

Banking Disrupted? Financial Intermediation in an Era of Transformational Technology

Kathryn Petralia, Thomas Philippon,
Tara Rice and Nicolas Véron

Banking Disrupted?

Financial Intermediation in an Era of Transformational Technology

Geneva Reports on the World Economy 22

International Center for Monetary and Banking Studies (ICMB)

International Center for Monetary and Banking Studies
2, Chemin Eugène-Rigot
1202 Geneva
Switzerland

Tel: (41 22) 734 9548
Fax: (41 22) 733 3853
Web: www.icmb.ch

© 2019 International Center for Monetary and Banking Studies

Centre for Economic Policy Research

Centre for Economic Policy Research
33 Great Sutton Street
London EC1V 0DX
UK

Tel: +44 (20) 7183 8801
Fax: +44 (20) 7183 8820
Email: cepr@cepr.org
Web: www.cepr.org

ISBN: 978-1-912179-26-8

Banking Disrupted?

Financial Intermediation in an Era of Transformational Technology

Geneva Reports on the World Economy 22

Kathryn Petralia

Kabbage

Thomas Philippon

NYU Stern School of Business and CEPR

Tara Rice

Bank for International Settlements

Nicolas Véron

Bruegel and Peterson Institute for International Economics

The International Center for Monetary and Banking Studies (ICMB)

The International Center for Monetary and Banking Studies (ICMB) was created in 1973 as an independent, non-profit foundation. It is associated with Geneva's Graduate Institute of International and Development Studies. Its aim is to foster exchanges of views between the financial sector, central banks and academics on issues of common interest. It is financed through grants from banks, financial institutions and central banks. The Center sponsors international conferences, public lectures, original research and publications. In association with CEPR, the Center has published the Geneva Reports on the World Economy since 1999. These reports attract considerable interest among practitioners, policymakers and scholars.

ICMB is non-partisan and does not take any view on policy. Its publications, including the present report, reflect the opinions of the authors, not of ICMB or any of its sponsoring institutions. The President of the Foundation Board is Thomas Jordan and the Director is Ugo Panizza.

Centre for Economic Policy Research (CEPR)

The Centre for Economic Policy Research (CEPR) is a network of over 1,300 research economists based mostly in European universities. The Centre's goal is twofold: to promote world-class research, and to get the policy-relevant results into the hands of key decision-makers.

CEPR's guiding principle is 'Research excellence with policy relevance'.

A registered charity since it was founded in 1983, CEPR is independent of all public and private interest groups. It takes no institutional stand on economic policy matters and its core funding comes from its Institutional Members and sales of publications. Because it draws on such a large network of researchers, its output reflects a broad spectrum of individual viewpoints as well as perspectives drawn from civil society.

CEPR research may include views on policy, but the Trustees of the Centre do not give prior review to its publications. The opinions expressed in this report are those of the authors and not those of CEPR.

Chair of the Board	Sir Charlie Bean
Founder and Honorary President	Richard Portes
President	Beatrice Weder di Mauro
Vice Presidents	Maristella Botticini
	Ugo Panizza
	Hélène Rey
Chief Executive Officer	Tessa Ogden

About the authors

Kathryn Petralia is the President and Co-Founder of Kabbage, a leading global financial services, cash-flow financial technology (FinTech) and data platform for small businesses. Before co-founding Kabbage in 2008, Kathryn spent 15 years focused on digital credit, payments and e-commerce. She was named on Forbes' 2018 list of the World's Most Powerful Women and currently serves on the boards of CARE USA, Fannie Mae Advisory Board, The Woodruff Arts Center, Padsplit, Rented.com and the Atlanta Chamber Music Festival.

Thomas Philippon is the Max L. Heine Professor of Finance at New York University, Stern School of Business. Philippon was named one of the "top 25 economists under 45" by the IMF in 2014. He won the 2013 Bernácer Prize for Best European Economist under 40, the 2010 Michael Brennan & BlackRock Award, the 2009 Prize for Best Young French Economist, and the 2008 Brattle Prize for the best paper in Corporate Finance. He is an academic advisor to the Financial Stability Board and the Hong Kong Institute for Monetary and Financial Research. He was an advisor to the New York Federal Reserve Board and a board member of the French prudential regulatory authority from 2014 to 2019, and the senior economic advisor to the French finance minister in 2012-2013. Philippon graduated from Ecole Polytechnique, received a PhD in Economics from MIT and joined New York University in 2003.

Tara Rice joined the Bank for International Settlements from BlackRock. Previously, Tara served as Deputy Assistant Secretary for International Financial Stability and Regulation at the U.S. Department of Treasury. Tara also worked for nearly 15 years in the Federal Reserve System, most recently as head of the global financial institutions section and as a visiting member of the Financial Stability Board in Basel. In 2012, she received the Fed's Special Achievement Award. Tara's research has appeared in academic journals such as the *Journal of Finance* and the *Journal of Financial Intermediation*, as well as in Federal Reserve publications. She holds a PhD in Finance from Boston College.

Nicolas Véron cofounded Bruegel in Brussels in 2002-05, joined the Peterson Institute for International Economics in Washington, DC in 2009, and is currently employed on equal terms by both organisations as a Senior Fellow. His research is primarily on financial systems and financial services policies. A graduate of France's Ecole Polytechnique and Ecole des Mines de Paris, his earlier experience includes senior positions in the French government and private sector in the 1990s and early 2000s. He is also an independent board member of the global derivatives trade repository arm of DTCC, a financial infrastructure company that operates on a non-profit basis, and an investor in funds managed by Newfund, a venture capital investment firm.

Acknowledgements

We are particularly grateful to Sam Taussig, Head of Policy at Kabbage, for his generous contributions, time and views in the preparation of this report. We thank Tobias Adrian, Simon Ainsworth, Agnès Bénassy-Quéré, Morten Bech, Alexandre Birry, Urs Bischof, Justin Bisseker, Claudio Borio, Agnieszka Brewka, Chris Brummer, Brad Carr, Martin Chorzempa, Stijn Claessens, Mark Cliffe, Benoît Coeuré, Jon Cunliffe, Udaibir Das, Tom Dechaene, Carlos Egea, Jon Frost, Gaston Gelos, Juan Luis Díez Gibson, Charles Goodhart, Yasuhiro Hayasaki, Carsten Hess, Patrick Honohan, Yi Huang, Stephan Imhof Thomas Jordan, Gergana Jostova, Rob Kendrick, Alejandra Kindelan, Michael Koetter, David Knutson, Jean-Pierre Landau, Clay Lowery, Andréa Maechler, Sean Marion, Véronique Ormezzano, Allison Parent, Alexander Philipov, Huw Pill, Andres Portilla, Adam Posen, Jun “QJ” Qian, Dolores Ramos, Sébastien Raspiller, Lucrezia Reichlin, Bertrand Rime, Torsten Schaper, Markus Schmaus, Catherine Shenk, Hyun Shin, Anna Sienkiewicz, Xavier Vives, Amber Wadsworth, Harald Waiglein, Beatrice Weder di Mauro, Arthur Wilmarth, Pierre Wunsch, Andrew Wyckoff and Fritz Zurbrügg for their advice and comments, including at the conference held in Geneva on 17 May 2019. We thank Codruta Boar and Giulio Cornelli at the Bank for International Settlements and Madi Sarsenbayev at the Peterson Institute for International Economics for excellent research assistance. All opinions and errors are ours.

Contents

<i>About the authors</i>	v
<i>Acknowledgements</i>	vi
<i>List of conference participants</i>	viii
<i>List of abbreviations</i>	xvi
<i>Foreword</i>	xviii
Executive summary	xix
1 Introduction: The death of banking?	1
2 Banking deconstructed	3
Why do we have banks?	3
Where are big banks located?	5
How do banks make money? The banking business model	8
Banks' economies of scale and scope	14
Market shares in finance compared with other industries	19
3 Banks' competition from Big Tech and Fintech	23
Challenges to banks	24
Big Tech and FinTech firms' entry into the provision of financial services	25
Payment services will continue to be shaped by emerging technologies	34
Advantages and disadvantages of banks vis-à-vis FinTech and Big Tech firms	38
Competitive advantages of FinTech and Big Tech	38
4 Public policy challenges	53
New dynamics shaping public policy: Scale, speed and border-hopping	54
A trilogy of policy imperatives	55
Addressing financial inclusion	66
Accommodating global diversity	68
Big Tech and prospects for a global currency	69
Financial authorities must adapt	80
5 Concluding remarks	83
Discussions	84
Morning session: Facts and trends	84
Afternoon session: Policies	97
<i>References</i>	<i>110</i>

List of conference participants

Ivan Adamovich	CEO Private Client Bank AG Zürich
Lionel Aeschlimann	CEO Asset Management Mirabaud Asset Management (Suisse) SA Geneva
Svein Andresen	Member of the Board Danish Financial Supervisory Authority
Óscar Arce Hortigüela	Director General Economics, Statistics and Research Banco de España Madrid
Mourtaza Asad-Syed	Chief Investment Officer Landolt & Cie Geneva
Katrin Assenmacher	Head of Division Monetary Policy Strategy Division European Central Bank Frankfurt am Main
Richard Baldwin	Professor of International Economics The Graduate Institute Geneva
Vít Bárta	Advisor to the Governor Czech National Bank Prague
Agnès Bénassy-Quéré	Professor Paris School of Economics University Paris 1 Panthéon-Sorbonne
Rémy Bersier	Member of the Executive Board Bank Julius Baer & Co. Ltd.
Karsten Bilotft	Assistant Governor Head of Financial Stability Danmarks Nationalbank

Codruta Boar	Research Analyst Bank for International Settlements (BIS) Basel
Claudio Borio	Head of the Monetary and Economic Department Bank for International Settlements (BIS) Basel
Jaime Caruana	Former Governor, Banco de España Former General Manager, Bank for International Settlements (BIS) Basel
Stijn Claessens	Head of Financial Stability Policy Deputy Head of the Monetary and Economic Department Bank for International Settlements (BIS) Basel
Benoît Cœuré	Member of the Executive Board European Central Bank Frankfurt am Main
Nicolas Cuche-Curti	Head of Inflation Forecasting Swiss National Bank
Jon Cunliffe	Deputy Governor, Financial Stability Bank of England London
Jean-Pierre Danthine	President Paris School of Economics Professor EPFL Lausanne
Renaud De Planta	Managing Partner Banque Pictet & Cie Geneva
Steve Donzé	Senior Macro Strategist Pictet Asset Management Banque Pictet & Cie Geneva
Frederik Ducrozet	Macro Strategist Investment platform Pictet Wealth Management Banque Pictet & Cie Geneva

Jean-Pierre Durante	Head of Applied Research Pictet Wealth Management Banque Pictet & Cie Geneva
Yannick Duval	General Secretary General Management BNP Paribas Switzerland Geneva
Lydie Favre-Felix	Credit Analyst Atlanticonium Geneva
Andrea Fracasso	Professor School of International Studies University of Trento
Gaston Gelos	Division Chief Monetary and Macprudential Policies Division IMF Washington, DC
Hans Genberg	Executive Director The SEACEN Centre Kuala Lumpur
Stefan Gerlach	Chief Economist EFG Bank Zürich
Nadia Gharbi	Economist Pictet Wealth Management Banque Pictet & Cie Geneva
Olivier Ginguené	Equity Partner - CIO Pictet Asset Management Banque Pictet & Cie Geneva
Michel Girardin	Lecturer Micro Finance University of Geneva
Claude Gonet	Adviser to the Board General Management Banque Eric Sturdza Geneva
Weiyun Gong	General Manager China Construction Bank Zürich Branch

Charles Goodhart	Professor Emeritus Financial Markets Group London School of Economics
Christos Gortsos	Professor of Public Economic Law National and Kapodistrian University of Athens Visiting Professor, Europa Institut, University of Saarland
Harald Hau	Professor of Economics and Finance University of Geneva Geneva Finance Research Institute
Patrick Honohan	Former Governor, Central Bank of Ireland Honorary Professor, Department of Economics Trinity College Dublin Nonresident Senior Fellow Peterson Institute for International Economics, Washington, DC
Haizhou Huang	Managing Director China International Capital Corporation (CICC)
Yi Huang	Executive Vice President China Construction Bank President, International Institute China Construction Bank Beijing
Yi Huang	Associate Professor of Economics Pictet Chair in Finance and Development The Graduate Institute Geneva
Thomas Jordan	Chairman of the Governing Board Swiss National Bank Zürich
Gero Jung	Chief Economist Mirabaud Asset Management (Suisse) SA Geneva
Anjeza Kadilli	Economist Pictet Asset Management Banque Pictet & Cie Geneva

xii *Banking Disrupted? Financial Intermediation in an Era of Transformational Technology*

Prakash Kannan	Deputy Chief Economist and Head of Total Portfolio Management Economics and Investment Strategy Government of Singapore Investment Corporation Singapore
Sabrina Khanniche	Senior Economist Fixed Income Pictet Asset Management Banque Pictet & Cie Geneva
Peng Kong	Deputy General Manager China Construction Bank Zürich Branch
Eduard Kronbichler	Deputy CEO Perreard Partners Investments Geneva
Jean-Pierre Landau	Professor Sciences Po Paris
Valérie Lemaigre	Chief Economist Head of Investment Office Asset Management BCGE Geneva
Clay Lowery	Managing Director Rock Creek Global Advisors LLC
Andréa M. Maechler	Member of the Governing Board Department III Swiss National Bank Zürich
Antoine Magnier	General Inspector of Social Affairs French Ministry of Labor and Social Affairs Paris
Nikolay Markov	Senior Economist Pictet Asset Management Banque Pictet & Cie Geneva
Alan Mudie	Head of Investment Strategy Société Générale Private Banking (Suisse) SA
Dirk Niepelt	Director Study Center Gerzensee Professor University of Bern

Nicholas Niggli	Deputy Secretary-General Département du Développement Economique Etat de Genève
Patrick Odier	Senior Managing Partner Lombard Odier Group Geneva
Pinar Özlü	Executive Director Research and Monetary Policy Department Central Bank of the Republic of Turkey Ankara
Ugo Panizza	Professor of International Economics and Pictet Chair in Finance and Development The Graduate Institute Director, ICMB Geneva
Pierre Pâris	CEO Banque Pâris Bertrand Geneva
Kathryn Petralia	Cofounder & President Kabbage Atlanta
Charles Pictet	Former Partner Banque Pictet & Cie Geneva
Huw Pill	Advisory Director Global Macro Research Goldman Sachs International London
Jun Qian	Executive Dean Professor of Finance Fanhai International School of Finance Fudan University Shanghai
Lucrezia Reichlin	Professor of Economics London Business School
Tara Rice	Member of Secretariat Committee on Payments and Market Infrastructures Bank for International Settlements (BIS) Basel

Bertrand Rime	Director Financial Stability Swiss National Bank Bern
Alain Robert	Executive Vice Chairman Global Wealth Management UBS Switzerland Zurich
Jean-Pierre Roth	Former Chairman Swiss National Bank
Hans-Joerg Rudloff	Chairman Marcuard Holding London
Nabil Jean Sab	CEO Compagnie Privée de Conseils et d'Investissements Geneva
Francesco Samson	Chief Operating Officer Quaero Capital Geneva
Hyun Song Shin	Economic Adviser and Head of Research Monetary Department Bank for International Settlements (BIS) Basel
Livio Stracca	Deputy Director General International and European Relations European Central Bank Frankfurt am Main
Alexandre Swoboda	Professor of Economics Emeritus The Graduate Institute Geneva
Gianluca Tarolli	Market Economist Research Department Banque Bordier & Cie Geneva
Pascal Towbin	Senior Economist Financial Stability Swiss National Bank
Karen Van Der Wiel	Head of Financial Markets Program Markets & Regulation CPB Netherlands Bureau for Economic Policy Analysis The Hague

Nicolas Veron	Senior Fellow Bruegel Brussels Peterson Institute for International Economic Washington, DC
Monique Vialatou	CEO BNP Paribas (Suisse) Geneva
Xavier Vives Torrents	Professor of Economics and Finance IESE Business School Barcelona
Ghislaine Weder	Head of Economics and International Relations Nestlé Vevey
Beatrice Weder Di Mauro	President CEPR Professor of Economics The Graduate Institute Research Professor and Distinguished Fellow Emerging Markets Institute INSEAD
Di Wu	Assistant Executive Office China Construction Bank Beijing
Charles Wyplosz	Professor of Economics Emeritus The Graduate Institute Geneva
Hui Yan	Senior Expert International Institute China Construction Bank
Attilio Zanetti	Head of Economic Analysis Swiss National Bank Zürich
Fritz Zurbrügg	Vice-Chairman of the Governing Board Department II Swiss National Bank Bern

List of abbreviations

AI	artificial intelligence
AML	anti-money laundering
API	application programming interface,
ATM	automated teller machine
B2B	business-to-business
BI	business intelligence
CCPA	California Consumer Privacy Act
CD	certificate of deposit
CFPB	Consumer Financial Protection Bureau
CFT	countering the financing of terrorism
CGFS	Committee on the Global Financial System
CPMI	Committee on Payments and Market Infrastructures
CR	concentration ratio
CSBS	Conference of State Bank Supervisors
DG COMP	European Commission Directorate General for Competition
DLT	distributed ledger technology
EMI	electronic money institution
ESMA	European Securities and Markets Authority
ETF	exchange-traded fund
FCRA	US Fair Credit Reporting Act
FDIC	US Federal Deposit Insurance Corporation
FMI	financial markets infrastructure
FSB	Financial Stability Board
FSOC	Financial Stability Oversight Council
FX	foreign exchange
G7	Group of Seven
G20	Group of Twenty
GDP	gross domestic product
GDPR	EU General Data Protection Regulation
G-SIB	global systemically important bank
HHI	Hirschman-Herfindahl index
ICBA	Independent Community Bankers Association
IFRS	International Financial Reporting Standards
IHC	intermediate holding company
IIF	Institute of International Finance
ILC	industrial loan company
M&A	mergers and acquisitions
MUNFI	monitoring universe of nonbank financial intermediation
NBFI	nonbank financial intermediation
NIM	net interest margin
OCC	US Office of the Comptroller of the Currency
OJK	Indonesian Financial Services Authority
P2P	peer-to-peer

PFMI	Principles for Financial Market Infrastructures
PSD2	Second EU Payment Services Directive
PSP	payment service provider
ROE	return on equity
SMEs	small and medium-sized enterprises
SoFi	Social Finance Inc.
TBTF	too big to fail

Foreword

The Geneva Reports on the World Economy are published annually by CEPR and ICMB and have been providing innovative analysis on important topical issues facing the global economy since 1999.

At a time when emergent FinTech and Big Tech companies are increasingly encroaching on the market to challenge and disrupt the financial establishment, the global banking sector faces unprecedented changes. This 22nd Geneva Report assesses in detail and with tremendous clarity the future prospects for banking and scrutinises crucial public policy questions.

The authors start by tracing the history that has shaped the structures of the sector and of its social, institutional and political environment, revealing that threats and innovations are not new phenomena and the industry has demonstrated remarkable durability. Indeed, the vast majority of the world's banking assets are still concentrated in the traditional financial hubs, while conventional banking activities still account for over two-thirds of total revenues.

The report argues that the current dynamics of change, brought about by a wave of innovation within financial technology, are unprecedented in their scale, speed of adoption and potential to 'hop' across jurisdictions. Riding this wave and bringing competition to the big bank business models are the Big Tech and FinTech firms, whose core strategies centre around technological innovation. These challenges to banks and the digital disruption they bring to financial sectors such as payment services, customer management and retail lending are discussed, along with a review of the competitive advantages and disadvantages of incumbent banks vis-à-vis Big Tech and FinTech firms.

Critical policy questions surround these issues, and the answers to these will determine the future of banking. The final part of the report outlines recommendations for policymakers as they deal with the attendant challenges, whether they be tech and data related or in the form of data ownership, privacy and regulatory practices.

Despite significant predicted disruption, the authors conclude that while the financial landscape will continue to radically transform, for the consumer, banking at large will remain a business conducted primarily by government chartered and regulated entities, including many incumbent banks.

This report was produced following the Geneva Conference on the World Economy held in May 2019. CEPR and ICMB are very grateful to the authors and several discussants for their efforts in preparing material for this report, as well as to the conference attendees for their insightful comments. We are also thankful to Laurence Procter for her continued efficient organisation of the Geneva conference series, to Hayley Pallan for recording and summarising the discussions and to Anil Shamdasani for his unstinting and patient work in publishing the report.

CEPR, which takes no institutional positions on economic policy matters, is delighted to provide a platform for an exchange of views on this topic.

Tessa Ogden
Chief Executive Officer, CEPR

Ugo Panizza
Director, ICMB

September 2019

Executive summary

Is this the end of banking as we know it? New technologies and regulations are changing the way households and businesses use financial services in general, and banking services in particular. A notable difference from previous waves of disruption is that today's competition emanates from 'Big Tech' and 'FinTech' firms and from nonbank financial institutions (NBFIs), such as large asset managers.

This report reviews ongoing changes in the finance industry, discusses the competition from Big Tech and FinTech, and considers critical public policy questions.

Banks are changing in many ways, but some features of banking are remarkably stable. Banking assets remain concentrated in a few countries. The US dominated the post Bretton Woods era, Japan took over in the 1980s, and China experienced extraordinary banking growth in the last decade. Traditional banking activities still account for more than two-thirds of total revenues of financial institutions, although some of these activities are now performed by nonbanks and profits margins are squeezed by the low-rate environment.

Technological disruption is having a positive impact on the finance industry. An overwhelming majority of the financial institutions that we survey believe that technological innovations lead to new and better products and services for their customers. Payment services are the most disrupted, followed by customer management and retail lending.

BigTech and FinTech are increasingly competing with banks, but in different ways. Banks are as likely to see Fintechs as technology partners and as competitors. BigTechs, on the other hand, are less likely to be seen as partners.

Technological disruption challenges not only the business models of banks but also the existing models of regulation. We identify the disrupting forces and explain how they affect policy making. Scale, speed of adoption and border-hopping are the three key disruptive forces. Financial stability, competition and data protection remain the three over-arching goals of financial regulation. The challenges range from cloud computing and artificial intelligence, to activity-based regulations, takeover legislation and data ownership and privacy. These challenges are playing out differently in the US, the EU and China. We explain how policymakers should differentiate and target their efforts to prevent unnecessary fragmentation while accommodating the diversity of jurisdiction-specific legacies and challenges. One key challenge for financial policymakers will be to work collaboratively with non-financial peers in areas such as competition and data rights, in order to adequately respond to increased salience of Big Tech in the financial system.

1 Introduction: The death of banking?

We are passing through [a] high tech era of information technology. Things are changing very fast and banking worldwide will soon die natural death due to the emergence of e-wallets. When computers arrived, typewriters died a natural death. With the arrival of mobile phones, most land line phones vanished. Change is inevitable also in [the] banking arena.

Gao Vijayan, entrepreneur (Vijayan, 2018)

If what we are witnessing continues, banks will slowly, and almost painfully, go down the path of extinction. I am not saying that banking will come to an end; I am only referring to the paraphernalia surrounding the banking system, especially the bank. Banks today have become vestiges of the traditional financial system and create more burden than value for the system.

Anton Dzatovkii, FinTech blogger (Dzatovkii, 2018)

Few will disagree that the current banking industry is facing a turbulent future, as the incumbents continue to struggle to keep up with the seemingly endless growth of FinTech “disrupters.” ...This FinTech revolution has put big banks in an even more precarious position, as their role as the go-to financial mediators is put into question.

Marko Sjoblom, entrepreneur (Sjoblom, 2018)

The provision of financial services is profoundly changing worldwide – so much so that many commentators are predicting the death of banking as we know it. Could it be that reports on the death of banking are largely exaggerated?

The threat of banks’ extinction is not new;¹ it has been heralded many times in the past. Going back to the mid-20th century, the threat in the United States (US) emanated from other credit institutions and other lenders, such as “sales finance companies, retail outlets and charge account and services credits” (*Banking*, 1960, p. 47). Money market mutual funds began to threaten the deposit franchise in the 1970s. In 1990, William Seidman, then Chairman of the U.S. Federal Deposit Insurance Corporation (FDIC), said in congressional testimony that “[b]anking is becoming a riskier, more volatile business, banks are encountering greater degrees of competition; and what constitutes the business of banking itself is undergoing

1 Banks are traditionally defined as specialised firms authorised by public authorities to provide maturity transformation of deposits into credit, and as such to contribute to the creation of money (Calomiris and Haber, 2014). We use the term “banks” in a similar sense to how is generally employed in Europe, which makes it broader than in typical US practice, where it refers to a narrower group of mostly depositary institutions insured by the US Federal Deposit Insurance Corporation (FDIC). Thus, from a US perspective and unless otherwise indicated, our references to “banks” may also include thrifts, credit unions, bank and financial holding companies, industrial loan companies (ILCs), and occasionally also broker-dealers.

rapid evolution” (Seidman, 1999). In the early 2000s, banks felt threatened by commercial and industrial firms, including the giant retailer Walmart, who sought to obtain banking licences to allow them to combine banking and commerce (Wilmarth, 2007).

Today’s competition primarily stems from ‘Big Tech’ and ‘FinTech’ firms, as well as from ‘challenger’ or ‘neo’ banks. Big Tech firms are large, globally active technology firms with a relative advantage in digital technology. FinTech (financial technology), on the other hand, is defined as technologically enabled financial innovation that could result in new business models, applications, processes or products with an associated material effect on financial markets, financial institutions and provision of financial services (FSB, 2019b).

Big Tech firms and their more focused FinTech cousins, some of which hold a banking licence (‘challenger banks’), present as primary competitors to traditional banks. Momentous changes are developing at a rapid pace and disrupting the provision of financial services. We view some of the dynamics at stake as unprecedented, not least in terms of their rapid ‘hyperscalability’ (Nguyen Trieu, 2017) and the extent to which technological solutions and their adoption by users tend to spread or ‘hop’ across jurisdictional borders.

In this report, we look back at the long and complex history of banks and ask whether the competition stemming from technology-driven actors presents a threat to the traditional banking model that is fundamentally different than in the past. Over centuries, history has shaped the structures of the banking sector and of its social, institutional and political environment. Is the end of that history imminent?

We combine quantitative analysis with an historical perspective and a short qualitative survey of market participants, including banks, nonbank financial institutions, FinTech, RegTech,² and Big Tech firms. Our survey asked questions regarding technology disruption in financial services and its impact on competition and product offering. It also asked questions on the changing nature of financial institutions’ relationships with customers and expectations for those relationships over the next several years.

Our geographical scope is global in principle, even as we are aware that many of the examples to which we refer emanate from the US, Europe or China. These jurisdictions together are home to the vast majority of the world’s banking assets, as observed in Chapter 2, although they represent only about a third of the world’s population.

The report is structured as follows. Chapter 2 reviews the banking and financial services landscape, how it has changed over the last several decades, and key drivers of banks’ current business models. Chapter 3 discusses the competition emanating from technology firms. Chapter 4 considers critical public policy questions surrounding the future of banking and outlines some recommendations for policymakers.

2 RegTech firms are any range of applications of FinTech for regulatory and compliance requirements and reporting by regulated financial institutions (also called SupTech, for supervisory applications) (FSB, 2017).

2 Banking deconstructed

[T]he function of the modern bank...was to give the maximum assistance to trade and industry, on the lowest terms compatible with safety to depositors, and a reasonable profit to shareholders.

The Banker (1925, p. 598)

Over the years, the banking industry has exhibited remarkable adaptability to changing conditions. Its fate is seldom as bad as the figures indicated it should be.

Banking (1960, p. 39)

Why do we have banks?

In theory, financial institutions exist to mitigate a host of problems that would otherwise prevent funds from flowing from savers (depositors) to those with a shortage of funds (borrowers). These problems arise because of informational asymmetries, contracting costs, and duration mismatches between the suppliers and demanders of those funds. Banks can alleviate these problems in a number of ways; ways that make them ‘special’.³

More specifically, banks engage in maturity and safety transformation, payment services and information processing (Navaretti *et al.*, 2017). Maturity and safety transformation is the use of safe short-term funding (i.e., deposits) to grant risky long-term loans. Banks can provide increased liquidity by pooling funds from many agents. Because of their function in providing liquidity to their customers, banks are also well placed to offer payment services.

Information processing includes all of the activities related to screening potential borrowers, together with the monitoring of their financial condition and managing loan portfolios. The economics literature highlights how banks are better able (and have greater incentive) than individual lenders to monitor borrowers. Additionally, banks have the ability to diversify away idiosyncratic credit risk by holding portfolios of multiple loans.

Banks have been providing these services for centuries. In fact, ‘modern’ banking (i.e., privately owned joint-stock companies with a government-granted charter) has existed since at least the 1600s. Some banks that still operate today can trace their origins back to even older (late Medieval) times (Calomiris and Haber, 2014; Conant, 1927). It has long been recognised that size and scope enable banks to engage in large-scale international transactions, such as the financing of international trade. It has also been recognised that large-scale mergers and acquisitions have been essential for banks to scale up to be able to finance the “manufacture, distribution and marketing of goods” from international corporations as trade developed and grew (*The Banker*, 1929, p. 47).

³ There is a vast literature on what makes banks special (see, for example, Saunders and Cornett, 2017).

But big banks do not only serve large, multinational companies. Throughout most of their history, they have been tightly linked to sovereigns and developed alongside the modern nation state, primarily to help finance those sovereigns in matters such as war, trade and infrastructure development (Cameron and Bovykin, 1991). Calomiris and Haber (2014) describe in detail how chartered banks and nation states began to emerge as organisational structures in the 1600s. Banks evolved to align the incentives of rulers, merchants and financiers – three parties critical to the development of a viable modern economy.

This was not necessarily a peaceful co-development, however. As nation states waged war, they required financing. Wealthy merchants or financiers were willing to lend their sovereigns the necessary funds, but the sovereigns did not always pay their debts. In 1584, for example, in a speech delivered to the Venetian Senate, Tomaso Contarini declared that there had been 103 banks, of which 96 had come to a bad end and only seven had succeeded (Conant, 1927, p. 9). The service rendered by the banks to commerce had been such, on the whole, that to “preserve the trade of the city without banking was not only difficult but impossible” (Dunbar, 1892, p. 6).

The early history of banking was one of necessity, but it soon gave way to financial innovation. A number of financial innovations provided the backbone of the modern banking system, including the joint-stock bank charter, the bill of exchange and the deposit contract.

The joint-stock banking companies were introduced in earnest in England in the early- to mid-1800s (Newton, 2010). They formalised modes of banking undertaken by the private banks and established the foundations for a stable domestic banking system, thereby providing the environment in which other sectors, and the overall economy, could flourish (Newton, 2010).

The bill of exchange, first made legal in England in 1882, became a means for making productive loans. The bill of exchange is a negotiable instrument⁴ introduced in international trade in the 1600s as a means of payment to bind one party to pay a fixed sum of money to another party on demand or at a predetermined date. Its innovation was that it allowed parties to transfer bills to other parties as a form of money and banks to hold them as a credit instrument.⁵ The bills of exchange later gave way to cheques and promissory notes.

The deposit contract provided another pillar of banking – it provided savers with the security to deposit their funds at a bank, and provided for interest and a guarantee of return of their deposits. Once deposits (previously restricted) were accepted to be loaned for profit, these profits were shared with the depositors.

4 A negotiable instrument is a document guaranteeing the payment of a specific amount of money, either on demand or at a set time, with the payer usually named on the document. More specifically, it is a document contemplated by or consisting of a contract that promises the payment of money without condition, which may be paid either on demand or at a future date (see <https://www.investopedia.com/terms/n/negotiable-instrument.asp>).

5 England codified the bill of exchange to be an unconditional order in writing, addressed by one person to another, signed by the person giving it, requiring the person to whom it is addressed to pay on demand or at a fixed or determinable future time a certain sum in money to or to the order of a specified person, or to the bearer (see <https://www.legislation.gov.uk/ukpga/Vict/45-46/61>).

The character of the loan changed from a specific deposit, transferable only by the owner, to a loan from the owner of the bank for which he received interest (Conant, 1927). The interest thus became a source of income to the bank for its services in intermediating between savers and borrowers. These innovations (among others) paved the way for the modern bank – and its development alongside its sovereign.

And so, because banks had depended heavily on their home country government to provide them with a charter, credibility (provided by a supervisory and regulatory regime) and a safety net, their development and existence relied on their government more directly than with other types of businesses. As a result, the political economy surrounding the existence and activities of banks and their relationship with the government is fraught with crisis, political interference and conflicts of interest. Indeed, many countries have experienced several banking crises since the 1800s (Laeven and Valencia, 2008; Reinhart and Rogoff, 2009). Yet despite their “fragile design” (Calomiris and Haber, 2014), the corresponding history of banking crisis and competition from other types of (bank or nonbank) entities, large banks remain prominent, if not dominant, in modern financial systems.

Modern credit thus gradually received its organization and needed only the creation of the bank note and the extension of the mechanism of clearings and cooperation among the banks to stand forth fully equipped for providing the motive power of commerce.

Conant (1927, p. 16)

These innovations provided the means for banks to grow. Yet, for centuries, as the banks expanded (in size and scope of activities) and evolved, they also faced competition from other types of financial institutions, such as credit unions and cooperatives, and from non-depository financial institutions and other nonbank actors, frequently referred to as shadow banks. Shadow banks perform the functions of banks (deposit taking and loan making) but are largely outside the perimeter of prudential bank regulation, and generally without public sector guarantees (Vives, 2019a). Thus the current threat of the demise of banking is not new, but has existed for centuries. Their future can be seen as a series of complex trade-offs, navigated by a number of parties across divergent domestic circumstances, including how banks adapt to customers' changing demand and technological innovation; how the competition chooses to interact with the banks (i.e., to partner or compete directly); how regulators and policymakers across the globe respond to the potential benefits, risks and competition posed by digital innovation driven by Big Tech and FinTech firms; and importantly, on jurisdiction-specific factors related to the technology environment, the current regulatory framework and ongoing financial system and political developments.

Where are big banks located?

Viewed from a global perspective, the banking sector is remarkably concentrated in a limited number of jurisdictions. By ‘jurisdiction’ we mean a geographic unit with a unique, integrated banking policy framework, particularly in terms of prudential regulation and supervision. Most jurisdictions coincide with countries,

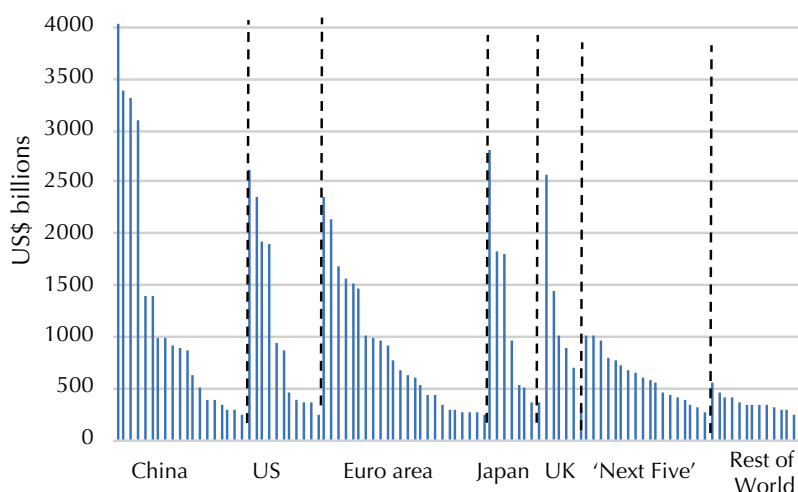
but some, such as Hong Kong, are sub-sovereign and some are shared by several countries, such as the European Banking Union. We treat the euro area as a single jurisdiction in view of the development of its Banking Union since 2012, even though that project remains partly unfinished.⁶

To analyse the geographical distributions of banks, we divide the world's banking jurisdictions into three groups:

- 'Top Five': China, the euro area, Japan, the UK and the US;⁷
- 'Next Five': Australia, Canada, Republic of Korea, Sweden and Switzerland;
- 'Rest of World'(RoW): all other jurisdictions.

Figure 1 shows the distribution of the world's 100 largest banks by assets at year-end 2018. It illustrates the concentration of the largest banks in the Top Five jurisdictions. In contrast, the Rest-of-World (RoW) banks are few and significantly smaller. The RoW banks represented 26% of global GDP in 2018 (at market exchange rates) but only 5% of the Top 100, whereas banks in the Top Five jurisdictions together accounted for 65% of GDP and 82% of Top 100 assets.⁸ The largest bank not located in the Top Five is a Canadian bank (Toronto-Dominion Bank of Canada), ranked 23rd by assets in 2018; the largest bank in the RoW is Danish (Danske Bank, ranked 53rd).

Figure 1 Top 100 global banks by assets, year-end 2018



Source: The Banker Database, a service from The Financial Times Limited, 2019. All rights reserved.

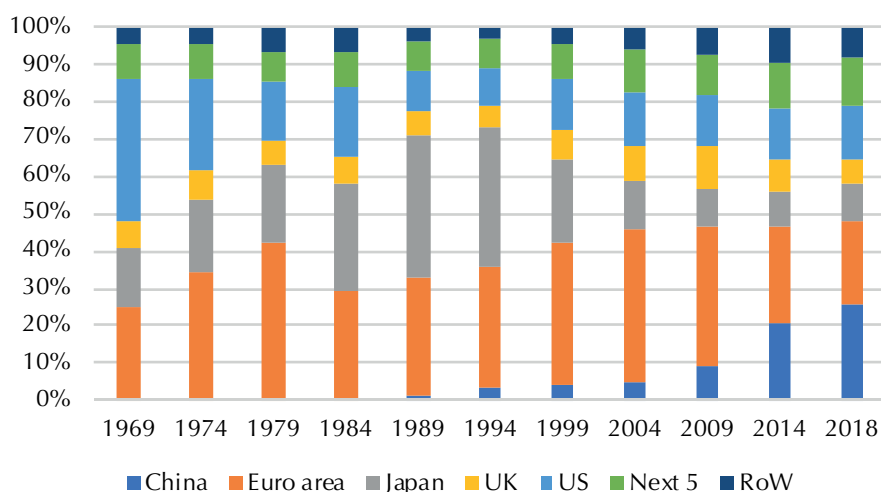
6 The geographical scope of the Banking Union is currently identical to the 19 member states of the euro area. In the future, non-euro area countries in the EU may join the banking union voluntarily through a process referred to in EU law as "close cooperation". Bulgaria and Croatia applied for close cooperation in 2018 and 2019, respectively – in both cases as part of a project to adopt the euro as their currency.

7 China excludes Hong Kong, Macao, and Taiwan; euro area does not include countries or member state dependencies that are outside of the European internal market, such as Vatican City or French Polynesia; United States including Puerto Rico and other territories.

8 For the Next Five countries, the corresponding numbers are respectively 10% of GDP and 12% of Top 100. All GDP figures are from the World Bank and bank assets are from The Banker Database, a Financial Times service. All rights reserved.

Figure 2 shows the evolution over time of the share of these jurisdictions in the aggregate banking assets held by the world's top 200 banks since 1969. While turnover of the largest banks within a given jurisdiction is typically low (as discussed below), there is significant shuffling among different countries/regions. The drivers of this turnover include booms and busts in asset prices, cycles of credit expansion or deleveraging, and foreign exchange movements. Changes in cross-border activity can also affect the rankings since we take the perspective of a home jurisdiction (for example, the US assets of Japanese banks are shown under "Japan" and not "United States").

Figure 2 Aggregate assets of top 200 global banks, selected years 1969–2018

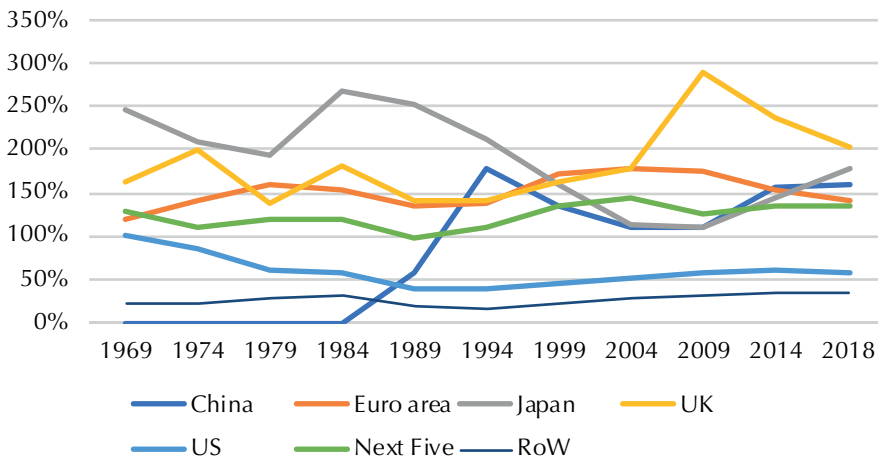


Source: Authors' calculations using The Banker Database, a service from The Financial Times Limited, 2019. All rights reserved.

Figure 2 illustrates the significant shifts in the global banking landscape over the last half-century: its domination by the US at the end of the Bretton Woods era (and presumably also in earlier post-war decades); the Japanese credit expansion and asset bubble of the 1980s, deflating in the 1990s and early 2000s; the continuously significant presence of euro area banks; and the extraordinary rise of Chinese banks in the last decade following the 'credit stimulus' started in 2008, with the inevitable question mark over how that growth will end. We discuss in greater details factors behind these regional trends in Chapter 3.

Figure 3 complements the analysis by showing each jurisdiction's share of its top banks' assets in the global sample, relative to its share of global GDP. The euro area, the UK, Japan and the Next Five, with ratios consistently above 100%, have banking sectors that are large relative to their share of the global economy. The US (at least since the 1970s) and the rest of the world have a relatively smaller banking sector, at least on this measure. China's banks were initially small (or non-existent) compared to its share of global GDP, but began to grow in prominence as early as the 1990s, well before the 'credit stimulus' of 2008.

Figure 3 Share of top 200 bank assets to share of global GDP



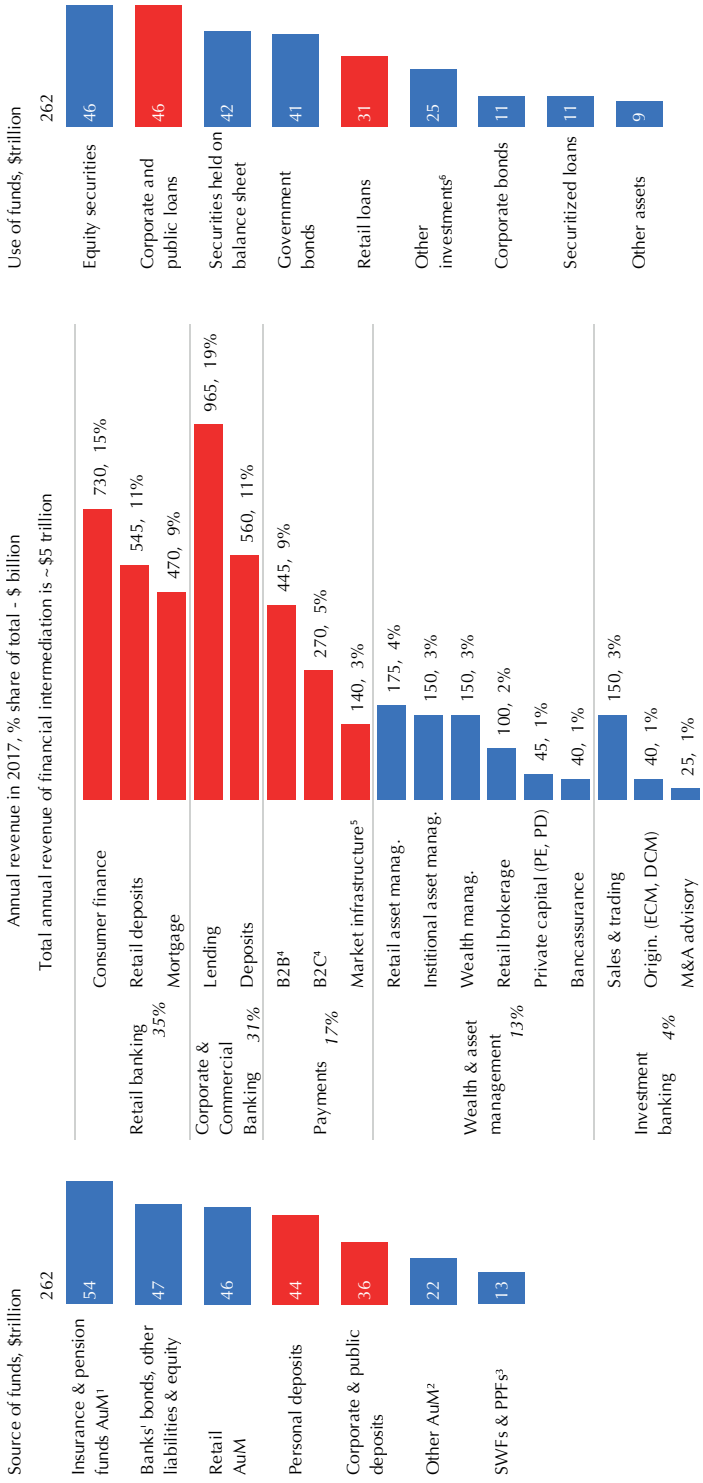
Source: Authors' calculations using The Banker Database, a service from The Financial Times Limited, 2019. All rights reserved.

How do banks make money? The banking business model

We will see the larger international US banks become ever more deeply involved in multinational syndicate financing. Because of the expanding communication and information-manipulating capacity, there will be a definite expansion in the range of financial services a global financial organization will be able to offer. These will include short-, medium- and long-term loans, equity capital, insurance, underwriting, analysis of relevant economic and financial conditions – in fact, just about any financial service that is required.

The Banker (1971, p. 148)

Today, the largest banks engage in a wide variety of activities including the facilitation of international financing (in syndicates), cross-border payments (correspondent banking) and international trade (trade finance). They also engage in other activities such as investment banking, securities brokerage, insurance agency and underwriting, and mutual fund sales. Banks engage in different intermediation activities and select their balance sheet structure to fit their business objectives; they choose a business model to leverage the strengths of their organisation (Roengpitya *et al.*, 2014). But despite radical advances in technology and financial innovation, constantly evolving regulation, and forays into new lines of business, banks' core operations of maturity and safety transformation, payment services, information processing, as well as liquidity provision and risk pooling, has remained central to their business.

Figure 4 The global financial intermediation system

Notes: ¹Assets under management (AuM). ²Endowments and foundations, corporate investments, etc. ³Sovereign wealth funds (SWFs) and public pension funds (PPFs). ⁴Business-to-business (B2B); business-to-consumer (B2C). ⁵Includes exchanges, interdealer brokers (IDBs) and alternative venues (e.g., ATS and MTF), but excludes dark pools. Custody, fund administration, corporate trust, security lending, net interest income, collateral management, and ancillary services provided by custodians. ⁶Real estate, commodities, private capital investments, derivatives, etc.

Source: McKinsey&Company (2018a).

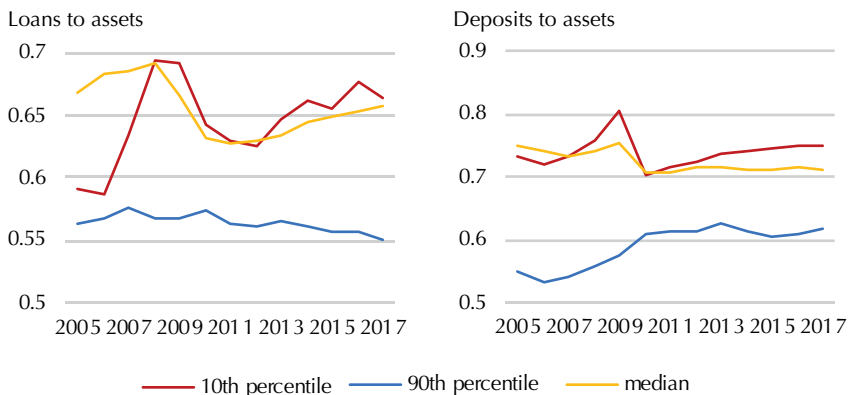
Figure 4 depicts the aggregate global revenue streams of financial institutions (not only banks) in 2017, with the red bars depicting traditional banking activity. Many of the activities are complex and broad in scope – they include asset management, payments, clearing and settlement, insurance, wealth management, and investment banking. Notice, however, that 30% of global funds come from retail and wholesale deposits (the red bars in the left-hand panel). This traditional source of funds still plays a key role in the global financial system. Likewise, loans account for about 30% of the use of global funds and lending is major source of revenues for financial firms (red bars, right-hand panel).

Strikingly, these traditional bank activities – labelled corporate and commercial and retail banking in the figure (red bars, centre panel) – provide about two-thirds of aggregate global revenues of financial institutions (McKinsey&Company, 2018a). And if we include payments, clearing and settlement revenue, that share is more than 80% of total revenue.

These are aggregate figures; they differ by bank size, as the larger banks tend to do less traditional banking (as a proportion of their balance sheets or income streams) relative to the smaller banks. Figures 5 to 7 show balance sheet and income statement ratios for the largest banks (banks in the 90th percentile by assets), the smallest banks (banks in the 10th percentile by assets), and the median bank. The data are drawn from a sample of about 2,200 banks from 2005-2017 (from S&P Global).

The largest banks hold a lower proportion of their total assets in loans than all other groups, but still, more than 50% of their assets are traditional loans (Figure 5, left-hand panel). The ratio of deposits to assets shows a similar pattern: the largest banks hold fewer deposits than the median and smallest banks, but even so, more than 50% of their liabilities are in deposits (Figure 5, right-hand panel).

Figure 5 Balance sheet ratios for large and small banks (as a fraction of total assets)



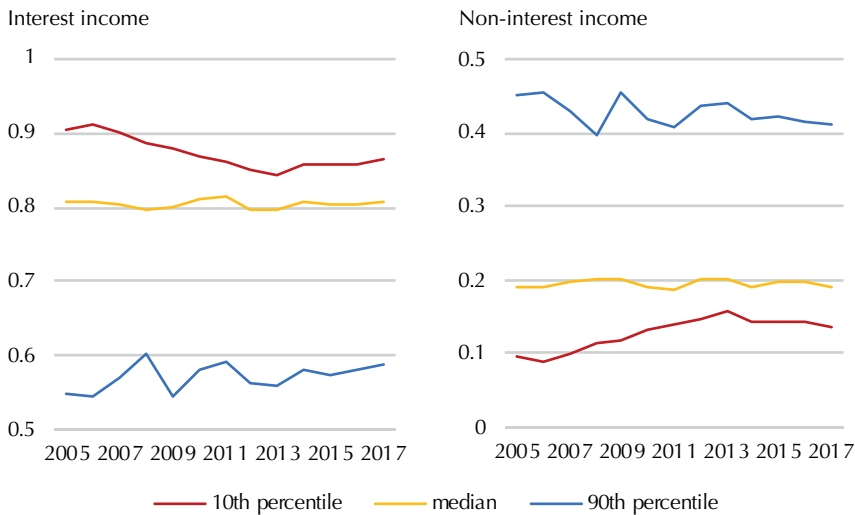
Notes: The 10th and the 90th percentiles are based on total assets, where the 10th percentile represents the smallest banks by total assets in the sample and the 90th percentile, the largest banks.

Source: Authors' calculations using data from S&P Global, based on a sample of roughly 2200 global banks.

Figure 6 shows income ratios. Interest income earned by intermediating between depositors and borrowers has traditionally been the primary source of profits for most banks, but banks also earn substantial amounts of non-interest income by charging their customers fees in exchange for a variety of financial

services and penalties. Many of these financial services are linked to traditional banking services: transaction services like checking and cash management; safe-keeping services like insured deposit accounts and safety deposit boxes; investment services like trust accounts and long-run certificates of deposit (CDs); and insurance services like annuity contracts. Some fee income derives from nontraditional sources such as investment banking, insurance underwriting and agency, and securities brokerage (DeYoung and Rice, 2004).

Figure 6 Income shares for large and small banks (as a share of total income)

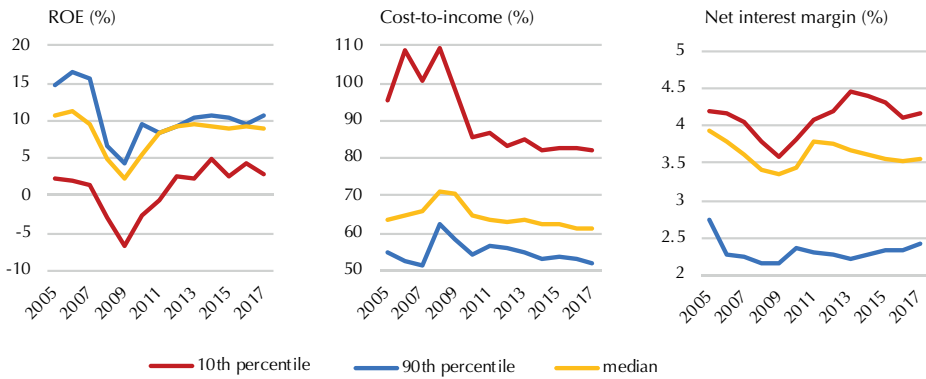


Notes: The 10th and the 90th percentiles are based on total assets, where the 10th percentile represents the smallest banks by total assets in the sample and the 90th percentile, the largest banks.

Source: Authors' calculations using data from S&P Global, based on a sample of roughly 2200 global banks.

Figure 6 illustrates that the share of interest income, the traditional source of income from loans, in total income (left-hand panel) was similar across the three groups. However, non-interest (or fee) income (right-hand panel) shows a different pattern. Here, the largest banks earn more than twice as much fee income (relative to total income) than the median or the smallest banks. Interestingly, this is quite stable over time. Some research has shown that increased reliance on fee-based activities tends to increase rather than decrease the volatility of banks' earnings streams (DeYoung and Rice, 2004; Stiroh, 2004).

Figure 7 Performance ratios for large and small banks



Notes: The 10th and the 90th percentiles are based on total assets, where the 10th percentile represents the smallest banks by total assets in the sample and the 90th percentile, the largest banks.

Source: Authors' calculations using data from S&P Global, based on a sample of roughly 2,200 banks.

As for performance (Figure 7), small banks have lower measured return on equity (ROE), higher cost-to-income ratios and higher net interest margins (NIMs) than large banks. Large and medium-sized banks have similar ROEs. We discuss costs (in terms of economies of scale) and NIMs below.

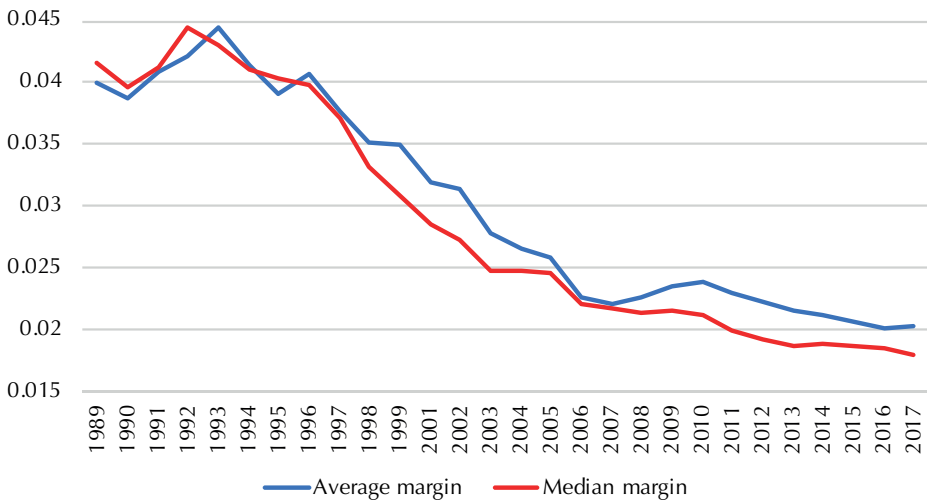
Interest margins

Banking profitability has ebbed and flowed alongside macroeconomic conditions. This section examines the profit margins of large banks, and in particular, whether the entry of nonbanks to financial services provision could be compressing banks' net interest margins – the difference between the interest earned on assets and paid on liabilities relative to interest-earning assets. The data consist of the largest 120 global banks from S&P Global. Figure 8 shows the evolution of their NIMs. From 1990 to 2017, the average net interest margin decreased from about 4% down to about 2%.

Several macroeconomic factors might have contributed to the decline. We study these in a simple statistical model. Our baseline main regression is as follows:

$$NIM(i,t) = a + b \cdot growth(j,t) + c \cdot slope(j,t) + d \cdot short_rate(j,t) + u(i) + v(it).$$

In this equation, *NIM* is the net interest margin of bank *i* at time *t*, *growth* is the growth rate of country *j* (where bank *i* has its headquarters), *slope* is the slope of the yield curve (ten-year government bond minus Treasury bill), *short_rate* is the T-bill rate, and the error term is either random-effect or fixed-effect at the bank level (panel data). There are of course other factors that can influence net margins, but data availability forces us to focus on this limited set of variables. We will then add proxies for nonbank competition.

Figure 8 Evolution of NIMs for large banks

Source: Authors' calculations using data from S&P Global.

Table 1 presents our estimated coefficients. The first column shows the expected coefficients. Macroeconomic growth has a positive impact on margins. The coefficient is about 0.025, which means that a 1 percentage point decrease in growth leads to a 2.5 basis point decrease in net interest margins. If we assume that average growth has declined by 2 points, this would explain about 5 basis points of lost margins. This is a relatively small impact and is consistent with the idea that, in the long run, the rate of growth of the economy affects the rate of growth of assets, but not the profits margins.

Table 1 Banks' interest margins: Estimated coefficients

Variable	Dependent variable: Net interest margin			
GDP growth	0.026 <i>4.36</i>	0.004 <i>0.49</i>	0.023 <i>3.52</i>	0.024 <i>3.74</i>
Slope of the yield curve	0.173 <i>12.14</i>	0.230 <i>9.41</i>	-0.011 <i>-0.8</i>	-0.010 <i>-0.78</i>
Short rate	0.189 <i>22.75</i>	0.235 <i>8.72</i>	0.109 <i>6.44</i>	0.109 <i>6.44</i>
Deposit rate		-0.068 <i>-1.92</i>		
Change in NBFI/GDP			-0.001 <i>-0.76</i>	
Log growth of NBFI				-0.001 <i>-0.71</i>
Number of observations	1,159	460	472	472

Notes: t-statistics in italics below the estimated coefficients. NBFI is nonbank financial intermediation. We use the 'narrow measure' of shadow banking as defined by the FSB (2018a) and data from the FSB (2019a).

The slope of the yield curve and the level of the short rate are both strongly significant. The coefficient on the level of the short rate is 0.19. Given that the short rate declined by about 8 percentage points, this can explain a decrease of about 1.5 percentage points in the average margin; this is large effect. The fact that banks' margins increase when the short rate increases is consistent with the theory and evidence in Drechsler *et al.* (2017). The slope effect is consistent with the maturity transformation by banks. The slope, however, does not show an obvious trend over our sample, so its contribution to the average decline in margins is small.⁹

The next column controls for the deposit rate. We lose many observations because a number of countries do not report reliable deposit rates. Nonetheless, for our small sample, we find that the deposit rate, controlling for the short rate, has a negative impact on margins, as expected.

Columns 3 and 4 add proxies for nonbank financial intermediation. Column 3 uses the change in the ratio of the Financial Stability Board's narrow measure of shadow banking over GDP (FSB, 2018a; 2019a). The narrow measure captures the part of non-bank financial intermediation that performs economic functions which may give rise to bank-like financial stability risks. It is defined by experts from the FSB in two steps. The first step defines the monitoring universe of nonbank financial intermediation, which is based on a very broad definition.

The second step is to classify activities into five economic functions that define 'bank-like' activities (FSB, 2018a).¹⁰ The largest category corresponds to "Management of collective investment vehicles with features that make them susceptible to runs" and includes money market mutual funds and other entities. Column 4 uses the log growth rate of the narrow measure, as defined by the FSB. The coefficients are negative, suggesting that nonbanks create competitive pressure on banks, but the effects are small and not statistically significant.

Over all, we conclude that banks' margins have mostly been affected by the level of interest rates, and, at least until recently, the impact of nonbank competition has been relatively small.

Banks' economies of scale and scope

We are witnessing some of the most outstanding developments and important changes in the banking industry. During the past year there have been upward of one thousand bank consolidations which represented, to a large extent, the results of economic forces, which requires great economies of scale in banking, more complete facilities, and larger reservoirs of capital.

C. Hazelwood, President of the American Bankers' Association,
The Banker (1929a, p. 141).

⁹ Note that estimates are driven by long run changes in interest rates, not mainly by monetary policy shocks. Altavilla *et al.* (2018) report that "following a monetary policy shock, the various components of bank profitability react asymmetrically. More specifically, since the impact on loan loss provisions largely offsets the one on net interest income, the overall effects of monetary policy on bank profitability are muted." This is consistent with our results. See also Goodhart and Kabiri (2019) for a discussion of the evidence.

¹⁰ These are: (1) management of collective investment vehicles with features that make them susceptible to runs; (2) loan provision that is dependent on short-term funding; (3) intermediation of market activities that is dependent on short-term funding or on secured funding of client assets; (4) facilitation of credit creation; and (5) securitisation-based credit intermediation and funding of financial entities.

One common factor did stand out in 1974. Size was a big advantage. For many people size signified safety...The premium attached to size was very evident in 1974 and it was not only confined to the cost of funds that banks purchased... The big banks grew fastest and for the first time for many years, a sizeable number of second tier banks actually saw their assets shrink. The Banker (1975, p. 525).

Banks, and not just the large ones, possess a number of advantages over their nonbank competitors. Banks benefit from lower costs of funding (relative to other sources of funding, such as debt and equity) due to their ability to take deposits. When a bank replaces deposits with equity, this substitution leads to a higher total cost of capital for the bank (Dick-Nielsen *et al.*, 2019). A higher proportion of deposits usually leads to lower funding costs, although there are exceptions. Covered bonds can be cheaper than time deposits, and when interest rates go negative, deposit funding can become a disadvantage as banks find it difficult to pass on negative rates to their depositors.

Big banks have also often benefitted from a sizable funding advantage over their smaller peers. The source of that funding advantage is somewhat more open to debate, but includes market perception (including by the bank's creditors and counterparties) of whether the bank is 'too big to fail' (TBTF). The phrase stems from the perception that certain large financial entities are too large, too complex or too central to the smooth functioning of the financial system and the real economy to be allowed to fail. TBTF reflects the view that regulators do not have the tools to resolve these large firms without causing broader economic harm. As a result, market participants rationally believe that these banks could expect public sector support in the event of distress or failure, and consequently their creditors are willing to provide more favourable financing terms to these firms than they would receive in the absence of the expectation of government assistance.

Estimates of the funding cost advantage vary significantly (roughly from 15 to 250 basis points),¹¹ based on the type of empirical method used, jurisdiction and point in time. The funding cost subsidy peaked during the financial crisis of 2007–8 and while it has shrunk significantly since the crisis, studies continue to find a small but statistically significant funding cost advantage for the largest banks over their smaller peers.¹²

But there are other reasons that big banks have a funding advantage over their smaller peers. First, many large banks have large (though, in some jurisdictions, shrinking) branch networks, and this may make deposit accounts at such banks more attractive, potentially lowering their cost of deposit funding. Second, bonds of large banks tend to be more liquid in secondary markets, allowing them to trade at a higher price and at lower yields than warranted by risk considerations alone. Third, big banks may enjoy economies of scale and scope (or market power), making them more profitable and less risky in certain dimensions.

Although bankers have been touting the advantages of economies of scale and scope for many years, until recently the academic literature did not provide empirical evidence of such economies. Studies from the 1980s and 1990s suggested that banks exhausted scale economies at low levels of input (Wheelock and

11 The United States Government Accountability Office (GAO) cites a funding cost advantage in the range of 17 to 630 basis points in 2008 (GAO, 2014).

12 See GAO (2014), Hoenig (2014), Bassett (2015) and Kroszner (2016) for a review of the literature. Grimaldi *et al.* (2019) has recent estimates of the funding subsidy.

Wilson, 2017; Johnson and Kwak, 2010), but more recent work using data into the 2000s found evidence of positive returns to scale for most banks, including the largest ones (Wheelock and Wilson, 2012; 2017; Bolton and Oehmke, 2018). A 2018 McKinsey&Company report finds an inverse relationship between banks' cost-to-asset ratios and their market share, and that these scale effects vary by country (McKinsey&Company, 2018a).

That said, the post-crisis financial regulatory reforms sought to “end TBTF” by creating “requirements for assessing the systemic importance of institutions, for additional loss absorbency, for increased supervisory intensity, for more effective resolution mechanisms, and for stronger financial market infrastructure” (FSB, 2013). In 2011, the FSB published a comprehensive set of policy measures to address the systemic and moral hazard risks associated with ‘systemically important financial institutions’ or SIFIs (FSB, 2010; 2013).

Concurrently, the FSB identified an initial group of global systemically important banks (G-SIBs), using a methodology developed by the Basel Committee on Banking Supervision (BCBS). That methodology allocates G-SIBs to systemic risk buckets corresponding to higher capital buffers that they are required to hold by national authorities in accordance with international standards (FSB, 2018b). The buckets range between 1 and 5, with bucket 5 (currently empty) holding the largest/most systemic firms – and consequently required to hold the highest G-SIB capital buffer – and 1 holding the least systemic. The group of G-SIBs would be updated annually (in November) based on new data and published by the FSB each year (FSB, 2018b).

Some policymakers and academics suggested more aggressive measures to address TBTF banks – some called for the break-up of the large banks, while others called for size-based caps (Stern and Feldman; 2009; Fisher and Rosenblum, 2012; Johnson and Kwak, 2010).

Some large banks did in fact shrink in asset size, at least in some jurisdictions, to avoid regulations aimed at large banks. For example, five of 17 banks in the US that were initially on a preliminary list of banks that could be subject to the Federal Reserve’s enhanced prudential standards for foreign banking organisations, including a requirement to form a separate legal entity in the country called an intermediate holding company (IHC), reduced their US-based assets enough prior to the implementation of the IHC rule to avoid the requirement (Federal Reserve Board, 2012; Reuters, 2014; Kreicher and McCauley, 2018).

Some G-SIBs also appear to be actively managing their risk to reduce their G-SIB buffer. Deutsche Bank, for example, announced recently that it expected its systemic risk charge to drop in 2019 (effective 2022) from 2% of risk-weighted assets to 1.5% (Aimone, 2019).

Table 2 shows the movement of G-SIBs between the systemic risk buckets. Baker (2018) makes the point that in every year since the original G-SIB list was established in 2011 (except for 2016), more G-SIBs have managed their way down the buckets or off then list than have moved up the list.

Table 2 G-SIB bucket movements

2012	2013	2014	2015	2016	2017	2018
BUCKET 4 Citigroup Deutsche Bank HSBC JPMorgan Chase	BUCKET 4 HSBC JPMorgan Chase	BUCKET 4 HSBC JPMorgan Chase	BUCKET 4 HSBC JPMorgan Chase	BUCKET 4 Citigroup JPMorgan Chase	BUCKET 4 JPMorgan Chase	BUCKET 4 JPMorgan Chase
BUCKET 3 Barclays BNP Paribas Citigroup Deutsche Bank	BUCKET 3 Barclays BNP Paribas Citigroup Deutsche Bank	BUCKET 3 Barclays BNP Paribas Citigroup Deutsche Bank	BUCKET 3 Barclays BNP Paribas Citigroup Deutsche Bank	BUCKET 3 Bank of America Citigroup Deutsche Bank HSBC	BUCKET 3 Citigroup Deutsche Bank HSBC	BUCKET 3 Citigroup Deutsche Bank HSBC
BUCKET 2 Bank of America BONY Mellon Credit Suisse Goldman Sachs Morgan Stanley MUFG RBS UBS	BUCKET 2 Bank of America Citigroup Credit Suisse Goldman Sachs Morgan Stanley MUFG RBS UBS	BUCKET 2 Bank of America Credit Suisse Goldman Sachs Morgan Stanley MUFG RBS	BUCKET 2 Bank of America Credit Suisse Goldman Sachs Morgan Stanley MUFG	BUCKET 2 Bank of America Citigroup Deutsche Bank HSBC	BUCKET 2 Bank of America Citigroup Deutsche Bank HSBC	BUCKET 2 Bank of America Bank of China Barclays BNP Paribas Goldman Sachs ICBD MUFG Wells Fargo
BUCKET 1 Bank of China BBVA BPCE Credit Agricole ING Mizuho Nordea Santander Société Générale Standard Chartered State Street Sumitomo Mitsui Unicredit Wells Fargo	BUCKET 1 Bank of China BBVA BPCE Credit Agricole ING Mizuho Nordea Santander Société Générale Standard Chartered State Street Sumitomo Mitsui Unicredit Wells Fargo	BUCKET 1 Bank of China BBVA BPCE Credit Agricole ICBC ING Mizuho Nordea Santander Société Générale Standard Chartered State Street Sumitomo Mitsui Unicredit Wells Fargo	BUCKET 1 Bank of China BONY Mellon BPCE Credit Agricole ICBC ING Mizuho Nordea Santander Société Générale Standard Chartered State Street Sumitomo Mitsui Unicredit Wells Fargo	BUCKET 1 Bank of China BONY Mellon BPCE Credit Agricole CCB Credit Agricole ING Mizuho Morgan Stanley Nordea RBS	BUCKET 1 ABC BONY Mellon Credit Suisse Credit Agricole ING Mizuho Morgan Stanley RBC Santander Société Générale Standard Chartered State Street Sumitomo Mitsui UBS Unicredit Group	BUCKET 1 ABC BONY Mellon Credit Suisse Credit Agricole ING Mizuho Morgan Stanley RBC Santander Société Générale Standard Chartered State Street Sumitomo Mitsui UBS Unicredit Group
REMOVED Commerzbank Dexia Lloyds	REMOVED Commerzbank Dexia Lloyds	REMOVED BBVA	REMOVED BBVA	REMOVED BPCE	REMOVED BPCE	REMOVED Nordea RBS

Notes: G-SIB list originally drawn up in 2011, but no bucket allocations were disclosed. Additional common equity loss absorbency as a percentage of risk-weighted assets is 1% for Bucket 1, 1.5% for Bucket 2, 2.5% for Bucket 4, 3.5% for Bucket 5 (no banks yet classified in Bucket 5).

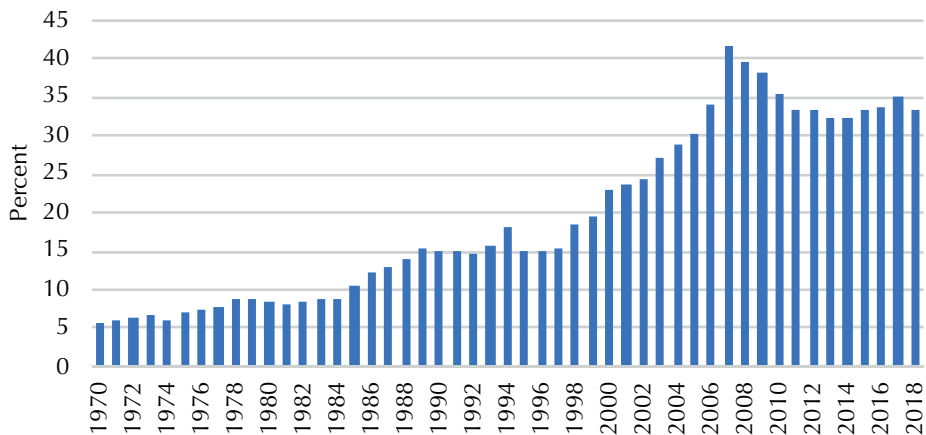
Source: Baker (2018).

Figure 9 shows the aggregate assets of the top ten banks as a share of global GDP for selected years from 1970 to 2018. In 1970, the share was roughly 5%. It rose steadily until peaking at roughly 42% in 2008. From 2009 to 2018, the share declined to a range of 32 to 35%; in other words, the largest banks have stopped growing relative to GDP in recent years. This is likely due to a combination of post-crisis deleveraging, a pause in merger and acquisition activity (particularly in the euro area), and the effectiveness of TBTF reforms and how they affected banks' behaviour.

Contrasting this observation, recent research suggests that banks could continue to exploit economies of scale and scope. Wheelock and Wilson (2017) find that banks continued to operate under increasing returns to scale in cost after the crisis, and the very largest US banks also in terms of profit, suggesting that scale economies "still provide impetus to become even larger".

More generally, Farboodi *et al.* (2019) analyse the expansion of big data and artificial intelligence (AI) technologies and suggest that big data could increase firm size further, with the largest of firms becoming significantly larger. Their work also suggests that the more technologically driven and 'data-savvy' firms are able to overtake traditional incumbents in capital investment and, eventually, in profitability. In short, it is unclear whether the largest banks will continue to get larger, or whether they have in fact reached an optimal size. (Future work should examine this topic in greater depth).

Figure 9 Aggregate total assets of top ten global banks as a share of global GDP, 1970-2018



Source: Authors' calculations using data from the Banker Database, a service from The Financial Times Limited, 1970-2019. All rights reserved.

Market shares in finance compared with other industries

Market shares can shed light on the nature of competition in an industry, but they need to be interpreted carefully. There are two types of measures: the first type focuses on concentration at a point in time, the second type focuses on changes in market shares over time (i.e., turnover).

Concentration

The simplest measure of concentration is the concentration ratio (CR). Imagine an industry with N firms. The market share of the first firm is s_1 , of the second firm s_2 , and so on. We rank firms so that 1 is the largest (by revenue), 2 the second largest, and so on. We then have:

$$CR(n) = s_1 + s_2 + \dots + s_n, \text{ which we can define for any } n < N$$

The typical values are CR4 and CR8, i.e., the cumulative market share of the top four and top eight firms.

Another measure of market concentration which is often used in antitrust is the Hirschman-Herfindahl index (HHI). The HHI is computed as the sum of the 'squared' market shares:

$$HHI = (s_1)^2 + (s_2)^2 + \dots + (s_N)^2$$

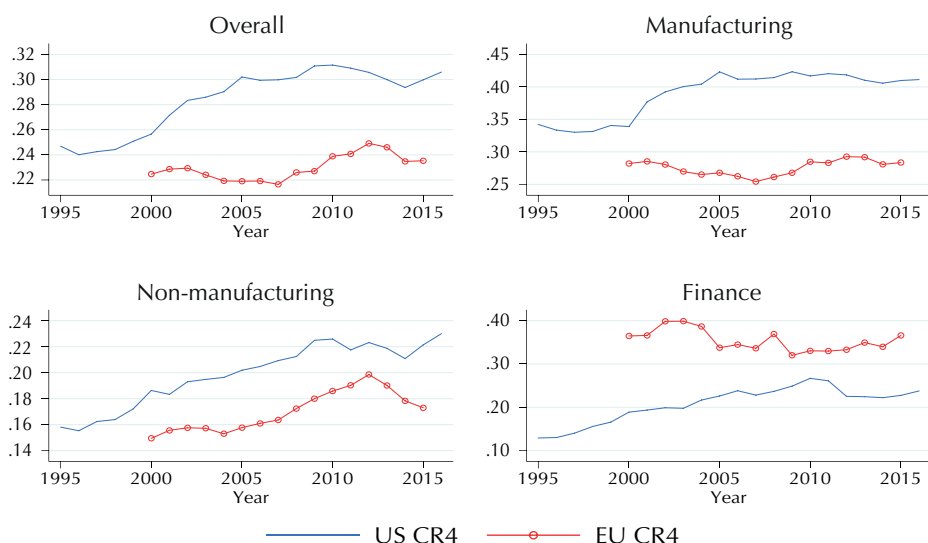
Compared to concentration ratios, the advantage of the HHI is that we do not have to choose an arbitrary cut-off such as four or eight. Squaring market shares allows us to put more weight on the larger firms. The HHI and concentration ratios usually suggest similar evolutions, so for simplicity we report concentration ratios here.

Figure 10 shows the CR4s for the US and the EU for the entire private sector, manufacturing, non-financial services, and finance (banking, insurance, funds). For each sector, we compute market shares at the most granular level available in the data and then the average concentration measure in the sector.

In the non-financial sector, we see that concentration is rising in the US and roughly stable in Europe. The rise in concentration in the US is well-documented (Grullon *et al.*, 2016; Autor *et al.*, 2017); the contrasting evolution in Europe is shown by Gutierrez and Philippon (2018).

Finance gives a slightly different picture. It has traditionally been more concentrated in Europe than in the US and remains so. Note that the financial sector includes all financial activities, not just banking services. Note also that the finance industry's share of GDP is higher in the US than in the euro area, so when we look at the market shares of the top financial firms the denominator is larger in the US.¹³ Concentration in the US is increasing, but it is still lower than in Europe. Part of the increase in concentration is due to mergers that took place after the financial crisis.

¹³ For instance, in 2008, euro area GDP was roughly €11.5 trillion. Finance has a share of 4.7%, so finance value added is €0.5405 trillion. BNP's revenues are €42.5 billion, or 7.86% of euro area finance value added. US GDP is \$20.5 trillion, and the share of finance is 7.5%, for a value added of \$1.5 trillion. JPM's revenues are \$109 billion, thus larger than those of BNP, but as a share of US finance GDP, they are slightly lower at 7.27%.

Figure 10 Top four concentration ratios

Source: Author's calculations as in Covarrubias *et al.* (2019). Data: Compustat NA, and Compustat Global.

Turnover

Economists who specialise in industrial organisation and antitrust rightfully complain about the use of CRs and the HHI to assess the evolution of market power. A rise in concentration does not imply a rise in market power; it depends on the underlying driving forces. If concentration is driven by mergers or rising barriers to entry, then one can make the case that concentration is positively related to market power. On the other hand, if consumers become price elastic, ex-post competition is stronger and margins are smaller. To cover fixed costs, firms need to be larger and concentration has to increase. In this case, concentration is actually a sign of competition. The same can happen if the industry leader becomes more productive and increases its market share. Rather than looking at the concentration of market shares at a point in time, we could look at the persistence of market shares over time. This would give us an alternative, more dynamic measure of competition.

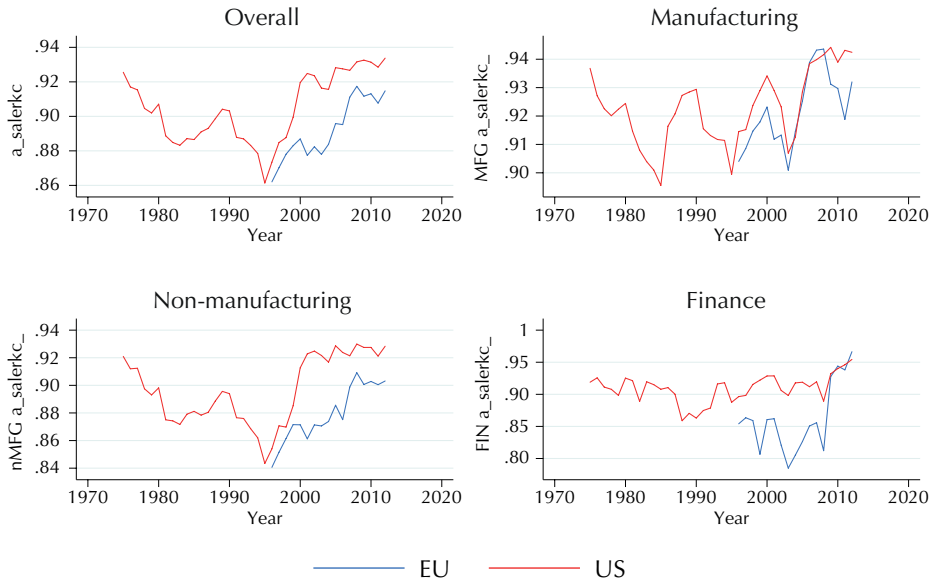
The basic idea is that, in a competitive industry, the leaders should be challenged. As a result, the leaders are not always the same. If the dominance of leaders is temporary, the industry can be competitive even if concentration is high at any point in time. We can compute two measures to capture the dynamics of market shares. One is the probability of turnover of leaders within five years – given that a firm is at the top of its industry now (it is among the top four by profits or by market value, for example), how likely it is that it will drop out over the next five years? Turnover has decreased in the US, as shown by Covarrubias *et al.* (2019).¹⁴ A second measure is the correlation of rank over time, which is a measure of persistence. We rank firms by revenues in a particular year, compute

¹⁴ Unfortunately, this measure requires a lot of data and we cannot estimate it precisely in Europe.

their rank again five years later, and then compute the correlation of the two rankings. If the correlation between the two ranking series is one, it means that the relative position of firms has not changed at all over five years. If it is zero, it means that there has been a complete reshuffling within the industry.

Figure 11 shows the evolution of rank correlations over the past 20 years. Sales rank correlations are lower in Europe overall, especially outside manufacturing. This figure shows that market shares have become more persistent. The increase is quite pronounced in the US, especially in the non-manufacturing sector. The persistence has increased in Europe as well, but not as fast as in the US. In the financial sector, correlations have historically been high. The correlation increases sharply in Europe after the crisis, suggesting a decrease in turnover.

Figure 11 Rank correlations of revenue



Source: Author's calculations as in Covarrubias *et al.* (2019). Data: Compustat NA, and Compustat Global.

3 Banks' competition from Big Tech and Fintech

The cataclysmic predictions of the slow death of banking reminds me of similar gloomy forecasts made over the past 35 years. When telephone banking was introduced in the 1980s, there were fears that telephone companies would enter the banking industry and displace the incumbent players. But that did not happen – the banks themselves started to offer telephone-based services.

Jean Dermine (Dermine, 2017, p. 18)

In recent years, there has been much hype that banks will soon experience a dramatic loss of market shares. Too slow and too old-fashioned for the ever-changing digital era, they could even disappear, overwhelmed by FinTech start-ups and tech giants.

Sylvain Bouyon (Bouyon, 2018, p. 2)

[N]ew entrants into the financial services space, including FinTech firms and large, established technology companies ('BigTech'), could materially alter the universe of financial services providers.

Financial Stability Board (2019a, p.1)

As yet, financial services are only a small part of [Big Tech's business globally. But given their size and customer reach, big techs' entry into finance has the potential to spark rapid change in the industry.

BIS Annual Economic Report (BIS, 2019, p. 55)

The manner in which households and businesses transact with each other and with their primary banking institution is radically changing. In some cases, specific demographics are even moving away from traditional depository institutions, with two-thirds of millennial Americans moving \$24 billion through the mobile P2P platform Venmo in the second quarter of 2019 (Rooney, 2019). The primary drivers are rapid advances in technology and post-crisis changes in the financial regulatory landscape, both of which have fuelled increased competition and encouraged new entrants in the provision of financial services. The competition to big bank business models emanates from Big Tech and FinTech firms whose core strategy centres around technological innovation and data. In this chapter, we discuss the challenges to banks emanating from the tech firms, detail the competitive advantages and disadvantages of incumbent banks vis-à-vis Big Tech and FinTech firms, and review the financial services that are undergoing the most digital disruption.

Challenges to banks

To put today's competition in context, we look back on history. We can draw on several historical examples of nonbank, non-depository financial firms challenging the traditional banking business model. In the 1970s, money market mutual funds offered competitive returns to investors at a time when banks were generally restrictively regulated in the West and unable to offer interest on certain types of deposits. In the US, consumer brands have sought to obtain special purpose charters to allow them to process and settle credit card payments or extend more formalised banking services, especially deposit-taking services, to affinity-type customers. Capital One, arguably one of the best-known brands in US financial services, began when it was spun off by Signet Bank as a credit card company. Today it is credited with a pioneering approach to information collection and data analysis to offer customers tailored combinations of product, price and credit limit (Capgemini, 2014).¹⁵

Are these challenges facing banks today new? To a surprising extent, many are not. A review of banking literature dating back to the 1800s suggests that, for at least the last century, banks have faced numerous challenges that have threatened their business model, and many of those challenges were *not* new. We also find a number of observed commonalities across the century that include (i) acknowledgement of the benefits of big banks; (ii) the importance of mergers and acquisitions (M&A) in achieving size and scope; (iii) recognition of the traditional bank business of deposit taking and loan making; and (iv) discussion of how technological advances could enhance the bank business models.

Somewhat ironically, banks have been investing in financial technology applications and platforms for many years – to lower acquisition costs, streamline the customer experience, move funds, better assess credit risk or access currency. Such investments in technology and process have been core to traditional banks' growth strategy, though the term 'FinTech' only entered the casual banker's lexicon around 2014.¹⁶ Arner *et al.* (2016) describe in detail the long history of the interlinkage of finance and technology – arguably beginning with introduction of the telegraph and completion of the transatlantic telegraph cable in the mid-1800s.

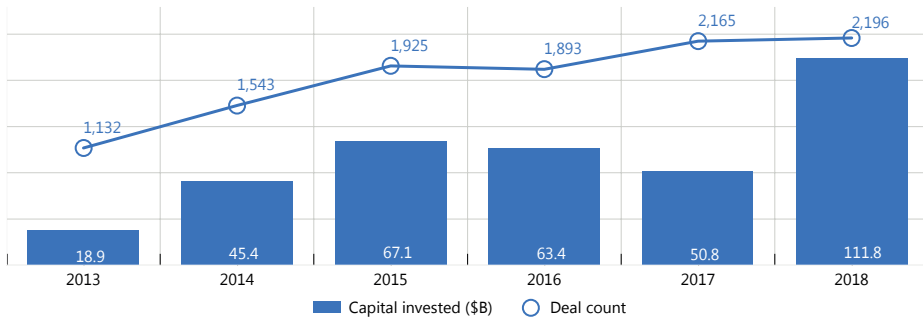
Only recently have upstart retail and business-to-business (B2B) firms offering unbundled financial products on digitally native platforms begun to popularise the term 'FinTech' and usher in a new era of challenges for traditional institutions. FinTech companies shaped the term away from an application of financial technology, such as the ATM, to a challenger industry originally intent on disrupting and replacing banks. The FinTech challengers aimed to bring about more customer-friendly products, services and experiences driven by automation and data analytics to compete (and possibly also, or later, to partner) with traditional institutions that were emerging with scarred reputations from the financial crisis of 2007–8 and its associated public bailouts (see, for example, Rooney, 2018; Sapienza and Zingales, 2012; Cojoianu *et al.*, 2019). In 2015, investors, consumer brands (e.g. retailers) and Big Tech companies validated this

15 Despite its forward-looking approach to data storage and analysis, including in fraud prevention, Capital One was the target of a data breach in July 2019 due to a security lapse.

16 Based on our search on Google Trend Analytics.

shift by investing \$67 billion in FinTech firms, thus collectively sending a market signal that challenges traditional retail financial institutions around the globe (Figure 12). By end-2018, cumulative investment activity in FinTech since 2013 totalled more than \$350 billion.

Figure 12 Total investment activity in FinTech



Note: Includes venture capital, private equity and M&A.

Source: KPMG (2018).

Our quantitative survey of financial institutions supports this analysis: an overwhelming number (around 90%) believe that technological innovations are leading to the creation of new products to offer their customers. Technological developments are also allowing firms to serve their customers better now than five years ago. Most respondents also raised the heightened competition within the financial industry, with FinTech and Big Tech firms providing financial services and collaborating with banks to create new technology-driven products and services.

Big Tech and FinTech firms' entry into the provision of financial services

Big Tech firms are challenging incumbent banks, but in a different manner than FinTechs. Big Tech firms are gaining significant traction in the provision of financial services in some markets, particularly in China, and are becoming active in other regions, including Africa, India, Indonesia and Latin America (Frost, forthcoming; Frost *et al.*, 2019). These firms can apply to the provision of financial services their unique features in terms of network effects and technology. Big Tech firms have large, developed customer networks established through, for example, e-commerce platforms or messaging services. Their collection of proprietary data and use of technology, increasingly including advanced practices such as AI and machine learning, allows these firms to gather significant information on their users to help tailor their offering to individual customers' preferences (Carstens, 2018; BIS, 2019; FSB, 2019b). Big Techs have the potential to become dominant through the advantages afforded by both of these features – their collection of valuable data and their large, established networks (BIS, 2019). While FinTech firms initially did not interact directly with consumers, Big Tech's aim is to enhance the interaction with the user or consumer.

Big Tech firms have also benefitted, particularly in China, from a supportive regulatory environment, with relaxed regulations on data collection practices and a different societal expectation of privacy from what is familiar to the West. More recently, however, Chinese officials have sought to rein in the Big Tech firms' payments activities through prudential regulation (e.g., Wildau, 2017; Carstens, 2018).

Box 1 Major inroads by Big Tech into financial services in China

China stands out as the world's major jurisdiction in which the large-scale entry of Big Tech firms into financial services has already happened. As calculated by Frost (forthcoming), Big Tech mobile payments in 2017 made up 16% of GDP in China, against well under 1% in the US, UK, Brazil, India or Indonesia. The bulk of this phenomenon is accounted for by Alibaba (through Ant Financial, see below) and Tencent, two of the world's leading Big Tech firms, headquartered respectively in Hangzhou and Shenzhen. The corresponding brands for payment services are Alipay for Alibaba/Ant Financial and WeChat Pay for Tencent.

The service ecosystems created by Alibaba and Tencent, initially rooted in e-commerce (Alibaba, Taobao, Tmall) and social media (QQ, WeChat) respectively, have been the major enablers of their financial services offerings, which now go far beyond payments. This connection gives them a decisive advantage in terms of access to individual data that can be used to create highly individualised profiles. Ant Financial operates a credit scoring system known as Sesame Credit; Tencent has Tencent Credit. McKinsey Global Institute (2018) calculates that the share of technology giants in total domestic retail payments in China has grown at a breath-taking pace in recent years, from 12% in 2014 to 45% in 2017. Klein (2019) estimates that more than 92% of mobile payments are made over the two giant platforms (53% via Alipay and 39% via WeChat Pay). He also calculates that the volume of mobile payment transactions has grown more than tenfold in just four years, from less than RMB25 trillion in 2014 to close to RMB300 trillion in 2018.

Ant Financial (called Alipay until 2014) was spun off from Alibaba in 2010. It operates as a separate company and has raised external capital from major investors, but is tightly bound to Alibaba through operational arrangements allowing for extensive data sharing. Alibaba also owns a large minority stake in Ant Financial.¹⁷ Unlike Alibaba, Tencent has not spun off its financial services activities.

Both companies have created in-house banks, branded (in English) as MYBank (Ant Financial) and WeBank (Tencent). These banks are still relatively small by Chinese standards: in *The Banker's* 2019 ranking, MYBank was the 121st largest bank in China by assets (and 881st globally), at \$14 billion as of end-2018, and WeBank did not feature in the Global Top 1,000. Much of the two giants' lending, however, is provided as microlending, which does not require a banking licence. As for asset management, Ant Financial's money market fund Yu'e Bao (generally translated as "leftover treasure"), created in

17 See <http://www.chinadaily.com.cn/a/201802/03/WS5a751cb1a3106e7dcc13a8c2.html>.

June 2013 and managed through Ant's majority-owned affiliate Tianhong Asset Management, allows Alipay users to put their spare cash to work. It rapidly became China's (and at one point the world's) largest money market fund, with a peak in 2018 above RMB1.5 trillion (Jia and Wildau, 2019).

The success of Chinese Big Tech owes to several drivers. Chorzempa (2018) identifies the 'leapfrogging' factor (lack of good financial services offered by banks and other incumbents) as critical, together with government support, generalised smartphone use, and synergies with the Big Tech firms' other internet service offerings. The Chinese authorities have appeared to initially welcome the entry of domestic Big Tech firms into finance, not least as a competitive stimulus to force incumbent (mostly state-owned) banks to improve their own service offerings. The policy stance is evolving rapidly, however. Jia and Wildau (2019) note that the Yu'E Bao fund shrank significantly in total size in the course of 2018, and write that "Chinese regulators pressured it to downsize over concerns about systemic risk". Further constraints may be applied to Big Tech's financial activities in the future.

Disruption is affecting the primary functions of banks

This disruption in banking is affecting banks' primary functions of maturity transformation (through competition in lending), payment services (through the introduction of new payment platforms and interfaces) and information processing (through the use of big data, machine learning and AI), as well as liquidity provision and risk pooling.

Maturity transformation

Maturity transformation, and specifically lending, has seen significant innovation in recent years. Many new entrants are disrupting the lending market with new business models and banking relationships. New credit review techniques, facilitated by the proliferation of data and access to machine learning models and automated decisioning platforms, have streamlined the time and processes for loan approval and origination. The positive consequences of this have included expanding access to credit for the underbanked, those without sufficient documentation and subprime customers. For example, like banks, marketplace platforms, which allow retail investors to directly invest in consumer loans, transform savings into loans and investments. But unlike banks, the information these firms use is based on alternative or non-standard data rather than on traditional financial account and long-term relationships. Individual and small business borrowers expect their lender to deliver the seamless digital origination and rapid onboarding pioneered by leading FinTechs. That said, while many new lenders have brought benefits to consumers, some FinTech lending models have

been the focus of consumer fraud and data leakages.¹⁸ In some cases, access to financial services is decentralised through online platforms and as a result, risk and maturity transformation is not carried out in the traditional sense where individual lenders and borrowers are matched directly (Naveretti *et al.*, 2017).

Competition in payments

Big Tech firms have been offering mobile payment services to their users for some time, mostly through app experiences such as Apple Pay or even as trivial and short lived as Snapchat's SnapCash. These services are provided on either a domestic (most common) or a cross-border scale. Payments services generate valuable data on consumer preferences (i.e., on purchase patterns), and the collection of such data allows both banks and FinTech/Big Tech companies to better tailor their offerings. Additionally, FinTech and Big Tech have the potential to offer payment services at a lower cost than traditional banks. Philippon (2019) suggests that FinTech firms can offer certain activities and products at a lower cost per customer/relationship because once the FinTech/Big Tech firm has invested in the fixed costs to set up a system or a platform, it can lower the fixed cost per relationship. Also some payments, such as cross-border payments (discussed below) are costly and inefficient. Fintech and Big Tech firms both see benefit and opportunity in providing payments services.

Competition in information processing

Today, competition in information processing is being powered by use of big data, machine learning and AI. In the late 1950s and throughout the 1960s, automation of manual and paper processes – such as cheque processing, accounting operations and financial reporting (Heald, 1960) – were driving competition in information processing. Centralised computer centres within large banks serviced their many branches. Writing about transforming banking services in the middle of the 20th century, Ackrill and Hannah (2001) write: “*The importance of information technology for creating competitive advantage became a cliché; interpreting the required service transformations was a management challenge which incumbent firms found extremely difficult to meet*” (p. 336). The same could apply today, but the processing activities that banks find important today include business intelligence (BI) and data analytics, customer and channel management, risk management and compliance and back office processing as firms look to improve the customer experience and provide more individually tailored products.

Qualitative survey provides insight on competition

To gain insight on how competition is affecting the provision of primary bank functions, we conducted a short qualitative survey of market participants, including banks, nonbank financial institutions, FinTech firms and Big Tech firms. We received nearly 60 responses, about three-quarters of which were from large banks.

¹⁸ On Chinese P2P lending, see for example Claessens *et al.* (2018). For more general information, see Clark (2017) and Hogue (2018).

Table 3 Products and services included in the qualitative survey

Financial intermediation function	Financial product or service	Description
Maturity transformation	Retail lending (consumer credit and mortgages)	Retail lending includes both traditional and technology-driven loan origination, electronic credit scoring, loan processing solutions and loan servicing solutions.
	Commercial lending	Consumer lending includes traditional and technology-driven commercial and industrial loan origination, electronic credit scoring, loan processing solutions and loan servicing solutions.
	Insurance products	Insurance products include property and casualty insurance products, accident and health insurance products, life insurance products and any other insurance or reinsurance product related to the acceptance of risk or commitment to pay or indemnify another for specific types of losses.
Payment services	Payment services (retail and corporate)	Payment services include the processing of card (credit and debit) payments, online payments, mobile payments, electronic bill payments, merchant remote deposit capture, cash payments.
Information processing	Business intelligence (BI) and data analytics	BI and data analytics are strategies and technologies used by businesses for analysis of information. BI technologies provide historical, current and predictive insights on business operations.
	Customer and channel management	Customer and channel management includes front office services (and excludes lending), account services, customer relationship management
	Risk and compliance	Risk management is predicting and managing risks that could hinder the organisation from reliably achieving its objectives under uncertainty. Compliance refers to adhering with the mandated laws and regulations as well as company policies and procedures.
	Processing (back office services)	Back office services provide administrative support to the front office such as keeping accounts, maintaining records, and checking regulatory compliance.

Financial intermediation function	Financial product or service	Description
Risk pooling/liquidity provision	Wealth management	Wealth management incorporates financial planning, investment portfolio management and a other financial services offered by a complex mix of asset managers, custodial banks, retail banks, financial planners and others.
	Foreign exchange (FX) and capital market products	FX and capital market products cover FX options and futures and long-term debt or equity-based securities.

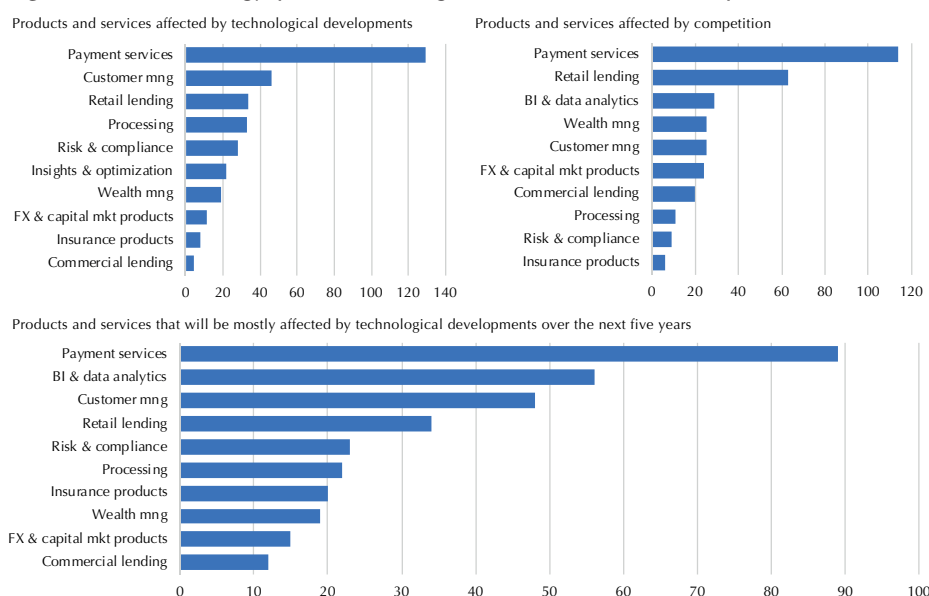
Source: Authors' qualitative survey of financial institutions.

We linked the primary functions to specific products and services (see Table 3). Maturity transformation includes retail and corporate lending, and insurance products. Payment services (its own category) includes processing of card (credit and debit) payments, online payments, mobile payments, electronic bill payments, merchant remote deposit capture, cash payments. Information processing includes business intelligence and data analytics, customer and channel management, risk management and compliance and back office/processing services. Finally, we add two additional products and services, listed under 'risk pooling/liquidity provision', which include wealth management and foreign exchange (FX) and capital market products.

Our survey asked financial institutions to select the financial products and services that are:

- most affected by technological developments now;
- likely to be most affected by technological developments over the *next five years*; and
- seeing the greatest competition.

Figure 13 displays the results. The responses have been 'scored' using weighted averages. In all three categories, *payment services* were by far the most important product or service chosen by survey respondents. Second to payments, respondents pointed to products and services under maturity transformation and forms of information processing as also facing digital disruption. Under maturity transformation, retail lending scored highly in all three categories. Indeed, this is consistent with recent analysis of FinTech investments. A 2017 KPMG report finds that the largest share of fintech investment has been in banking, with payments and lending comprising 65% of all banking FinTech investments (KPMG, 2017). Retail lending is more prone to disruption than commercial lending as retail lending is often more standardised and easier to underwrite.

Figure 13 Technology, product offerings and customer relationships

Note: The longer the bar, the more important the product or service in the ranking.

Source: Authors' qualitative survey of financial institutions.

Of the information processing categories, customer and channel management was the second most important product and service currently affected by technological developments. Respondents believe that in five years time, business intelligence and data analytics will have taken that second place position. Survey respondents noted that technology developments were enabling them to improve service quality and better understand customers' behaviour. A large number of respondents raised the potential for better data, algorithms and AI to improve their processes over time, for example to improve regulatory and security controls, including AML/CFL compliance, and to improve success rates in detecting and preventing fraud. Box 2 contains selected quotes from survey respondents.

Box 2 Summary and selected quotes from the qualitative survey

The qualitative survey contained two free-text questions, and the responses here were wide-ranging and insightful. The first question asked how technological developments are most significantly impacting firms' existing products and services. Many of the bank respondents described how digital transformation is a priority for their firms for reasons including improving efficiency, improving the product offering for their customers and reducing the time it takes to roll out new products, downsizing branch networks, improving risk management and compliance (particularly with AML/CFT).

Bank respondents also noted impediments that were hindering their firms' ability to make full use of digital innovation and big data. Some noted challenges in the current environment in Europe, including increasing regulatory and compliance costs, margin compression due to persistent low interest rates and competition from cooperative banks and new entrants. Respondents felt that compliance costs and consumer protection legislation are limiting the extent of other technological advances in the case of banks.

The second free-text question asked for thoughts on the structure of the financial services industry in the next five years. In sum, respondents believe the ecosystem will be more diverse, with banks, FinTechs and Big Techs competing and partnering at the same time. How they do this is one of the most critical questions for the future of banks. A number of bank respondents believe that consolidation in the banking sector is needed but had differing views on which types of entities would be most affected. Some thought that the small and medium-sized banks would be targets, while others thought that the larger banks could be susceptible, particularly those in Europe and those unable to effectively evolve their business model.

The importance of data as an asset was recognised by many with regard to their ability to provide a more holistic view of clients' needs and to mitigate risks. Several firms raised the value of data in compliance and risk management, in particular to enhance anti-money laundering and financial crime prevention capabilities and to improve success rates in detecting and preventing fraud. Combining relevant external and internal data was thought to enable banks to better understand and monitor the risk posed by customers to holistically reduce information asymmetry and lead to better informed credit decisions.

However, despite the critical importance of data in the future of financial services provision, there were a number of questions raised about the 'unknowns', including how data collection and protection would affect the pricing of traditional financial products and services (would the products be free in return for the value generated by client data?). Other issues raised included uncertainty about regulatory tools that would be needed in the future, and the extent to which the role and toolkit of central banks and regulators should evolve if a large part of financial transactions is executed outside the banking sector in some regions.

Selected quotes from survey respondents

This age of automation and ever-increasing pace of technological change requires urgent action.

We are leveraging the best of our business — including data and analysis, deep industry insights and human capital — to help people build new skills, adapt and succeed in an ever-changing world of work.

Social changes and the development of exponential technologies, such as DLTs or AI, in the coming years will produce important changes in the structure of financial services. The other main issue will be the use of data as main asset, to develop new personalised services.

The current incumbent entities will have to transform themselves to compete with other companies, not only in the financial industry but also from other sectors, especially technological, in order to maintain customer relations and trust. This relationship is what allows the capture of interaction data to improve the service and allow a personalized offer. Only the banks that are prepared to compete in the digital world, leveraging the new technologies and offering data driven services to their customers will maintain their position.

There will be a convergence of Big Tech, FinTech, and traditional financial services and this will follow a long period (~10 years) of complex challenges; political, commercial and technological in character. We also anticipate an exponential growth in the development of regulatory tools and approaches that will be both a driver of some of the changes in the financial system as well as reflecting reactions to it.

Technology has enabled greater ability to assess and manage risks in an effective and proactive manner with better prediction. Data analytics and AI can expand the safe space within which banks can operate responsibly and cost-effectively. For example, better data can enable banks to screen customer and transactions more effectively against sanction list and AI algorithms are beginning to be used to partially automate financial crime investigations. Better data and algorithms can improve success rates in detecting and preventing fraud. Combining relevant external and internal data can enable banks to understand and monitor the risk posed by each customer holistically. In turn, [this could] reduce information asymmetry and lead to better informed credit decisions, with little or no manual intervention.

There will continue to be the emergence of new FinTech companies, which will promote competition in the industry resulting in lower costs for the client... We expect to see banks, including smaller banks that may not have the resources to build internally, continuing to partner with tech firms as the costs and risks of doing so decrease, to improve their ability to service their customers, increase efficiencies and improve controls. The ability to recognize economies of scale by leveraging FinTech services will allow small banks to remain competitive with larger banks. Small banks will also remain competitive through different cost structures, or by differentiating on product and services. The players most likely to succeed are those that are best able to meet their clients' needs which means delivering to your client more, better, faster and quicker in one way or another, while balancing protecting their privacy and avoiding bad actors from engaging.

The ubiquity and exponential growth of data has implications that are poorly understood. "More is different," as it's been said. With this new data, an ability to move it securely through the cloud at low cost, and with the rapid advance in machine learning/AI technologies, we will be increasingly more capable of discerning meaningful patterns in the data that provide heretofore unavailable insight in to a host of what are currently "unknown unknowns." We're moving from Galileo to Hubble: the scope, scale and granularity of inquiry these new lenses on life make possible are difficult to fathom and even beg credulity -- today.

Digital transformation is a priority for the bank. On top of improving efficiency, technological development has enabled the bank to improve its offer to customers, with a better understanding of their needs. The bank maintains a mix of physical and digital channels that allow customers to choose how they relate with the bank: in branches, remotely with personal advisors or through purely digital channels, being mobile is the most relevant of them.

Payment services will continue to be shaped by emerging technologies

Survey respondents were clear that payment services are being disrupted and will continue to be shaped by emerging technologies. The two survey quotes below illustrates this point:

Big Tech companies will continue to move into the payments ecosystem, and at the same time we will see fresh independent offerings start to challenge the traditional payments... models with low-friction, low-cost solutions, beginning with peer to peer and informal payments.

Niche payments and micro lending FinTechs will also be a furious force of competition particularly in [emerging market countries].

Types of payment services/platforms

To better understand the ongoing developments in payments, it is helpful to understand the ‘plumbing’.

Payment providers can deliver payment services either by accessing existing payment systems (i.e., using an overlay system) or by creating a standalone system. Overlay systems build a mobile or web interface that improves the ease with which customers can send and receive payments. These systems then use existing payments infrastructure, such as credit card or retail payment systems, to process and settle payments – ApplePay, Venmo and Google Pay are examples of such systems. They allow users to store debit and credit card information on their mobile devices, and allow payment using the device rather than the physical card. These are ‘front end’ services since they provide an improved user interface, but the payments are transferred using the traditional systems. These services are not typically regulated because they are providing the customer interface or point-of sale payment instructions to allow customers to initiate payments. Meanwhile, the ‘back-end’ of the system is unchanged.

Standalone payment providers, on the other hand, are ‘closed-loop’ payment providers and do not interact with or depend on existing payments infrastructure (except when they require a bank account to withdraw or top up the funds). Alipay in China and M-Pesa in Kenya are examples (McGath, 2018). In these arrangements, payments are processed, cleared and settled by the platform provider independent of any other system. In contrast to the examples of Apple Pay, Venmo and Google Pay given above, these standalone providers are providing services similar to a bank. Therefore, in most jurisdictions, standalone payment providers would be regulated or overseen by the authorities.

While Alipay and M-Pesa are large, they are primarily domestic payment systems.¹⁹ Apple Pay, Google Pay and PayPal and Venmo can operate across borders, but these overlay providers rely on the existing correspondent banking relationships for payments, clearing and settlement and are typically slower, costlier and more opaque than domestic payments.²⁰ According to the Committee on Payments and Market Infrastructures (CPMI), cross-border payments through the correspondent banking model involve “more risks to manage, complexities to navigate and rules to comply with than domestic payments” (CPMI, 2018, p. 1).²¹ They involve technical, operational and legal complexities. Challenges include different hours of operation across borders, different laws across jurisdictions, counterparty risks, significant compliance costs, problems tracing transactions and uncertainty over settlement timing, all of which lead to high fees and slow processing times (CPMI, 2018; Wadsworth, 2018a). Many of these systems settle transactions in batches several times a day but only during banking hours, though many consumers and small businesses wish to access funds outside of banking hours.

To add to the challenges above, consumer expectations of cross-border payment services have changed as users have become accustomed to (and expect) faster, cheaper and more convenient domestic payments (CPMI, 2018). Such domestic payments could provide a way for employers to pay employees in real time and offer businesses and consumers greater flexibility in managing their money (Demos, 2019). To address these demands, real-time retail payment schemes have been introduced around the world, beginning when Korea launched its fast payments service in 2001. Many have followed suit, including the Faster Payments Service in the UK, the New Payments Platform in Australia and the Faster Payment System in Hong Kong (Bech *et al.*, 2017).²² The Federal Reserve recently announced plans to develop a 24-hour real-time payment and settlement service, called FedNow, which will allow any consumer or business with a US bank account to securely receive real-time payments.²³

19 While largely domestic, Alipay began partnering with Finnish payment provider ePassi in 2016 to allow its customers to make payments in Finland. It has since expanded to its mobile payments service (and partnership) to Europe (in Sweden, Norway, Iceland and Estonia) (see <http://www.goodnewsfinland.com/epassi-moves-beyond-finland-with-alipay/>). Chinese tourists use the Alipay app to make the payment, and the merchant uses the ePassi service, which transfers all payments to the service provider's account from a Finnish bank. ePassi's operations are regulated and supervised by the Finnish Financial Supervisory Authority. All payments and transactions are denominated in euros (see <https://www.epassi.fi/en/epassi-alipay-mobile-payment>).

20 Additionally, foreign exchange payments can be conducted using nostro-vostro accounts, where one bank has another bank's money on deposit, typically in relation to international trading or other financial transactions (see <https://www.investopedia.com/ask/answers/051815/what-difference-between-nostro-and-vostro-account.asp>).

21 Correspondent banking is an arrangement under which one bank (correspondent) holds deposits owned by other banks (respondents) and provides payment and other services to those respondent banks (CPMI, 2018, p. 13).

22 Updated using data from <https://www.instepay.today/tracker/>.

23 The FedNow Service is proposed to begin operating by 2024, and could also provide an opportunity for open banking to flourish in the US by allowing consumers to access funds and information about funds in real time, pay in a secure environment, and validate accounts or balances in real time or at the point of sale. The Federal Reserve also announced plans to expand the FedWire Funds Service and National Settlement Service to run around the clock to facilitate liquidity management and to support a wide array of transaction activities, beyond those related to faster payments (<https://www.federalreserve.gov/newsevents/pressreleases/other20190805a.htm>).

But simply offering faster payments alone will not resolve all of the current challenges facing cross-border payments raised above; there are also a number of regulatory issues to resolve. Jurisdictions' regulatory frameworks for the provision of payment services and access to domestic infrastructures vary widely and there is little operability across platforms. Some jurisdictions have established regulations for nonbank payment providers, others require firms to become a bank or a 'bank-lite', and some are currently planning to develop or amend standards or regulations. Nonbank payment providers often have to partner with a bank for clearing and settlement among banks and providers, which is done through the central bank's access to the payments system because most jurisdictions do not allow nonbanks access to central bank accounts. These firms must work through a bank that has been granted access. Public policy challenges in this regard are discussed in Chapter 4.

Standalone providers have the potential to remove many of the frictions associated with cross-border payments, particularly when combined with new uses of technologies such as blockchain²⁴ or distributed ledger technology (DLT).²⁵ The rise of cryptocurrency arrangements such as Bitcoin (the digital token or coin) and their related platforms (DLT or blockchain) has shed light on this technology. DLT can enable multiple organisations to work together on a common, shared, auditable database (Casey *et al.*, 2018). A prominent feature of this technology is that it removes the need for users to trust one or more centralised parties to clear and settle payments. Banks and tech firms alike are looking to DLT – and specifically to permissioned (or private) ledgers which allow a limited set of entities access – to offer standalone retail payments (e.g., Facebook) or wholesale services (e.g., JP Morgan and Fidelity Utility Settlement Coin).

Creating a global currency? The Libra proposal

In June 2019, Facebook announced ambitious plans to lead the implementation of a new global digital currency called Libra and accompanying wallet Calibra. Facebook's stated goal for Libra is to create a "stable currency built on a secure and stable open-source blockchain, backed by a reserve of real assets and governed by an independent association".²⁶

Libra also endeavours to solve an important challenge facing financial services today: financial inclusion. The 12-page white paper contains promises of banking the unbanked or underserved and offering financial services across borders that are cheaper and faster than what is currently provided. Such goals are laudable, but the announcement – though largely anticipated – raised widespread concerns among public sector authorities (Schulze and Choudhury, 2019). This was certainly not because a Big Tech firm was announcing a foray into payment services; Big Tech firms Alibaba, Amazon, Apple, Google and Tencent already offer payment

24 See Kavuri and Milne (forthcoming) and last year's Geneva Report on the World Economy (Casey *et al.*, 2018) for a detailed description of blockchain and DLT and the impact of such technologies on financial services.

25 A distributed ledger is a collection of data that are spread across multiple nodes and whose consistency is enforced by means of a distributed ledger technology. The technology provides a means of recording information through a distributed ledger. These technologies enable nodes in a network to propose, validate, and record state changes (or updates) consistently across the network's nodes – with no need to rely on a central trusted party to obtain reliable data.

26 See the Libra white paper at <https://libra.org/en-US/white-paper/>.

services on their platforms. Nor was it the first offering of a digital currency by a Big Tech; a decade ago, Facebook created its first digital currency, Facebook Credits, which enabled people to purchase items for games and applications on the social network platform.²⁷

But Facebook's Libra proposal is different. It proposes to use its social media network to create a standalone payments arrangement based on (initially) permissioned blockchain technology, and new currency called Libra Coin. Facebook's proposal is to develop a token-based currency – one that is encrypted (secured) using cryptography and that transmits over a permission-based distributed ledger, with approved nodes that validate all transactions chronologically.²⁸ Further, because many token-based currencies have proven too unstable in their value, Facebook plans to tie its currency to a pool of assets as a stability mechanism. In that sense, Libra is economically akin to a global exchange traded fund (ETF) with transaction services and has been referred to as a 'stablecoin' by cryptocurrency experts (Alois, 2019), meaning its value is loosely pegged to a fiat currency (or currencies) such as the US dollar.

With 2.4 billion active users monthly, Facebook already has the large network required for a payment service to be widely adopted. It has also signalled intent to work with other partners, including big players such as Visa, Mastercard, Vodafone and Uber, to further expand the potential reach of the resulting network of possible users.

With its potential to become globally adopted, Libra also raises concerns about it becoming a truly global currency that operates largely outside the regulatory perimeter, with the potential to render sovereign currencies less attractive, or even irrelevant. A globally adopted stablecoin has considerable implications for the conduct of monetary policy and for financial stability.

That said, a large network of users alone does not guarantee widespread use. Big Tech payment offerings are yet to gain traction in jurisdictions with well-developed payment infrastructure, with Big Tech payment volumes making up less than 1% of GDP in advanced economies (Frost, forthcoming). Adoption has been higher in China, where Alipay (owned by Alibaba) and WeChat Pay (owned by Tencent) process payments worth about 16% percent of GDP (Frost, forthcoming).

Libra may be the first large tech company to announce plans to establish a global digital currency, but other large-scale proposals will certainly follow in due course. Thus, the public policy and regulatory challenges that the Libra proposal raises should be viewed more broadly in the context of digital token-based technologies that aim to offer financial services on a potentially global scale. We discuss public policy challenges that Libra presents in the next chapter.

27 It was followed by Facebook Gifts and Facebook Messenger Payments. The first two were shut down some time ago, and the latter, launched in 2015, is winding down its activities.

28 See Adrian and Mancini-Griffoli (2019) and Bech and Garatt (2017) for a taxonomy on digital currencies.

Advantages and disadvantages of banks vis-à-vis FinTech and Big Tech firms

Whether we will see banks endure or disappear will depend on how the incumbents, their competitors and regulators approach the opportunities and challenges of the technology transformation. Table 4 outlines competitive advantages and disadvantages that banks face vis-à-vis FinTech and Big Tech firms. We split these advantages and disadvantages into three primary categories: technology, size and policy-based considerations. The red crosses are disadvantages, the blue ticks are advantages, and the black empty squares are neutral or in the midst of change.

Table 4 Banks versus their partners and competitors

Banks vs competitors	Big banks	FinTech	Big Tech
Technology	×	✓	✓
Customer experience	□	✓	✓
Size (scale & scope)			
Cost of funding	✓	×	×
Network effects	✓	×	✓ ✓
Policy-based			
Prudential regulation	□	□	✓
Data privacy/protection	✓	□	×
Political/lobby power	✓	×	×

Note: Red crosses are disadvantages, the blue ticks are advantages, and the black empty squares are neutral or in the midst of change.

Competitive advantages of FinTech and Big Tech

Technology

Fintech and BigTech firms have a number of significant technology advantages over incumbent banks: they do not have to work with legacy IT systems, they have nimble modern platforms that mean greater pivot speed, and they have the flexibility to work with new and existing technology.

No legacy tech systems

Generally, customer-facing FinTechs are built on new platforms, in the cloud, with modern programming languages that provide an opportunity to efficiently scale up without the cost of legacy core banking systems. The digital-first architecture, proprietary or outsourced, allows market entrants a low-cost path to hosting a marketing page, application wizard, financial technology application (such as account insights or personal financial management) and system of record in a mobile or desktop environment.

Conversely, banks face challenges in upgrading their legacy IT systems. It is costly and time consuming, and banks with such legacy systems find it difficult to issue new banking products. FinTechs can be more nimble in issuing services because they can build new systems and are also less encumbered by regulation.

Modern platforms mean greater 'pivot speed'

Digitally native platform architectures typically allow FinTech and Big Tech greater 'pivot speed' to build responsive products in far less time than traditional banks and to deploy to a live environment with far greater speed thanks to modern computer coding languages. Modern platforms breed product innovation because of their deployment speed and ability to integrate with machine learning applications to ingest and understand consumer taste and preference patterns, allowing the FinTech to respond to changing environments, circumstances or simply preferences.

A modern FinTech architecture can provide a comparative advantage relative to a bank's ability to serve customers when the technology application is presented to the customer on their digital terms. The functionality, design and experience of a mobile banking application can be the deciding factor for a mobile native customer who needs or wants to transact their commercial or consumer life in an iOS or Android environment. Firms that are able to master a strong mobile-first or mobile-only experience can significantly decrease onboarding times, lower conversion costs and decrease long-term customer acquisition costs if they can market to the customer inside a highly targeted mobile environment (see Box 3).

Box 3 Big bank versus Big Tech: Moving consumers to new platforms

Wells Fargo is one large bank that has made significant mobile investments in hopes of decreasing their servicing costs through their Control Tower application. Wells Fargo Control Tower users can view connected accounts, switch on and off their credit and debit cards, access funds at ATMs and utilise mobile wallets. Wells Fargo estimated that 79% of Americans use automatic recurring payments, but that 31% of Americans have paid financial service memberships or subscriptions that go unused or underused. The bank's bet on the Control Tower application is that more customers will engage with it for additional services and that the bank can push the customer towards digital payment methods that are less expensive for it to service than physical transactions requiring a visit to a branch office (Businesswire, 2018).

Apple's new credit card similarly aims to push consumers towards a FinTech platform architecture in the payments space to reduce the use of physical cards, readable card numbers and transaction times and to create a better customer experience. A card that primarily operates in ApplePay and has no readable numbers would change customer behaviour to outmanoeuvre would-be online fraudsters and reduce the cost of managing a transaction account using some of the technology developed by the early FinTech platforms, many of them outsourced.

Flexibility to work with existing technology

A FinTech's or Big Tech's ability to work with existing technology to run core systems, ledgers, accounting or servicing platforms can quickly, cheaply and fundamentally change how a customer interacts with businesses in the physical world. ApplePay and the Starbucks mobile order-and-pay applications are both outsourced to FinTechs that run the architecture and have digitised some of the core businesses of the physical company's operations (how iPhone applications and coffee are purchased, for example).

Banks could use technology too

The technology advantages that tech firms have over banks is significant, but banks could also use technology to their advantage. Indeed, many of our bank survey respondents identified where new technologies can be leveraged to deliver custom services and pricing and to better serve clients. They also noted the costs, which are significant, of updating legacy infrastructure. Three emerging technologies could, in particular, benefit banks. The first is cloud computing. Banks that are able to move their systems and data into the cloud, and off legacy systems, will increase their efficiency and enable interoperability. Interoperable systems would allow banks to merge and analyse the customer and business intelligence data they collect. Making better use of the wealth of data that banks have been collecting on their customers for years would enhance their product offering. As more banks move to the cloud, consolidation – much needed in some regions – becomes more manageable. But the cloud also presents risks (discussed below).

Box 4 Case study: Upstart and the FinRegLab

US FinTech firm Upstart experienced friction when attempting to enter the consumer lending market. Upstart uses non-traditional data such as bill payment information in making credit and pricing decisions for consumer lending platform underwriters. Upstart felt it was necessary to obtain a no-action letter from the US Consumer Financial Protection Bureau (CFPB) to ensure that its use of non-traditional data would not trigger consumer protection enforcement actions. According to the CFPB, “as part of the agreement, Upstart will regularly report lending and compliance information to the CFPB to mitigate risk to consumers and aid the Bureau’s understanding of the real-world impact of alternative data on lending decision-making” (CFPB, 2017). As a result, Upstart, an intermediary underwriting tool for other platforms, was also subject to bank-grade regulation to assuage regulatory concerns around disparate impact, fair lending and data security.

Most recently, the FinRegLab, an independent Washington-based research organisation, undertook a rigorous analysis of the value of cash-flow data for underwriting both consumer and small business lending platforms in the US. Its analysis used cash-flow variables and computed scores from Accion, Brigit, Kabbage, LendUp, Oportun, and Petal, and found several important quantitative findings that are relevant to policymakers concerned about the use of non-traditional data in underwriting.

The study shows that cash-flow scores and attributes were comparable to traditional credit scores in terms of predictive power and that the use of cash-flow-based underwriting improves risk-sorting among borrowers that traditional metrics perceive as being similar. In other words, the platforms' scores and processes separate risk differently than traditional manual bank and FICO-based underwriting, such that using a combination of both methods yields even greater predictive power.

The study also discusses how the methodology is useful for underwriting credit applicants that lack traditional scores and demonstrates the potential that FinTech platforms have to access underserved communities. It also examined indicators for disparate impact and found that predicted credit risk was consistent across subpopulations when divided into subgroups based on likely race, ethnicity, and gender. "Moreover, when compared to traditional credit scores, the cash-flow based metrics appeared to predict creditworthiness within the subpopulations at least as well as the traditional scores and attributes, and better in selected cases" (FinRegLab, 2019).

Another technology that shows promise for banks is AI and machine learning, through which more manual processes could be automated. Standardising and automating processes such as onboarding new clients or making credit decisions would lower costs and make banks more competitive in some products and services. Gambacorta *et al.* (2019) show, for example, that standard credit scoring plus machine learning on mobile-based and other alternative data improves default prediction compared with traditional credit scoring models. Other alternative data used by FinTechs include transactional data, shipping data, e-commerce and social media (Prior, 2019). See Box 4 for more detail on the use of alternative data in credit scoring models.

Finally, blockchain and distributed ledger technologies are transforming the nature of data storage. Some banks have noted that these technologies could be used for improved data collection and record-keeping. Data would be fed sequentially into the blockchain, which could be quicker and less costly in terms of compliance.

The recent Swiss National Bank survey of Swiss banks details the banks' challenges we have discussed (see Box 5). The banks highlighted enhanced competition, both with other banks and with new market participants such as bigtechs and digital banks. Against this backdrop, banks, particularly the large ones, "are seeking to achieve ambitious digital maturity targets, and are investing in innovation or acquiring innovative solutions from specialised firms such as fintechs." Moreover, at the strategic level, the banks "seek to bring their existing business models to a high level of digital maturity with the aim of cutting costs and retaining their attractiveness to customers," (SNB, 2019, p.5).

Box 5 Key findings from the Swiss National Bank Survey on Digitalisation and Fintech at Swiss Banks 2019

In the longer term, banks envisage themselves continuing to play a central role in financial intermediation, albeit amid heightened competition and significant digitalisation of financial services.

They believe that customers are less likely to maintain a permanent relationship with a single financial institution in the future, and will instead increasingly turn to different intermediaries from the banking and nonbanking sectors to find the best service. In certain segments, such as payments and corporate lending, Big Techs and digital banks could emerge as important competitors – the former on account of their size and access to customer data and the latter thanks to their technological lead. By contrast, FinTechs are seen more as partners given their modest size and specialised focus.

At the strategic level, banks are seeking to bring their existing business models to a high level of digital maturity with the aim of cutting costs and retaining their attractiveness to customers. An advanced level of digital maturity has already been attained in deposits and payments. Other digitalisation efforts relate to the automation of account opening and enhanced user-friendliness in response to the market entry of Big Techs and digital banks.

The majority of larger banks plan extensive process digitalisation in the area of mortgage lending to households. However, there is a large gap between current and targeted levels in this respect. In the future, credit checks, decisions on granting loans and ongoing borrower monitoring are to be digitalised. In the banks' view, advisory services and personal contact will continue to play an important role and will be supported by digitalised processes.

Digitalisation strategies vary greatly depending on the size of the bank. The larger banks have set themselves more demanding digitalisation targets than their smaller counterparts, in particular in the mortgage business. Furthermore, larger banks have already achieved a higher level of digital maturity. The differences are less pronounced in deposits and payments, where all banks are already well advanced in terms of digitalisation. In their innovation strategies, the larger banks are focusing on developing proprietary solutions, with priority being given to biometric identification and robotics. The smaller banks are working with FinTechs or acquiring innovations from third-party providers.

Source: SNB (2019).

The customer experience

Consumers increasingly expect platforms to be mobile-first and fully digital (e.g. The Economist, 2019). They expect to obtain credit not in months or weeks, but in days or minutes. The trend is for greater acceptance of AI-powered applications to make portfolio allocation decisions. In developing and middle-income economies, customers look to their phones and mobile carriers to offer payment, deposit and sometimes crowdfunding credit applications to conduct

business or make consumer transactions. These changes in consumer demand, sentiments and expectations point to radical changes in the way that individuals, households and businesses transact in the digital era. The primary drivers are rapid advances in technology, mostly outside of banking, and post-crisis changes in the financial regulatory landscape that compelled increased competition and encouraged new entrants to compete in a financial ecosystem. FinTech and Big Tech investment and innovation are responding to consumers' expectations of options from their banks, ranging from 24-hour support to completely mobile, autonomous account opening and servicing.

Third-party technology helps FinTech firms

A robust market for third-party technology vending and servicing has allowed FinTechs to outsource some of the more costly and complicated components of building an application, such as the core system development and management, creative user experience design, customer service and bank data aggregation. This gives FinTech providers a low-cost advantage to enter and pivot in markets and products. A small number of data aggregators²⁹ dominate the data markets as the primary sources through which read-only, permissioned customer banking and transaction data can be accessed from traditional depository institutions. These aggregators act as collective receptacles for raw data consumers and establish direct connections or 'screen scrape' permissioned customer accounts on behalf of a large number of FinTech providers and banks.³⁰

Scale and scope

Banks' scale and scope creates competitive advantages both in terms of (lower) cost of funding and large branch networks. Big Techs' benefit in, arguably, greater ways from the network effects that give them dominance in many markets.

As discussed in Chapter 2, large banks benefit from lower costs of funding due to a number of factors, including their ability to take deposits, potentially from market perception of government support, their branch networks and the more liquid nature of their debt. Big banks may also enjoy economies of scale and scope (or market power), making them more profitable and less risky in certain dimensions.

Big Tech firms also benefit from size and scale. In particular, the '*network externalities*' of a Big Tech's platform represent an essential element in its life cycle of "data analytics, network externalities and interwoven activities" (BIS, 2019). Consumers' value from participating on one side of a platform (for example, as an online merchant) grows with the number of users on the other side of a platform (for example, buyers). The more users, the more data that can be collected and analysed. Such analysis can improve existing services and attract further users. More users, in turn, can provide the critical mass of customers to offer a wider range of activities, which yield even more data.³¹

29 For example, Envestnet/Yodlee, Plaid/Quovo and MX.

30 An application program interface (API) is a set of rules and specifications followed by software programs to communicate with each other, and an interface between different software programs that facilitates their interaction (FSB, 2017).

31 See the discussion of the DNA of Big Techs in BIS (2019, p. 62).

While FinTech firms have a number of advantages over banks, they also face a number of challenges compared with the big bank or Big Tech model, primarily because the upstart FinTech lacks the scale, size and trust that often give banking and Big Tech institutions runway to enter the digital banking space.

Policy-based advantages

Regulation

Traditional banks have not introduced a new major retail credit product since the consumer credit card. The first credit card was introduced in the late 1950s, but it did not become a mass offering in the US until the 1990s. This lack of investment in new products, combined with the financial crisis of 2007–8, has led to the introduction of a number of innovative consumer and small business products by FinTechs aiming to reach consumers directly, unburdened by the crisis and its ensuing regulatory reforms.

Upstart companies using non-traditional data to assess credit-worthiness are gaining traction around the globe, particularly in developing markets where mobile phone data or social data can become a proxy for credit risk.³² In ‘older’ markets such as the US and Europe, concerns about issues ranging from privacy to disputability make it difficult for lenders to serve new and developing markets with data gleaned from sources that did not previously exist (i.e., when the regulations that govern their activities were conceived).

Regulations, however, may restrict use of new credit models, adversely affecting some consumers. In the US, these regulations preclude institutions from using data not mandated under the Fair Credit Reporting Act (FCRA). For young people or recent immigrants who do not have reliable data, these regulations can make it difficult to obtain credit. Their lack of access to products from traditional institutions pushes them not only towards FinTech providers, but also to unreliable and unregulated providers operating in the shadows. A more tailored set of regulatory lanes could smooth the on-ramp for FinTech startups, complementing banking regulation not intended for the digital age with a more dynamic set of risk-appropriate controls (Taussig, 2018a).

In the US, data used to make a consumer credit decision must be provided by a credit reporting agency (or credit bureau) and data usage is governed by the FCRA. Companies that do not wish to comply with FCRA guidelines may not share data with third parties if they are intended to be used to make a credit decision. Credit bureaus, such as Experian, Equifax and TransUnion, have extensive consumer protection obligations, including a requirement to correct data that are disputed by a consumer. These obligations are necessary, but may limit the interest of other data providers – such as mobile phone carriers, lessors and utilities – in providing such information to augment a consumer’s credit.

Credit bureau data may include both positive (e.g., timely bill payments) and negative (e.g., credit delinquencies) data. The coverage of positive credit information in the US is nearly 100%, but coverage is less reliable in Europe (Wolcott, 2007). While credit bureaus do exist in Europe, the type of data collected and shared is inconsistent. In some regions, negative data are the only

³² See, for example, Agarwal *et al.* (2018), Shema (2019) who used mobile phone-based socio-behavioural data to enhance credit-scoring models.

available data, while in others both positive and negative data can be obtained by a potential lender. European data access rules such as PSD2 ('open banking') aim to increase consumer access to data that can be used to enable financial accounts and transactions.

Open banking is becoming established in a number of countries as a consumer right. This means that consumers should have the right to access, control and share their banking data as they choose (see Box 7 on open banking). FinTech firms, however, may struggle to meet or demonstrate data protection standards to customers and regulators, and therefore may struggle to access the data needed to deliver their product or service.

An additional complication for technology firms is that the information used for data-driven decisions may be fundamentally different than the traditional data and attributes that prudential regulators are accustomed to reviewing for traditional banks. Concerns around disparate impact and larger ethical concerns about the use of specific variables in automated marketing or decision platforms have led global regulators to exercise caution in granting FinTechs access to consumer data. Big data can generate a trade-off between efficiency and discrimination in credit markets (Philippon, 2019). Better data analytics can reduce inefficient discrimination because computers do not suffer from instinctive human biases. But there are also rational statistical discriminations that improve profits but are nonetheless negative for welfare. Lending regulations that have been developed to limit these kinds of discriminations can be challenged by big data, which can create proxy variables in many different ways.

In the US, for example, state and federal regulators are debating the application of the Gramm–Leach–Bliley Act, also known as the Financial Services Modernization Act of 1999, to FinTech platforms and their data in the absence of a federal privacy and data protection law. Most jurisdictions provide the banks with a natural data advantage as the data custodian if they comply with a host of notice, consent, protection, breach and data-sharing standards, and banks are not required to share such data with other firms.

Trust and data protection

Trust is an integral part of any bank's franchise, even as many banks' reputations have been tarnished in the past.³³ As Bank of England Governor Mark Carney observed, "[a]n industry the scale and importance of finance needs social capital as well as economic capital. It requires the consent of society in order to operate, innovate and grow" (Carney, 2018).

The architectural design of bank branches is crafted to inspire trust and confidence. Traditionally, their imposing stone edifices, white marble lobbies replete with security guards and prominently displayed depositor trust signs signalled that the depositors' hard-earned money would be safe and available when they returned, under any condition. Banks place significant importance on the privacy of their customers' data to support such trust. This trust encourages customers to take their money to the bank in the form of demand deposits and

33 Most recently, the financial crisis of 2007–8 led to a "veritable collapse of the global financial industry's reputation" (Eisenegger and Kuenstler, 2011).

to use the bank for credit and payments. A recent study found that customers' trust in banks is high and increasing (Accenture, 2019; McIntyre 2019). As noted earlier, this trust-based franchise provides them a low-cost source of funding to conduct the daily business of banking.

Big Tech firms have been able to replicate some of the reciprocal exchanges of funding for credit with data for services. Google and Facebook, for example, have demonstrated that consumers are highly willing to engage in a swap of one valuable asset (i.e., data) for a free or low-cost service, just as the banks offer free chequing and loans. Some Big Tech brands that have built longer-term trust with the consumer and their wallets, such as Apple, may be able to successfully pivot to digital financial services using the same argument of stability resulting from size and their established brand.

FinTech models, conversely, have not been able to capitalise on big data; nor do they lend themselves to a low-cost model of funding. Moreover, often fully digital and sometimes opaque FinTech business structures do not inspire deep consumer trust and confidence that the model will last for a long time. Despite being digitally native platforms with all the technology plumbing advantages, FinTechs face a steep marketing challenge with customers to establish their brands and establish trust as new market entrants. Likewise, banks and Big Tech platforms with well-respected commercial brands outpace FinTechs in generating trust in matters such as privacy, data security and cybersecurity.

That said, consumers are beginning to express more concerns about 'becoming the product'. And the Cambridge Analytica and Facebook controversy – in which data from 50 million users were unknowingly harvested from their profiles and passed on to a consulting firm to target communications – demonstrates the need for clearer policies around data ethics (Granville, 2018). Facebook's popularity plunged between 2017 and 2018 amidst the negative publicity, and Google, Amazon and Apple also saw their popularity ratings drop in that same period, though not as sharply (Hart and Fried, 2018). More recently, the results of the Harris Poll (a survey on the corporate reputations of companies) indicated continued fallout. "Google's reputation fell 13 spots in the most recent Harris Poll issued in 2019, one of most precipitous declines in the survey. One of the few companies to see more reputational damage was Facebook, which fell 43 places on the 100-company list to become about as popular — or unpopular, depending on how you look at it — as other scandal-plagued companies such as Wells Fargo and the Trump Organization," (Schleifer, 2019). Julian Wheatland, the interim CEO of Cambridge Analytical who has been outspoken on the scandal, observed that "[i]f this data technology is to thrive, the public must have trust in its practitioners" (Wheatland, 2019).

'Soft information' and relationships

While digitally native firms often have an edge on data skills, banks may retain an advantage in handling soft, context-dependent information that cannot be reliably tracked from quantitative metrics. The importance of this factor varies considerably across bank business segments, but it exists in many of them – including, for example, small business lending and advisory services. Banks are able to extract proprietary information from strong bank–consumer relationships and use this information to set contract terms and make credit underwriting decisions. Research suggests that small businesses, for example, benefit from relationships in terms of credit availability, credit terms, and firm performance

(for a review of the literature, see Berger *et al.*, 2014). Research also indicates that banks also benefit from a fairly sticky customer base that is disincentivised to switch deposit institutions, and is likely to work with banks with which it has an existing relationship. While the relationship-based dimensions of banking may be on a long-term trend of erosion, due to changes in lending technology and banking regulation, they are unlikely to disappear altogether.

Box 6 Lessons learned from challenger banks

WingspanBank

During the heady days of the 1990's dotcom boom, online banking was changing rapidly, and the US saw an 80% growth in the number of households using online financial services from year-end 1998 to June 1999. Hoping to ride the wave and beat bigger competitors to market, FirstUSA, a credit card issuer purchased by Bank One in 1997, envisioned a one-stop, online shop for financial services. Bank One decided to operate and market their online vision independently from the rest of the organisation to avoid the drag of the home bank and get to market as quickly as possible. They decided on a piecemeal partnership structure that pulled the 'best of breed' financial products from a variety of providers, intended to become one vast product offering. They called it WingspanBank.com, and it began operations in the summer of 1999 as a new brand with the promise, "If your bank could start over, this is what it would be."

Following a breakneck development sprint, massive marketing campaigns and aggressive promotional offers, WingspanBank found itself live on the world wide web with some version of the offering it had envisioned only a few months earlier. The site's product portfolio was the most comprehensive of any pure-play competitor, and the online-only model allowed it to offer attractive rates that challenged its parent company's rates at Bank One.

However, Wingspan's speed to market and organisational independence would come at a cost: brand equity had to be built from scratch, physical BankOne branches were not made available to WingspanBank customers (although Bank One ATM access was provided) and the WingspanBank offering competed directly with Bank One's branded website. The brand stumbled out of the blocks to recognise what customers actually wanted in a holistic banking experience and adoption remained low, with those who did convert feeling left without key functions.

Ultimately, the \$150 million bet on Wingspan went sour. Failing to generate the customer and financial metrics required to justify the cost of sustaining a separate brand, all WingspanBank customers were migrated to bankone.com by September 2001. Though the bank had competitive rates, it lacked a core customer focus as the mission. Wingspan built the technology to conquer a technology feat; it didn't design for the brand, features or mission that customers wanted and was never fully transformative. According to Jamie Dimon, who was named Bank One CEO in March 2000, the move

would “accelerate greater efficiency and profitability within all of Bank One's internet operations.” Some say Wingspan was ahead of its time, but it actually fell victim to poor planning and a misunderstanding of consumer tastes and preferences.

ZUNO Bank

ZUNO Bank was an online Czech bank, launched in 2010 and folded into its parent Raiffeisen Bank in 2017, that also struggled to reach profitably and fully monetise the customer base. Unlike Wingspan Bank's offering of everything and the kitchen sink, ZUNO was laser-focused on a simple product mix: current accounts, savings accounts and personal loans.

ZUNO had early potential to reach the elusive digital bank success story with its popular mobile app and successful branding launches in stable banking areas in Slovakia and the Czech Republic. Zuno's marketing messages were successfully tailored for millennials – the target audience – offering speed and efficiency. It performed well with early indicators on dimensions customers cared about, including low fees, simplicity of communication and account handling.

However, despite acquiring 266,000 customers in Slovakia and the Czech Republic, the bank never found a way to balance growth, customer satisfaction and financial return. ZUNO lost €130 million over the course of its short operational life. Much of this failure centred around ZUNO's business model. It focused first on customer acquisition in the deposits space, adding in credit products later. The bank accrued approximately €800 million in deposits liabilities far faster than it was able to cultivate productive credit assets. Even by the time it shut its doors, ZUNO's loan-to-deposit ratio hovered around only 10%. Simply put, it was never designed to be a sustainable digital bank and was rolled into Raiffeisen Bank International (RBI) in 2017.

Revolut

Today's challenger banks learned from their failed predecessors and designed for discrete deposit, checking and lending offerings with amazing experiences. But, if the industry heeds one lesson from Zuno, challenger banks must revisit the business model and determine an effective way to monetise the customer and deposit base. The neo-banks of the 21st century inside the tech boom are also balancing non-bank investor growth expectations with scalability and running an ethical operation built on good principles.

Revolut, a UK-based challenger bank (with a banking licence in Lithuania) started in 2015, is undoubtedly one of the fastest growing challenger banks in Europe today, boasting over four million users. Within a span of six months between 2017 and 2018, the company managed to raise its valuation from \$350 million to \$1.7 billion, a testament to its rapid growth. Revolut now aspires to expand into the US and Asia while continuing its transformation from a single-product to a multi-product business and maintaining an astronomical growth rate in its core product offering.

The rapid growth and grand ambitions have tested the core of Revolut and its management. Statements from former applicants and employees indicate that behind the growth story lies a tale of unpaid work from job applicants and a culture that encourages “hitting targets at all costs”, leading to a burnout culture and high staff turnover (Mellina, 2019). The quintessence of this culture was the company’s now abandoned motto of “Get sh*t done”.

Revolut also faced regulatory scrutiny in the UK in early 2019. In February, *The Telegraph* reported that the company had a potential sanctions screening breach (Cook, 2019a).³⁴ Though Revolut denies the allegations, stating that no sanctions transactions happened during the three-month period in question, the incident was a wake-up call to management.

Revolut demonstrates the downside of focusing solely on short-term growth rather than building an organisation along the way that is founded on good principles. While Revolut has achieved some success thus far, it has incurred negative publicity along the way due to its lack of a strong organisational culture that enables the business to retain talent as well as rigorous risk management practices. Its CEO, Nikolay Storonsky, has reflected publicly on the lessons learned: “We made mistakes. We matured. It was a good lesson” (Cook, 2019b).

Political power/lobbying

Banking and politics have historically been intertwined as much bigger banks have been created and the banking system has consolidated. Banks have often been able to use their lobbying power to restrict entry, for example, or prevent commercial firms from acquiring banks (as in the US with WalMart; see Chapter 4) (e.g., Johnson and Kwak, 2010; Chalmers, 2017; Igan and Lambert, 2019).

At one point, Big Tech firms shared some of that power, but they have seen their political power wane against the backdrop of data breaches such as the Cambridge Analytica event. Despite the tech industry’s constant deflection that their platforms are apolitical, politicians around the globe have become dissatisfied with the spat of election interference, data leaks and reports of inappropriate content propagating on these sites (Schulze, 2019; Hart and Fried, 2018; Schleifer, 2019). More recently, several jurisdictions have raised queries into the anti-trust behaviour and advertising, tax and data protection practices of Big Tech firms. The EU has been particularly effective in enforcing its anti-trust policies, and the US is stepping up its efforts (Schulze, 2019). Wary of government scrutiny, Big Techs have been increasing their lobbying expenditures and campaign donations and have “amassed an army of lobbyists” to prepare for either ongoing or potential investigations (Trebbi, 2019; Kang and Vogel, 2019). Trebbi (2019) shows that Big Tech firms have been progressively entering into politics (through campaign donations and lobbying expenditures) in the US since the early days of the anti-trust inquiries into Microsoft in the late 1980s. Even without formal government investigations, the political pressure for action has been mounting, with politicians on both sides of the Atlantic calling for regulation, or even

³⁴ See also McDonald (2019).

the break up, of Big Tech (Kang *et al.*, 2019). Microsoft founder Bill Gates, who once bragged that he “didn’t have an office in Washington, DC”, now believes that regulation could be critical in ensuring that technology is being used in a beneficial way (Eadicco, 2019).

Box 7 Open banking challenges

Data ownership

Clear and consistent customer data ownership is core to any open banking model. The European PSD2 is relatively clear, but the situation in the US is more confused. The Dodd-Frank Act, Section 1033 lays forth the notion that consumers own their financial data. A 2018 US Treasury report recommends that the government clarify that ‘access’ to a consumer’s financial data includes third-party access permissioned by the consumer (US Department of the Treasury, 2018). While the Consumer Financial Protection Bureau (CFPB) recognises this idea in its non-binding data sharing principles,³⁵ there is strong market appetite for more substantial and official guidance to ensure the free flow of data. Section 1033 only applies to banking institutions, but the Treasury also urged other financial regulators at the state and national levels to consider aligning their rules, regulations, guidance and policies with the CFPB’s concept of consumer financial data ownership.

Consent

Any third party (a bank to a FinTech, or vice-versa) in a customer data transaction must obtain clear customer consent in any regulatory jurisdiction before using data for a purpose not originally captured in the original terms and conditions. Open banking advocates have urged regulators to ensure that ‘consent’ is a well-defined term, written in plain language, and that the technical use case, protections and security protocols are clearly and appropriately communicated to the end consumer.

There is general consensus that should the customer elect to revoke consent, the third-party developer (the FinTech or their aggregation agent) must have a method to receive the notification and the means to sever the contractual relationship between the customer and the third party if necessary.

Technological standards and API

A successful open banking ecosystem requires a standardised technology (application programming interface, or API) protocol from both a security and an implementation perspective. APIs define standardised methods of interactions that govern and execute data flows between different systems (Deloitte, 2019).

A single interoperable technology and data-sharing protocol enables entrants to focus on customer-facing innovations instead of the ‘plumbing’ of transactions. It also improves audit and regulatory compliance.

35 <https://www.consumerfinance.gov/about-us/newsroom/cfpb-outlines-principles-consumer-authorized-financial-data-sharing-and-aggregation/>.

Although the strengths of uniform technical standards far outweigh the weaknesses, there are cases in which standardising can create complications. Differences in the development and implementation of API standards across borders requires attention. And banks with already robust digital infrastructures and offerings should be able to comply with the standards while also offering services that go beyond the standards.

Liability

Agreeing on a model for liabilities has been one of the more contested and difficult issues for policymakers across jurisdictions. The liability framework drives a significant portion of the economic risk that banks and non-banks must bear in a third-party data-sharing arrangement.

A prerequisite to a clear, evenly applied apportionment of liability in a system in which consumer data are an asset is the concept of traceability. Traceability means the ability to track – using registries, encoded headers, and other tools – the path taken by users' data after they consent to using a third party.

With traceability functionality woven into the fabric of an open banking system, regulators are able to assign a higher degree of certainty for fault through a kind of forensic ledger that allows them to appropriately assign liability for a data breach.

The concern from incumbent financial institutions is that third-party FinTechs are new and often untested. The question then for policymakers is what to do if the third-party FinTech is not able to pay out – how can the market provide a solution to protect the customer and the soundness of the original custodian, the financial institution, while ensuring customers have competitive products?

If a third party cannot pay under PSD2, the liability for making the customer whole rests as a contingent liability on the balance sheet of the cyber risks insurance market that has provided coverage to the third party. Policymakers need to understand the extent of various types of claims and the various situations of fault or contribution to fault that may exist. This step remains an outstanding issue in the EU and requires additional work and definition in all markets. There may be circumstances where a customer suffers a loss and requires compensation, yet the insurer is not compelled to act.

In addition to the liability model of PSD2, industry best practices discussions have introduced some central ecosystem components, such as open banking directory functionality, which will also be party to the liability model. Just as with the technology standards, the processes of the liability model should also have some standards to avoid bad outcomes from private or public sector insurers and administrators.

There is also a role for enhanced research in forensic data science to help identify the source of a data breach, in a situation where the customer might not be able to correctly identify the source of the problem. Ideally, the dispute system should seek to build some monitoring capability to provide a probability function that correlates emerging issues. Forensic traceability is not limited to a breach scenario – for example, incorrect data transferred

through a relationship can cause consumer harm. The provision of clearly incorrect information presented to the third party, which has been correctly formatted and presented in a standardised way, should lead to reprimands for isolated errors and more substantial regulatory enforcement if the problems persist.

The situation in the US is complex. Although banks and third parties recognise customer demand for open data, the ecosystem risks being stunted by traditional contractual law. Today, primary providers in the US, such as banks or credit card providers, remain connected to certain risks and potential obligations to the end customer through third-party vendor risk management supervision, even after they have carried out the customer's wishes and enabled access to a third-party FinTech. The US Office of the Comptroller of the Currency (OCC) is required to ensure that large banks effectively supervise the technology firms which connect to them, and potentially any technology firms that connect to those technology firms. The concern of the potential liability in this situation, coupled with the lack of clarity on the ownership and control of customer data, is leading many banks to limit their partnership options with FinTechs.

This has also led to the proliferation of for-profit bilateral agreements between banks and certain aggregation services performing for other FinTech firms. In the long run, policymakers should worry that this will limit efficiency, restrict market access and competition, reduce innovation and ultimately provide significantly poorer customer outcomes. Incumbent banks might fear that third-party providers will compete with the banks' business models. Whilst many third-party providers will indeed compete, the UK market – where open access is now present for payments data – is beginning to demonstrate that the incumbent bank can innovate new services and revenue streams on top of the open data access regime.

4 Public policy challenges

The notions that banking systems can arise spontaneously or that they could function efficiently without active government involvement are utopian fantasies.
Calomiris and Haber (2014, p. 491)

Increased fragmentation can make market reform less effective and more costly. There are many different kinds of fragmentation. Some are relatively simple – just technical discrepancies between jurisdictions that nevertheless increase cost and inefficiency in unintended ways – while others...can be interpreted as a result of conflicting policy objectives.
Ryozo Himono (in Evans-Pritchard, 2019, p. 59).

As technology-driven disruption challenges the business models of incumbent banks, it also brings into question traditional modes of financial policymaking and opens new areas for public oversight and regulation. The future of incumbent banks will be defined by a series of complex trade-offs to be navigated by a number of parties across divergent domestic circumstances. Their future will depend crucially on the following factors:

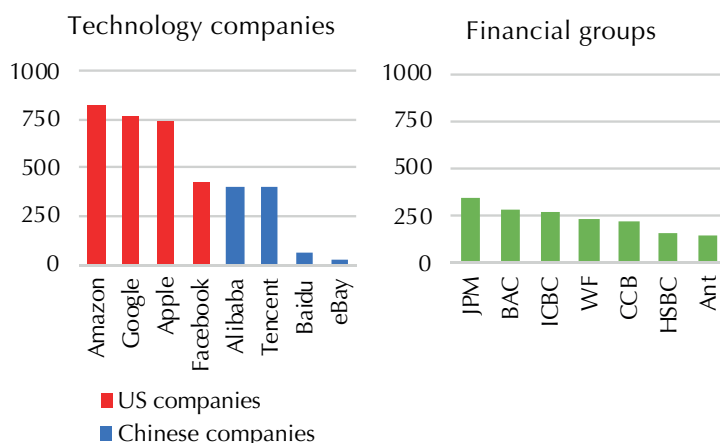
- how they adapt to customers' changing demands and technological innovation;
- how the technology competitors interact with them (i.e., partner or compete directly, by choice or necessity);
- the current state of the technology environment and financial system developments in individual jurisdictions (i.e., data rights, consumer protection, privacy, and cross-border data flows); and, perhaps most critically,
- how regulators and policymakers across the globe respond to the potential benefits, risks and competition posed by digital innovation driven by Big Tech and FinTech firms.

This chapter reviews the correspondent dynamics shaping public policy, outlines the policy trade-offs, and discusses how policymakers may adapt to the rapidly changing financial services landscape.

New dynamics shaping public policy: Scale, speed and border-hopping

The growth of Big Tech firms and the adoption of digital technologies are occurring at a very rapid pace. The current market capitalisation of the largest Big Tech firms is now greater than that of the largest financial institutions (Figure 14). Meanwhile, the pace of technology adoption, defined as the time it takes to reach 50 million users, has accelerated spectacularly (Figure 15).

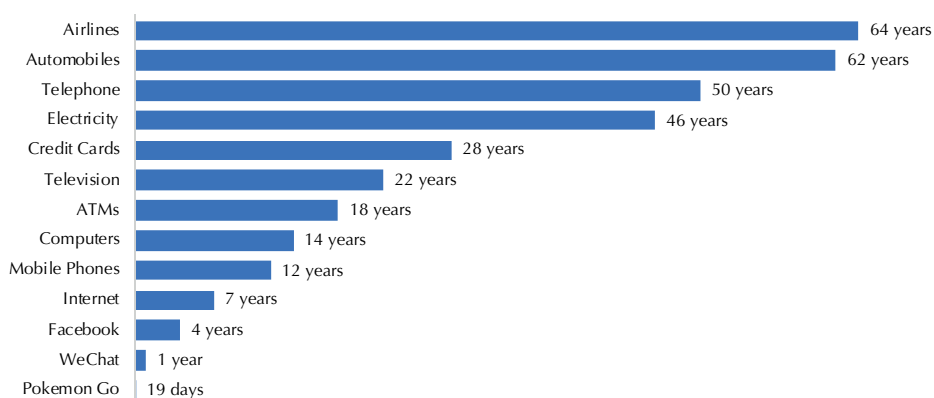
Figure 14 Market capitalisation of major financial groups and Big Tech firms



Notes: Stock market capitalisation as of 18 January 2019. Ant = Ant Financial; BofA = Bank of America; CCB = China Construction Bank; ICBC = Industrial and Commercial Bank of China; JPM = JPMorgan Chase; WF = Wells Fargo. The estimated value of Ant Financial was derived from the amount raised in the company's recent funding rounds times the stakes sold.

Sources: Figure 1 in Frost *et al.* (2019); Thomson Reuters Eikon; company reports.

Figure 15 Speed of adoption: Time it takes to reach 50 million users



Source: DesJardins (2018).³⁶

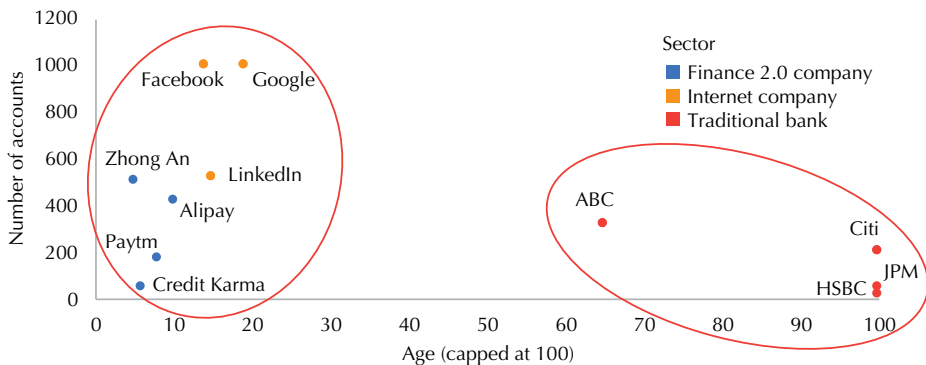
³⁶ There are a number of versions of this stylised chart available. Arguably, more attention could be paid to the definition of adoption, start date of a new invention and the source of the statistics.

Moreover, the disruption from Big Tech is not only happening quickly, it is also hopping jurisdictional borders. The extraterritorial impact of new technology is a key driver of the perception that ‘this time is different’, or at least has the potential to be.

The scale of the Big Tech firms and the speed of adoption across borders in the digital era suggest that developments in the provision of financial services could accelerate at a faster pace than seen before. Nguyen Trieu (2017) argues that “[t]he [technology] investments in the last few years have laid the foundations – in terms of infrastructure, talents, technology, but more importantly consumer behavior – of dramatically new business models in finance, which I would summarize with one word: hyper scalability.” He further argues that traditional financial companies have scaled up over decades and centuries while internet-based tech companies (“digital-first companies operating in finance”) have scaled from 10 times to 100 times faster than traditional financial institutions. Figure 16, which plots for internet companies, Big Tech companies and traditional banks the number of accounts with age of the entity, illustrates this point.

This scale and speed, combined with the ease of crossing borders enabled by technology, creates unprecedented challenges and trade-offs for policymakers and financial institutions.

Figure 16 Number of accounts (millions) and age (years)³⁷



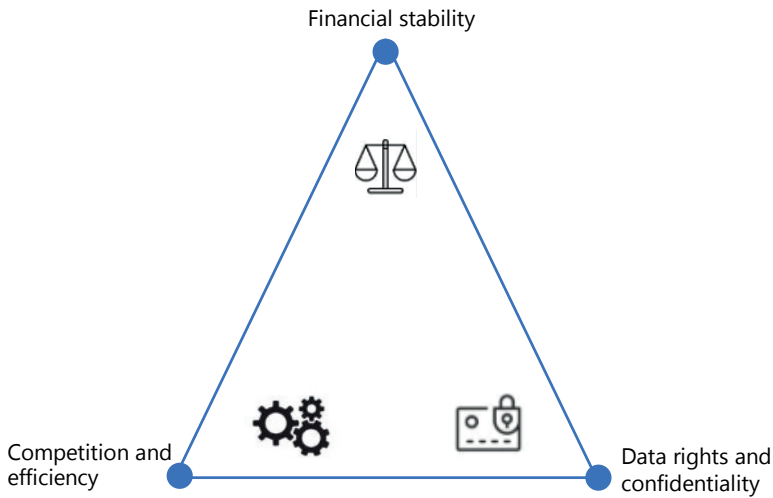
Source: Nguyen Trieu (2017).

A trilogy of policy imperatives

To address the challenges presented by the speed, scale and border-hopping nature of technology, policymakers across the globe are faced with three overarching objectives of public policy in shaping the financial services landscape: financial stability, competition and efficiency, and data rights and obligations. Figure 17 illustrates these objectives.

³⁷ Of course, one could argue that banks accounts and social medial accounts are not directly comparable. It is more burdensome to open up a bank account than to get a Google account or start a new Facebook profile (in terms of documentation required and time to register, etc.). People could have multiple (inactive) accounts with Google or Facebook.

Figure 17 A financial policy trilogy for the FinTech and Big Tech era³⁸



At the top of the triangle is financial stability. Financial stability, which refers to the policies that protect the soundness of the financial system and, by implication, of the monetary system itself, is critical to any sustainable retail banking innovation (e.g., Menand, 2019). These policies include the prudential framework of banking regulation and its supervision (including resolution, the regime that applies to non-viable banks). Broadly speaking, financial stability policies apply specifically to the financial sector, although the boundary between financial institutions (and banks among them) and the rest of the economy is not uniformly defined across jurisdictions, and less so in some jurisdictions than others. At the global level, they fall under the broad coordinating remit of the FSB, which brings together finance ministries, central banks and securities markets regulators from the G20 jurisdictions, as well as relevant international bodies, researchers and standard-setters.³⁹

At the bottom left of the triangle is competition and efficiency. These primarily aim to promote market success, development and efficiency in markets. To meet this objective, authorities monitor markets for signs of anti-trust, see to market liberalisation (where relevant) and ensure that government aid does not distort the level of competition, and investigate mergers and takeovers between firms.

The policies pursued to achieve a competitive landscape vary by jurisdiction, particularly in the banking sector. For example, in the US these policies limit the size, activity mix and geographical expansion of banks and consequently have played a critical role in the country's banking history (although regulations in this respect have been relaxed somewhat over the last four decades). In the EU, competition policy enforcement by the European Commission's Directorate-General for Competition (DG COMP) has also acquired major importance in shaping the development of banking sector structures since the first corresponding

³⁸ To be clear, this 'policy triangle' is intended as a way to think about future priorities, not only about trade-offs. It is not a policy trilemma – in our view, all three policy objectives are imperative and should not be meaningfully compromised.

³⁹ Plus a few other major economies (Hong Kong SAR, Netherlands, Singapore, Spain, Switzerland).

decisions in the 1990s, even though the Commission's mandate was established in principle as early as the late 1950s (Moser *et al.*, 2002). In China, competition policy is more complex because the central Party-State directly controls the largest banks in the system as well as many other financial firms, including key institutional investors. Even so, Chinese authorities acknowledge the importance of competition policy and in 2018 consolidated a vast swath of competition and conduct mandates under a newly formed agency, the State Administration for Market Regulation (Butcher Piat, 2018).

Globally, competition authorities coordinate across jurisdictions and markets, on individual cases and, on occasion, general policy stances, despite the fact that there is no international body for competition policy. For example, in June 2019 the competition authorities of the G7 jurisdictions published a "common understanding" document on "competition and the digital economy" (G7, 2019).⁴⁰

Finally, in the lower right corner of the triangle are data rights and obligations. These include a set of mandates and regulations that are increasingly taking shape as a largely autonomous policy area despite being in their early stages of development. Such rights and obligations cover data ownership, privacy, security and other dimensions that may emerge gradually as the use of data becomes increasingly essential to a broader range of business and official activities.

While recent debates⁴¹ have brought data privacy and protection to the forefront of policy discussion, the world is still far from global agreement on the most appropriate market or societal mix of data rights and access with respect to financial services policy. Greater cross-border coordination is required to uphold customers' rights to authorise access to their data, while simultaneously safeguarding against unauthorised data misuse (Taussig, 2019). Specifically, global policymakers must better understand the appropriate cultural, societal and economic tolerances for data privacy within their jurisdictions and across borders. The increased salience of FinTech and Big Tech in banking and finance warrants a rethinking of how global policy-setting can be effectively organised and how coordination between non-financial authorities and financial sector authorities could be enhanced.⁴² The extent to which the major Big Tech firms enter into financial services in the future could be constrained as much by competition and data authorities as by financial regulators, and thus the three policy areas of the triangle (financial stability, competition and efficiency, and data privacy) become comingled in the debate on the future of FinTech in financial services.

Financial stability

While the advent of new technologies could reduce market inefficiencies and enhance financial inclusion in the provision of financial services, new risks are prone to emerge. History has shown that when regulation tightens on regulated entities, activities can migrate to the unregulated space. This can result in the following risks (Vives, 2019a):

40 The signatories were the competition authorities of each G7 country (for the US, both the Department of Justice and the Federal Trade Commission), plus DG COMP for the EU.

41 See, for example, Brody (2019), Eadicicco (2019), Kang and Vogel (2019) and Kang *et al.* (2019).

42 See, for example, Institute of International Finance (IIF) (2019) for a discussion of cross-border cooperation on data flows.

1. a build-up of vulnerabilities that are not being monitored and are prone to liquidity risks given a lack of deposit-backed assets;
2. heightened cyber-attacks and operational risks; and
3. nonbank business activity (commerce) mixing with banking.

The extent to which FinTech, in itself, will have an impact on financial stability is not clear. Most financial crises of the past have had nothing to do with technology. They have historically been caused by excessive leverage or risk-taking as well as maturity or currency mismatches, and they have often been linked to asset bubbles. The unbundling inherent in the current technological disruption may create new forms of risks, not least as it may move some types of activity outside of the scope of prudential regulation and supervision. Additionally, some new FinTech business models are reliant on wholesale funding and may be vulnerable to liquidity shocks in some market stress scenarios. However, we could also see a decreased reliance on short-term debt, which has been at the root of most financial crises. Technology could create flexible solutions that reduce the need for short-term debt, such as real-time settlement.

As for AI and algorithm-based financial services using non-traditional data, it remains to be seen how they will operate in crisis conditions. Moreover, the systematic operational risks and cyber risks that arise from the increased reliance on digital systems and processes must be addressed. Traditionally, these risks have mostly been perceived and regulated as idiosyncratic risks, though the institutions attempting to balance regulatory compliance with consumer demand may push for change.

Two new technologies that have generated financial stability concerns are AI/machine learning and cloud computing. Cloud computing simply transfers the management of a server (a computer that manages the transfer and storage of data via the internet) from an entity that owns the hardware to a third party that facilitates the management of the hardware. At a theoretical level, data that reside on hardware that operates 'in the cloud' (meaning it is accessed via the internet) could be accessed by any entity at any time unless the data are properly protected via access controls and encryption. The issues of data access and data rights are further complicated by the desire of some jurisdictions to protect their citizens' data and to restrict storage, usage and IP derivatives to their own borders ('data localisation').⁴³ The trade tensions between the US and China and between the US and India highlight the focus on this issue.⁴⁴ While data controls and access should be strongly regulated across all geographies, borders are becoming less important to consumers and the portability of data more important. This is an area where countries should work together to ensure that data are equally protected and available to their owners (end users) at such time as they deem necessary. In this regards, data *ownership* is as important an issue as data protection.

⁴³ See IIF (2019).

⁴⁴ For a more detailed discussion of the issues, see Schroeder (2019), DLA Piper (2019), *The Economic Times* (2019) and Reuters (2018).

AI has become an increasingly important technology in financial and regulatory circles, given the proliferation of data.⁴⁵ The modern definition of AI is "the study and design of intelligent agents", where an intelligent agent is a system that perceives its environment and takes actions which maximise its chances of success. The important component of this definition, from a financial services perspective, is "take actions". Regulatory interest in AI will increase the more autonomy the AI takes on (for example, if a machine makes a decision about key pricing terms for a financial product or declines a customer who has applied for a financial product).

A key component of financial regulation in the US and Europe is 'disparate impact', which measures whether certain constituent groups have diminished access to key financial products based on their race, gender, ethnicity, geography or other defining characteristics. Many regulators require lenders in particular to provide a list and weighting of variables that are included in empirical analysis, along with samples of outcomes for real customers, in order to safeguard against disparate impact. The challenge with AI is that this type of disclosure cannot be provided in a true AI setting as the models change with every new data point that is ingested by the machine. As computer speeds continue to advance, regulators will need to find ways to understand and monitor equal access to core financial services. To this end, a variety of companies known as 'RegTech' have emerged to conquer this challenge and ensure compliance with applicable regulations. Many authorities will also need to become considerably more data-centric. Expanding their own public provision of data, in the form of statistical or other datasets, can be a valuable part of such efforts.

Entity versus activity based regulation and supervision

The rise of FinTech is likely to heighten the long-running debate on regulation by activity versus regulation by entity, if only because it fosters the emergence of new types of financial firms. Entities fail, not activities. Firms that require a special regime when they become non-viable, such as banks, will inevitably remain subject to specific and generally more demanding requirements than other commercial firms. That said, we expect further policy experimentation in the direction of activity-based regulation to accommodate the diversity of business models, at least as long as these have not yet stabilised into established patterns.⁴⁶

Competition and banking industry structures

The inefficiencies of the incumbent banking system are well documented. Philippon (2015) documents the unit cost of financial intermediation in the US, which has remained at about 2% for most of the past 130 years. On average, it costs 200 basis points to create and maintain the financial assets that businesses and households need for all forms of financial intermediation. But we have not observed, until very recently, productivity gains in financial intermediation

45 Big Tech and FinTech companies alike laud their AI capabilities to increase their market share and value, yet real AI is something barely used, particularly in financial services. Journalists often conflate AI with data science, supervised and unsupervised machine learning, and advanced analytics.

46 For more discussion, see Deloitte (2019), KPMG (2018) and Taussig (2019)

despite heavy investment in information technology. Vives (2019b) argues that financial technologies should “increase the contestability of banking markets and increase competition in the short term”. Philippon (2019) offers some early evidence that the unit cost of finance may be declining in recent years.

Similarly, in the euro area the rigidities in the current banking structures are a well-identified obstacle to adaptation, investment and efficiency gains. These rigidities partly reflect the desire of member states to maintain control of their national banking systems *despite* the pressure towards cross-border integration stemming from the EU Single Market framework, and more recently from the Banking Union reforms. National governments have had to erect unusual barriers, a dynamic often complemented by banking nationalism (i.e., the protection and promotion of national banking champions against foreign competitors).⁴⁷

The outcome in the EU is an ownership and governance structure that provides unusually high protection against (especially foreign) takeovers, even friendly ones. More specifically, a remarkably small share of euro area banks are listed entities with dispersed ownership.⁴⁸ The dispersed ownership model dominates in most other jurisdictions, however, and especially in ‘Anglo-Saxon’ ones such as the US, Canada, and Australia. Table 5 summarises this contrast.

Table 5 Ownership and governance structure at banks, by region

	No. of banks	GSIBs	% of aggregate assets		No. of banks	GSIBs	% of aggregate assets	
			All	Non-GSIBs			All	Non-GSIBs
Listed, dispersed	15	6	44%	16%	43	9	87%	93%
Minority influence	18	-	13%	27%	5	2	6%	2%
Private control	11	-	3%	5%	-	-	-	-
Cooperative	13	2	24%	22%	4	-	2%	5%
Public sector	19	-	10%	19%	-	-	-	-
Nationalised	8	-	6%	11%	1	1	4%	-
<i>Total</i>	<i>84</i>	<i>8</i>	<i>100%</i>	<i>100%</i>	<i>53</i>	<i>12</i>	<i>100%</i>	<i>100%</i>

Source: Véron (2017).

The patterns of ownership are likely to evolve because the loss of autonomous national prudential supervision following the banking union reforms of 2012-2014 makes financial repression through the banking system less effective and less important to defend at the level of individual euro area countries. One might expect the national banking ownership and governance idiosyncrasies in the euro area to gradually fade away, and a more ‘standard’ pattern of listed banks with dispersed ownership to correspondingly gain ground. However, this evolution is likely to be slow due to the unfinished nature of the Banking Union (Véron, 2019a).

⁴⁷ The exceptions are former communist member states which had to privatise most or all of their national banking systems in the context of their post-communist transition.

⁴⁸ Especially outside of the group of the largest banks or G-SIBs, which are protected against undesired takeover by their sheer size.

In the meantime, the patterns of bank ownership and governance make it relatively more difficult for euro area banks to mobilise large amounts of finances for their own transformation and investment. Conversely, the need for additional investment and transformation may accelerate the differentiation of outcomes between banks that can afford to invest – typically those with capital flexibility – and the others which may find themselves left behind. This governance structure leaves many euro area banks without the flexibility to make necessary changes to their business model. While many banking sectors across the globe have recovered from the recent crisis, banks in Europe are still adjusting to the post-crisis financial services landscape, against the backdrop of a challenging operating environment. Large European banks, particularly those with large investment banking businesses, are struggling to be profitable and consolidation is greatly needed.

US versus EU price-to book ratios

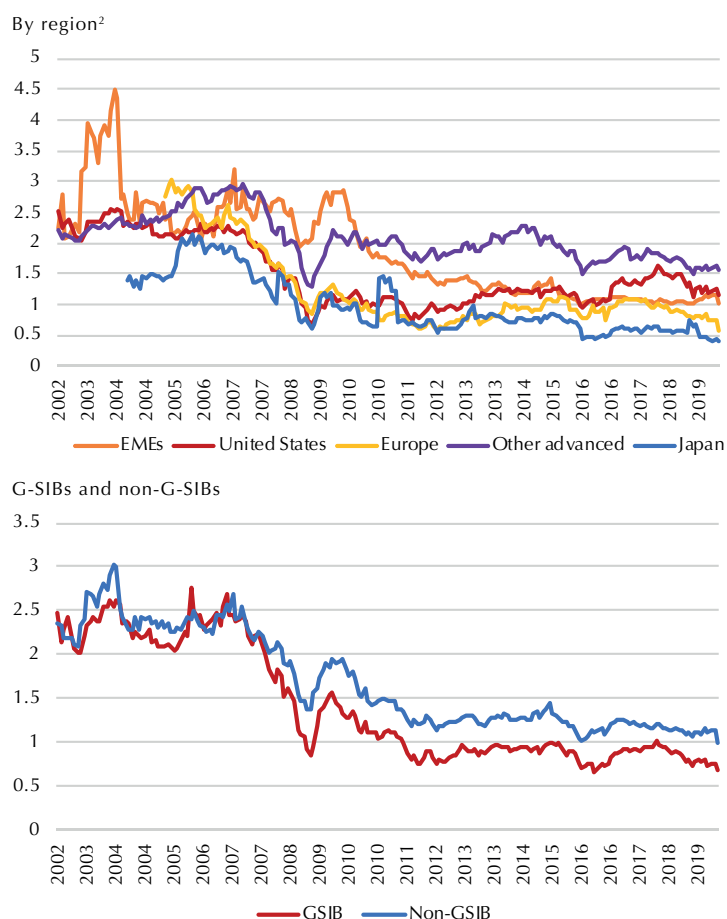
Prior to the crisis, large US and European banks had similar price-to-book ratios (at about 2 in 2006), but since the crisis, EU banks have lagged behind the US considerably. Large US bank price-to-book ratios now stand at about 1.5, while large European banks ratios are about half that level (Figure 18).

A report by the Committee on the Global Financial System (CGFS, 2018) examines the structural changes in banks since the crisis, including its potential future profitability. The study finds a number of conclusions relevant to this discussion. European banks, relative to their peers in the US and other advanced economies, face the greatest challenges in achieving higher profitability. The profit margins of European banks have generally been eroded, with many banks underperforming due to high credit or operating expenses (including misconduct-related litigation costs). Improvements in cost efficiency are essential, and progress on this front may require that banks re-evaluate their cost structures more broadly.

China

Competition and efficiency challenges are even greater in China given the pervasive control by the central Party-State, even though a number of banks – though not the very largest ones – technically have a majority of private-sector owners. State-owned banks also compete against each other, despite being subject to a common governance overlay. As a consequence, the capacity of the Chinese banking sector to generate innovation is more limited than in other jurisdictions, and financial services innovation has often come from other areas, especially private-sector nonbank firms. But since nonbank financial institutions are less regulated than banks, such innovation is associated with a higher risk of fraud and instability than elsewhere. The iconic illustration of this dynamic is the rise and fall of the Chinese P2P lending sector (e.g., Jenik and Lauer, 2017). Unlike in the euro area, where the Banking Union could lead to a more productive banking system, there is little prospect of this structural feature of the Chinese banking sector fundamentally evolving to a more dynamic and competitive system in the foreseeable future.

Figure 18 Price-to-book ratios¹



Notes: 1 Simple averages across the sample. 2 Based on the sample of individual advanced economy and EME banks in Annex 2, subject to data availability. 3 Australia and Canada. 4 Brazil, China, Chinese Taipei, Hong Kong SAR, India, Israel, Korea, Malaysia, Mexico, Qatar, Russia, Saudi Arabia, Singapore, South Africa, Turkey and Venezuela.

Source: CGFS (2018), updated by the authors.

Public authorities have to ensure that the governance, accountability, transparency and behaviour of financial firms is not at odds with the expectations of society in a manner that might threaten the sustainability of the financial system.

Data rights and obligations

As more data are used in financial services provision (for making lending decisions or tailoring customers' product offering and pricing) and machine learning and AI become more developed, policy issues around both personal and financial data protection and privacy will become increasingly important. For example, Garatt and van Oordt (2019) show that the failure of individuals to preserve

their privacy in payments by using privacy-enhancing techniques may lead to socially suboptimal outcomes (for credit provision, for example). Elliot (2019) sets out answers to some preliminary public policy questions regarding financial data ownership, usage rights and privacy. Data policies are difficult to coordinate across borders, especially with disparate laws and regulations across regions as well as differing views on data protection and privacy. Improved coordination and development of forward-looking approaches to data are needed. Loose constraints on data could result in data breaches (which are increasingly more likely as hackers become more savvy). Customers could lose trust in firms or sectors that are adversely impacted. It could result in inappropriate use of customers' data, including fraud and identity theft. Data policies that are too stringent could provide competitive disadvantages to those that collect the data or prevent customers and businesses from sharing information for obtaining loans, insurance or other financial services (Elliot, 2019). Below, we also consider the trade-offs in an open banking environment.

The 2019 Japanese Presidency of the G20 gave impetus to the idea of establishing global standards for how to define, protect, store, exchange and trade data, which could be developed by a common global standard-setter. Discrepancies in data regulation between the EU and US are considerable, with the General Data Protection Regulation (GDPR) in the EU giving individuals full ownership of their personal data while regulation is generally less protective in the US (and more complex because it is overseen at the state level). Additionally, the Payment Services Directive II (PSD2) imposes that banks in the EU grant third-party providers access to their clients' accounts for account aggregation and payment initiation, which is not the case in the US (where banks are free to deny access or charge for it).

In the US, the Business Roundtable has called for a national consumer privacy law, asserting that the lack of such a law undermines consumer trust and leaves companies to navigate through the confusion on their own and consumers with a disjointed experience and privacy expectations. The lack of data ownership laws can also hinder competition, since well-defined control and property rights play an important role in the development of competitive markets.

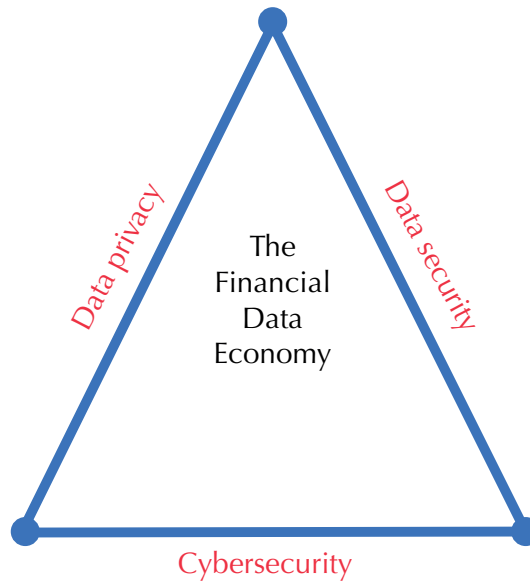
PSD2, regulating payment services providers in the EU, is an example of pro-competition regulation that attempts to provide the end consumer with greater choice over the intersection of technology and financial services. Data rights policy may also be more consumer protection oriented. A prime example of this is GDPR of 2016, which aims to provide European citizens with individual control over their personal data. Similarly, the US state of California enacted the California Consumer Privacy Act in 2018, which will become effective in January 2020, and several major Big Tech firms including Apple, Facebook and Microsoft have advocated for GDPR-like legislation at the US federal level (Tung, 2019; US Chamber of Commerce, 2019). China is also rapidly creating its own body of law in this area, aiming to strike a balance between individual, corporate and Party-State rights over data (Sheng, 2019; Bannan, 2019).

More data requires more rigorous cybersecurity monitoring and protections

Financial services firms are increasingly using new technologies to prevent and mitigate economic crimes, including cyber incidents (PwC, 2019). But as the February 2016 cyber incident at the central bank of Bangladesh illustrated, such incidents can carry enormous economic and reputational risks (e.g.,

Spicer, 2019). Kopp *et al.* (2017) document that such incidents are on the rise. Public policymakers face a difficult trade-off (see Box 8): cyber incidents could have systemic financial stability risk, but effective monitoring needs to overcome information asymmetries and coordination failures. This often requires a coordinated approach and must address data privacy, data security and cybersecurity (see Figure 19). Some work has been done to assess regulatory practices at banks (BCBS, 2018), propose regulatory architectures for cyber risk (Kopp *et al.*, 2017) or provide guidance for financial markets infrastructures (FMIs) to enhance their cyber resilience (CPMI-IOSCO, 2016) and set global security standards (World Economic Forum, 2017). However, views differ on how prescriptive these regulations should be (Cristano and Prenio, 2017).

Figure 19 Data policy operating definitions



Notes: **Data privacy** is concerned with establishing practices and policies around how information is collected, stored, used, shared and retained in order to protect the sensitive (personal) (identifiable) information. Privacy affords individuals control over their information, i.e, opting out of marketing use cases. Privacy also means the right to be left alone or forgotten.

Data security is the means by which privacy is implemented. The protection of information and information-technology systems, through controls, from unauthorised use, access, disclosures, disruption, alteration, loss, or destruction in order to provide confidentiality, integrity and availability of the information.

Cybersecurity is concerned with implementing data security to protect information against cyber (online, electronic, digital) threats, accidental exposure, malicious attacks or any other types of unauthorized access.

Source: Ranglin and Taussig (2019).

Box 8 Privacy and consumer data protection

Privacy laws need to address critical technical issues, such as: (i) the definition and treatment of de-identified data; (ii) the scope of entities covered by the law; and (iii) the method of consent, the right to data portability and the right to correct inaccurate data.

The breadth of the definition of ‘personal data’ is key for appropriately balancing privacy and commercial interests. A definition that is too broad might hinder innovation. On the other hand, sensitive personal data should warrant a heightened standard of care.

Data protection in the EU and the US

Data protection regulations differ significantly across jurisdictions. The GDPR took effect in May 2018 in the EU, restricting firms’ ability to gather and store personal data and requiring firms to notify users promptly in the event of a breach.

The US does not have a comprehensive federal data privacy legislation yet, and it appears unlikely to happen before the end of the 116th Congress. Following the EU GDPR, California passed a Consumer Privacy Act (CCPA) in June 2018.

The lack of federal consensus could have important implications over the next two years. Other states may pass their own data privacy legislation, establishing a patchwork of obligations and increasing compliance costs. The US Federal Trade Commission could begin case-by-case regulation of data privacy for repeat offenders of its unfair and deceptive acts rules.

Multinational companies have already developed compliance teams for GDPR and are in a better position to comply with the additional and sometimes conflicting responsibilities under CCPA than smaller companies, for whom the incremental cost could be prohibitive.

Some industry proposals

Some important industry actors, however, continue to push for a single US data privacy standard. Since the passage of the CCPA, several banks and technology companies have partnered with the US Chamber of Commerce ("US Chamber") to draft a national privacy law that standardises privacy, data security and basic cybersecurity requirements in a single, federally pre-emptive bill (US Chamber of Commerce, 2019).

The US Chamber argues that such a legislation should establish a nationwide privacy framework. Consumers and businesses benefit from predictability and consistency, and they lose when they have to navigate a confusing and inconsistent patchwork of state laws. Businesses should be transparent about the collection, use and sharing of consumer data and provide consumers with clear privacy notices.

The laws and regulations should be industry neutral and flexible. Privacy laws should not require businesses to use specific technological solutions to implement consumer protections. They should include safe harbours and other incentives to promote the development of adaptable, consumer-friendly privacy programmes. According to the US Chamber, enforcement provisions of a federal data privacy law should only apply where there is concrete harm to individuals.

Difficult issues for the near future

Pre-emption and rescission are likely to remain difficult political issues. The establishment of a federal standard that pre-empts state regulation of data privacy is critical to industry support, but the House might reject a federal bill that provides fewer privacy controls than CCPA. Federal law already includes privacy protections, including GLBA, FERPA, HIPPA and COPPA. Businesses already subject to a federal privacy law have expressed divergent views on the value of being covered by a new federal law instead of existing law.

Several House members have expressed support for allowing individuals the right to sue companies for privacy violations. Senator Schatz, a member of the Senate Commerce Committee working group, has introduced a data protection bill, the Data Care Act, with 14 other senators, that would establish a federal duty of care for data usage and protection.

In the absence of a better solution, the FTC could respond to public pressure by imposing fines and requiring company-specific plans to remediate poor data privacy practices evidenced by repeat violations of the FTC's unfair and deceptive acts rules. The FTC has privacy enforcement jurisdiction only over companies that have breached a prior FTC settlement; it does not have authority to do a broad privacy rule-making.

Finally, the EU-US Privacy Shield, the legal mechanism by which transatlantic data flows occur, is based on mutual US and EU data privacy adequacy determinations. Many EU officials have said that US enactment of federal privacy legislation is important to the continuing existence of the Privacy Shield, and the EU is likely to continue to be frustrated by the lack of action in the US.

Addressing financial inclusion

FinTech holds the promise of improving financial inclusion by offering affordable financial solutions to underserved communities. For countries with underdeveloped financial systems, new technologies could offer an opportunity to 'leapfrog' stages of financial sector development (Claessens et al, 2001). It can also create challenges, however, and the net welfare consequences will certainly depend on the quality of regulations and probably on the particular market where the innovation takes place.

Philippon (2019) argues that the welfare consequences of FinTech could be different for asset management services than for credit provision. He analyses two features of new financial technologies – returns to scale and big data – and argues that changes in the nature of fixed costs and returns to scale are likely to improve access to financial services and reduce inequality. To understand this result, one needs to distinguish between two types of fixed costs: the fixed cost of creating a company or entering a market, and the fixed cost of servicing one client. The fixed cost per client used to be significant and prevented poor households from accessing some financial services (e.g. asset management services). Robo-advisors can drastically reduce this cost. By lowering the fixed cost per relationship, computer-based advising allows more households to benefit from advisory services. The entry cost (e.g., the cost of writing the code), on the other hand, can remain significant but it is spread among many households and, importantly, the rich pay the lion's share of the fees that serve to cover this cost. Once the cost is paid, poor households benefit from cheap services. Philippon (2019) therefore argues that FinTech is likely to improve access to asset management and other services where fixed costs per client can be reduced. There is additionally some evidence to suggest that FinTech firms can fill gaps in the provision of financial services when banks reduce their presence in certain markets (e.g., mortgage lending) (Buchak *et al.*, 2018).

Capacity to provide SME credit

Small businesses stand to benefit from access to new data sources and models. New entrants, combined with lighter regulation on the use of data, have allowed new FinTech entrants to serve a market that has been underserved – particularly since the financial crisis of 2007–8. There are roughly 30 million small and medium-sized businesses in the US, employing nearly 48% of the work force (US Small Business Administration, 2018). These businesses are generally seeking less than \$250,000 in working capital, yet traditional banks struggle to serve them because it is not economically efficient for them to do so. Underwriting a business for a \$5 million line of credit involves the same cost as a \$50,000 line of credit, and therefore banks tend to focus on larger businesses. FinTech lenders are using new data sources to serve this large market and are making significant inroads (Pryce, 2019).

Tech disruption and emerging economies

Regulating nonbanks in emerging markets brings particular challenges. M-Pesa in Kenya, for example, operates a microfinancing product that was initially launched by a telecom company and is now one of the most successful branchless providers of core banking services in the developing world. Prudential regulators generally see rapidly scaling nonbank financial platforms such as M-Pesa as a positive catalyst for bringing the unbanked and informal businesses into the formal economy, banking system and tax base. However, regulators struggle to figure out how to regulate the huge swath of business models and activities in this sector.

In another example, the Indonesian Financial Services Authority (OJK) has ambitions to improve services to consumers and SMEs classified as unbanked and underbanked. However, it has been challenging to implement regulations and rules that preclude predatory lenders from accessing the Indonesian consumer because of the volume and complexity of platforms currently operating and seeking licensure.

Public sector officials around the emerging world struggle to effectively wield their authorities, scope and capabilities with respect to regulating, supervising and overseeing nonbank FinTech entrants and other tech giants entering the ecosystem. Many private sector participants point to regulatory regimes that are not empowered to regulate nonbanks, while others point to a poor base of technologists that can accurately understand and respond to the privacy, data security, cybersecurity and disparate impact risks presented to the consumer and the financial ecosystem by Big Tech and FinTech models.

Accommodating global diversity

All of these policy challenges must be addressed by authorities in jurisdictions that are becoming more diverse in terms of political regimes, legal systems, institutional arrangements, and levels of financial and economic development. At the same time, technology is removing barriers imposed by geographical borders and multiplying incentives for authorities to collaborate internationally.

The border-hopping nature of technology, and the global reach of Big Tech firms, will shift the balance between what has until now been handled at the national level and the international level. Even if banking balance sheets are geographically ring-fenced, the similarity of technology-enabled user experiences across borders will imply that more frictions, costs and opportunities for harmful arbitrage may result from diverging regulations between jurisdictions. Public authorities might consider preparing to expand the scope for international financial services policy coordination and regulatory harmonisation. They might even consider targeted experiments of supranational supervision (see below). This observation also relates to the growing concerns about fragmentation as a consequence of the significant number of financial regulatory initiatives introduced in the wake of the financial crisis of 2007-8. Japan's G20 presidency, for example, is working to address market fragmentation as one of its G20 priorities.

Inevitable versus unnecessary fragmentation

The diversity of institutional structures and legacies across the world's jurisdictions will prevail, despite the technology-driven disruption. As a consequence, it is inevitable that different policy choices will be made and that some fragmentation will be unavoidable. The vision of a seamlessly integrated global financial system will remain broadly as remote in the era of FinTech and Big Tech as it was before these new players entered the financial services landscape. Even so, there is a distinction between *inevitable* fragmentation and *unnecessary* fragmentation.⁴⁹

⁴⁹ We thank Sir Jon Cunliffe for his insightful comments on this topic at the May 2019 'Geneva' conference.

The degree of system fragmentation can and should be mitigated by targeted policy initiatives. This has long been the case for global financial standards, such as International Financial Reporting Standards (IFRS) or the successive Basel Accords.

A prime example of unnecessary fragmentation is the implementation of the reforms initiated by the G20 in 2008-2009 in the area of derivatives markets. In particular, the G20 mandated the reporting of all derivatives transactions to specialised entities designated as 'trade repositories'. The stated aim was for financial policymakers to have a globally consistent, near real-time picture of derivatives exposures to be able to assess risks more effectively in the future (for example, to better assess events such as the September 2008 distress at Lehman Brothers and AIG) (G20, 2009). The implementation of the reporting mandate was left to individual jurisdictions, which used different data standards and platforms, and a decade later a global view of current derivatives exposures remains a distant dream despite recent improvements in global standard-setting. In the case of the trade repositories, data collection standards should have been introduced by public authorities prior to the collection of data and with either more stringent requirements for the interoperability of repositories or a framework that could accommodate a single, globally integrated repository. The lessons learned from this policy misstep can instruct future reforms.

Big Tech and prospects for a global currency

If Big Tech firms are willing, from a business model and regulatory perspective, to compete directly with banks on their product and service offerings, the effects could rapidly prove disruptive to the core business of banking. Some Big Tech firms are so large that a chartered bank inside of their naturally advantaged corporate scope could muscle out incumbent banks and create an oligopoly that stifles competitive pricing, suppresses innovation and concentrates risk. This calls for the maintenance of a cautious stance as to which firms could be permitted to participate in consumer banking.

Due to its potential ability to rapidly become systemic, Facebook's Libra proposal instilled a sense of urgency in policymakers to form a globally consistent view on what can and needs to be done from the policymakers' perspective. Libra and other such proposals highlight the current shortcomings in the financial system, especially regarding cross-border payment systems. Technology firms, and advances in financial services provision more generally, may be able to resolve some of these shortcomings. At the same time, authorities have a duty to assess what regulatory framework(s) are best suited to assure safety and soundness for end users, whether for payments or storage of funds, and to ensure robust, level-playing field competition with other market participants. Additionally, public sector officials should consider what more they can do directly and indirectly to improve the current financial system, particularly with respect to issues of financial inclusion and efficient cross-border payments.

What is clear from statements to date by public officials (Schulze and Choudhury, 2019) is that financial services that have the potential to rapidly achieve a globally systemic size will not be allowed to operate until authorities are satisfied that adequate regulatory frameworks are in place and the multitude

of risks have been adequately mitigated. Authorities and firms alike may also decide once again that banking and commerce should not mix, but such decisions should be made taking considerations of both current proposed arrangements and the potential for future innovations alike.

Separating banking from commerce

To date, no Big Tech firms have been granted a full-fledged deposit-taking banking licence in the West, though both Alibaba/Ant Financial and Tencent in China have banks (BIS, 2019; IIF, 2018). In the US and Europe, some have been granted e-money licences (see Box 9). Additionally, some have applied for limited or special purpose banking charters. Alibaba's and Tencent's moves to offer banking services and the desire of Social Finance (SoFi), Square and Rakuten (a Japanese e-commerce company) to become industrial loan companies (ILCs) have reignited the age-old debate in the US on the separation of banking and commerce. These events have revived regulators' concerns that emerging tech giants and nonbank FinTechs lack the appropriate methods for managing financial applications by risk and activity (see Box 10 for a history of the ILC debate).

Box 9 Payment licensing and regulation

In early 2018, Uber Technologies Inc. quietly applied to the Dutch central bank for an electronic payment processing licence under the trade name Uber Payments BV, reportedly to diversify Uber's breadth of services (see below for a selection of recent non-banking licences granted in the EU). The same month that the second EU Payment Services Directive (PSD2) rolled out, an Uber spokesperson confirmed that becoming an electronic money institution (EMI) with "an e-money licence will enable us to support the continued innovation and growth of our business in Europe by streamlining our payment processes".

Did Uber want to reduce fees paid to payment service providers (PSPs) by bringing the functionality in-house, or is it approaching the consumer with a more tactical FinTech offering by placing itself inside the customer's wallet when they need a ride or another Uber service? Uber's intentions are unclear, but the licence provides business model flexibility and options. Uber could create e-wallets to generate Uber credit and digital Uber cards to better connect with the end consumer-rider, or it could lay the groundwork for driver financing, or instantly settle payments as the ride is complete.

Elsewhere in the world, Singapore-based Uber rival, Grab, was perfecting a P2P payments platform that also offered car insurance and micro-loans for drivers. Grab has applied for e-money licences and received approval from the Philippines in 2018.

Uber's and Grab's forays into the FinTech ecosystem were fairly quiet and non-controversial. By contrast, Alibaba's entry into the regulated EU financial space has generated controversy and highlights the age-old debate about mixing commerce and banking. Alipay in Luxembourg, part of the Alibaba Group, received a licence in early 2019 for a new entity called Alipay (Europe) Limited S.A that allows the company to make e-payments under

the PSD2 regime to connect Chinese customers with merchants in EU by leveraging EU-wide ‘financial passporting’. This allows, for example, Chinese tourists access to EU merchants when physically paying with mobile pay, and a larger cross-border trade scheme for EU merchants wanting to do business with Chinese retailers without international money transfers or prolonged payment terms.

Alibaba’s Alipay application move to place cash on payment accounts, execute transactions, acquire payments, remit money and potentially offer future cash withdrawals brought much more attention to the debate about the separation of banking and commerce. Google, Facebook, Amazon, eBay and Starbucks similarly argue that their applications for point-to-point mobile payments, credit, remittance and transaction execution authority are central to what they view as their global missions.

Selection of recent non-banking licences granted in the European Union under PSD2

Company	Country	Reason for licence
Airbnb Payments UK Limited	UK	Freedom to provide payment services
Alipay - Alibaba	Luxembourg	Issuing, distribution and redemption of electronic money, utilise digital wallet and ancillary services
Alipay - Alibaba	UK	Ability to place cash on payment account, cash withdrawals, executing payment transactions, executing payment transactions with line of credit, issuing/ acquiring of payment instruments, money remittance, and executing payment transactions by telecom, etc.
Alphabet, Inc., Google Payment Lithuania UAB	Lithuania	To authorise the issue of and redeem electronic money and provide payment services
Amazon Payments Europe	Luxembourg	Issuing of electronic money – execution of payment transactions including transfers of funds on a payment account with the payment service provider
Bancom Europe Limited	UK	Issue electronic money, distribution and redemption of electronic money, cash withdrawal, payment transactions, payment transactions by line of credit, acceptance of payment transactions, ability to place cash on a payment account
CashDash UK Limited	Cyprus	Issuing, distribution, and redemption of electronic money
Devere E-Money	Lithuania	Issuing, distribution, and redemption of electronic money
eBay	Luxembourg	Execution of payment transactions, including transfers of funds on a payment account with a payment service provider

Company	Country	Reason for licence
Ebury Partners UK Limited ZNL Österreich	Austria	Ability to issue electronic money and provide payment services (must refrain from AIS or PIS for an indefinite period of time); ability for cash payment on account, cash withdrawals, payment transaction, payment transactions covered by a line of credit, money remittance, execution of payment transactions via IT system or network operator
Facebook	Ireland	To issue e-money and payment services including credit transfer, payment transactions, and money remittance; ability of the execution of credit transfers including standing orders, issuing of payment instruments and/or acquiring of payment transactions, and money remittance
First Data GmnH	Germany	Issuing, distribution, and redemption of electronic money
HiPay ME	Belgium	Issuing of electronic money, distribution/redemption of e-money, execution of operations of payment, execution of operation of payment with line of credit
iCard	Bulgaria	Issuing, distribution and redemption of electronic money
Ingenico Finacial Solutions	Belgium	Issuing, distribution and redemption of electronic money
International FinTech UAB	Lithuania	Issuing of electronic money, distribution/redemption of electronic money, issuing of payment instruments and/or acquiring of payment, execution of payment transactions
Lycamoney Financial Services Ltd	UK	Issuing of electronic money, distribution/redemption of electronic money, and money remittance
Mangopay S.A.	Luxembourg	Issue of electronic money, distribution/redemption of electronic money
Mister Tango	Lithuania	Issuing, distribution and redemption of electronic money
Papaya Ltd.	Malta	Issuing of electronic money, distribution/redemption of electronic money, ability to place cash on a payment account, cash withdrawals, payment transactions, payment transactions by line of credit, acceptance of payment transactions
Payoneer	Gibraltar	Issuing, distribution and redemption of electronic money
Paysera LY	Lithuania	Issuing, distribution and redemption of electronic money
PerfectCard DAC	Ireland	Can place cash on account, cash withdrawal, execution of payment transactions through card, and ability of issuing of payment instruments and/or acquiring of payment transactions
Qivi Wallet Europe	Latvia	Issuing, distribution and redemption of electronic money
Revolut	Lithuania	Issuing, distribution and redemption of electronic money
Seven Seas Europe	Lithuania	Issuing, distribution and redemption of electronic money
SnapSwap International S.A.	Luxembourg	Issuing of electronic money

Company	Country	Reason for licence
Starbucks Card Europe Ltd	UK	Issuing of electronic money
Stripe Payments UK Limited	UK	Issuing of electronic money and provide payment services
SysPay Ltd.	Malta	Issuing, distribution and redemption of electronic money
Trustcom Financial UAB	Lithuania	Issuing, distribution and redemption of electronic money
Uber Payments BV	Netherlands	To register Uber Payments BV as electronic payment institution
Viva Payment Services S.A.	Greece	Issuing, distribution and redemption of electronic money
Volkswagen Payments	Luxembourg	Issuing of electronic money
Yoyo Wallet Limited	Cyprus	Issuing, distribution and redemption of electronic money

Box 10 Separation of commerce and banking: The Walmart case study

The quintessential banking and commerce discussion begins with the ‘big box’⁵⁰ desire to enter the banking industry.

Washington policymakers have in the past allowed specific commercial product companies to create chartered banks, such as the BMW Bank of North America Industrial Loan Company and the Toyota Financial Savings Bank, without restriction on the maximum size of the parents.

In 2005, however, US federal regulators, aligned with a broad coalition of large banks, community banks, grocers, and members of the US Congress (Wysocki, 2006), opposed Walmart’s bid for an industrial loan company (ILC) charter⁵¹ to process payments.

Banking industry advocates, academics and regulators have long debated whether commercial enterprises should be allowed to own and operate full-service state, limited purpose, or national banks. Opponents typically point to safety and soundness, fair competition, Congressional intent, transparency and trust and historical precedent for maintaining the separation of banking and commerce in the US. Supporters of the separation of banking and commerce argue that since banks are special and enjoy a government safety

50 A ‘big box’ retailer is a retail store that occupies an enormous amount of physical space and offers a variety of products to its customers. These stores achieve economies of scale by focusing on large sales volumes (see https://www.investopedia.com/terms/b/big_box_retailer.asp).

51 An industrial loan company or charter is an industrial bank financial institution that is permitted to lend money and take limited deposit structure, and, uniquely, may be owned by non-financial institutions because they are exempted from provisions in the Bank Holding Company Act. ILCs in the US are regulated by state-charters but also offer FDIC-insured deposits subject to Sections 23A and 23B of the Federal Reserve Act, which limits bank transactions with affiliates, including the non-bank parent company (FDIC.gov). ILCs generally cannot accept demand deposits that the depositor may withdraw by check or similar means for payment to third parties but can use negotiable orders of withdrawal accounts. Most ILCs are in the state of Utah, but others are also chartered in California, Colorado, Minnesota, Indiana, Hawaii, and Nevada.

net, they should not engage in risky commercial activities. “There have been times when banks invested in, or formed affiliations with, commercial enterprises. Indeed, failures of depository institutions involved with commercial activities triggered serious financial crisis on several occasions” (Wilmarth, 2007).

Walmart first applied to the state of Utah and the Federal Deposit Insurance Corporation (FDIC) in 2005 for an ILC charter after carefully examining its failure in the late 1990s to acquire Federal BankCentre,⁵² an Oklahoma-based savings and loan bank. Through 2001 and 2002, Walmart executives worked to establish partnerships with TD Bank to offer limited payment services and later to buy Franklin Bank, an existing California ILC with direct payment service access, but the Office of Thrift Supervision (OTS) and the California Legislator both succumbed to intense political pressure to block Walmart’s retail banking plans. The widespread view was that a commercial giant’s ownership of a bank could create irreversible conflicts of interest with respect to the impartial allocation of credit and idiosyncratic risks, and present safety and soundness challenges within the depository institution, parent company and the secondary markets.

The FDIC’s Advisory Committee on Banking Policy said in 2005 that “[the] FDIC’s supervisory experience with ILCs suggests that ILCs charters pose no greater safety and soundness risk than do other charter types. ... The FDIC and state chartering authorities directly supervise insured ILCs, which must comply with the FDIC’s Rules and Regulations, including but not limited to, requirements for capital standards, safe and sound operations and consumer compliance and community reinvestment” (FDIC, 2005).

Walmart’s 2005 bid to “reduce credit and debit card transaction costs” without opening branches was viewed as not acceptable. Walmart’s application “provoked intense opposition” from a broad coalition of parties (Wilmarth, 2007, p. 1542). In July 2006, the FDIC placed a six-month moratorium on Walmart’s application and then extended it in January 2007 for another year (FDIC, 2007). A three-year legal moratorium on ILC approvals was adopted in the Dodd-Frank Act of 2010.

Alibaba’s move to offer banking services and the ILC desires of Social Finance (SoFi), Square and Rakuten (a Japanese e-commerce company) have reignited the ILC debate and revived concerns among regulators, banks and other parties that emerging tech giants and nonbank FinTechs lack the appropriate methods for managing financial applications by risk and activity (Clozel, 2017; 2019).

The Independent Community Bankers Association of America (ICBA) has led the faction opposing the ILC applications by SoFi, Square and Nelnet Bank (ICBA, 2019). The ICBA and others have taken the position that ILC charter holders avoid key examination and supervision requirements that full-service national banks are subject to for safety and soundness protections. The present arguments question whether further technology integration(s)

52 See <https://www.latimes.com/archives/la-xpm-1999-jun-30-fi-51528-story.html>. The acquisition failed because the US Congress enacted the Gramm-Leach-Bliley Act (GLBA) of 1999, which prohibited nonbanks from outright purchasing thrifts and nullified Walmart’s efforts to directly enter the consumer retail banking sector (Neely, 2007).

will cause a concentration risk for bank and nonbank assets at the holding company and bank level that could spill over to public and secondary markets, ultimately putting depositors and related or affiliate organisations at risk. Of principle concern to ILC opponents is that ILCs are not supervised by the Federal Reserve's prudential regulation powers under the Dodd-Frank Act that allow for close examinations of holding companies and bank owners.

Regulatory concern about fully consolidated supervision from all relevant prudential regulators has been central to the ILC debate. The Federal Reserve's *Bank Holding Company Supervision Manual* (Federal Reserve System, 2019) states that: "Financial trouble in one part of an organization can spread rapidly to other parts of the organization; moreover, large [bank holding companies] increasingly operate and manage their businesses on an integrated basis across corporate boundaries. Risks that cross legal entities or that are managed on a consolidated basis cannot be monitored properly through supervision directed at any one of the legal entity subsidiaries within the overall organization." The idea is that the Fed needs consolidated supervision to fully understand the risks a bank and parent present to the system and the deposit base and taxpayer, and the Fed does not have such detailed insight into ILCs. The assumption is that ILCs may engage in riskier behaviour or forgo Fed interventions that would stabilise the entity before the parent or bank became insolvent. It is important to note though that an ILC's holding company parent is subject to the "source of strength doctrine" (Dodd-Frank) that requires parents to support a struggling bank with cash injections, and regulations govern affiliate relationships, including certain safety and soundness practices.

Congressional debate around the mix of banking and commerce has touched on concerns about federal 'safety nets' in the event of receivership for commercial owners and fears that a bank may suffer as a result of reputational or idiosyncratic performance issues from its parent company. Opponents have also suggested that the commercial owners may engage in anticompetitive behaviours when it comes to serving customers not affiliated with their commercial brand or provide preferential commercial rates to commercial business partners, thus concentrating greater economic power in a limited number of large conglomerates.

The cohort of ILC advocates has predominantly argued that some, though not all, commercial brands are well positioned to serve the banking consumer with respect to higher quality products, enhanced service and a deeper appreciation to meet the demands of the underserved with inclusive products. ILC proponents point to FinTechs' dedicated financial mission as opposed to true retail use case and to the use of large inclusive datasets as an opportunity to bring non-bank financial services into a more regulated space while allowing for integration with consumer financial transaction.

Some FinTechs, such as Square, are seen as poised to bridge the traditional financial system and the underserved community by engaging directly with consumers and removing intermediaries in the payments space. Industry advocates suggest such technological and business model efficiencies with access to high quality customer data at economies of scale, typically generated and permissioned by the customer, could reduce the costs of lending, making

and taking payments, and accepting consumer and commercial deposits. Technology platforms have demonstrated an ability to quickly scale, offer competitive products, and reach customer bases across vast geographic areas, thus introducing a diversification function for potential ILC applicants that serves the mission for financial inclusion and reduces traditional deposit base concentration risk concerns.

Federal regulators may increase the attractiveness of the ILC option for some established FinTech models given formal and offhand comments about the Office of the Comptroller of the Currency's proposed limited Special Purpose National Bank charter. The lack of certainty on where the Federal Reserve stands on key issues – such as the application of the Bank Holding Company Act and the legal definition of a bank (deposit taking activity) – may drive financial and risk decisions at the board level to avoid the legal and political troubles of a FinTech *de novo* full service or limited purpose charter.⁵³ Certainly, the ILC charter has its own challenges, but it may be an attractive option depending on the FinTech's business model and appetite for safety and soundness supervision.

US state regulators have directly responded to technology companies' interest in banking and commerce with the coordinated Vision 2020 programme, organised by the Conference of State Bank Supervisors (CSBS) to make "supervision more efficient", a rare recognition that differing nonbank state regulatory standards hamper certain financial innovations. CSBS' mission for Vision 2020 is generally recognised as harmonisation and uniformity of licensing, regulations and examination standards across state regulatory and legislative bodies (Taussig, 2018b).⁵⁴

The safety and soundness arguments from opponents predominantly stem from a lack of full transparency of the activities of the parent firm, but ILCs' state regulators are fully capable of enacting additional oversight, although so far they have not. State regulators and legislators, potentially through the Vision 2020 platform, could coordinate with the FDIC and other federal examiners to ensure the state regulator has access to non-public financial information from the commercial holding company and can take additional steps or enforcement actions against the parent corporation in the event safety and soundness concerns, consumer protection violations or anti-competitive behaviour are observed. From a taxpayer's perspective, the St. Louis Federal Reserve points to the Conseco bankruptcy in 2002 as an example of a proper wind down with sufficient information for all parties. The solvent ILC was sold to GE Capital when the parent company declared bankruptcy and there was no loss to the taxpayer via the FDIC (Blair, 2005).

Maintaining the separation of commerce and banking is a distinctly US-centric topic and points to the fact that the US is out of step with most countries. A survey of 142 countries conducted by the World Bank in 2007 found that only four prohibited commercial firms from owning banks (the

53 Noted by Sam Taussig, head of global policy at Kabbage, in Witkowski (2019).

54 Federal laws supersede state laws whenever there is a conflicting provision (Article VI of the US Constitution). National banks are not subject to many state banking laws and provide a competitive advantage over firms that do not enjoy the benefits of a national charter, though the Dodd-Frank Act provided state consumer financial regulators expanded powers (12 U.S.C. § 25b) over all financial institutions.

other three being Fiji, Guernsey and the Isle of Man) (Barth and Tong, 2011). But history suggests that it will be a contentious ILC application process for SoFi, Square and Rakuten. The ICBA is again calling for an ILC moratorium “before irreversible steps are taken” (ICBA, 2019, p. 4). The continued resistance today illustrates the deep-seated belief in the separation of banking and commerce in the US that has prevailed since the early 20th century. Banking industry advocates, academics and regulators have long debated whether commercial enterprises should be allowed to own and operate full-service state, limited purpose, or national banks. Opponents typically point to safety and soundness, fair competition, congressional intent, transparency and trust, and historical precedent for maintaining the separation of banking and commerce in the US.

The regulatory and systemic risk of combining banking and commerce requires further attention. Section 123 of the Dodd-Frank Act required the Financial Stability Oversight Council (FSOC) to study the economic impact of “financial services regulatory limitations intended to reduce systemic risk and to make recommendations regarding the optimal structure of any limits considered” with respect to banks carrying out nonbank activities.⁵⁵ The FSOC found that:

“[t]he limited literature on combining traditional banking and non-traditional higher-risk operations does not support either strict separation or unrestricted mixing. Some researchers find that allowing banks to engage in non-traditional financial activities appears to have been socially beneficial. Other researchers find that removing the barriers separating bank and nonbanks appears to have increased systemic risk. In many cases, however, the evidence concerning segregation of banking and nonbanking financial activities is still quite limited, suggesting a robust agenda for future research”

(US Department of the Treasury, 2011, p. 47).

Systemic concerns should prevail against the attractions of granting Big Tech companies any banking licences. But we must also balance consumer benefits with opportunities for financial inclusion and innovation, enhanced commerce and the reality that many consumers expect and demand technological integration with banking and commerce platforms. Some financial technology firms that have a history of offering banking services may deserve closer examination, especially if considering undeserved markets. We suggest that additional research focus on examining Herfindahl-Hirschman Index (HHI) values for Square and other bank charter applicants to determine market concentration and the potential for concerning levels of market power concentration across banking, e-money or other special purpose licences.

The Libra proposal for a digital coin arrangement raised concerns among policymakers, academics and financial institutions because of its potential to reach systemic importance rapidly and the ‘untested’ nature of the emergence of a global (relatively) stable digital currency (Cœuré, 2019). Central bankers raised concerns regarding the potential impact on the effectiveness of monetary policy and risks to financial stability, as well as longer term implications for the monetary

⁵⁵ See Dodd-Frank Wall Street Reform and Consumer Protection Act (2010) and US Treasury (2011).

system and the role of the central banks.⁵⁶ Specifically, policymakers noted that global digital coin arrangements “may raise broader issues for the international monetary system, in particular if they become a widespread substitute for cash and deposits in some economies” (Cœuré, 2019). The proposal also raised risks related to “public policy priorities including, in particular, anti-money laundering and countering the financing of terrorism, as well as consumer and data protection, cyber resilience, fair competition and tax compliance” (Cœuré, 2019).

Questions were raised as to how the Libra would protect users’ data, particularly given the recent issues that have emerged with Facebook’s data breach and use of customer data (Spangler, 2019). The Libra white paper noted that Libra data would be kept separate from Facebook’s social media data, but was not clear on whether the social media data could be shared with Libra to augment financial data for making potential financial decisions. It additionally raised a host of legal and governance questions regarding what rights the users of the Libra coin would have, and how and where the reference assets to the coin would be managed and kept.

Underlying these concerns, the very framework under which the arrangement would be regulated and supervised was unclear. Policymakers were quick to clarify, however, that Libra would not be allowed to operate until the arrangement appeared “rock solid” to regulators and met the “highest regulatory standards and be subject to prudential supervision and oversight” (Schulze and Choudhury, 2019; Mallet, 2019; Jones, 2019). ECB board member Benoît Cœuré has asserted that for something as important as a new payment system that could be accessible to over two billion individuals across the globe, everything needs to be “safe, robust, and resilient from day one” (Capana and Thomas, 2019).

As with the Sofi, Rakuten and Square applications for ILC charters, policymakers have a number of issues and questions to resolve before granting such permissions. Regardless of the outcome, technology firms will continue to innovate and proposals such as Libra will continue to press the debate. Innovators equally must resolve numerous issues and challenges: “Significant work...and further engagement with the public and authorities will be required before they [innovators] can expect approval by relevant authorities” Cœuré (2019).

Prudential framework: No scope for relaxing the constraints

The financial regulatory reforms that were put in place post-crisis were comprehensive and wide-reaching, but there is more to be done. Implementation should be completed, and the effectiveness of those financial regulatory reforms should be evaluated. A number of policymakers have stated this publicly and the global community has taken action. The FSB and other standard-setting bodies regularly monitor implementation. The FSB has put in place a framework to evaluate the post-crisis G20 financial regulatory reforms and has completed two evaluations, with another two underway.⁵⁷

Naturally, the reforms that were easiest to implement were implemented first, and those remaining pose challenges. The FSB standards for bank resolution regimes are essentially untested and work remains in areas such as funding in resolution and developing effective cross-border cooperation and information

⁵⁶ See Tucker (2017) for a thorough discussion of the political economy of central banking in the digital age.

⁵⁷ See the “Effects of Reforms” page on the FSB website.

sharing agreements (FSB, 2019c). As for prudential regulation, the Basel III Accord (BCBS, 2018) has largely been implemented, but there remain considerable lapses in compliance (BCBS 2014; 2017). Evaluations on the effects of reforms are proceeding but are in their early stages. Unlevel playing fields result from inconsistent and/or delayed implementation and could produce competitive disadvantages.

Consumer and investor protections

The immediacy of newly technology-enabled financial transactions creates unprecedented scope for financial firms to exploit the asymmetries of information inherent in the provision of most financial services, creating new risks for retail customers in particular. Conversely, the ease of access to multiple financial services platforms opens up new avenues for customer fraud, which can in some cases endanger the viability of financial services providers. Many financial customer protection rules were established in an era of personal contact between customers and service providers and require extensive rethinking in an era when that interaction becomes increasingly remote. In this area, however, the scope for global coordination is limited. While integration efforts in the euro area/EU would be welcome to achieve the objective of a single market, elsewhere we view consumer and investor protection as a predominantly local endeavour – setting aside wholesale investor protection standards such as the IFRS and, of course, anti-money laundering and countering the financing of terrorism (AML/CFT).

The global approach: Targeting and experimentation

To prevent unnecessary fragmentation while accommodating the diversity of jurisdiction-specific legacies and challenges, global policymakers will need to carefully differentiate and target their efforts. The rhetoric that accompanied the G20 reforms initiated a decade ago often suggested that financial regulatory efforts should, in principle, be coordinated at the global level. In practice, this is difficult (Rottier and Véron, 2010). Even so, it may be that more ambition at the global level will be needed than has been the case in the past in some specifically defined market segments.

Continued monitoring of financial stability risks, as is conducted in many central banks and in standard-setting bodies such as the FSB, helps to detect new and emerging risks – especially those emanating from new digital products and activities and new types of entities – and to mitigate financial crises. This presents a challenge as such digital developments are occurring at a rapid pace and may be difficult to detect, particularly when sufficient data to detect vulnerabilities are lacking. Given the potential for large players to provide financial services outside the traditional banking sectors, vulnerabilities could be increasing without appropriate monitoring or oversight. An adverse shock could result in vulnerabilities unwinding quickly (i.e., runs on entities), with significant adverse impacts on financial services (FSB, 2019a).

For effective and sufficiently integrated monitoring and assessment of risks at the global level, and given the increasingly border-hopping nature of finance enabled by new technology, the system will need some adaptations, including institutional experimentation. An increasing array of critical data and information intermediaries are naturally global in scope, and presumably not all of them will

be left unregulated. Indeed, market segments such as credit ratings agencies, trade repositories and benchmark index providers have been brought within the scope of public supervision in many jurisdictions over the past decade, and more are probably to come – not least among new technology-enabled models. It is questionable whether their supervision can be durably left to individual jurisdictions without resulting in harmful fragmentation of the global financial information system.

One novelty of the past decade has been the advent of supranational financial supervision in the highly specific environment of the EU and the euro area. Ratings agencies and trade repositories have been supervised by the European Securities and Markets Authority (ESMA) since 2011 and 2013, respectively, and euro area banks have been supervised – the larger ones directly, the smaller indirectly – by the ECB since late 2014. Some of the corresponding reforms, such as the licensing of banks by the ECB as a supranational monetary authority, clearly cannot be extrapolated beyond the EU context. But the European proof-of-concept of supranational supervision may inspire similar reasoning in a wider geographical context and even possibly (if only for some data-heavy, balance-sheet-light market segments) at the global level. After all, the idea of supranational supervision was deemed utopian in the EU itself before the financial crisis of 2007–8 and the euro crisis made it an inescapable necessity there. It may be wise for international financial policymakers to consider more limited forms of enforceable supranational financial oversight in a proactive manner if there is a significant likelihood that a future crisis would force them to do so under duress (Véron, 2019b).

Financial authorities must adapt

Financial regulatory authorities, unlike some incumbent financial firms, do not face an existential challenge from technology-driven disruption – but many of them will need to change to effectively fulfil their mandate in a fast-changing environment. As Bank of England Governor Mark Carney quipped, “anything that works in this world [the network of Facebook] will become instantly systemic and will have to be subject to the highest standards of regulation” (Reuters, 2019). We believe that financial authorities face a number of complex interrelated challenges in this context and raise four ways that authorities must adapt to the emergence of fintech and big tech.

First, and perhaps most critically, financial authorities may need to find new ways of working together with their peers across the globe as well as with non-financial authorities. This will involve several challenges. Alongside their peers, financial authorities will have to define new modes of cross-border coordination and, in some cases, possibly pooling of their mandates when these cannot be effectively fulfilled at the level of each individual jurisdiction. Whether this involves new standard-setters, sharing of data for holistic monitoring or direct supervision of specific firms by supranational (regional or global) institutions, the potential cost of ‘unnecessary fragmentation’ may in some instances be simply too high to justify a strictly fragmented, jurisdiction-by-jurisdiction approach.

Perhaps more challenging, financial authorities will have to find ways to work with authorities with whom they may have had little or no interaction, or with entities which simply did not exist previously. This is likely to be the case with competition authorities, since these authorities will be increasingly involved in checking the scope of activity of Big Tech firms, and, perhaps most critically, with emerging data authorities, whose role and mandate are currently still at a formative stage (where they exist at all) but who may well become an increasingly significant fixture of the broader regulatory landscape. The inherent interdependency between some financial and non-financial data categories may require them to accept, or even promote, new forms of coordination and cooperation with authorities that are primarily active in the non-financial space.

Second, some rules and standards may need revisiting to assess whether they remain fit for purpose. Some standards, such as the PFMI, are meant to be technology-neutral but others, such as data privacy standards across borders, may need to be updated. In particular, the emergence of individual data rights as an area of considerable salience calls for a flexible but significant principles-based response, in which the EU's adoption of the GDPR in 2016 may be viewed as a first step.

Authorities will also need to determine if there are new categories of entities and/or activities over which they require formal supervisory powers that do not currently exist. Just as the crisis of 2007-2008 moved derivatives markets into the scope of public regulation, the boundaries of regulatory mandates will likely need to evolve with the experience of new technology-enabled modes of delivery of financial services.

An aspect of that adaptation will be the continued fine-tuning of the financial supervisory architecture. One constant concern of authorities will likely be to pre-empt harmful regulatory arbitrage, while leaving sufficient space for 'responsible' innovation to emerge. 'Regulatory sandboxes' are one model that could contribute to managing this trade-off, and others are likely to emerge. A regulatory sandbox is a framework set up by a financial sector regulator to allow small-scale, live testing of innovations by private firms in a controlled environment (i.e., operating under a special licence or exemption) (Jenik and Lauer, 2017). The first sandbox-like framework was set up by the U.S. Consumer Financial Protection Bureau (CFPB) in 2012 under the name Project Catalyst (CFPB, 2016), and in 2015 the UK's Financial Conduct Authority (FCA) coined the term "regulatory sandbox" (FCA, 2015). Since then, the concept has spread across more than 20 countries (Jenik and Lauer, 2017).

Third, authorities will need to foster awareness of how the digital era is transforming the future of work. The combination of technological development alongside demographic change will likely affect the quantity and quality of jobs available (OECD, 2017). Change must become an integral part of authorities' culture and organisation. Authorities may be faced with the difficult balance between a culture of prudence and attention to detail, which is often essential to delivering on their mandate, and the ability to adapt their frameworks rapidly to a fast-moving environment. Constantly adapting the organisation's outlook and priorities to the latest breakthroughs, without ever succumbing to hype, is easier said than done.

Finally, like earlier rounds of financial innovation and transformation, the technology-driven disruption will require authorities, at least some of them in some jurisdictions, to update their framework for public accountability, possibly including their governance arrangements. They may not be always be insulated from the inherent tendency of data-driven services to involve social dynamics of inclusion or discrimination, connectivity or polarisation, empowerment or alienation. This will force some financial authorities to step up their awareness of, and participation in, societal debates and transformations that in some cases may call for new forms of stakeholder outreach or legitimization.

5 Concluding remarks

The technology of banking has changed radically more than once over the past two hundred and fifty years. It seems likely to do so again. But so long as the underlying economic service is liquidity transformation and credit supply, the changes in technology will not alter the public interest in prudent [bank] balance sheet management and [a] resilient monetary system.

Sir Paul Tucker (2017, pp. 11-12)

To conclude, we return to the initial question raised at the outset of this report: Are we seeing the death of banking? Over centuries, history has shaped the structure of the banking sector and of its social, institutional, and political environments. This history has inexorably linked banks to their sovereign. Is the end of that history imminent? We think not.

While the financial landscape will continue in radical transformation for the consumer, we believe that banking at large will remain a business conducted primarily by government chartered and regulated entities, including many incumbent banks. Banks and governments have co-existed through history, and often relied on each other symbiotically to fulfil their missions. Banks have developed extensive institutional knowledge, precedent, and organisation around working with their governments. They have successfully mobilised their lobby to maintain the status quo, drive regulation in their favour, and discourage the emergence of nonbank firms as major players in the financial sector. Conversely, technology firms, generally lacking comparable policy and regulatory muscle memory, have been slow to see the importance of public sector calls for high standards of governance, protections, and ethics. Yet, the scale of the Big Tech firms and the speed of adoption across borders in the digital era suggest that developments in the provision of financial services could accelerate at a faster pace than seen before and rapidly change the competitive landscape.

Thus, there is an alternative outcome, namely, that banks do not live up to customers' expectations and demand for faster, cheaper, personalised financial services. This would allow technology firms to wedge their way between banks and customers and disintermediate the provision of financial services, relegating the banks to simple utility providers. In this context, and irrespective of its outcome, the Libra announcement in June 2019 has been a salutary wake-up call, as it has demonstrated the transformative potential inherent in the entry of FinTech and Big Tech to the financial sector. And it has highlighted the need for public authorities to collectively set the parameters on which banks, FinTechs and Big Tech will compete, exchange data and protect consumers interests.

For banks to succeed, they should embrace technology, partner with tech firms, meet customers' expectations and maintain their trust. But what could shift the bank-tech firm dynamic distinctly in their favour? If banks were to enable and offer the free (or very cheap) and easy transfer of money and assets between institutions and individuals globally. The motivation and means to enable 'free and easy' banking will soon be here. Will banks be ready?

Discussions

Morning session: Facts and trends

Gaston Gelos, *International Monetary Fund*

The report covers key conceptual issues in banking, combined with an historical perspective, summarising trends and discussing opportunities for FinTech and Big Tech. Additional considerations in understanding the future of banking are important, such as a more systematic discussion of banking functions, financial stability and understanding other fundamental drivers (e.g., demographic developments and low levels of natural interest rates).

The nature of banking and the threat of FinTech

Basic banking remains the core of bank business, and taking deposits and lending are the core of banking. This entails three services: maturity transformation, provision of payment services and information processing (Navaretti, Calzonari, and Pozzolo, 2017). Where in these areas does FinTech pose a threat?

The first and third services pose less of a current threat. In terms of maturity transformation, this would require a banking licence. Big Tech firms may seek to obtain a banking licence, but then they would be subject to the same regulation. Regarding information processing, an open question is whether hard data can fully replace relationship banking.

In payment services, there is a more immediate threat since there are clear economies of scope with other business services, giving internet retailers and social media companies an advantage. One example is e-money, which can be defined as a means of payment and a store of value fully backed by fiat currency. It is the digital equivalent of a pre-paid card. e-money can be issued as tokens or accounts, settled in a centralised or decentralised fashion. If properly supervised, e-money can be extremely safe – safer than bank deposits. For example, if accounts are fully backed by reserves at the central bank, this comes close to a central bank digital currency. The convenience and safety it represents may be a threat to bank deposits.

An example of how differences in information processing between banks and FinTech lenders interact with regulation is discussed in a paper by Buchak et al. (2018). The authors look at the market for residential mortgage origination. They find that traditional banks reduced activities in markets where they faced more regulatory constraints; shadow banks partially filled gaps. FinTech lenders appear to use different information to set interest rates. The authors attribute about 60% of shadow bank growth to regulation and 30% to technology. The implications are likely to be different in developing economies with large underbanked sectors.

Financial stability

The report touches on policy implications and very briefly on financial stability, and while I understand that it cannot cover every aspect, this issue is important enough to warrant a bit more of a discussion. Historically, financial innovation has been associated with financial instability. FinTech may affect financial stability through higher risk taking by banks. FinTech/Big Tech may induce greater competition and thereby erode franchise values and induce higher risk taking in at least two ways. One way is that FinTech firms directly compete with banks; the other is that banks feel driven to compete more intensively with each other for partnerships with Big Tech. Of course, there are many other potential risks.

Demographics

Another key driver of banking is demographic development. Population ageing is likely to weigh on the natural rate of interest, which in turn is likely to contribute to a flatter yield curve. As a result, the core banking business of maturity transformation is becoming less profitable. This is occurring in a pronounced way in Japan – you can see the effects on traditional banking in regional banks. An interesting question related to the future of banking ties demographics to financial sector development – how does the slow movement of demographics, as an important driver of the financial sector, interact with fintech?

Yi Huang, *The Graduate Institute*

The report is timely for the future of banking and the role for new technologies. It covers a broad discussion and presents findings on the differences between FinTechs and Big Techs.

Contribution

On the demand side, the report contributes to understanding unmet customer demand (see Frost, Gambacorta, Huang, Shin and Zbinden, 2019 for global evidence; and Huang et al., 2018; De Roure et al. 2016; and Tang, 2018 for evidence for China, Germany and the US, respectively) and consumer preferences (Bain & Company and Research Now, 2017). Here, consumer preferences refers to preferences for mobile or online banking versus physical banking.

On the supply side, the considerations are many: banks have access to new data (Jagtiani and Lemieux, 2018; Fuster et al., 2018 for FinTech lenders), there are technological advances (van Liebergen, 2017), lack of regulation (Buchak et al., 2018 for FinTech) and lack of competition (as alluded to in Philippon, 2015).

Platform lending

The interest margin is declining for top global banks. What's new? FinTech lending is providing credit to online customers. One case is Ant Financial, which exemplifies increasing platform lending (providing credit to both merchants and consumers).

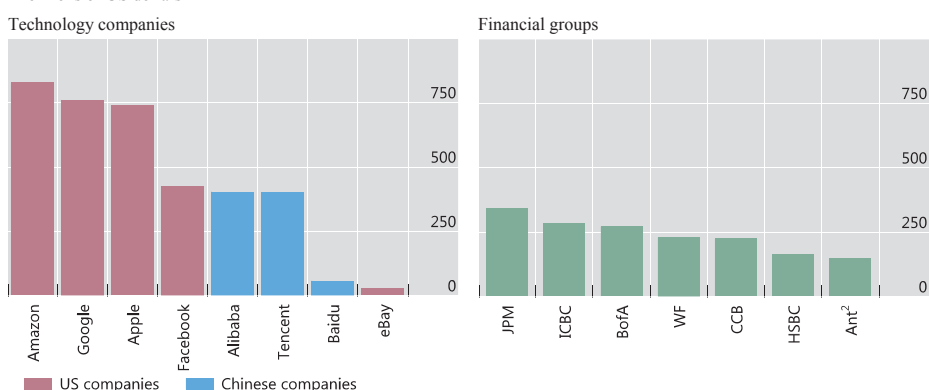
FinTech firms are taking advantage of platforms and different business activities. These include, information from payments, wealth products, financing side and credit referencing. In China and other emerging markets, it is a common phenomenon for the majority of the population to be unbanked (in particular, to

have no credit card and no credit score). Over the past year, Ant Financial provided \$8.5 million in loans and even more in micro-credit. It is all uncollateralised and the delinquency rate was 2%.

Comparing the stock market capitalisation of financial companies and technology companies providing financial services, technology companies are larger (Figure 1). In terms of funding costs, the borrowing costs for technology firms are much cheaper. Additionally, there is an information advantage coming from payments (Figure 2). Activities differ in scale across jurisdictions, but they typically began with the provision of payment services. For example, in 2017 Big Tech firms accounted for 76% of payments in China.

Figure 1 Challengers and size

In billions of US dollars

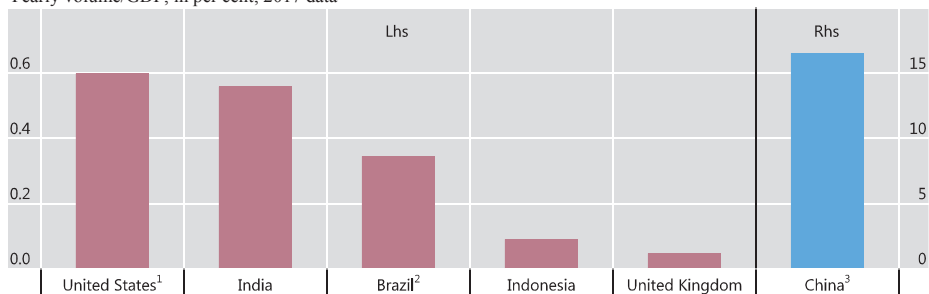


Note: Ant = Ant Financial; BofA = Bank of America; CCB = China Construction Bank; ICBC = Industrial and Commercial Bank of China; JPM = JPMorgan Chase; WF = Wells Fargo. 1 Stock market capitalisation, 18 January 2019.

Sources: Figure 1 in Frost *et al.* (2019); Thomson Reuters Eikon; company reports.

Figure 3 Challengers and information

Yearly volume/GDP, in per cent; 2017 data



Notes: 1 2016 data are used for US. 2 An estimate based on the public data for Mercado Libre. 3 Only mobile payment for consumption data used.

Sources: Forrester Research; GlobalData; iResearch; Mercado Libre; Nikkei; Worldpay; BIS. See Frost *et al.* (2019).

China and FinTech Growth

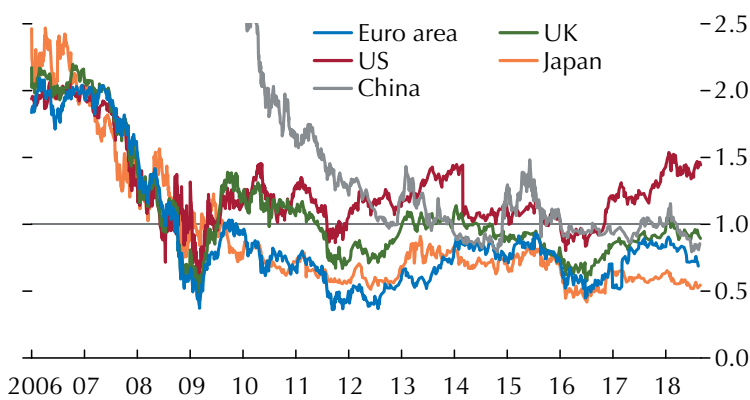
FinTech spread quickly across China between 2011 and 2015. Chinese FinTech firms are at the forefront of credit innovation. One interesting development in China is the use of facial recognition in determining credit.

Floor discussion

Xavier Vives, IESE Business School

We know that banking, in particular in the euro area and Japan, is having problems of profitability (see Figure 1), stemming from many factors: the legacy of the crisis, deleveraging, low interest rates, flat yield curve, increasing compliance costs, and so on. In addition to all of this, now there is a digital disruption.

Figure 1 Bank price-to-book ratios



What is the impact of this phase of digital disruption? Technology developments are moving the sector to be customer-centred with an upgraded customer experience. This leaves incumbents with obsolete technologies (e.g., rigid mainframes) and an overextended branch network while new generations want to bank with the mobile phone. Many banks continue to have overextended bank networks/branches. The result is that the industry is facing a deep restructuring.

Big Tech platforms have most of the advantages of FinTechs (see Table 1) with practically none of the drawbacks. As a result, Big Tech may be a more severe cause of disruption for traditional banks.

Table 1 FinTech: Advantages and disadvantages

Advantage	Disadvantage
Superior technology free of legacy systems; leaner operation	Absence of an installed, loyal customer base
Friendly consumer interface and new standard of consumer experience	Limited access to soft information
Focus on activities with higher ROEs	Lack of reputation and brand recognition
More equity funding	High cost of capital
Able to attract best talent	

How will the incumbents respond to the potential entry of Big Techs (Table 2)? They have all the incentives to enter into financial services since they offer complementary services. For example, if Amazon sells a lot of consumer goods, consumer lending is extremely natural for the customer and for Amazon. Then the Big Techs can compete head-to-head with banks. However, they may avoid taking deposits to avoid additional regulatory obligations.

From the perspective of Big Techs, this would not be the preferred strategy. They should pursue a platform involvement strategy, as done traditionally by Google and Apple. When you see a rival in a line of business, you provide the same line of business exactly as the competition (but more). You provide more, because you have a wider range of products and technology that allows you to do so. With this strategy, you can monopolise the interface with customers.

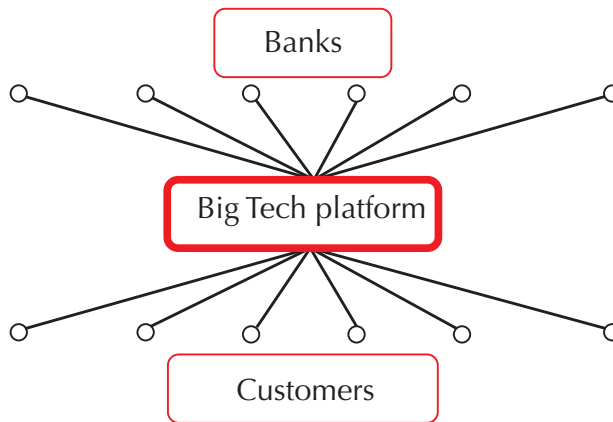
Incumbents may respond to the Big Tech strategy by choosing between the same options: competing head to head or cooperating (in partnerships or specialising in non-replicable services). If they want to compete via platforms, some banks may manage, but it is quite difficult. They cannot really match the Big Tech bundling packages due to lack of services. Incumbents may have some advantages though, due to trust with customers and data protection records.

Table 2 Strategies: Incumbents and Big Techs

Incumbent strategies	Big Tech strategies
• Compete head-to-head with Big Techs • Cooperate with partnerships • Provide specialised unique banking products and services	Become banks (intermediaries) bundling their offerings and exploiting economies of scope • They may opt not to accept deposits to avoid regulatory obligations
Become platforms • To benefit from the co-investments of all participants • Offering products of rivals • Profit from superior (?) trust from customers and security; better regulatory navigation skills	Multi-sided platforms (marketplaces) • Platform envelopment • Gatekeeper: Monopolise interface with customers
• Cannot match Big Tech's bundling strategy	• Cross-subsidisation of financial and non-financial products • Target the most profitable business segments of incumbents

The major threat for banks from Big Techs is depicted in Figure 2. Big Tech platforms manage to create an ecosystem in which the interface with the customer for financial services are those platforms and not the banks. The banks feed products and services to the platform and then the platform distributes these products and services to customers. High-margin business of the distribution of financial services would be captured by those platforms. Banking would move from its traditional oligopoly to a new platform-based oligopoly where a few platforms have an ecosystem, and some banks manage to get into this platform model.

Figure 2 The future?



Scenarios

Possible scenarios are the following. First, the impact of digital disruption will increase competition. It will erode incumbents' margins, in particular from the entry of Big Techs rather than FinTechs. It will increase competitive pressure and contestability – and perhaps risk-taking incentives for traditional banks. Incumbents will have to restructure due to the current overcapacity together with the need to invest heavily in information technology in a low-profitability environment, which will lead to consolidation. Consolidation is on the horizon in particular in regions with persistently low interest rates. Many banks will be unable to sustain the compliance standards, capital requirements and increased competitive pressure.

The long-run impact will depend on two key developments. First, it will depend on the extent of entry of Big Tech (which will in turn depend on regulation). Additionally, it will be shaped by whether we move from traditional oligopoly to new platform-based oligopoly where platforms manage to monopolise the interface with customers and appropriate the rents in the business.

Regulation and financial stability

Regulation will be crucial. The open banking initiatives in Europe and in the UK rely on information-sharing requirements between PSD2 and GDPR. Banks will have to open the data to their consumers for Big Techs but not the other way, since it is under a different regulation. This is an important issue.

Other issues on data ownership, portability and interoperability are key. If we do not want these new oligopoly platforms to consolidate, interoperability between them and information sharing and consumer data moving across platforms will be important (lower switching costs). If we manage to keep these switching costs low, then it will be a more competitive structure. Consumer protection comes to the forefront with protection of data and transparency. It is at the forefront since new technology allows for perfect price discrimination.

Does that imply having a different compliance burden for dominant players and small entrants (UK)? Possibly, yes. This way you entice entry. From a financial stability perspective, when you have many small players that correlate their strategies, they are no longer small players – they are big.

Another idea gaining traction is to regulate activities and not entities, especially as we see increasing connections between non-financial and financial firm activities. Reorienting regulation from entities to activities contributes to a level playing field. However, it is entities that fail, not activities, and they may have systemic effects.

Hyun Shin, *Bank for International Settlements*

What's special about Big Techs in banking? Two elements are often mentioned: technology (AI, machine learning) and data. Technology is available to incumbent banks as well and traditional banks have been investing heavily in this area. However, data are a new element and the issue is the economics of data.

Economic rationale for regulation

Why do we regulate? What is the economic rationale? One set of issues relates to financial stability risks. For example, peer-to-peer lending and shadow banking generate concerns about circumvention. If you take advantage of new forms of delivery, perhaps this is just a way of replicating the same activities of banking without banking regulation.

The reinforcing cycle of data, network effects and interwoven effects is key. In banking we talk about 'know your customer' (KYC), but if you have a set of other interwoven activities you know much more about the customer (their friends, *their* customers, etc.). If you can unleash machine learning on all that data, you know more than the balance sheet of your customer. The advantage is in being able to expand market services by using data in a more granular way with more information. As this develops, you can lend to more people, including those who are unserved in the current banking system.

But once you have this loop between data, network effects and interwoven effects, where does the loop end? Eventually this leads to tremendous concentration and market power. This kind of built-in externality leads to certain conduct which will be reinforced and further entrench market power. For example, increasing consumer switching costs, price discrimination and exploitation of cognitive biases. We think about preferences as given and calculate consumer surplus from there. But if there are ways of exploiting cognitive biases, the notion of preferences becomes much more fluid – for example, wanting things you did not know you wanted.

Four intermediate objectives of regulation

How to regulate? It is still too early to think of concrete remedies, but we can orient ourselves in the various dimensions that might be relevant. Below, four objectives are discussed.

First, financial stability risks must be addressed. The gap between Big Techs and incumbent financial institutions (i.e., bank licence requirements) must be closed. This would be an example of a risk-based approach – the ‘same-risk, same rule’ principle. The same principle could be applied to treating peer-to-peer lending with banking rules.

A second angle is the antitrust perspective. Upgraded competition rules and practices are needed. For example, going back to the 1980s literature on telecoms, there was a distinction between platforms and access to them. A similar setup may apply for banking developments.

A third consideration is data portability. Sharing personal data is socially desirable (low marginal production cost, non-rival good, level playing field). One way to ensure pro-competitive exchanges of data is to enable users to transfer their data from one service provider to another.

A fourth objective is to strengthen data privacy (which leads in the opposite direction as the third point on portability). This would give individuals full control of their personal data and restrict the ability of digital platforms to generate sensitive data in the first place.

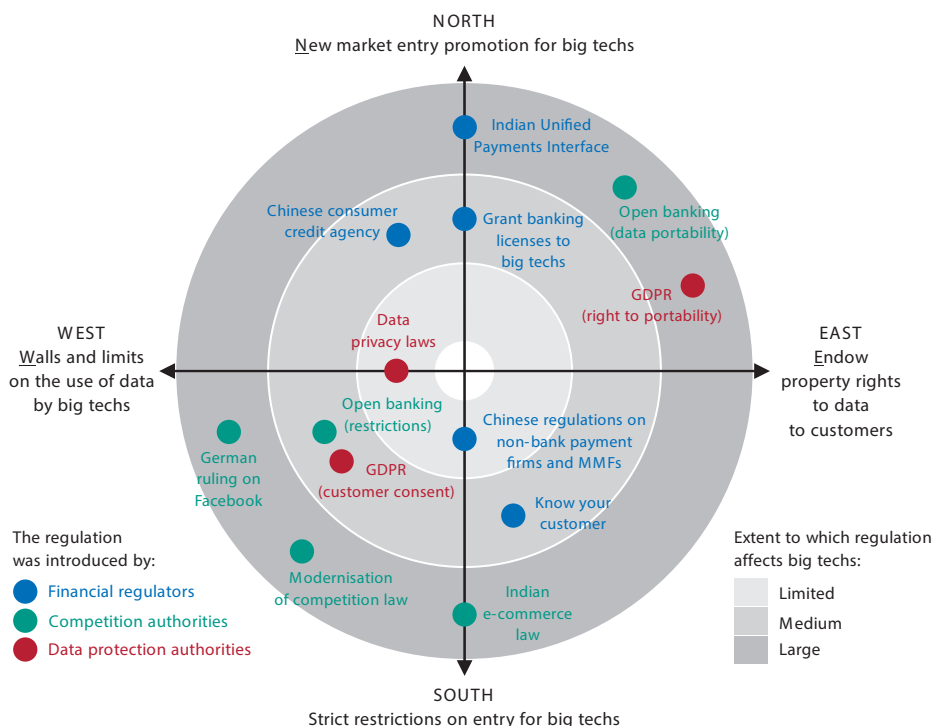
Regulatory compass

The regulatory compass is a way to think about these issues regarding policies and data (see Figure 1). The north-south axis is traditional – financial stability versus antitrust. The east-west axis represents how you deal with the data portability issue.

The traditional banking and level playing field argument is focused on the north axis – for example, extending KYC regulation to Big Tech (‘same activity, same regulation’). The opposite would be to focus on antitrust - for example, the EU fining and India setting strict rules on e-commerce carried out in the country for vertical integration and what e-commerce firms can do.

In terms of the data dimension, one way is open banking, where banking customers can take their data to other banks (the UK, Australia and Mexico, for example, are moving in this eastward direction). The other way is to have more direct restrictions on the way data are used. To some extent, the EU’s GDPR’s is going in both directions. Where you fit in this diagram determines regulatory regimes. There is a growing need to strengthen the theoretical framework for this.

Figure 1 A new regulatory compass



Source: BIS (2019).

Conclusions

In the face of the rapid and global digitalisation of the economy, policymakers need to build and share knowledge – for example, through the development of and support for innovation hubs, regulatory sandboxes, as well as international coordination. Some initial steps include the Global Financial Innovation Network of 29 organisations – including the UK Financial Conduct Authority, the Hong Kong Monetary Authority and the US Consumer Financial Protection Bureau – and the EU and Japan’s mutual recognition of data protection regimes for personal data.

General discussion

Agnès Bénassy-Quéré (Paris School of Economics) noted that the discussants had begun to design possible scenarios. With new technologies there are new market structures requiring new competition policies. Regarding the financial sector, there is a need to ensure financial stability while incorporating new technology.

The way the report frames the competition triangle between traditional banks, Big Techs and FinTechs demonstrates that each comes with advantages and disadvantages. However, there is an impression that Big Techs have a net advantage in terms of scope and capital relative to both traditional banks and FinTechs. Soft information appears to be the main comparative advantage for traditional banks.

Due to this triangle and competition trends, Bénassy-Quéré asked whether the process might lead to an unbundling of various banking services and a rebundling (with other activities). This scenario raises significant questions for the banking business model. Banks often expect to recover their costs over time by selling other products in their bundling of services. If the traditional bundle changes, the traditional banking model will require rethinking. Are we seeing something like this in financial services?

Role of the central bank

Katrin Assenmacher (European Central Bank) noted that, traditionally, banks take deposits and bundle services, including loans. Banks have capital, they know their customers and traditionally have an edge over other companies in the loan business. Now we are seeing companies with other products venturing into financial services, and they may have a new edge. Take the example of automotive producers setting up their own leasing arms and their own financing arms – at some point they became banks. The main reason was to have access to the central bank. While this is probably not as important for e-commerce firms because they sell a product and offer loans, at some point they may want to have access to the central bank.

Haizhou Huang (China International Capital Corporation) referred to Shin's emphasis on network externalities. If we really believe network externalities are tied to financial systemic risk, this calls for a very important role for the central bank. Whether Google has access to the Fed, or Alibaba to the People's Bank of China, the lender of last resort is vitally important. To take this comparison further, if technology is used for customer service, that is welcome as it will likely enhance profitability, as ATMs did. However, since the main force of competition is coming from Big Tech (rather than smaller FinTechs), the result might be ugly. Neither the Fed, the PBOC or the Bank of Japan would be ready to lend to a Big Techs such as Google.

Dirk Niepelt (Study Center Gersenzee) asked whether the usual notion of liquidity is too narrow. Should the ability of Big Techs and FinTechs to use an increasing amount of information, for example, make us think about a broader notion of liquidity? Information becomes more symmetric as a consequence of these new platforms, which enable a much broader set of securities to be used as means of payment. Therefore, non-traditional banks are playing a much broader role in this regard.

Hyun Shin (Bank for International Settlements) replied to the concerns, explaining that this issue comes to the fore in the payments business. A two-tier system, where the individuals interact with their bank and the banks have access to the central bank, is how we traditionally think about the payment system. However, the payment system is evolving rapidly – for example, in China 90% of the payments business is accounted for by nonbank payment firms. To increase transparency in the system, a reform required all these payment firms to channel payments through a state-owned clearing house. Such regulatory requirements can be seen as restrictions to Big Techs' free entry in finance. For this reason, they are positioned on the southern half of the regulatory compass. Niepelt's point is not a concern for way into the future, it is an issue now and will occupy us directly at the heart of central banking.

Benoît Cœuré (European Central Bank) asked about the potential consequences of Big Tech entering the financial services field for competition *outside* of finance. In the US, there is separation between banking and commerce. This could give undue market power to companies able to provide finance, who could use it to provide subsidised lending to their own subsidiaries, increasing their market power and the power of incumbents. These developments will play out differently in the US and Europe. EU DG Comp will act in a very forceful way against it, but antitrust issues are less clear in the US.

Andrea Maechler (Swiss National Bank) noted that some countries are allowing FinTechs to go directly to the central bank for accounts. What are the risks of this? Are there risks from narrow banking? **Xavier Vives** (IESE Business School) explained that after any crisis, the narrow banking solution drops out. The core functions of banks (loans, deposits and creating money) will continue. There can be some versions of narrow banks but this will not be the centre, independently of digital disruption.

Alexandre Swoboda (The Graduate Institute) asked to what extent we are talking about the future of banking and the future of fractional banking. It was mentioned that one of the areas Big Techs could compete most with banks is in the payment system. The deposit base of traditional banks is shrinking; there might be a role for deposit-like electronic money (perhaps at central banks). This suggests we might be moving to a system with more narrow banks. One of the incumbent advantages (potentially competed away) is access to the central bank as lender of last resort.

Role for consumer protection and privacy

Cœuré raised concerns about regulatory silos, which will be a major regulatory issue over the coming years. While this conference is discussing data against the backdrop of banks and financial regulations, most people outside of this room would think about it as a privacy issue to be dealt with by privacy authorities. Since these are different groups of supervisors, there is potential for fragmentation across countries and across regulatory domains. Regulatory hurdles arising from, say, different privacy frameworks could spill over to the financial field in a new way, which would be an issue for regulation.

Tara Rice (Bank for International Settlements) agreed that we also need to think about customer protection, competition policy and financial regulation policy, all of which require harmonisation. We have achieved more harmonisation in the financial regulatory space compared to the data protection and privacy space. With GDPR in Europe, there was concern in the US about being able to keep memoranda of understanding (MOUs) active between US and EU officials. This is a concern, especially if MOUs for supervisory data sharing lose effect.

Vives emphasised that with digital disruption, consumer protection would be at the forefront. In several European countries there is consumer protection under the wing of the supervisor; this is not a good idea. The UK model is a financial conduct authority with a remit in competition and consumer protection. This model seems much more appropriate and avoids conflict of interest. At the end of the day, competition policy and consumer protection are aligned. With a supervisor they are not as aligned due to the overriding effect of the financial stability concern. We should move towards a more integrated perspective. As mentioned above, the UK model has both a consumer protection and competition remit. Consumers would be better served.

Jean-Pierre Landau (Sciences Po Paris) added to the issue of privacy. Between the US, Europe and China, there are different privacy preferences. For example, US has no federal privacy legislation, and compatibility between the US and Europe with GDPR is still an open question. There are free-trade agreements with prohibition on any restriction of cross-border data flows, and they are proliferating. If we have different privacy preferences, free cross-border data flows, and if finance is about data, what is the risk that such distinctive preferences will trigger a segmentation of the international financial system, and that it will impede the free movement of capital and cross-border banking activities? The risk is real. In addition to the silo situation mentioned by others, perhaps financial regulators should be more up to data and gaining influence in the privacy debate.

Role of data policies

Jean-Pierre Danthine (Paris School of Economics) agreed with Hyun Shin – technology is transferable, so the big issue is the economics of data. We should dig deeper under the postulate that the volume of data is the only important thing. All banks may have less data than Google but they may be of better quality. Of course, whether banks retain that advantage may depend on future regulation on data. The combination of soft information with data may make a big difference in competition between Big Tech and banks.

Xavier Vives questioned whether banks would be pushed out. He explained that banks have done well on data protection and keeping secrets. In addition, they know how to navigate the regulatory maze. They have invested in regulation, while Big Techs may be afraid to do so. Supporting Danthine's view, all the indications are that AI and algorithms work well in combination with soft information. As a result, banks can still have an advantage.

Cœuré shared his thoughts on the nexus between data ownership/control and competition. The EU's new payment directive (PSD2) gives clients/customers control of their banking data and possibly access to nonbank services (provided it is authorised by the customer). PSD2 has created a lot of competition against incumbents. Banks do not like it, but it allows many nonbank players to enter the payments field with new technologies and generate innovation pressure on the payments field in the EU. Control and ownership of one's own data may mitigate concerns on competition.

Nicolas Véron asked about the fact that there is complementarity between data and money and how money crosses borders. Both money and data cross borders. What do you think about the future of financial globalisation using that framework?

Shin explained that imagining a payment system in a specific jurisdiction is relatively simple. As soon as you begin to imagine a cross-border system, however, there are other issues that arise. There is a large buffer of rents up for grabs for disruptors. A potential benefit of this is that the discussion of disruption has lit a fire under the feet of incumbents and may result in lower rents (for example, there have been reforms to SWIFT). In the end, the banking system may become sufficiently efficient, and the rents will decrease further than we once thought.

Cœuré disagreed on the complementarity between money and data. We learned from the financial crisis of 2007–8 that we do not want money to be informationally sensitive. If you make the value of money dependent on individual data, you have a false sense of security. This has been a major challenge for central banks over the last ten years. We want to protect the stability of money.

Benefits versus risks

Haizhou Huang (China International Capital Corporation) mentioned that the most important financial innovation according to Paul Volcker in the last century was the ATM. The most important financial innovation for this century is probably something in FinTech. Something to keep in mind – Fintech can enhance banking capability and help them to perform other risk management and additional services.

Thomas Philippon (New York University) One thing that is very striking and clear is that many of the issues discussed are not new; with technology, old issues are resurfacing. Many of the ideas and problems have been around for a long time. As soon as banks were invented there was talk of them disappearing. There is something quite stable in the banking system and it takes a lot of disruption to change the system.

New technologies make old issues more salient and more important. For example, regulation of activity was discussed after World War II, when money markets came in. With financial technology it becomes important (again) to focus on regulation of activities. Switching costs are also an old idea from every network industry. In banking we have not made much progress in this area. However, with new technology and the rise of data, this is once again an important consideration for banks.

Rice commented on the positive effects for financial inclusion. There are many examples of how financial inclusion has been enhanced by FinTech. RegTech or SupTech can help in the more traditional channels. If we lower compliance costs for big banks, then correspondent banking can be cheaper and safer.

Harald Hau (University of Geneva) made a factual remark on the threat of Big Tech to the existing banking sector. This threat is still a fantasy. If you look at the biggest Big Tech in China, Ant Financial, the market share of small loans is less than half a percent. The kind of Big Tech observed is not of a nature to pose a substantial competing threat to the existing banking sector in China. Keep in mind the quantitative proportions, which are not likely to change.

Maechler referred to Shin's regulatory compass, noting that a lot is happening with payments due to the value of data. It may be important to consider why nonbanks are expanding to payments. If it is not for financial intermediation, is that an issue for banks? Are we losing the financial intermediation role of banks?

Vives explained that Big Techs have a choice between becoming an intermediary and becoming a marketplace/platform. The impression is that if there is no partnership between a bank and a Big Tech, typically the Big Tech would rather be a marketplace where it monopolises a segment of customers. Then, banks provide services to customers on the platform. Depending on switching costs, there will be competition.

Philippon mentioned that the post-crisis regulation created space for new entrants and disruption for the industry. However, this also means that we need to continue, so that there is still room for new players. For example, it would be unfortunate if we replace large banking incumbents with large Big Tech incumbents. One issue with banks is that they grow and become too big to fail and manage. Regulators and academics are already at a loss as to how to regulate FinTechs – they are already too big to regulate. If in addition they become banks, it might not be a good outcome.

Philippon also remarked that there are some productivity gains in finance thanks to FinTech. We have to have a long-term perspective. We want to build a sustainable system for the long term. In this case, making sure new entrants are competitive and not too big is the most important thing we can do for the future.

Afternoon session: Policies

Huw Pill, *Goldman Sachs*

The report is an impressive contribution to the analysis of developments and trends in the financial services industry, focusing on how the technological shock associated with digitalisation and the rise of 'big data' is influencing the banking sector. When drawing policy implications from the analysis, considerations revolve around three issues: (i) understanding trade-offs across the various dimensions of the banking sector that are affected; (ii) assessing whether the impact of technological change on banks might be different this time; and (iii) anticipating the dynamics of the transition to a new banking system following from the shock.

Tradeoffs

From a public policy perspective, it is natural to take a welfare view. A technological shock to the financial sector creates opportunities for a more accessible and resilient banking and payments system. But it also creates risks on various dimensions. The interesting question is how to quantify and manage the trade-offs that arise.

In his opening remarks, SNB President Thomas Jordan described his mandate in this context as managing the trade-off between innovation, on the one hand, and stability, on the other. This is perhaps an appropriate perspective for a central banker I agree, but if we take a broader public policy perspective beyond the remit of the central bank, it goes beyond the mandate of central banks more complex, multi-dimensional analysis has to be made.

Beyond implications for financial stability and opportunities to promote efficiency in the financial sector, important issues in assessing the banking system's response to technological change include the potential for network effects to create monopoly rents (with implications for competition and anti-trust policy) and the privacy and data issues that arise in a big data context. For this reader, the paper has the most interesting and new things to say on the lattermost issue. But to make these novel insights operational, we need to understand the character of interactions with other policy concerns and, crucially, quantify those interactions.

Why is this time different?

As Thomas Philippon remarked in presenting the report, there is nothing really novel in any of these issues. Technological change and financial innovation are not new. Previous financial innovations have raised similar questions. But ultimately their impact on the financial sector has proved manageable.

The report suggests ongoing technological change has the potential to have a different and more profound impact. It is therefore important to establish why. Only this motivates a need for significant reform to the existing regulatory framework, which has successfully managed such issues in the past (to a greater or lesser extent). Why do new developments and trends prompt policy concerns? And are these qualitatively or quantitatively different from past experience?

To understand why this time may be different, it is helpful to distinguish more carefully between financial functions and the form of the firms that provide them. What is new is that FinTech firms and Big Tech firms have emerged alongside banks (and other traditional financial firms) within the financial sector.

As Gaston Gelos described this morning, financial intermediation encompasses a number of sub-activities. Traditional banking business has bundled a set of these activities together in a certain way. Thus far, a specific set of activities has been jointly produced within a single banking firm because of synergies among those activities. At the heart of this has been what the macro-finance literature has labelled the “special nature” of banks. Because of their closeness to borrowers and knowledge of payment patterns stemming from their deposit business, banks enjoy informational advantages in managing credit risk.

The fundamental premise of the report is that technological innovation is allowing unbundling of traditional banking business. The big data revolution has created other repositories of information which are located outside of the banking sector. These may even be better sources of information: for example, internet retailers may have a more comprehensive view of spending patterns than banks.

Viewed in this light, the specialness of banks may have diminished to be replaced by a specialness of BigTech. As a result, the possibility to unbundle and then re-bundle banking and payment services in a different way has emerged. FinTech firms are facilitators of this process: they incubate the technical innovation that harvests the informational advantage of BigTech at the expense of traditional banks.

Against this background, the policy question posed by the report can be made sharper. Given the network effects embodied within BigTech, should we allow them to supersede banks in the payments system? Are the problems that may create in terms of monopolisation and competition policy sufficient to outweigh the more efficient management of information and credit risk that may result? More fundamentally, if banking services can be unbundled, the potential emerges for a separation of activities and institutions. This leads to very basic ambiguity about the character of the report: are we talking about the future of *banks* or the future of *banking activities*?

Dynamics of the transition

Much of the discussion in the report focuses on the possible emergence of a new BigTech-based system of payments and financial intermediation. Less emphasis is placed on the dynamics of transition from the current bank-based system to such a new environment. But it is during this transition that many of the trade-offs discussed above would likely be most sharp.

Moreover, one of the potential novelties of this wave of financial innovation that distinguishes it from technological shocks in the past is the speed at which its impact is felt and propagated. This makes transition issues more acute. In contrast to new innovative firms that are unburdened by outmoded computers,

inflexible operations systems, expensive branch networks and other stranded assets, legacy players in the banking sector may be distressed during a rapid transition, with adverse impact on systemic financial stability. When the speed of change possible in the digital era interacts with the pressure to innovate and perform that is strongly embedded in the incentives facing employees in the financial sector (e.g. to push to the boundaries set by legal rules to gain an edge over competitors), the potential for unintended and (potentially) unpleasant systemic consequences is large.

This leads to the question of how much we should rely on regulation to contain behaviour. Is it easier to contain the behaviour of people or machines? How do you combine the soft information of people and the hard information of machines?

Further thoughts

Finally, in assessing the future of banking, some general equilibrium considerations apply. The report understandably focuses on one issue: how a technological shock propagates to the financial sector. However, there are other shocks driving developments in the financial system.

Notably the financial crisis of 2007–8, its macroeconomic aftermath, and the monetary policy response to it, all weigh heavily on bank profitability and behaviour. Moreover, there are other players in the financial sector beyond the commercial banks, FinTech and BigTech that will stake a claim to unbundled activities. For example, traditional investment banks are entering the deposit and payments business in response to regulatory pressures on their funding.

If the correct policy conclusions are to be drawn, the impact of technology on banks and banking activities ultimately needs to be placed in this broader context.

Charles Goodhart, *London School of Economics*

Hyun Shin has already raised a number of the policy issues that I might have covered. So, I am only going to raise two critical comments. Despite these being criticisms, I do concur with others that the bulk of the report, especially the earlier chapters, is excellent.

First, I would not agree with the largely unqualified support that the paper appears to give to an ‘open banking regime’ in Box F.⁵⁸ Whatever other misdemeanours banks and bankers have been accused of over recent years, the protection of client confidentiality is not one of them. Indeed, here in Switzerland the accusation has been the opposite, i.e. that banks have not been willing to make the data available that would enable the authorities to track down tax evaders and other miscreants. The problem that I see with open banking is that it could be an ‘open sesame’ for abuse. By being offering slightly higher interest rates, the credulous and myopic could easily be persuaded to switch their accounts to intermediaries whose primary purpose would be to exploit financial data for their own profits, as Big Tech companies already do. The concept that financial data might be merged with other sources of data to enable companies to exploit confidential information on an enormously wide range of activities and transactions makes my blood run cold. One of the concern of libertarians has always been to limit the access of government to private data; while many doubt the good intentions of government, and rightly so in many instances,

⁵⁸ A revised version of Box F appears as Box 7 in the final version of the report.

the intentions of a profit-maximising private corporation are no better, possibly worse. Towards the end of Box F, the authors state that “[i]n the event they have lost funds as a result of a breach, the party responsible for the breach will make them whole.” But what if the party responsible is a private company which has already gone bankrupt? It would hardly be fair to then turn around to the original bank and ask them to repay the loss, when the depositor had voluntarily shifted their deposit out under the open banking regime.

Second, the authors support the present reformulation of banking regulation, which puts most weight on raising capital adequacy requirements (CARs). Their main plea is that it should be more fully implemented. While this was undoubtedly necessary, the problem is that bankers worship at the altar of the great God RoE (return on equity). And this leads to a problem that higher CARs have an immediate adverse effect on the great God RoE.

This leads to two problems. First, senior management in banks have an inbuilt incentive to avoid or evade the higher CARs by any means that they can find. So, the process is working against the flow of bankers’ objectives. Second, when given the choice of achieving the higher CARs by raising equity or deleveraging, they will choose the latter. This means that the regulatory process in Europe has itself been partly responsible for the sluggish recovery in bank credit expansion.

There are a range of proposals out there now in the literature to try to change bankers’ incentive structure. One such set would involve changes in the governance arrangements, e.g. in the articles of association for such corporates, or in the structure of boards and remuneration committees. These have mostly been put forward by lawyers, and more recently by politicians. Examples are to be found in works by Peter Conti-Brown (Conti-Brown, 2012), Steven Schwarcz (e.g., Schwarcz, 2019) and a recent book by Andreas Kokkinis (Kokkinis, 2018), with a proposal by Sir Vince Cable⁵⁹ being a recent politician’s offering. Alternatively, economists have suggested a variety of methods whereby banks facing loss, misconduct or, at the extreme, insolvency should have that met in some large part by a claw-back or additional liability on management. This latter is a field in which I am currently working in conjunction with Rosa Lastra, with a paper on “Equity Finance: Matching Liability to Power”.

Floor discussion

Patrick Honohan (*Trinity College*)

For an institution that is so old, banking has long had a surprisingly complex joint production technology. They have been central to the production of widely different financial services, including the provision of a liquid store of value, maturity transformation, payments services, mobilisation of loanable funds and the appraisal and monitoring of opaque borrowers.

This production bundle is associated with most individual banks and with the industry as a whole. Although not all customer relationships involve all elements of the bundle, many do. Anyway, this bundle is what has made banks different.

⁵⁹ Sir Vince Cable has wondered, “Could appointing workers to boards fix capitalism’s crisis?”, in an Opinion article published in City AM on 14 May 2019. See also Cable’s speech on “Capitalism in Crisis”, dated June 7, 2018 and available at http://www.libdems.org.uk/capitalism_in_crisis, in which he explains how a modern liberal approach can help capitalism save itself.

The arrival of potential disrupters may entail an unbundling. But these functions will all continue to be needed and the services will continue to be provided – though not necessarily by banks – whether or not the bundling survives. In this light, what should central banks and financial regulators be concerned about when looking into the future of banking?

The business pages of the financial press obsess over the question of winners and losers as far as shareholders (and other institutional stakeholders) of incumbent firms facing disruptive entry are concerned. Public authorities have often been rightly criticised for being too attentive to the prosperity of financial firms; I think that this question should be of relatively little interest to the public authorities.

Instead, they should have as a *goal* ensuring that disruption and technical progress is carried out in such a way that the (currently bundled) services will in the future be better (i.e., cheaper and safer), including during any transitional period.

If the identity of the service providing firms changes, and if the bundle of services is unpacked or re-bundled in a new way, the authorities may need to react. In particular, let us mention three areas possibly requiring reaction.

The first area, regulation, has already been discussed in some detail earlier today – it is the likely need to expand the regulatory perimeter as well as the content of regulation. This applies especially to regulation directed at consumer protection. That potential disrupters will have to be regulated may indeed act as a brake on the extent of entry, especially where this is driven by regulatory arbitrage. But it will surely not prevent entry or disruption altogether.

Others have already spoken today of the huge potential for Big Tech companies to use their command of micro data not only to act as discriminating monopolists, but also to exploit behavioural biases to an extent not hitherto observed. Although they have certainly been faster and more adept in exploiting technological advances in information processing, it is their data more than their technology per se that will fundamentally distinguish these firms in finance. Regulating the more sophisticated use of data will bring financial authorities into a much closer collaboration with other data regulators, a collaboration which may prove challenging.

The second area relates to the appropriate policy response to disruption of the bundle of services. But, although the bundle is what defines the bank today, it is not obvious that the bank bundle in its present form will, or should, continue to dominate. After all, changing technology may have increased the number of available equilibria and the existing bundle may not represent a socially optimal way of delivering the services. Furthermore, even though the bundle may have offered the potential for cross-subsidisation between different services, this may no longer be so easy if technology is allowing individual services to be peeled off the bundle.

Some existing banks may be able to adapt to the threat of disruption by bolting on some of the technological improvements that Big Tech and FinTech firms have pioneered. On the other hand, the Big Tech entrants will bring with them complementary services and the associated data troves that are hard for banks to emulate.

Although some banking services may be unbundled altogether and provided by nonbank specialist providers, I think that the threat that this could unravel the bundle in a socially destructive way can be overstated. Regulators need not fear a loss of service even during a transition period.

Regulated or not, though, the entry of Big Tech disrupters into banking services is likely to increase differentiation of bank business models. The result will likely imply a shrinkage of slow-adapting universal banks. But Big Tech firms will probably not sweep all before them. I imagine that over the next ten to twenty years, we will see a progressive segmentation of banking into four contrasting groups. Regulation will need to respond to this differentiation, adapting regulation and supervision to each segment.

Group I will be the Big Tech firms, transactional and driven by hard data. They will capture much of consumer and small business payments and credit services. They will make an important contribution to financial access or inclusion, especially where this is currently weak.

Group II will include entities concentrating on the provision of deposit and liquidity services. I imagine this as being a form of endogenously created narrow banking. Not one mandated, as has been proposed by some scholars, to reduce systemic risk, but as a response by medium-sized banks to a situation where they can no longer compete on the provision of credit and so concentrate on safe investments for their assets.

Group III will be the investment banks. These are not so reliant on a large balance sheet but will use their soft information for large-scale financing projects. Here they will blur into the private equity and investment firm sectors.

Group IV could be called community banks. They too will use soft, locally acquired data and serve small and medium-sized firms that are not catered to by the hard data-driven Group I banks.

Finally, let me mention the implications for monetary policy. After all, central banks have long worked through their impact on bank behaviour to achieve the necessary transmission of monetary policy to inflation and the real economy. Will monetary policy effectiveness be reduced by changing industrial structures and a reduced role for existing banks? I think the answer here is 'no'. Central banks have often needed to adapt their operating procedures in response to changing institutional practices and structures in the private financial sector. What is likely is that central banks may have to be ready to intervene in more markets as a 'market maker of last resort' and be prepared to act as a lender of last resort to a wider range of big institutions. In other words, some of the expanded toolbox that was deployed during the crisis may prove to be necessary in normal times if a more differentiated industry replaces the existing banking system. Ensuring the adequacy of the technical and legal basis for such interventions will be an interesting, though manageable, challenge.

It is important, though, to recognise that the expanded activities of the central bank and the financial regulator – both in regard to monetary policy activism and to data regulation – will raise complex political and ethical questions about the democratic mandate of central banks and the scope of their independence.

Jun "QJ" Qian, Fudan University

China's banking system has many unique features. In terms of its structure, there is large government ownership of banks. There has also been much growth of China's shadow banking sector, which has come with potential risks. However, new financial technology companies operate in a low-regulation environment.

Chinese banks

China has a three-tier structure which consists of the following groups: the 'Big Four' (ICBC, BOC, CCB, and ABC), Bank of Communications and Postal Savings Bank (the fifth and sixth largest commercial banks in China, respectively), the policy banks (China Export-Import Bank, China Development Bank, and the Agricultural Development Bank of China); stockholding banks (most of which are listed); and regional banks and nonbank institutions. There has been much improvement in the efficiency of China banks, especially with IPOs (e.g., Allen et al., 2017).

For example, the IPO prospectus of ICBC, China's largest bank, shows that the largest shareholder is the government. Interestingly, there was a group of foreign institution investors (Goldman Sachs, Allianz, American Express). It is government-majority owned, but there is still influence from foreign investors. In addition, large banks are listed in both China and Hong Kong. With monitoring from global investors, this kind of dualism has made them behave much more like commercial banks. The mixture of large banks majority-owned by the government and privately owned smaller banks is not such a bad mix.

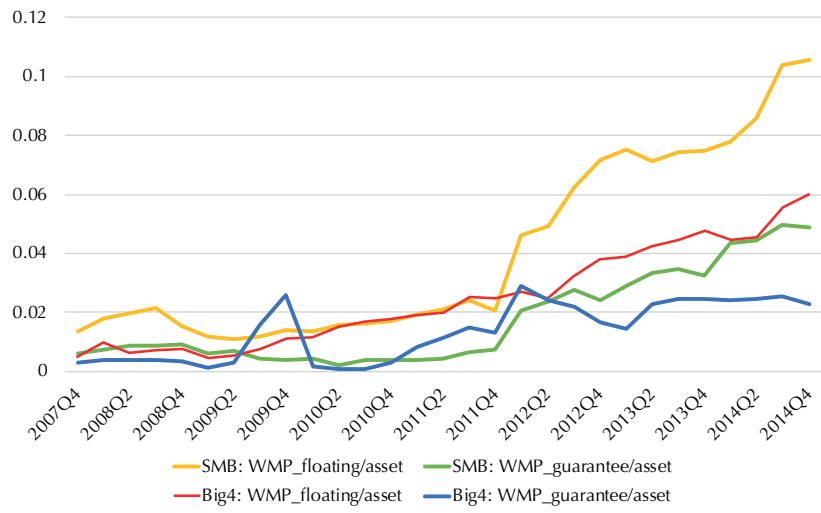
Shadow banking

Shadow banking refers to all investment products *off the balance sheet* of (deposit-taking) banks. It has many components, with the largest being wealth management products. Wealth management products (or 'principal-floating' products) are off the balance sheet and took off around 2010 (Figure 1).

An important reason for that was the debt problem in China. This problem can be attributed to the credit expansion (RMB 4 trillion in stimulus). Most of the stimulus was in the form of the 'Big Four' banks issuing loans (see Figure 2). This in turn created competition at the local branches for deposits, and with more loans deposits must grow, which led to off-balance-sheet products.

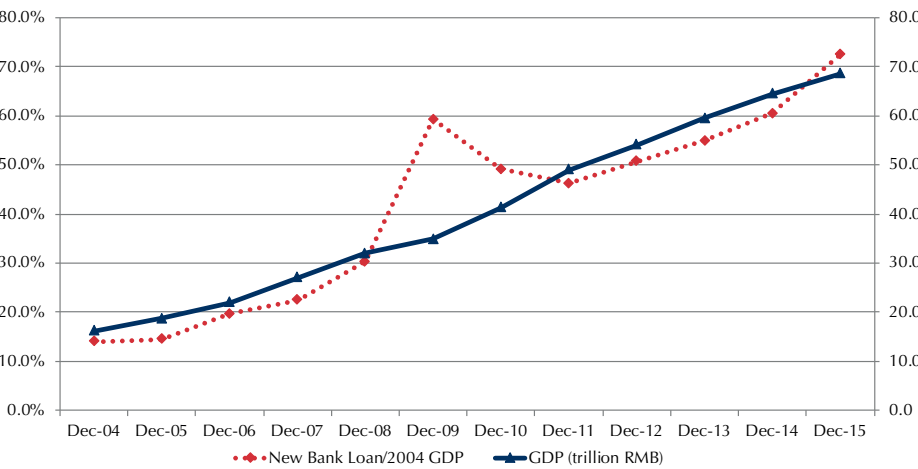
Shrinking these off-balance-sheet products has been the focus of China's regulators through liberalisation of interest rates, reducing the risky part of the shadow banking sector. It was so forceful that it created additional problems in 2018.

Figure 1 Principal-floating versus principal-guaranteed wealth management products, small and medium-sized Chinese banks (SMB) and the 'Big Four'



Source: Acharya *et al.* (2019).

Figure 2 Stimulus and credit expansion (new bank loans as a percentage of 2004 GDP)



Contrasting lending platforms

Companies like Ant Financial were able to develop using extensive payment information and data in a low-regulation environment. From a traditional bank's point of view, if you lend to a small business, you know everything about that business. Ant Financial knows even more, since all transactions are captured by the database. They use a credit-scoring system and have done very well.

In contrast, P2P in China has done less well. In P2P there was a lack of transparency and disclosure. They started as information-based platforms but then failed due to lack of financial expertise.

The generally accommodating regulatory environment in China led to very different outcomes. The lessons from comparing these platforms are two-fold. First, transparency and disclosure of platforms and targeted customers is very important. Second, the core financial activities (lending, investment, trading, etc.) require an infrastructure and a skilled finance/risk management team.

General discussion

Andrea Maechler (Swiss National Bank) began the discussion by summarising the key policy takeaways of the report:

1. Public authorities should not defend incumbents as a matter of principle (safety versus innovation).
2. Public authorities should be cautious to provide banking licences or even more limited financial services authorisation (ins versus outs).
3. Nonbank access to RTGS and the extent of such access should be granted with caution.
4. There is an important role for international policy coordination, possibly supranational supervision.
5. The economics of data is important, especially with regard to consumer protection.

What is different in this case with FinTechs or Big Techs? Should the title of the report be “The Future of Banking” or “The Future of Banking Intermediation”? Is it about the institutions or unbundling/the way banking is done? Will Big Techs/FinTechs help reshape banks in a better way? Will they change how intermediation is provided?

Competition and coordination

Patrick Honohan (Trinity College) supported proactive regulation for nonbanks, for example, licensing subject to certain conditions. It is important to legitimise the activities of nonbanks conducting bank activities. If regulators do not respond to who is playing the game and what to do about it, new entrants will still find ways to participate. Non-traditional entrants may not get access to RTGS or the lender of last resort, but they will enter the game. As a result, there is a need to legitimise what they are doing and regulate new entrants by licensing, for example.

Jun"QJ" Qian (Fudan University) noted that there are many cases of cooperation and coexistence. There have been several cases in China where a bank works with a FinTech to establish new institutions. Banks have capital, FinTechs have data and algorithms. They are also developing new ways of financial intermediation. Traditional banking and FinTech financial intermediation deal with different customers. For example, traditional banks tend to deal with large firms. In contrast, 99% of Ant Financial customers had never received credit from formal institutions prior to receiving credit from Ant Financial.

Maechler (Swiss National Bank) remarked that it may be less the function of banks that is put to question by FinTech, but rather that FinTech may help banks do a better job and lower costs. New technology may further help to introduce changes in the way services are provided to customers.

Kathryn Petralia (Kabbage) contrasted the difference in motivation between technology companies and traditional banks. Technology companies start with what the consumer wants and develop a relationship with the customer. From there it is easy to take the next step towards financial services. This is a fundamentally different approach to that taken by the banks. Banks typically start with what the bank can offer based on regulatory encumbrances. These differences are what changes the face of financial services today. The preferences surrounding acceptable regulation have also shifted.

Nicolas Véron (Peterson Institute) explained that going back five years, or even more recently, the notion that Big Tech should be regulated at all was completely unacceptable. These developments are moving very fast today.

Clay Lowery (Rock Creek Global Advisors LLC) commented that antitrust authorities between the US, Europe and China are very different. It is tougher to harmonise on antitrust issues when it comes to the financial system. He cautioned that it would be a big issue to take on in the report.

Véron discussed the issue of supranational frameworks being utopian or something worth considering. When thinking about supranational supervision, it sounds grand. However, there are modalities of it which are relatively bottom-up. They are not necessarily global, but can still be plurilateral. The international data hub at the BIS is a good example of this. You could imagine a setup between Europe and UK, Europe and the US, or other perimeters. If we assume we cannot do anything supranationally, we may run into difficulties because some dynamics of confrontation may be so exacerbated that they will create their own crisis and force a solution of that type (but after a lot of damage has already been done).

Claude Gonet (Banque Eric Sturdza) asked about the implications for wealth management. In Geneva, wealth activity is very important. What type of activities in wealth management do you see as being at risk in the future with new technologies?

Honohan explained that private banks offer wealth management services, to the extent what they are offering is something that can be offered outside what we traditionally call banks – money market funds or any fund managers who do not necessarily have or want a banking licence. This specialised business is still there. The fund manager doesn't have to be a bank.

Resolution

Agnès Bénassy-Quéré (Paris School of Economics) challenged the view that it would not be a good idea if Big Techs were to become banks because they are already large and difficult to regulate. What do you think of this evolution in terms of resolution? Would it not be easier to resolve a bank within a Big Tech with a lot of capital and only one actor? Perhaps a Big Tech would be able to continue some of its activities and perhaps the process would be less politicised than the resolution of traditional banks?

Regarding resolution, **Honohan** remarked that the problems that we have seen in the last couple of years, with attempts to introduce a proper resolution scheme in Europe, have been the traditional expectation that your money is safe in a bank. Presumably when the Big Tech companies get involved in banking, they will do so in separate structures. For most of what they are doing, they may

not be entrusted with the main deposits of customers – it will only be very short-term and liquid. As a result, resolution would be much simpler for that kind of entity. The bulk of bank deposits would not end up with Big Techs unless they set up subsidiaries for that specific purpose.

Honohan further commented that this scenario has echoes of previous crises. For example, in East Asia there were a number of private equity firms who brought capital (not technology or data). Regulators did not like the idea, despite providing a valuable injection of capital. It is interesting to think of this as another type of entrant in the banking market. Similar attitudes can be thought of in the context of today: “Do we really want a tech company involved here?”

Jean-Pierre Danthine (Paris School of Economics) noted that if Big Techs were to take on bank activities, they would change character. Once they take on bank functions, they will “worship ROE” and change behaviour.

Beatrice Weder di Mauro (CEPR and the Graduate Institute) echoed Danthine’s concerns, while trying to imagine a Big Tech becoming a big bank and the notion that resolution would be easier. She contrasted two scenarios: If the bank activities of the non-bank were limited to small payments then it can be imagined. However, if large deposits were part of the non-bank’s services then it must be subject to the same recovery resolution of large global banks today. Questions regarding recovery and resolution are an understudied area in academia and recently examined in the Barcelona Report.

The result of bank activities within a big bank would be fragmentation. For example, Swiss banks had to completely restructure themselves, creating legal entities in many jurisdictions. They went from being managed centrally to being decentralised. Capital is held *ex ante* in different places. To a certain extent, it is trapped and cannot be deployed in case of a shock in another region. As a result, different regulators may intervene without coordination (failure of single point of entry, defector multiple points of entry).

Mobility and deposits

Livio Stracca (European Central Bank) posed a question on the implications of FinTech for deposits. We talk a lot about credit and FinTech. What about the role of FinTech for deposits? Could FinTech make deposits flightier and more prone to runs? Greece in 2015 comes to mind. If depositors could move funds with a mobile phone, rather than physically going to the bank, would that have made the outflow of deposits more serious? Is that a concern or not?

Honohan expressed that money could already move quickly. It is not necessarily FinTech that changes this, but rather the behaviour of customers. It may be a generational thing – millennials will know how to move their money. This is not a threat that can be managed, it is inherent in technology that we have already had for a long time.

Jun "QJ" Qian noted that the largest mutual fund in China does not have any minimum requirement. The fund grew from nothing in 2014 to over \$80 billion in less than two years. The reason for growth is that interest rates in traditional banks were very low. In mutual funds, returns were much higher and there was no minimum requirement nor a need to physically present yourself. Is that risky? Regulations are likely coming for these funds due to their riskiness.

Tara Rice suggested that this question requires cross-country thought. In a survey of 26 countries about their non-bank payment providers there was enormous cross-country variation. For example, Switzerland has an interesting e-wallet. If an e-wallet satisfies certain conditions (less than 300 CHF and no interest paid), then it falls outside the regulatory perimeter. Thinking about the mutual funds discussed by Jun Qian, there are different implications. Deposit questions will depend on underlying regulation, and whether deposits are being levered up, being held at central bank or another institution, or a small amount on a credit card for purchases.

Issues in emerging markets

Cœuré encouraged participants not to lose sight of the financial inclusion dimension. It is an important part of the trade-off discussion, including in terms of societal acceptance of banking's future. In particular, there are key trade-offs in emerging and developing market economies. For example, Kenya has been able to leapfrog some of the legacy issues in banking (which is great progress), but the authorities are then faced with new issues regarding data protection and cybersecurity (which they confront with less capacity).

Jun "QJ" Qian explained that the reason why Ant Financial and similar firms have been successful is because traditional banking has not reached enough customers. In China, certain factors stand out: there is high demand, new entrants can reach and attract small customers, and regulation has not been too restrictive.

Another important consideration for capacity in emerging markets was raised by **Yi Huang** (The Graduate Institute). We talk about discount lending between banks and FinTech companies. A fundamental question concerns contract enforcement, legal systems and institutions. There is an extensive literature on this in low-income countries. Do you see anything changing in contract enforcement across regions or time in China?

Jun "QJ" Qian remarked that in China there is enforcement by formal institutions (in courts), but banks cannot enforce contracts. They cannot smoothly seize assets. The best contract enforcers are private enforcers. What is interesting about Ant Financial is the credit system where good credit implies low interest rates, in addition to other special benefits.

Harald Hau (University of Geneva) commented on the welfare benefits of FinTech firms such as Ant Financial. One cannot evaluate the welfare benefit independently from the state of the banking system with which a FinTech firm is competing. One particular aspect of China and why firms like Ant Financial are welfare-enhancing is the state of the banking system itself and its distortions. In the case of China, there are regional distortions from the allocation of credit from the central bank, distortions from real estate reallocation, fragmentation of local saving and its diversion into real estate booms leading to credit scarcity in some areas, and a sharpening rural-city divide. Under these conditions of fragmentation and an underdeveloped banking system, FinTech has a very different role compared to in developed banking systems (in Geneva, for example). The welfare benefits of FinTech play out differently in emerging markets compared to OECD countries.

Banking issues beyond the scope of this report

Ugo Panizza (The Graduate Institute) mentioned that the original question for the report was: “As the optimal size of banks changes, do we need super banks?” Is Europe disadvantaged because of size and fragmentation compared to the larger banking system in the US, and what is the role of technology? The report evolved, and there might be important policy implications which are not a focus of the report. For example, what is the future for non-big banks?

Rice shared thoughts on bank consolidation. In the report’s survey on banks and nonbanks, there was a lot of concern about what the future financial landscape would look like with the consolidation that was needed, particularly in Europe. How can we foment easier exit? To the big-bank and small-bank questions, at a minimum we know that consolidation will change the landscape. This issue links to the four types of banks identified by Honohan in his presentation.

Honohan noted that fragmentation of banking in Europe after the crisis was a problem. Will the arrival of Big Tech or Fintech help to reintegrate the European banking scene? The answer is probably no, but it might have some potential.

Véron commented on the banking union and linkages to the report. The short answer is that there are difficult political decisions to complete the banking union. Technology is not fundamentally changing the equation, but this is a very monetary union-specific topic.

On European integration, **Rice** thought that FinTech might help banks in three areas. First, cloud competing would have benefits. Imagine if banks in fragmented markets are brought onto the cloud, then M&A becomes easier because you are on the same platform. Second, AI/machines facilitate on-boarding of clients and assets. And finally, DLT allows banks to keep a history of their data, and, if compliance issues arise, this history can be quickly and easily provided.

Véron commented on the potential risks stemming from the creation of a new clearing house for mobile payments in China. New infrastructure becomes a part of new system, and you cannot think about banks themselves without the surrounding system (and the system carries significant systemic risk). Is that the future? The decision to mandate central clearing was made without any consideration of cross-border aspects. As Shin mentioned, it is easy to make these decisions if you have a national system, but we have a global system. There are important cross-border implications and fragmentation.

Cœuré emphasised the potential threat to financial stability arising from cloud services. Non-financial service providers have become new nodes of transmission for financial instability outside of the financial regulatory universe.

References

- Accenture (2019), *2019 Accenture Global Financial Services Consumer Study*.
- Acharya, V., J. Qian, Y. Su, and Z. Yang (2019), "In the Shadow of Banks: Wealth Management Products and Bank Risks", working paper, Fudan University.
- Ackrill, M. and L. Hannah (2001), *Barclays: The business of banking 1690-1996*, Cambridge University Press.
- Adrian, T. and T. Mancini-Griffoli (2019), "The rise of the digital monies", IMF fintech note 19/01.
- Agarwal, S., N. Mahoney, S. Chomsisengphet and J. Stroebel (2018), "Do Banks Pass through Credit Expansions to Consumers Who want to Borrow?", *Quarterly Journal Of Economics* 133(1): 129-190.
- Aimone, A. (2019), "Deutsche predicts lower G-SIB charge", Risk.net, 26 April.
- Allen, F., X. Gu, and J. Qian (2017), "An Overview of China's Financial System", *Annual Review of Financial Economics* 9: 191-231.
- Alois, J.D. (2019), "Facebook Launches Stablecoin Libra and Accompanying Wallet Calibra. Is This Good for Crypto?", Crowdfund Insider, 18 June (<https://www.crowdfundinsider.com/2019/06/148516-facebook-launches-stablecoin-libra-and-accompanying-wallet-calibra-is-this-good-for-crypto/>).
- Altavilla, C., M. Boucinha and J.-L. Peydro (2018), "Monetary Policy and Bank Profitability in a Low Interest Rate Environment", *Economic Policy* 96: 533-586.
- Arner, D., J. Barberis, R. Buckley (2016), "The Evolution of FinTech: A New Post-crisis paradigm", *Georgetown Journal of International Law* 47: 1271-1319.
- Autor, D., D. Dorn, L. Katz, C. Patterson, and J. Van Reenen (2017), "Concentrating on the fall of the labor share", *American Economic Review* 107(5): 180-185.
- Bain & Company and Research Now (2017), "Evolving the customer experience in banking", November.
- Baker, M. (2018), "G-SIB assessments questioned as BPCE put back in after just one year out", Euromoney, 20 November.
- Bank for International Settlements (2019), *Annual Economic Report*, June.
- Banker, The* (1925), "Modern banking in relation to trade", April.
- Banker, The* (1929a), "A crisis in American banking", November.
- Banker, The* (1929b), "Are bank fusions advantageous to the nation?", January.
- Banker, The* (1971), "New era for international banking", February.
- Banker, The* (1975), "How size came back into fashion", May.
- Banker, The* (selected years, 1980-1985), "Top 500 banks".
- Banker, The* (selected years, 1990-1996), "Top 1000 banks".
- Banker, The* (selected years 1996 to 2019), "Top 1000 world banks".
- Banking Magazine* (1960), "Banking 1950-1970: Two decades of growth and competition".
- Bannan, Karen (2019), "China's data protection laws go further than GDPR", InfoGoTo, 22 January (<https://www.infogoto.com/chinas-data-protection-laws-go-further-than-gdpr/>).

- Barth, J and L Tong (2011), *Industrial loan companies: Supporting America's financial system*, Milken Institute, using data from Barth Caprio and Levine (2008).
- Basel Committee on Banking Supervision (BCBS) (2011)
- Basel Committee on Banking Supervision (BCBS) (2014), *Regulatory Consistency Assessment Programme (RCAP). Assessment of Basel III regulations – European Union* (<https://www.bis.org/bcbs/publ/d300.pdf>).
- Basel Committee on Banking Supervision (BCBS) (2017), *Basel III: Finalising post-crisis reforms* (<https://www.bis.org/bcbs/publ/d424.pdf>).
- Basel Committee on Banking Supervision (BCBS) (2018), *Cyber-resilience: Range of practices* (<https://www.bis.org/bcbs/publ/d454.pdf>).
- Bassett, W. (2015), "Using insured deposits to refine estimates of the large bank funding advantage", Federal Reserve Board of Governors Working Paper, 9 March.
- Bech, M. and R. Garratt (2017), "Central bank cryptocurrencies", *BIS Quarterly Review*, September.
- Bech, M., Y. Shimizi and P. Wong, (2017), "The quest for speed in payments", *BIS Quarterly Review*, March.
- Berger, A., W. Goulding and T Rice (2014), "Do small businesses still prefer community banks?", *Journal of Banking and Credit* 44: 264-278.
- Blair, C. (2005), "The Mixing of Banking and Commerce: Current Policy Issues", *FDIC Banking Review* 16(4): 97-120.
- Bolton, P. and M. Oehmke (2018), "Bank resolution and the structure of global banks", NBER working paper 24737.
- Bouyon, S. (2018), *Cost and value in banks: A model fit for the digital era?*, European Credit Research Institute Research Report No. 20.
- Brody, B. (2019), "Google, Facebook Set 2018 Lobbying Records as Tech Scrutiny Intensifies", Bloomberg, 22 January (<https://www.bloomberg.com/news/articles/2019-01-22/google-set-2018-lobbying-record-as-washington-techlash-expands>).
- Buchak, G, G Matvos, T Piskorski and A Seru (2018), "Fintech, Regulatory Arbitrage, and the Rise of Shadow Banks", *Journal of Financial Economics* 130(3): 453-692
- BusinessWire (2018), "Wells Fargo launches control tower, new digital experience for customers nationwide", 1 October.
- Butcher Piat, H. (2018), "China's New State Administration for Market Regulation", China Briefing, Dezan Shira & Associates, 11 October (<https://www.china-briefing.com/news/chinas-new-state-administration-market-regulator-samr>).
- Calomiris, C.W. and S. Haber (2014), *Fragile by design: The political origins of banking crises and scarce credit*, Princeton University Press.
- Cameron, R. and V.I. Bovykin (1991), *International Banking 1870-1914*, Oxford University Press.
- Capana, F. and L. Thomas (2019), "Libra launch won't happen until regulators are happy: Coeure", Reuters, 18 July.
- Capgemini (2014) *Doing Business The Digital Way: How Capital One Fundamentally Disrupted the Financial Services Industry*.
- Carney, M. (2017), "What a difference a decade makes", remarks at the Institute of International Finance's Washington Policy Summit, Washington, DC, 20 April.
- Carney, M. (2018), "Worthy of trust? Law, ethics and culture in banking", remarks at the Banking Standards Board Panel, 21 March.

- Carney, M. (2019), "Enable, empower, ensure: a new finance for the new economy", remarks at the Lord Mayor's Banquet for Bankers and Merchants of the City of London, London, 20 June.
- Carstens, A. (2018), "Big tech in finance and new challenges for public policy", keynote address at the FT Banking Summit, London, 4 December.
- Carstens, A. (2019), "Increasing innovation and the future of money and payments" (<https://www.bis.org/speeches/sp190617.htm>).
- Casey, M., J. Crane, G. Gensler, S. Johnson and N. Narula (2018), *The Impact of Blockchain Technology on Finance: A Catalyst for Change*, The 21st Geneva Report on the World Economy, ICMB and CEPR.
- Chalmers, A. (2017), *When Banks Lobby: The Effects of Organizational Characteristics and Banking Regulations on International Bank Lobbying*, Cambridge University Press.
- Chorzempa, M. (2018), "How China Leapfrogged Ahead of the United States in the Fintech Race", Peterson Institute for International Economics blog, 26 April (<https://www.piie.com/blogs/china-economic-watch/how-china-leapfrogged-ahead-united-states-fintech-race>).
- Claessens, S., T. Glaessner and D. Klingebiel (2001), "E-Finance in Emerging Markets: Is Leapfrogging Possible?", World Bank Financial Sector Discussion Paper No. 7.
- 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): 29-49.
- Clark, T. (2017), "Fintech and the Battle Against Fraud", *PaymentsJournal*, 7 June (<https://www.paymentsjournal.com/fintech-and-the-battle-against-fraud/>).
- Clozel, L., (2017), "Square's bid to be industrial bank inflames ILC debate", *American Banker*, 6 September (<https://www.americanbanker.com/news/square-to-apply-for-industrial-bank-inflaming-ilc-debate>).
- Clozel, L., (2019), "Japanese Online Retailer Rakuten Seeks U.S. Bank Charter", *The Wall Street Journal*, 26 July (<https://www.wsj.com/articles/japanese-online-retailer-rakuten-seeks-u-s-bank-charter-11564161337>).
- Cœuré, B. (2019), "Update from the Chair of the G7 working group on stablecoins", 18 July (<https://www.bis.org/cpmi/speeches/sp190718.pdf>).
- Cojoianu, T., G. Clark, A. Hoepner, V. Pažitka and D. Wójcik (2019) "Fin vs. Tech: Determinants of Fintech Start-Up Emergence and Innovation in the Financial Services Incumbent Sector", SSRN.
- Committee on the Global Financial System (GCFS) (2018), "Structural changes in banking after the crisis", CGFS Papers No 60.
- Conant, C. (1927), *A history of modern banks of issue*, G.P. Putnam's Sons.
- Consumer Financial Protection Bureau (2017), "CFPB Announces First No-Action Letter to Upstart Network", 14 September (<https://www.consumerfinance.gov/about-us/newsroom/cfpb-announces-first-no-action-letter-upstart-network>).
- Conti Brown, P. (2012), "Elective Shareholder Liability", 64 *Stanford Law Review* 409.
- Cook, J. (2019a), "Digital bank Revolut's sanctions screening issue revealed", *The Telegraph*, 28 February.
- Cook, J. (2019b), "Inside Revolut and why the booming finance firm is facing a tide of criticism", *The Telegraph*, 7 May.

- Covarrubias, M., G. Gutierrez and T. Philippon (2019), "Explaining the Rising Concentration of US Industries: Superstars, Intangibles, Globalization or Barriers to Entry?", NBER Chapters, March.
- Committee on Payments and Market Infrastructures (CPMI) (2018), "Cross-border retail payments", CPMI Papers No. 173.
- Consumer Financial Protection Bureau (2016), *Project Catalyst report: Promoting consumer friendly innovation* (https://files.consumerfinance.gov/f/documents/102016_cfpb_Project_Catalyst_Report.pdf).
- Deloitte (2019), "The future of regulation", 19 June (<https://www2.deloitte.com/insights/us/en/industry/public-sector/future-of-regulation/regulating-emerging-technology.html>).
- Deloitte (2019), "RegTech Universe", (<https://www2.deloitte.com/lu/en/pages/technology/articles/regtech-companies-compliance.html>).
- Demos, T. (2019), "The Wait for Payday Doesn't Have to Be So Long", *Wall Street Journal*, 10 August (<https://www.wsj.com/articles/the-wait-for-payday-doesnt-have-to-be-so-long-11565429401>).
- Dermine, J. (2016), "Digital banking and market disruption: a sense of déjà u?", *Banque de France Financial Stability Review* April: 18 (<https://faculty.insead.edu/jean-dermine/documents/BanquedeFrance-DigitalBanking-Proof-2016.pdf>).
- De Roure, C., L. Pelizzon and P. Tasca (2016), "How does P2P lending fit into the consumer credit market?" Deutsche Bundesbank Discussion Paper No 30/2016.
- DeYoung, R. and T. Rice (2004), "Noninterest Income and Financial Performance at U.S. Commercial Banks", *The Financial Review* 39(1): 101-127.
- Dick-Nielsen, J., J. Gyntelberg and C. Thimson (2019), "The Cost of Capital for Banks", working paper, March.
- DLA Piper (2019), "Data protection laws of the World: India" (<https://www.dlapiperdataprotection.com/index.html?t=transfer&c=IN>).
- Dodd-Frank Wall Street Reform and Consumer Protection Act (2010), Pub. L. No. 111-203, § 929-Z, 124 Stat. 1376, 1871 (2010) (codified at 15 U.S.C. § 78o).
- Drechsler, I., A. Savov and P. Schnabl (2017), "The deposits channel of monetary policy", *Quarterly Journal of Economics* 132(4): 1819-1876.
- Dunbar, C. (1892), "The bank of Venice", *Quarterly Journal of Economics* 6(3): 308-335.
- Dziatovkii, A. (2018), "Are we witnessing the death of the bank?", *Medium*, 7 June.
- Eadicicco, L. (2019), "Bill Gates says today's big tech companies have learned from Microsoft's mistakes in its big antitrust battle", *Business Insider*, 25 June (<https://www.businessinsider.com/bill-gates-microsoft-antitrust-lawsuit-2019-6?r=US&IR=T>).
- Economic Times, The* (2019), "US criticises India's data localisation norms, draft e-commerce policy", 9 April (<https://economictimes.indiatimes.com/news/economy/foreign-trade/us-criticises-indias-data-localisation-norms-draft-e-commerce-policy/articleshow/68794927.cms>).
- Economist, The* (2019), "Special Report: Banking", 2 May.
- Eisenegger, M. and D. Künstle (2011), "Long-Term Reputation Effects in the Global Financial Industry: How the Financial Crisis Has Fundamentally Changed Reputation Dynamics", in A. Hiles (ed.), *Reputation Management*, Bloomsbury.
- Elliot, D. (2019), *Data rights in finance: Key public policy questions and answers*, Oliver Wyman.

- Evans-Pritchard, E. (2019), "Defragging the market (Q&A: Ryozy Himono)", *Risk* April: 59-61.
- Farboodi, M., R. Mihet, T. Philippon and L. Veldkamp (2019), "Big data and firm dynamics" NBER working paper 25515.
- Federal Reserve Board (2012), "Enhanced Prudential Standards and Early Remediation Requirements for Foreign Banking Organizations and Foreign Nonbank Financial Companies", notice of proposed rulemaking, 28 December.
- Federal Reserve System (2019), *Bank Holding Company Supervision Manual*.
- Financial Conduct Authority (2015), "Regulatory Sandbox" (<https://www.fca.org.uk/publication/research/regulatory-sandbox.pdf>).
- Financial Stability Board (FSB) (2010), "Reducing the Moral Hazard Posed by Systemically Important Financial Institutions", working paper.
- Financial Stability Board (2013), "Progress and Next Steps Towards Ending "Too-Big-To-Fail" (TBTF)", working paper.
- Financial Stability Board (2017), "Artificial intelligence and machine learning in financial services: Market developments and financial stability implications", 1 November.
- Financial Stability Board (2018a), *Global Shadow Banking Monitoring Report 2017*.
- Financial Stability Board (2018b), "2018 list of global systemically important banks (G-SIBs)", 16 November.
- Financial Stability Board (2019a), *Global Monitoring Report on Non-Bank Financial Intermediation 2018*.
- Financial Stability Board (2019b), *FinTech and market structure in financial services: Market developments and potential financial stability implications*.
- Financial Stability Board (2019c), *Thematic Review on Bank Resolution Planning: Peer Review Report*.
- FinRegLab (2019), *The Use of Cash-Flow Data in Underwriting Credit*.
- Fisher, E. and H. Rosenblum (2012), "How huge banks threaten the economy", *Wall Street Journal*, 4 April.
- Flitter, E. and K. Weise (2019), "Capital One data breach compromises data of over 100 million", *New York Times*, 26 July.
- Frost, J. (forthcoming), "Economic forces driving fintech adoption across countries", in M. King and R. Nesbitt (eds.), *The Technological Revolution in Financial Services: How Banks, FinTechs, and Customers Win Together*, University of Toronto Press.
- Frost, J., L. Gambacorta, Y. Huang, H. Shin and P. Zbinden (2019), "BigTech and the changing structure of financial intermediation", BIS Working Papers no. 779.
- Fuster, A., M. Plosser, P. Schnabel and J. Vickery (2018), "The role of technology in mortgage lending", Federal Reserve Bank of New York Staff Report No 836.
- G7 (2019), "Common Understanding of G7 Competition Authorities on 'Competition and the Digital Economy'", Paris, 5 June (http://www.autoritedelaconurrence.fr/doc/g7_common_understanding.pdf).
- G20 (2009), "G20 Leaders Statement: The Pittsburgh Summit".
- GAO (2014), *Large bank holding companies: Expectations of government support*, Report to Congressional Requesters.
- 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 paper.

- Garratt, R. and M. van Oordt (2019), "Privacy as a Public Good: A Case for Electronic Cash", working paper.
- Goodhart, C.A.E. and A. Kabiri (2019), "Monetary Policy and Bank Profitability in a Low Interest Rate Environment: A Follow-up and a Rejoinder", EPR Discussion Paper 13752.
- Gutierrez, G. and T. Philippon (2018), "How EU Markets Became More Competitive Than US Markets: A Study of Institutional Drift", NBER working paper 24700.
- Granville, K. (2018), "Facebook and Cambridge Analytica: What You Need to Know as Fallout Widens", *New York Times*, 19 March.
- Grimaldi, M., A. Crosta, A. David and J. Linder (2019), "The value of an implicit state guarantee for systemic banks", FI Analysis No 15, Swedish National Debt Office.
- Grullon, G., Y. Larkin, and R. Michaely (2016), "Are US industries becoming more concentrated?", working paper.
- Hart K. and I. Fried (2018), "Exclusive poll: Facebook favorability plunges", Axios, 26 March (<https://www.axios.com/exclusive-poll-facebook-favorability-plunges-1522057235-b1fa31db-e646-4413-a273-95d3387da4f2.html>).
- Heald, M. (1960), "How we handle automation", *Banking* June.
- Hoening, T. (2014), "TBTF Subsidy for Large Banks--Literature Review".
- Hogue, J. (2018), "7 Warning Signs of a Personal Loan Scams", PeerFinance101, 2 April.
- Huang, Y., C. Lin, Z. Sheng and L. Wei (2018), "FinTech Credit and Service Quality", mimeo.
- Igan, D. and T. Lambert (2019), "Bank lobbying: Regulatory capture and beyond.", IMF working paper 19/171.
- Independent Community Bankers of America (ICBA) (2019), "Industrial loan companies: closing the loophole to avert consumer and systemic harm", White Paper (https://www.icba.org/docs/default-source/icba/advocacy-documents/reports/ilc-white-paper.pdf?sfvrsn=ea6f4317_2).
- Institute of International Finance (IIF) (2018), "A new kind of conglomerate: Bigtech in China" (<https://www.iif.com/Publications/ID/16/A-New-Kind-of-Conglomerate-Bigtech-in-China>).
- Institute of International Finance (IIF) (2019), "Data flows across borders" (https://www.iif.com/Portals/0/Files/32370132_iif_data_flows_across_borders_march2019.pdf).
- Jagtiani, J. and C. Lemieux (2018a), "The Roles of Alternative Data and Machine Learning in Fintech Lending: Evidence from the Lending Club Consumer Platform", Federal Reserve Bank of Philadelphia Working Paper No. 18–15.
- Jenik I., and K. Lauer (2017), *Regulatory Sandboxes and Financial Inclusion*, CGAP.
- Jia, Y. and G. Wildau (2019), "Ant Financial's money market fund shrinks to 2-year low", *Financial Times*, 28 January (<https://www.ft.com/content/35bbbef6-20a8-11e9-b126-46fc3ad87c65>).
- Johnson, S. and J. Kwak. (2010), *13 Bankers: The Wall Street Takeover and the Next Financial Meltdown*, Vintage.
- Jones, H. (2019), "Facebook's Libra must be 'rock solid' before launch warns BOE's Carney", Reuters, 11 July.
- Kang C. and K. Vogel (2019), "Tech Giants Amass a Lobbying Army for an Epic Washington Battle", *The New York Times*, 5 June (<https://www.nytimes.com/2019/06/05/us/politics/amazon-apple-facebook-google-lobbying.html>).

- Kang C., D. Streitfeld, K. Rogers and S. Saul (2019), "Google and Amazon Are at the Center of a Storm Brewing Over Big Tech", *The New York Times*, 2 June (<https://www.nytimes.com/2019/06/02/business/google-antitrust-investigation.html>).
- Kavuri, A. and A. Milne (forthcoming), "Distributed Ledgers – A distraction on the road to digital transformation of financial services", Swift Institute Working Paper.
- Klein, A. (2019), *Is China's new payment system the future?*, Brookings Institution, (https://www.brookings.edu/wp-content/uploads/2019/05/ES_20190617_Klein_ChinaPayments.pdf).
- Kokkinis, A. (2018), *Corporate Law and Financial Instability*, Routledge.
- Kopp, E. L. Kaffenberger and C. Wilson (2017), "Cyber Risk, Market Failures, and Financial Stability", IMF Working Paper No. 17/185.
- KPMG (2017), *Value of Fintech*.
- KPMG (2018a), *Regulation 2030* (<https://assets.kpmg/content/dam/kpmg/gh/pdf/regulation-2030.pdf>).
- KPMG (2018b), *The Pulse of Fintech: Global report on FinTech investment trends*.
- Kreicher, L. and R. McCauley (2018), "The new US intermediate holding companies: reducing or shifting assets?", *BIS Quarterly Review* March: 10-11.
- Kroszner, R. (2016), "A Review of Bank Funding Cost Differentials", *Journal of Financial Services Research* 49(2-3): 151–174.
- Laeven, L. and F. Valencia (2008), "Systemic banking crises: a new database", IMF Working Paper WP/08/224.
- Mallet, V. (2019), "G7 warns on 'serious risks' posed by Libra and other digital coins", *Financial Times*, 18 July.
- McDonald, K. (2019), "Revolut: the latest controversy to hit the app after single-shaming and data fakery", iNews, 3 March.
- McGath, Thomas (2018), "M-PESA: how Kenya revolutionized mobile payments", *N26 Magazine*, 9 April (<https://mag.n26.com/m-pesa-how-kenya-revolutionized-mobile-payments-56786bc09ef>).
- McIntyre, A. (2019), "People Trust Banks, But Banks Need to Continue to Earn That Trust", *Forbes*, 25 March (<https://www.forbes.com/sites/alanmcintyre/2019/03/25/people-trust-banks-but-banks-need-to-continue-to-earn-that-trust/#20e4ff403472>).
- McKinsey&Company (2018a) *New rules for an old game: Banks in the changing world of financial intermediation*, McKinsey Global Banking Annual Review 2018.
- McKinsey&Company (2018b), *Global payments 2018: A dynamic industry continues to break new ground*.
- Mellina, E. (2019), "Revolut insiders reveal the human cost of a fintech unicorn's wild ride", *Wired*, 28 February (<https://www.wired.co.uk/article/revolut-trade-unions-labour-fintech-politics-storonsky>).
- Menand, L. (2019), "The Monetary Basis of Bank Supervision" (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3421232).
- Moser S., N. Pesaresi and K. Soukup. (2002), "State guarantees to German public banks: a new step in the enforcement of State aid discipline to financial services in the Community", European Commission Competition Policy Newsletter No. 2.
- Navaretti, G., G. Calzonari and A. Pozzolo (2017), "FinTech and banking: Friends or foes?", *European Economy: Banks, Regulation and the Real Sector* 2017(2).

- Neely, M. (2007), "Industrial Loan Companies Come out of the shadows", *The Regional Economist*, Federal Reserve Bank of St Louis, July.
- Newton, L. (2010), "The birth of joint-stock banking: England and New England compared", *The Business History Review* 84(1): 27-52.
- Nguyen Trieu, H. (2017), "Why finance is becoming hyperscalable", *Disruptive Finance*, 24 July.
- OECD (2017), *Future of Work and Skills*.
- Philippon, T. (2015), "Has the US finance industry become less efficient? On the theory and measurement of financial intermediation", *The American Economic Review* 105(4): 1408-1438.
- Philippon, T. (2018), "The FinTech opportunity", NBER working paper 22476.
- Philippon, T. (2019), "On Fintech and Financial Inclusion", BIS Working Paper
- Prior, R. (2019), "Kabbage on the US open banking market", Mobey Forum, 24 April (<https://www.mobeyforum.org/kabbage-on-the-us-open-banking-market>).
- Pryce, J. (2019), "The FinTech revolution is here. Can it help build a better economy?", *Forbes*, 22 February.
- PwC (2018), *Pulling fraud out of the shadows: Global economic crime and fraud survey 2018*.
- Ranglin, C. and S. Taussig (2019), Data Policy Operating Definition, Kabbage, Inc.
- Reinhart C. and K. Rogoff K (2009), *This Time is Different: Eight Centuries of Financial Folly*, Princeton University Press.
- Reuters (2014), "Factbox: Fed lists foreign banks that may fall under new rule", 20 February.
- Reuters (2018), "Mastercard lodged U.S. protest over Modi's promotion of Indian card network", 1 November (<https://www.reuters.com/article/us-india-mastercard-exclusive/exclusive-mastercard-lodged-u-s-protest-over-modis-promotion-of-indian-card-network-idUSKCN1N65IU>).
- Reuters (2019), "BoE's Carney says keeping open mind on Facebook's Libra", 18 June (<https://www.reuters.com/article/us-facebook-crypto-carney/boes-carney-says-keeping-open-mind-on-facebooks-libra-idUSKCN1TJ26A>).
- Roengpitya, R., N. Tarashev and K. Tsatsaronis (2014), "Bank business models", *BIS Quarterly Review*, December.
- Rooney, K. (2018), "After the crisis, a new generation puts its trust in tech over traditional banks", *CNBC*, 14 September (<https://www.cnbc.com/2018/09/14/a-new-generation-puts-its-trust-in-tech-over-traditional-banks.html>).
- Rooney, K. (2019), "PayPal stumbles 6% after missing on revenue, slashing full-year outlook.", *CNBC*, 24 July (<https://www.cnbc.com/2019/07/24/paypal-q2-earnings.html>).
- Rottier, S. and N. Véron. (2010), "Not all financial regulation is global", *Bruegel Policy Brief*, August.
- Sapienza, P. and L. Zingales (2012), "A Trust Crisis", *International Review of Finance* 12(2): 123-131.
- Saunders, A. and M. Cornett. (2017), *Financial Institutions Management: A risk management approach*, McGraw Hill.
- Schleifer, T. (2019), "Why does Washington suddenly seem ready to regulate Big Tech? Look at the polls", *Vox*, 4 June (<https://www.vox.com/2019/6/4/18652469/washington-antitrust-regulate-amazon-google-facebook-look-at-polls>).

- Schroeder, R. (2019), "How the U.S.-China trade war started, and what's coming next", *Market Watch*, 9 August (<https://www.marketwatch.com/story/how-the-us-china-trade-war-started-and-whats-coming-next-2019-08-05>).
- Schulze, E. (2019), "If you want to know what a US tech crackdown may look like, check out what Europe did", *CNBC*, 7 June (<https://www.cnbc.com/2019/06/07/how-google-facebook-amazon-and-apple-faced-eu-tech-antitrust-rules.html>).
- Schulze, E. and S. Choudhury (2019), "Facebook's dream of a global cryptocurrency raises political stakes for the regulators themselves", *CNBC*, 25 August.
- Schwarcz, S. (2019), "Systematic Regulation of Systemic Risk", forthcoming in *Wisconsin Law Review* (<https://ssrn.com/abstract=3233666>).
- Seidman, L. (1999), "Testimony on deposit insurance reform before the Subcommittee on Commerce, Consumer and Monetary Affairs of the Committee on Government Operations", United States House of Representatives, 3 October.
- Shema, A. (2019), "Effective credit scoring using limited mobile phone data", January.
- Sheng, W. (2019), "One year after GDPR, China strengthens personal data regulations, welcoming dedicated law", *Technode*, 19 June (<https://technode.com/2019/06/19/china-data-protections-law/>).
- Sjoblom, M. (2018), "The death of the high-street bank", *Finance Monthly*, June.
- Solon, O. and S. Siddiqui. (2017), "Forget Wall Street – Silicon Valley is the new political power in Washington", *The Guardian*, 3 September (<https://www.theguardian.com/technology/2017/sep/03/silicon-valley-politics-lobbying-washington>).
- Spangler, T. (2019), "Facebook Under Fire: How Privacy Crisis Could Change Big Data Forever", *Variety*, April (<https://variety.com/2018/digital/features/facebook-privacy-crisis-big-data-mark-zuckerberg-1202741394/>).
- Spicer, J. (2019), "Fed backs Bangladesh as cyber-heist lawsuit kicks off", *Reuters Technology News*, 1 February.
- Stern, G. and R. Feldman (2009), "Addressing TBTF by Shrinking Institutions: An Initial Assessment", *The Region*, Federal Reserve Bank of Minneapolis, June.
- Stiroh, K. (2004), "Diversification in Banking: Is Noninterest Income the Answer?", *Journal of Money, Credit and Banking* 36(5): 853-82.
- Swiss National Bank (SNB) (2019), *Survey on digitalisation and fintech at Swiss banks*.
- Tang, H. (2018), "Peer-to-peer lenders versus banks: substitutes or complements?", *Review of Financial Studies*, forthcoming.
- Taussig, S. (2018a), "Ending data breaches", *The Washington Times*, 15 November (<https://www.washingtontimes.com/news/2018/nov/15/why-the-data-debate-must-separate-authorized-versu/>).
- Taussig, S. (2018b), "Opinion: How 'too-big-to-fail' banking giants limit ways fintech firms can handle your money", *MarketWatch*, 26 July.
- Taussig, S. (2019a), "Before they regulate AI, Congress needs to define it", *American Banker*, 25 June (<https://www.americanbanker.com/opinion/before-they-regulate-ai-congress-needs-to-define-it>).
- Taussig, S. (2019b), "How AI can advance the cause of fair lending", *American Banker*, 23 July (<https://www.americanbanker.com/opinion/how-ai-can-advance-the-cause-of-fair-lending>).

- Trebbi F. (2019), "The Political Footprint of Big Tech in Five Easy Charts", ProMarket, 8 May (<https://promarket.org/the-political-footprint-of-big-tech-in-five-easy-charts/>).
- Tucker, P. (2017), "The political economy of central banking in the digital age", SUERF Policy Note 13, June.
- Tung, L. (2019), "GDPR, USA? Microsoft says US should match the EU's digital privacy law", ZDNet, 21 May (<https://www.zdnet.com/article/gdpr-usa-microsoft-says-us-should-match-the-eus-digital-privacy-law/>).
- US Chamber of Commerce (2019), Ensuring Business Innovation While Protecting Consumer Privacy website (<https://www.uschamber.com/data-privacy>).
- US Department of the Treasury (2011), *Study of the effects of size and complexity of financial institutions on capital market efficiency and economic growth*.
- US Department of the Treasury (2018), *A Financial System That Creates Economic Opportunities*, Report to President Donald J. Trump.
- US Small Business Administration (2018), "2018 Small Business Profiles for the States and Territories" (<https://www.sba.gov/advocacy/2018-small-business-profiles-states-and-territories>).
- Van Liebergen, B. (2017), "Machine learning: a revolution in risk management and compliance?", *The Capco Institute Journal of Financial Transformation* 45: 60-67.
- Véron, N. (2017), "Governance and ownership of significant euro area banks", Peterson Institute for International Economics Policy Brief 17-18.
- Véron, N. (2019a), "Memo to the European Commissioner for Financial Services", in Braver, Greener, Fairer: *Memos to the EU Leadership 2019-2024*, Bruegel.
- Véron, N. (2019b), "Supranational financial regulation: a pipe dream, or an idea whose time has come?", in F. Allen, E. Carletti, M. Gulati, and J. Zettelmeyer (eds), *European Financial Infrastructure in the Face of New Challenges*, European University Institute.
- Vijayan, G. (2018), "Death of the banking industry worldwide", Medium, 13 August.
- Vives, X. (2019a), "Competition and stability in modern banking: A post-crisis perspective", *International Journal of Industrial Organization* 64: 55-69.
- Vivies, X. (2019b), "Digital disruption in banking", paper prepared for the OECD Competition Committee FinTech Roundtable, 5 June.
- Wadsworth, A (2018a), "Decrypting the role of distributed ledger technology in payments processes", *Reserve Bank of New Zealand Bulletin* 81(5).
- Wadsworth, A, (2018b) "The pros and cons of issuing a central bank digital currency", *Reserve Bank of New Zealand Bulletin* 81(7).
- Wheatland, J. (2019), "I was a top executive at Cambridge Analytica. It taught me a tough lesson about public trust", CNN Business Perspectives, 19 August.
- Wheelock, D. and P. Wilson. (2012), "Do large banks have lower costs? New estimates on returns to scale for US banks", *Journal of Money, Credit and Banking* 44(1): 171-199.
- Wheelock, D. and P. Wilson. (2017), "The evolution of scale economies in US banking", *Journal of Applied Economics* 33: 16-28.
- Wildau, G. (2017), "China targets mobile payments oligopoly with clearing mandate", *Financial Times*, 9 August.
- Wilmarth, A. (2007), "Wal-Mart and the separation of banking and commerce", *Connecticut Law Review*, May.

- Wilmarth, A. (2017a), "The road to repeal of the Glass-Steagall Act", GW Legal Studies Research Paper No. 2017-61.
- Wilmarth, A. (2017b), "Beware the return of the ILC", *American Banker*, 2 August.
- Wolcott, M. (2007), "Effect of Positive Credit Bureau Data in Credit Risk Models", Equifax (<https://cra.business-school.ed.ac.uk/wp-content/uploads/sites/55/2017/03/wolcott-1.pdf>).
- World Economic Forum (2017), *Beyond Fintech: A Pragmatic Assessment of Disruptive Potential in Financial Services*, prepared in collaboration with Deloitte (http://www3.weforum.org/docs/Beyond_Fintech_-_A_Pragmatic_Assessment_of_Disruptive_Potential_in_Financial_Services.pdf).
- Wysocki, B. (2006), "How broad coalition stymied Wal-Mart's bid to own a bank", *Wall Street Journal*, 23 October.

The provision of financial services is profoundly changing worldwide – so much so that many commentators are predicting the death of banking as we know it. The threat of banks' extinction is not new; it has been heralded many times in the past. For centuries, as banks have expanded and evolved, they have faced competition from other types of financial institutions. Despite high barriers to entry and as a result, relatively low turnover, many commentators have anticipated the end of the traditional banking business model.

Today, we are again experiencing radical changes in the way households and businesses transact. The primary drivers are rapid advances in technology and post-crisis changes in the financial regulatory landscape, both of which have fuelled increased competition and encouraged new entrants in the provision of financial services. Critically, today's competition for big bank business models emanates from nonbank firms whose core strategy centres around technological innovation ('Big Tech' and 'FinTech' firms) and from nonbank financial institutions such as large asset managers.

This report reviews the financial services landscape and how it has changed over the last several decades, discusses the competition from FinTech and Big Tech, and considers critical public policy questions surrounding the future of banking.

Centre for Economic Policy Research

33 Great Sutton Street • LONDON EC1V 0DX • UK

TEL: +44 (0)20 7183 8801 • FAX: +44 (0)20 7183 8820 • EMAIL: CEPR@CEPR.ORG

WWW.CEPR.ORG

