taking, and record keeping (FSB, 2019a). Distributed ledger technologies (DLT) have already demonstrated the potential for transfers of value without intermediaries. P2P lending was designed as a way to directly transfer resources and risk, with limited centralized matching services by the P2P platform. Technology obviates the need for a bank balance sheet by synthesizing a set of contributing liabilities against each asset (loan) as it is originated. Even these platforms could be eliminated. Drastic reductions in search costs could allow individuals at the retail level to connect directly to borrowers. Publicly available data and analytics applications could be applied to investments decisions and portfolio construction at the individual level, as roboadvisors are already doing. Smart contracts could automate monitoring and collection processes and reduce the coordination costs for a borrower working with multiple small lenders.



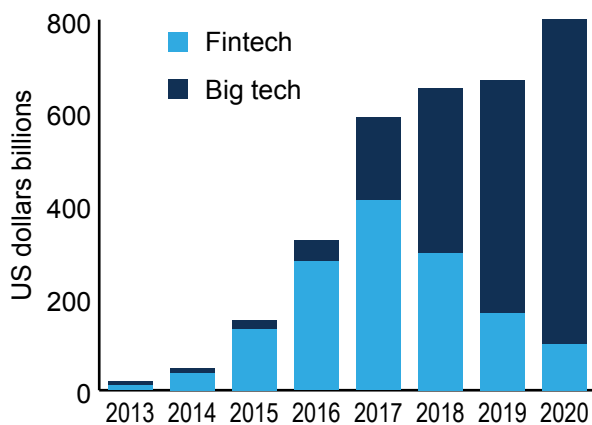
**Box 2. The data-network-activity feedback loop may explain the rapid growth of big tech credit**

The data-network-activity (DNA) feedback loop helps big tech firms to correctly predict clients’ creditworthiness, future income, and individual demands (BIS 2019). As a result, big tech firms can have a competitive advantage over banks and serve firms and households that otherwise would remain unbanked. Recent work suggests that big tech firms’ credit scoring applied to small vendors outperforms models based on credit bureau ratings and traditional borrower characteristics (Frost et al. 2019; Gambacorta et al. 2019). All this could represent a significant advance in financial inclusion and help improve firms’ performance (see Luohan Academy, 2018).

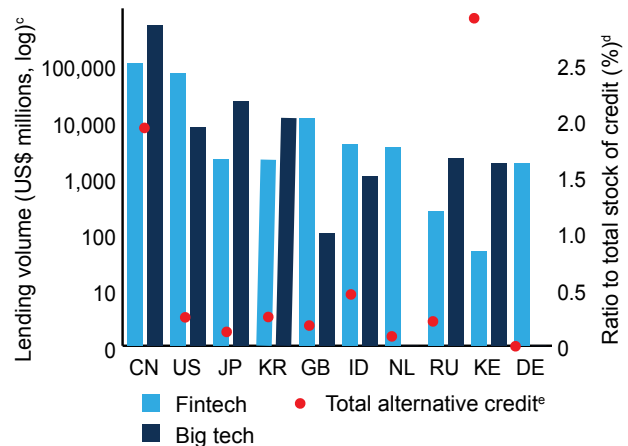
Cornelli et al. (2020a) find that in 2019, fintech and big-tech credit (together “total alternative credit”) reached nearly \$800 billion globally (see figure B2). Big-tech credit has shown particularly rapid growth in Asia (China, Japan, Republic of Korea, and Southeast Asia), and some countries in Africa and Latin America. By contrast, fintech credit volumes declined in 2018-20, largely due to market and regulatory developments in China. Fintech lending continued to grow outside of China in 2018-2019, but the overall volume was lower due to the decline in China. In 2020, the biggest portion of the global decline was again in China, where fintech lending all but ceased with the closure of P2P platforms. Fintech credit volumes also fell in some other key jurisdictions, including the UK, Netherlands, Korea and India during the Covid-19 pandemic. Volumes rose however, in the US, where fintech platforms were able to participate in the Paycheck Protection Program.<sup>a</sup> These alternative forms of credit are more developed in countries with higher GDP per capita (at a declining rate), where banking sector mark-ups are higher and where banking regulation is less stringent. Fintech credit is also more developed where there are fewer bank branches per capita. Moreover, these alternative forms of credit are more developed where the ease of doing business is higher, investor protection disclosure and the efficiency of the judicial system are higher, the bank credit to deposit ratio is lower, and where bond and equity markets are more developed. Overall, both fintech and big tech-credit seems to complement other forms of credit, not to substitute for them, and may increase overall credit access.

**Figure B2. Global big tech credit is booming, overtaking fintech credit**

Big tech credit grew further during the pandemic<sup>b</sup>



These alternative forms of lending are becoming a significant portion of total credit in a few economies



Source: IMF World Economic Outlook; World Bank; Brismo.com; Cambridge Centre for Alternative Finance and research partners; WDJ.com; companies’ reports. Cornelli et al. (2020a).

- a. The 2nd Global Alternative Finance Market Benchmarking Report - CCAF publications - Cambridge Judge Business School ; fintech lending is referred to in that report as “debt-based alternative finance”
- b. Includes estimates.
- c. Data for 2019.
- d. Domestic credit provided by the financial sector. Data for 2018.
- e. Total alternative credit is defined as the sum of fintech and big-tech credit.

**To date, consumers have not broadly embraced the role of direct payments provider in decentralized models.** DLT-based alternative payments via crypto-currencies are growing but the main use of crypto-currencies has been speculation rather than payments. Most individuals using crypto-currency still prefer to go through crypto-currency wallet providers or exchanges. While decentralized finance (“DeFi”) and decentralized apps (“DApps”) are growing, these are still a niche market (Schär, 2021). Other venues that might have fostered direct peer-to-peer exchange such as social media platforms and messaging apps have either offered payments intermediation themselves or linked to banks.

**Similarly, individuals have been reluctant to act as direct lenders assuming full responsibility for credit screening and lending decisions.** P2P marketplaces initially offered savers the ability to choose individual borrowers. The option for micro-assembly of loan portfolios is not much used, however; most consumers chose to let the platforms algorithmically allocate their funds. Behaviour on equity crowdfunding platforms is somewhat different, though increasingly these platforms are also offering diversified fund structures to consumers, who would prefer not to individually vet investments. OurCrowd, for example, began with a direct individual selection model but now operates a full menu of funds to allow investors to programmatically deploy and diversify.

**The direction of technology and developments in decentralized finance, however, suggests that these trends bear monitoring.** While savings and investment activities still bear a high cost of assembly, part of the promise of technology is the empowerment of individuals. Technology is reducing the need for intermediaries. Un-intermediated finance would render any individual with surplus funds a financial services provider. While the emergence of individuals as direct providers of financial services is nascent at present, it cannot be discounted as a potential influence on market structure in the future.

---

### 3.4 Impact on Sector Composition, Competition, Concentration

---

**The diversity of the financial sector has increased in both developed and emerging markets.** Alongside incumbents, there are many different types and sizes of fintech and big tech firms, offering a wide range of financial services. Some remain focused on a single product or service, while others have leveraged their initial successes to broaden their service offerings (for example, Square and PayPal moving from payments to lending). Some fintech firms are converting to banks, while others have become service providers to, or value-chain partners with banks. Depending on licensing approaches in different jurisdictions, a range of digital-only or digital-mainly neo-banks have emerged. They compete largely in the same regulatory space as incumbents, but with modernized business models and streamlined infrastructure. Big tech firms with core markets ranging from telecommunications to logistics, transportation, e-commerce marketplaces, and online search add another set of diverse players to the industry. Incumbents are also adopting new technology, partnering with fintech firms, setting up new digital units and otherwise adapting to the new environment. This hyper-diversification of financial services has implications for competition, as well as for regulation (see section 4).

**Fintech firms have significantly increased competitive pressure by directly engaging with the consumer.** The battle to ‘own the customer’ will be closely fought, since in most industries the links in the value chain closest to the customer earn the highest margins (for example, European Banking Authority 2018, OECD 2020, Petralia, 2020). Some fintech firms have skilfully targeted high-margin products or services and stripped those away from incumbents, leaving the incumbents with a lower-margin product mix. For example, companies like Wise (previously Transferwise) and Remitty targeted the relatively high-margin international transfer business. However, many fintech firms are struggling to compete at scale. Through re-bundling, some digital-only banks may be able to broaden scope and compete at scale, but at the cost of having to maintain a broader product mix in which some products or customers will generate lower margins.

**Disruption may be contained in areas where fintech firms themselves rely on incumbents for their operations.** As described above, many fintech firms still rely on banks to store value and process payments, and users often originate fintech transactions from an account with a financial institution. Products like Wise rely on existing bank or card accounts

not only for the cash-in/cash-out (CI/CO) functions, but also for a layer of KYC compliance. In some markets, digital financial services providers have built their own infrastructure for some of these functions (for example, mobile agent networks for CI/CO). The introduction of stablecoins and CBDCs might reduce the dependence of fintech firms on incumbents, particularly for payment services.

**For fintech firms that target back-office activities, the relationship with incumbents will be collaborative.** For example, B2B fintech firms offer services to incumbents in the form of partnerships or SaaS engagements. BaaS providers present a distinct competitive challenge. These regulated banks enable a range of businesses, including fintech firms, to compete more effectively with *other* banks. The ability to embed a tailored payment, loan, insurance, or other financial service into any economic, business, or social activity may be the most powerful disruptor of traditional financial services, and this is an area in which big tech firms excel.

**Big tech firms have the potential to compete at scale and become dominant players.** They already enjoy economies of scale and scope and network effects in their core markets. By adding financial services to their ecosystems, on their own or using BaaS, they can leverage these economies to compete with traditional providers and fintech firms. They also have the clout and deep pockets to navigate complex regulations and build parallel infrastructures and closed-loop systems, which could solidify their role as gatekeepers to the consumer (and their relevant data) in the financial sector. The resulting “winner-takes-all” or “winner-takes-most” dynamics may reduce competition and contestability of the sector and trigger monopolistic behaviour as customers become locked in. Some big tech firms (for example, Alipay) fortify customer lock-in by allowing funds to flow into their systems for free but charging a fee for withdrawals. They may tie the availability of a loan to consumption of other platform services, or cross-subsidize financial services with revenues from their core business. This could result in consumer benefits but destructive competition for the rest of the sector and potentially in other sectors. While there are ways regulators can attempt to re-level the playing field,<sup>9</sup> the intermingling of financial and non-financial services presents a number of challenging financial regulation and competition policy issues (see below).

**Incumbents large and small are embracing digital transformation across the value chain to compete with fintech and big tech firms.** Competitive pressure on traditional financial institutions may force even those that are lagging to transform or risk erosion of their customer base, income, and margins. In addition to partnering with fintech firms, some have set up their own digital-only banks. Where regulation permits, as in Thailand, some banks have countered the big tech incursion into banking with bank-centric e-commerce marketplace offerings (for example, Kasikorn Bank’s K+ market). Formerly captive local markets have become highly contestable by international players (for example, DBS entry into India via Digibank). Local banks or those serving specific industries may still be competitive in their niche markets, if they can manage the transition to digital delivery and maintain customer trust and loyalty and the other competitors don’t turn their focus to those niches.

**The largest markets might be expected to receive more attention from innovators, but small markets are affected as well.** Overall, fintech adoption seems to be higher in higher-income markets (Didier et al. 2021), and these will often be more attractive for Venture Capital investment. However, some mid-size countries have been ahead of the digital finance curve, perhaps because they had not received sufficient investment in traditional financial services and there were more underserved segments or larger margins to capture. Kenya’s ecosystem of digital payments, savings, and lending is a prominent example. Innovators in small countries can leverage the cost reductions discussed above to enter markets that may not have been viable with a higher cost structure. For some services, however, small markets may lag in terms of home-grown innovation. Innovations centred on data use may advance faster in larger markets that generate more data (World Bank 2021). Emerging and smaller markets could nonetheless benefit from incumbent transformation or geographic extension. The local incumbents can adopt new technologies to improve reach and efficiency, and large regional telecom and e-commerce players could extend financial services into these smaller markets. The ability to serve remotely could make a small market part of a larger market, provided the regulatory frameworks permit.

9. In Thailand, for example, regulators responded to e-commerce entry into financial services by permitting banks to operate e-commerce marketplaces and offer certain IT services to their clients. See Bank of Thailand 2019.

**More intense competition among a more diverse set of industry participants could result in a range of possible market outcomes.** As different institutions compete, cooperate or do both, industry structure will evolve, depending on which combination of three forces prevail in a given market.

5. **Economies of scale and scope:** where production costs remain significant relative to revenues (or cross-subsidization is possible), and network effects and switching costs or convenience effects are significant, we may expect consolidation into a set of large players, who can leverage scale in capital, connectivity, and data to offer a broad range of products at high volume and low cost. This could potentially also result in displacement of incumbent financial institutions by big tech firms, in particular in the retail banking domain. The conditions for “natural monopolies” could result from strong scale economies combined with low marginal costs of service provision. These are countered by the reduction in fixed costs that allow for smaller scale entry.
6. **Preferences for choice or convenience:** As we have seen, alongside the economies of scale achievable by big players, technology has enabled unbundling of products and services. These may vary along price, quality, and service dimensions. Customer can choose a custom mix of separate products and self-aggregate. This is more likely when customers are extremely price-sensitive or value more tailored services, and search and switching costs are low. Niche providers can then focus on product-market fit for a target customer base, and that customer base can easily find the product and migrate to it. The niche providers can thrive, taking advantage of their ability to manage infrastructure costs while reaching and retaining their target customers wherever they may be. The unbundling effects could dominate, with a resulting atomization of the industry. In this scenario, there would be space for new players that enable aggregation of the services and those that provide common services to the entire market. On the other hand, too much choice can overwhelm individuals and undermine the benefits that choice can provide (Schwartz 2005). Search and switching costs may reduce the convenience of self-aggregation. Customers may then prefer banks or platforms that integrate services for them, even if they end up paying more or accepting inferior service for one or more products.
7. **Regulation:** The above two forces will not play out independently from the actions of financial services and competition regulators, who will continue to shape outcomes with a variety of policy instruments.

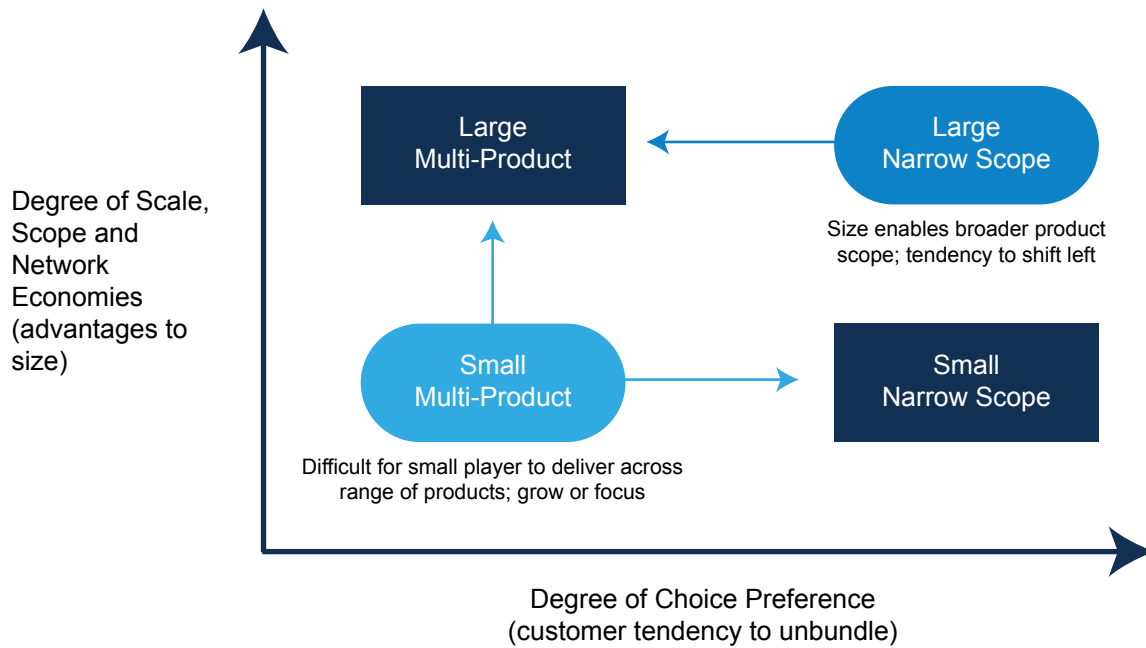
**Given the diversity of providers and consumers, the corner solutions of large multi-product players and small focused players may co-exist.** As shown in figure 8, the tendency of providers to seek scale (leverage scale, scope, and network economies) alongside consumer preferences for choice could result in four potential configurations, of which two appear to be dominant outcomes. A small player (left bottom corner) attempting to provide a broad range of products will find it difficult to deliver fully across that product range and will be pressured to either merge with others to grow large (left upper corner) or to focus on niche services (right lower corner). A large company with an initially narrow scope (right upper corner) will find that its size enables it to broaden, and will tend to add products (left upper corner). For instance, a payments firm may choose to add lending or insurance services, while an international money services provider may start offering checking accounts.

**Thus the financial services market may coalesce around one set of providers adopting large/multi-product strategies, and another set offering focused products and services.** This might be termed a “barbell” distribution, with a small set of large multi-product players on one side, and a large set of small niche service players on the other.<sup>10</sup> While this market structure reflects in part the “winner-takes-all” or “winner-takes-most” character of some tech-driven markets, the impact of friction and cost-reducing innovation in finance leaves the door open for smaller players to thrive. If regulation permits, this may mean continued market fluidity from new entrants and cross-overs from one sub-sector to another.

**The large, multi-product players could include traditional players, fintech and big tech firms—that is, both incumbents and new entrants (figure 9).** These may include banks that master the digital transformation, along with new financial services entrants that achieve scale, and big tech or other firms that have customer data and can link to

10. So-called ‘barbell’ distributions, with clusters on two ends of the scale have been observed in many markets, including labour markets (Autor 2019), product pricing and quality (Britton 2018), and portfolio strategy (Rutherford 2013). Such distributions have been observed in banking markets in previous periods or disruption, for example in the wake of mega-mergers in the US in the 1990s (Deogun 1996) and the financial crisis of 2008.

Figure 8. Corner solutions of scale vs. atomization



Source: Authors' elaborations.

BaaS. A recent survey indicated that large banks are ahead of smaller banks in terms of digital transformation, and are overall more positive about the impact of technology on their businesses (Feyen et al. 2021). Banks that pull ahead in terms of digitization will be able to leverage the DNA feedback loop to grow market share relative to other banks. Some technology-savvy and agile smaller or newer banks and bank-like players could also ride this wave to grow.<sup>11</sup> Big tech firms, on the other hand, enter the large size of the barbell on the strength of the customer base they bring from their core businesses, and the ability to convert those relationships into financial service product offerings at scale.

**The small, niche players could also include some traditional providers alongside fintech firms (figure 9).** Niche players may directly serve customers with a focused product set, or may serve large players with B2B services. Small local institutions such as community banks and credit cooperative banks, for example, occupy geographic niches and fill gaps not served by larger institutions, and may have significant trust capital as a competitive advantage (Mester 2018). A recent study of regional banks in the US found that many have been able to leverage technology and geographic focus to thrive against large-scale players (Alexopoulos, 2020). Many fintech firms enter the market as single product providers or with a product tailored to a specific market segment, such as small businesses in a given industry or set of markets. Unbundled fintech service providers with a strong value proposition can viably serve a narrow market given the ability to reduce fixed costs using flexible cloud-based infrastructure, digital channels, and other service delivery innovations, and build customer affinity with tailored products. De-centralization through DLT and other innovations will enable service providers to build on these new products and infrastructures to provide additional unbundled services. Small niche players could thus continue to thrive as they tailor their products and services to a specific market segment or customer base. As noted above, there are scenarios where individuals could act as direct providers of certain products or services; these would be extreme instances of small niche players.

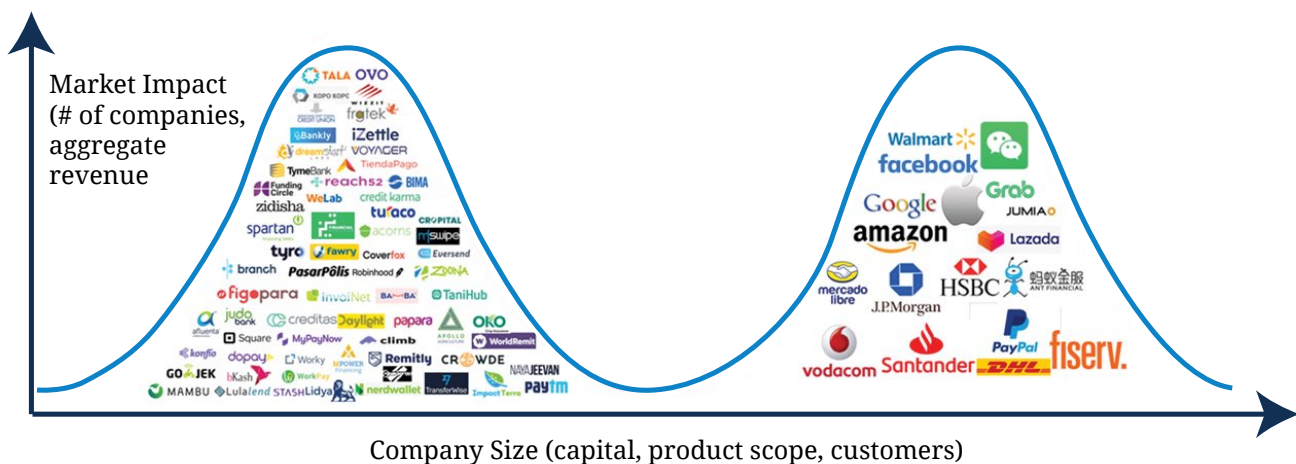
11. For example, NuBank (a payment services provider) in Brazil went rapidly from challenger bank to 30 million customers, placing it in the top ranks in that market. Cross-River Bank in the US has just one branch, but leveraged fintech to be one of the biggest lenders nationwide for the US Government's pandemic response program (Cowley 2020).

There is likely to be a degree of connectivity between the two ends of the barbell. Some narrow, tailored services will partner with large institutions to provide their specialized services to the customers of the larger institutions, while big tech and other platforms may provide some of the connectivity that allows small fintech firms to reach customers. The size of both ends of the barbell are also influenced by regulations that might limit the size of a particular firm.

**A barbell is a potential steadystate market structure, as some participants grow larger but innovation drives continued entry.** During the current transition phase, small multi-product providers and mid-size players continue to operate, increasingly challenged to compete against the scale players or to lock in a focused niche. Rebundling by the larger formerly single-product fintech firms is well underway in the more advanced markets, and entry by big tech firms is adding to the large player end of the distribution directly. Entry can continually replenish the small player end of the distribution. Large players will inevitably leave some markets less well served and new technologies will continue to reduce costs or offer the prospect of new products. As long as regulatory barriers are not raised, entrepreneurs will continue to bring innovative new products and services to the market; these may not compete across the board with the large players but provide a reservoir of contestability to counterbalance the concentrated end of the barbell. As illustrated in figure 8, there will be a tendency for players to either focus or to move to the large/multi-product space. Left to market forces, the dominance of the two sides of the barbell may very well squeeze out the middle (except insofar as a company passes through on its growth path from one side to the other). Those providers that cannot achieve the scale to compete with the larger providers but fail to focus on a sustainable niche may be forced to exit. A recent survey by FIS on new banking relationships established in the US in the last 12 months showed that 37 percent of new banking relationships went to large banks and 48 percent went to niche and neo-banks (community banks, credit unions, online banks and non-bank entities); the in-between regional banks got only 10 percent (see Marous, 2021).

**A barbell is not the only possible outcome, but is a central case given the economic forces at work.** Continued atomization, stalled re-aggregation, or limits on entry could result in a different configuration. Factors that will contribute to determining this outcome include core market forces such as the economies of scale and scope discussed above, regulatory limits on entry or on re-aggregation by non-banks, and consumer preferences for trusted incumbents or for convenience and internal product linkage vs. tailored solutions and more direct control. Societal preferences will matter and will be expressed not only by consumers but also in the degree to which policies for, and regulation of, financial services, competition, and consumer protection shape both market forces and consumer behaviour.

Figure 9. Potential barbell financial services market (illustrative)<sup>a</sup>



a. Graph 9 is purely illustrative and does not constitute endorsement of particular companies' potential roles in financial services or projections as to their future size or success.

Source: Authors' elaborations.

---

## 4. Policy Implications and New Trade-offs

---

**National authorities aim to foster the benefits of digital transformation in finance.** These include reduced costs and frictions, increased efficiency and competition, narrowing information asymmetry, and broadened access to financial services. At the same time, authorities are aware of the potential risks to the financial system and to customers (FSB 2017). A policy agenda (“Bali Fintech Agenda”) outlined by the World Bank and IMF advocates embracing the promise of fintech while managing risks to consumers and to the stability and integrity of the financial system (World Bank/IMF 2018). In particular, *reinforcing competition* and a commitment to open, free, and contestable markets were seen as a foundation for innovation and consumer choice while maintaining a level playing field. The Agenda also recognized the need to *adapt regulatory frameworks and supervisory practices*, including monitoring of new market participants, to facilitate the safe entry of new products, activities, and intermediaries while maintaining financial stability and sustaining trust, confidence, and the ability to respond to risks. The importance of robust data infrastructure, both from a cybersecurity perspective and with respect to concentration risks, data ownership, protection, and privacy, was also noted.

**Reinforcing competition requires taking both horizontal and vertical views of the financial services landscape, and cooperation between financial and competition authorities.** Horizontally, how a market is defined is fundamental to the assessment of competition. The multiplicity of financial products, the tendency to bundle them, and the role of multi-sided market dynamics in providing and pricing, all make this a more complex landscape. Vertically, a competitive market at the consumer level may mask concentration at different levels of the reconfigured financial services value chains. With finance increasingly embedded as an adjunct in other businesses, it becomes critical for financial regulators to coordinate with other regulators, particularly where the adjacent businesses are themselves highly concentrated or subject to network effects. Consideration of *ex ante* vs. *ex post* remedies may need to recognize the particular features of data concentration, the power to exclude, and the gateway functions inherent in emerging digital business models.

**Adapting regulatory frameworks will require recognizing new and sometimes heightened trade-offs between specific policy goals.** Changes in provider diversity and the competitive landscape may imply a need to revisit the regulatory perimeter and supervisory practices. Meanwhile, authorities may need to make tough choices between: (i) financial stability and market integrity, (ii) efficiency and competition, and (iii) data privacy and consumer protection. It is important to find policies that can mitigate these trade-offs and allow priority goals to be achieved simultaneously to the degree possible. In the next sections we explore the implications for the regulatory perimeter, supervisory practices, and competition, and the relevant trade-offs between the policies that authorities are adopting in practice.

---

### 4.1 Implications for the Regulatory Perimeter and Supervisory Practices

---

**The growing diversity of financial services providers and business models often requires expanding the regulatory perimeter.** Payments, loans, and deposit-taking services may be provided by specialized payment service providers (fintech firms), ecommerce platforms (big tech firms), and other non-banks. It is therefore important that regulators develop approaches to ensure a level playing field and provide clear requirements for licensing. Similar activities and similar risks should in principle be treated similarly, regardless of the market participant, underlying technology, or method by which the service is provided. Yet in practice, a purely activities-based approach to regulation may not be sufficient. Particularly, the entry of big tech firms may require more, not less, entity-based regulation, for instance to address risks

around competition and operational resilience (Restoy, 2021). Expansion of the regulatory perimeter can ensure that activities are appropriately and comparably regulated and supervised (World Bank and IMF 2018; Alonso et al. 2021; Ehrentraud et al. 2020). This may extend to the perimeter of financial safety nets. Data reporting perimeters may need to be expanded even further, given the disaggregation of finance and the embedding of financial services into non-financial activities. The adoption of targeted regtech and suptech solutions may merit consideration by regulators as part of the policy response to fintech developments (Broeders and Prenio, 2018).

**Expanding the regulatory perimeter may be challenging in practice.** Bringing new entities into the fold of financial regulation may require legislative changes, which could be considered controversial and may be resisted by powerful interests with deep pockets, such as big tech firms. There may be resistance to granting more discretionary powers to supervisors, even though such powers may be needed to continually adapt policy approaches to a changing sector. The challenges may be even more acute in EMDEs, where resource constraints make it more difficult to stay abreast of changes and to regulate powerful (foreign) service providers. Yet emerging policy approaches in several jurisdictions show that applying an entity-based approach to new players such as big tech firms may be possible (see section 4.2).

**The disaggregation and reconfiguration of finance value chains introduces new challenges in day-to-day supervision.** For a traditional, vertically integrated bank, it is clear where responsibility lies for the financial soundness, cybersecurity, and consumer impacts of a product. When the financial services value chain is spread across different players with, for example, one holding the customer relationship, another holding the customer funds, a third providing data analytics and deciding which customers get services, and a fourth providing technology infrastructure, it is more difficult to pin down responsibility for mishaps or misdeeds and to ensure that consumers' interests are protected. Moreover, when customer interactions are handled by entities that are not directly subject to extant consumer protection regulations, any shortcomings such as unfair practices may not surface through traditional supervision focused on the regulated entity. This can lead to undetected consumer protection risks. This becomes even more challenging when services are provided across borders.

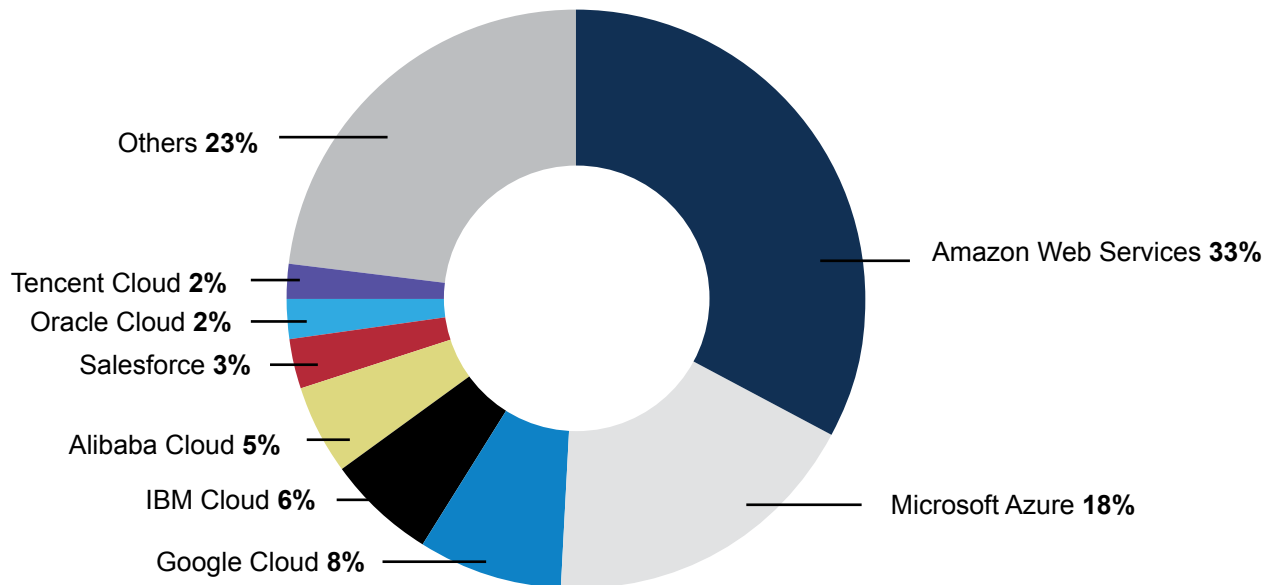
**Complex processes and interactions across different players and systems can create new points of failure.** Multiple entities and interlinkages create a wider attack surface for cybercriminals, which requires a strong regulatory approach to promote cyber security. The balance of power in these partnership relationships is very different than in a traditional outsourcing relationship, so the ability of the regulated financial institution to enforce its own policies might be challenging. Multi-tiered access to regulated systems, for example through BaaS models, requires that regulators ensure that the BaaS provider has sufficient visibility through the value chain to ensure compliance. In some circumstances, regulators may need to extend their supervision past the first-tier regulated entity, downstream to the customer interface entity or upstream to infrastructure providers.

**Reconfiguration of value chains is creating concentration risks at the technology services level that need to be monitored from both competition and systemic stability perspectives.** The cloud services market is highly concentrated. While provision of services to financial institutions has long been subject to concentration (for example, limited numbers of mainframe, ATM, cash transport, and payments network providers), growing reliance by a large swath of the financial sector on a small number of cloud services providers has been flagged as carrying the potential for new concentration or single point-of-failure risks (FSB, 2019b). Notably, four players control around two-thirds of the global market for cloud services (figure 10). While cloud providers generally have deep expertise in systems architecture and cyber security, an operational or cyber incident at one major cloud provider could have systemic implications for the financial system (Danielsson and Macrae, 2020). Open infrastructure, including API hubs, KYC utilities, and changing access policy for existing payment systems and credit reporting infrastructures, can mitigate concentration risks, increase contestability, and dilute data concentrations. However, there are indicators that a number of B2B fintech services may be equally prone to concentration; the example of API middleware providers cited earlier is a case in point.

**As authorities contemplate the regulatory and supervisory response to fintech, developments need to be examined in light of the needs in each market.** Some of the issues related to disaggregation and the incorporation of new players into financial product value chains can be addressed through regulatory guidance on governance of partnerships



**Figure 10. Market share of leading firms in the cloud infrastructure-as-a-service (IaaS) market, across all industries (Q4 2019)**



Note: As classified by PitchBook. CloudTech and development operations (DevOps) include companies that help organizations develop, operationalize and monitor software applications at scale. Data accessed on November 18, 2020.

Source: Synergy Research Group.

and outsourcing, including clear allocation of responsibilities and supervisory reporting, applied to each individual institution. Traditionally, regulators have placed responsibility for regulatory compliance with the licensed institution. However, as mentioned before, this may not work in a scenario where the licensed institution has much less scope to enforce specific requirements—for example a small niche player partnering with a big tech or using a global cloud provider. Thus, many challenges, such as up or downstream concentration risks, may need to be addressed at the sector level, for example, through enhanced oversight of systemically important providers. Further, regulatory authorities might need to increase their ongoing scrutiny of the operational and process model of licensed institutions and introduce changes to ensure that they are able to discharge their consumer protection responsibilities.

## 4.2 Implications for Competition Policy

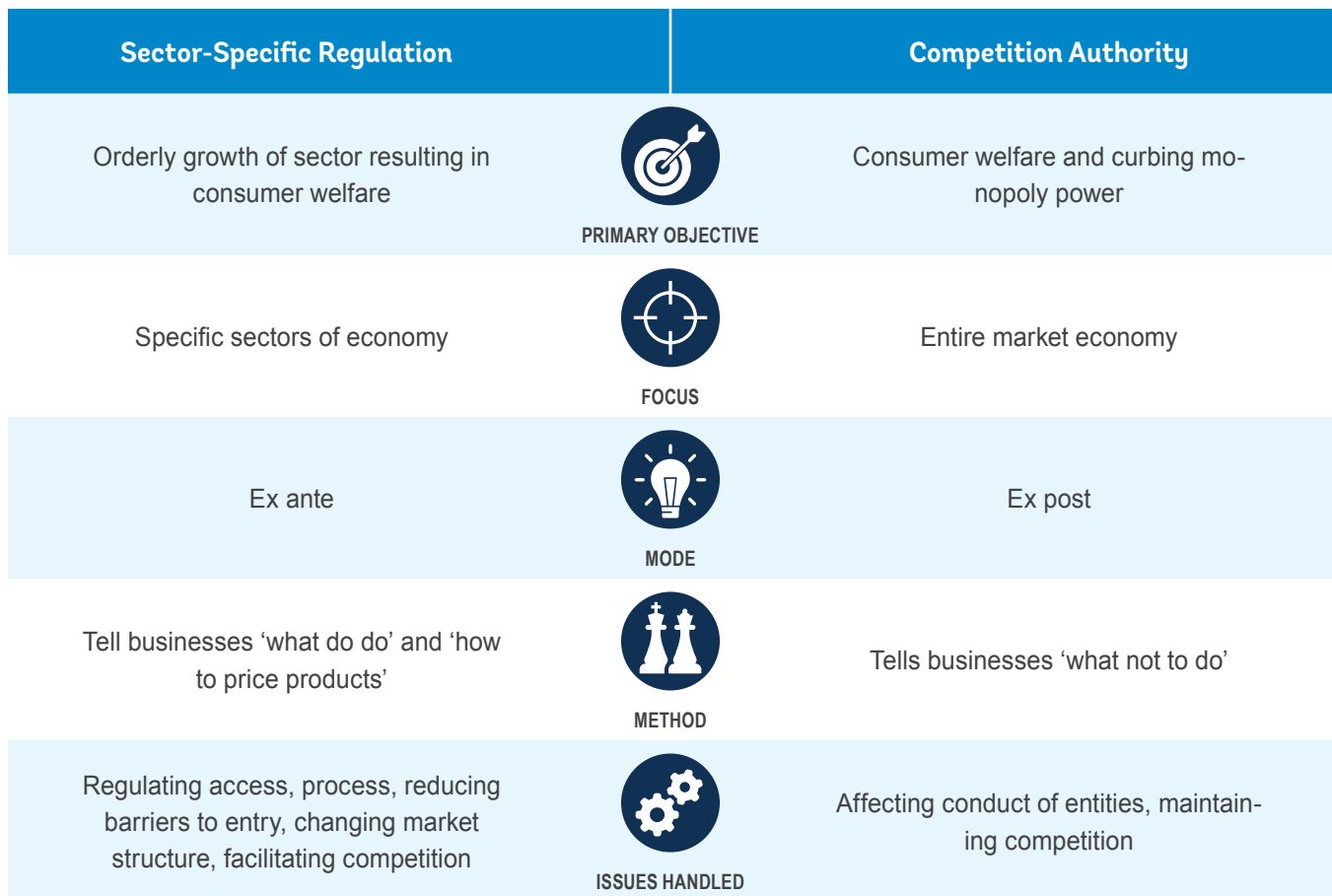
**Concentration risks in financial service provision may increase under the central scenario outlined above.** Digital platform providers, in particular, may quickly achieve dominant positions. On its own, this need not have a detrimental effect on consumer choice and welfare, even if a small number of dominant players reduces coordination barriers and may increase the risk of collusion. Provided switching costs remain low, markets can remain contestable and deliver beneficial outcomes—even in a barbell market structure. On the other hand, the concentration of Big Data may result in data monopolies. Data-driven advantages of larger players can increase switching costs and effectively lock in certain customers, and ex post remedies for abuse of this customer lock-in may be difficult. In such cases ex ante remedies by sectoral regulators regarding the ability to switch or interoperability requirements are better suited. Figure 11 compares ex ante sectoral regulations with ex post competition interventions. As an example, the largest two mobile payment providers in China reached a combined market share of 94 percent in 2019 (FSB 2019). The authorities were concerned that this could also pose severe systemic risks if one such provider were to be impaired. In 2018 the People's Bank of

China (PBC) implemented a new mobile payment regulation requiring all mobile payments to be cleared through the PBC rather than settled internally within the mobile payment platform provider (Liu 2019). In this way, a sector-specific ex ante approach was able to address concerns rather than waiting for ex post correction.

**While overall financial services may remain competitive, in certain specific product segments, monopolies or quasi-monopolies could emerge.** Some services, such as exchanges, have inherent network and scale economies that could result in only a very few viable providers. While this is not new, the entry of companies from adjacent spaces or the embedding of financial services into non-financial products means the market structure of those industries becomes relevant. A monopoly utility or logistics company could require customers to use its embedded payment instrument. It could also embed working capital lines that could not be obtained by most customers from other lenders, who do not have the data and leverage of these providers. This would allow them to effectively dominate a financial services segment by virtue of the control held in the primary industry. The movement of highly concentrated mobile network operators into payments, often setting up their own proprietary agent networks, is an example of how a player from concentrated adjacent market that is regulated with respect to competition can carry that market structure over into a financial product area where the regulation is not attuned to that issue. Kenya provides a case study of regulatory response to concentrated market structure and anticompetitive behaviours in digital payments (see box 3).

**The proliferation of new products has not always resulted in competition at all levels of the restructured value chains.** The consumer-facing end of payments has become more diverse, with a range of wallets, affinity and prepaid

**Figure 11. Interplay of ex ante sectoral regulations and ex post interventions by competition authority**



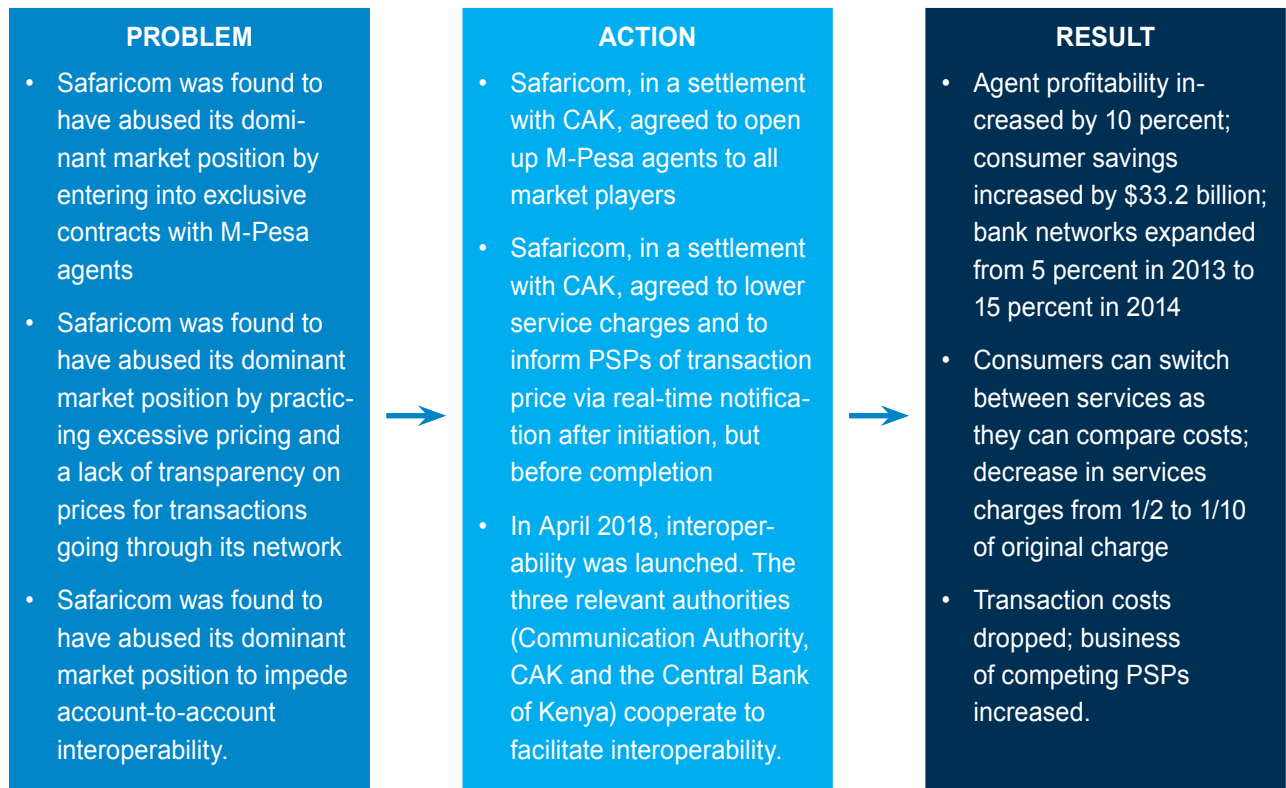
Source: Authors' elaborations.

card programs, and embedded payments offerings. At the underlying transaction processing level, though, there is an oligopoly in many markets. In 2016, the UK Payment Systems Regulator (PSR) reviewed the ownership and competitiveness of infrastructure that supports the three major UK payment systems—BACS, Faster Payments Service, and LINK—and found there was no effective competition for the provision of UK payments infrastructure (UK PSR, 2016). Various measures were proposed to increase competition and remove barriers to entry.

**A similar challenge is emerging in the context of open banking and APIs.** The back-end connection to APIs to facilitate data exchange is a high-volume, low-margin business. But since each bank may have different API specifications, it can be costly for a specific provider, such as a fintech start-up, to develop connections to everyone. Aggregation occurs at a middleware level through players like Plaid, Tink, and Yodlee. These are emerging as dominant networks of API connections, a potentially oligopolistic layer at the choke point between more competitive segments. Even in markets where APIs are standardized, API hubs are emerging to simplify the interface requirements.

**Box 3. Competition in digital payments: the case of Kenya**

The Competition Authority of Kenya (CAK) is a state corporation and was established by the Competition Act No. 12 of 2010. It is mandated to promote and safeguard competition in the national economy by effectively enforcing economy-wide competition law and rules, to open markets by advocating for the removal of anticompetitive sector regulation, and to protect consumers and suppliers. CAK has intervened in a number of sector cases. With specific regard to the market for digital payments, the figure lists some identified issues, policy actions taken, and results achieved.



Source: Adapted from Bossone and Natarajan, 2021.

**While unbundling would tend to reduce anti-competitive product tying, re-aggregation and embedding potentially put tying at the centre of financial product economics.** In particular, platform models that combine free services that have network effects with financial services might represent exactly the type of situation anti-trust authorities were concerned with when establishing anti-tying rules: that a monopoly provider of one service might require customers to use its other products. Thus a dominant social network platform that has a quasi-monopoly position over small local businesses' connections to their customers might embed payments in the social networking experience, and make it difficult for a customer to pay the business through anything other than the network's payment product. The more dominant the social network, the more necessary it is for a business to be present on that platform, effectively reducing competition in payments acceptance. Dominant technology companies have already run afoul of anti-tying regulations (for example, Apple, Microsoft). While regulators have moved away from considering tying arrangements to be illegal per se, and focused more on rule-of-reason analysis that looks at both the benefits and potential costs of tying, these analyses are sure to be tested as financial services tying moves from the "traditional bank product exception" space to the sphere of big tech firms and embedded finance.

**Market structures that concentrate data and supercharge network effects could reduce intermediation costs and broaden inclusion.** In many markets, however, the resulting market power might be seen as more detrimental than these benefits. For example, in November 2020 the US Department of Justice sued to block the proposed merger of Visa, a payments company, and Plaid, a fintech data aggregation platform; the merger was abandoned in early 2021. Chinese regulators have recently addressed concerns of anti-competitive practices that exclude competitors in associated digital services such as e-commerce and social media when providing services to customers (McMorrow, 2021). As in other industries, regulators will have to balance the efficiencies of natural monopolies against restraining market power. This is not a new consideration in financial services, but is just one of several trade-offs that become more pronounced as technology re-shapes financial services.

**Different societies will also attach different preferences to market structure outcomes.** Regulatory policies governing entry and scope of activity of new players, from small fintech firms to big tech platforms, will have profound effects on competitive dynamics both in financial services and in the core industries of cross-over players. Fintech and big tech will require changes in the way that competition authorities and financial regulators interact, and calls for more coordination between regulators (Petralia et al. 2019). Approaches to competition policy differ starkly across societies. Some societies may welcome market structures that concentrate data and supercharge network effects if they reduce intermediation costs and broaden inclusion. In other markets, the resulting market power might be seen as more detrimental than these benefits. Concentration of infrastructure and data in state hands may be accepted in some societies, while others may be more concerned about potential extension of state surveillance. As in other industries, regulators will have to balance the efficiencies of natural monopolies against restraining market power. This is not a new consideration in financial services, but is just one of several trade-offs that become more pronounced as technology reshapes financial services.

---

## 4.3 New Dimensions to Financial Regulation Policy Trade-offs

---

**Digital innovation may thus give rise to complex trade-offs between three categories of policy goals.** These are: (i) financial stability and market integrity; (ii) efficiency and competition; and (iii) data privacy and consumer protection. Figure 12 gives a visual representation of these trade-offs as a triangle. This final section discusses the three edges of the triangle in turn—and which types of policies authorities are applying to mitigate these trade-offs.

---

### 4.3.1 Efficiency and competition vs. financial stability and integrity

---

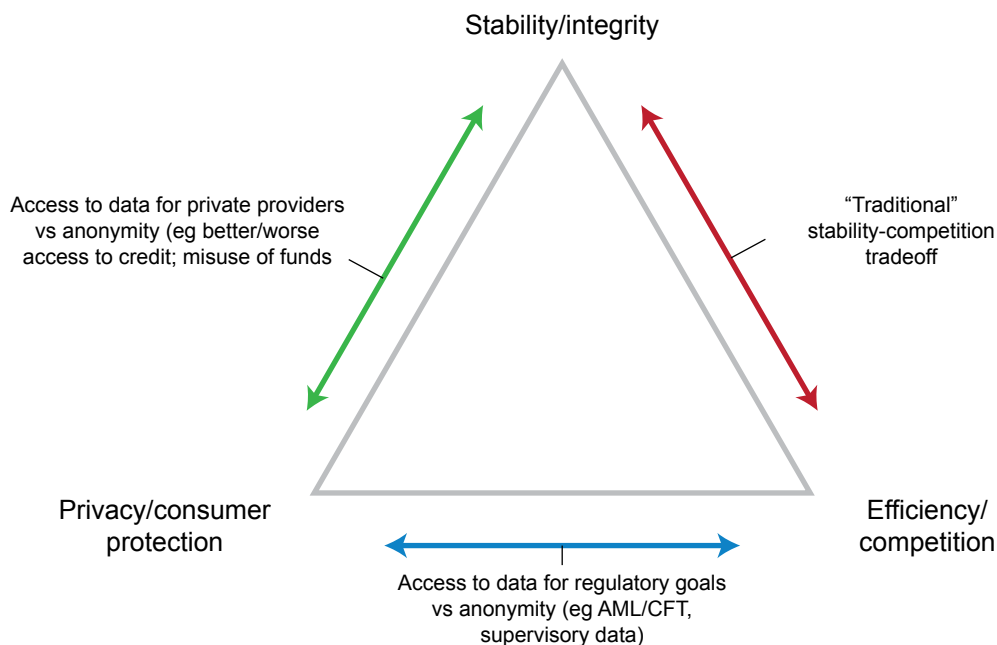
**Regulators have long debated the relationship between competition and financial stability.** There are broadly two schools of thought on the competition-stability nexus (red arrow in figure 12). One school of thought argues that

greater market entry, or at least contestability, in the financial sector is desirable, as it fosters competition and reduces incumbents' market power. This can lead to greater efficiency and better outcomes for customers. It can also lead to more diversified activities (Amidu and Wolfe, 2013) and fewer institutions that are individually systemically important and must be treated as "too-big-to-fail." Systemic importance can introduce governance challenges and moral hazard, as well as a financial sector that is, on aggregate, larger than would be economically optimal (Feldman 2010). An alternative school of thought emphasizes that greater competition is not always optimal or conducive to financial stability. Financial institutions that are more profitable may be able to accumulate more equity capital, have a higher *franchise value* and therefore act more prudently (Keeley 1990). This may occur at least up to a point where they incur moral hazard by becoming too big to fail. An implication may be that some barriers to entry are justified to help mitigate risks (Hellman et al. 2000). This may be particularly true in a period of rapid market transition. New entrants can target high-margin products, or skim off the most profitable customers, leaving incumbents with loss-making and riskier businesses. Regulators may prefer managing incumbents' adjustments to the adoption of new technology, consolidation, or exit by slowing down the pace of entry or dampening competition in order to avoid rapid and potentially disruptive exits .

**Fintech and big tech entry may turn some existing insights on their head.** In particular, the assumption that entry increases competition may no longer be true in an environment supercharged by the DNA feedback loop (see box 2). While there is agreement that contestability matters greatly for the overall degree of competition (Claessens 2009), and the reservoir of contestants represented by the small niche services side of the barbell would tend to maintain at least some competitive pressure on the larger players, big tech firms with control over key digital platforms in e-commerce, search, or social media may establish and entrench market power very quickly after entry. Such control may also generate conflicts of interest when both big tech firms and their competitors (for example, banks) rely on the same core infrastructures such as networks or cloud computing services.

**The traditional focus of competition authorities on a single market, firm size, pricing, and concentration may no longer be well suited to these market outcomes.** Indeed, digital platforms that pursue growth over profits, and data over revenue, may not be well-captured by competition policy approaches focusing on prices and consumer welfare

Figure 12. Policy trade-offs from digital transformation in finance



Source: Authors' elaborations.

(Khan 2017). While indicators of market power like large market share and high margins provide useful first-order indications, they are insufficient to determine whether a provider has market power and has the incentives to abuse it. Moreover, the speed of changes to market structure presents challenges, as firms can go from “too small to care” to “too large to ignore” to “too big to fail” in only a few short years (Arner et al. 2017). This was apparent particularly with the growth of the big tech firms in China, but similar growth is being seen in many other markets, particularly EMDEs. Large foreign players, in particular, may become “too powerful to regulate and supervise.” Ex post remedial action, as with traditional antitrust and mergers policies, may not be sufficient to address risks.

**This may be a reason that some jurisdictions have upgraded their rules and methodologies for assessing and addressing anticompetitive conduct.** 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 (BIS 2019). In the EU, proposals for a Digital Markets Act (DMA) and Digital Services Act (DSA) include ex ante requirements on “gatekeepers” to prevent self-preferencing and bundling or tying, and requirements on “very large platforms” around reporting, risk assessment, and crisis protocols (European Commission, 2020a,b). In the UK, the Digital Competition Expert Panel (“Furman Report,” HM Treasury 2019) recommended the establishment of a digital markets unit to develop a competitive code of conduct, enable greater personal data mobility and advance data openness. In the United States, a US House (2020) committee recommended rules to prevent discrimination, favouritism, and self-preferencing, and to strengthen antitrust laws and enforcement. In China, meanwhile, the State Administration for Market Regulation (SAMR) published draft guidelines on antitrust measures for internet companies (including big tech firms), proposing to block anticompetitive behaviours such as exclusivity clauses, price discrimination, and market barriers (Restoy, 2021).<sup>12</sup>

**There could be stability challenges in a barbell outcome with respect to both large and small players.** As in the traditional competition-stability nexus, greater franchise values may create incentives for large players to act prudently and mitigate risk (such as those around cyber security, where the expertise of big tech firms is clear). However, systemic importance (too big to fail) may entail pressing risks to financial stability. Meanwhile, small, specialized players may help to serve specific market segments, but their lack of diversification may also mean less stability. The niche providers would not have the diversification to survive a demand shock affecting their segments, and a specific market segment dependent on only a few niche providers could be particularly hard hit when a specialized player exits. In addition, costs to authorities to effectively supervise a large number of small entities is significant; this would be particularly burdensome for many EMDEs.

**Authorities may also need to revisit existing rules on the relationship between banking and commercial activities.** In some jurisdictions (for example, the UK and Japan), it is common for non-financial institutions to own financial institutions subsidiaries, while in others (for example, the US) there is an explicit separation between banking and commerce.<sup>13</sup> As the boundaries between digital financial services and other services blur, there may be new challenges. For instance, would a big tech that partners with a small bank and provides financial services have indirect power to influence lending decisions without having to have an ownership stake? Can cross-subsidization of financial and non-financial services introduce systemic risks, either from the “real” or financial side of such links? These and further aspects may require additional attention.

12. Meanwhile, regulatory sandboxes may facilitate new entry into the market. Cornelli et al. 2020 show that in the UK, firms in the regulatory sandbox were able to attract greater funding, given lower information asymmetries and regulatory costs.

13. In China, rules stipulate that big tech firms may only hold a 30 percent share in financial institutions—hence the 30 percent stake of Alibaba in Ant Group, and of Tencent in WeBank.

### 4.3.2 Efficiency and competition vs. privacy and consumer protection

**As data become an even more important source of market power, a trade-off between efficiency/competition and privacy/consumer protection arises.** This is represented by the blue segment in figure 12, and has implications for financial inclusion and market structure.

**The massive volumes and types of data powering new financial services offerings have unique characteristics.** One special aspect of the use of Big Data as an input to production is that data can be used many times and by any number of firms simultaneously, without being depleted. This is referred to as “non-rivalry.” Data are often generated at zero marginal cost as a by-product of other digital services. Reuse and exchange of data can generate large welfare gains, but market mechanisms may result in reuse and exchange at below optimal levels (World Bank 2021).

**The control by providers of their customers’ data maintains privacy but can reduce competition.** The non-rivalry of data can generate increasing returns for data in both scale and scope (Farboodi et al. 2019; Boissay et al. 2021). Any single additional piece of data (for example, payments information or a client’s review on a firm’s product) has additional value when it is combined with an already existing large stock of data. For this reason, data are more valuable to big tech firms and other firms with a wide range of business lines, giving rise to so-called digital monopolies. Data may thus become an “essential facility” in an antitrust sense. Fuelled by Big Data, algorithmic price discrimination is able to parse the population of potential customers into finer and finer subcategories—each matched with a different price. Large multi-product providers could in principle capture the entire consumer surplus (Bar-Gill 2019).

**In the absence of privacy concerns, wider sharing of data could in principle be more efficient.** If markets are competitive, it could be socially desirable to enable data sharing with providers able to make better use of the data, for example as manifested by being able to sell a product to the customer and therefore being willing to pay the data producer for access. This could increase efficiency and personalization and enhance competition and financial inclusion. This consideration has been an important driver behind open banking rules, which allow customers to share their data between providers (for example, banks and fintech firms), and thus support competition.

**Privacy concerns are valid, however; free sharing of data can harm individuals.** In the case of personal data, open access to data can bring important costs, as individuals value their privacy (Acquisti et al. 2019). Bank transaction data can be an important input into credit scoring decisions and it can reveal a wide array of information about consumers’ preferences, buying habits, location, and a host of other attributes, particularly when combined with other data sources. Open access to personal data can allow for identity theft, reputational damage, and the manipulation of behavioral biases to sell consumers products that are not in their interests—to name only a few examples (Ru and Schoar, 2016). Open access across providers could also leave consumers worse off through high, personalized prices.<sup>14</sup> In insurance markets, greater data could allow for more granular pricing, thus undermining the risk pooling or solidarity function of insurance (IAIS, 2017).

**Control over personal data may be subject to market failures.** These come about as data are non-rival and only partially excludable (Carrière-Swallow and Haksar, 2019), and due to challenges in obtaining reliably informed consent. This can invite too much data sharing (Acemoglu et al. 2021), hoarding of data, too little investment in cyber-security, and fragmentation across borders. While it would in principle be optimal to define “property rights” over data—a decentralized or “Coasian” solution, in line with Coase’s classic theory of property rights (Coase 1960)—this may not be easily applied in practice. In particular, large, multi-product institutions may have access to types of data that others do not have, and

14. In a recent paper Brunnermeier et al. 2020 argue that Big Data and machine learning invert adverse selection problems. Artificial intelligence allows insurers to infer many statistical insights from the insurance customer and thereby reverses the information advantage from the customer to the insurer. This determines an “inverse selection.” A customer knows her multiple attributes, but a platform and only a platform can connect them. Given this comparative advantage, the insurer can try to protect its statistical information by offering only a few screening contracts. In this case, forcing the insurance company to reveal its statistical information to the customer can be welfare-improving. Their research shows indeed that in a setting with naive agents, who do not perfectly infer statistical information from the price of offered contracts, price discrimination significantly boosts insurers’ profits.

given returns to scale and scope, they may be able to bid more for such data than specialist providers. Thus, data can be the source of further competitive distortions. In addition, consumers cannot always fully process available information, and the information available when they grant ‘consent’ may be incomplete. This could result in consumers over-sharing, or under-valuing their own data property rights.

**Given the network effects underlying competition, the competitive playing field may be levelled more effectively by placing well-designed limits on the use of data.** Introducing some additional rules regarding privacy—while at the same time allowing selectively for the sharing of some types of data—could increase effective competition, because the addition of such limitations on the use of data could curb big tech firms’ exploitation of network effects. Just as governments have decided that certain information—such as gender or pre-existing medical conditions—cannot be used in the pricing of health insurance contracts, there may be a need for legislatures to define types of personal data that cannot be used in credit decisions or other types of financial services. Moreover, policies may be needed to give individuals greater control over their data. Jones and Tonetti (2020) show in a theoretical model that endowing individuals with data rights may lead to outcomes that are close to optimal. Design of such policies must also recognize that mandating data sharing could reduce incentives to produce high-quality data, or to provide valuable services that depend on the provider monetizing data (World Bank 2021).

**Data mobility requirements may also help to mitigate trade-offs.** Work on consumer data rights in the EU, Australia, and Canada are examples of steps in this direction. Proposals on data mobility are also included in the EU DMA and DSA proposals and the UK Digital Competition Expert Panel (2019). Making data “portable” across providers and increasing data subjects’ control of their data could help to allow the efficient uses of data while preventing data monopolies from arising. While some types of data (for example, genome data, social contacts) may still be judged “off-limits” for use in financial services, the ability to port permissible data between different providers may allow for efficiency and competition in a way that empowers and benefits consumers, reducing rents by providers.

**Beyond data privacy, new entrants are often shifting credit, market, and operational risks to consumers with limited validation of informed consent or product appropriateness.** Marketplace finance platforms were initially designed as a regulatory arbitrage, gathering funds through a non-deposit mechanism to avoid being termed a bank. The platforms introduced competition to banks, reducing costs to borrowers, and offering higher yields to investors. The increased efficiency of the platforms, stems in part from the reduced regulatory overhead, minimal required capital, and absence of deposit insurance premiums (some P2P platforms do set aside funds to self-insure). Investors in many marketplaces have looked at P2P as an alternative to bank savings products, but in most cases they bear direct credit risk without any type of deposit insurance, and often are not aware of that risk. Robo-advisors and gamified trading platforms expose consumers to market risks from new instruments with which they may have limited familiarity. Cryptocurrencies have been subject to volatility risk that might not be anticipated by those seeking to use them for payments. DLT-based payments embed operational risks with respect to the exchanges, and even the underlying consensus mechanisms, that are not always well understood. While stablecoins seek to address volatility against a particular basket of currencies, they fundamentally alter the protection for the holder by removing the guarantee of redemption at par that e-money issuers and banks provide their customers. Increased usage of digital means of communication between providers and customers might expose the customers to clever social engineering attacks. The increased speed of processing of transactions affords little or no time to rectify any mistakes by customers.

**Regulators need to balance the innovation and efficiency introduced by broader competition with the potential dampening effects of consumer protection oversight and enforcement.** Much depends, as with data privacy, on whether consent can be adequately ‘informed’ and whether there are reliable objective tests for product suitability. The challenge of protecting the consumer will become more acute as the consumer takes on more direct roles in assembling, and even providing, financial services (for example, unintermediated P2P). Depending on how the regulatory perimeter is set, new approaches to disclosure, determining product appropriateness, and informed consent need to be developed to ensure the promise of increased efficiency does not come at the cost of customer losses and reduced trust.



### 4.3.3 Privacy and consumer protection vs. financial stability and integrity

**Data sharing can alleviate problems of asymmetric information and thus could be beneficial for financial stability and integrity.** This potentially introduces a new trade-off between privacy (and consumer protection more generally) on the one hand and financial stability and market integrity on the other. This trade-off is represented by the green segment in figure 12.

**In the credit market, there is ample evidence that more data can improve stability.** Credit registries (CRs), for instance, can counter adverse selection and reduce information asymmetry between lenders and borrowers. CRs allow loans to be extended to safe borrowers who had previously been priced out of the market, resulting in higher aggregate lending (Pagano and Jappelli, 1993) and furthering financial inclusion. They can also counter moral hazard by increasing borrowers' cost of default, thus increasing debt repayment (Padilla and Pagano 2000).<sup>15</sup> Conversely, sharing of credit-related information has the benefit of reducing the information monopoly a lender has on its borrowers. For example, banks with long-standing relationships with their borrowers have exclusive information that allows them to charge higher interest rates and extract other rents from those high-quality borrowers (Padilla and Pagano, 1997). CRs can counter this. Finally, they can reduce over-indebtedness by revealing borrowers' debt exposure to all participating lenders, leading informed lenders to extend less credit (Bennardo, Pagano and Piccolo, 2015). Brown and Zehnder (2007) show that an information-sharing institution helps lenders avoid serious losses from short-term borrowers.

**As the experience with credit registries shows, this is not without its downsides for consumers.** In the United States, for instance, consumer advocates have criticized systems that screen for past overdraft fees and allow banks to deny account services to individuals (Baradaran, 2015). Transparency in how personal data are used, and recourse in the event of misuse, provide some mitigation for these potential exclusionary effects. A large body of regulations has allowed borrowers to gain insights into their personal credit score and the information collected about them. In a world of digital innovation, in which a much wider range of data is available for screening, there may be an even higher premium on giving individuals such access and rights, commensurate with the growing impact of providers' use of individuals' data on availability of services.

**For example, there are concerns that opaque algorithmic processing of personal data in banking could result in biases and discrimination.** AI/ML-based credit scoring is supposed to reduce the incidence of non-performing loans, thereby contributing to stability. However, sophisticated ML algorithms may not be as neutral as their mathematical nature suggests at first glance. While less human intervention means that taste-based discrimination may decline, algorithms developed by humans or trained on historical data can introduce new biases (Morse and Pence 2020). Using data on US mortgages, Fuster et al., 2019, find that Black and Hispanic borrowers are disproportionately less likely to gain from the introduction of machine learning in credit-scoring models. This suggests that the algorithm may develop differential effects across groups and increase inequality (figure 13, left-hand panel). Borrowers to the left of the solid vertical line represent "winners," who are classified as less risky by the more sophisticated algorithm than by the traditional model. Based on the cumulative share, about 65 percent of White Non-Hispanic and Asian borrowers would win, compared with about 50 percent of Black and Hispanic borrowers. In another study, fintech does not seem able to close the gender gap in access to financial services, as women have a lower propensity to share data than men. Chen et al., 2021, find that men are more likely to use fintech product services than women (27 percent vs. 19 percent), and that this pattern holds in every country (except for Peru and India; figure 13, right-hand panel). Moreover, women report being more worried about their security when dealing with companies online, and less willing to share data for better offers on financial services.

**Reducing illicit activity is another area where use of personal data can potentially improve stability and market integrity, but carry costs in terms of privacy and financial exclusion.** For example, anti-money laundering (AML) and Combating the Financing of Terrorism (CFT) practices require the exchange of detailed information on all parties

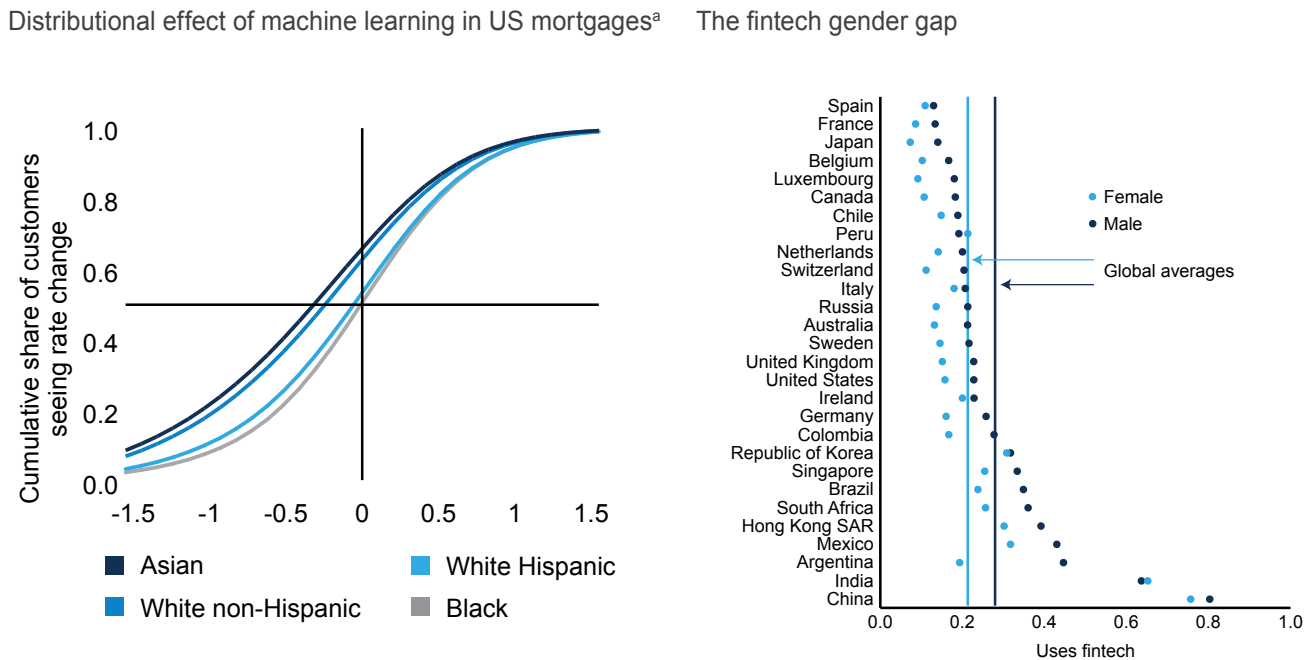
15. Doblas-Madrid and Minetti, 2013, find that if lenders enter a credit information sharing institution, their borrowers improve their repayment performance—delinquent payments on leases and loans decrease.

involved in a financial transaction. This could result in exclusion of individuals who cannot present sufficient documentation or have not had prior access to demonstrate positive patterns that the screening mechanisms may seek. The data analysis may reveal habits and preferences that are not related to illicit activity but are nonetheless sensitive or personal. Since sanctions monitoring, KYC remediation, AML measures, and transaction monitoring are among the most expensive elements of compliance by banks, the motivation to use advanced data analytics is strong. Increased automation and use data generated at low marginal cost could drive down costs and enable more low-income customers to be accredited. However, a general raising of the bar, as data coverage of the more active and/or high-income customers improves, will exacerbate the data divide relative to previously excluded segments. Tiered KYC requirements attempt to address this as a way of balancing data coverage and market integrity requirements.

**Discussions around central bank digital currencies put these issues into particularly sharp focus.** Some central banks, such as the People’s Bank of China, are considering CBDC architectures in which the central bank will have full access to transactions data so as to support AML/CFT and prudential supervision. Other central banks are leaning against having access to such data, and looking into so-called “intermediated” options where private sector intermediaries keep such data and the central bank only has a ledger of wholesale transactions (Auer et al. 2020b; Carstens, 2021). Given the stark divergence in preferences for privacy-stability trade-offs across different jurisdictions, it is possible that final designs may also differ in this regard.

**Addressing these trade-offs, too, will require a societal discussion on data sharing.** Data protection rules like the EU General Data Protection Regulation (GDPR) and California Consumer Protection Act (CCPA) have represented important steps in protecting privacy and limiting data use based on consumer consent. Yet further debate will be needed to determine under which circumstances privacy rules may be relaxed to improve stability and integrity, and how consumers can be protected from algorithmic discrimination. This remains a frontier issue in policymaking in the financial sector and the digital economy more generally, where different jurisdictions may continue learning from one another going forward.

**Figure 13. Winners and losers of machine-learning credit scoring and the fintech gender gap**



a. The change in the log-predicted default probability as lenders move from traditional predictive technology (a logit classifier) to machine-learning technology (a random forest classifier) is reported on the horizontal axis. The cumulative share of borrowers from each racial group, which experiences a given level of change, is reported on the vertical axis.

---

## 5. Conclusions

---

**This note has shown that digital innovation is bringing about economically meaningful changes in the production of financial services, with implications for the industrial structure of finance.** Improvements in *connectivity* and *computing* can help to enhance efficiency and competition. In many cases, financial services have seen an unbundling of different products and services. At the same time, financial *frictions* and *forces* that drove the need for financial intermediators in the first place have re-asserted themselves. The financial sector may be tending toward a barbell outcome in market structure, in which large multi-product institutions exist alongside more specialized niche institutions.

**Regulatory and supervisory policy tools will have to adapt.** Existing regulatory perimeters may not adequately cover emerging providers of financial services, and new players may pose challenges for day-to-day financial supervision. It is increasingly challenging to balance competition and stability, both among financial services providers and across myriad players in reconfigured financial product value chains. Rules for control over data, and which data are allowable for specific services, will need to be defined—ideally in a way that gives individuals’ control, balances competition and efficiency with privacy and consumer protection, and enhances financial inclusion. New forms of discrimination and bias will need to be understood and countered. A new balance will have to be struck across consumer protection, privacy considerations, and stability and integrity in a way that respects societal preferences in different jurisdictions around the world, and within different societies. Monetary policy, systemic stability, and consumer protection tools, which have been left largely beyond the scope of this note, may also need to adapt. Challenges include access to lender of last resort programs by new providers, stabilizing credit markets in which non-bank players become major lenders, and maintaining the viability of deposit insurance programs where new players become large.

**Authorities need to be intentional with respect to market structure.** Prior notions around the trade-offs between competition and stability need to be re-examined. Longstanding precepts on the separation of banking and commerce are already being upended. Existing approaches to competition policy and antitrust may not be well-suited to digital financial services, where measures of pricing and concentration for one market or firm may have become less informative. The nature of contestability must be understood anew in markets driven by increasing returns to scale but also increasingly low entry barriers for niche services. The desirability of a barbell market configuration will depend in part on consumer behaviors and skills that determine switching costs in a given market. Market forces are already being shaped by minimum capital, licensing requirements, activity restrictions and other policies. Pretending that market forces are just running their course is inaccurate at best, and at worst could lead to negative outcomes for consumers and macro stability.

**Several authorities are taking promising policy measures to mitigate trade-offs.** Recent entity-based measures around big tech firms, such as the proposals in China, the EU, UK, and US, can take a more ex ante approach to address risks, prevent anticompetitive behaviors, and in the process promote a level playing field. Data privacy protections and data mobility requirements can support consumer protection and may also promote competition. Still, a societal debate will be needed on what types of data should be permissible for use in financial services and when privacy rules can be relaxed in the service of stability.

**To tread into this new territory effectively, and to balance the necessary policy goals, authorities will need to collaborate.** At the domestic level, central banks and other financial sector regulators need to cooperate with industry regulators (for example, for telecoms and other utilities that may offer financial services) as well as competition and

data protection authorities. At the international level, authorities are working together to share expertise on financial regulation of both new entrants and incumbents, and to coordinate policies. This becomes ever more important given the cross-border spillovers of anti-trust and data governance decisions, and the potential to improve service efficiency through harmonization of standards in areas such as cybercrime prevention, data protection, and interoperability (World Bank 2021). Collaboration can help to ensure regulatory consistency and peer learning between countries, and ultimately higher welfare for their populations.

# Bibliography

- Acemoglu, D., A. Makhdoumi, A. Malekian, and A. Ozdaglar. 2021. "Too Much Data: Prices and Inefficiencies in Data Markets." *American Economic Journal: Microeconomics*, forthcoming
- Acquisti, A., C. Taylor, and L. Wagman. 2016. "The economics of privacy." *Journal of Economic Literature*, 54(2)
- Aghion, P., P. Bolton. 1997. "A theory of trickle-down growth and development." *Review of Economic Studies*, 64(2), 151–72
- Alexopoulos, S. 2020. "US Mid- and Small-Cap Banks Technology Disruption Report: With a New Breed of Regional Banks Emerging, Many Are Positioned as Endgame Winners in the Digital Age." JPMorgan, December 15
- Aldasoro, I., J. Frost, L. Gambacorta, and D. Whyte. 2021. "Covid-19 and cyber risk in the financial sector." BIS Bulletin 37
- Alfonso, V., C. Boar, J. Frost, L. Gambacorta, and J. Liu. 2021. "E-commerce in the pandemic and beyond." BIS Bulletin 36
- Tatiana Alonso Gispert, Pierre-Laurent Chatain, Karl Driessen, Danilo Palermo, and Ariadne Plaitakis with contributions from Ana M. Carjaval and Matei Dohotaru. 2021. "Regulation and Supervision of Fintech: Considerations for EMDE Policymakers." Regulation Note, World Bank Group, Fintech and the Future of Finance report
- Amidu, M. and S. Wolfe. 2013. "Does bank competition and diversification lead to greater stability? Evidence from emerging markets." *Review of Development Finance*, 3(3), 152–66
- Armantier, O., S. Doerr, A. Fuster, J. Frost, and K. Shue. 2021. "Whom do consumers trust with their data? US survey evidence." BIS Bulletin 42
- Arner, D., J. Barberis, and R. Buckley. 2017. "FinTech and RegTech in a Nutshell, and the Future in a Sandbox." CFA Institute Research Foundation Briefs, 3(4), July
- Arner, D., R. Auer, and J. Frost. 2020. "Stablecoins: risks, potential and regulation." BIS Working Paper 905
- Arrow, K. and G. Debreu. 1954. "Existence of an equilibrium for a competitive economy." *Econometrica*, 22, 265–90
- Auer, R. 2019. "Embedded supervision: how to build regulation into blockchain finance." BIS Working Paper 811
- Auer, R., G. Cornelli, and J. Frost. 2020a. "Covid-19, cash and the future of payments." BIS Bulletin 3
- Auer, R., G. Cornelli, and J. Frost. 2020b. "Rise of the central bank digital currencies: drivers, approaches and technologies." BIS Working Paper, 880
- Autor, D. 2019. "World of the Past, Work of the Future." *AEA Papers and Proceedings*, 109, 1–32
- Baltensperger, E. 1980. "Alternative Approaches to the Theory of the Banking Firm." *Journal of Monetary Economics*, 6, 1-37
- Bank for International Settlements. 2019. "Big tech in finance: opportunities and risks." BIS Annual Economic Report, June
- Bank for International Settlements. 2020. "Central banks and payments in the digital era." BIS Annual Economic Report, June
- Bank of Thailand. 2019. "Permission for Commercial Banks to Undertake Information Technology Related Services to Support Digital Banking." (unofficial translation), available online at <https://www.bot.or.th/Thai/FIPCS/Documents/FPG/2562/EngPDF/25620188.pdf>, August

- Baradaran, M. 2015. *How the Other Half Banks: Exclusion, Exploitation, and the Threat to Democracy.* Cambridge, MA, Harvard University Press
- Barrett, A. 2018. "The Unbundling and Rebundling of Banks." [dxjournalco/2018/09/the-unbundling-rebundling-of-banks/](https://dxjournalco.com/2018/09/the-unbundling-rebundling-of-banks/), September 11, 2018
- Bar-Gill, O. 2019. "Algorithmic price discrimination: when demand is a function of both preferences and (Mis) perceptions." *University of Chicago Law Review*, 86(2), 217-254
- BBVA. 2020. "The five V's of big data." <https://www.bbva.com/en/five-vs-big-data/>
- Bennardo, A., M. Pagano, and S. Piccolo. 2015. "Multiple-Bank Lending, Creditor Rights and Information Sharing." *Review of Finance*, 19(2), 519–70
- Bodie, Z. and R.C. Merton. 2005. "Design of financial systems: towards a synthesis of function and structure." *Journal of Investment Management*, 3(1), 1–23
- Boissay, F., T. Ehlers, L. Gambacorta, and H.S. Shin. 2021 "Big tech in finance: on the nexus between data privacy and competition" in R. Rau, R. Wardrop, and L. Zingales (eds) *The handbook of technological finance*, Palgrave-Macmillan, forthcoming
- Bossone, B. and H. Natarajan. 2021. "Digital Payment Systems Strategy for the MENA region." mimeo
- Britton, M. 2018. "The Importance of The Barbell Economy In 2019." <https://www.mattbritton.com/blog-posts/2018/12/17/the-importance-of-the-barbell-economy-in-2019>
- Broeders, D. and J. Prenio. 2018. "Innovative technology in financial supervision (suptech) – the experience of early users." FSI Insight 9
- Brown, M. and C. Zehnder. 2007. "Credit reporting, Relationship Banking and Loan Repayment." *Journal of Money, Credit and Banking* 39(8), 1883–18
- Brunnermeier, M.K., R. Lamba, and C. Segura-Rodriguez. 2020. "Inverse selection." mimeo, Princeton
- Carletti, E., S. Claessens, A. Fatas, and X. Vives. 2020. *The Bank Business Model in the post-Covid-19 World.* The Future of Banking 2, London: CEPR Press
- Carrière-Swallow, Y. and V. Haksar. 2019. "The economics and implications of data: an integrated perspective." IMF Departmental Papers 19(16)
- Carstens, A. 2021. "Central bank digital currencies: putting a big idea into practice." Speech, March
- Chen, S., S. Doerr, J. Frost, L. Gambacorta, and H.S. Shin. 2021. "The fintech gender gap." BIS Working Papers, 931
- Claessens, S. 2009. "Competition in the Financial Sector: Overview of Competition Policies." *The World Bank Research Observer* 24(1), 83–118
- Claessens, S. and L. Laeven. 2005. "Financial dependence, banking sector competition, and economic growth." *Journal of the European Economic Association*, 3(1), 179–207
- 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
- Coase, R. H. 1960. "The problem of social cost." *Journal of Law and Economics*, 3
- Coase, R.H. 1937. "The Nature of the Firm." in P.J. Buckley and J. Michie (eds). *Firms, Organizations and Contracts*, Oxford: Oxford University Press
- Cornelli, G, J. Frost, L. Gambacorta, R. Rau, R. Wardrop, and T. Ziegler. 2020a. "Fintech and big tech credit: a new database." BIS Working Papers, 887

- Cornelli, G., S. Doerr, J. Frost, and L. Gambacorta. 2020b. "Big techs vs. G-SIBs: differences in market funding." mimeo
- Cornelli, G., S. Doerr, L. Gambacorta, and O. Merrouche. 2020c. "Inside the regulatory sandbox: effects on fintech funding." BIS Working Paper, 901
- Cowley, S. 2020. "The Tiny Bank That Got Pandemic Aid to 100,000 Small Businesses." *New York Times*, June 23, <https://www.nytimes.com/2020/06/23/business/paycheck-protection-program-cross-river-bank.html>
- Croxson, K., T. Valletti, L. Gambacorta, and J. Frost. 2021. "Platform-based business models and financial inclusion." BIS Paper, forthcoming
- D'Silva, D., Z. Filková, F. Packer, and S. Tiwari. 2019. "The design of digital financial infrastructure: lessons from India." BIS Papers, 106, December
- Danielsson, J. and R. Macrae. 2019. "Systemic consequences of outsourcing to the cloud." VoxEU, December 2
- Deogun, N. 1996. "Back to the Fray: Displaced by Mergers, Some Bankers Launch Their Own Start-Ups --- They Win Over Customers With Personal Service Popular in Small Towns --- A Barbell-Shaped Industry." *The Wall Street Journal*, March 4, 1996
- Dewatripoint M. and J. Tirole. 1994. "*The Prudential Regulation of Banks Cambridge*." MA, MIT Press
- Tatiana Didier, Erik Feyen, Ruth Llovet Montanes, and Oya Ardic. 2021. "Global Patterns of Fintech Activity and Enabling Factors." *Fintech Activity note*, World Bank Group, Fintech and the Future of Finance report.
- Doblas-Madrid, A. and R. Minetti. 2013. "Sharing Information in the Credit Market: Contract-Level Evidence from US Firms." *Journal of Financial Economics*, 109(1), 198223
- Ehrentraud, J., D. Garcia Ocampo, and C. Quevedo Vega. 2020. "Regulating fintech financing: digital banks and fintech platforms." FSI Insight 27
- European Banking Authority. 2018. "Report on the impact of fintech on incumbent credit institutions' business models." July
- European Commission. 2020a. "Proposal for a Regulation of the Council and the European Parliament on contestable and fair markets in the digital sector (Digital Markets Act)." December
- European Commission. 2020b. "Proposal for a Regulation of the Council and the European Parliament on a single market for digital services (Digital Services Act) and amending Directive 2000/31/EC." December
- EY. 2020. "A vision for platform-based banking." February
- Farboodi M., R. Mihet, T. Philippon, and L. Veldkamp. 2019. "Big data and firm dynamics." NBER Working Papers, 25515, January
- Feldman, R.J. 2010. "Size and Regulatory Reform in Finance: Important but Difficult Questions." *Scale Economies in Banking Symposium*, Federal Reserve Bank of Minneapolis, September
- Feyen, E., R.R. Heffernan, H. Natarajan, M. Saal, and A. Sarkar 2021. "Fintech Market Participants Survey." World Bank Group, Fintech and the Future of Finance report
- Financial Stability Board (FSB). 2017. "Artificial intelligence and machine learning in financial services: Market developments and financial stability implications." November
- Financial Stability Board (FSB). 2019a. "Decentralised financial technologies: Report on financial stability, regulatory and governance implications." June
- Financial Stability Board (FSB). 2019b. "Third-party dependencies in cloud services: Considerations on financial stability implications." December

- Financial Stability Board (FSB). 2020. "BigTech in emerging market and developing economies." October
- Frost, J. 2020. "The Economic Forces Driving Fintech Adoption Across Countries." In M King and R Nesbitt (eds), *The Technological Revolution in Financial Services*, Toronto: University of Toronto Press
- Frost, J, L. Gambacorta, Y. Huang, H.S. Shin, and P. Zbinden. 2019. "BigTech and the changing structure of financial intermediation." *Economic Policy*, 34(100), 761–99
- Frost, J., L. Gambacorta, and H.S. Shin. 2021. "From Financial Innovation to Inclusion." IMF Finance & Development, Spring
- Fuster, A., P. Goldsmith-Pinkham, T. Ramadorai, and A. Walther. 2019. "The effect of machine learning on credit markets." VoxEU January
- Gambacorta, L., Y. Huang, H. Qiu, and J. Wang. 2019. "How do machine learning and non-traditional data affect credit scoring? New evidence from a Chinese fintech firm." BIS Working Papers, 834
- Gambacorta, L., Y. Huang, Z. Li, H. Qiu, and S. Chen 2020 "Data vs. collateral." BIS Working Papers, 881, September
- Goldfarb, A and C Tucker 2019 "Digital Economics" *Journal of Economic Literature*, 57(1), 3-43
- Hellmann, T., K. Murdock, and J. Stiglitz. 2000. "Liberalization, Moral Hazard in Banking, and Prudential Regulation: Are Capital Requirements Enough?" *American Economic Review*, 90(1), 147–65
- HM Treasury. 2019. "Unlocking Digital Competition: Report of the Digital Competition Expert Panel." March
- Hileman, G. and M. Rauchs. 2017. "Global Cryptocurrency Benchmarking Study." Cambridge Centre for Alternative Finance
- Holmström, B. and J. Tirole. 1997. "Financial intermediation, loanable funds and the real sector." *Quarterly Journal of Economics* 112(3), 663–91
- International Association of Insurance Supervisors (IAIS). 2017. "FinTech Developments in the Insurance Industry." February
- International Monetary Fund (IMF) and World Bank Group. 2019. "Fintech: The Experience So Far." June
- International Monetary Fund (IMF) and World Bank Group. 2018. "The Bali Fintech Agenda." October
- Jappelli, T. and M. Pagano. 2000. "Information sharing in credit markets: A survey." CSEF Working Paper, 36
- Jones, C. and C. Tonetti. 2020. "Nonrivalry and the economics of data." *American Economic Review*, 110 (9), 2819–58
- Kahn C. and W. Roberds. 2009. "Why pay? An introduction to payments economics." *Journal of Financial Intermediation*, 18(1), 1–23
- Keeley, M. 1990. "Deposit insurance, risk and market power in banking." *American Economic Review*, 80(5), 1183–1200
- Liu, A. 2019. "An Analysis of the PBOC's New Mobile Payment Regulation." *Cato Journal*, Winter
- Lukoianova, T. and V. Rubin. 2014. "Veracity Roadmap: Is Big Data Objective, Truthful and Credible?" *Advances in Classification Research Online*, 24(1), 4-15
- Luohan Academy Report. 2019. "Digital Technology and Inclusive Growth." Shenzhen
- McKinsey. 2020. "Three actions CEOs can take to get value from cloud computing." July
- Marous, J. 2021. "Will regional banks survive the digital future?" The Financial Brand, <https://thefinancialbrand.com/111327/regional-bank-competition-digital-fintech-transformation-trends/>
- Mester, L. 2018. "Community Banking and the Community Reinvestment Act." Federal Reserve Bank of Cleveland speech, October 3
- Mester, L. 2010. "Scale Economies in Banking and Financial Regulatory Reforms." *Scale Economies in Banking Symposium*, Federal Reserve Bank of Minneapolis, September



- McMorrow, R. 2021. "China tech groups given a month to fix antitrust practices." *Financial Times*, April 13, 2021
- Morning Consult. 2021. "Most Trusted Brands 2021." Available online at <https://morningconsult.com/most-trusted-brands-2021/>
- Morse, A. and K. Pence. 2020. "Technological Innovation and discrimination in household finance." NBER Working Paper, 26739
- OECD. 2020. "Digital Disruption in Banking and its Impact on Competition." <http://www.oecd.org/daf/competition/digital-disruption-in-financial-markets.htm>
- Office of the Comptroller of the Currency (OCC). 1995. "Tying Restrictions: Guidance on Tying." OCC Bulletin, 1995-20
- Oliver Wyman. 2019. "The Race for Consumer Trust." March
- Padilla, A. and M. Pagano. 1997. "Endogenous communication among lenders and entrepreneurial incentives." *The Review of Financial Studies*, 10(1), 205–36
- Padilla, A. and M. Pagano. 2000. "Sharing default information as a borrower discipline device." *European Economic Review*, 44(10), 1951–80
- Pagano, M. and T. Jappelli. 1993. "Information Sharing in Credit Markets." *Journal of Finance*, 48(5), 1693–18
- 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
- Pazarbasioglu, C., A. Garcia Mora, M. Uttamchandani, H. Natarajan, E. Feyen, and M. Saal. 2020. *Digital Financial Services*, World Bank, April
- Restoy, F. 2021. "Fintech regulation: achieving a level playing field." FSI Occasional Paper 17, February
- Ru, H. and A. Schoar. 2016. "Do Credit Card Companies Screen for Behavioral Biases?" NBER Working Paper, 22360
- Rutherford, D. 2013. "Barbell (G1)." In *Routledge Dictionary of Economics* (3rd ed, p 38) Routledge
- Schär, F. 2021. "Decentralized Finance: On Blockchain – and Smart Contract-Based Financial Markets." Federal Reserve Bank of St Louis Review, February
- Schwartz, B. 2005. "The Paradox of Choice: Why More is Less, New York." NY: Harper Perennial
- Shevlin, R. 2019. "The Real Story Behind The PNC-Venmo Clash." Forbes, December 18
- Snow. 2020. "How the 'new normal' is changing cloud usage and strategy." June 16
- Stulz, R. 2019. "FinTech, BigTech, and the Future of Banks." *Journal of Applied Corporate Finance* 31, 86–97
- UK Digital Competition Expert Panel. 2019. "Unlocking digital competition." March
- UK Payment System Regulator 2016. "Market review into the ownership and competitiveness of infrastructure provision." July
- US House of Representatives (US House). 2020. "Investigation of competition in digital markets." Majority staff report and recommendations, House Judiciary Committee's Subcommittee on Antitrust, Commercial and Administrative Law, October
- White, J., Chapsal, A., and Yeater, A. 2018. "European Union – Two-Sided Markets, Platforms and Network Effects." *Global Competition Review - E-Commerce Competition Enforcement Guide*
- Williamson, O.E. 1971. "The Vertical Integration of Production: Market Failure Considerations." *American Economic Review* 61(2), 112–23
- World Bank. 2021. "World Development Report 2021: Data for Better Lives."

