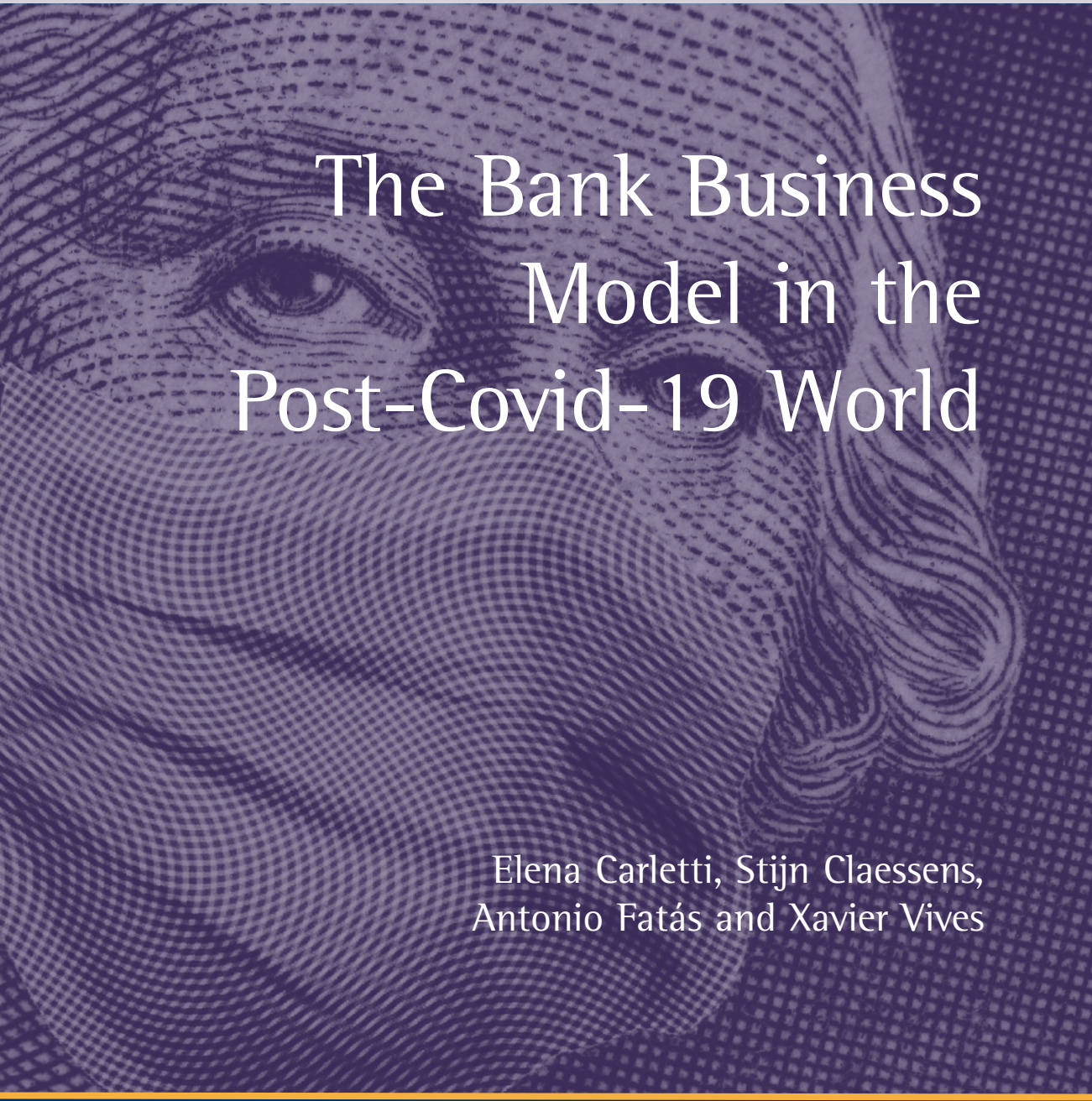
The Future of Banking 2



The Bank Business Model in the Post-Covid-19 World

Elena Carletti, Stijn Claessens,
Antonio Fatás and Xavier Vives

IESE Business School University of Navarra
Banking Initiative

CEPR

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Xavier Vives is Chaired Professor of Economics and Finance at IESE Business School. He is a Fellow of the Econometric Society since 1992, the European Economic Association since 2004; and the Academia Europaea since 2012. He was Duisenberg Fellow of the European Central Bank in 2015, and President of the European Association for Research in Industrial Economics for 2016-2018. He has recently published the book *Competition and Stability in Banking* and he is currently editor of the *Journal of Economic Theory*. In 2011-2014 he was Special Advisor to the EU Commissioner for Competition, Mr Joaquín Almunia, and until May 2020 he was Lead Independent Director of CaixaBank.

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The views expressed in this report are those of the authors and should not be taken to represent any of the institutions with which they are or have been affiliated, or the individuals mentioned above.

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15:00	**Digital money, payments and banks** Antonio Fatás, INSEAD Discussant: Dirk Niepelt, Study Center Gerzensee and University of Bern Chair: Jean-Pierre Landau, Sciences Po and Banque de Franced
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List of conference participants

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Foreword

This is the second report in the series on The Future of Banking, part of the Banking Initiative from the IESE Business School that was launched in October 2018 and is supported by Citi.

The goal of the IESE Banking Initiative is to establish a group of first-rate researchers to study new developments in banking and financial markets, paying particular attention to regulation and competition policy and to the impact on business banking models. It promotes a rigorous and informed dialogue on current issues in the fields of banking and financial markets amongst academics, regulators, private sector companies and civil society.

The first report assessed the regulatory reform of the banking system after the Great Recession induced by the crisis of 2007-2009. We could not imagine 12 months ago that we would have to face another major crisis so soon. We stated then that the next global crisis might have different origins, possibly in entities that perform the functions of banks but are outside of the regulatory perimeter, with operational risk on the rise, or in an emerging market where regulation could well be different from the reformed patterns of the West. The Covid-19 induced crisis may affect the financial system by increasing bad loans, keeping interest rates low for a long time, and accelerating previous tendencies such as digitalisation. The crisis will test the regulatory reform put in place after the Great Recession that we analysed in the first report. There we concluded that the system had been made more resilient but that further work remained to be done. We will see how the present crisis affects banks and shadow banks.

In this second report we address the changes in the business models of banks and identify that the challenges that banks faced in the pre-Covid-19 world, low interest rates and digitalisation, will be made more severe in the post-Covid-19 world. Banks will have to deal with the fact that the crisis will dramatically increase non-performing loans, although with temporary relief from strict regulations and with massive liquidity help from central banks. Restructuring in the sector will accelerate. An open question is whether surviving incumbents will move ahead or if powerful BigTech will enter the sector with force, or possibly a new form of platform-based oligopoly will emerge including some transformed bank incumbents.

The report was produced following the conference "The bank business model of the future" which was held online on 1 April 2020. The conference programme together with the comments of the three discussants are included in this report. The team of authors was brought together and is led by Xavier Vives.

The Banking Initiative has benefitted from the keen support of the Dean of IESE, Franz Heukamp, and the former Dean, Jordi Canals. CEPR and IESE are very grateful to the authors and discussants for their efforts in preparing this report, as well as to the conference attendees for their perceptive comments.

We are also grateful to Carlota Monner for her extremely efficient organisation of the conference as well as providing support for the report, to the Florence School of of Banking & Finance at European University Institute for hosting the online conference, and to Anil Shamdasani for his unstinting and patient work in publishing the report.

The views expressed in the report are those exclusively of its authors and do not represent those of CEPR, which takes no institutional positions on economic policy matters. CEPR and IESE are delighted to provide a platform for an exchange of views on this topic.

Tessa Ogden
Chief Executive Officer, CEPR

Xavier Vives
Director, IESE Banking Initiative

June 2020

Executive summary

The Covid-19 pandemic has induced a deep economic crisis that may provoke another financial crisis. Yet, in the middle of the financial turmoil over the past few months, banks have been a source of resilience. Thanks to major reforms after the crisis of 2007-2009, the much better capitalised and more liquid banks were not under immediate stress. In fact, they are seen as useful to support the real sector's financing needs. However, banks will come under stress. Large-scale insolvencies among firms may arise. A wave of bankruptcies among households may follow. Banks could eventually get caught up, with stresses to exceed those envisioned in many tests.

The crisis comes on top of the combination over the past decade of persistently low interest rates, regulations, and competition from shadow banks and new digital entrants that has challenged the traditional business model in banking. The question is what the consequences will be for banks' business model. We argue in this report that the Covid-19 crisis will accelerate pre-crisis tendencies as subdued growth and low interest rates will persist for a long time and digitalisation will see a large impetus, with many new digital entrants. Deep restructuring in the sector will be needed.

The Covid-19 crisis comes at the end of a decade that has witnessed significant transformation in the financial services industry around the world. The business model of banking has been challenged by three developments. The first is low interest rates, which are affecting the profitability of financial institutions, in particular those that are more reliant on maturity transformation and net interest income. The second is increased prudential requirements, regulatory scrutiny and compliance costs in the wake of the 2007-2009 financial crisis. As analysed in the first Future of Banking report, these rules have contributed significantly to enhancing the stability of the financial sector. At the same time, they have put pressure on banks' profitability and lessened their competitiveness relative to shadow banks. The third development is the massive application of digital technologies and the emergence of new competitors. While these have allowed for many new products and services and helped improve the efficiency of incumbent banks, they have also favoured the entry of new FinTech firms, as well as BigTech players in banking-related activities, in competition with traditional bank business models – in particular in the area of payments.

The report thus tackles the three crucial areas where the bank business model is being challenged: the low interest rate environment, regulation and digitalisation. It also examines the competitive strategies of the different players – both incumbents and new entrants – and the policy and regulatory issues associated with the digital world. Both pre-Covid tendencies and post-Covid scenarios are analysed.

Challenges to the business models of banks

Banks perform several key functions in the economy by allowing investors and borrowers to reallocate funds more effectively thanks to reduced opacity, less information asymmetries, longer maturities, lower risks, and lower transaction costs. This intermediation role has been performed through different business models, which have evolved over time depending on technological developments and market conditions and based on the risk appetite of the specific bank.

The Covid-19 outbreak and its adverse economic effects come at the end of a decade of significant transformation for the banking industry around the world due to three main factors. The first is the persistent low level of interest rates, with negative nominal rates in some jurisdictions in the recent years. While low interest rates affect bank profitability positively in the short term, their persistence has negative consequences through reduced net interest margins as well as weaker monitoring incentives and laxer lending standards, in particular for those institutions that are more reliant on maturity transformation and net interest income.

The second factor is increased financial regulation and supervision, in particular stricter capital and liquidity requirements, macroprudential instruments and resolution regimes. These rules have contributed to the build-up of a more resilient banking sector, which is very beneficial in the current content. At the same time, the tighter rules have added to the reshuffling of some business activities outside the banking sector towards shadow banks. The third factor is the massive advent of digitalisation and the emergence of FinTech as well as BigTech companies. While representing an opportunity in terms of more effective processes and new products, as well as enhanced competitiveness of the industry, these developments have also favoured the entry of new competitors in banking-related activities, thus further challenging banks' traditional business models, in particular in payments.

The Covid-19 crisis brings new challenges and opportunities for the banking industry. It will most likely mean that interest rates will remain low for much longer. Although in the short run banks are bound to benefit from being the channel of liquidity support in the crisis and having access to central bank reserves, the deep crisis hitting the real economy is likely to bring a new surge in non-performing loans and eventually threaten banks' solvency once again. While providing at least temporary regulatory and supervisory relief for banks, the crisis may accentuate the digitalisation tendency, which may lead to substantial changes in the sector going forward.

The digital economy and banks' business models

The impact of technology on bank business models has been profound, likely more so in the face of the Covid-19 crisis. Banks will have to adjust how they provide financial services in face of the greater competition, importantly from new entrants, and related pressures on profitability. The effects of technology on financial services provision have long been recognised. Technological advances have affected especially payments services, but also capital markets activities, credit extension and deposit collection. The last decade has seen a step-up, with the entry of new types of providers ('FinTech' and 'BigTech') in various financial

service segments. New entry in payments services relates to both the quality of existing services and the scope for network externalities. FinTech providers of credit are more present when the country's general development is higher and its banking system is less competitive, but less so when the country's regulation is stricter. Non-bank entry is not yet meaningful in demand deposit-like taking activities, possible due to concerns about regulatory burdens. BigTech platforms, with their advanced technology and especially their (associated) greater access to (big) data, could make major inroads, but have not done so to date.

The entrants have lowered the costs and enhanced the quality and convenience, as well as the reach, of various services. In some countries, this has led to greatly increased financial inclusion. It has also helped reduce the cost of cross-border payments. The developments greatly affect banks. Some business segments, notably payments, are migrating to the new entrants, with health concerns related to Covid-19 likely to add to this (for example, by accelerating the trend toward contactless forms of payments). The resulting downward pressures on fees and prices and compressed margins have further squeezed banks' profitability, which was low already in some jurisdictions and is further challenged by the current crisis. While the newcomers using advanced technologies challenge banks, many argue that banks are far from adopting technology effectively themselves.

The technological advances and new entry provide many benefits, but they also introduce new risks that require regulatory responses. Concerns are both of a microprudential and macroprudential nature, the latter as the effects on incumbent commercial banks can give rise to systemic risk. The technologies used by the new entrants can create new risks, including new consumer and investor protection issues, as the accumulating evidence on the risk of discrimination with greater use of technology and big data shows. Changes make ensuring a level playing field between incumbents and new players even more important and call for adjustments in competition and data policies. An important related question is where to draw the regulatory 'perimeter', i.e., which entities and activities should be regulated in the first place. As entry barriers have declined, while at the same time network externalities have increased due to technological advances, the overall industrial organisation of the various financial services markets is changing. Other policy issues relate to the greater importance of (personal) data, for which control rights are not always well defined. The technology-induced changes therefore call for reassessments of competition and data policies.

Digital money, payments and banks

For decades, banks have controlled digital forms of money and payments. This is because of the regulatory protection of deposits (the digital asset used in payments), their exclusive access to the central bank settlement and their close partnerships with the credit card companies that owned and controlled the digital payment infrastructure.

An initial challenge to the status quo came from cryptocurrencies – digital assets (such as Bitcoin) associated to a payment technology that was completely independent of the traditional channels. However, their reliance on separate units of account without a proper monetary policy framework led to very high volatility in prices that made their use in payments impractical.

In parallel, we have seen other more successful digital assets that do not sit on the balance sheet of banks. These assets can take many forms: electronic wallets, stablecoins, or balances with a telecom provider. The competitive advantage is not with the asset itself but the payment technology associated to it. The convenience of payments and the connection to other parts of our growing digital life has been the key to success. The dominance in payments of tech companies in China or mobile telecom providers in parts of Africa are examples of the extent of disruption.

How much of a threat these innovations represent for banks depends on many factors. Unlike in the case of China, in countries where banks were stronger and more protected by regulators, the shift away from banks has been minimal, partly because they reacted to the threat and partly because the regulators limited the scope for innovation.

Going forward, as technology is likely to create faster connectivity between all these repositories of digital assets and allow for the seamless creation of alternative payment channels, banks might have a more difficult time maintaining their current position. At a minimum, their profitability might suffer because of the competition and their need to invest in new technologies while managing their expensive physical infrastructure. The biggest threat comes from developments of new forms of digital assets and payments associated with either large digital or ecommerce platforms or companies providing the omnipresent technology to access our digital life – the smartphone. The presence of network effects in these cases could be strong enough to overcome the current dominant positions of banks.

The post-Covid world

Covid-19 will accelerate some existing trends in the banking sector, will temporarily reverse others, and will influence the private and public players in the sector. Most importantly, it will accelerate the digitalisation and restructuring of the sector.

BigTech companies have all the ingredients to get ahead, in general, in the post-Covid world. They are digital natives and have the technology, customer base and brand recognition, as well as vast amounts of data and deep pockets. They also have the incentives to enter into financial services. However, banks may also enjoy a revitalisation of relationship lending as they continue lending to customers during the crisis, with soft information more valuable than hard information. They also enjoy the protection of the safety net and access to deposit financing.

The banking sector will face deep restructuring, accelerating the pre Covid-19 trend, with medium-sized banks suffering since cost efficiencies and IT investment will be crucial in a persistently low interest environment. This raises questions over the ability of some banks to survive the crisis and to generate and attract capital, and over the future structure of the banking sector. Consolidation will be an escape route, but in the post-Covid-19 world, political obstacles to cross-border mergers will resurface as states become more protective of their national banking champions, since banks are considered strategic.

In the short run digitalisation will increase the contestability of banking services, but the long-term impact will depend on the market structure that prevails. Banking may move from the traditional oligopoly to a system with a few dominant platforms that control access to a fragmented customer base, with a few BigTech firms, together with some platform-transformed incumbents, monopolising the interface with customers. In this case, customer data ownership and portability for individuals, and data interoperability between platforms, will be key to keeping switching costs for customers low and the market sufficiently competitive.

The financial sector will become more efficient, with greater financial inclusion and stability, as long as efficiency advantages – such as superior information and screening technologies, leaner operations and less leverage – are the drivers of the digitalisation and the entry of BigTech into banking. This will particularly be the case if, as a response to BigTech's entry, incumbent banks restructure and adopt more advanced technologies. However, if the driver behind BigTech entry becomes the search for market power, taking advantage of regulatory loopholes and exclusionary strategies based on bandwagon effects, then the efficiency of the banking system could suffer in the long-run.

Digital disruption poses a formidable challenge to regulators, which must adapt by balancing facilitating competition and allowing the benefits of innovation to pervade the system with protecting financial stability. In order to so, regulators must coordinate prudential regulation and competition policy so that compliance does not becomes a barrier to entry and nor does entry become destabilising. Competition can be fostered through light regulation of the entrants, but at the potential cost of decreasing the profitability of incumbents and thus increasing their risk-taking incentives. In addition, this may transfer the generation of systemic problems to non-bank entities.

The current crisis will test the resilience of the financial system and the regulatory reforms implemented after the global financial crisis of 2007-2009, which were examined in the first Future of Banking report from the Banking Initiative. In particular, it will stretch the limits of central bank intervention and put to the test the incomplete Banking Union in the euro area, where the ECB will face political obstacles going deep into fiscal territory by monetising the deficits of countries in need.

1 Introduction

Banks have come a long way since medieval times, enduring and surviving many crises. The economic crisis induced by the Covid-19 pandemic may provoke another financial crisis. This comes on top of the combination over the past decade of persistently low interest rates, regulations, and competition from shadow (unregulated) banks and new digital entrants that has challenged the traditional business model. The question is what the consequences will be for banks. We argue in this report that the Covid-19 crisis will accelerate pre-crisis tendencies as subdued growth and low interest rates will persist for a long time, and digitalisation will see a large impetus.

At the end of February 2020, the Covid-19 outbreak progressively interrupted the functioning of economies across most of the world. The first country outside China to be hit by the epidemic was Italy, and many others (Spain, France and the United States among them) followed shortly thereafter; almost no country has been spared. At the time of writing, the economic outlook is highly uncertain, as the dynamics of the pandemic and the economic lockdown intertwine, and exit strategies are tentative and dependent on better and more wide-scale testing for immunity and on the development of a vaccine. The range of estimates for the fall in GDP for 2020 is staggering, with double digits for many economies, the prospects for 2021 are uncertain and, most importantly for the focus of our report, the effects of Covid-19 on the financial system are difficult to estimate.

The Covid-19 crisis has differential ingredients than the global financial crisis of 2007-2009 and the ensuing sovereign debt crisis in Europe in 2011-2013. First, it directly hits the real economy, combining huge supply and demand shocks – the former due to disruptions in the global value chain and the latter due to demand freezes because of lockdowns. Second, it constitutes an exogenous, global shock to economies, although the consequences will vary due to the different productive structures and fiscal positions of each country. It therefore requires different policy responses. A first objective is to provide liquidity to firms, in particular to those directly hit by lockdowns and chain disruptions, while at the same time shielding the financial sector from firm defaults, a new surge of non-performing loans and the erosion of the capital position of intermediaries. The immediate aim is to keep the economy in an induced coma during the lockdown but to avoid a chain of defaults, so that activity can start again without permanent damage to the productive fabric of society.

The Covid-19 crisis comes at the end of a decade that has witnessed significant transformation in the banking industry around the world. The business model of banking has been challenged by three developments. The first is low interest rates, with nominal rates becoming negative in a few countries in recent years. These low rates are affecting the profitability of financial institutions, in particular those that are more reliant on maturity transformation and net interest income. The second is increased prudential requirements, regulatory scrutiny and heavy compliance costs in the wake of the 2007-2009 financial crisis. These rules have contributed significantly to enhancing the stability of the financial sector (see

the first Banking Initiative report by Bolton et al., 2019), but at the same time they have put pressure on banks' profitability and lessened their competitiveness relative to shadow banks. The third development is the massive application of digital technologies and the emergence of new competitors. While these have improved the efficiency of incumbent banks and allowed new products and services, they have favoured the entry of new FinTech firms, as well as BigTech players in banking-related activities, in competition with traditional bank business models – in particular in the area of payment systems.[1]

The Covid-19 crisis will accelerate pre-existing trends in banking, most significantly the extension of the low interest rate period and the impact of digital technology (including digital money as cash is used less and less), as well as the importance of IT investment, with the move from the bricks-and-mortar branch model to the mobile phone apps ecosystem accelerating. The crisis will push for further restructuring of the sector, with consolidation in potentially more efficient institutions. The Covid-19 crisis leaves open many questions, such as whether shadow banks will continue to grow their share in financial intermediation or whether incumbent banks will benefit instead. Another question is whether BigTech platforms will emerge the winners in the quest to dominate financial services – the market capitalisation of BigTech (Microsoft, Apple, Amazon, Google, Facebook, Alibaba, Tencent) already dwarfed that of the large banks (JPM Chase, Bank of America, Industrial and Commercial Bank of China, Wells Fargo, China Construction Bank, HSBC) before the Covid-19 crisis (see Figure 24 in Chapter 3).

In summary, the business model of banking was already being challenged in the pre-Covid world by a perfect storm of low economic growth and low interest rates, increased compliance costs, increased competition from more digitally able entities – both nimble FinTech firms and giant BigTech that benefit from deep pockets as well as the push towards more digital lives – and the introduction of digital currencies such as stablecoins. Profitability was low (particularly in Europe and Japan) and some institutions were having trouble adapting to the challenges. The post-Covid world will bring new challenges and opportunities, most likely in the form of large corporate sector and household defaults and related non-performing loans, interest rates that are low for much longer, and an accelerating trend for digitalisation. At the same time, governments are already providing temporary regulatory and supervisory relief for banks. Furthermore, banks are bound to benefit from being the channel of liquidity support in the crisis and having access to central bank reserves.

In the rest of this chapter, we summarise the analysis and conclusions of this report, starting with the main challenges that banking faced in the pre-Covid world: the low interest rate environment (LIRE), regulation and digitalisation. We then turn to the scope for digital money and the revolution in payments, the competitive strategies of the different players – both incumbents and new entrants – and the policy and regulatory issues associated with the digital world. We end by assessing banking in the post-Covid world.

1 FinTech is the use of innovative information and automation technology in financial services. BigTech refers to large technology companies, typically platform-based, such as Amazon, Google, Apple, Facebook, Alibaba and Tencent.

1.1 Challenges to the business models of banks

Banks perform several key functions in the economy, more so in bank-dominated financial systems such as those in Europe and Japan. First, banks process information and monitor borrowers, which helps them to develop long-term relationships with firms. Second, banks perform maturity transformation when they extend loans with long maturities and take demandable deposits. The resulting maturity mismatch offers risk-sharing to depositors, but it exposes banks to runs. Third, they provide payment services. In both the US and Europe, banks have had a monopoly in offering retail and wholesale payment services, as only they have access to central bank payment settlement accounts, although this is changing. Finally, they offer risk management to their clients and absorb inventory risk.[2]

Banks operate different business models. Stricter regulation, together with a moderation in risk-taking incentives, have modified these business models after the global financial crisis of 2007-2009. Within the commercial banking model, smaller banks have reduced wholesale funding in favour of more stable retail funding, while large banks have remained focused on the universal banking model.

Bank profitability was relatively homogeneous across jurisdictions before 2007, and decreased significantly during the financial crisis. While US banks recovered to pre-crisis profitability levels by 2013, euro area, British and Japanese banks lagged behind. The different profitability trends in the US and Europe are explained by the following factors. The first is the European sovereign debt crisis in 2011-2013, which was particularly severe for banks in peripheral countries (the GIIPS: Greece, Italy, Ireland, Portugal and Spain). The second factor is the high level of non-performing loans (NPLs), particularly in those countries that were most affected by the sovereign crisis. In the US, the situation was different due to early government support that induced banks to quickly clean up impaired assets on their balance sheets and increase their capital levels. The third factor is the macroeconomic environment: in the US, fiscal stimulus led to stronger economic growth in contrast to the much more austere approach imposed in Europe. A consequence of this was a divergence in interest rates between the two areas. Finally, the market structure is different in the US and Europe, as the former is an integrated market while, in the latter, retail banking is fragmented with very little cross-border merger activity. In the euro area, regulatory, supervisory, financial law and political obstacles to cross-border operations loom large.[3]

Within the euro area (and in the UK), the level of profitability across banking is also heterogeneous, albeit at low levels, with general steep declines in price-to-book ratios, which were below one even before the Covid-19 crisis. Profitability has evolved differently across the various bank business models. In general, retail-oriented banks have tended to perform better in terms of profitability (return on equity, or ROE, and returns on assets, or ROA) and cost-efficiency measures (such as cost-to-income ratios). However, going forward, it is not clear whether the retail banking model will remain the most successful given that it is vulnerable to low interest rates and the reduction in net interest margins, which will become more acute after the Covid-19 crisis.

2 See Section 3.1 in Vives (2016).
3 See Section 2.3 in Vives (2016).

In the pre-Covid-19 world, banking faced three main challenges: a low interest rate environment, more strict regulation and increasing digitalisation. In the last section of this chapter, we discuss how these may evolve in a post-Covid-19 world. First, we consider them in turn.

Since the mid-1980s, interest rates have been decreasing, with an accelerated decline after the financial crisis of 2007. This has been accompanied by a flattening of the yield curve, which impairs the profitability of maturity transformation. In the short run, an interest rate cut is beneficial to bank profitability; it translates into lower funding costs, higher asset and collateral values and lower default risk on new and repriced loans. In the medium to long run, however, the positive effects of low interest rates are likely to disappear, since as the short-term nominal interest rates approach the effective lower bound (because rates on retail deposits do not go below zero) and long-term interest rates continue to decrease, the net interest margin falls. In an attempt to boost profitability, banks can take on more risk, reducing monitoring activity and relaxing lending standards. The total impact of low interest rates on banks' profitability is still debated, together with the differential influence of changes in long-term versus short-term rates. Low (or negative) interest rates have an adverse impact on net interest margins, with more pronounced effects for deposit-oriented banks, small banks and less-capitalised banks, but other factors – such as reduced risk of borrowers' default, lower funding costs and higher non-interest income – may compensate for this.

The trade-offs deriving from a reduction in interest rates may induce a (hotly debated) 'reversal rate' – the level of the policy rate below which a further reduction becomes contractionary for lending and thus growth. Central banks in countries including Japan, Denmark, Norway, Switzerland and, more recently, the euro area have introduced a 'tiering' system, with the purpose of lessening the adverse impact of negative interest rates on banks. This is a mechanism that exempts a portion of banks' excess reserves from negative rates. In the euro area, deposit-funded banks are likely to be most affected by negative rates. In Sweden, the implementation of negative rates has been somewhat successful in stimulating inflation without adversely impacting bank profitability. The country was in a deflationary situation but was not much affected by the European sovereign debt crisis and had banks that could maintain profitability despite reductions in their net interest margin due to negative rates.

Before Covid-19, a second major challenge for banking was how to adapt to the reformed *regulatory environment* after the financial crisis. Stricter capital and liquidity regulation has been effective in making the banking system more stable, as we described in our first report in 2019.[4] Banks have increased their capital levels considerably since the financial crisis of 2007-09. Banks with more capital have lower funding costs and tend to provide more credit. Nonetheless, this may not hold in the short run if banks are forced to comply with stricter capital regulation. The reason is that they may do so by adjusting the denominator of the capital ratio by limiting lending to reduce risk-weighted assets. In the US, and even more so in emerging market economies where the economy and the financial system were less affected by the past financial crisis, banks have increased both capital and total assets. By contrast, European banks have reduced total assets while increasing capital slightly. These results are in line with the greater difficulties experienced in the European banking system relative to the

4 Bolton et al. (2019).

US since the crisis. As usual, small and medium-sized enterprises (SMEs) and unlisted firms are the most affected by the reduction in bank lending, since they lack access to the bond market. Indeed, bank-dependent countries like those in Europe are more affected because bond markets are less developed.

In summary, regulation has contributed to the build-up of a more resilient banking sector, while at the same time contributing to a reshuffling of part of their business within and outside the sector. What remains to be seen, however, is the extent to which the new growing lenders will be able to substitute for bank lenders and what this will imply in terms of overall risk in the financial industry.

The third major challenge facing banks is digitalisation. The disruption that the application of digital technology brings to financial intermediation is major and concerns many lines of business. Payments is perhaps one of the most affected, and the introduction of central bank digital currency (CBDC) may represent a major threat to the traditional banking model depending on its implementation. We turn in the next two sections to the digitalisation challenge facing banks, presenting in Section 1.2 a general view on the disruption of the business model and the major players and an analysis of digital money in Section 1.3.

1.2 Digital disruption and banks' business models[5]

Among the functions that banks perform in the economy mentioned above, the core function consists of maturity transformation and liquidity provision: taking short-term deposits and making medium- and long-term loans. This function goes together with the monitoring of opaque loans, for which it is difficult to get funding on the market. Payment and transaction services constitute a second important function. Both functions are based on processing both hard information (that is, information which is verifiable and codifiable) and soft information (which is obtained mostly from relationship banking). The digitalisation process has greatly increased the weight of the former and improved the tools available to process big data – namely, artificial intelligence (AI) and machine learning (ML). The functions that are more exposed to information processing will therefore be more affected by digital disruption. We will explore the drivers of digital disruption and the advantages and disadvantages of the new entrants relative to the incumbents in the pre-Covid world.

1.2.1 Supply and demand drivers of digital disruption

Factors on the supply side – mostly technological – and on the demand side – such as changes in consumer expectations of service – drive digital disruption in the financial sector.

Relevant factors on the technological supply side are smartphones, internet application programming interfaces (APIs), cloud technology, and distributed ledger technology (DLT). In addition, market structure and regulation considerations (discussed below) may also lead to disruption.

5 This section is partially based on Vives (2019).

Mobile devices have expanded the availability of financial services and have become a platform for third-party developers. They offer multiple functions including payments (i.e., digital wallets), money transfers and online shopping. APIs have enabled service improvements, especially faster payments, and the unbundling of services. They have become the standard for data sharing in open banking[6] and have increased contestability as they help consumers compare product and service offerings. Asia is at the forefront of their integration in financial services, with payment apps forming part of a bundle with e-commerce, chat, deliveries, food ordering and ride-hailing (Alibaba and Tencent in China are good examples) and currently serving a billion users. New payment systems as well as loans targeted to consumers with a short credit history are often tested in less-developed areas (for example, in African countries), which allows technological leapfrogging for people who do not have a bank account but have access to banking services through their mobile phones.

Blockchain technology provides a means to achieve a decentralised consensus and may support 'smart' contracts, which can be enforced without the need for a third party. Smart contracts can lower contracting and verification costs. FinTech platforms can, in principle, better exploit the cost-saving innovations allowed by the new technology. More generally, this disruptive impact may be exacerbated since traditional banks are intermediaries, and the need for these may be reduced by distributed ledger technology such as blockchain.

Higher customer expectations drive demand and result from the digitisation of commerce and the real-time transacting capability of internet-connected devices, which offer greater convenience, higher speed and better user-friendliness of the financial services employed by FinTech. Those firms have taken advantage of unmet customer needs in payments and transfers (international transfers being a good example), segments of the credit market and investment advice. Younger generations are more likely to adopt FinTech products from digital banks, and some consumers might perceive FinTech companies as being more socially responsible than incumbent banks.

In summary, the digital revolution has changed the demand for financial services and led the sector to become more centred on the customer. It has also left incumbents with obsolete technologies, such as an overreliance on rigid mainframes and an overextended branch network, when young customers want to bank with their mobile phones. The consequence is that the sector has overcapacity and, perhaps worse, the wrong kind of capacity. The industry will face a deep restructuring in a context of low interest rates, diminished profitability, and the acceleration of digitalisation with the advent of Covid-19, as we will argue in the last section.

1.2.2 FinTech, BigTech and incumbents

FinTech may lead to lower financial intermediation costs in a range of financial services (lending, payment systems, financial advising, and insurance) and at the same time increase the capacity to price discriminate, with its ability to process big data efficiently. Indeed, FinTech can screen potential borrowers quickly by using statistical models based on big data and more effectively overcoming information asymmetries and substituting collateral for information. It reduces the need for

6 Open banking enables third parties to provide services to a bank's customers by facilitating the sharing of their financial information.

staff and for an extended branch network, and it can increase financial inclusion by opening the door to financial services for segments of the population and SMEs currently unserved or underserved by banks, which is especially important in less-developed countries. FinTech companies have no legacy technologies to deal with (for example, they largely use the cloud instead of mainframes) and are characterised by a culture of efficient operation with higher innovating capacity than traditional entities.

FinTech firms have not yet managed to acquire a dominant position in the market despite having made progress in the structure, provision and consumption of financial services. For example, they have yet to make significant inroads in corporate lending to medium-large and large firms. FinTech credit still represents a small share of total credit, even in China (where it has the greatest share of total credit activity). FinTech credit tends to be more important in countries with higher income per capita and a less-competitive banking system. Total FinTech credit per capita is high in the United Kingdom, the United States, South Korea and China. In South Korea and Argentina, BigTech firms provide the majority of FinTech credit (see Chapter 3). FinTech companies have led innovation efforts and raised customer expectations via innovations such as rapid loan adjudication. However, the willingness of customers to switch from incumbents has been moderate. The reasons for this are that the costs of switching and consumer inertia are high and incumbents have adopted FinTech innovations (with joint payment ventures such as Zelle or Bizum, for example). The result is that quite a few FinTech firms have formed partnerships with incumbents when faced with difficulties trying to increase scale, access infrastructure or raise customer numbers.

New entrants have attained significant scale in locations where incumbent service providers were not present and in market segments where customer needs were not met (mostly in China, Southeast Asia and parts of Africa). Chinese BigTech giants (Alibaba, Baidu and Tencent) are very active in the provision of financial services.

The fundamental advantages of FinTech firms are their lean business operations and the fact that they are able to attract the best talent and benefit from state-of-the-art technologies that allow for fast and flexible responses to changing consumer preferences. They focus on banking activities with higher returns on equity (ROE) such as payments, advice and the distribution of financial products. FinTech firms have a capital structure with more equity than incumbent banks, but they have to overcome challenges such as the absence of a loyal customer base, limited access to soft information on potential customers, a comparative lack of reputation and brand recognition and a relatively high cost of capital.

BigTech platforms benefit from most of the advantages of FinTech firms with few of the drawbacks – and they have more advantages. They have an established, loyal customer base and large quantities of customer data that they can use with ML techniques, a strong reputation and lobbying capacity, strong brand names and the ability to exploit network effects. BigTech platforms have access to valuable business data and can benefit from their scale and network

effects to provide financial services at a lower cost and at high volume.[7] BigTech companies are therefore potentially much more disruptive to the traditional banking business. BigTech platforms have penetrated a greater number of less-developed banking markets (in particular those with high mobile penetration) with payment services (and even money market mutual funds such as Yu'ebao for users of Alipay in China) and insurance offerings. With regard to lending, BigTech platforms tend to lend more in countries with a less-competitive banking sector and less-strict regulation.

The source of the market power of BigTech platforms is a feedback loop with the following steps. The platforms (i) generate vast quantities of customer data with its own activity; (ii) process the data with AI and ML techniques; (iii) exploit network externalities; and finally (iv) generate more activity and more data (due to dynamic learning curve-type economies of scale, since more data leads to better algorithms and prediction capacity). This feedback loop consolidates an ecosystem with high built-in switching costs for customers wanting to change platforms. Financial services may complement and reinforce the platform business model. A first natural step in this direction is to offer payment services in a more mature phase of the development of the BigTech business.

However, both FinTech and BigTech firms may face a higher cost of capital and are still lacking the extensive experience and expertise in risk management that represents one of the strengths of large banks. Incumbents already provide numerous financial products, some of them quite complex, and have access to cheaper funding due to their banking charters. Furthermore, they have accumulated informational capital thanks to their long customer relationships and have a reputation for preserving customer privacy.

FinTech is bound to increase the contestability of banking markets as well as competition in the short term. In Sections 1.4 and 1.5, we will explore whether the entry of BigTech platforms may entrench large players with dominant positions and whether it may raise systemic risk concerns.

1.3 Digital money, payments and banks

Payment technology has been disrupted and, together with digital money, this poses a challenge to the traditional bank business model. Cash is being used less and less; Covid-19 is accelerating this process.

Money, along with its three main functions (a unit of account, a medium of exchange and a store of value), was identifiable by being associated to the object through which value was transferred during a transaction (for example, banknotes issued by a central bank). Banknotes are accepted because of a combination of their legal tender status and, more importantly, the trust by the public in its face value and its stability over time. The three functions of money become more difficult to identify – in particular, the fundamental medium of exchange function – when we move from physical cash to bank accounts. This

7 BigTech platforms with a focus on internet search (e.g. Google) gather information about customers from search activity; those with a focus on social media (e.g. Facebook) have direct personal data on users and their connections; and those with a focus on e-commerce (e.g. Amazon) have data on both sellers and buyers and their habits. The complementarities of BigTech business with financial services will depend on the type of data gathered. For social media and search companies, data will help with distributing and pricing financial services, while for e-commerce platforms, data will facilitate credit assessment.

is because typically there is no legal tender status for bank accounts and because we need a payment technology for the asset to become a medium of exchange. A bank account, as a form of digital money, creates a separation between the asset and its value and the medium of exchange function. In other words, we need a payment technology to convert a bank balance into a medium of exchange so that it becomes 'money'.

The coexistence of different payment technologies has mostly been managed by banks – from the deposit accounts connected via settlement systems through the central bank, to credit or debit cards, to cheques or bank-to-bank electronic transfers. The increasing digitalisation of our economic activities, fostered by technology platforms and social media, has led to increasing customer demand for faster and cheaper forms of payments.

Early FinTech start-ups realised that working with bank deposits was difficult and costly because it typically required using the expensive and slow credit card infrastructure. In addition, banks were not willing to give easy access to potential competitors. Cryptocurrencies and the associated blockchain technology became a natural solution for these new demands for alternative digital assets outside of the traditional deposit-taking institutions. Money can be stored in any form of trusted database (digital ledger). Mobile telephone providers (such as M-Pesa in Kenya) or BigTech platforms (such as WeChat or Facebook Pay) have also created digital repositories of value that can be used for payments.

The recent Covid-19 pandemic has accelerated the trend towards digital forms of payment. It is very likely that the forced adoption of digital forms of communication and related ways of doing business will have a long-lasting effect on our daily routines, certainly including payments.

There are many forms of *digital money*.[8] The most common is bank deposits; cryptocurrencies and stablecoins are other forms of digital money. Many other examples of digital currencies already exist, including Alipay and WeChat Pay in China, M-Pesa, and the Libra project sponsored by Facebook. Cryptocurrencies such as bitcoin have inherent drawbacks – the time and cost of transactions or regulatory threats due to their facilitating money laundering and criminal activity, for example – that make them more a speculative investment rather than a store of value and/or means of transaction. *Stablecoins* refer to digital assets that are liquid enough to be considered money and whose value is fixed to a currency. Quite a few stablecoins are designed as currency boards, which are an extreme version of fixed exchange rates. The stability of the stablecoin is promised with a pool of liquid assets denominated in the currency to which the coin is pegged and of equal value to the liabilities being used. The stability of the peg is guaranteed by the commitment to the redemption mechanism.

Libra, promoted by Facebook, is an example of a *global stablecoin* (as it was announced originally). Libra promised a fixed value relative to an explicit basket of currencies, with the weights of each of the currencies known in advance. There are technical issues concerning how to ensure that the valuation of the assets matches that of the liabilities, and, in any case, the Libra would fluctuate relative to national units of account. The potential destabilising effect of running a parallel currency and its influence on a country's monetary policy, as well as

8 Liquid assets with value and ownership are recorded in digital form; see Section 2.1 in Vives (2019) for a classification and discussion of digital currencies.

other regulatory issues – not least the potential threat to the international status of the dollar – have raised concerns amongst policymakers. In response, the latest proposal by the Libra Association is to also issue a set of single-currency stablecoins (using the US dollar or the euro as the reference).

A key issue for digital currencies is stability. Electronic money (e-money) is exposed to liquidity, default and market risk (including foreign exchange risk), which can be minimised by the issuers with prudential measures. E-money issuers typically hold bank deposits that are not protected by deposit insurance because those deposits are wholesale. Despite these limitations, e-money may gain ground, as it has done in China and Kenya, because of its convenience, the low transaction costs (in particular for cross-border payments), complementarity with blockchain technology, and the power of network effects.

Digital currencies may threaten the banking sector with disintermediation if substantial retail deposits were to move to e-money providers. In an extreme case of disintermediation, deposits would go to e-money providers that invest in very safe short-term assets (in particular if they have access to central bank reserves) and thus become narrow banks. Central bank digital currency (CBDC), allowing access to central bank accounts for everyone ('reserves for all'), not just commercial banks,[9] represents another form of disintermediation. Either form could undermine the fractional system by unbundling one of the main banking functions.[10]

CBDC has potential advantages. It may foster innovation in payments, in addition to facilitating cross-border payments, avoiding potential monopolisation of digital money provision and making monetary policy transmission more effective. If physical cash is less relevant and so the zero lower bound constraint does not bind, the central bank would potentially be able to set negative interest rates. Last, but not least, in a deep economic crisis such as that induced by Covid-19, which requires large stimulus packages by governments, transfers to individuals or grants to firms need to be made through bank accounts, but the necessary government information might be incomplete. With a digital form of money available to all citizens, however, these payments could be made immediately. The potential disintermediation of the banking sector induced by CBDC could be limited, insulating bank balance sheets if necessary, even if households or firms shift funds from deposits to CBDC.[11]

A cohabitation scenario of banks and e-money providers is likely, with the latter complementing banks' offerings either by catering to population segments not covered by banks or forming partnerships with banks. E-money providers would compete for funds and force banks to improve their terms and service in order to retain customers. However, if e-money providers do not have access to central bank reserves, then they would be subject to market and liquidity risk even if they deposit client funds as wholesale deposits. This would make the system less stable, since e-money holders would run to banks to obtain their deposit insurance protection in case of trouble. At the same time, banks' funding may also become less stable, since the banks would be holding the volatile wholesale deposits of e-money firms.

9 We can think in terms of a two-tier model, with the commercial banks performing the front-end duties and the central bank the settlement.

10 See Section 5.4 in Vives (2016) for an assessment of the consequences of narrow banking.

11 Brunnermeier and Niepelt (2019) argue that CBDC can affect the composition of bank funding but need not reduce it since it need not alter allocations, credit, or the price system, provided that a pass-through mechanism is in place.

In summary, several forms of digital money may disrupt the bank business model, in particular by taking away a good part of the payment function from banks. The level of disintermediation from incumbent banks will depend on whether the e-money providers will have access to central bank reserves and be under the umbrella of the safety net.

1.4 Competitive strategies of the players[12]

Before Covid-19, banking was already moving from being relationship-based, with a central role for soft information, to being market-based and data-driven, with hard information prevailing. Payments have been an entry point for new competitors. What strategies have the different players – incumbent banks, FinTech firms and BigTech – employed?

To start with, we have to recognise that regulation and government guarantees will drive the choices of the new entrants and the reactions of the incumbents. For example, the environment in the UK – with a single regulator, the Financial Conduct Authority (FCA), a sandbox to test innovative products, and open banking – facilitates the entry of FinTech firms, while in the US, by contrast, there are many more barriers with a fragmented regulatory structure. Moreover, if regulation manages to ensure a level playing field between incumbents and entrants, then head-to-head competition is more likely. However, policies that imply asymmetric regulation between FinTech and BigTech firms, on the one hand, and incumbent banks on the other could encourage entry and contestability by lowering switching costs. As we will argue below, however, there may be only a short-term increase in competition if, in the long term, monopolisation by BigTech firms and/or platform-transformed incumbents occurs.

The *incumbent banks* may either decide to collaborate with the new entrants or to confront them and attempt to prevent their entry into financial services. The details of each segment of the market being contested will matter, and so will the extent of the legacy technologies of incumbents. Incumbents may accommodate the entry of FinTech firms in some market segments but try to prevent it in others. One possibility is that FinTech firms divide either into specialised service firms with no banking licence or into digital banks. The former would tend to form partnerships with the incumbents, while the latter would tend to consolidate or sell to the incumbents (unless they manage to establish a sufficient client base and successful brand).

When there are high customer switching costs, an incumbent bank will protect the profitability of its customer base (behaving like a 'fat cat'). This may allow a new competitor to enter and attract a particular segment of consumers – for example, technology-savvy customers or unbanked consumers. Banks may prefer to accommodate entry in this case if they are compensated by receiving, for example, interchange fees from the new operators. This would be the case if the cut in revenues to banks for purchases that are 'taxed' by the new entrants is more than compensated by the increase in customers' aggregate transactions. The new entrants may also decide to enter at a small scale so as not to elicit

12 This section draws partially on Vives (2019).

an aggressive response from incumbents. This will not be the case for BigTech, which may attempt large-scale entry by controlling the interface with customers and leveraging its dominance in certain areas, such as search or online retail, by tying financial services to its core offerings.

The primary business of BigTech platforms is technology and data and, unlike small FinTech firms, they enjoy economies of scale and scope, large installed customer bases, an established reputation and brands, deep pockets and access to capital markets. The complementarities of financial services with the customer data that BigTech firms possess and the products they offer provide an incentive to enter into this line of business. The extent of their entry will depend very much on the regulatory treatment. BigTech can compete head-to-head with incumbent banks in essentially two ways: by becoming financial intermediaries and exploiting economies of scope, bundling their existing offerings with traditional banking products; or by acting as multi-sided platforms or marketplaces, focusing on the most profitable business segments. BigTech platforms may opt not to accept deposits, as doing so would constrain their innovation abilities by imposing on them the regulatory obligations that the banks have to fulfil. They can act then as marketplaces offering customers the ability to deal with different financial institutions. As with other products or services, platform delivery of financial products may well become the dominant distribution channel.

BigTech companies have used a 'platform envelopment' strategy to exclude, or raise the costs of, other intermediaries by using their ecosystem to replicate and extend the offerings of rivals and being the gatekeeper of captive customers. Switching costs and data superiority (with complementary sources of data on customers from other lines of business) reinforce their dominance. In this way, banks might be forced to be present in the different competing ecosystems established by BigTech. BigTech firms could then try to monopolise the interface with customers, for example by controlling the origination of loans and the distribution of products, while the incumbent banks take deposits and invest in the products distributed by BigTech. If BigTech manages to control the consumer interface, incumbent banks will see their profitability cannibalised and they would become utilities – mere product providers on platforms that are out of their control. In response to the threat, some banks are offering open platforms that incorporate products from other financial providers or forming partnerships with BigTech.

Incumbents do have some advantages that they can leverage, such as championing customer data security, a cheap source of funding, as well as expertise on how to deal with complex regulatory environments. Well-performing incumbents will have managed the transition from a mainframe to the cloud, be lean in 'bricks' but strong on human capital. Furthermore, they will either become digital platforms to retain the customer interface or have specialised products for the platforms.

There is no doubt that digitalisation will erode the margins of incumbents and increase the contestability of banking services in the short run. The long-term impact will depend on the market structure that prevails. One possibility is that banking moves from the traditional oligopoly to a system with a few dominant platforms that control access to a fragmented customer base if a few BigTech firms, together with some platform-transformed incumbents, monopolise the

interface with customers and appropriate rents. To keep switching costs for customers low and the market sufficiently competitive, customer data ownership and portability for individuals, and data interoperability between platforms, will be key.

The financial sector can become more efficient, with greater financial inclusion and stability, as long as efficiency advantages – such as superior information and screening technologies, leaner operations and less leverage – are the drivers of the entry of BigTech into banking. This will be especially so if, as a response to BigTech's entry, incumbent banks restructure and adopt more advanced technologies. However, if the driver behind BigTech entry is market power, taking advantage of regulatory loopholes and exclusionary strategies based on bandwagon effects, then the efficiency of the banking system could suffer in the long run.

1.5 Regulation, policy, and financial stability

The digital disruption in banking raises regulatory issues in at least the following domains: micro-prudential, macroprudential and competition policy, consumer protection and data management.

Micro-prudential regulation (as well as competition policy) is concerned with a level playing field for incumbents and entrants. It may be that the new financial providers face lower regulatory burdens because some digital products are not yet regulated. It may also be the case that banks have to share data with the new providers, as in the case of open banking, whereas the new entrants have exclusive access to data that banks do not have access to (as would be the case for BigTech).

The main approach in most jurisdictions relies on the principle that risks should be regulated in the same way across financial services. The question is where to draw the regulatory 'perimeter', that is, what activities and entities should come under the regulatory umbrella to start with. Two recent examples regarding how to draw the regulatory perimeter are cryptocurrencies and stablecoins.

International business operations may be at risk, given that cross-border regulatory asymmetries – for example, in data protection regimes – may lead to market fragmentation and impede, for example, the operation of companies based in countries with restrictive data protection regimes. Other jurisdictions may cite the inability of those foreign countries' regulatory agencies to effectively supervise firms. Supranational regulation and supervision, however desirable, are not foreseeable in the short run, given current ring-fencing and security concerns. The money laundering concerns associated with FinTech are likely to drive international regulatory cooperation.

Macroprudential regulation concerns systemic stability. New competitors will bring greater efficiency to financial intermediation by offering more diversity of products and services as well as lower costs (including the response of incumbents in both aspects). This will have a positive impact on financial stability, but it raises potential concerns in terms of systemic risk due to the following factors:

i) The erosion of incumbents' profitability, generating increased risk-taking incentives.
ii) Potential aggravated moral hazard and adverse selection problems, leading to less monitoring or worse screening of entrepreneurial projects.
iii) The danger of development of a parallel payments system unsupervised by central banks; this may happen if BigTech firms deposit customer funds directly with banks, as in China.
iv) The potential systemic risk of a cyber-attack or operational failure if a proportion of financial institutions rely on a BigTech firm – or several firms as for example, in the concentrated cloud service sector – that provides third-party services (for example, data storage, transmission or analytics).
v) The development of online money market funds (MMFs), such as Yu'e Bao in China, which are not insured and are therefore vulnerable to runs (these are possible, as we witnessed during the 2007-09 financial crisis in the US).
vi) The impact on financial stability if FinTech firms, even if small, correlate their strategies; however, FinTech start-ups may operate with less leverage than traditional entities.
vii) An increase in systemic concerns if BigTech enters into the core of banking, since problems in the non-bank business of the platform may contaminate the bank; the prudential principles that call for separation of banking from commerce and industry should apply here.

A policy tension occurs between extending the perimeter of bank regulation to new financial service providers, thus constraining financial innovation and (implicitly or explicitly) extending the safety net to new entrants; or keeping the latter out of the perimeter, tilting the playing field in their favour. The principle is that the regulatory perimeter should cover all activities that have the potential for systemic risk. A possible obstacle is that entities, rather than activities, fail and may generate systemic risk. The principle of regulating by activity fosters a level playing field, but may collide with the protection from systemic risk generated by failed entities. So far, regulators of FinTech services have tended to offer a regulatory sandbox that gives companies the opportunity to experiment without the regulatory burden faced by banks, and the regulators the chance to learn about the most effective ways to safeguard stability while fostering innovation.

Consumer and *investor protection* concerns also come to the forefront. Consumer protection is paramount in general – more so in an open banking environment, since consumers should have confidence in the integrity of the process; their transactions should be traceable in case there is any breach or cyber-attack. The enhanced ability to target customers for *price discrimination* purposes may exacerbate behavioural biases of more easily exploitable consumers. The aim is to enhance consumer welfare with a wide spectrum of providers, better accessibility and quality and respect for data privacy, while at the same time mitigating the risks of misperception and cyber-attacks.

Regulators must establish who controls the data (in this area, the EU seems to be taking the lead) and ensure security when transacting on platforms. They must also account for the fact that digital technology allows a greater degree of price discrimination, which calls for enhanced consumer protection. Consumer protection regulators must ensure that the use of digital technology minimises the behavioural biases of customers and investors.

Competition policy is necessary in the digital world since ex-ante regulation will not suffice. In industries with network externalities, there are incentives to compete for the market but ex post monopolisation may occur, and firms may entrench themselves. Indeed, dominant BigTech platforms have successfully discriminated in favour of their own upstream or downstream platform affiliates. According to the European Commission, this is the case in a string of three antitrust cases against Google, which is accused of exploiting its dominant position in order to favour its own vertical business and attempting to protect its search dominance by leveraging its dominance in operating systems with Android.

We can appreciate a pairwise tension between efficiency, stability and privacy. In addition to the 'traditional' stability–competition trade-off,[13] there are two more new trade-offs. The first is between efficiency and privacy – specifically, access to data for private providers (with risk of misuse of the data) versus data anonymity. The second is a trade-off between stability/integrity and privacy – specifically, access to data for regulatory goals versus anonymity. The major jurisdictions (the US, the EU, China, India) take different positions in these trade-offs – for example, in terms of the intensity of competition policy (maximal in the EU, minimal in China) and the protection of privacy rights of platform users (maximal in the EU and India, minimal in the US).

With regard to the trade-off between *competition* and *stability*, a new dimension is concentration in the collection and exploitation of data. BigTech platforms have the ability to collect massive amounts of data at very low cost. In addition, as noted before, data have more value to them than to competitors. In fact, such dominant positions in data can lead to systemic risks and less competition. The trade-off is bound to vary by jurisdiction. In both well-developed financial systems with good institutional environments and very underdeveloped financial systems, a laissez-faire model with regard to access to data may be more attractive, but for different reasons. In the former, financial stability concerns may be less acute because the institutional environment is strong, and this allows for greater experimentation. In the latter, the worry about financial inclusion is greater, making trying new models more attractive, whereas financial stability is less of a concern.

With regard to the trade-off between *efficiency* and *privacy*, given the current lack of clarity over who controls access to data, BigTech may be favoured. The decentralised 'Coasian' solution is to assign control over personal data by allocating property rights and creating a competitive market for data (as in recent open banking initiatives in Australia, the EU and Mexico). The potential problem with that approach is that the information markets are not competitive. Another approach involves government-led rules on the processing of user data (as in the recent data protection laws in Brazil, California, the EU, Japan and Singapore). There is also an international dimension to data-sharing. Some jurisdictions have

13 Examined in Vives (2016).

taken measures to restrict data flows within and across borders, as they fragment the data landscape and limit the potential benefits. A third approach consists of the public sector setting up a large digital institutional infrastructure (as in India and Singapore) that includes the sharing of data.

The final trade-off is between *access to data for regulatory goals* and *privacy*. Data are needed for regulatory and supervisory purposes, including for consumer and investor protection, for the fight against money laundering and terrorism, as well as for systemic risk assessment and to manage crises and resolve institutions. Furthermore, judicial authorities need to have access to data for trials and enforcement purposes. In addition, international coordination on personal data issues in finance could be challenging. This trade-off may become starker in general after Covid-19, given that several countries have instituted (or are planning to institute) personal controls (via mobile phones) dealing with highly personal information for the purposes of containing the epidemic.

In these actions, public authorities need two levels of coordination: national and international. At the national level, despite the need to coordinate, the current mandates and practices of the competition authorities, financial regulators and data protection supervisors may have compatibility problems when dealing with the new issues. For example, cooperation of competition and prudential authorities should be extended to encompass the units responsible for consumer protection and data management. Furthermore, it will be necessary to coordinate rules and standards internationally (for example, for data exchange and privacy) as the digital economy expands across borders.

Digital disruption poses a formidable challenge to regulators, which must adapt by balancing facilitating competition and allowing the benefits of innovation to pervade the system with protecting financial stability. In order to so, regulators must coordinate prudential regulation and competition policy so that compliance does not become a barrier to entry and nor does entry become destabilising. Competition will be fostered by light regulation of the entrants, but at the potential cost of decreasing the profitability of incumbents and thus increasing their risk-taking incentives. In addition, this may transfer the generation of systemic problems to non-bank entities. In the United States, for example, shadow banks (including FinTech firms) already account for an important share of mortgage loan originations.[14] We know that for most financial crises, from the Panic of 1907 in the United States to the global crisis of 2007–2009, a shadow banking system was at the core. A question arises whether this will be also the case in a post-Covid world.

1.6 Banking in a post-Covid world

Covid-19 will accelerate some existing trends in the banking sector, will temporarily reverse others, and will influence the players in the sector (including the regulators).

Covid-19 will deepen and lengthen the period of low or negative interest rates and will accelerate digitisation and increase investment in IT, with operational risk and cyber-attacks on the rise. It will temporarily increase NPLs, hurting profitability, impairing the ability of banks to generate capital and buffers and

14 See the discussion by Amit Seru.

constraining their capacity to provide loans. In the euro area, it will reinforce the doom loop between sovereign and bank risk, since the foreseen large increases in debt-to-GDP ratios, in particular in Southern Europe, may raise problems of sovereign debt sustainability over the medium term. The Covid-19 crisis will also lead to a temporary relaxation of capital and liquidity requirements. However, over the long run the outcome may be the opposite to protect against tail events, which seem to happen more often than expected.

In the pre-Covid-19 world, banks were facing the challenges of low interest rates, the legacy of the global crisis with high NPLs, new competitors and digitalisation and a much heavier regulatory burden. In the post-Covid-19 world, these challenges will intensify, with only temporary alleviation of the regulatory burden due to the impending crisis.

The Covid-19 crisis makes evident that low interest rates are here to stay for much longer than was expected before the crisis. The prospect of negative economic growth and higher indebtedness will translate into even lower interest rates, both nominal and real, with several central banks – including in the UK and US (see Table 1) – already having declared an extended LIRE period. This will lead to further pressure on banks' profitability and, in turn, cutting of costs. Low rates will continue to reduce banks' net interest margins, but may help contain default by firms and preserve collateral values somewhat, thus mitigating the new increase of NPLs. In any case, banks will again suffer a surge of NPLs due to the crisis which, together with persistent low profitability, will impair their ability to generate capital, constraining the capacity to provide loans to the real sector.

Banks remain exposed to credit risk in lending to the economy during the crisis, at least as regards loans outside of or beyond the coverage of government guarantees. Both central banks and regulators have taken measures to enable banks to keep lending during the crisis (see Table 1). Central banks have implemented a number of measures to ensure liquidity to banks and credit to the economy, such as the ECB's modified TLTRO-III and the re-introduced LTRO policies, and relaxed criteria for collateral eligibility in liquidity operations. Regulators and supervisors have relaxed a number of regulations to reduce the potential procyclicality of measures introduced in the last two decades and to avoid a credit crunch. Supervisors have provided temporary relief by allowing banks to fully use their capital and liquidity buffers, and have relaxed accounting procedures, introducing more flexibility in the criteria for loan classification as well as in the implementation of IFRS 9. In addition, the 2020 stress tests have been postponed and the implementation deadlines of Basel IV have been extended in different jurisdictions. Liquidity and capital relief are a temporary reversal of the increased prudential requirements that were imposed on banks in the aftermath of the 2007-2009 crisis. A question arises over whether the relaxation of the implementation of IFRS 9 is appropriate, as it may change the accounting of expected losses in the middle of a crisis. The pre-Covid-19 analysis of the impact of the 2007-2009 crisis and post-2008 regulatory reforms (see the first Future of Banking report)[15] can be used to ascertain the resilience of the banking industry to the Covid-19 shock. Even though those reforms have made the banking system more resilient, it is not clear that this is enough for a shock of the type we are facing at present.

15 Bolton et al. (2019).

Table 1 Main policy measures to enhance banking activity due to the Covid-19 pandemic, by jurisdiction

Policy measure	United States	Euro area	United Kingdom
Regulatory relief	Reduced reserve requirement to zero Technical change to TLAC to help the use of buffers	Banks temporarily able to operate below the level of capital defined by P2G, CBB and on liquidity by LCR EBA postponed stress test exercise to 2021 Flexibility in prudential treatment of NPL and loan provisioning (implementation of IFRS 9)	Countercyclical capital buffer rate to 0% PRA cancelled the 2020 stress test Relaxation of some prudential measures
Liquidity support	Plan to purchase $75 billion Treasury securities and $50 billion GSE MBS PDCF lending to security firms and MMLF to assist MMFs in meeting demand for redemptions Provide up to $2.3 trillion in loans, mainly through the PPP, MSLP and TALF	Additional LTROs and new PELTROs to safeguard money market conditions TLTRO III can be as low as 50 basis points below the average deposit facility rate PEPP to purchase public and private securities of €1.35 trillion until at least June 2021	Introduction of TFSME, financed by the issuance of central bank reserves CCFF will purchase commercial paper to provide support to firms with liquidity shortages
Interest rate policy	Cut fed rate to a range of 0-0.25% Reduced rate discount window to 0.25%	No changes in the reference rates	Reduced bank rate to 0.1%
Collateral policy	New repo facility, FIMA, to smooth functioning of financial markets	Expanded range of eligible assets under the CSPP to non-financial commercial paper Temporary package of collateral easing measures	Activated CTRF to alleviate frictions in money markets

Notes: CCB: Capital Conservation Buffer. CCFF: Covid Corporate Financing Facility. CSPP: Corporate Sector Purchase Programme. CTRF: Contingent Term Repo Facility. EBA: European Banking Authority. FIMA: Foreign and international monetary authorities. FPC: Financial Policy Committee. GSE: Government Sponsored Enterprise. IFRS: International Financial Reporting Standards. LCR: Liquidity Coverage Ratio. LTROs: Long Term Refinancing Operations. MBS: Mortgage-Backed Security. MMF: Money Market Fund. MMLF: Market Mutual Fund Liquidity Facility. MSLP: Main Street Lending Program. NPL: Non-performing loans. PELTROs: Pandemic Emergency Long Term Refinancing Operations. PEPP: Pandemic Emergency Purchase Program. PDCF: Primary Dealer Credit Facility. PRA: Prudential regulatory authority. PPP: Paycheck Protection Program. P2G: Pillar 2 Guidance. TALF: Term Asset-Backed Securities Loan Facility. TFSMF: Term Funding for Small and Medium-sized Enterprises. TLAC: Total Loss Absorbing Capacity. TLTRO III: Targeted Longer-Term Refinancing Operations.

Member states of the EU face a further obstacle in trying to help their economies and the financial intermediaries in the form of state aid and resolution regulations. To ease the former, the European Commission adopted in March 2020 a temporary framework to enable member states to support their economies with different types of state aid, such as direct grants or subsidised state guarantees on bank loans. However, help for financial intermediaries is restricted. According to the Bank Recovery and Resolution Directive (BRRD), only in "circumstances of very extraordinary systemic stress, authorities may also provide public support instead of imposing losses in full on private creditors. The measures would nonetheless only become available after the bank's shareholders and creditors bear losses equivalent to 8% of the bank's liabilities and would be subject to the applicable rules of State aid."[16] This 8% bail-in is applicable as of January 2016 – that is, bail-in is required even under systemic stress, for example out of a macroeconomic shock as in the Covid-19 crisis. This represents an obstacle to the creation of a bad bank where legacy assets from the past crisis would be parked, alleviating the balance sheet of banks to face the current crisis.[17]

Furthermore, the massive expansionary fiscal policies that are currently being adopted by many countries, while limiting the damage from the crisis and therefore indirectly helping the banking sector, will most likely lead to significant increases in debt-to-GDP ratios (by an average of 20% in 2020 alone). This may raise sovereign debt sustainability problems over the medium term, in particular in the euro area, when central banks retreat from their asset purchase programmes. The consequence is that the doom loop of sovereign debt risk and bank risk that afflicted the euro area in the previous crisis may resurface. This may particularly be so if the economies in Southern Europe suffer disproportionately from the crisis and the ECB reaches the limits to its sovereign debt purchases.

The Covid-19 epidemic has led to an impressive acceleration of the digitalisation process in the banking industry. For example, the industry has started operating almost entirely remotely quickly – online banking, remote working, e-commerce and electronic payments are on the rise and these trends are here to stay, particularly if social (physical) distancing has to remain in place in the medium term. This massive and sudden increase in digitalisation channels entails a significant increase in operational risk – cyber risk in particular – that will require banks to make appropriate adjustments to their risk management functions. The banks that can react quickly will be better able to use and exploit the benefits of more advanced technology relative to before the crisis, but they will face the threat of digitally able Fintech and BigTech competitors in some segments of the business. The rapid shift towards a more digital world as a result of the confinement policies in response to Covid-19 is a reminder that the speed of change may take the sector (and everyone) by surprise. This change may also speed up the adoption of different forms of digital currencies and may put the focus on the introduction of central bank digital currency.

The question arises as to what the impact on the various players in the banking sector will be. BigTech companies have all the ingredients to get ahead, in general, in the post-Covid world. They have the technology, customer base and brand recognition, as well as vast amounts of data and deep pockets. They also have the incentives to get into financial services, as discussed before. However, before

16 See the FAQs on the BRRD at https://ec.europa.eu/commission/presscorner/detail/en/MEMO_14_297.

17 Andrea Enria, current head of the Single Supervisory Mechanism, proposed the creation of a bad bank in 2017 when he was the head of the European Banking Authority.

Covid-19, BigTech did not need the funding and had the customer data, while banks wanted the data. Post Covid-19, banks might have the upper hand in funding, with their deposit funding and large balance sheets, while BigTech has a higher cost of capital. Furthermore, banks are now back at centre stage of the intermediary chain as lenders to the real economy. Banks will distribute direct support and credit (typically with partial public guarantees), or both, with the backup of the central bank. Banks may also enjoy a revitalisation of relationship lending as they keep lending to customers over the crisis, with soft information more valuable than hard information. They also enjoy the protection of the safety net, with a low volatility of deposits. All these factors will give them an advantage over shadow banks and new digital entrants. While all financial institutions will suffer the consequences of this crisis, policymakers will tend to focus on saving the banks, where the majority of deposits and lending take place. FinTech platforms may do well if they are included in the rescue schemes that governments are putting together to help SMEs (this is the case for the Funding Circle in the UK and US, for example). FinTech firms may be faster in providing loans to SMEs, which may work to their advantage, but they do not have large balance sheets and are dependent on secondary capital markets to unload their loans, and these markets are illiquid in times of crisis.[18] FinTech start-ups in particular might suffer and may not be able to survive the crisis.

What is certain is that the financial intermediation sector will face deep restructuring, accelerating the pre Covid-19 trend, with medium-sized banks suffering since cost efficiencies and IT investment will be crucial in a persistent LIRE. In the period of slightly over a month after the crisis struck in Europe, major banks' stocks lost 40-50% in nearly all jurisdictions. This raises questions over the ability of some banks to survive the crisis and to generate and attract capital, and over the future structure of the banking sector. Weak banks – in particular those with legacy assets from the previous crisis, high costs and obsolete technology – will not be able to sustain a long period of very low interest rates and the investment in IT needed to compete in an increasingly digital world. All these factors point towards a restructuring and consolidation in the sector. One potential obstacle to consolidation is the lack of capital to carry out a merger due to the weak position of many institutions prior to the Covid-19 crisis, which is made worse by the depletion of buffers during the crisis. In Europe, consolidation will most likely occur along national (or regional) lines because cross-border mergers contribute more to diversification but generate less synergies and, as stated before, those mergers face regulatory, supervisory, and financial law obstacles. In particular, the failure to complete the Banking Union (with no effective euro area backstop and area-wide deposit insurance) stands in their way. Furthermore, in the post-Covid-19 world, political obstacles will resurface as states become more protective of their national banking champions, since banks are considered strategic as they are the instruments through which to convey help to the economy.

18 See the discussion by Amit Seru.

The current crisis will test the resilience of the financial system and the regulatory reforms implemented after the global financial crisis of 2007-2009, which were examined in the first report of the Banking Initiative.[19] In particular, it will put to the test the incomplete Banking Union in the euro area, where the ECB cannot go very far into fiscal territory by monetising the deficit of countries in need (Vives, 2020). Let us hope that the international system proves resilient and that the financial intermediaries respond adequately to the challenge.

19 Bolton et al. (2019).

2 Challenges to banks' business models

The Covid-19 outbreak in Europe at the end of February 2020 signalled a new watermark. Over the span of a few days, at most weeks, the normal working of societies as well as economies was interrupted almost worldwide. The first country outside China to be hit by this surreal situation was Italy, but many other countries (including Spain, France and the United States) followed shortly. What started as a virus outbreak in China became a worldwide problem in an instant. At the time of writing, the economy is surrounded by uncertainty over the duration of the pandemic and the economic lockdown, the drop in GDP, the recovery phase and, most importantly for this report, the effect of the pandemic on the financial system.

The Covid-19 crisis is profoundly different from the 2007-2009 financial crisis and the 2011-2013 sovereign debt crisis. First, it is hitting the real economy directly, combining supply abruptions due to global chain disruptions with demand freezes following lockdowns. Second, it constitutes an exogenous, sudden and symmetric shock to numerous economies. As such, it requires different policy responses relative to the previous crises. Immediate priorities include ensuring the provision of liquidity to firms (of any size and sector) while at the same time shielding the financial sector from possible firm defaults and thus a new surge of non-performing loans and a drain of capital. These objectives are difficult to achieve, given the current depth of the crisis and the shockwaves it is likely to leave behind once the health emergency has passed.

As the Covid-19 crisis has hit the real economy, it requires a substantial use of fiscal policy. This has to sustain workers by substituting for their lost income. In addition, it will have to provide massive guarantees to ensure an abundant flow of credit from banks to firms, and thus sustain the economy. As a complement to this, monetary policy must avoid any disruptions to the transmission mechanism and financial markets by providing ample liquidity to both banks and markets, while at the same time engaging in massive asset purchase programmes. In addition, financial regulation must shield banks and avoid procyclicality. In stark contrast to the last decade, regulators have provided relief to banks through several measures, including a relaxation of the criteria for loan reclassification as well as of capital and liquidity buffers.

The Covid-19 crisis began at the end of a decade of significant transformation for the banking industry around the world. Many factors have contributed to this change.

First, the macroeconomic scenario has continued to deteriorate, leading to a prolonged period of low interest rates. Both real and nominal rates have steadily declined almost everywhere, with nominal rates becoming negative in some jurisdictions in the recent years. This has affected the profitability of financial institutions, in particular when banks are heavily reliant on maturity transformations and net interest income to generate revenue, thus putting into question their traditional business models.

Second, the global financial crisis of 2007-2009 represented a watermark in terms of financial regulation. Existing regulation has been substantially strengthened since then and many new regulatory tools (liquidity regulation, macro prudential policies, etc.) have been introduced. These rules have contributed significantly to enhancing the stability of the financial industry, while at the same time putting pressure on bank profitability and reducing bank competitiveness.

Third, the advent of new technologies and the rise of new competitors, in particular BigTech and FinTech companies, has enhanced the competitiveness of the industry. While representing an opportunity in terms of more effective processes and new products, these developments have also favoured the entry of new competitors in banking-related activities and thus further challenge banks' traditional business models, in particular in the area of payment systems.

The objective of this chapter is twofold. It first analyses how all these elements – the low interest rate environment, regulation and digitalisation and technological advances – have affected the traditional business of the banking industry in the last decade. It then offers some perspectives on how the Covid-19 crisis may affect the banking industry going forward. One main conclusion is that the pre-Covid-19 trends are here to stay. Despite all the uncertainty and the very likely threat to their solvency, banks are now more important than ever in their role as lenders to the real economy. Only banks will be able to provide credit backed by public guarantees, so they will be shielded by the Covid-19 crisis to the extent possible. In addition, the lockdown has significantly accelerated the process of digitalisation and technological transformation. These two elements may provide substantial advantages to the sector going forward.

The chapter proceeds as follows. Section 2.1 provides an overview of banks' main functions. Section 2.2 categorises the different banking business models. Section 2.3 presents the evolution of bank profitability in the last decade and its determinants. Section 2.4 turns to the analysis of the challenges to this profitability and to banks' business models. Section 2.5 concludes.

2.1 The role of banks in the economy[20]

Crises are good reminders of the key role that banks play in the economic system. The efficiency of the process through which savings are channelled into productive activities is crucial for growth and welfare. Lenders of funds are primarily households and firms. These lenders can supply funds to the ultimate borrowers – who are mainly firms, governments and households – in two ways. The first is through financial markets (money markets, bond markets, and equity markets). The second is through banks and other financial intermediaries. Thus, banks are a crucial part of the saving/lending process, especially in bank-

20 This section draws partly on Allen et al. (2019).

dominated financial systems such as Europe and Japan. It is therefore important to analyse their main functions and business models to understand how the challenges that these institutions are currently facing may affect the sustainability of the industry and, ultimately, the economy.

According to contemporary banking theory, the banking functions can be sorted into: (i) processing information and monitoring borrowers; (ii) maturity transformation and liquidity; (iii) payment services; and (iv) risk management. These functions provide the rationale for the emergence of banks and their specific business models, as well as for their vulnerability to crises.

2.1.1 Information processing and relationship lending

One of the primary functions of banks concerns their ability to solve, or at least ameliorate, various informational problems in the relationship between borrowers and lenders. One important problem for a lender is how to select credit-worthy borrowers, i.e., how to screen borrowers and decide to sustain positive net asset value projects. One other important issue is whether borrowers must take some action to make proper use of the funds they have borrowed. This action could be the level of effort or the choice of project among various risky alternatives. The borrower can always claim that a low outcome is due to bad luck rather than from not taking the correct action.

Lenders cannot easily observe the creditworthiness of a potential borrower or the action that it takes after having initiated the loan unless they pay a fixed cost to monitor the borrower. In a financial market with many lenders, there is a free-rider problem. Each lender is small, so it is not worth paying the fixed cost. Everybody would like to free ride, letting someone else bear the monitoring cost. As a result, no monitoring would be done. A possible solution is to have a single monitor to check what the borrower is doing. This is precisely what the bank is supposed to do: raise funds from dispersed investors and act as their delegated monitor of the borrower. The scheme works as long as the bank raises funds in the form of debt and finances a diversified portfolio of projects. In this way, the bank can pre-commit to monitoring borrowers by promising lenders a fixed return. If the intermediary does not monitor, then it will be unable to pay the promised return to lenders. This provide banks with the incentive to act as a delegated monitor and produce the information necessary for an efficient allocation of resources.[21]

The role of banks as delegated monitors helps create the possibility for them to develop close and long-term relationships with firms, which may enhance access to credit and further alleviate some of the information problems characterising lending relationships. This 'relationship lending' requires certain conditions to be met: (i) the financial institution gathers information on top of available public information; (ii) this information accumulation process takes place over time through the provision of different financial services; (iii) the information remains proprietary to the collector to extract rents from it.[22]

21 Diamond (1984).
22 Berger (1999).

These conditions highlight the pros and cons of relationship lending.[23] On the one hand, it generates welfare improvements due to the revealing of borrowers' proprietary information that otherwise would not have been disseminated to the financial markets.[24] It also creates the possibility for banks to accommodate several special contractual features, such as flexibility and discretion towards borrowers, compared to more rigid capital market funding arrangements.[25] It follows that relationship banking can help alleviate credit constraints, in particular in downturns.[26] This positive role of relationship banking is more pronounced for small and opaque firms and in regions with more severe recessions.[27]

However, relationship lending generates inefficiencies related to the hold-up and the soft budget constraint problems. The former refers to the possibility that a relationship bank uses the superior private information it possesses about a firm to extract rents, thus distorting entrepreneurial incentives and causing inefficient investment choices.[28] The latter concerns the inability of a relationship bank to commit to a particular course of action in advance. The problem is that once the borrower has defaulted, the initial loan becomes a 'sunk cost'. If the firm has another good project, the bank will continue to extend credit even if the borrower defaults. In other words, renegotiation creates a time-inconsistency problem. The threat to terminate credit provides proper incentives for the borrowers to avoid the risk of default. If, however, the borrower anticipates that the bank will not exercise that threat, the incentive effect disappears and default risk increases.[29] Therefore it is crucial that banks terminate their loan relationships with defaulting borrowers with no prospects of improving their creditworthiness ('zombie firms'), irrespective of the immediate losses it may generate.

2.1.2 Maturity transformation and liquidity provision

As part of the pooling of resources and allocative function of banks as financial intermediaries, these institutions act as asset transformers, converting short-maturity liabilities to long-maturity loans for entrepreneurs. The liabilities come mostly from demandable deposits, but also from short-term assets from the capital markets.

The maturity mismatch that is generated by asset-liability management allows banks to offer risk sharing to depositors, but also exposes them to the possibility that all depositors withdraw their money early, thus triggering a run.[30] Similarly, the short maturity of wholesale debt exposes banks to rollover risk, driven by the possibility that investors do not roll over their short claims, leading to a drying up of liquidity in the short-term capital markets.[31]

Despite the negative consequences that may arise from the 'demandability' of bank liabilities, these are desirable in that they offer households insurance against idiosyncratic liquidity shocks. In addition, banks offer liquidity provisions to borrowers through the provision of credit lines, that is, commitments to lend

23 For 'classic' reviews, see Boot (2000), Gorton and Winton (2003) and Degryse and Ongena (2008).
24 Bhattacharya and Chiesa (1995).
25 See, for example, Boot (2000).
26 Evidence is provided, for example, in Beck et al. (2018).
27 Evidence is provided in Agarwal and Hauswald (2010), Ergungor and Moulton (2014) and more recently in Agarwal et al. (2018).
28 Sharpe (1990); Rajan (1992); von Thadden (1995).
29 See, for example, Dewatripont and Maskin (1995).
30 See, for example, Diamond and Dybvig (1983) and the vast literature it originated.
31 See, for example, Allen et al. (2019).

on demand. While this also exposes banks to liquidity risk on the asset side, the combination of liquidity provision on demand to both depositors and borrowers allows banks to exploit the synergies from their maturity transformation function.[32]

2.1.3 Payment services

Another core function of the banking system is its ability to enable the trade of goods and services through extensive payment systems. These networks, built via interbank payments, facilitate the transfer of funds between consumers and merchants with high levels of safety and efficiency and are essential for efficient economic exchange. This function has become more relevant with the integration of international markets, and it has increasingly migrated from physical paper (cheques, paper-based giros) to electronic non-cash payments using cards, electronic giros, and automated clearing houses. Daily retail payments have relatively small average values but number in the hundreds of millions. Daily wholesale wire transfer transactions are in the thousands, but their value is in the trillions. Wholesale wire transfers are used to make large-value business, government, and financial market transactions, along with settling payments made over other networks.[33]

In the US and Europe, banks have traditionally had an effective monopoly in offering retail and wholesale payment services, since deposit accounts contain the funds needed for almost all types of transactions. This is enforced by the legal definition of what a bank is and does, as only banks are typically allowed access to central bank payment settlement accounts. Some countries (including Canada and Australia) allow non-bank financial firms to have limited access to central bank settlement services, and in many countries non-bank institutions may offer limited payment services outside of usual banking channels (e.g., money order firms or money transmitters of inter-country remittances). Even so, almost all payments have traditionally gone through banks, and have been an important source of revenue. This situation is changing rapidly, however, due to the entry of non-bank intermediaries and BigTech firms in this area, as discussed in more detail in the following chapter.

2.1.4 Risk management

The very nature of the day-to-day banking business requires that banks become experts at assessing and managing risks. Banks exist to take on the risk of their customer base and offer them hedging against cross-sectional risk, intertemporal risk and liquidity risk.[34] By offering its clients risk-management products, the bank itself absorbs an inventory of risk. The bank prices these products by estimating the costs of managing the risks inherent in each transaction. In doing so, banks themselves become exposed to numerous risks, ranging from interest rate risk, credit risk, currency risk and liquidity risk to operational risk (including,

32 See, for example, Kashyap et al. (2002).
33 See, for example, Humphrey (2019).
34 See, for example, Levine (1997).

recently, climate risk and cyber risk). It follows that financial institutions are specialists in risk management. Indeed, their primary expertise stems from their ability to measure and manage risk exposure on their own behalf and on behalf of their clients.[35]

2.2 Banking business models

Although most perform all the functions described above, banks operate different business models based on their risk preferences, market niche and comparative advantages. Each banking business model puts emphasis on some activities as opposed to others, affecting the composition of their balance sheets.

It is important to group business models, as each can be associated with different performance levels and risk factors, allowing not only the shareholders but also the regulatory agencies to fine-tune or incentivise the right business choices to generate reliable and long-term earnings.

Bank business models are traditionally classified into four categories: two models of commercial banking, one trading model and one universal model. The first model of commercial banking, known as the retail-funded business model, is funded mainly through stable sources such as deposits, with limited interbank activity. The second model of commercial banking, known as the wholesale-funded model, has a greater weight of wholesale debt relative to deposits and a more active interbank market. The trading-oriented business model has a small loan book compared to the trading book, and less stable funding coming from wholesale and interbank markets. Finally, the universal business model is a hybrid version of the other three, with a moderate loan book, a significant portfolio activity, a solid deposit base and an active role in the interbank market as both borrower and lender.

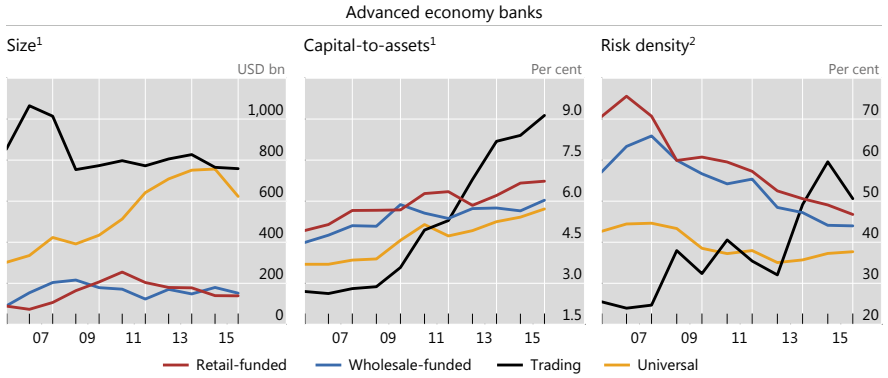
These business models have evolved over time, in particular after the 2007 global financial crisis due to a mix of stricter regulation and change in risk aversion. Smaller banks operating under the commercial banking model have reduced the component of wholesale funding in favour of more stable retail funding, while large banks have remained focused on the universal banking model. Finally, banks with a trading-oriented model have maintained this model, although the turmoil in the market shrank their size.

These changes have affected the evolution of the different business models with respect to size, capital-to-asset ratios and risk density. These adjustments have been more acute in the most globally active banks and large European banks, and less significant for banks in emerging markets.[36] As can be seen in Figure 1, only the banks following the universal model have managed to expand in size since the financial crisis. Importantly, also in light of the Covid-19 crisis, all banks have built a higher capital-to-asset ratio over time. This is particularly true for banks active in the trading model, although their risk density has decreased only in more recent years.

The following sections analyse how bank profitability has evolved over time and what factors affect it most. Particular attention is given to the role of interest rates, regulation and digitalisation in affecting business models.

35 Allen and Saunders (2019).
36 Roengpitya et al. (2017).

Figure 1 Size and risk profile by business model



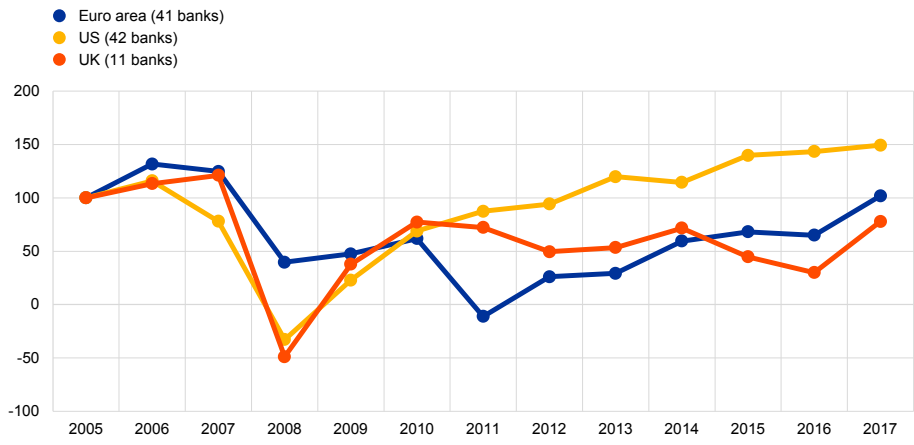
Notes: For the included banks, there are enough data to allow for model allocation in each of the following years: 2005, 2007, 2013 and 2015. 1) Total assets net of derivatives positions. The netting minimises differences due to the different treatment of off-balance sheet exposures under IFRS and GAAP. 2) Ratio of risk-weighted to total assets net of derivatives positions. 3 Lines for wholesale-funded and trading models are not shown, as there are only 26 and 11 bank-year observations, respectively.

Source: Roengpitya et al. (2017).

2.3 Evolution of bank profitability

Crises always have significant effects on the performance of the banking sector, and the 2007-2008 financial crisis was no exception. The period before the crisis was characterised worldwide by loan portfolio growth, high leverage, ample liquidity and over-valued assets. The problems observed in the US financial system were transmitted overseas to both the financial industry and the real sector. Defaults hiked, liquidity sources shrank and risk premia increased for most assets, making refinancing unviable. These trends were reflected in bank profitability, as shown in Figure 2.

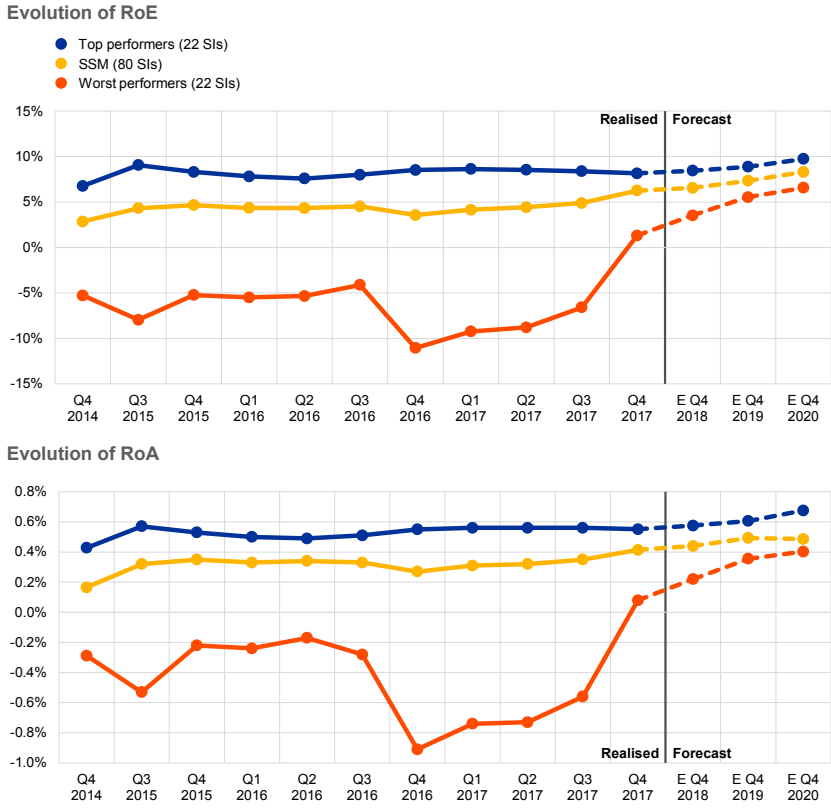
Figure 2 Evolution of aggregate profits before taxes by jurisdiction (2005 = 100)



Source: ECB (2018).

The figure shows that bank profitability decreased significantly in the US and UK during the financial crisis, while the major decline in the euro area occurred at the time of the sovereign debt crisis in 2011. Bank profitability was rather homogenous across jurisdictions before 2007, while it appears quite heterogeneous after that. US banks recovered to pre-crisis profitability levels in 2012, but European and UK banks have never recovered, despite an improvement in recent years prior to the outbreak of the Covid-19 crisis. This improvement can be at least partly explained by an expansion of fee- and commission-generating businesses, a reduction in the level of NPLs in weaker banks and a strong focus on growth in stronger banks.[37] This entails heterogeneity in the level of profitability across the different banks and jurisdictions. The best performers in the euro area exhibit a return on equity (ROE) and return on assets (ROA) below 10% and 1%, respectively. The worst performers had negative ROE and ROA until the end of 2017, but have been catching up significantly since then. However, the average ROE of banks in the European Union was still only 7% as of June 2019, a level well below the cost of equity for many banks.

Figure 3 Evolution of ROE and ROA



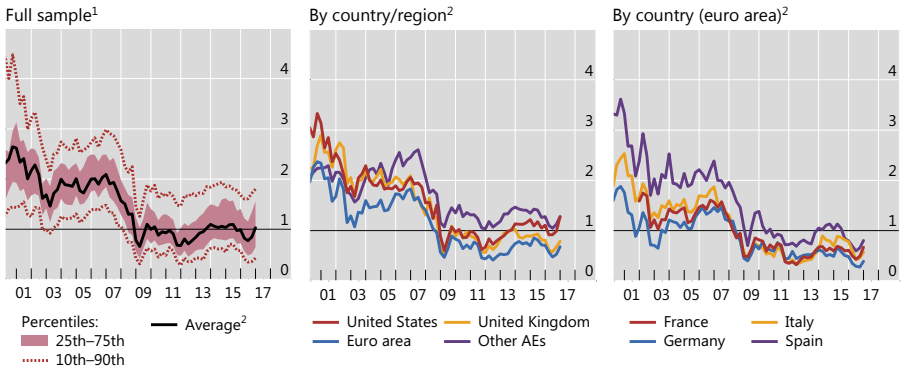
Notes: All samples exclude subsidiaries of non-SSM banks; Top performers: 22 SIs with average RoE ≥ 6% over the last 3 years; worst performers: 22 SIs with a negative average RoE over the last three years.

Source: ECB (2018).

37 See also ECB (2018).

The low levels of profitability translate into low market valuations. Figure 4 shows that the price-to-book ratio has declined since the early 2000s across all jurisdictions, and particularly in the euro area and UK, where it remained below one at the outbreak of the Covid-19 crisis. The price-to-book ratio is important because it reflects markets' concern about banks' potential to create profits. As such, the measure is used as a proxy for banks' ability to attract capital and sustain the economy, and is therefore also a key parameter in view of future consolidation in the industry.[38]

Figure 4 Price-to-book ratios across jurisdictions



Notes: End of quarter. 1) The sample covers 72 banks in advanced economies (AT, AU, BE, CA, CH, DE, ES, FR, GB, IT, JP, NL, SE and US). 2) Asset-weighted averages across countries/regions/full sample.

Source: Bogdanova et al. (2018).

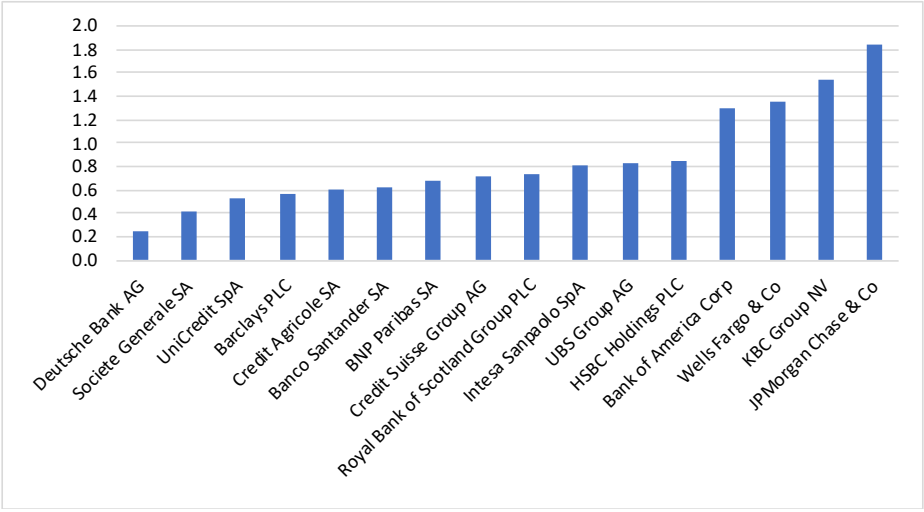
Within the euro area, Spain and Italy performed slightly better than France and Germany, at least in the period 2015-2017. Several factors may explain this heterogeneity across countries, including higher cost-to-income ratios, different market structures and business models.

Among the European banks, only Intesa San Paolo, UBS and HSBC exhibited a price-to-book ratio near 0.8 at the end of 2019; major US banks traded at a price much higher than their book values, with JP Morgan Chase reaching 1.8 (Figure 5). However, these values have dramatically worsened since the outbreak of Covid-19.

In a period of just over a month, all major banks' stocks have lost between 40% and 50% (Figure 6), with almost no jurisdiction excluded. This raises further questions over banks' ability to survive the Covid-19 crisis.

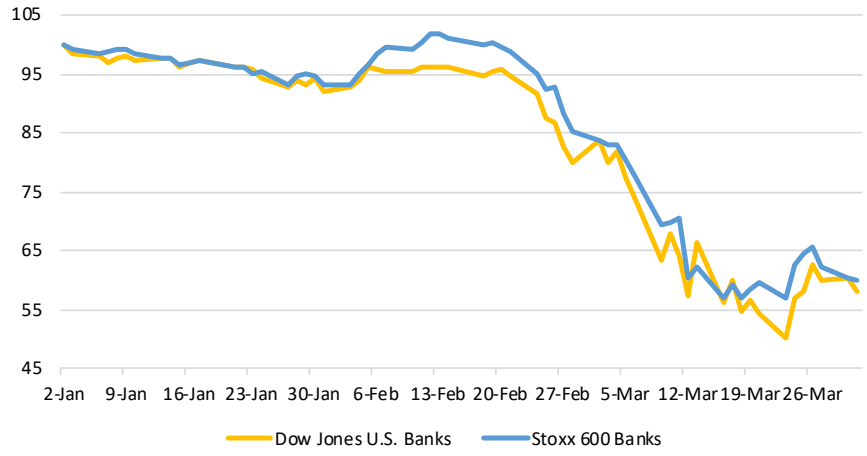
38 Bogdanova et al. (2018).

Figure 5 Price-to-book ratios for individual banks, 2019Q4



Source: Author's calculations based on Bloomberg data.

Figure 6 European and US banks stock prices, indexes rebased



Source: Own Calculations using S&P data.

Various factors may explain the differences in pre-Covid-19 profitability between the US and Europe. The first relates to the different crises that affected the two continents. The US was heavily affected by the financial crisis in the years 2007-2009 but its economy recovered relatively quickly after that. By contrast, Europe also experienced a sovereign debt crisis in the period 2011-2013 that affected banks all over the continent, particularly in countries such as Greece, Italy, Portugal, Spain and Ireland. The sudden increase of sovereign spreads led to a sharp decline in the market valuation of bonds issued by peripheral countries, with significant consequent losses for banks and widespread concerns about

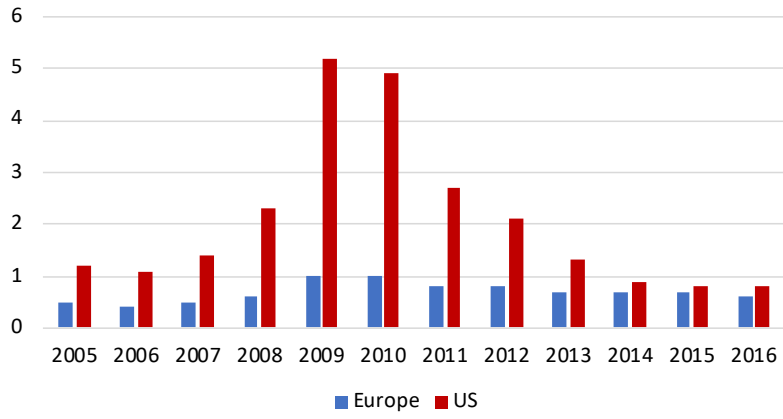
their solvency due to their large holdings of sovereign debt.[39] The problem was more severe for banks located in peripheral European countries because of the 'home bias' in sovereign debt holdings and undercapitalised banks. Furthermore, government-owned banks in peripheral countries were even more exposed to the home bias problems compared to private banks, due to political coercion.[40]

The situation was further aggravated by the fact that European banks were undercapitalised relative to other jurisdictions and thus were less prepared to absorb large losses driven by the lower market valuation of sovereign bonds.[41] This also led to a crowding-out effect on the provision of bank loans to corporations, hampering capital formation and profits.[42]

The second factor that hindered bank profitability in Europe relates to the high level of NPLs, particularly in the countries that were most affected by the sovereign crisis and the consequent economic recession. In the euro area, NPLs doubled to €1 trillion (more than 9% of the region's GDP) from 2009 to 2014, with extreme cases in a few countries. In Greece and Cyprus, almost half of loans were non-performing, while in Italy, Portugal and Slovenia, this indicator reached more than 15%.[43]

The situation in the United States has been very different. Government bailouts and stronger economic growth helped the banking sector to recover to pre-crisis levels by 2013. Moreover, even though the level of NPLs increased dramatically in the US, banks quickly rid their balance sheets of impaired assets and increased their capital levels. Figure 7 shows that US banks had much higher average write-offs relative to loan volumes than European banks, thus managing to reduce their exposure to defaulted loans and clean up their balance sheets. In less than five years after the crisis, US banks returned to pre-crisis write-off ratios; their European peers have not yet managed to do so.[44]

Figure 7 Average write-offs relative to loan volumes (%)



Source: Own Calculations using BCG data.

39 Acharya and Steffen (2015).
40 De Marco and Macchiavelli (2016) and De Marco (2019).
41 Popov and van Horen (2015).
42 Becker and Ivashina (2018).
43 Aiyar et al. (2015).
44 BCG (2018).

A third reason behind the difference in bank profitability in the US and Europe lies in the level of interest rates. While real interest rates have been progressively declining in both jurisdictions in the last decades, the level of nominal rates has been quite different in the two continents, in line with the different economic situations.

Although the short-term effect of a reduction in nominal interest rates is to boost profitability through reduced funding costs, higher asset and collateral values and lower default risk on new or repriced loans, a prolonged period of low rates may have negative effects on profitability, and thus on the resilience of the industry (more on this in Section 4.1).

All of the above-mentioned factors are likely to persist in a post-Covid-19 world. The massive expansionary fiscal policies that are currently being adopted will most likely lead to significant increases of debt-to-GDP ratios in the affected countries – current estimates point to an average increase of 20% in 2020. This is likely to raise problems of sovereign debt sustainability over the medium term, in particular when the emergency is over and central banks retreat from their asset purchase programmes.

Similarly, banks are likely to once again suffer a surge of NPLs. Despite the ample provision of public guarantees, banks remain exposed to credit risk in lending to the economy, at least for the part of loans outside the coverage of guarantees. Finally, due to the negative growth prospects, interest rates are likely to remain low for a prolonged time. While this may help contain credit risk and boost asset values, it will weigh on interest rate income.

Levels of profitability have evolved differently across the various bank business models described in Section 2.2. There is a general consensus that retail-oriented banks perform better than their peers in terms of profitability (ROE and ROA) and cost-efficiency measures (cost-to-income ratios). Wholesale banking models and investment banks, on the other hand, supply lower and less stable profits due to their significant trading losses.[45]

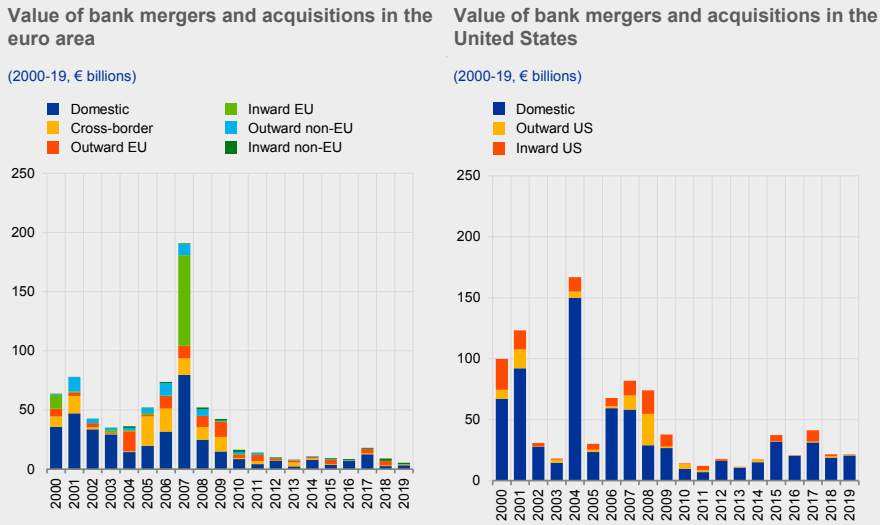
In line with this, the evidence shows that the banks that switched to the retail-funded model in the period 2005-2015 increased their ROE by 2.5 percentage points on average across all jurisdictions compared to non-switchers, while those switching to the wholesale-funded model decreased their ROW by 5 percentage points on average.[46] Among the retail-oriented banks, those that achieved greater diversification of revenues exhibited greater profitability and greater stability,[47] as well as funding costs.[48] It is unclear, however, whether the retail banking model will remain the most successful given its vulnerability to low interest rates and consequent reduction in net interest margins, as we discuss below.

45 Ayadi et al. (2012).
46 Roengpitya et al. (2017).
47 Mergaerts and Vander Vennet (2016).
48 Köhler (2015).

Box 1 Market structure and consolidation

Another reason for why the US banking sector has been more profitable than the European sector in the last decade relates to market structure. To provide a striking example, the six largest banks in the US count for around 60% of total assets, while the corresponding banks in the euro area reach only 30%. This greater fragmentation is at least partly the result of a less dynamic merger and acquisition (M&A) environment in Europe relative to the US. As Figure 8 shows, both the US and the euro area have witnessed a significant decrease in the value of bank M&As since 2010, but the decrease has been much less pronounced in the US thanks to a still active domestic dynamic. By contrast, the euro area has witnessed very limited M&A activity both domestically and across borders, which has also contributed to creating fragmentation in the Single Market.

Figure 8 M&A activity in the US versus the euro area



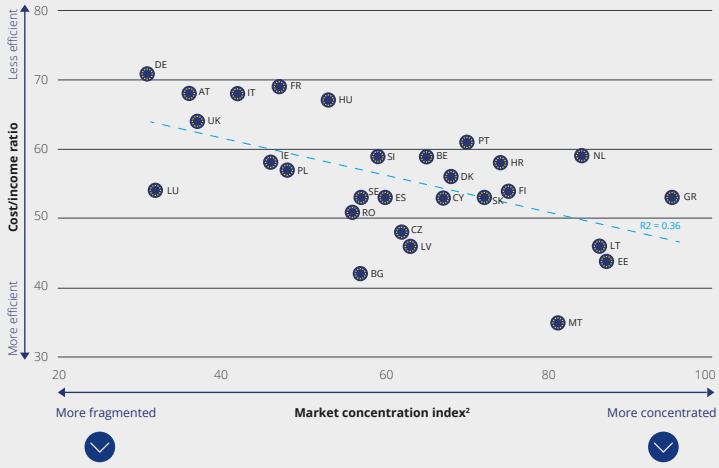
Notes: M&A refers to transactions where the acquired stake is more than 20% of the target bank. "Domestic" refers to transactions that take place within the national boarders of euro area countries. "Cross-boarders" M&A involve euro area targets and non-domestic euro area acquirers. "Inward" refers to M&A by non-EU or non-euro area EU banks in the euro area, while "outward" indicates M&A carried out by euro area banks outside the euro area.

Source: ECB (2019a).

The difference in M&A dynamics in the two jurisdictions has its roots in a number of factors: (i) faster recapitalisation of US banks in response to the crisis; (ii) different speeds of economic recovery; (iii) business obstacles (e.g., reluctance of current shareholders in the euro area to see their stakes diluted given the context of low bank share prices and price-to-book ratios); and (iv) regulatory, supervisory and political obstacles in the euro area, which include higher capital requirements for large and systemic banks, and a lack of harmonisation of financial laws and tax systems across countries.

Recently, there has been a growing debate on the opportunity to promote a new wave of M&A in Europe, in particular with cross-border combinations to better achieve efficiency gains and foster the Single Market. Some industry commentators argue that in fragmented markets, M&A may help banks reduce their cost-to-income ratios while reaching bigger scope and thus greater economies of scale. Stylised facts support this argument. Figure 9 documents a clear negative correlation between the cost-to-income ratio and market concentration, as measured by the index representing the aggregated share of the top five banks in each country.

Figure 9 Cost-to-income and market concentration



Source: Deloitte (2018).

The figure shows significant heterogeneity across the different European countries, and a strong correlation between high market concentration and a low cost-to-income ratio. Clearly, this has to be interpreted with caution. First, the figure documents only simple correlations, and not a causality nexus. Second, although greater concentration has the potential to generate economies of scope and scale, it is also associated with greater market power. It follows that a lower cost-to-income ratio in the presence of greater concentration may derive from either greater efficiency (and thus lower costs) or higher income. Only in the former case would this translate into higher consumer welfare as banks pass on the higher efficiency to customers.

This discussion suggests that the domestic consolidation process should be promoted in systems with many weak-performing and very small banks, operating at a sub-optimal scale and with inefficiently high costs. Larger banks should instead try to enhance their profitability through cross-border consolidation, given their higher systemic footprint and potentially greater negative effects on consumer surplus. For this to occur, however, it is important to decrease the implementation risk associated with the type of transaction and thus start removing regulatory and political obstacles. These considerations are even more relevant in a post-Covid-19 world, in which national governments are likely to raise obstacles to cross-border consolidation even further.

2.4 Challenges to the sector's development

We now turn to analyse the main challenges to bank business models in the last decade: the low interest rate environment (LIRE), the design of financial regulation, and the advent of digitalisation. The focus of this section is on how these factors have affected bank profitability and bank business models in the last decade, and their likely role in a post-Covid-19 world. The driving assumption is that persistently low levels of bank profitability can limit banks' ability to generate capital from their operating business, making it harder for them to build up buffers against unexpected shocks, constraining their capacity to fund loan growth as well as potentially increasing their costs of raising capital from market sources.[49] In this sense, the pre-Covid-19 analysis is used to discuss the resilience of the banking industry to the Covid-19 shock.

2.4.1 Low-interest rate environment[50]

Interest rates have been decreasing since the mid-1980s, but their decline accelerated after the financial crisis and the sovereign debt crisis in Europe. As can be seen from Figure 10, interest rates declined in all developed economies, although with some heterogeneity. Japan was the first country to experience zero nominal rates at the end of the 1990s, but other jurisdictions followed.

The decline, which affected both short- and long-term rates, is explained by the reduction of inflation expectations and inflation risk premia due in large part to the credibility of monetary policy during 'Great Moderation' and the slack of the economy during the 'Great Recession', as well as by the downward trend of real interest rates and real term premia.

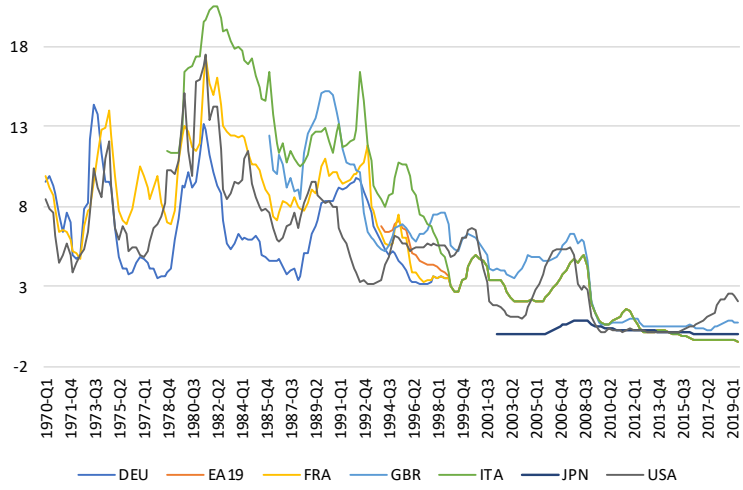
Two main explanations have been put forward for the decline of these real components. The first, described as the 'structural view', focuses on the structure and the functioning of the real side of the economy.[51] The idea is that demand and supply factors (adverse demographic developments, price reduction in investment goods and low pace of technological innovation, etc.) have led to a structural imbalance between the demand for investment and the supply of savings, resulting in a reduction of equilibrium interest rates and a relative price reduction of investment goods.

The alternate view, which focuses on financial-cyclical factors, argues that deregulation of financial and credit markets, excessively expansionary monetary policies and overly optimistic expectations about future macroeconomic and financial prospects during the Great Moderation have favoured an excessive increase in the supply of funds, a compression of risk premia and a reduction of interest rates. In this context, the sharp correction in the financial cycle that occurred with the outbreak of the financial crisis, followed by a persistent contraction in aggregate demand and an increase in the demand for long-term safe assets, has led to further reductions in term premia and real interest rates. However, interest rates should rise again once the deleveraging process ends and expansionary monetary policies are phased out.

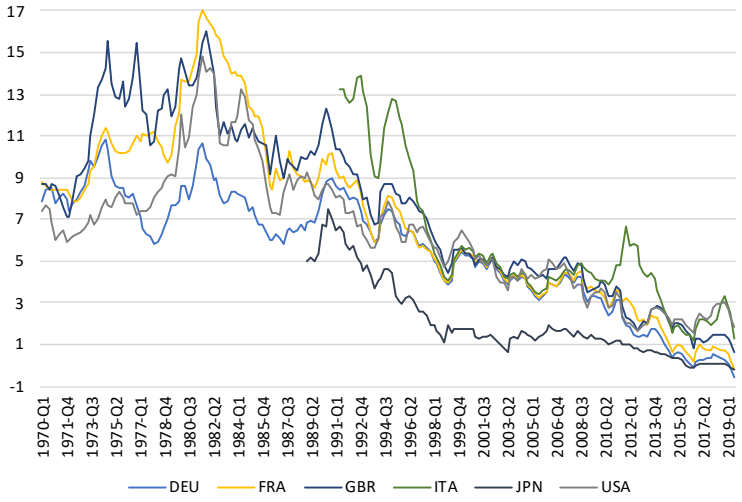
49 De Guindos (2019) and Hernández de Cos (2019).
50 This subsection is largely based on Carletti and Ferrero (2017).
51 See, for example, Summers (2014), Gordon (2016) and Eggertsson et al. (2017).

Figure 10 Short- and long-term nominal interest rates

a) Short-term interest rates (3-month OECD)



b) Long-term interest rates (10-year OECD)



Notes: Long-term interest rates are yields on 10-year government bonds (or on the closest maturity); short-term interest rates are yields on 3-month deposits, or Treasury bills.

Source: Own calculations using OECD data.

The level of interest rates has a significant impact on bank business and profitability. Traditional commercial banking activities based on the intermediation function between savers and lenders generate most of banks' revenues in the form of the net interest margin (i.e., net interest income over

total assets), while maturity transformation activities in the form of short-term liabilities and long-term assets are mostly reliant on the level of term premiums. Similarly, trading activities rely heavily on asset market valuations, which in turn are also greatly impacted by the level of interest rates.

A persistent LIRE, due to either structural or financial-cyclical factors, has very different implications for bank business relative to a short-term decline in interest rates. This is because it is accompanied by low inflation, stagnating GDP growth and weak employment dynamics, which contribute to the flattening of the yield curve.

In the short run, a reduction of interest rates is likely to have a favourable impact on bank business and profitability. As long as the yield curve does not flatten, lower rates translate into lower funding costs, higher asset and collateral values, lower default risk on new or repriced loans and higher equity values, thus attracting investors' funding and favouring credit lending.[52] It follows that lower short-term interest rates steepen the yield curve, thus increasing the future net interest margin and the risk capacity of the banking sector.[53]

In the medium to long run, however, the positive effects of low interest rates are likely to fade way. As the economy enters into a scenario where short-term nominal rates approach the effective lower bound (ELB) and long-term interest rates continue to decrease, the slope of the term structure of interest rates is likely to flatten, negatively affecting the net interest margin and thus banks' risk-taking capacity.[54]

Several mechanisms are at play here. First, the flattening of the yield curve reduces the margins that institutions such as banks can obtain between long-term assets and short-term liabilities. This reduces the net interest margin, which currently represents the most important component of banks' overall income. While this mostly affects new issuances of loans and other credit facilities, the use of floating rates on loans may also reduce the margins attainable from current assets. Second, the presence of an effective lower bound on nominal rates creates rigidity in the funding rates such as deposit rates or bond returns. This effect contributes to the reduction of profitability of financial institutions, in particularly those that are more leveraged or deposit funded or that grant floating rate loans. Third, a prolonged LIRE makes it difficult to earn high returns, particularly on fixed-income related investments.

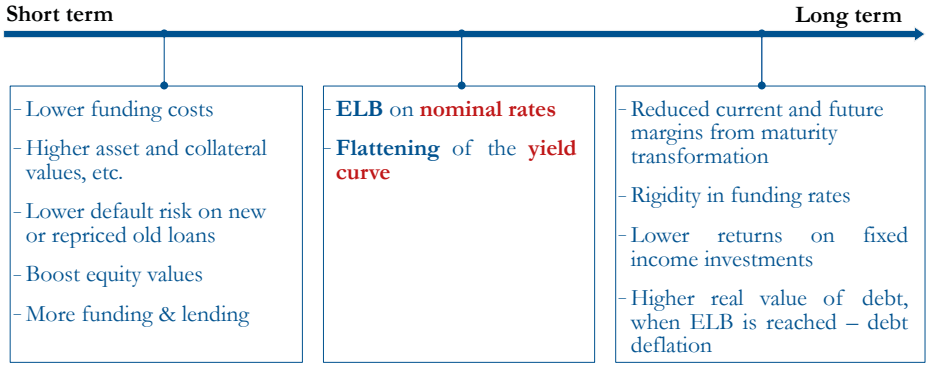
Finally, in an attempt to boost profitability, banks can start engaging in a search for yield through a relaxation of lending standards or increased investment in lower-quality asset classes.[55] The former is typically associated with a reduction in the monitoring activity of borrowers by banks, since their monitoring incentives decreases as the spread between loan and deposit rates decreases in a LIRE.[56] This may in turn produce mispricing and excess volatility risks.[57]

52 Gros et al. (2016) and ESRB (2016).
53 Adrian and Shin (2010).
54 IMF (2017).
55 The 'search for yield' phenomenon has also been pervasive among other financial institutions. For example, to meet their mandates and obligations in a LIRE, pension funds and insurance companies in many advanced economies have increased the risk profile of their asset holdings, including offering (directly or through brokers) housing loans and various investment products to households, thus taking business away from banks.
56 See Allen et al. (2011) and Dell'Ariccia et al. (2014). Importantly, this strand of literature only focuses on lenders' incentives to monitor and disregards the positive effects that lower interest rates may have on borrowers' incentives and ability to repay.
57 Martinez-Miera and Repullo (2017).

The trade-off of a reduction in interest rates in the short and long run suggests the possibility that the economy may reach the 'reversal rate', that is, the rate at which accommodative monetary policy reverses and becomes contractionary for lending and thus growth.[58] The exact level at which this may happen is clearly very difficult to pin down; factors affecting it include the quantity and the maturity of banks' asset holdings with fixed interest rates, the extent of interest rate pass-through to loan and deposit rates, and the capital constraints banks face.

Recent studies have analysed the effects of low interest rates on banks' profitability and 'search for yield' behaviour, but the results are ambiguous. There is a broad consensus on the adverse impact of low interest rates on net interest margins, with more pronounced effects for banks with high deposit rates,[59] small banks[60] and less capitalised banks,[61] and in a period of negative nominal rates.[62]

Figure 11 Summary of effects of LIRE on bank business and profitability



However, there is also evidence of other compensating factors for overall bank profitability, such as reduced borrowers' default risk (and thus a diminished need for banks to accumulate loan loss provisions), lower funding costs, higher non-interest income in the form of higher capital gains, fees and commissions, as well as higher investor appetite for NPLs.

This translates into non-conclusive results on the effects of low/negative interest rates on banks' overall profitability, as summarised in Table 2. It is worth stressing that most studies analyse the short-term consequences of low interest rates and do not always take into account the flattening of the yield curve in their analysis. It follows that some results may not hold once these factors are considered.

58 Brunnermeier and Koby (2019).
59 Urbschat (2018).
60 Claessens et al. (2018a) and López et al. (2018).
61 Arce et al. (2018).
62 Coleman and Stebuvnovs (2019) and López et al. (2018).

Table 2 Impact of low/negative interest rates on banks' profitability and its components

Direction of impact	Outcome variable	Paper(s)	Geographic coverage
↓	Net interest income	Claessens et al. (2018), Coleman and Stebunovs (2019), Urbschat (2018), Borio et al. (2017), Lopez et al. (2018), Altavilla, Boucinha and Peydro (2018)	Advanced economies, Europe, Germany, Japan, euro area
↓	Deposit expenses	Lopez et al. (2018)	Europe and Japan
↑	Non-interest income	Borio et al. (2017), Lopez et al. (2018)	Advanced economies
0	Non-interest income	Altavilla, Boucinha and Peydro (2018), Urbschat (2018)	Euro area, Germany
↓	Loan loss provisions and non-performing loans	Borio et al. (2017), Altavilla, Boucinha and Peydro (2018), Urbschat (2018)	Advanced economies, euro area, Germany
↓	Overall profitability	Coleman and Stebunovs (2019), Borio et al. (2017)	Europe, advanced economies
0	Overall profitability	Lopez et al. (2018), Claessens et al. (2018), Altavilla, Boucinha and Peydro (2018)	Europe and Japan, advanced economies, euro area

Source: Albertazzi and Gross (2020).

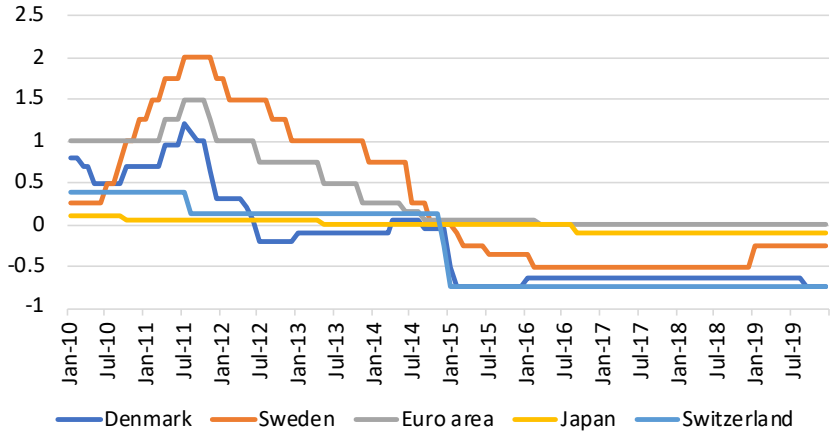
In the past few years, a number of countries have experienced negative interest rates. In particular, the Danmarks Nationalbank, the European Central Bank, the Sveriges Riksbank, the Swiss National Bank and the Bank of Japan have been charging negative rates on deposited excess reserves. While the motives behind this unconventional monetary policy vary across countries, the core conditions are similar: a persistent deflationary risk, weak economic recovery, excessive risk aversion, upward pressure on the domestic currency and concentration of liquidity in a few agents.

Some studies have focused on the potential discontinuity effects that negative rates may generate in terms of profitability and consequently lending supply. The results are again mixed, as summarised in Table 3.

Key elements for the impact of negative interest rates include the amount of excess liquidity held by banks and the composition of funding sources (for example, the reliance on deposit funding versus interbank funding). Banks with large deposit bases, for instance, may cut lending – and in particular to riskier borrowers – as a result of the squeeze on their net worth induced by the negative rates and the inability to transmit these to retail depositors.[63] By contrast, banks with excess liquidity may have an incentive to shift investments from liquidity assets to loans – especially to riskier and smaller firms – to boost revenues, thus expanding credit supply.[64]

63 Heider et al. (2019).
64 Bottero et al. (2019).

Figure 12 Policy rates in jurisdictions with negative interest rates



Source: Own Calculations using BIS data.

Table 3 Impacts of negative interest rates on lending.

Direction of impact	Outcome variable	Paper(s)	Geographic coverage
↑	Lending	Demiralp, Eisenschmidt and Vlassopoulos (2018), Altavilla, Boucinha, Holton and Ongena (2018), Lopez et al. (2018), Altavilla, Burlon, Giannetti and Holton (2019), Bottero, Minoiu, Peydro, Polo, Presbitero and Sette (2019)	Euro area, Italy, EU, Japan
↓	Syndicated lending	Heider, Schepens and Saidi (2019)	Euro area
↑	Loan pricing on fixed-rate mortgages	Amzallag, Calza, Georgarakos and Sousa (2019)	Italy
0	Lending	Arce, Garcia-Posada, Mayordomo and Ongena (2018)	Euro area, Spain

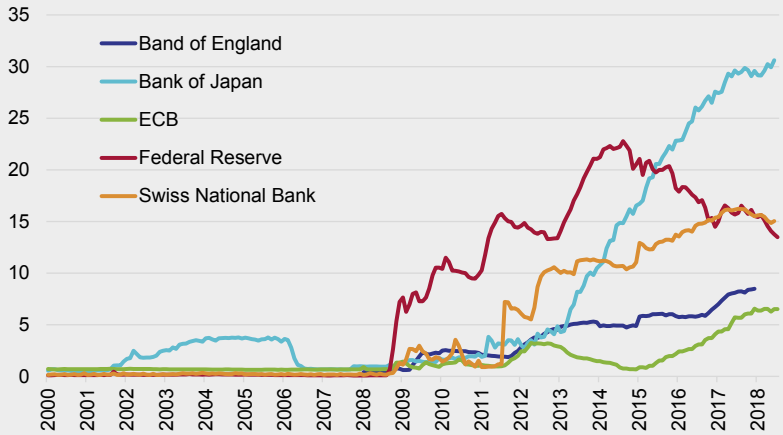
Source: Based on Albertazzi et al. (2020).

Box 2 Tiering policies

There is a broad consensus that negative rates have an adverse impact on banks' net interest margin and income, also given their difficulty or reluctance to pass negative rates to customers. This effect is further exacerbated by the high amount of excess liquidity that banks have accumulated at their respective central banks in recent years and that is remunerated at negative rates. In the euro area, for example, banks' excess liquidity went from zero before September 2008 to €1,000 billion in 2012 and €1,800 billion in 2019.

This phenomenon has accumulated in specific euro area countries and in a small group of financial institutions. Data show that around 80-90% of the excess liquidity is located in Germany, France, the Netherlands, Finland and Luxembourg, with around 70-80% being held by the top 50 banks. This concentration was due in part to the 'flight to quality' in the years 2020-2012 and to the capital key of quantitative easing (QE) coupled with the location of the counterparties. Banks with business models focused on investment banking and clearing activities tend to hold more excess liquidity relative to their size than banks with retail or wholesale commercial business models.[65] Even larger amounts of excess liquidity appear in Japan, Switzerland, UK and US, as shown in Figure 13.

Figure 13 Bank's total reserves held at the respective central bank, as a share of system assets



Source: Bruegel based on ECB's Statistical Data Warehouse (deposit facility: ILM.M.U2.C.L020200.U2.EUR, current account: ILM.M.U2.C.L020100.U2.EUR, Fixed-term deposits: ILM.M.U2.C.L020300.U2.EUR); Federal Reserve Bank of St. Louis (total reserves: RESBALNS); Bank of England (total reserves: LPMBL22, total assets via ECB: DD.A.GB.TA_DBG.PGDP.4F_N); Bank of Japan (total reserves: MD07'MAREM1, total assets: BS02'FAABK_FAAB2DBEAS); Swiss National Bank (reserves: EPB@SNB.snbbipo{GB} and EPB@SNB.snbbipo{GBI}, total assets: BSTA@SNB.MONA_U.BIL.AKT.TOT{U,T,T,A40}.

Source: Darvas and Pichler (2018).

65 Darvas and Pichler (2018).

In an attempt to lessen the negative impact of negative interest rates on banks, various central banks have introduced a 'tiering' system in their policy framework – that is, a mechanism of exemption from negative rates for at least a portion of banks' excess reserves. Central banks tend to adjust the tiering over time so that the amount of excess reserves below the exemption threshold is sufficient to keep money market rates aligned with the marginal policy rate and at the same time to increase the opportunity cost of lending rather than depositing cash as reserves with the central bank.

Such a policy has been introduced, at different points in time and with different characteristics, in countries including Japan, Denmark, Norway and Switzerland, and more recently in the euro area. Tiering regimes can be broadly categorised depending on the number of tiers and the allocation of reserves across these tiers. For example, Japan introduced a three-tier system for central bank deposits in 2016, depending on the time when reserves were initially deposited. Existing balances as of 2015 (the 'basic balance') represent roughly 50% of reserves and continue to earn a rate of 0.1%.

An additional 30-40% of reserves qualified as 'macro add-on' would earn zero. Only the remaining share, which corresponds to roughly 10-20% of reserves (depending on the bank), would earn a rate of -0.1%.[66] By contrast, in the euro area the ECB introduced a two-tier system in 2019 whereby excess reserves up to six times the minimum required reserves are exempted from the deposit facility rate.

How successful is a tiering policy in improving bank profitability and stimulating lending? This is a difficult question to answer. In Japan, where de facto only a very limited fraction of reserves is subject to negative rates, a recent study estimates that tiering increases lending by 0.25%, which is rather contained relative to the overall 4% decrease due to negative rates.[67]

Estimating the effects of tiering is further complicated by the heterogeneous exposure of different banks to the effects of negative rates and the potential tiering benefits. With reference to the euro area, for example, deposit-funded banks are likely to be most affected by the negative rates, while tiering is likely to benefit most – at least in the short run – banks that have investment bank-type business models or operate clearing activities. In addition, tiering may also have a signalling effect on the term premiums as investors may expect a further extension of the negative rate policy.

All in all, the question of whether the reversal rate was reached before the Covid-19 outbreak remains unanswered. So many factors come into play when looking at the effects of low or negative interest rates that conclusions remain ambiguous. In addition, short-term effects may differ from long-term ones, and the overall impact may depend crucially on the specific characteristics of each banking system.

For example, the extent to which banks can pass the negative rates on to deposits appears crucial for the effects on banks' profitability. Supervisory reporting data indicate that around 22% of banks in the EU apply negative rates to deposits held by non-financial corporations, while only around 3% do so for

66 Natixis Consulting (2019).
67 Balloch and Koby (2020).

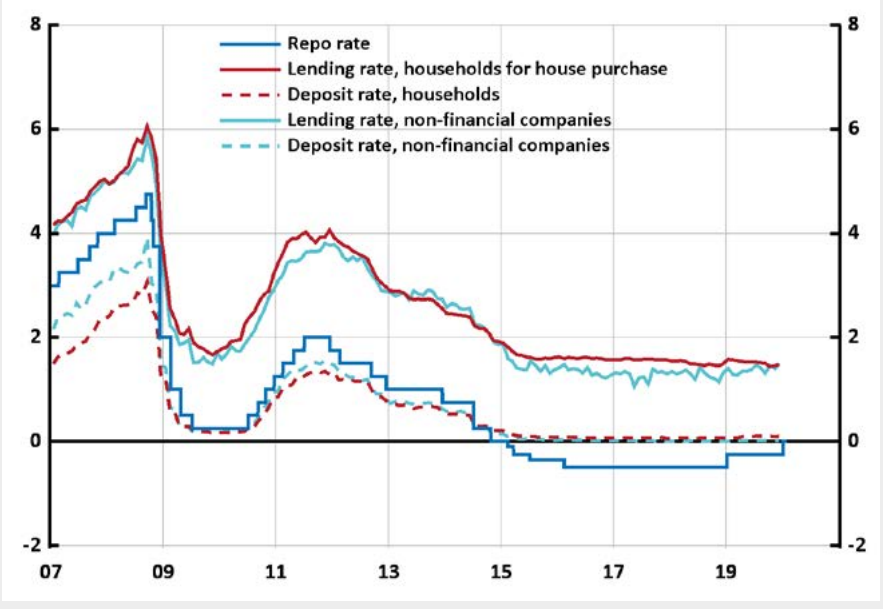
household deposits above a certain threshold (due also to legal impediments in many jurisdictions or reputational concerns). Yet, in some countries the implementation of negative rates has been successful in stimulating inflation without adversely impacting bank profitability and business. Sweden is a case in point.

Box 3 Successful negative interest rates: The case of Sweden

The Riksbank, the world's oldest central bank, brought its main overnight repurchase (Repo) rate into negative territory in 2015. The measure was relaxed only in 2019, when the repo rate was gradually brought back to zero.

Implementing negative rates was deemed necessary to fight a period of deflation, not weak growth like in other jurisdictions. Inflation fell below zero in 2014 and it only returned to the central bank's inflation target of 2% three years later, when the repo rate reached -0.5%. Then, after closely monitoring the economic activity and inflation expectations, the Riksbank started reverting the policy while reiterating its willingness to use it again together with other expansionary monetary policy measures.[68]

Figure 14 Benchmark rates in Sweden

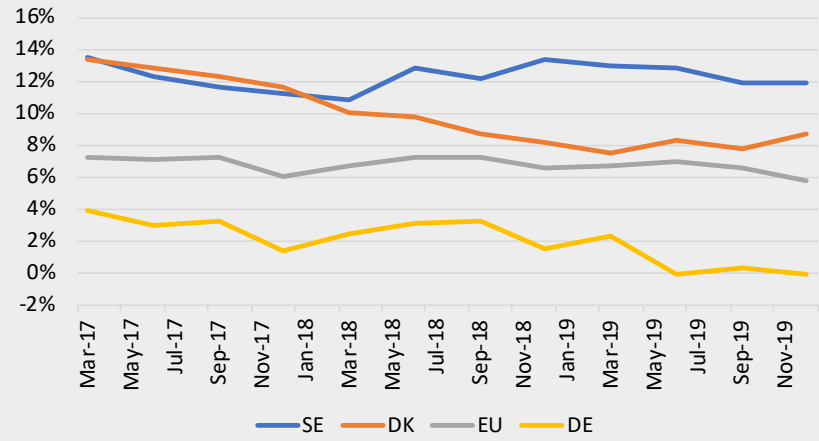


Sources: Statistics Sweden and the Riksbank, 2019

The implementation of negative repo rates was considered by the Riksbank to be successful: it contributed to boosting economic activity and keeping inflation close to target without negatively affecting banks, which continued to enjoy high and stable profits and sustained their lending policies, as reflected in high ROE levels.

68 Riksbank (2019).

Figure 15 Return on equity (ROE) for banks across different jurisdictions



Source: Own Calculations using EBA data.

How could Swedish banks maintain the high levels of profitability and ROE despite the negative rates? Many factors may have contributed to this. First, the problem in Sweden was deflation, not economic growth; GDP growth remained positive and rather high from 2013 onwards. Second, Sweden was only moderately affected by the financial crisis and the sovereign crisis in the euro area. Third, Swedish banks could operate at low cost-to-income ratios relative to their European peers. Thus, they could maintain low funding costs, high profitability and high ROE levels, despite experiencing a reduction in their net interest margin because of the negative rates.[69]

The Covid-19 outbreak is likely to affect the persistence of the LIRE and its consequences. The new crisis will further worsen the macroeconomic environment through a new period of reduced consumption, investment and output. The prospect of low (if not negative) growth and higher indebtedness will translate into even lower rates, both nominal and real, and a thus an even longer LIRE period. A few central banks have already decreased nominal rates following the Covid-19 outbreak (for example, in China, the UK and the US) and many others are likely to follow in an attempt to stimulate the economy. While low rates will keep reducing banks' net interest margins, they may help contain firms' default risk and preserve collateral values, thus mitigating a new increase in NPLs.

2.4.2 Regulation

The global financial crisis of 2007 represented an enormous challenge for the functioning and resilience of the banking industry. As a result, financial authorities around the world adopted various measures to prevent further bankruptcies and propagation of systemic risk in the financial sector, while at the same time supporting financial institutions to preserve their functions and credit support

69 *Financial Times* (2020a).

to the real economy. A big part of these efforts included the restructuring of the regulatory framework, as the pre-2007 crisis requirements were clearly flawed and bank capital levels were too low. This situation contributed to incentivising banks to take excessive risk in the run up to the crisis, with all the consequences in terms of lax lending standards, asset bubble creation and surging systemic risk.

The regulatory reforms following the global financial crisis concerned many aspects: stricter capital regulation with the introduction of macro-related buffers, as well as ad hoc buffers for systemic institutions and limits to leverage. In addition, the reforms included new liquidity regulations in the form of the liquidity coverage ratio and the net stable funding ratio, a new crisis management framework with orderly bank resolution and proper funding structures, changes to compensation structures and a proliferation of new macroprudential policies. The reforms were accompanied by important changes to the financial architecture through the creation of new institutions overlooking systemic risk (such as the European Systemic Risk Board), more intensive supervisory oversight for global systemically important financial institutions (G-SIFIs) and a series of regional initiatives to better coordinate supervision and resolution (including Banking Union in Europe and the reform of the functioning of the Federal Bank Regulatory Agencies in the US).[70] In addition, a plethora of guidelines, secondary regulation and other implementation documentation were produced.

There is little doubt that these reforms have been effective in making the banking system more stable over the years. Banks in all jurisdictions have increased their capital levels significantly since the financial crisis, as shown in the left panel of Figure 16. Banks with higher capital levels are associated with lower systemic risk – both in terms of lower tail risk and weaker systemic linkage.[71] The result is based on the idea that well-capitalised banks find it more costly to take on risk, in addition to the buffer effect of greater capital.[72] Notwithstanding these results, the evidence also shows that banks try to circumvent regulation and keep their pre-policy risk exposure constant.[73]

Notwithstanding the positive effect of all the reforms adopted in the last decades in terms of financial stability, there is a growing debate on their potential costs for the banking industry and subsequent effects for bank strategies and business model components. An important question concerns the extent to which the system is better positioned to sustain economic growth. In fact, financial stability is supposed to be a prerequisite for growth, and not the objective in itself.

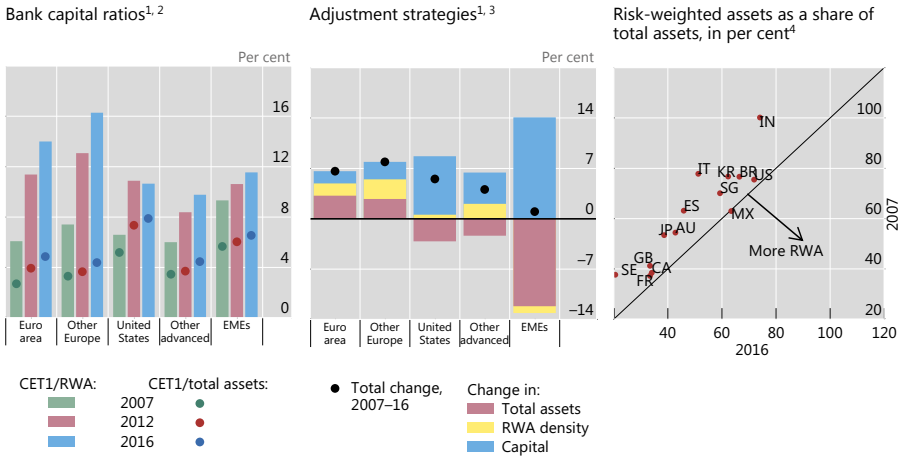
Research suggests that better-capitalised banks are better positioned to undertake profitable business opportunities, have lower funding costs and provide more credit.[74] However, this may not be true in the short run, when banks may comply with stricter capital regulation by adjusting the denominator of the capital ratios – that is, by limiting lending to reduce risk weighted assets.

The middle panel in Figure 16 describes the adjustment strategies that banks adopted in the various jurisdictions in the period 2007 to 2016 to comply with stricter capital regulation. The blue bar represents changes in capital levels (i.e., the numerator of capital ratios), the pink bar represents changes in total assets

70 See, in particular, Tarullo (2009).
71 See, for example, Van Oordt and Zhou (2019).
72 Laeven et al. (2016).
73 For example, Acharya et al. (2019) show that Irish banks reduced risky mortgages after the introduction of loan-to-income regulation but readjusted other assets so that their overall risk exposure did not change.
74 See Boissay et al. (2019a) for an overview.

(i.e., the denominator of capital ratios) and the yellow bar captures changes in risk density. Outside of Europe, the total improvement in capital ratios, represented by the black dots, is mainly explained by increases in capital, the issuance of new equity and/or retained earnings, and asset diminishing. By contrast, European banks, particularly in the euro area, increased their capital ratios mainly by reducing total assets while increasing capital slightly.

Figure 16 Banking capitalisation



Notes: 1) Based on the sample of individual advanced economy and EME banks in Annex 2, subject to data availability. 2) Median ratios. 3) Decomposes the change in the Common Equity Tier 1 (CET1) capital ratio into additive components. The total change in the ratios is indicated by dots. The contribution of a particular component is denoted by the height of the corresponding segment. A negative contribution indicates that the component had a capital ratio-reducing effect. All figures are weighted averages using end-2016 total assets as weights. 4) For country codes, refer to CGFS (2018, Graph 4).

Source: CGFS (2018).

In general, as visible in the right panel of the figure, risk-weighted assets have decreased, although again not in the same proportions across jurisdictions. The results are aligned with the greater difficulties experienced in the European banking system relative to other jurisdictions since the crisis.[75]

The claim that the documented decline in lending, even if only in the short term, is caused by stricter regulation is difficult to prove empirically given the challenges in terms of endogeneity of banks' funding sources and lending policies. In addition, the presumed reduction in bank lending may not be problematic in terms of real effects if borrowers are able to substitute bank lending with alternative funding sources such as non-bank financial institutions and bond markets.

75 A similar potential tension between short- and long-term effects of regulation emerges when looking at a more comprehensive set of regulatory measures. A meta-analysis exercise reveals that capital regulation has the most pronounced effects both in the short and long term, with the short term effect being rather negative: a one percentage point increase in the capital ratio is associated with a lending growth rate equal to -6.9% in the transition and to 0.4% in the long run. Liquidity regulation in the form of a liquidity coverage ratio and stable funding ratio has more contained but positive effects on the long-term lending growth ratio (Boissay et al., 2019a).

A group of recent studies provide direct tests for the effect of regulation on banks' lending activities and the consequent possible real effects on the economy. Some of these studies exploit specific policy experiments to obtain a causal nexus,[76] while others use large loan-level data sets to exploit heterogeneity across banks and borrowers.[77] Results are quite unambiguous: stricter regulation in the form of capital regulation or the application of bail-in instruments induce banks to adjust their activities in an attempt to reduce their risk-weighted assets. It follows that lending to corporate and retail borrowers is most affected. Not all borrowers are able to obtain loans from alternative sources and/or on the same terms. This inability produces real effects, as firms tend to cut asset growth and reduce both investment and employment.

These effects may not be uniform across firms and countries. Small and unlisted firms are the most affected by the reduction in bank lending due to the difficulty they have in obtaining alternative funding. Risky firms with lower levels of capital are similarly affected. Among countries, bank-dependent countries such as those in Europe are more affected due to less developed bond markets and, in general, less innovative financial systems. Also, the severity of regulation may be heterogeneous in terms of geographical scope or the type of institutions to which it applies. This leaves scope for some credit reallocation within the banking sector or migration of some bank activities to non-bank institutions.

Recent evidence documents that as banks get squeezed out of certain loan areas by higher capital standards, others fill in. This happens, for example, in the US where banks not subject to stress tests fill the space in commercial and industrial lending left by those banks that need to satisfy higher capital buffers to pass the stress tests. Thanks to this substitution, firms' overall debt volumes, investment spending and employment remain constant.[78] These results suggest that stricter regulation implies credit reallocation but does not necessarily have adverse real effects.

Stricter regulation also seems to have led to a growing credit reallocation to non-banks. For example, evidence shows that starting as early as 2000, less-capitalised banks have reduced loan retention in the US syndicated loan market, particularly of higher capital requirement loans, mostly in favour of CLO and mutual funds, as seen in Figure 17.

A similar pattern has been documented for the mortgage market in the US, where FinTech mortgage lenders have gained most market share in geographical areas where regulation has been tightened the most.[79]

Thus, overall, the stricter regulation introduced after the financial crisis seems to have contributed to the build-up of a more resilient banking sector, while at the same time changing the relative convenience of banks' activities and thus contributing to a reshuffling of part of their business within and outside of the sector. This does not necessarily mean that the financial industry as a whole provides less support to the real economy, and thus to long-term growth, but rather that there may be a change in the relative importance of the various components of the financial system.

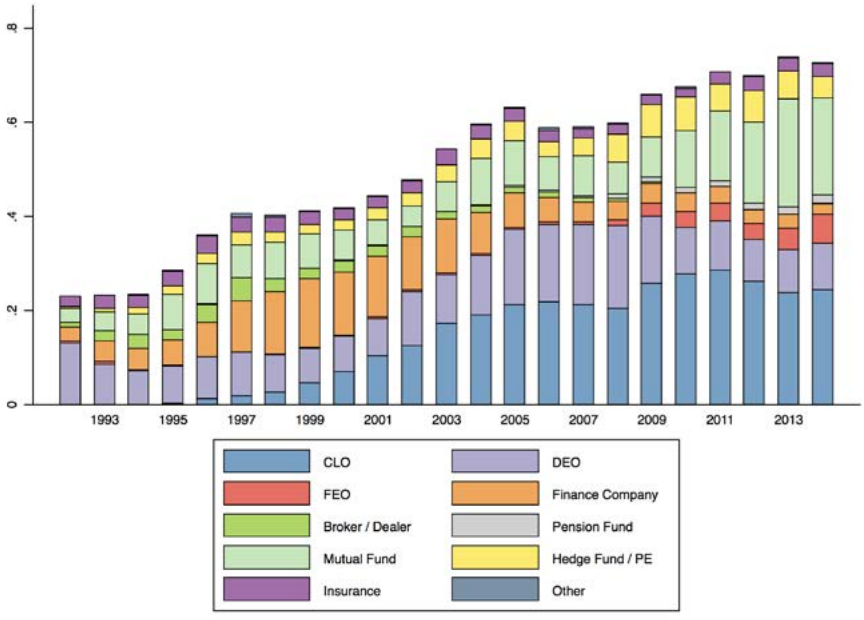
76 See, for example, Gropp et al. (2019) for an analysis of the impact of capital regulation and Beck et al. (2020) for an analysis of the real effects deriving from the application of resolution tools such as bail-in.

77 Fraisse et al. (2019).

78 Berrospide and Edge (2019); similar evidence is obtained by Cortés et al. (2018).

79 Buchak et al. (2018a).

Figure 17 Non-bank share of US syndicated term loans by entity type



Notes: Composition of funding by lender type. DEO and FEO stand for other domestic and foreign entity, respectively.

Source: Irani et al. (2018).

The Covid-19 outbreak is likely to change the described dynamics and, in particular, to reverse the trend of stricter requirements on banks. Due to the widespread lockdown and the freeze of economic activities, firms are in need of massive liquidity support. To obtain this, central banks have implemented a number of measures aiming at ensuring liquidity to banks and facilitating credit to the economy. Examples are the modified TLTRO-III and the re-introduced LTRO policies, as well the relaxed criteria for collateral eligibility adopted by the ECB.

At the same time, regulators and supervisors have relaxed a number of regulations in an attempt to avoid a credit crunch and reduce the procyclicality of the measures introduced in the last two decades. In particular, supervisors have provided temporary and operational relief by allowing banks to fully use capital and liquidity buffers, and by introducing more flexibility in the criteria for loan classification as well as the implementation of IFSR 9. In addition, the 2020 stress tests have been postponed in various jurisdictions, as well as the implementation of Basel IV.

2.4.3 Digitalisation

As we will explain in greater detail in Chapter 3, another important challenge in the last decade for banks' core functions is the advent of new technologies, innovative products and players. The extent to which such innovations will either increase or decrease the need for banks is unclear at this stage, and again may differ significantly across functions, banking sectors and bank models.

The demand for innovative products in a fast-changing environment, and particularly the digital revolution in the past 20 years, has incentivised non-banking institutions to provide services traditionally provided by banks. These firms are leveraging their comparative advantages in technological advancements, capital availability and lower regulatory compliance costs to seize banking functions.

These newcomers promise a customer-centric model in terms of increased efficiency and services. They rely on big data, artificial intelligence, machine learning and blockchain technologies to provide conventional and new financial services while overcoming the information asymmetries that traditional banks face.[80]

In order to understand the impact of digitalisation on credit provision and the traditional banking business, it is important to analyse to what extent non-financial companies, particularly BigTechs and FinTechs, have been able to perform the core banking functions. Given the nature of the tasks and capabilities needed to perform each of them, variation in the levels of substitution, involvement with incumbents and regulatory reception has been observed.

One of banks' traditional functions is the processing of borrower information. Even though non-banking institutions have a comparative advantage in big data and analytics, the long-term relationships that banks have created with clients have helped them not only to create a reputation and trust, but also to monitor borrowers and reduce moral hazard.[81] The question is to what extent the massive use of data and advanced technology substitute for the soft information and relationship advantage that banks traditionally have with their borrowers. This is particularly important in times of crisis, when banks are traditionally called on to play an important role in the intermediation channel.

Payment services are the business activity that has seen the largest entry of non-banking institutions, proceeding rapidly towards a disintermediated market. These companies are appropriating a growing share of the profits generated from payment services thanks to the use of products such as digital wallets or pre-funded e-money by relying on mobile devices and connectivity. In addition, they have all the customer transactional data that allow them to sell non-bank products. This fast-paced, highly competitive and innovative environment has seen participation from BigTech companies and a welcoming regulatory approach from authorities.[82]

Newcomers have been able to reduce and manage credit risk using non-conventional data sets along with advanced analytics. The use of toolsets such as machine learning-based methods to support credit underwriting decisions has shown potential.[83] Preliminary analyses show that even without the 'soft

80 Vives (2019).
81 Jakšič and Marinč (2019).
82 EBA (2019).
83 US Treasury (2018)

information' that traditional banks use for credit screening, models designed by BigTech with e-commerce information and social media data outperform credit bureau ratings in terms of predicting SME default.[84] These new approaches may allow lenders to expand the pool of borrowers, especially in opaque markets with scare information on creditworthiness. However, in managing other risks such as strategic risk, operational risk, cyber risk or compliance risk, incumbents have a comparative advantage given their experience in dealing with regulation and oversight.[85]

Notwithstanding all the considerations above, the Covid-19 outbreak has led to an impressive acceleration of the digitalisation process in the banking industry. In the span of a few weeks, the industry has begun to operate almost entirely remotely. The number of remote accesses and work functions have increased dramatically. The situation is likely to have longer-term consequences. First, banks will be better able to use and exploit the benefits from more advanced technology relative to before the crisis. Second, as they are back at centre stage of the intermediary chain, they may accumulate an advantage vis a vis FinTechs and, to some extent, BigTechs. Finally, the massive use of technology and remote working will substantially increase operational and cyber risks, thus requiring banks to make appropriate adjustments to their risk management functions and related governance structure.

2.5 Conclusions

Banks have traditionally played a very important role in the economy as intermediaries between borrowers and lenders, thus making them critical to the efficient allocation of resources. In doing this, they have relied on their advantages in terms of information processing, maturity transformation activities, liquidity provision, provision of payment services and risk management.

Over the last decade up to the Covid-19 outbreak, however, banks' traditional functions and business models have been under pressure because of a number of factors that have been challenging their profitability, albeit not uniformly across jurisdictions. In this chapter, we have argued that these factors include low interest rates, regulatory regimes and the advent of digitalisation and technology.

The low interest rate environment puts pressure on bank business models focused on traditional commercial banking activities and maturity transformation, while pushing banks to increase fee incomes and risk taking in an attempt to boost profitability. The negative nominal rates introduced in various jurisdictions in recent years have further stretched net interest margins because of the zero-lower bound on deposit rates, but it remains unclear whether the economy has reached the so-called reversal rate. Various central banks have recently introduced tiering policies aimed at alleviating the negative rates banks pay on their excess reserves. The available evidence suggests, however, that such policies are not sufficient to compensate for the decline in net interest margins.

84 Frost et al. (2019).
85 BIS (2018a).

Two main messages follow. First, the experience of countries such as Sweden suggests that negative rates are not necessarily detrimental to bank profitability if implemented in a context of sustained economic growth and an efficient banking sector. Second, to the extent that bank profitability needs to be sustained in a context of low/negative interest rates, central banks need to design a tiering policy that sufficiently alleviates the effects of their monetary policy decisions and takes into account the heterogeneity of the banking sectors.

The Covid-19 crisis implies that low interest rates are here to stay for even longer than previously expected. This will put further pressure on banks' profitability, while simultaneously mitigating NPLs and boosting collateral values, thus helping preserve bank capital and solvency.

The massive regulatory apparatus set in place after the global financial crisis has certainly contributed to enhancing the resilience of the banking sector. Bank capital has increased in all jurisdictions and liquidity regulation has contributed to making banks more prepared for liquidity shortfalls. However, many have argued that regulation has put pressure on bank profitability and business models, in particular with regards to the financing of assets and borrowers carrying high risk weights, the convenience of maturity transformation and the level of the overall costs (funding costs, compliance costs, operational costs, etc.). Although it is difficult to establish a causal nexus, in some jurisdictions banks tend to comply with regulation by reducing lending activities, at least in the short run.

Also, regulation seems to prompt some reshuffling of activities within the banking sector from banks that are more affected by regulation to those that are less affected, as well as some migration of bank activities in favour of players outside the banking sector. It remains unclear at this stage what effects these trends may have for the real economy and for the overall riskiness of the financial industry. Regulators need to carefully monitor the rise of non-bank intermediaries and guarantee a level playing field, as well as an adequate level of risk control. This may call for an enlargement of the regulatory perimeter to all institutions that carry out bank-alike functions.

The Covid-19 pandemic has led to some relaxation of regulation concerning capital and liquidity requirements so to free resources for lending. Banks are back at centre stage of the intermediation channel and may thus benefit relative to non-bank lenders. Yet, depending on the unfolding of the crisis and the design of public policies, banks may experience a substantial increase in credit risk in the medium term and a consequent drain of capital. Their future solvency very much depends on the extent to which fiscal policies are used now and on future growth prospects.

The advent of digitalisation and technology represents an opportunity as well as a threat to bank functions, and much will depend on the ability of banks to exploit these transformations and form cooperation agreements with FinTechs and BigTechs (or mergers with the former). After a decade when many banks were not able to grasp the opportunities deriving from digitalisation and technology due to lack of ability to invest in innovation, banks are now confronted with a massive increase in the use of digitalisation and remote working as a result of the Covid-19 outbreak. This may facilitate the role of banks and shield them from their competitors. At the same time, however, the massive and sudden increase of digitalisation channels may entail a significant increase in operational risk, including cyber risk.

3 The digital economy and banks' business models

This chapter reviews the impact of technology on bank business models and develops areas where policy adjustments may be necessary. Section 3.1 reviews the effects of technology on financial services provision from a conceptual perspective. Section 3.2 reviews the entry of new types of providers (FinTech and BigTech) in specific financial service segments. Section 3.3 discusses the evidence on the impact, including on banks. Section 3.4 reviews the risks and regulatory responses, and Section 3.5 assesses the broader policy implications of the changes in the entities and forms in which financial services may be provided going forward, focusing on competition and data policies. Section 3.6 concludes.

3.1 Technology in finance and banks' business models

As reviewed in Chapter 2, and with significant differences across economies, banks' business models have been under pressure due to many developments, including low interest rates, low economic growth, and regulatory changes following the global financial crisis. In addition to those challenges, a nearly universal challenge facing many banks today is how to obtain the greatest benefits from advances in technology for their own businesses and how to confront the rise of new entrants using advanced technologies that have the potential to disrupt banks' business models. This section reviews current conceptual thinking.

3.1.1 Banking and other financial services

There is, as of yet at least, no consensus on how technology may affect the provision of financial services in general and banks' business models. Nevertheless, there is agreement that some financial services are more likely to be under pressure from technological developments than others. The starting point is therefore to differentiate banking services. As also reviewed in Chapter 2, banks' main functions are typically divided into four categories: (i) maturity transformation, (ii) payment services, (iii) processing information and monitoring borrowers, and (iv) risk management.[86]

These functions can in turn be mapped into specific products, but only very imperfectly and often with significant overlaps. For example, deposit and lending services include some aspects of maturity transformation, but long-term savings products (pensions, life insurance, etc.) also involve maturity transformation. Lending obviously involves, besides maturity transformation, processing information and monitoring borrowers, as well as risk management. As such,

86 See Merton (1995) and Levine (1997) for early forms of this classification; other classifications are possible.

the fact the services that we observe in reality are not the pure functions alone likely means that there are complements among the basic four functions. In other words, there may be a natural bundling of activities where, say, a deposit provides both elements of payments services and some maturity transformation, either because that is a more efficient way to produce the service or because of demand.

Furthermore, financial institutions partly distinguish themselves from each other by the combination of specific financial services they offer. Banks offer both deposit and lending services, with, as argued in many papers, the combination of the two being an efficient one. Conversely, insurance corporations provide maturity transformation and risk management services. What this means is that the provision of a specific service can be affected not just by the technology of producing that service (and its overall demand and supply factors), but also by the economics of producing the other services that institution provides. For example, if low interest rates affect a bank's maturity transformation function, the effects may (also) show up in the pricing of the bank's payments services. Related to this, banks can have distinct business models, including purely commercial banking, investment banking and the universal model (see Chapter 2). This in turn means that the effects of various factors of specific financial services can vary widely by the type of bank. In addition, many financial services are provided not only by banks, but also by other types of institutions (for example, insurance corporations). If this makes for important substitution between banks and these other service providers, then the factors affecting banking services also include some of those affecting the other providers of financial services.

In practice, therefore, conceptual distinctions by function do not map well onto specific products provided by certain types of financial institutions, including banks. Moreover, even when mapping is feasible, data are not always available on each financial product for each type of provider. The more commonly used classifications therefore start with the practical consideration of the availability of data. These classifications are typically created using a combination of type of financial activity and type of costumer, as is done in Table 4.[87] The specific classification used in the table combines types of financial activity with types of costumer (e.g., retail versus corporate) or markets (e.g., asset management, capital markets). The table also provides the gross revenue under each activity for banks worldwide, using estimates from McKinsey (2018b).

These and other data indicate that globally, retail banking is the most important component of banks' gross revenues, closely followed by institutional and corporate products. Revenues from payments systems and asset management are next in importance, followed at some distance by revenues from investment banking and capital markets activities. Note that these are gross revenues, i.e., there is no consideration of the associated operational costs (in terms of staff and other costs) or financial costs (related to the capital required for that activity, for example). In addition, since these are aggregate numbers, they obviously hide large differences among banks, related in part to variations in the business models they pursue and the economies in which they operate. As noted in Chapter 2 and above, commercial banks in the euro area, for example, are more engaged in

87 See Table 3 in Petralia et al. (2019) for a more extensive mapping.

traditional banking services and thus more dependent on net interest margins as a source of gross income. This helps to explain why, given they operate in a low interest rate and low growth environment, they are among the most challenged, at least in view of the market.[88]

Table 4 The importance of specific financial services for banks' earnings (2017 data, main areas only)

Activity	Affected	Risks
Retail banking: credit, deposit, insurance (life and P&C), brokerage	√√	$1745 billion
Institutional, corporate: credit, deposit, insurance (life and P&C)	√	$1525 billion
Payments (retail and wholesale)	√√√	$715 billion
Asset management, wealth management	√	$670 billion
Investment banking (underwriting; M&A, advice, etc.)	√	$215 billion
Capital markets, foreign exchange (trading FICC (fixed income, currency, commodities); clearing, settling, custody, etc.)	√	$140 billion

Source: McKinsey (2018b).

3.1.2 The effects of technology and digitalisation

The effects of technology in general, and digitalisation in particular, on financial services provision will manifest themselves in a number of ways. The discussion so far, as well as the conceptual analysis in Chapter 2, suggest that the impact of technology is likely to differ across the financial functions traditionally provided by banks (maturity transformation, processing information asymmetries and monitoring borrowers, risk management, and payments system provision). As such, one can expect the effects to vary by each financial service that represents a specific (combination of) financial function(s) (e.g., payments, deposit, credit, insurance, capital markets). It will be hard to generalise, however, and the current Covid-19-related economic and financial crisis is likely to change many past patterns.

Technology can, for example, allow for new delivery mechanisms and reduce transaction costs, which may affect payments services more. However, technology can also help reduce the cost associated with collecting and processing information, which may affect lending more. Furthermore, since banks and other types of financial institutions often provide and produce financial services as bundles, the effects of technology can manifest themselves in unexpected ways. For example, a reduction in transaction costs for payments services may show up in the pricing of deposit services. In addition, the overall economic and financial environment in which banks operate may have effects on their provision of financial services which can vary across services. Low interest rates that reduce the net interest margin may, for example, prompt banks to raise their fees for payments services. These spillover effects are likely to be all the more important

88 For further analysis on the shifts in and the cross-section of market valuation of banks and banking activities, see Calomiris and Nissim (2014) and Egan et al. (2018) for US banks; and Bogdanova et al. (2018) for an international cross-section of banks.

in the context of the Covid-19 crisis, which is likely to have large adverse effects on banking systems around the world (see Chapter 2). At the same time, the competition from other types of incumbent financial intermediaries and new providers unleashed by technological advances will also play an important role.

This all means that the possible channels and the effects through which technological advances manifest themselves are likely to vary in many ways and may be hard to predict and identify. Nevertheless, the effects can conceptually be classified into several, partly overlapping dimensions, with differences likely by both the type of service and the bank business model.

One dimension is that technology can allow existing financial service providers to alter their production function – for example, by 'moving out the frontier' – and thereby lower their (unit) costs to provide a specific service. Obvious examples are the, by now standard, online provision of many financial services and the greater use of automated credit scoring combined with better and more information. Additionally, technology can allow banks to more easily add new services and products. By lowering production costs and extending supply in these ways, technology can lower the cost of, and increase the access to, financial services (i.e., it can lead to more financial inclusion). These are standard channels and the developments have been underway for many years, but at an accelerating pace lately.

The most discussed dimension currently is the easier entry for new providers that greater availability and lower costs of technology allow. The revolution underway in payments services, for example, is largely due to a number of technology-driven new entrants (see Chapter 4). This entry of new types of providers forces price and quantity adjustments and restructuring among the incumbents, possibly in part by forcing exits. Besides greater entry, the overall industrial organisation of the market is likely to alter due to technology-induced changes in the economies of scale and scope of financial services provision. The greater use of technology comes with large upfront entry costs (to overcome the two-sided market problems, for example) and large fixed costs to maintain a competitive advantage. At the same time, of course, some financial services come with large network externalities, which can lead to rapid changes in market structure.[89] These changes affect both new entrants and incumbents (or at least the larger players among the incumbents).

Through these various channels, the effects of technological advances can show up in several forms. First, prices of financial services can adjust. This will mostly take the form of downward pressure on margins, fees, and so on. This has been the main channel to date, as seen in capital markets where technology has been having an impact for some time (for example, with the emergence of no-fee brokerage services in some jurisdictions). Nevertheless, as analysed further below, technology, especially when combined with greater use of data, also provides greater scope for cream skimming and discrimination of users. This may mean that some consumers end up paying relatively more for some services, (i.e., their surplus diminishes).

In terms of quantity, as prices are likely to fall and convenience to increase, one may expect an overall greater use of financial services. At the same time, there may be less use as the supply of or the demand for (some) services declines. Greater use of technology and big data can allow for more efficient tailoring

89 See also BIS (2019a), Stulz (2019) and Vives (2019).

of services to the circumstances of an individual consumer, reducing the need for services. For example, pension or insurance services could be provided to people through one service depending on their specific circumstances, rather than through a bundle of services as is currently the case. Another example is that one may see tailored derivatives contracts for firms rather than a bundle of contracts. For example, there may be more efficient ('smart') contracts in capital markets perhaps using distributed ledger technology (DLT), which may mean less need for some (auxiliary) financial services and supervisory involvement.[90]

Regardless, greater use of technology will lead to changes in the competitive landscape that can profoundly alter the distribution of revenues and profits between incumbents and new entrants, reflecting shifts in prices and quantities as, for example, business migrates away from incumbents towards new financial service providers. To compete and survive, banks will have to adapt their business models while capitalising on their comparative advantages.

3.2 Technology-driven changes in provision

The previous section has made clear that the technology-induced shifts in prices and quantities, and related revenues, costs and net profits, due to both the efficiency gains and developments in market structure are difficult to document. The existing evidence is often anecdotal and country-specific, with cross-country evidence largely missing. Often, case studies are the best available. Moreover, developments are hard to foresee. Technological advances are rapid; witness the 2019 introduction of global stablecoins, which threatened to dramatically change financial services provision and raised many new issues (see Chapter 4).[91] In addition, the current Covid-19 crisis is both accelerating the process of technological change and also leading to many changes in financial services provision around the world, some of which may lead to structural changes.

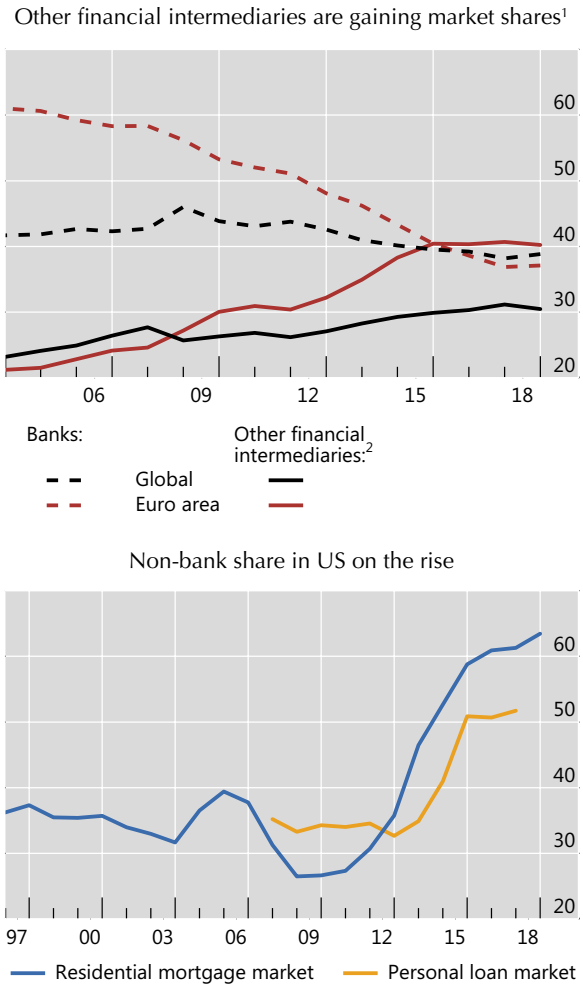
With these as important caveats, this section presents an overview of technology-related developments in financial services provision using the available data. It first provides information on the presence of FinTech and BigTech in financial services around the world. It also summarises the current knowledge on the drivers of this presence.

3.2.1 Overall importance in financial intermediation

The importance of commercial banks for financial intermediation has generally declined over the past decade. This shift has occurred in many economies around the world (Figure 18, top panel), with trends in some economies quite sharp. In the euro area, for example, the share of banks has declined by some 20 percentage points, and in 2018 non-banks overtook banks in terms of share in overall financial intermediation. The shifts relate in part to the factors analysed in Chapter 2, but they have also been facilitated by technological advances and new entry. In the United States, non-banks originated more than two thirds of residential mortgages at end-2018 and one half of personal loans at end-2017, both up from one third or less a decade earlier (Figure 18, bottom panel).

90 See Auer (2019a).
91 Group of Seven (2019).

Figure 18 Non-banks pose structural challenge for banks (%)



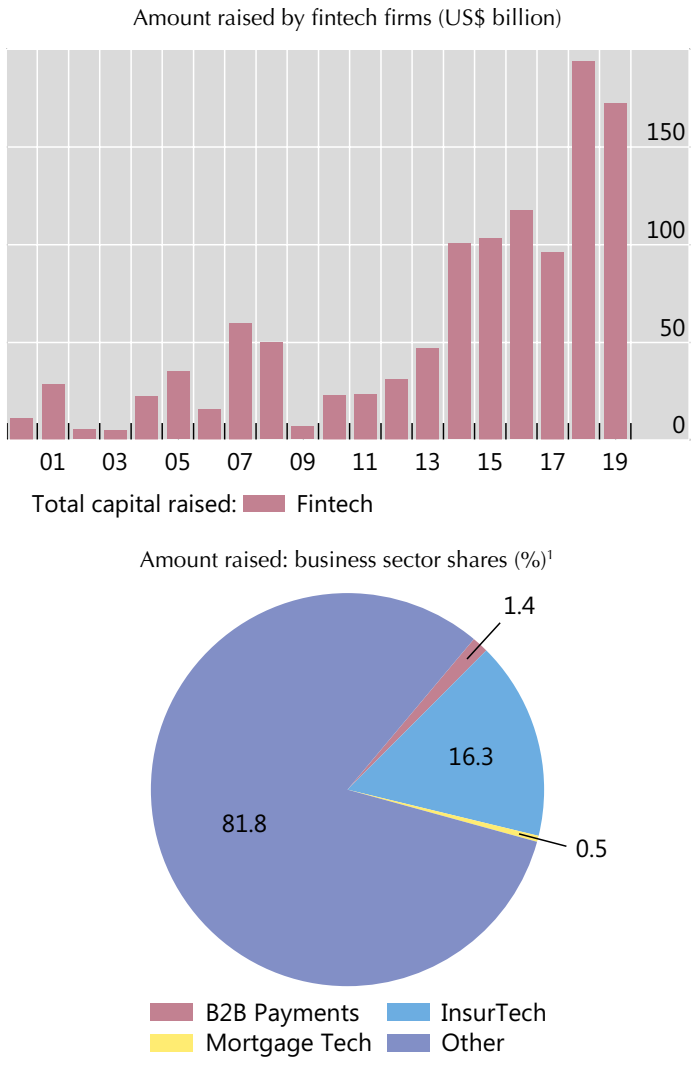
Notes: 1) Shares of total financial corporations' assets (excluding assets of central banks). 2) Non-bank financial intermediaries, excluding insurance companies, pension funds, public financial institutions and financial auxiliaries.

Sources: FSB (2019); Seru (2019); Refinitiv Eikon; S&P Capital IQ; author calculations.

The decline in the importance of banks has been due in part the rapid entry of new firms. FinTech firms have been raising significant funds and have already made significant inroads into some financial services. Total funds raised peaked in 2018 at some $230 billion (Figure 19, top panel). This has since declined, possibly a sign of saturation of the market for new entry. It is not easy to break down new entry by this measure, as there are large overlaps in the classifications

used (Figure 19, bottom panel). In general, however, it is thought that the highest level of entry has been seen in payments followed by credit, with some entry in asset management and capital markets-related activities, limited entry in insurance, and the lowest level of entry in deposit-taking activities.

Figure 19 Funds raised by FinTech firms



Notes: The figures reflect completed deals. Given the nature of the business there might be double-counting across the categories. Data accessed on 2 March 2020. 1) Data for 2018.

Sources: PitchBook Data Inc; authors' calculations.

BigTech – defined here as large companies whose primary business is technology (e.g., Alibaba, Amazon, Apple, Facebook, Google, and Tencent) – has also entered financial services. These firms have largely done so using their own, internal funds so their financial services activities numbers do not show up in funds raised. They have so far only entered in selected segments, notably payments, and more selectively credit and asset management. Finally, the presence of BigTech firms in financial services is geographically more concentrated than that of FinTech firms.

3.2.2 Importance in specific services

We next review the two main types of financial services – payments and credit – for which information on the entry of new providers and analysis of their effects are available.

Payments

Payments have seen a rapid impact of technological advances, but not a universal one (see also Chapter 4).[92] In a few countries, a rapid increase in the entry of FinTech and BigTech in payments has led to large changes in the market structure (Figure 20, top panel). In these countries, payments services have become much more convenient, less costly and more easily accessible, leading to large gains in terms of financial inclusion. In other countries, the entry of new players in payments has been much more limited. In some countries, for example, cash still dominates in retail transactions. The least progress has been in the market for cross-border payments, where costs are only slowly coming down for small transactions (e.g., for those sending remittances) and the use of convenient and safe forms of digital cross-border payments is still limited. In all countries, we can expect the trend to accelerate given the coronavirus pandemic. Public concerns around viral transmission through cash, for example, have recently risen. While the risks may be relatively low, the concerns could lead to greater use of digital (contactless) payments going forward.[93] Furthermore, as retailers have shuttered physical stores, e-commerce activity has surged.[94]

The diversity in entry has many drivers and finds its counterpart in the degree to which the business model of commercial banks in the payments segment is being affected. The degree of presence of new entrants in payments services appears to relate to both the quality of existing payments services and the scope for network externalities.[95] China is the quintessential example of both factors. By 2017, Alipay (launched in 2004) and WeChat Pay (launched in 2011) had acquired 500 million and 900 million monthly active users, respectively, and together accounted for 94% of the $16 trillion mobile payments market. This rapid growth reflects in part the poor existing services from (state-owned) banks and the presence of large network externalities (related in part to the customer bases these entities already had from their e-commerce and messaging platforms). In India, a more top-down strategy for enhancing access to bank accounts and payments, based on the understanding that the latter is the point of entry for

92 See CPMI and World Bank (2020) for evidence, including a collection of case studies.
93 Auer et al. (2020).
94 This is also having an effect on revenues. McKinsey (2020b) notes that some transaction banks and mobile money providers in Africa are temporarily waiving fees on retail transactions.
95 See also Frost (2020) and Feyen et al. (2020) for developments in payments system in emerging markets and developing countries.

many consumers into the financial system, has been paying off rapidly, with large gains in financial inclusion. India's approach rests on the principle of providing digital financial infrastructure as a public good, which makes it an interesting case study.[96]

In East Africa and some other developing countries growth has been more organic, but also quite rapid. M-Pesa, first launched by the Kenyan mobile network operator Safaricom in March 2007, quickly captured a significant market share of cash transfers in Kenya. It has expanded to other countries, and in 2017 Safaricom had 32 million active monthly users in East Africa, Egypt and India, processing 6.5 billion transactions. In Latin America, Mercado Pago has 12 million active monthly users. In Indonesia, Go-Jek's Go-Pay (established in 2016) processes half of Go-Jek's 100 million monthly transactions. Grab's GrabPay is rapidly expanding its network of merchants in Malaysia, Singapore and the Philippines.

In contrast, payments services in many advanced economies are still largely provided in traditional ways by commercial banks and credit card companies (Figure 20, bottom panel).[97] In the United States, Apple Pay has 22 million users who have made an in-store payment in the last six months, Google Pay 11.1 million and Samsung Pay 9.8 million, according to eMarketer estimates.[98] While substantial and on a growing trend, these numbers represent relatively much smaller market shares in payments services than those in some of the emerging markets noted above. This suggests that both the quality of existing services and as well as stickiness in consumer habits are important determinants, at least in the short run. In other advanced economies, the relative presence of new types of providers is even lower, in part as digital payments are more limited in the first place (cash is still the dominant form of payment in many European countries, for example).[99] The influence of other factors such as the more ample (local) supply of equity and other funding for new entrants, or better legal and regulatory environments for starting new ventures, appears more limited.

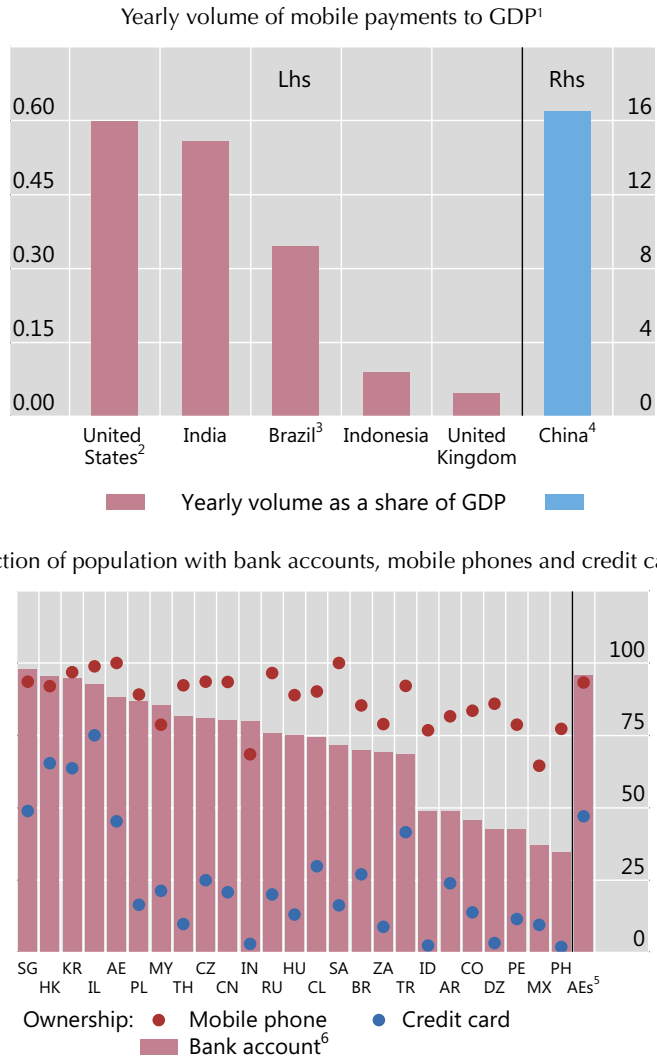
96 Building on the Aadhaar programme, the world's first initiative to provide biometric identity launched in 2009, new biometric-based account and payments services have also been developed. Almost 380 million 'no-frills' bank accounts for individuals had been opened by December 2019. Payments have followed and expanded quite rapidly. The monthly volume of digital retail transactions has risen seven-fold since the beginning of 2018; in November 2019, there were more than a billion transactions, totaling around $27 billion in value. For the six months through September 2019, payments via the new system accounted for 25% of the volume of all digital retail payments, compared with much smaller numbers for other forms of payment; see also D'Silva et al. (2019).

97 See CPMI (2019) for data on payments modalities used in various jurisdictions.

98 The largest mobile payments company in the US was actually Starbucks, with 23.4 million users, but because its primary business is coffee, not technology, it is typically not considered a BigTech company.

99 Bech and Boar (2019).

Figure 20 Mobile payments and bank accounts (%)



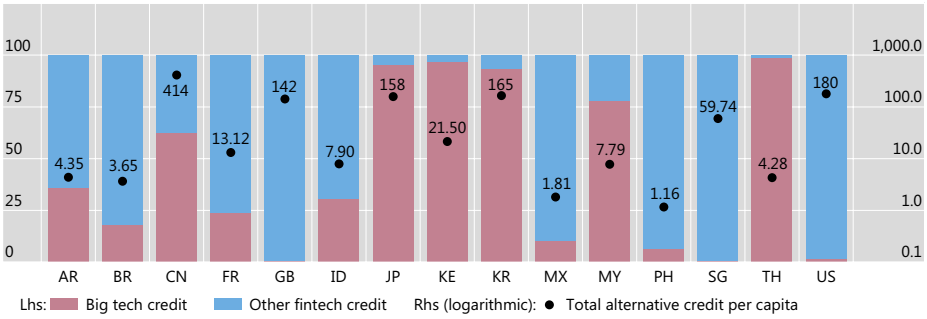
Notes: 1) 2018 data. 2) Mobile POS payments data. 3) Only mobile payments for consumption. 4) 2017 data. 5) Advanced economy (AE) average. 6) Respondents who report having an account at a bank or another type of financial institution or report personally using a mobile money service in the past 12 months.

Sources: Frost et al. (2019); World Bank; Asian Banker; GlobalData; iResearch; Statista; Nikkei; Worldpay; BIS; Cambridge Centre for Alternative Finance and Research Partners; national data; BIS calculations.

Credit

While FinTech credit has grown rapidly around the world in recent years, its size still varies greatly across economies.[100] The presence of new entrants in credit using new technologies is still small in most markets (Figure 21). There are some exceptions, however, notably the United States and China.[101] In these countries, FinTech credit has become a significant source of funding, at least for some classes of firms. Work analysing the drivers of the size of FinTech across countries has found that differences reflect general economic development and financial market structure: the higher a country's income and the less competitive its banking system, the larger the FinTech credit activity. However, analysis also shows that the presence FinTech credit activity appears to relate to a country's regulatory environment. Specifically, FinTech credit volumes are greater in countries with less stringent banking regulation.

Figure 21 Big tech and other FinTech credit in selected jurisdictions



Notes: The bars show the share of big tech and other fintech credit in selected jurisdictions in 2018, while the dots show total fintech credit per capita.

Source: Frost et al. (2019); Cornelli et al. (2020).

Of course, there are exceptions to the importance of these drivers. In the United States, for example, FinTechs are very active in mortgage origination as they are able to easily sell so-called conforming loans to government-sponsored enterprises (GSEs).[102] While the specific institutional environment has thus allowed for the rapid emergence of FinTechs, they employ a unique business model more akin to a broker than an intermediary.[103] Examples of this are Quicken Loans and LoanDepot, which can offer quick loan approvals and greater consumer convenience. Other factors may also be driving the specific growth in the United States. For example, one analysis estimates that the greater regulatory

100 Claessens et al. (2018b) document the development in FinTech credit and analyse its drivers.

101 This excludes peer-to-peer (P2P) lending platforms, as least when they initially started. For one, their (original) business model is quite different from how banks fund and lend; most often, P2P took the form of an agent or broker model, without the platform taking on any credit (or liquidity) risks. Many P2Ps have also disappeared, in part because a significant share of platforms had very high default rates. In China, the P2P industry saw many 'problem platforms' that promised unrealistic returns and/or 'rigid redemptions', and instances of fraud were commonplace. Together with tighter regulation and measures designed to encourage the exit of non-qualified P2P platforms, this led to a significant decline in entrants and exits in recent years. In various jurisdictions, many of the platforms that survived have started to rely more on banks and institutional investors for their funding, including by securitising their claims. As such, some of these P2Ps can at this point be considered FinTechs.

102 GSEs include the Federal National Mortgage Association (Fannie Mae), the Government National Mortgage Association (Ginnie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac).

103 See also Seru (2019).

burden on traditional banks can explain up to 55% of the recent growth of non-banks in the US mortgage market, including FinTech lenders.[104] Evidence of the impact of the regulatory framework is confirmed by some studies of other jurisdictions. Some work has found, for example, that P2P lending in China rose in cities that tightened loan-to-value (LTV) ratios, consistent with borrowers tapping P2P credit to circumvent these regulations.[105]

A review of this nascent literature[106] concludes that the evidence suggests FinTech adoption is higher where (i) there is unmet demand for financial services, (ii) macroeconomic conditions are supportive, (iii) regulation is accommodative, and (iv) demographic forces are favourable (such as a young population or high trust in new providers).

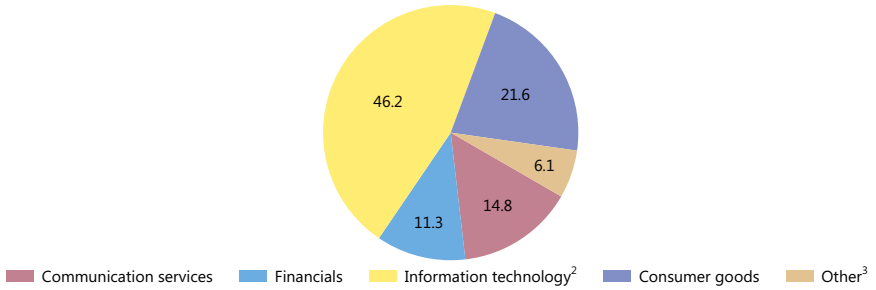
The entry of BigTechs into credit and the related drivers are less researched. Data on credit extended by BigTech are even more limited than for FinTech, but a team of researchers have recently collected data from many sources and constructed a dataset that includes BigTech credit in the FinTech credit measure (as reported in Figure 21).[107] The authors then consider the drivers and implications of the growth of BigTech-provided credit. They find that the factors that appear to explain the development of FinTech credit – such as regulatory stringency and banking sector competition measures – are even more important in jurisdictions in which there is significant BigTech credit activity. They also find support for the hypothesis that BigTech lenders have an information advantage relative to conventional incumbent financial institutions, particularly in credit scoring. However, the authors do caution that some of the additional advantages may arise from bundling and network effects that rely on market power. As such, there may be costs to the consumer. Again, individual case studies, also reviewed later in this study, confirm this.

Summary

To date, the entry of FinTech has mainly been limited to payments and, to some extent, credit. With the exception of a few jurisdictions, BigTech has not entered financial services in a major way, and the financial activities of BigTech firms are still a small part of their overall revenues (Figure 22). Nevertheless, the (attempted) foray of Facebook into payment services through Libra shows that there is ambition on the part of BigTechs to operate in this and associated financial services (see also Chapter 4). Here, as noted, BigTech may have some regulatory advantages, notably with regard to the treatment of data. However, observers also acknowledge that it is an open question how far BigTech will advance into financial services provision in economies around the world, in part as they are reluctant to be drawn into a regulatory net.[108] We will discuss these and other issues in the section on policy.

104 Buchak et al. (2018a).
105 Braggion et al. (2019).
106 Frost (2020).
107 Frost et al. (2019).
108 See, for example, McKinsey (2019a) and Oliver Wyman (2019).

Figure 22 Big techs' revenues by sector of activity[1]



Notes: The sample includes Alibaba, Alphabet, Amazon, Apple, Baidu, Facebook, Grab, Kakao, Mercado Libre, Rakuten, Samsung and Tencent. 1) Shares based on 2018 total revenues, where available, as provided by S&P Capital IQ; where not available, data for 2017. 2) Information technology can include some financial-related business. 3) Includes health care, real estate, utilities and industrials.

Sources: S&P Capital IQ; BIS calculations.

3.3 Evidence on technology-driven changes in financial services

This section reviews the evidence on technology-driven changes on financial services provision, including for banks. It first reviews the state of the knowledge on the impact of technology, focusing on the evidence of the impact on financial services provision, and then discusses what the evidence may imply for the evolution of banks' business models.[109]

3.3.1 Effects of technology on financial services provision

The business models of the new entrants – FinTech and BigTech – in providing various financial services and their effects on other providers, including banks, and on overall market structure have not yet been studied systemically to any great extent. Mostly case studies exist, with some systematic analysis regarding credit services and some for payments service. We review the existing knowledge.

Payments

To assess the impact of technology on (the market for) payment services, it is important to break down the chain involved in the production and the value-added allocations along the chain. Payments, in particular mobile payments, usually flow through a 'front-end' that interacts with consumers and businesses, a number of 'middle' arrangements that, among other things, help transmit messages (e.g., for payment requests and authorisations), and finally 'back-end' arrangements that clear and settle payments (see Chapter 4).[110] To date, the innovative parts of the business models of the new payments providers have largely concerned the front-end.

109 Other reviews include Petralia et al. (2019).

110 See the features in BIS (2020) for more institutional background on the operations of various types of payment systems. See also Bech et al. (2020a).

This kind of innovation focuses on increasing consumer convenience, and often does not change the middle or back-end arrangements. Most (new) smartphone and other mobile apps, for example, use the existing card network to send messages (for example, for initial exchange and confirmation of payments) and use existing back-end systems to settle the payments. This has also meant that the developments to date have largely implied a reallocation of revenue streams (such as a sharing of exchange fees between, say, a FinTech and the credit card network companies and banks), rather than a fundamental disruption of the model for and system of payments.

There are exceptions to this model, however, the most important of which are the payments systems developed by telecommunications and BigTechs. These tend to be 'closed-loop' systems, i.e., they are (largely) independent of existing payments systems and often more vertically integrated. Of course, in these systems there still is some involvement of commercial banks (through the master deposits held at one or more banks, for example). Moreover, the central bank still needs to finally clear and settle across banks. Nevertheless, with these more closed payments systems, these providers not just gain revenue streams, but also valuable payments information.

The impact of these and other technological advances on payments, besides the greater ease of conducting (retail) payments and more financial inclusion,[111] manifests itself in lower costs. There is some evidence of this in the general declined in the cost of payments over the past few decades, albeit at a lower speed in recent years.[112] Further entry by technology-based providers holds the promise of more efficiency gains, lower costs and the associated benefits from greater financial inclusion.

New entry, however, will typically require support by the relevant regulatory and supervisory agencies, importantly including the central bank. These agencies need to consider various issues before they can approve the operation of non-banks in this space; for example, they need to be assured that consumer protection and AML/CFT[113] issues are adequately addressed. If authorities want greater competition, they need to give new providers access to their payments systems on terms that are favourable enough, while preserving a level playing field with existing providers and assuring safety and soundness. To facilitate efficient real-time payments systems, in addition to making operational changes (such as extending opening hours to allow 24/7 access), central banks also may have to extend access to their balance sheets to the new providers. The latter is happening but to different degrees around the world, implying that the speed of actual new entry varies greatly.[114] Altogether, these (necessary) requirements and frictions suggest limits to cost reduction and to greater convenience.

Similar, but even larger constraints exist in terms of facilitating new technology-driven solutions at the cross-border level, especially with regard to retail payments. Cross-border payments are generally slower, more expensive and more opaque than domestic payments. The average cost for a US bank to execute a cross-border payment was more than ten times that for a domestic

111 CPMI and World Bank Group (2020).

112 See BIS (2020) for the costs of domestic payments and World Bank (2019) for the costs of cross-border payments related to remittances. Attribution of the lower costs is not to technology alone, of course.

113 Anti-money laundering/combating the financing of terrorism.

114 The central banks of the UK, Switzerland, Singapore, Hong Kong and China have decided to grant non-banks limited (compared with banks) access to their systems. See Bech and Hancock (2020) for recent developments; see also CPMI (2016) and BIS (2020).

payment, and it can take up to seven days to complete a cross-border payment.[115] Progress has been less than hoped for.[116] While the competition triggered by new entrants has been useful for enhanced convenience, it has only led to some minor improvements in terms of costs (for example, a decline in average costs for remittances from 8% in 2014 to around 6.8% in 2019).

As for domestic payments, most new initiatives rely on existing institutional infrastructures. Many of the new cross-border payments tools, such as TransferWise, Worldremit and XE, are only available if both ends of the payment involve a bank account. These and many other recent developments still largely rely on the traditional correspondent bank-based system.[117] New entrants, such as N26 and Revolut, avoid foreign exchange or 'processing fees' on currency conversions – which can run to between 1.75% and 3% for small amounts on credit and other cards – by holding funds in several currencies for (part of) the day for transactions, and then only exchanging the net amounts at intervals.[118] Nevertheless, many of these models do not fundamentally change the system of cross-border payments.

While many gains are still feasible within existing configurations, significant changes to cross-border payments will only come with greater interoperability, better connections and an associated step up in public sector actions.[119] The technology exists; for example, SWIFT recently demonstrated that it is possible to complete a cross-border payment in 18 seconds.[120] Part of the solution will require payment systems to become more interlinked across borders, for which there are several projects underway. One example of the potential application of central bank digital currency (CBDC) to cross-border payments is shown in the joint research study of the Hong Kong Monetary Authority and the Bank of Thailand (see Chapter 4).[121] But that alone will not suffice, given some of the deeper underlying reasons for why cross-border payments are more complex. Most of these factors are well understood and involve, among others, the additional compliance costs and more complex back-end arrangements in cross-border payments.[122] Various agencies, international groups and organisations are currently exploring models to overcome these constraints.

As new parties enter the value chain at different points, often with significant market power (for example, as consumers seek the additional convenience of linking payments with the e-commerce they carry out on the same platform), the implications for commercial banks are nevertheless overall clear: they are losing an important source of revenue. Possibly the most important implication is that they stand to lose an interface with customers, which is potentially valuable for data acquisition and as a gateway for providing other, more valuable services.

115 Cost figures are from McKinsey (2016); days to process are from CPMI (2018).

116 CPMI (2018) identified many of the problems. For recent developments, see Bech et al. (2020b), CPMI and World Bank Group (2020), World Bank (2019) and BIS (2020).

117 See also Bech and Hancock (2020).

118 These and several other initiatives involve using incoming payments over a period (e.g., intra-day) to fund outgoing payments in order to minimise the need to execute and settle foreign exchange transactions. While this can be an effective way to decrease costs for currencies that are frequently used and where the flows roughly offset, as it minimises the amount of funds held in any one currency, there is still at the end of the period (day) the need to convert; it also works less well for bilateral currency exchanges that are less frequent.

119 See Bech and Hancock (2020) and BIS (2020).

120 SWIFT (2019).

121 Bech and Hancock (2020) provide other examples of linking payments systems across borders. For the Bank of Thailand and HKMOA link using CBDC, see Bank of Thailand and HKMA (2020).

122 CPMI (2018).

Credit

Technology, and especially the associated greater access to (big) data, in principle allows financial service providers to provide credit at a lower cost to larger segments of households and firms (see Box 4). For one, greater use of technology and data can allow for scoring credit and other risks at lower cost and with greater precision. Evidence for the United States shows that the use of unconventional data for credit scoring or even shallow 'digital footprints' can be effective – and as good as credit bureau scores.[123]

Box 4 The importance of data for credit

Data are core to FinTech and BigTech business models, and data matter for credit perhaps more so than for other services. FinTech and BigTech firms involved in credit extension collect, analyse and use a large amount of customer data for many purposes.

1. Data can help *identify* and *screen* the borrowers that 'qualify' for credit. Past purchase patterns, for example, can be a very valuable input for identifying potential clients and better screening. This is especially the case for the large BigTech providers that can use their 'big' data collected from other parts of their platform (e.g., in the marketplaces or social media services they run) to help with marketing and pricing strategies. Combined with advanced data analytics, this can allow for quick loan approval.
2. Data are obviously important for the *monitoring* of the behaviour of borrowers – for example, for observing their (real-time) cash flows, sales, relationships with other agents (clients, suppliers, etc.), rating of services by clients, and so on. Payment transactions can generate much insight on the network of links between fund senders and recipients, which, in addition to enhancing the financial services offered and provided, can then be used for credit scoring and credit risk management. All of this can help in identifying (emerging) credit risks, and thereby mitigate the information and incentive problems traditionally addressed through the posting of collateral.
3. Access to data and to related platforms for data could also be a source of *enforcement*. For example, it can help to establish some costs of defaulting for the borrower by having the borrower enter a negative list (the equivalent to a blacklist in the traditional credit registries). Such 'reputational' costs to a default are especially large in the case of the big platforms. Captive ecosystems can arise given the significant network externalities with data collection (large economies of scale and scope). These systems come with potentially high exit costs, since being excluded from a specific platform adversely affects a firm's overall business prospects, thus allowing for enforcement that is possibly better or cheaper than that obtained through traditional methods.

Source: Boissay et al. (2020).

123 Berg et al. (2019).

The new technology and big data even work for people without the traditional credit bureau scores. A recent study shows that a model based on machine learning (ML) and non-traditional data used by a FinTech company in China is better able to predict losses and defaults than traditional models, notably in the presence of a negative shock to the aggregate credit supply.[124] This suggests that ML can better mine the non-linear relationship between variables in a period of stress. However, the study also finds that the comparative advantage of credit scoring based on ML and big data tends to decline for borrowers with a longer credit history, suggesting that banks may still have a comparative advantage in relationship-based lending, where they exploit the soft information acquired. Furthermore, access to large amounts of data alone is not always enough for at least two reasons: first, data need to be related to specific individuals and business; and second, data often need to be verified, something which is not guaranteed with big data.

BigTech entry into credit is likely to lead to even greater changes. There is, however, little evidence so far, in part because entry to date has been limited and only in a few countries. As highlighted by many observers and several researchers, BigTech firms have unique technology and big data advantages that banks cannot easily replicate.[125] They therefore represent a much stronger challenge to established banks, especially in consumer finance and loans to small firms. In particular, BigTech's lending decisions are based more on artificial intelligence (AI) and ML and the processing of large quantities of information (big data). This model makes credit extension speedier than traditional forms of lending and reduces the need for extensive documentation.

Furthermore, for SMEs and other borrowers with limited data and credit histories, BigTech firms are able to overcome certain limitations by exploiting the considerable information they already have on the (potential) borrowers and their activities through their core business, such as e-commerce. This 'inside' information not only gives BigTech a competitive advantage, it also reduces the need for collateral.[126] This helps expand the set of borrowers and facilitates financial inclusion in markets where financing opportunities are otherwise scarce or often involve a long and frictional process. While analyses confirm these beneficial effects of this new lending model, the model also alters the lending relationship in that it becomes more transaction-oriented, which introduces an important risk (see the next section).

Due in part to restrictions on raising deposits (see below), there can be funding-related limits on the ability of new entrants, including BigTechs, to provide credit. For example, in the absence of a well-developed financial market for transferring funds from commercial banks, insurance corporations, or pension funds, the new entrants will not easily be able to lend. It can be that regulatory limits prevent providers from accessing already mobilised funds. Similarly, if they are restricted in their ability to raise funds directly themselves (for example, if they cannot securitise their credits), they will be at a disadvantage relative to other financial service providers.

124 Gambacorta et al. (2019).

125 See also BIS (2019a), Stulz (2019) and Vives (2017).

126 Data obtained directly from the platform can cover (i) transactions (sales volumes and average selling prices); ii) reputation (claim ratios, handling time and complaints); and iii) industry-specific characteristics (sales seasonality, trend and macroeconomic sensitivity). These data can also be enriched with additional data from social media and other channels. This allows for the extension of some credit without the necessity of collateral or extensive documentation.

The ability to raise funds will typically be country-specific, as there is large variation in the development of alternative funding structures. Overall, however, FinTechs and BigTechs are likely to have less access to, and higher costs of, capital than commercial banks. (The presumption here is that the licensing and supervisory regime is such that only commercial banks can raise deposits; otherwise, regulatory arbitrage arises). Some evidence indeed suggests that, on average, BigTech's weighted average costs of capital (WACC) is some 3.25 percentage points higher than that of the largest global systemically important financial institutions (G-SIFIs).[127] This in turn means that the lending rates of BigTechs would have to be higher, unless their screening and monitoring technology is much more superior. This pattern, if confirmed going forward, would provide some protection for banks against the new competition, at least in terms of credit extension.[128]

Deposits

Technology has affected the deposit-taking functions of commercial banks for some time, but to a lesser degree through new entry. As noted, the main development on the deposit side has for some time been the internet-based (or more generally, mobile-based) collection and use of deposits. (Related of course are the changes in retail payments, such as the digital depositing of checks and more and easier digital (routine) payments). This ability to collect deposits without a physical presence has obviously introduced more competition. It has affected pricing, even though there is still a large stickiness in deposits (i.e., people do not move their funds quickly). Banks have also been shown to maintain some pricing power on deposit rates,[129] and they continue to derive much value from their safe asset (deposit) production.[130]

Despite technology easily allowing it, non-bank entry in demand deposit-like taking activities has not taken off on a meaningful scale. On one hand, this is consistent with the fact that traditional forms of commercial bank entry have numbered less in the deposit markets in the recent decade.[131] One reason is the overall low level of interest rates, including negative interest rates in some jurisdictions, which makes deposits perhaps a less attractive form of funding (in a negative interest rate environment, rates on retail deposits are typically still kept above zero, making them an expensive source of funding). This constraint is likely to be even more binding in the post-Covid environment.

Clearly, there are many factors other than technology at work behind the low entry in deposit taking. The lack of new non-bank entrants is largely related to regulation. Banking is by nature risky, as banks provide safe and liquid claims that are instantly redeemable ('deposits') while investing in assets that are risky and with repayment due over longer periods. To offer deposit accounts at

127 Boissay et al. (2019b).

128 Obviously, this advantage relates in part to the synergies banks obtain from funding loans with deposits.

129 Drechsler et al. (2020).

130 Egan et al. (2018) find that variation in deposit productivity explains the majority of variation in bank value, consistent with theories emphasising safe-asset production. While they also find evidence of value creation from synergies between deposit taking and lending, their findings suggest it is the heterogeneity in banks' abilities to capture value by manufacturing safe assets that mainly drives valuation differences.

131 After the global financial crisis, there have been very few new banks established in the United States (only about 60 up to 2019; see https://www7.fdic.gov/qbp/grgraph.asp) and elsewhere; for the euro area, see ECB (2019b). For the United States, McCord et al. (2015) write: "while it is not easy to explain bank entry, practically no new banks have entered the US market since 2008".

reasonable interest rates, banks have to have the trust of their customers. This trust comes from capital and reputation, but also in part from banks' access to deposit insurance. To avoid risk taking and moral hazard, this access to deposit insurance in turn calls for strict entry rules and processes, various regulations and close supervision. As long as non-banks do not satisfy the same (or similar) regulations and are not supervised in a similar way to banks, they must be excluded from deposit taking, or at least should not be allowed to provide demand deposit accounts (though they can offer substitutes like money market funds). As such, the (regulatory) hurdles are justifiably large and funding costs for non-banks likely higher (deposits typically have lower costs as they include a liquidity premium, given the convenience for users).

There are some exceptions to the lack of entry in deposit taking. Entrants with bank licenses but different business models have provided for some competition. These include new banks in Europe – such as the N-26 bank and Revolut – and some online banks in the United States – such as Ally, Capital One, Chime and Marcus (note that these are not all pure online banks, as some have an albeit limited physical presence). Moreover, a number of virtual banks have started in other parts of the world (eight were recently allowed in Hong Kong SAR and two retail licenses are open for bid in Singapore, for example). However, their market shares are still low.

While non-banks cannot offer deposits, some do offer digital wallets that provide some store-of-value services. Paypal's balance sheet, for example, shows $25 billion of accounts payable (which do not qualify as deposits). In the case of BigTech payment platforms, customers often maintain unused balances in their accounts. Some BigTechs offer consumers short-term investments into money market funds (MMFs) to earn interest or fees on these balances. One example is the Yu'eBao money market fund offered to Alipay, a subsidiary of the Alibaba group. Within five years, it grew into the world's largest fund, with assets of CNY1.9 trillion ($270 billion) and over 600 million customers at its peak in early-2018. These products can provide the group with access to (cheap) financing, some of which can be used for credit. This type of arrangement can vary both across countries and over time. In China, for example, the payment providers of the BigTechs were required in 2018 to deposit their excess float in the central bank, thus eliminating a preferential funding source.[132]

3.3.2 Effects of technology on banks

Staying at the technology frontier obviously matters for incumbents as well. Evidence is limited, but some analysis suggests that in previous decades the returns for commercial banks of investments in technology were considerable.[133] Evidence on how banks are adopting the latest wave of technologies is obviously more scarce. Many would argue, however, that while outsiders are challenging banks, the banks themselves are far from adopting technology effectively.[134]

132 See also BIS (2019a).

133 For example, Pierri and Timmer (2020) find that among US commercial banks a higher intensity of IT adoption led to significantly lower NPLs when the global financial crisis hit: banks with a one standard deviation higher IT adoption experienced 10% lower NPLs. Loan-level analysis also showed that high IT-adoption banks originated mortgages with better performance and did not offload low-quality loans.

134 Stulz (2019) provides a review of the adaption by banks of new technology and the evidence on banks' return on IT investments.

Banks are by nature more product-centric and less consumer-driven – surely more than the new entrants are. This appears to make it harder for them to adopt the consumer-friendly interfaces that rely on technology. Banks often have legacy systems sometimes dating back decades (many reportedly still use the COBOL computer language invented in the 1960s, while 92 of the top 100 world leading banks are reported to rely on IBM mainframes in their operations). The maintenance of these systmes takes up a large part of IT budgets.[135]

Another constraint to benefitting from new technology are data. In part due to the silo focus on specific products (e.g., the provision of deposits, credit, or insurance), data at large banks are typically not organised in such a way that they can be mined using the new techniques. In part due to rigid internal processes, as well as the need to comply with a myriad of regulations, banks tend to be slower at innovation in general. As such, they have severe challenges and a variety of rigidities to overcome.[136] Evidence including case studies and self-reporting by banks appears to confirm this challenge.[137] At the same time, in the current Covid-19 crisis, banks have proven able to switch to remote operations very quickly, and this may have longer-lasting beneficial effects on their productivity of technology use.

One may conclude that while advances in technology are forcing banks to adjust, many commercial banks are unlikely to fundamentally change their business model quickly enough. Of course, there are notable exceptions, with some banks having embraced technology and making it their core comparative advantage. Nevertheless, the challenges facing commercial banks have led some to observe that "a majority of banks globally may not be economically viable."[138]

3.4 Risks and regulatory responses

The technological advances provide many benefits, as discussed, but can also lead to new risks. These benefits and risks can relate to the technologies and new entrants directly or to the effects on incumbent commercial banks. Moreover, they can be both micro (prudential) and systemic or macroprudential. To organise the discussion, Table 5 juxtaposes the benefits with the risks. In this section, we also discuss the possible justified calls for regulatory responses.

3.4.1 Microprudential risks

Technological activities offer many benefits, as reviewed above. New forms of payment offer convenience and can enhance financial inclusion. FinTech and BigTech credit offers an alternative funding source for businesses and consumers, and can improve access to credit for underserved segments. Deposits and other savings instruments can become easily accessible and better priced. Insurance can become more available and better targeted to users' risk characteristics. However, the developments also raise a number of challenges, including for regulators, as new risks arise.

135 See also Protivi (2019).
136 See also Loderer et al. (2016).
137 For example, McKinsey (2018a) reports that "[n]early 50% of financial institutions say that their latest digital investment is failing to generate returns greater than the costs of capital."
138 McKinsey (2019a, p. 16).

Table 5 Issues raised by technology and digitalisation

Benefits	Risks
Micro	*Micro*
Convenience for users	Consumer protection concerns, including due to data privacy, advertising, disclosure
Greater access to financial services	
Lower production and transaction costs	New complexity, operational (cyber) risks
Better risk assessments for some users	Cream-skimming (e.g., insurance)
	Misconduct, failures. Not yet tested over a full cycle (losses already in some markets)
Systemic (if banks or new techs make greater use)	*Systemic* (if banks or new techs make greater use)
Greater diversity of funding and investment	Erosion of incumbents' profitability, franchise value
Greater efficiency of incumbents, more financial stability	
	New too big to fail institutions
	Weaker risks management/more procyclical lending
	Competition paradigm slow to adjust

Sources: BIS (2019).

The starting point for microprudential approaches is a level playing field – the standard principle for conducting regulation and supervision across various service providers and activities. The principle also applies to the new entrants. Are those entities engaged in technology-driven production and delivery of financial services possibly held to different regulatory standards than traditional providers are?[139] An unlevel playing field can arise for many reasons and can tilt in either direction. For example, it may be that the new providers face lower regulatory burdens; or it could be that they are not be allowed to use certain tools, such as deposits, to raise funds themselves or they can only access funds at higher regulatory costs (for example, internet-only banks may have special liquidity requirements). Another example is if mobile network operators active in payment services are not allowed to extend credit or, if they can extend it, the rules under which they can differ from those for commercial banks.

A lack of a level playing field can also arise if some digital products are not yet regulated. For example, digital wallets or other store-of-value services may not be captured in the definition of a 'deposit', making them thus not eligible for deposit insurance. It may be that there is less access for the new providers, compared to traditional providers, to the existing (privately provided) digital infrastructure (such as payment systems) or platforms (such as credit bureaus). In the other direction, banks may be forced to share data with the new providers, as in the case of open banking, while the new providers may have exclusive access to data or platforms that banks do not have access to, as would be the case for

139 One also has to analyse the extent to which rules that apply to various types of traditional financial service providers may be limiting the extension of financial services in an economically inefficient way. It could be, for example, that there are caps on interest rates, which make lending unprofitable. Alternatively, there may be direct lending schemes that distort the environment, or pension products that are functionally equivalent to bank products may be treated more or less favourably. Even if they are not technology-specific, rules can prevent a level playing field in financial services provision.

BigTechs. Some of these and other rules may end up preventing financial services provision from being on an equal basis. Remedies would call for specific issues to be addressed, including adjustments to conditions for deposit insurance, access to the payments systems, access to information, sharing of data, and so on.

Many other regulatory concerns centre on assuring adequate consumer and investor protection with regard to the new financial service providers and products. The main approach relies on the principle that risks should be regulated in the same way across financial services. This is no small agenda and there are many challenges involved in ensuring that the new activities are not over- or under-regulated.[140] The core question here is where to draw the regulatory 'perimeter', i.e., what activities and entities should be regulated in the first place. Much relates to 'definitional' issues: What defines a specific new application or instrument as a financial service? How does it fall (or not) within the existing definitions and related rules? And what, if any, rules need to be adjusted? The recent discussions on how to regulate cryptocurrencies and global stablecoins are two prominent examples regarding how to classify these instruments and where to draw the perimeter.[141] As technological advances occur and experiences accumulate, there will be much 'learning by doing' in the development of the new 'regulatory paradigm', including to ensure a level playing field.

At the microprudential level, there also is a need to address new forms of risk, some of which are already becoming apparent. Important among these are (new) forms of (greater) discrimination. FinTech and, to an even greater extent, BigTech have access to two kinds of data: standard data similar to those used by banks, and additional data from sources such as social media. With this greater access to data, FinTech and BigTech can differentiate more and thus potentially target financial services better. Above it was noted that this can bring benefits in terms of more convenience and greater financial inclusion. However, it also increases the risk of discrimination, and the evidence of this is growing.

Discrimination may arise with the use of algorithms for credit allocation. It has been found that loan automation is less likely to benefit minorities, and research has also found that minorities can be charged more because as a result of big data usage.[142] Other evidence shows how credit card companies use big data to target consumers so as to exploit behavioural biases.[143] Data may be used not only to assess a potential borrower's creditworthiness, but also to identify the highest rate the borrower would be willing to pay for a loan (or the highest premium a client would pay for insurance). There are also some signs that consumers pay more for convenience, which means the benefits go more to the provider.[144]

140 See FSB (2017; 2019b) and Ehrentraud et al. (2020) for an overview of policy responses to FinTech.

141 See Auer and Claessens (2018) and BIS (2018b) for cryptocurrencies and Group of Seven (2019) for global stable coins respectively.

142 Fuster et al. (2019) and Bartlett et al. (2019), respectively.

143 Ru and Schoar (2019).

144 For example, Seru (2019) reports evidence that consumers pay more for the convenience of obtaining online mortgages. This would be consistent with the evidence for e-commerce, as inter alia reflected in the market valuation of the BigTechs.

Of course, whether or not the data and analytical advantages of BigTechs mean an increase in consumer surplus depends a lot on the relative bargaining power of consumers and BigTechs.[145] Nevertheless, such negative effects – if confirmed on a large scale and if they were to become transparent to consumers, so they can act on them, or if regulators intervene – may tilt the balance away from FinTech and BigTech. It may mean some businesses stay with banks, as possibly more trusted and better or more favourably regulated intermediaries.

Regardless of the division of the surplus, new consumer and investor protection issues can arise which relate directly to the greater use of technology. More use of technology raises the risk of new types of failure, notably cyber risk.[146] This risk, a sub-category of operational risk, has become a significant issue for new firms and banks alike, as shown by some high-profile cases such as Capital One. Increasing digitalisation and the lack of (geopolitical) consensus to tackle the issue (or worse still, if it were to be seen by states and sponsored entities as a form of economic 'arms race'), could lead to a structural increase in cyber risk. Whether the new providers, with their more recent technologies, are more or less exposed to cyber risk than traditional banks is unclear. On the one hand, technology is their comparative advantage: they use newer generations of IT, which may be more robust to attack, and are likely to invest a great deal to prevent disruptions. At the same time, pressure to quickly come to market may lead to more risk-taking. Regardless, the reputational and financial costs of cyber incidents are likely higher for the new providers, as they affect their core businesses.

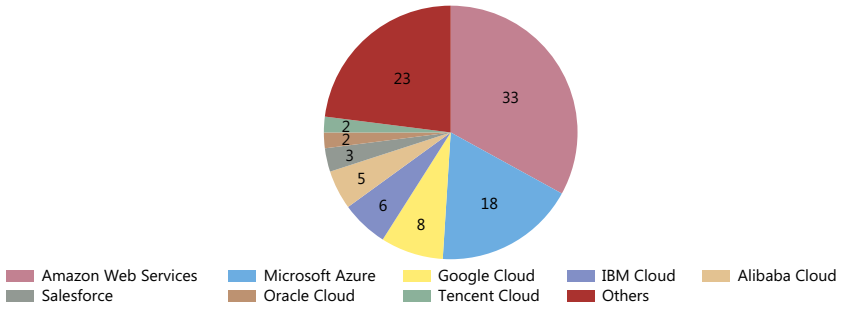
3.4.2 Macroprudential risks

Related to some of these risks are technology-related concerns about financial stability. Some financial stability risks may increase simply as this part of the non-traditional sector grows in size.[147] Financial stability may also be affected if the FinTech credit sector and banks make greater use of similar technological innovations. In addition, some new risks can quickly become systemic. For example, cyberattacks can affect, directly or indirectly, multiple financial institutions at the same time. Additional systemic vulnerabilities are also increased through the use of common infrastructure such as cloud services, the market for which is highly concentrated globally (Figure 23).[148]

The appropriate responses to these new systemic risks are, however, not obvious. The macroprudential toolkit usually relied on for systemic risk – for example, the capital surcharge for G-SIBs or the countercyclical capital buffer to address risk associated with banking system procyclicality – does not easily apply. This is not only because, again, the regulatory perimeter is not (yet) drawn to include many of these new activities, but also because the design of such macroprudential tools and their effective implementation are (as yet) unknown. Furthermore, the Covid-19 crisis has led to some very quick adjustments in banking and other regulations, the impacts of which are hard to assess at this time.

145 See also Bar-Gill (2019) and Boissay et al. (2020).
146 See Aldasoro et al. (2020a, 2020b) for analyses of cyber risk incidence and the costs for financial institutions; see also ESRB (2020).
147 See, for example, CGFS and FSB (2017).
148 See also FSB (2019a).

Figure 23 The market for cloud services is highly concentrated



Notes: The graph reports the share of each firm in the Cloud Infrastructure-as-a-Service (IaaS) market, across all industries, as of Q4 2019.

Source: Synergy Research Group.

3.4.3 The future

The 'predictions' of the conceptual analysis on the impact of technology and the (anecdotal) evidence to date largely square with what those in the business of advising incumbents or new entrants are suggesting. In terms of financial services, the consensus is that payments are more likely affected in the short run, while investment banking is least likely to be affected.[149] While many agree on the profound and wide-ranging implications of technology, they do not necessarily agree on the likely future model of financial services provision. Some see cooperation between incumbents and new entrants, including in the form of merger and acquisitions, as the base case. Others expect the new entrants to become large in selected market segments. Differences here relate to the split between FinTech, where cooperation is deemed more likely, and BigTech, where dominance in some segments is deemed more likely. Others expect the (large) traditional banks to be able to adapt their business models and capitalise on their strengths, even though nobody argues that banks do not need to adjust their business models.

The assessment very much depends on how one considers the comparative advantages of the incumbent (large) commercial banks versus the new entrants. Table 6 provides a synopsis of possible differences, organised along three dimensions: data, network and analytics. For the new technology-based providers, these three elements reinforce each other: network externalities make data more valuable, and multiple activities help with reaping the benefits of economies of scope.[150] For the incumbents, the strengths are the quality of data, the network

149 See, for example, McKinsey (2019a) and Oliver Wyman (2019). See also Petralia et al. (2019) for results of a survey on what services are the most likely affected.

150 The network externalities of a BigTech's platform relate to the fact that the benefit to a user from participating on one side of a platform (e.g., as a seller on an e-commerce platform) increases with the number of users on the other side (e.g., the number of buyers). Network externalities beget more users and more value for users. These externalities in turn allow the BigTech to obtain more data, thus generating a positive feedback loop. The analysis of large troves of data enhances existing services and attracts yet more users. More users, in turn, provide the critical mass of customers to offer a wider range of activities, which yield even more data. These network externalities apply to many financial services and accordingly represent an essential element of BigTechs' entry into financial services provision.

of existing contacts (related to the trust they have and the range of financial services already being provided) and their experience with risk management and regulatory compliance. However, limited new data, high costs, and legacy systems are weaknesses.

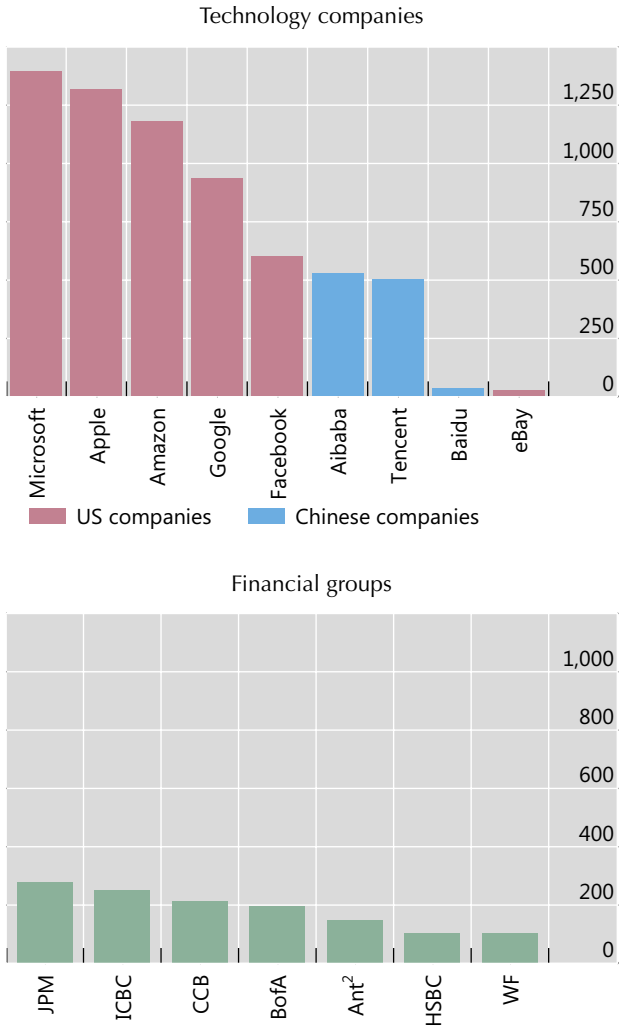
Since the three aspects all have pluses and minuses for banks and the new entrants, an overall judgement is difficult. In large part, it will depend on the desire and regulatory ability of the BigTechs to enter financial services. Valuations in the equity markets would suggest that BigTech could have the upper hand compared to the largest commercial banks if it were solely an issue of ability to invest resources (Figure 24). Most agree, though, that regulatory responses will be important in shaping the future of financial services provision. It is therefore very important to understand how the new FinTech and BigTech firms fit within the current framework of financial and other regulations, and under which principles their regulation should be organised.

Table 6 Large banks versus BigTechs: Competitive advantages (+) and disadvantages (–)

	Large banks	**Big techs**
Data	+ Verified/reliable customer data with long history; "soft" information on customers; high data privacy supports trust – Fewer customers and limited range of non-financial activities to collect data from; transactional data often "one-sided" (e.g., counterparty of transactions with another bank); legacy technology limits data processing capabilities	– Mixture of verifiable and potentially less reliable data; shorter history; data privacy and protection lower priority + Data on many customers; technology, business models built to collect, merge data; network of interactions is key
Network	+ Many financial activities and services already provided – Strict regulatory limits on activities and use of data; higher marginal costs of serving additional customers	– Need many customers to exploit network gains + Significant network gains given many other activities; captive ecosystem, potential high exit costs
Activities	+ In high margin and complex products requiring personal interaction (e.g., corporate finance, investment banking); wider range of financial services; access to large and relatively cheap funding sources; experience in risk management – Legacy IT systems barriers to using existing data for new services (low economies of scope); limited to finance	– So far limited or no footprint in finance (e.g., mortgages, loans to medium and large firms, insurance); funding limitations; lack of regulatory, risk experience/expertise + Can provide commoditizable services at near zero marginal costs; pre-existing activities yield data that can support new services (high economies of scope)

Source: BIS (2019a).

Figure 24 Market capitalisation of BigTech, major financial groups (US$ billions)



Notes: 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 capitalization, 7 May 2020. 2) The estimated value of Ant Financial was derived from the amount raised in the company's 2018 funding rounds times the stakes sold.

Sources: Refinitiv Eikon; company reports.

3.5 Policy issues raised by digitalisation

A reviewed above, FinTechs' and BigTechs' entry into finance makes it necessary to revisit many traditional issues – microprudential, consumer and investor protection, 'know your customer' (KYC), etc. – to ensure a *level playing field*. It also introduces many new policy issues, two specific elements of which are *competition* and *data*.

3.5.1 Competition

Given favourable feedback loops (i.e., between the data, network and activities as highlighted above) and other network externalities, FinTech and especially BigTech could easily become dominant in the provision of some financial services. The valuations of BigTech (see above) already show the potential scope for dominance if they enter financial services provision. Their entry thus raises some traditional and some new competition policy issues.[151] The traditional issues include how to assure a contestable market given the many network externalities. Developments in payment systems offer a good example of the competition issues and related possible risks. The industry has seen rapid consolidation both globally and within many countries in recent years, a trend which seems to be accelerating with the new technologies.[152] High fixed costs are surely one factor behind this trend. Nevertheless, there is also a healthy 'competition for the market', with new, well-capitalised entrants aiming to supply the whole market with products or services. Over time, however, this can lead to less than optimal outcomes.[153]

There are parallels here to other industries such as telecommunications, where competition policy has been well aware of concerns related to network externalities.[154] Applications of this framework to financial services, however, are still few.[155] These provide some of the ingredients for assuring competitive, contestable markets. A key ingredient is maintaining the traditional ex-ante institutional and functional-based approaches (i.e., approaches based on ensuring 'adequate' entry and exit of financial institutions and activities). However, these need to be complemented with what one might call a 'production approach' – that is, policies to ensure that the various inputs required for the production and distribution of financial services are available to those interested in using them. Additionally, they should be fairly priced and efficiently provided. These inputs include access to information and payment systems, and, of course, distribution networks.

151 Vives (2019).
152 McKinsey (2020a) and *Financial Times* (2020b).
153 As discussed in Bourreau and Valletti (2015) in the context of mobile payment and mobile money systems, due to the sunk costs of infrastructure, these forms of financial services are characterised by the presence of economies of scale. Mobile payment platforms therefore have to reach a large enough scale to be able to offer affordable services to users on both sides of the transaction. Indeed, in some countries, private sector efforts have had limited success precisely because they failed to reach the critical mass of users participating in the platform needed to make the endeavor profitable. However, once a scale is reached, situations of natural monopolies can arise which call for policy interventions.
154 See the seminal work by Laffont and Tirole (1999).
155 Vives (2016) and (2019) are very important contributions; an earlier attempt is Claessens et al. (2003).

This type of ex-ante regulation assumes that with the adoption and enforcement of the right set of rules, the market will generate an efficient outcome. However, ex-ante approaches are not likely to suffice. For one, there must be some incentives to compete for the market, i.e., there has to be some expectation of rents and franchise value from the development of new products or from entering new market segments. This can mean that a very competitive situation is less conducive to innovation. Second, given the rapidly changing technology and the various, hard to predict developments, unexpected adverse effects on competition may arise (say, due to new and unanticipated network externalities). As such, at times, to restore a competitive environment, there will be no choice but to use ex-post policies to varying degrees. This type of regulation refers to regulatory interventions only after a market failure is identified, for example following an investigation. This approach is typically followed in telecommunications and many other economic sectors to ensure adequate market conduct, especially to avoid anticompetitive behaviour by market players. When relying on general anti-trust legislation and processes applicable to all sectors in the economy, ex-post intervention may also be needed for new forms of financial services provision.

While some elements of competition policy responses are known, many are unknown. In particular, given the greater importance of data, the most appropriate policy and how to operationalise it – including the mix of ex-ante and ex-post regulations – is an open issue. Platform economics in a world of digitalisation and big data (and BigTechs) is a new area which has received only limited (policy) analysis.[156] Besides an incomplete analytical framework, quantitative indicators to assess differences across jurisdictions to allow for easy analysis, including the impact on competitive conditions, are most often missing.

Nevertheless, Table 7 provides a very high-level summary of the characteristics of the competitive structure across four major jurisdictions: China, India, the United States and Europe. The first row suggests that market structure is more of an issue in China and the United States, but less so in India. The second row suggests that the absence of a digital platform that gives equal access to various providers is more of an issue in emerging markets than in advanced economies. Anti-trust policy, in the third row, is most clearly established and practiced in the European Union, followed by the United States and India, but much less so in China. (The data and privacy aspects are reviewed further below.) This structure can be a starting point for further analysis of market structure, with the analysis varying by financial service.

156 Important work includes Farboodi et al. (2019) and Khan (2019); see also Philippon (2019). Ongoing work includes that conducted at the Bennett Institute for Public Policy (2020).

Table 7 Characteristics of competition and related policy for major jurisdictions

	China	US	EU	India
BigTech firms dominate digital platforms	Yes	Yes	Partly	No
Digital platforms' big impetus to provision	Yes	No	No	Yes
Active competition (anti-trust) policy	No	Partly	Yes[1]	Partly[2]
Legislation-set privacy rights for platform users	Partly[3]	No	Yes[4]	Yes[5]

Notes: 1) An example is the German competition authority's (Bundeskartellamt) ruling that prohibits a social network from systematically combining user data from different social network applications, 2019. 2) Indian e-commerce law, amended in 2019, prohibits foreign e-commerce platforms from selling products supplied by affiliated companies on their Indian shopping sites. 3) The Personal Information Security Specification, May 2018, sets out guidelines for the collection, transfer and disclosure of personal information. 4) EU General Data Protection Legislation, 2018. 5) Ministry of Electronics and Information Technology standard for digital signature to gain users' consent on use of data; RBI guidelines for account aggregators to collect data and share with consent, 2016; Data Protection Law under discussion, 2019.

Source: BIS (2019a).

3.5.2 Data

As already highlighted above, a policy issue that is new to technology-based financial services provision, and one that calls for specific assessments and related policy recommendations, are data. FinTechs and BigTechs differ qualitatively and quantitatively from traditional financial services providers in their greater reliance on data from both the pool of (potential) clients and specific clients.[157] Data are always important for financial services provision for several reasons: screening potential users (e.g., borrowers); monitoring users' performance and behaviour; and enforcing claims in case of payment difficulties or default. While some of these aspects are similar across traditional and digital financial services provision, digitalisation can imply a material difference in the importance of data.[158]

The increased importance and use of data bring many benefits, but also can lead to new issues. Conceptually, one can think of these along three dimensions (see Figure 25): (1) the 'traditional' stability-competition trade-off; (2) a (new) trade-off between access to data for private providers and anonymity (e.g., better/worse access to credit versus the risk of misuse of data); and (3) a trade-off between access to data for regulatory goals vs anonymity and privacy (e.g., the application of AML/CFT or supervisory data versus privacy). Of course, there are many interactions among these three dimensions, and not all involve trade-offs – it need not be a trilemma, it can be a trilogy.[159]

157 The importance of data holds also for insurance, with the additional twist that the insurance market can stop functioning if perfect discrimination is possible since the pooling equilibrium then breaks down.

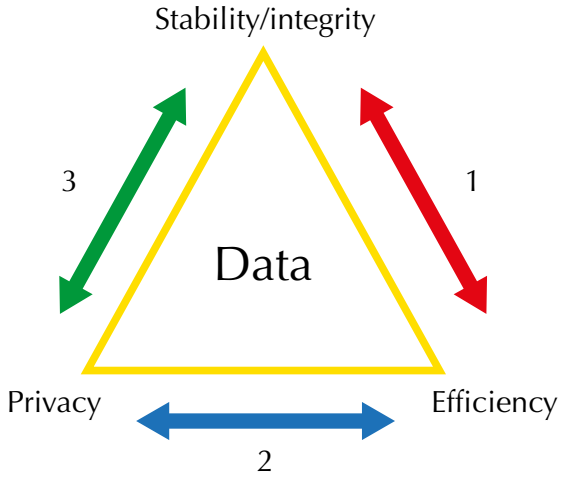
158 Many studies (e.g., Jappelli and Pagano, 1993) have documented, for example, the impact of credit registries with negative (late payments, defaults, etc.) and positive information on the volume and efficiency of credit extensions. For further analysis of data with regard to BigTechs, see Boissay et al. (2020).

159 See also Brummer and Yadav (2018).

The stability–competition trade-off

The traditional stability–competition trade-off concerns balancing the desire for efficient financial services provision, including through the entry of the new providers, versus the risks of too much competition and too little franchise value, which can lead to risk-taking and financial instability. While this traditional issue has received much analysis,[160] the large-scale use of data for financial services provision changes the issue – perhaps fundamentally so. The presence of network externalities changes the competition policy approach to be followed (see above). Moreover, with regard to the trade-off with financial stability, many new data and technology-related issues arise.

Figure 25 The challenges with respect to data: Trilemma or trilogy?



Source: Author's own work.

One new dimension is concentration in the collection and use of data. Given their scale and technologies, BigTech platforms have the ability to collect massive amounts of data at near zero cost. In addition, as noted in the discussion on competition, data have more value to BigTech firms. With their dominant position in data established, they can not only reap more benefits from new data availabilities, but also drive others out. This can give rise to 'digital monopolies', or 'data-opolies'. Besides the anti-competitive issues discussed above, such dominant positions in data can lead to systemic risks. Almost by definition, BigTechs would be 'too big to fail' if they were to enter financial services provision on a large scale.[161]

It is not clear how a competitive playing field can be ensured while balancing financial stability concerns in light of the greater importance of data. It is still too early to develop a good conceptual framework that can shed light on the possible approaches. The question is difficult since policy responses will involve various regulatory bodies. Besides the participation of financial regulatory and

160 See Beck (2008) and Vives (2010) for reviews, Claessens and Klingebiel (2001) for a policy-related review, and Claessens and Rojas-Suarez (2016) for applications to digital financial inclusion.

161 A related, technology-based new dimension is the common use of back-end service providers (such as cloud services, as noted above) with large overlaps in data collection and analysis (BigTechs like Amazon, Google, Alibaba are also involved in cloud services for example).

supervisory agencies, the overseers of telecommunication industries will need to be involved as the traditional financial perimeter does not include many aspects of the new activities, leading to many design and operational implementation questions.

The comparison of the models in the United States, Europe, China, India (bottom row of Table 7) shows a wide spectrum of how to organise and collect data and how to grant access to specific (financial) service providers. In the European Union, the General Data Protection Regulation (GDPR) assigns data rights to individuals. In India, the India Stack generates large volumes of new data which users have control over, but data privacy regulation is not yet in place. In China and several other countries, data localisation rules prevent data from being shared across borders. The United States has sector-specific legislation at the federal and state levels, and Congress is currently debating federal privacy legislation. In practice, companies have had relatively free access to data. Meanwhile, only a few countries have a national data strategy, in part as they face the difficult choice of whether to invest scarce resources in a data strategy or in areas such as public health or physical infrastructure.

Some countries have adopted a more top-down, government-led approach, developing a general framework for data collection and dissemination; others have adopted a more bottom-up, market-led approach. India is closer to the European model for data and privacy in that it relies more on the adoption of a consent-based approach. The United States and China have more laissez-faire models. Since choices of data access are likely not driven (solely) by considerations related to the stability–competition trade-off, they imply that the trade-off will vary by country.

Where to draw the line is not clear. In both financially developed countries with good institutional environments and in counties with underdeveloped financial systems, a more laissez-faire model with regard to access to data may be acceptable, but for different reasons. In the former, financial stability concerns may be less important as the institutional environment is strong, allowing for greater experimentation. In the latter, the gains from financial inclusion are larger and new models more attractive, whereas financial stability is less important. Obviously, this is all very preliminary. However, in light of the increased importance of data as an input for financial services delivery, these and other elements need to be assessed and analysed to establish the best balance between stability and competition considering the greater importance of data and access to data as a policy tool.

The efficiency versus privacy trade-off

Another, 'new' trade-off related to access to data is that between the efficient delivery of financial services and anonymity vis-à-vis both the provider and others, where the data can potentially be misused. This trade-off is a general issue in a more digitalised world. People often 'use' their personal data as a means of exchange (e.g., for 'free' online services), but this may not be the most efficient or fair outcome. This is (again) because property and control (i.e., access) rights to data are not well defined, meaning that the platforms – typically BigTechs – de facto control the data and they become data-oligopolies. Given the current lack of clarity over who controls access to data, BigTechs may also do well in financial services provision, as their extensive access to (personal) data can be very valuable for credit scoring, insurance pricing, marketing of financial products, and so on.

The economies of scale in IT investments (machine learning and AI) and network externalities could further solidify their presence in financial services. This risks consumer discrimination, rent extraction and other, possibly inefficient and welfare reducing outcomes.[162]

Defining the control (access) of data in this context is thus crucial. However, there is no consensus from the economics side, let alone an international binding agreement, on how this is best done.[163] It is clear, though, that the degree of sharing of personal data will dictate the scope for overall gains – for example, from better tailoring products or overcoming information asymmetries in lending – as well as the potential costs and risks. It is also clear that one needs to differentiate between kinds of data. Obviously, some data are purely private or only meant to be shared with some (e.g., medical records). People may want to make other types of data freely available and there may be no economic harm in doing so, only (private) benefits. In between these two types are data that may not be valuable to the users (e.g., browsing histories), but may be valuable for providers as they can use them to target advertisements and services better to the specific user or in general. This latter type of data user may not want to share (if they fear misuse, for example) or they may want to control the access to the data in some forms (so they can 'sell' it to the highest bidder, for example).

Differentiating between the costs and benefits of these kinds of data calls for the complex assignment of some control rights over specific types of data to consumers. There are no clear answers yet, but one can think of several (potentially complementary) approaches to address, or even avoid, the efficiency–privacy trade-off. One approach is to assign greater control over personal data. The idea here is to resolve inefficiencies or risks by allocating property rights and creating a competitive market for data – the decentralised or 'Coasian' solution. In particular, customers could grant multiple firms differential access to relevant information. Recent open banking initiatives (including in Australia, the European Union and Mexico) are examples of this approach.[164] Upon request, financial firms must make their customers' transaction (or equivalent) data portable, i.e., directly transferable to third parties or competitors – typically through open application programming interfaces (APIs). Open banking rules put the consumer in control, but they selectively restrict the range of data that can be transmitted (e.g., financial transaction data), as well as the types of institutions among which the data can be shared (e.g., accredited deposit-taking institutions). In some cases this may not fully level the playing field, such as when access is asymmetrical (between BigTech firms and incumbent service providers, for example). Nevertheless, it allows one in principle to better calibrate any trade-off between efficiency and privacy.

A second approach involves government-led rules and restrictions on the processing of user data. For example, recent data protection laws in, among others, Brazil, California, the European Union, Japan and Singapore have addressed data collection and use to protect personally identifiable information. The challenge with these laws is how to address differences in privacy concerns with regard to the types of data. While the differentiation of data has been kept in mind,

162 See further BIS (2019a) and Vives (2019). For an analysis of the effects of technology through some of these channels, including on inequality, see Mihet (2020).

163 See Carrière-Swallow and Haksar (2019) for initial work. For a further discussion, see Acquisti et al. (2016).

164 See further BCBS (2019) for an overview of policy issues and country rules on open banking and other forms of data sharing.

the laws have not always been very specific. In part, this 'blanket' approach was taken because the technology has not been in place yet. While, in principle, technology might be able to separate various types of data at the point of the user interface with agents, this has not yet been feasible. Nevertheless, and more generally, technology can help to better balance economic efficiency and data privacy. For instance, better software could allow users to be more selective in revealing their identity by allowing them to anonymise data for certain purposes. BigTech firms could also be required to use just enough data to provide their services without necessarily identifying the user ('differential privacy'). There is also an international dimension to data sharing. Some jurisdictions have taken the drastic measure of restricting data flows within and across borders (the latter, for example, through data localisation). These rules may be justified on national security grounds but they fragment the data landscape; this might limit the potential benefits and can even lead to protectionism.

A third, and related, approach consists of setting up a larger digital (institutional) infrastructure, including for the sharing of data. To date only a few countries have embarked on this (examples are India and Singapore), with many steps yet to come. Data-sharing arrangements typically form part of establishing a more general digital framework and public infrastructure upon which to build layers of services. Elements of such an institutional infrastructure include the development of core services such as digital identity (e.g., India's Aadhaar, Singapore's MyInfo and Estonia's e-identity) and the encouragement of new data collectors (e.g., India's 'account aggregators'), and can include the standardisation of APIs (e.g., for open banking).[165] Such infrastructure is typically combined with mechanisms to empower users to share their data selectively. Once the infrastructure is in place, in addition to data control and portability, payments, digital government services and a host of other solutions become possible. For example, India's Unified Payment Interface (UPI) facilitates the entry of new firms and spurred competition, which helps reduce prices.

The desirability and feasibility of these and various other possible approaches regarding the use of personal data are likely to differ by country, depending, for example, on the level of financial development, the (risk of) misuse of data, and the quality of services currently offered. They will also require coordination among regulators. Financial laws and regulations focus on the specifics of the financial sector, whereas competition and data privacy laws often impose general standards for a wide range of businesses. At the domestic level, central banks and financial regulators may need to sharpen their understanding of personal data issues and coordinate with competition and data protection authorities. However, the mandates and practices of these bodies may not always be compatible.

165 Some of the development of an infrastructure for sharing of information to improve financial services delivery can also occur through market forces. For example, Plaid in the US created a business out of producing APIs for banks so that they could then give access to others, for example loan providers to check/validate credit and transaction history of future customers. It is an example where open banking creates a new set of intermediaries, and illustrates how information provision becomes a new business. At the same time, the company was recently bought by Visa, which suggests that there can be (new) competition issues given (vertical) integration to large existing networks. The premise of the India model of the need for a public role to assure that the information can be easily shared arises in large part as it aims to weaken the power of platforms.

The specifics of the financial sector may not match the general standards that competition and data privacy laws often apply to a wide range of industries. Moreover, some countries have no clearly defined competition or data protection authority.

In addition to regulatory arrangements having to consider the efficiency versus privacy trade-off, solutions will have to take into account global variations in how people value their privacy. For example, people in advanced economies countries tend to value their privacy in financial matters more than those in emerging markets and developing countries – differences that may reflect, at least in part, the relative costs and benefits. As well as differences between countries, there are also large differences between groups within society.[166] However, the mapping between economic incentives and privacy preferences is not obvious – for example, it would be misleading to claim that privacy is a luxury good. Legal differences are a related dimension.

The regulatory goals versus anonymity trade-off

There is also trade-off between privacy and financial stability and financial integrity, which raises another angle to the rules governing data. As already noted, given the network externalities, their (expected) size immediately makes firms involved with big data – as well as BigTech as the cloud providers – too big to fail. They also have many links to other institutions which can lead to adverse (reputational) spillovers from their actions. Cyber-attacks and breaches of personal data, for example, can erode trust in the overall financial system. Greater use of technology may also lead to more volatility in financial markets. These considerations may call for some limitations or rules on the sharing of data.

At the same time, many data are needed for regulatory and supervisory purposes, including for consumer and investor protection, for AML/CFT objectives, as well as for systemic risk assessment and, in the event they occur, for crisis management and resolution. In addition, judicial authorities need to have access to data for enforcement, for example. As such, privacy with regards financial transactions has not been, and cannot be, full. Here as well, many (new) considerations arise: how to regulate access to and use of data for supervisory and other regulatory purposes among the new providers; how to assure that adequate safeguards are in place; and how to ensure that there are means for (resolving) legal disputes that are efficient for all consumers.

166 Some argue that data privacy has attributes of a fundamental right that cannot be traded off against economic benefits. Yet preferences on how much people value privacy differ between jurisdictions and even between groups within societies, suggesting economic factors to pay a role (Doerr et al., 2019). In a recent survey (Ernst and Young, 2019), respondents were asked if they would be open to their bank securely sharing their data with other organisations in exchange for better financial service offers. In India, 65% of respondents said yes; in the Netherlands, only 13%. Overall, willingness to share data is lower for countries with higher per capital income. Within jurisdictions, differences by age and gender are large: globally, 38% of 25- to 34-year-olds were willing to share their data, but only 16% of those over 65 were. At the global level, 34% of men were willing to share data, but only 27% of women, with this gap larger in some countries. A related issue is with whom people are willing to share data. A recent survey on the anonymous sharing of DNA and medical information also points to large differences between countries. For example, more than 65% of the Chinese and Indian respondents would share their health data with governmental authorities, while fewer than 20% would do so in European countries.

The already large policy agenda is made even more complex when considering the international dimension. Differences are large, as noted, and international coordination on issues of personal data in finance could be challenging. Some commentators have called for the development of international standards for the digital economy. As difficult as it may be for national authorities to define regulatory approaches for personal data usage, it may be even more difficult to form minimum international standards. There may be a need for a dedicated standards-setting body for data protection. Although the Global Privacy Assembly (GPA) meets annually, there is no formal standards-setting body responsible for personal data use, either for all industries or specifically for financial services.

3.6 Summary

3.6.1 Bank business models

Banks' business models are under threat from several directions, including due to the weak economic environment in which many banks operate. One important threat that is common to almost all banks is from the technological advances and the related rapidly changing market structures, with many new players entering. This is most obvious in payments, where innovations are quickly changing the landscape. This reflects in part shifts in consumer demand, given the emergence of the digital economy and the desire for greater convenience. However, it also shows that incumbents – notably banks, but also other financial companies – did not have enough incentives to improve payment services to end users. Similar, but less abrupt developments are underway in credit extension and, to a lesser degree, in deposit taking.

How are these developments affecting banks and their business models? Some banks may be able to adapt their business model and bring on board some of the most promising technologies, in part by acquiring FinTechs. However, experience suggests that many will fail to invest enough, and quickly enough, in order to be sufficiently nimble to reap adequate returns, especially if BigTechs enter financial services provision. Some of the right incentives are in place; many countries have beefed up corporate governance, disclosure and accountability rules and now have resolution and exit regimes in place to deal with those banks that cannot make sufficient profits. But the collective outcome is still one in which there are too many banks with (excessively) large balance sheets, many employees and costly offices and networks of affiliates, with associated low market valuations. As such, one may be sceptical that the transformation of banks will happen quickly enough.

3.6.2 Policy and regulatory responses: Three elements

A level playing field

Regulators need to ensure a level playing field between BigTechs and incumbent financial institutions, taking into account BigTechs' wide customer base, availability of information and broad-ranging business models. Achieving this level playing field has many elements, ranging from adapting consumer and investor protection, to revisiting microprudential and macroprudential regulation and supervision.

Competition and data policy

It is not just financial regulation, but also competition and data privacy laws that matter in the new world. These laws often impose general standards that apply to a wide range of businesses, but they need to be adapted to the shift brought about by technological advances, notably BigTechs entering in financial services provision. It will remain necessary to have a contestable (entry and exit) market for entities and activities, but this may not be sufficient. In addition, anti-trust policies will need more emphasis. Moreover, data policies in particular will require major adaptations.

Coordination

Public authorities need two levels of coordination. At the national level, the current mandates and practices of the competition authorities, financial regulators and data protection supervisors may not be compatible with dealing with the new issues. In addition, as the digital economy expands across borders, it will be necessary to coordinate rules and standards internationally (for data exchange, localisation, privacy, etc.). This will be challenging, in part as there is no dedicated standards-setting body.

4 Digital money, payments and banks

The fractional-reserve banking model has been a central element of the money and payments technology in modern economies. On the liability side, banks provide deposit accounts as a repository of value for their customers. The balances of these accounts, together with cash in circulation (provided by governments and central banks), then become the two components of the standard definition of the money supply, as the assets used in payments.

Over time, the records of the balances of these accounts have moved from paper to digital format. In addition, access to the value of the accounts in order to carry out payments has also increasingly been through technology involving digital communications (as opposed to cheques or other physical forms of paper). In many ways, we have been living with digital money for decades. But changes to technology and new interactions with other forms of digital information, such as social platforms, are creating an environment where large disruption to banks and traditional financial institutions seems possible.

What are the fundamental changes created by these technologies and how will they modify our use of money and payments? Today, payments rely on two fundamental pillars: bank accounts, and a payment infrastructure either under the control of banks or managed by close partners.

When it comes to the asset used for payments, it is mostly sitting in bank accounts and indexed to the traditional unit of account (the currency of the country). The redemption value of the deposit is therefore fixed (a Citibank $ is the same as the US dollar).[167] To make this more explicit, one can always redeem the value of the account in cash – i.e., physical money issued by the central bank. And we have regulation and supervision (including deposit insurance) to provide guarantees to bank customers.

A payment infrastructure allows the balance of the account to be used as a medium of exchange. This includes bank transfers, online banking and credit and debit cards. This infrastructure is either fully under the control of the banks (e.g. online banking) or via close partnerships with credit card companies.[168]

Technology changes have started to change the landscape of money and payments and are threatening to disrupt some or all of the features above. Changes are already visible in payment technologies, but they are also slowly affecting the other building blocks. These changes are coming from a variety of sources.

167 There could be a return on this fixed value if interest rates are paid on the account, and it is also possible that fees are levied on the balance or transactions.

168 Visa and Mastercard were originally launched by an association of banks.

First, new technologies in the payment infrastructure allows other players to enter the business of connecting consumers to other consumers, or consumers to businesses, to facilitate payments. Electronic wallets used for retail and peer-to-peer payments are one of the most prominent examples. In addition, the synergies between payments and other forms of digital activity, such as social media or messaging apps, have increased the demand for integration of previously bank-controlled platforms into ecosystems driven by tech firms

Second, the introduction of alternative forms of digital money (cryptocurrencies, stablecoins), some of which rely on different units of accounts and make use of decentralised governance models, have the potential to change the way individuals manage the assets that are being exchanged in both retail and wholesale payments.

While this chapter mostly deals with technology trends that have been with us for some time and that might take years or even decades to fully transform the way we manage money and payments, the Covid-19 pandemic has raised interesting questions about the potential acceleration of these trends. While some of these changes will disappear in a matter of months or quarters, some might permanently change the way we interact with each other. First, a period of social distancing has put further emphasis on teleworking and digital forms of communication. While financial institutions have remained open for business, they are encouraging online transactions to avoid close interactions. The same is true for payments, where the handling of physical cash (or credit cards) has the potential to spread the virus and contactless payment may be seen as preferable. Finally, as governments and central banks discuss large stimulus packages, the issue of speed in processing information and payments is crucial. While governments can potentially make fast digital payments to citizens via bank accounts, they might not be able to reach everyone. The idea of individuals having access to a public digital form of money (what we refer to as central bank digital currency or 'reserves for all') might, as a result, pick up some momentum after this crisis.

This chapter presents an analysis of how the combination of those long-run trends, recent technology changes and the short-term disruption of the Covid-19 pandemic are transforming digital money and payment technologies and, as a result, are challenging the business of banks. Section 4.1 provides a framework for thinking about digital money and payments. Section 4.2 analyses the features of new forms of digital money. Section 4.3 discusses the role of central banks and regulators. Section 4.4 reviews the different industry actors, their incentives and their motivations. Section 4.5 looks at the implications for the competitive landscape of banks. Section 4.6 concludes.

4.1 Technology, digital money and payments

4.1.1 Definition of money

Any textbook on monetary economics starts with a definition of money as "the stock of assets that can be readily used to make transactions". Money is seen as "serving three purposes: medium of exchange, unit of account and store of value".[169] These three purposes, or functions, of money should be separated into

169 Mankiw (2018).

those that are required and those that are desirable. A medium of exchange is a requirement. In many ways this is the definition of money – an asset that can be used to make transactions. The existence of a unit of account is a desirable feature to facilitate trade as it allows a common unit in which to measure all forms of value (goods, services, assets). In most countries the unit of account and the currency come together, but one could in theory separate the two.[170] The stability of the unit of account relative to the value of goods and services is ensured by the central bank and its management of inflation. This is a desirable feature of the asset that we call money, but it is not required. For example, countries with high levels of inflation use their currency as money even if it is not a (good) store of value.

Since the creation of modern central banks, the definition of money as well as its three functions have been easily identifiable and associated to the object through which value was transferred during a transaction, namely, physical banknotes issued by the central bank. Banknotes are denominated in the unit of account and, as a result, the ability of a banknote to serve as a store of value is inherited from the stability of the unit of account. If the central bank maintains low and stable inflation, banknotes will be assets whose value is stable over time.

Box 5 Legal tender status

The definition of legal tender status and its economic implications is not as crystal clear as many assume. In the United States, Section 31 U.S.C. 5103 states that "*coins and currency [including Federal reserve notes and circulating notes of Federal reserve banks and national banks] are legal tender for all debts, public charges, taxes, and due*s." However, there is no legal obligation for a private business, individual or organisation to accept physical currency or coins as a means of payments.[171] In the case of England, the Bank of England's notes are seen as legal tender (other forms of payments such as cheques are not). But as the Bank states, "*legal tender has a narrow technical meaning which has no use in everyday life*" as there is no requirement to accept payments in cash for any daily transaction.[172] In the case of the euro area, the definition of legal tender is even more fluid. The legal definition might differ across countries, although the European Commission has issued a recommendation on the scope and effects of legal tender for cash in the euro area. The principles state that notes and coins should be accepted as a default, but there is room for exceptions (for example, merchants refusing large denomination notes when it is inconvenient).[173]

In addition to the legal tender status, governments can also require certain payments, such as taxes, to be made using its currency. This guarantees that one can always get the value of a banknote back by using it to pay taxes.

170 This would introduce a second unit of account and an exchange rate, making it less convenient and the reason why we do not see such arrangements.
171 See https://www.treasury.gov/resource-center/faqs/Currency/Pages/legal-tender.aspx
172 See https://www.bankofengland.co.uk/knowledgebank/what-is-legal-tender
173 See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010H0191

But what about the fundamental property of money as a medium of exchange? The physical note is passed from the buyer to the seller and in doing so, the ownership of the value of the asset changes hands. The medium of exchange property of the asset is thus fundamentally associated with the physical object that represents its value. Of course, for this to work it needs to be the case that the note is generally accepted as a means of payment. How does a banknote become accepted? Because of a combination of the legal tender status provided by governments (see Box 5) and, more importantly, the trust of the public in the value printed on the banknote and its stability over time.

4.1.2 From physical to digital money

As we move from physical cash to bank accounts, the medium of exchange function of money becomes more difficult to identify. For the other two functions, however, it is still quite straightforward. Bank accounts are assets that are denominated in the unit of account. Because of their fixed redemption value, they inherit the stability of the value of the currency.

When it comes to the question of how bank accounts become a medium of exchange, there are several complications. First, there is no legal tender status that applies to bank accounts (or any other form of digital money). Second, in order for the asset to become a medium of exchange we need to figure out how its ownership can change hands, i.e. we need a payment technology.

Payment technologies come in many forms. Cheques constitute a non-digital payment technology associated with bank balances, but the technology is not as universal as cash as their acceptance is much more discretionary and subject to credit risk.

Debit and credit cards rely on digital technologies for communication between the different players involved in a transaction. They require a connection between the bank account of the buyer and that of the merchant, provided via a technology associated with a merchant's point-of-sale terminal connected either directly to the bank or via an intermediary such as a credit card company. These networks are not always present and, even when they are, there can be some form of segmentation (with only certain types of credit cards accepted, for example).

In the case of both cheques and credit cards, there is no guarantee that they will be accepted as money and therefore their property as a medium of exchange applies only in some circumstances. In fact, each payment technology comes with a set of features that distinguishes it from the others in terms of the degree of convenience and ease of use, speed and cost. Cash machines, cheques, bank-to-bank transfers, credit cards and smartphone apps all give access to bank account balances, but have very different attributes.

The main insight is that in the transition from physical cash to bank accounts or any other form of digital money, the label 'money' is no longer precisely defined. We have many forms of money, and some of them only serve their full functions in certain circumstances or within certain platforms. What some might consider money is not money to others.

Fundamentally, bank accounts as a form of digital money create a separation between the asset (and its value) and the medium of exchange functionality that we require from it. A payments technology is necessary to convert a bank balance into a medium of exchange so that we can call it money.

4.1.3 The evolution of payment technologies in a digital world

For decades, the coexistence of different payment technologies and its evolution was mostly managed and controlled by banks. Banks provided liquid and safe deposit accounts and these accounts were connected via settlement systems, through the central bank. Requesting a payment from one bank account to another meant using a particular payment technology – credit or debit cards, cheques or bank-to-bank transfers – mostly managed by banks.

Innovation in payments, and in particular the development of faster and more universal credit card networks and of online banking, made digital payments the preferred payments technology.[174]

The digitalisation of our economic and social activities has led to increasing demand for faster and cheaper forms of payments. This has mostly been made possible by the explosion of technology platforms and social media, which have become omnipresent in our lives via mobile devices such as smartphones. Interactions on these platforms take many forms, including communication and the search for and consumption of information. It became natural to extend the functionalities of these platforms to payments, either peer-to-peer payments or retail payments.

It is important to understand that these changes in retail payments have been mostly driven by consumer convenience.[175] They are associated with the constant digital presence of technology platforms that have created forms of payment that are not only seamless and as fast, or faster than, traditional ones, and that allow transactions to take place within their ecosystem. The key becomes the platform and not the actual form that money takes. If the payment is convenient given the connections of the platform network, it will dominate traditional forms of payment. As Benoît Cœuré puts it:[176]

> *"WhatsApp, for example, is a messaging service. Adding a payment leg that enables direct transfers of money between registered users will not change the nature of its business. But it will provide a platform to turn a means of payment into a global currency. This is the exact opposite of what theoretical models of global currency use would predict. According to these models, payments lead and other uses follow."*

But remember that creating a payments technology in one of these platforms requires more than just technology. The payment technology has to be matched to an asset that is being used to transfer the required value for the transaction.

Some of the early FinTech start-ups soon realised that working with bank deposits as the asset being exchanged was difficult and costly.[177] Accessing bank accounts typically required using the expensive and slow infrastructure of credit cards and partnership with banks that were, justifiably, not willing to give easy access to potential competitors. Because of this reluctance to work with banks, some of the early developments were focused on developing alternative digital

174 Cash remained an option because part of the population is unbanked and also because of issues of trust and the possibility of fraud remained a concern for some consumers. In addition, some of the new digital technologies were sometimes more expensive for merchants than cash, particularly for small payments.

175 Brunnermeier et al. (2019).

176 See https://www.ecb.europa.eu/press/key/date/2019/html/ecb.sp190917~9b63e0ea23.en.html

177 In addition, some of these new ventures were sold as alternatives to an old, inefficient and intrusive financial system. Independence from banks was one of their value propositions.

assets that interacted better with these new platforms. Cryptocurrencies and the associated blockchain technology became a natural solution for these new demands. But it did not stop there. As long as one develops trust, money can be stored in any form of digital ledger or database and, as a result, we have witnessed the development of new forms of money that are sitting outside of the traditional deposit-taking institutions. In addition to a large number of cryptocurrencies, we have seen mobile telephone providers (e.g., M-Pesa) and BigTech platforms (e.g., WeChat, Venmo or Facebook Pay) create digital repositories of value that can be used as a form of payment.

Box 6 The fluidity of money demand

There are two phenomena that are changing the way we think about demand for liquidity. First, we are witnessing increasing possibilities of storing value in digital assets that did not exist before, many of them sitting outside of the traditional banking sector. Second, we now have a much more complex set of networks, or 'pipes', that connect these repositories and allow individuals to quickly move value between different assets. This is fundamentally changing the way we think about money and the demand for liquidity. In a world where cash and traditional bank accounts were the main form of money, demand for liquidity was seen as a function of the transactions and the opportunity cost of holding interest-bearing illiquid assets (as in the textbook Baumol-Tobin money demand model). In a world where the costs of moving value across different accounts approaches zero and it can be done instantaneously, we reach an almost complete separation between the balances in these accounts and the transactions that they can finance. Today, a provider of payments can work with very small customer money balances and still manage a large volume of payments. New digital coins, tokens or simply electronic wallets can become a vehicle for payments without capturing a significant volume of 'money demand'. In this new world, the benefit of money and payments is not about the properties of the asset holding the value (as was always the case for banks), but instead it is in the convenience, cost or speed of the payment technology.

Finally, the recent Covid-19 pandemic has accelerated some of these trends towards digital forms of payment. From a health point of view, the initial fears were that handling physical cash could increase the risk of contagion. But the same fears apply to credit cards where either a signature or the input of a code on a PIN pad is required.[178] In the case of contactless payments, regardless of the actual implementation, the risk is almost non-existent. For this reason, some central banks have recently raised the limits on contactless payments to encourage their use. In addition, social distancing encourages electronic commerce, which relies on digital forms of payments. While some of the draconian social distancing measures will disappear over time, it is very likely that the large imposed adoption of digital forms of communication and ways of doing business will have a long-lasting effect on our daily routines, including payments.

178 In fact, it is likely that contagion is easier via plastic surfaces than banknotes; see Auer et al. (2020).

In summary, an increasingly digital world is creating demands both for new forms of digital assets and for faster, seamless and better-connected payment technologies. Innovations are taking place in both of these areas, often in ways which reinforce each other. And these innovations are sometimes driven by, and under the control of, FinTech and BigTech companies rather than banks. We study these two types of changes separately in the next sections. First, in Section 4.2 we look in detail at new forms of digital money. Later, in Sections 4.4 and 4.5, we look at how the infrastructure of payments is changing to make use of these assets and is transforming financial markets and the competitive landscape of banks.

4.2 New forms of digital money

In this section we describe different forms of digital money, starting with bank accounts and moving to new digital assets. We use the label 'digital money' in a broad sense to refer to liquid assets whose value and ownership are recorded in digital form and which are used for payments using technologies that could be fully digital or could potentially include physical objects such as a cheque or a credit card.

4.2.1 Bank deposits as digital money

The starting reference is bank deposits, which has been the most common form of digital money. This is a liability issued by a commercial bank that is liquid and readily available for withdrawal in the form of cash (which is issued by the central bank). Its value is denominated in the unit of account and the redemption value is fixed: a $1 bank deposit is always worth $1.[179] The asset can be used for payments using different methods – from cheques and paper-based bank transfers to credit cards, online transfers and smartphone apps. The fixed redemption value is supported by a combination of deposit insurance, regulation as well as an explicit and simple redemption processes (withdrawal as cash). Of course, the history of bank failures is a reminder that the fixed redemption value is not guaranteed in all circumstances and depends on the safety of a particular banking sector and the willingness of governments to step in and bail out depositors if the deposit guarantee is not large enough.

4.2.2 Cryptocurrencies

While there were some earlier attempts to launch digital assets as alternatives to traditional currencies, it was a paper published on 31 October 31 2008 with the details of Bitcoin that led to the explosion of cryptocurrencies.[180] Bitcoin was launched not only as an alternative to banks and payments systems but also as a challenge to central banks. In the words of the original Bitcoin paper:

> *"The root problem with conventional currency is all the trust that's required to make it work. The central bank must be trusted not to debase the currency, but the history of fiat currencies is full of breaches of that trust."*

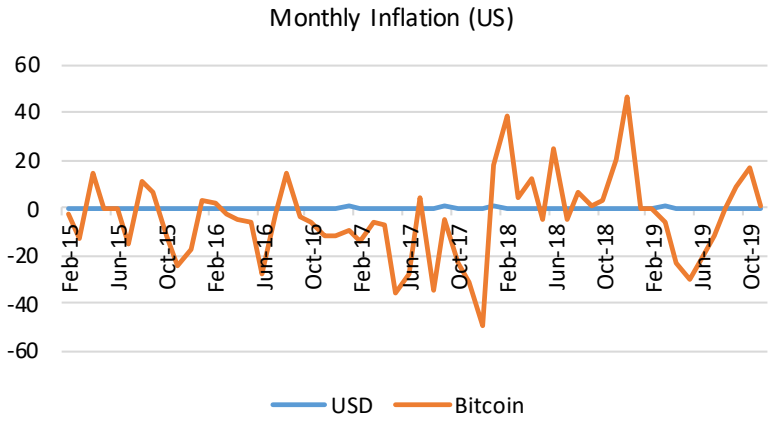
179 We ignore foreign-currency deposits for the sake of simplicity.
180 Nakamoto (2008).

In practice, this meant that this new form of digital money was associated with a new unit of account and its properties as a store of value would depend on its ability to maintain a stable value relative to the goods and services against which it would be exchanged. Bitcoin was the first, but many other cryptocurrencies that used a similar model soon followed. More than 3,000 digital coins are now listed on exchanges, although only about 45 of them have a daily trading volume of more than $50 million.[181]

These new digital assets are associated with an innovative technology that relies on a decentralised system of validation and that promised speed, low cost as well as pseudo-anonymity.[182]

The reality of the ten years that followed the launch of Bitcoin has not quite matched the initial hopes. These digital assets did not perform well as a store of value. Figure 26 displays the monthly inflation rate in the US expressed in US dollars as well as in Bitcoin. The very large volatility of Bitcoin was matched by that of other cryptocurrencies. In fact, the correlation of prices across cryptocurrencies was high and increasing after the 2017 bubble burst.[183]

Figure 26 Bitcoin versus the US dollar as a store of value



But in addition to stability of value, there are also increasing concerns about the ability of the technology to deliver the promised scalability and efficiency.[184] So while it is still early days, ten years after the launch of Bitcoin, none of these new units of account has become a competitor to the regular business of payments and bank deposits.[185] While the volumes of trade are not insignificant, they seem to be dominated either by speculation on the valuation of the asset or uses of money that require a level of anonymity that is not possible with traditional means of payment or related to platforms where software apps can be developed (Box 7).

181 Source: https://coinmarketcap.com

182 Pseudo-anonymity means that while no personal details are recorded, the IP address of the device used to initiate the transaction, as well as the transaction itself, is stored in the system and made public to all participants.

183 Hu et al. (2019) and Fatas and Weder di Mauro (2019a).

184 Auer (2019b).

185 It is not easy to produce reliable statistics on the importance of cryptocurrencies in retail payments, but all the evidence points out to very low levels of activity and without a clear trend over the years.

Box 7 Cryptocurrencies, DLT/blockchain platforms and anonymity

The high volatility of cryptocurrencies and their poor ability to replicate the store of value functionality of traditional currency should have been a deterrent for any activity related to these digital assets. However, there has been substantial interest in cryptocurrencies and many new business ideas have relied on their infrastructure. One of the reasons for this interest is the importance of the payment technology that is attached to these cryptocurrencies. This technology is very much linked to the technology on which these platforms are being built, namely, blockchain. In particular, when it comes to cryptocurrencies such as Ether, they are implicitly the currency of a platform (Ethereum) that allows for development of other applications (DApps). Any economic transaction requires a payment. As argued earlier, building a connection to the traditional forms of payments was costly (e.g., dealing with credit card infrastructure and fees) whereas using Ether as the currency was seamless. The same can be said about the development of initial coin offerings (ICOs), where the token serves a purpose as a mean of payments and at the same time allows for a cheap and efficient way for entrepreneurs to fund an idea. In addition, many of these tokens are built on platforms where there is an element of interoperability across different cryptocurrencies, which facilitates access in and out of a particular asset within that ecosystem.

A final source of demand for cryptocurrencies comes from individuals and businesses that value the pseudo-anonymity associated with them. Illegal activities such as money laundering have found in these cryptocurrencies a vehicle for digital transactions outside of the official banking system.[186] In addition, in countries with strong capital controls, cryptocurrencies have allowed for the use of parallel currencies without requiring access to any official currency.

4.2.3 From Bitcoin to stablecoins

The large volatility of cryptocurrencies has led to several initiatives designed to provide stability to the value of these new forms of digital money. Many of these initiatives are still supported by the same technology as the original cryptocurrencies, namely, distributed ledger technology (DLT) (of which blockchain is one example).[187] These technologies are typically associated with decentralised models of governance and verification of transactions, without a central authority. The label 'blockchain' is often used to refer to the universe of technologies that share some of the features of the Bitcoin model, but not all. As an example, it can refer to technologies where there is a central authority in charge of the verification of transactions (a 'permissioned' or 'private' blockchain). Finally, one can also store these assets or coins in technologies that have very little to do with DLT (i.e., traditional databases).

186 Foley et al. (2019)
187 Bullmann et al. (2019).

In our analysis we will ignore these technological differences and refer to all these assets as 'stablecoins'. By a stablecoin we mean a digital asset that is liquid enough to be considered as money (even if it is not universally accepted) and whose value is fixed to a traditional currency.

There are several key features of these new forms of digital money:

i) the way in which stability in value is achieved;
ii) the ability of holders of the stablecoin to redeem their value back into traditional currency; and
iii) the governance of the stability mechanism and the extent to which redenomination of its fixed value is possible.

From an economic point of view, each of these features also appears in any type of fixed exchange rate between two currencies, and in our analysis we will often refer to the parallels between the two arrangements.

We find three alternative mechanisms by which stablecoins guarantee the stability of their value:

i) An arrangement where the value of the coins being issued is fixed to a traditional currency and the issuer ensures the stability of the value through a pool of safe assets of equal value to the liabilities it has issued. In addition, there is a redemption mechanism to convert the new coins back into traditional fiat money. Tether is by far the largest of this type of stablecoin, with a value pegged to the US dollar and a supply of well over $4 billion. The newly proposed LibraUSD and LibraEUR also fall into this category.
ii) Over-collateralised coins where the stability of the value is supported by assets denominated in a different currency than the peg, with the assets typically denominated in cryptocurrencies (although in some cases it can be commodities). The reason for using cryptocurrencies is that it allows the system to function within the 'blockchain platform'. The reason for the over-collateralisation is that the value of these currencies can fluctuate, and there is a need to guarantee that it never goes below the value of the liabilities. The best-known example is Dai, with a market value of above $100 million.
iii) An algorithmic rule that controls the supply of the asset to ensure that the price stays stable relative to a traditional currency. While this represent an innovative approach towards fixing the value of a currency, so far it has not proven to be a successful model.[188] Basis was one of the original and better funded start-ups pursuing this model, but the project never materialised and the company returned the majority of $133 million raised to investors. NuBits is an algorithmic stablecoin that started operating in 2014 but its value collapsed in 2016; it was repegged to a new value but since then has continued losing value relative to the US dollar.[189]

188 Bullmann et al. (2019).

189 Saga is another example of a new coin that uses an algorithmic monetary model to determine its value, but it is not a stablecoin because its value is expected to increase over time relative to the IMF SDR basket. It started as a fully backed coin with a value of 1 SDR, but then switched to a 'fractional reserve' monetary model where its value is expected to increase over time. In some ways it can be seen as a crawling peg; the price path is not pre-announced, but depends on its demand via an explicit monetary model.

All of these examples involve a coin that has its own unit of account (it is not simply a digital version of a traditional currency), but one that is stable relative to the traditional currency. There are interesting issues regarding the way the assets backing the value of the coin are kept and whether they can be accessed automatically (because they are 'on-chain') or require a central custodian accountable for holding the assets (because they are 'off-chain'). We will ignore these issues and focus only on the economics of the stability of value.[190]

The economics of providing stability is very similar to the features of fixed exchange rates, via the commitment of a central bank. For example, the use of assets to sustain the valuation of the coin and provide trust resembles the use of foreign reserves in fixed exchange rate systems. In fact, many stablecoins are designed following the principles of an extreme version of fixed exchange rates, namely, currency boards. Stability is ensured by having a pool of liquid assets available and denominated in the currency to which the coin is pegged that is of equal value to the liabilities being used (the stablecoin). As long as there is commitment to the redemption mechanism, the stability of the peg should be guaranteed.[191]

How does the redemption mechanism provide stability? The commitment to keep the value constant and the redemption mechanism associated with the assets backing this commitment are akin to the central bank intervention of fixed exchange rates. Private investors understand this and are likely to trade at a price very close to the peg. What if the price deviates from the peg? Either there is an intervention by selling or buying the 'reserves', or private arbitrageurs step in and take advantage of the price differential. In the case of the largest stablecoin, Tether, it seems that the latter mechanism is the one that provides most of the stability.[192] But, of course, arbitrageurs provide this stability because of the ultimate commitment of the issuer of the stablecoins to redeem them for the traditional currency.

A key issue in these arrangements is the commitment to the pre-announced fixed value of the currency. In the case of fixed exchange rate arrangements, there can be circumstances where the central bank finds itself in a position where it is optimal to renege on its commitment. While a currency-board type arrangement guarantees that sustaining the peg is economically feasible, it may not be politically feasible.[193] Here, there is no obvious parallel to stablecoins. There is no monetary policy associated to these coins, there is no government in desperate need of seignorage, so the possibility of a 'devaluation' must be associated with a failure of the business model to maintain the value of the assets, or just fraud. This issue becomes one of governance, regulation and supervision. In many ways this resembles more the enforcement of the commitment of any financial institution to honour its liabilities denominated in a traditional currency, in particular those that resemble money.

One way to reinterpret the design of stablecoins is that they are simply providing a particular digital form to the value of a previously issued asset. There are a variety of digital forms of money that have been in place for years that follow this model but that do not rely on a separate unit of account. Pre-paid debit cards or electronic wallets (such as Venmo in the US or WeChat in China)

190 Claeys and Demertzis (2019).
191 Ghosh et al. (2000).
192 Lyons and Viswanath-Natraj (2019).
193 Hanke (2002).

are all examples of a digital asset that is liquid. What guarantees that the value of that asset (call it $1 Venmo) is equal to the value of the underlying traditional currency (i.e. $1)? The answer is the trust in the provider of the digital asset that it has the necessary assets (or future income) to back the stated value of the asset.[194] And there are many other examples that come in slightly different flavours. A Starbucks card is an asset that promises a fixed redemption value against the goods sold by the issuer. The mechanism is the same even if this is a very restricted form of money, given the limited acceptance of its use as a means of payment, just by the issuer.[195] Similarly Apple cash can be used for purchases of Apple products but also for P2P payments.

Box 8 Why a separate unit of account?

An interesting economic question concerns the value of creating a separate unit of account if it will be fixed to the traditional one. Why not use digital versions of the regular currency? There are two potential arguments. The first is about the technology. When the technology used as a storage of information for the value of the assets is related to DLT (or blockchain), adding a separate unit of account might be necessary. For example, Tether is a cryptocurrency that is traded on the blockchain. As such, calling it a US dollar would be confusing and would possibly attract the attention of regulators. Tether can now be traded through cryptocurrency exchanges using the usual tools associated with these assets. Similarly, JP Morgan Coin is a stablecoin running on a permissioned blockchain platform which is a variant of Ethereum. The coin is supposed to be used for settlements of wholesale payments.[196]

The second reason for having a different unit of account is to create some restrictions on where payments can be carried out. Some tokens can be used only within a certain platform, ecosystem or store. Tether and the JP Morgan coin fall into this category, but it is also true for some virtual currencies created for trading within video games, and even store gift cards.[197] A platform-specific token offers some potential benefits by engaging customers, reducing the transaction fees associated with other forms of payments and even reducing the cost of funding. These benefits have to be traded off against the costs associated with a restricted form of digital money. Under certain circumstances, it might be beneficial for companies to issue pure non-tradable tokens that are restricted in their use to their platform.[198]

194 In a historical analysis of money, Schnabel and Shin (2018) suggest that even older forms of money, such as that issued by the Bank of Amsterdam in the 17th century, could be seen as stablecoins because of the anchoring of their value to the assets held by the bank.

195 Under some circumstances, its value can be redeemed back into the traditional currency (i.e. US dollars), but the process takes time so it cannot be considered a liquid asset.

196 See https://www.jpmorgan.com/global/news/digital-coin-payments

197 Gans and Halaburda (2015).

198 You and Rogoff (2019) provide a detailed analysis of these cases. Their analysis also makes explicit the heterogeneity in the forms of tokens one can design (redeemable versus non-redeemable, interest bearing versus non-interest bearing). This heterogeneity, together with different environments in terms of taxation and regulation, could lead to different optimal solutions for issuers of tokens.

The restriction in terms of how these assets can be used as a means of payment takes us back to our earlier discussion of the separation of the value of the asset and the payment technology when it comes to digital money. Not all forms of money are universal. Even broader forms of digital money such as pre-paid debit cards or electronic wallets are restricted in their use because not every merchant accepts credit or debit cards and not all accept all forms of electronic wallets. And we can even argue that the same is true for deposits in a bank account as a form money. To use the balance of a bank account, one requires a certain payment technology that might also be restricted. Not all stores will accept all credit cards or cheques.

In summary, from an economic point of view stablecoins resemble many other forms of digital money where the value of the asset is tied to the traditional unit of account and backed by some other previously issued assets. Stablecoins might come with their own name (i.e., a separate unit of account), but as long as their peg is as credible and trustworthy as the value of the liabilities of other forms of digital money (bank accounts, electronic wallets), they can end up with similar functionalities and similar risk to any other digital representation of traditional currencies. How trusted these stablecoins are will ultimately depend on their convenience and ease of use of their technology, but also on governance and the way they are regulated. We will come back to these issues when we address the regulatory perspective of these new forms of money.

4.2.4 Retail versus wholesale stablecoins

The development of stablecoins has occurred in both retail and wholesale payments. In retail payments, they are competing with a well-established system of digital transactions that makes use of bank accounts and settlements via the central bank. This is not the case in wholesale payments, where the potential for improvement may be much greater. Today, when it comes to wholesale payments, participants need to rely on other intermediaries (for example, banks) for settlements. The intricated network of communication and verifications leads to serious delays in the settlements of, for example, purchases of securities. A digital token that is available to all participants and is used to facilitate the payment and settlement of these transactions could represent a large improvement in the efficiency and speed of these markets. It could switch these markets from the current model of 'delivery versus payment', where delivery of the asset follows confirmation of payment, to one of 'payment versus payment', where both the payment and the delivery are done immediately and simultaneously.[199] It would make sense for such a digital token to be a stablecoin, given the necessary certainty in the value of the asset used for the payment. Two of the most prominent examples of stablecoins being developed for this purpose are the JP Morgan coin and the Utility Settlement Coin (USC) launched by Fnality. In the case of USC, a consortium of banks provides a digital asset that is backed one-to-one by reserves held at the central bank. This digital asset is made available to others for the settlement of wholesale transactions. Given the opportunities and the current backing of established financial institutions, we could see much faster progress on stablecoins for wholesale payments than for retail payments.

199 BIS (2019b).

4.2.5 Global stablecoins

The stablecoins we have considered so far have their value fixed to a particular currency, but one could in principle design units of accounts that are fixed to a basket of currencies. Libra, originally announced as a global stablecoin by the Libra association, is the best-known example of this.[200] The logic behind Libra is, once again, familiar to the world of fixed exchange rates, where pegs are occasionally set against the value of a multiple-currency basket. This is true for the Singapore dollar, the Chinese yuan and the IMF SDR. However, none of these cases is exactly what the Libra association has in mind. The SDR it is not available as a means of payment, and in the case of the other two currencies the peg to the basket is loosely defined, with limited transparency on the basket and bands. This flexibility allows for fluctuations in the value of the currencies.

Libra is supposed to have a fixed value relative to an explicit basket where the weights on each of the currencies are known in advance. The Libra white paper specifically refers to its design as a currency-board type.[201] The logistics of a currency board using a basket of currencies are not as obvious as with a single-currency board. In the single-currency currency board, the value of the assets will, by design, always be identical to the value of the stablecoin being issued. In the case of a basket, if redemptions are allowed, these do not need to take place in exactly the same proportions as the basket to which the stablecoin is pegged. This means that the reserves would have to be constantly rebalanced to ensure that the valuation of the assets matches those of the liabilities.

Beyond these logistical complications, there are several issues raised by global stablecoins. While these coins are stable relative to the basket, they fluctuate relative to national units of account. This makes them a less-than-ideal means of payment for those whose transactions are always denominated in the national currency. How costly this additional volatility is depends on the volatility of the currencies included in the basket. Interestingly, given the recent low volatility of major exchange rates, these costs could be similar to, or even lower than, the potential transaction savings of a digital coin.[202]

But even if the volatility associated with these coins is limited, the potential destabilising effect of running a parallel currency, and its influence on monetary policy as well as other regulatory issues, has raised significant concerns among policymakers.[203] As a result, we have seen a very strong reaction from regulators around the world against the Libra project, in some cases leaving limited room for the development of such projects.[204] Other regulators and government officials have offered a more measured response, suggesting the need to pause and reflect on the consequences before approving any global stablecoin. That was the coordinated response of the G7 group, which wants clarity on the stability and market concentration effects of these new forms of money to design a new regulatory framework before approval.[205]

200 Although originally conceived as a global stablecoin, the latest white paper by the Libra association is now planning to also issue a set of single-currency stablecoins (using the US dollar or the euro as the reference) as well as the global Libra stablecoin; see https://libra.org/en-US/white-paper/.

201 See https://libra.org/en-US/white-paper/#the-economic-and-the-libra-reserve

202 Fatas and Weder di Mauro (2019b).

203 Eichengreen (2019) and Cecchetti and Schoenholtz (2019).

204 "We cannot allow the development of Libra on European soil" was the response of Bruno Le Maire, the French finance minister (see https://www.ft.com/content/6d414606-d549-11e9-a0bd-ab8ec6435630).

205 Group of Seven (2019).

4.3 The role of regulators and central banks

So far, this report has considered private activities to create new forms of digital money. Given these new forms of digital assets, is there a role or need for policy intervention? There are two separate questions that we will consider in this section. First, do central banks and regulatory (or supervisory) agencies need to play a more active role in the development or monitoring of these new forms of money and payments? And second, how should regulations be adapted to take into account new products and new institutions from a perspective of financial stability or consumer protection?

4.3.1 Central bank digital currency (CBDC)

Central banks are key to the provision of money both in physical and digital form. They are in control of the physical cash in circulation and, when it comes to digital forms of money, they are involved in the creation and management of accounts of commercial banks at the central bank. These accounts are used as the ultimate means of settlements for most payments by the private sector.

The current infrastructure relies on commercial banks as intermediaries that provide indirect access to the central bank liquidity via bank deposits through fractional-reserve banking, a model that has been around for decades. As we discussed earlier, some of the innovations in the financial sector are creating alternative digital forms of money and payments, and in some cases these forms might be less dependent on, or completely independent from, the central bank. In addition, in some countries physical cash is disappearing, leaving the central bank with a very limited role in the provision of liquidity.[206] Should the central bank take a more active role in these developments? In particular should the central bank offer access to its accounts to everyone and not just to commercial banks? This is what we refer to as central bank digital currency (CBDC).[207]

If we ignore some of these complications associated with the different parts of the payment systems, we can simplify the debate on CBDC to the question of whether the central bank should offer accounts 'for all', including households and potentially any private company, not just commercial banks.

The potential benefits of CBDC are centred around the efficiency of one system for managing liquidity and payments, something that the private sector might not be able to achieve without coordination. The efficiency of settling payments at a central repository of accounts is similar to the notion of all private agents 'banking with the same bank'. It eliminates all complications associated with the sharing of information, the verification of identities, errors in communication and potential credit risk when several layers are involved in the transaction. But one could make the argument that such a system could be provided by the private sector even if there were multiple institutions involved. And in some countries, the role of the central bank in the current configuration of the payments infrastructure is not seen as the most efficient one, with the central bank perceived to be behind the curve when it comes to innovations. The private

206 One of the most visible cases is Sweden, where physical cash withdrawals from cash machines fell by 50% in the period 2012-2018. At the same time, payments via mobile phones (using the Swish network) multiplied by a factor of 10 and in 2018 their volume was double that of the cash withdrawals (see https://www.riksbank.se/en-gb/payments--cash/payments-in-sweden/payments-in-sweden-2019/the-payment-market-is-being-digitalised/)

207 See Boar et al. (2020) for a survey on current CBDC projects by central banks.

sector can be a catalyst for improvements in the overall payments system. For example, in some countries we have seen developments by the private sector in creating separate parallel private networks for regular bank-to-bank settlements (thus replacing the central bank). In the US, the Clearing House is a private network of banks that runs a private settlement system in parallel to that of the US Federal Reserve (CHIPS). As of November 2017, this network also includes real-time payment system.

What is the argument against having the private sector run and organise all digital payments? Is there a market failure that requires central bank involvement? There are several potential arguments:

i) CBDC represents a modern version of the historical involvement of central banks in the provision of banknotes and reserve accounts for commercial banks, both of which have always been at the centre of the retail payment systems. This is particularly relevant in countries such as Sweden, where the use of physical cash is decreasing rapidly and the central bank feels pressure to provide a digital equivalent to money to avoid the whole payments infrastructure being run by the private sector.

ii) Related to the previous point, payment systems are subject to large network effects. If left to the private sector, we could end up either with a system of multiple parallel systems or one dominated by a monopolist. Multiple parallel systems would be inefficient given the need to keep a pool of liquidity in each of the competing networks and the potential economies of scale of a single integrated payment system. The more likely scenario is one of concentration in very few or potentially just one provider, and this would limit the benefits of competition and leave the payments infrastructure in the hands of a small number of private companies.

iii) CBDC, by not being motivated by purely profitable motives, could also be a catalyst for the adoption of digital forms of payments by a larger share of the population, improving financial inclusion and replacing cash, which is a costly form of money.

iv) CBDC could be seen as a way for central banks to remain more in control of monetary policy. Not only would the central bank be in control of the interest rate of a larger share of the deposits, but it would potentially be able to set interest rates below zero, under the assumption that physical cash has become less relevant and therefore the zero lower bound does not apply.[208]

The first three arguments are relevant to the current economic environment of a deep economic crisis that requires large stimulus packages by governments. Governments need to take actions that involve payments (transfers to individuals, grants to firms). Obviously, these payments will not be made via cash, the form of money controlled by the government, given the delays and logistics involved. The payments need to be made through bank accounts. The government has information on bank accounts through the administration of tax refunds (or

208 Bordo and Levin (2017).

payments), but this information might be incomplete. With a digital form of money available to all citizens ('reserves for all'), these payments could be made immediately and there would be a strong signal about the public ownership of the actions.

But CBDC does not come out without risks. Bank accounts are more than just the balance necessary for the settlements of transactions; they are associated with many other customer-oriented services in which the central bank might not have a comparative advantage, from enforcing regulatory requirements ('know your customer', anti-money laundering) to the interactions with other banking services (credit and debit cards, mobile banking, etc.). The private sector has developed an expertise that might not be easily replicated by central banks and where competition could be required to keep innovation going.

But the biggest perceived risk is not operational inefficiencies but potential disintermediation of the banking sector. If central banks can take advantage of the centralisation of settlements and offer a cheaper system that, in addition, is seen as safer than any private alternative, it could lead to a significant shift of deposits from commercial banks to the central bank. This will increase the cost of funding for banks, and it will be even more problematic in times of crisis where the safety of the private banking sector might be questioned. It could lead to bank runs.[209]

What is the risk of bank runs in the presence of CBDC? It all depends on the way the central bank deals with funding of banks both in normal times and in crisis. The central bank might be seen as more stable than commercial banks and become a deposit monopolist, attracting all the deposits away from commercial banks and endangering maturity transformation.[210] But this need not always be the case. If a central bank is willing to lend reserves to commercial banks in order to replace the deposits moving away from their balance sheets, banks' lending behaviour will be unaffected by CBDC and the probability of a bank run will remain the same as without CBDC.[211] The key issue is the way the central bank manages its asset side, whether it lends or not to banks and the rate and availability of those loans.

Given the potential risks of bank disintermediation by CBDC, a few solutions are being explored. One of these is to limit balances at the central bank accounts. CBDC might only be issued against eligible securities, or strict limits could be imposed on those accounts.[212] A second potential solution involves modifications to the way interest rates are applied on CBDC balances. Either by applying below-market interest rates or by introducing a tiering system of interest rates, the central bank could limit the amount of disintermediation it creates.[213]

209 Griffoli et al. (2018).

210 Fernández-Villaverde et al. (2020).

211 This result is true as long there are no regulatory binding constraints on banks (Andolfatto, 2018). A similar, although more abstract, conclusion is reached by Brunnermeier and Niepelt (2019), who establish a proposition under which private and public forms of digital money can coexist and lead to the same equilibrium.

212 Kumhof and Noone (2018).

213 Bindseil (2020) or Engert and Fung (2017).

Box 9 Global CBDC

When we look at the concept of CBDC at the international level, there are additional considerations to take into account. At the global level, there is no centralised system of payments, which has led to the dominance of the US dollar in international payments, invoicing and issuance of assets. The dominance of the US dollar has been on ongoing concern, partly due to fact that the US economy will keep shrinking as a percentage of world GDP but also after the experience of the Global Financial Crisis. The current US dominance is seen as not sustainable in the long run.[214] In addition, since the breakup of the Bretton Woods system, there has been limited appetite for coordination of central banks. These changes have also led to the 'weaponisation' of the US dollar dominance. Access to the US dollar payment system is under the control of the US administration, and this access has been used as a tool to enforce economic sanctions against certain countries.

While many of these issues are not directly linked to any of the technology innovations we have discussed here, there are two important ways in which they are related. Some of the central banks behind currencies that could replace, at least partially, the US dollar are considering issuing CBDC. The central bank of China has indicated that its plans to issue CBDC are fairly advanced.[215] Providing digital access to central bank accounts for all could make a difference in terms of the international use of the renminbi.

The second connection is the fact that developments in the private sector might be running ahead of central banks' plans. The possibility of a private global stablecoin such as Libra is a good example. Libra is designed as a global stablecoin that, if successful, could become a global currency. Should such a project be left in the hands of the private sector? Some policymakers have been very vocal that central banks need to find an alternative before Libra or any other private sector initiative manages to produce a successful global digital form of money.[216] It is clearly too early to tell where these discussions will lead central banks, but the inherent global interconnectivity of technology and the new ventures coming from the private sector could be a wakeup call for governments and central banks to coordinate, facilitate and maybe issue a global digital currency.

There is an implementation of CBDC that does not require the central bank to provide accounts for all. The central bank could give access to financial institutions that are not banks but issue different forms of electronic money (such as electronic wallets). These institutions would be required to operate as narrow banks and back the value of their liabilities with assets at the central bank. By doing so, these private institutions will be providing a digital equivalent of a central bank account (referred to as 'synthetic' central bank digital currency).[217] The central bank remains in control of liquidity, but it does not need to deal with all the customer-centric activities of running checking accounts. While

214 Gourinchas (2019).
215 See https://www.ft.com/content/e3f9c3c2-0aaf-11ea-bb52-34c8d9dc6d84
216 Carney (2019).
217 Adrian and Mancini-Griffoli (2019).

this solution addresses some of the operational issues we mentioned earlier, it is not immune to concerns regarding how it will affect banks. It could lead to disintermediation of the fractional-reserve banks, and bank runs in times of crisis.[218]

4.3.2 Regulation

Even if central banks do not launch their own versions of digital money, the new private forms of digital money require a rethinking of how we regulate the institutions that are issuing them. Regulators have been occasionally caught off guard because of the speed of change and the difficulty of mapping the new assets and institutions into the traditional regulatory model.

The framework of regulation of money and its different forms has traditionally been centred around the banking version of money. Banks accept deposits that have a fixed redemption value, can be redeemed by central bank money (banknotes), can possibly earn an interest rate, might require maintenance and other fees and, in most countries, are protected up to a certain amount by some form of deposit insurance. Banks engage in maturity transformation and lending with the associated liquidity and solvency risks. Regulation of liquidity and capital is designed to provide the necessary protection to consumers and create a stable banking system.

In addition to money sitting in bank accounts, there have been other forms of saving that are liquid enough to call them money. These assets have also been subject to a well-defined regulatory environment. For example, money market funds provide a potential return to depositors with very limited risk because of the assets they hold. While money market funds do not quite promise a fixed redemption value, they are seen as having almost no downside risk. Recent cases where their value went below the original deposit value (known as 'breaking the buck' in the US) have led to new regulations designed to reduce the risk and maturity of the assets being held by these funds.[219] There are other forms of investments that are not quite as liquid and are not typically considered forms of money. These expose savers to risk and potentially higher returns. For example, exchange-traded funds (ETFs) cannot guarantee a fixed redemption value; instead, theirs shares promise the value of the assets held on the funds and that value will be as risky as the risk composition of those assets. Because of this they are regulated as securities.

The initial response of regulators to new forms of digital money has been to try to fit them into one of these categories. The spirit is to ignore the technological differences and treat assets with the same risk with the same regulations. As an example, the Swiss regulator (FINMA), one of the regulators that has been more open to FinTech innovations, has issued guidelines on a potential regulatory

218 This seems to be the project currently being tested by the People's Bank of China, the Chinese central bank.

219 In the US, a new regulation (Rule 2a-7) required that money market funds can no longer have an average maturity exceeding 60 days and there were also stringent criteria on ratings.

framework for stablecoins.[220] In these guidelines different cases are being considered, but the principle is clear: 'substance over form' and 'same risks, same rule'. When following that approach, there are some standard categories of digital money that can fit into current regulations (see Box 10 for examples).[221]

Box 10 Fitting stablecoins into a regulatory box

How might stablecoins be categorised? It should depend on the way they are structured, their governance and redemption rules and the risk of assets they use to back the value of the coins. Below are three potential categories.

i. A digital stablecoin linked to a traditional currency with a fixed redemption value and where the issuer has safe assets in custody that are equal in value to the liabilities being issued. This falls under the category of an electronic wallet or electronic money in the revised payment service directive in Europe (PSD2), requiring institutions issuing them to register as electronic money institutions. The regulation imposed on them is light given the limited risk. The level of regulation could also depend on the potential volume of the deposits. For example, gift cards represent a much smaller risk than electronic wallets with unlimited balances (this distinction is made in, for example, the guidelines of the Australian regulator).[222]
ii. A digital stablecoin that is linked to a traditional currency (or a basket of currencies) with a fixed redemption value (i.e., the risks of the balance sheet still fall on the issuer and not the holder). Given that the valuation of the assets can change, the issuer will need to have enough capital to absorb the losses. FINMA (2019), for example, argues that this falls under Swiss banking law. Regulations should then follow the standard regulations of banks.
iii. A stablecoin that is linked to a traditional currency (or a basket of currencies) where the risk is borne by the account holder (and not the issuer). FINMA (2019) suggests that this can be seen as security, a collective investment scheme, and the usual regulations apply.

The logic behind the above categorisation is clear: to distinguish the assets by the risk that they impose on their holder.

But this approach of fitting these digital assets into a standard regulatory category faces difficulties. Many of the potential new assets could fall into categories that are somewhere in between the three examples in Box 10. As an example, the new single-currency versions of Libra (such as LibraUSD) are built on the model of a fixed redemption value. The white paper mentions that the assets held to back up the value of these coins will be safe assets of short maturities. From a risk perspective, this resembles a money market fund (not a bank). But unlike the case of money market funds, it does not promise a return to asset holders. It is not quite electronic money or an electronic wallet because the funds are not deposited at the central bank or a commercial bank with a deposit guarantee.

220 FINMA (2019).
221 See Adrian and Mancini-Griffoli (2019) for a more comprehensive classification of different forms of money.
222 APRA (2020).

What should regulators do with each of these unique proposals? They could engage in a model of tailoring regulations to each of these innovative digital products, but that is unlikely to happen given the tradition of regulating institutions, not products.[223] It is more likely that regulators will force a limited set of regulations into these innovations. While in some cases this might stifle innovation, it would create a simpler and more transparent regulatory framework.

Beyond the question of how to regulate the risk of these assets there are, of course, many other regulatory aspects that also need to be clarified. When it comes to regulations regarding KYC/AML, the approach of regulators is to be broad and apply them to most of these new products unless their size and use are limited by design.[224] There are also some specific issues regarding new forms of money, in particular those associated with decentralised governance (such as DLT) where responsibility, accountability and recovery procedures need to be properly specified. Finally, the cross-border nature of these products and the extent to which international cooperation is needed is another very important dimension. While this applies to any financial product, it becomes more relevant given the virtual nature of these assets and the fact that some are defined as global assets.[225]

4.3.3 Financial regulation or competition policy?

So far, we have discussed the issue of regulation from the perspective of financial risks, operational risks and consumer protection. There is one more dimension that is important: some of these digital innovations are associated with platforms and ecosystems where these coins can be used. In some cases the use of these coins is restricted to the platform, in other cases the use of these coins is through interfaces from part of the platform (messaging apps, for example). As an example, the development of WeChat wallets as a significant mobile payment channel in China is directly linked to the use of WeChat as a communications technology. Over time, some of these platforms have become 'superplatforms' that handle a large variety of services. This is particularly the case in Asia. In Indonesia, GoJek provides services that include transport, entertainment, dry-cleaning, food delivery as well as payments.[226] As digital ecosystems grow, network effects, which are already present in most forms of money or payments, become a potential threat to competition.[227] Payments themselves can be simply a part of the ecosystem, maybe not the service where profits are produced but one that attracts a lot of attention and generates a lot of engagement.[228] Because of this, competition policy becomes particularly relevant when it comes to digital payments that are associated with a platform. If use of the digital coins is restricted to that platform, regulatory concerns might be less.[229] But if the coin can be used as a universal payment system, it can be the key to creating a closed network, providing a barrier to competition.[230]

223 Vives (2017).
224 APRA (2020).
225 Group of Seven (2019).
226 https://www.gojek.com/about/
227 See Calvano and Polo (2020) for a recent survey of the literature and Crouzet et al. (2019) for an example of adoption externalities in digital payments.
228 Prat and Valletti (2019).
229 Gans and Halaburda (2015).
230 See Brunnermeier et al. (2019) for a discussion on the role of platforms in digital money.

In these cases, competition policy can either take the form of dealing with monopolistic behaviour by dominant firms or guaranteeing innovation and competition by removing barriers to entry. An obvious example of these policies is the regulation of interchange fees for credit cards to ensure a level playing field in one of the most important parts of the payment system. The European Commission, for example, has placed caps on these fees since 2015. Initially, the caps were applied to internal payments, but they were extended to external payments in 2019.[231]

Regulating prices might not be enough, however. An objective of competition policy should be to ensure reduced switching costs and allow for interoperability of the different platforms. This can be achieved in two ways. The first is to set universal standards when it comes to network payments – for example, the development of unique QR codes for merchants that allow authentication and potentially establish a link to the merchant's bank account, as in Singapore.[232] A similar example is the development of universal interfaces for payments, such as the Unified Payments Interface in India. The interface provides the necessary infrastructure to handle the inter-bank payments associated with transactions. These two examples highlight the importance of creating a level playing field for all forms of electronic wallets and payment apps, ensuring that users do not get locked into a particular payment technology. They also create efficiency by unifying the authentication and payment methods.

The second way to create competition is open banking. The idea is to provide, via APIs, access to the balances of bank accounts for any platform or mobile app authorised by the user. The motivation of open banking is to reduce the monopoly power of commercial banks when it comes to deposits. Because of switching costs, banks have a captive audience. Open banking, by allowing those accounts to be used for other services, reduces the ability of banks to restrict the services offered by others to their customers.[233] While open banking was designed to limit the monopolistic power of banks, its logic can be applied to new forms of digital money such as stablecoins, in particular those offered by BigTech companies.

4.4 Technology, new entrants and competition

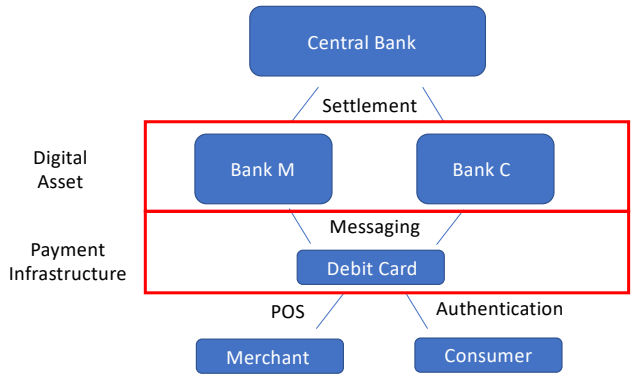
In Section 4.2 we introduced new forms of digital money, from cryptocurrencies to stablecoins. These assets need to find their way through the payments system to become a medium of exchange. Payments systems are complex and require many parts, each possibly controlled by a different actor. In this section, we provide an analysis of the different actors that play a role in payments. The goal is to understand their motivation, strategy and the way they interact with other parts of the system. In the next section, we use these insights to understand how changes in this environment are affecting the competitive landscape for banks.

231 See https://ec.europa.eu/commission/presscorner/detail/en/IP_19_2311
232 See https://www.mas.gov.sg/development/e-payments/sgqr
233 Zachariadis and Ozcan (2016).

4.4.1 Banks, payments and transfers

To frame our discussion, Figure 27 shows a simplified version of the different actors in a payment associated with a transaction between the buyer ('consumer') and the seller ('merchant'). It involves two banks, the central bank performing the settlement and a payments network that, for simplicity, is represented as a debit card. The payments network authenticates the buyer (via a signature or a PIN code) and the merchant provides the necessary hardware and software via a point-of-sale terminal (POS).

Figure 27 Payments infrastructure for retail purchase



Banks are central to this transaction. They hold the accounts of the two parties, they control the settlement via the central bank, and they partially or fully control the payment infrastructure in partnership with the credit and debit card companies (in many countries, the issuance and risk assessment of credit cards is managed by banks).

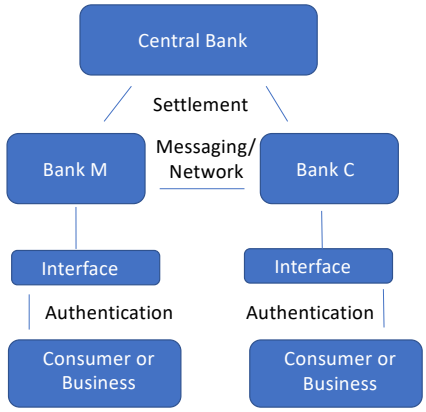
Payments can also take the form of bank-to-bank transfers. This is typically the case for consumer-to-consumer transfers and business-to-business transfers, and it is becoming increasingly common in transactions between a business and a consumer (Figure 28).

In this case there is no intermediary (such as a debit card or the associated POS network) but rather an interface, via online banking or a smartphone app, that allows for communication with a bank; and then a network of interbank payments associated with the settlement performed via the central bank.

Many of the recent technology changes in payments aim to innovate in all or parts of either (or both) of the processes above. The rationale is that there is room for improvement as payments and bank-to-ban transfers are considered slow and costly.[234]

234 Hayashi and Keeton (2012) provide a review of estimates of different retail payment methods. For estimates of cross-border transfer costs, see https://remittanceprices.worldbank.org/en. Bech et al. (2017) make the case for the need for faster payments.

Figure 28 Inter-party transfers or payments

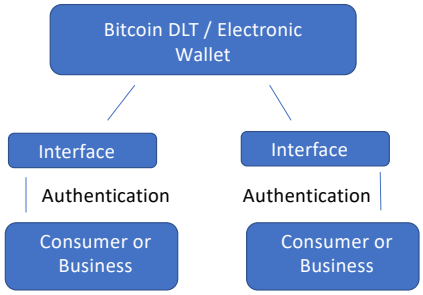


4.4.2 Banking with a single bank or multiple payment networks

The most radical disruption to the above model is caused by launching a separate currency and a unique ledger where all accounts are held (Figure 29). This fits well the Bitcoin model, which represents an alternative to the full payments system and even to the central bank.

Figure 29 represents the model of electronic wallets or stablecoins if the two parties share a balance in the same network; this could also be a representation of CBDC, where all citizens have accounts.

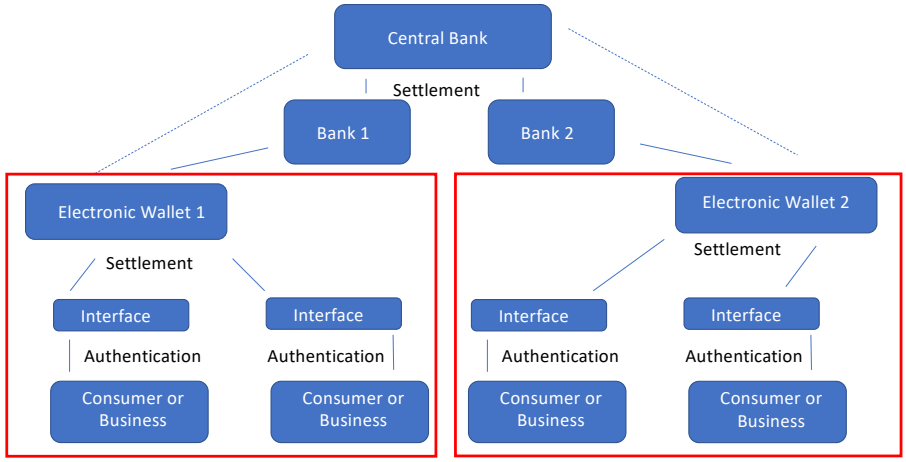
Figure 29 Simplifying payments via a single 'bank'



This 'closed loop' model is clearly the simplest due to the lack of intermediaries. But in a more realistic scenario, where there is no full adoption of one particular payment technology, what we have is a set of networks where payments can be summarised by Figure 30, but each of these networks is then connected to the overall payment system and possibly to the central bank.

In this configuration we need a way in and out of each of these networks, sending us back to the representation of Figure 28 with a set of intermediaries connected to a central system (possibly the central bank). Figure 30 is a schematic representation of what this might look like. We have two separate closed-loop networks managed by electronic wallets (possibly using a stablecoin). These electronic wallets have connections either to an intermediary (a bank) or directly to the central bank to provide the ultimate form of settlement.

Figure 30 Networks of closed-loop payments connected to the central bank



The co-existence of multiple networks adds complexity to transactions and might lead to a situation where users need to keep liquidity in different networks. This would have been unthinkable a few years ago, but with the improvements in technology and omnipresent mobile devices connecting all the nodes in these networks, moving or managing value across each of these nodes has been become a reality in many financial systems.

The rapid proliferation of electronic wallets and the associated payments in Asia follows the model of Figure 30. In China, WeChat and Alipay have grown over time to become dominant in the world of electronic payments. Both have direct access to the central bank, and they are used by more than 90% of adult internet users. Originally developed as wallets for P2P transfers, they have become central to the payment infrastructure in China. To move towards a C2B and B2B payment solution, they have incorporated QR code payment systems. These systems were originally independent of each other, but recently Tencent (which owns WeChat) has agreed to a common standard with UnionPay (the main provider of credit cards and debit cards in China).

The disruptive development of electronic wallets in China and also in the Asia Pacific region means that today electronic wallet payments account for the majority (52%) of electronic commerce payments in the region and represent the largest form of electronic payment in POS payments.[235]

235 WorldPay (2018).

We have seen similar developments in other emerging markets, including the growth of M-Pesa in Kenya and other countries in the region and Mercado Libre in Argentina, Brazil and Mexico.[236]

In advanced economies the development of electronic wallets has been slow due to the strong initial position of banks. In addition, banks have reacted by improving the traditional technology to make it faster and more efficient. There are, however, some success stories in the P2P and e-commerce spaces. Venmo in the United States started as a P2P model of payments mostly for individuals. As time has passed, it has expanded into businesses as a means of payment in electronic transactions. PayPal started as a payment business for e-commerce, but over time it has also developed electronic wallet facilities. The reason for starting in e-commerce is that the infrastructure necessary to handle these payments does not require being part of the POS systems physically present in stores. What we see in these two examples is players that are trying to create different 'pipes' in the payment networks that avoid certain intermediaries and the associated costs. The dilemma that these companies face is that in avoiding certain intermediaries, their reach becomes smaller. For that reason, it is not uncommon that, as time passes and they establish themselves as credible players, we see them engaging in partnerships with the traditional intermediaries. For example, Venmo and PayPal both allow for interactions with bank accounts and credit cards so that they can be used in settings where either of these is necessary.[237]

In Europe the development of both electronic wallets and e-commerce providers has been slow because of a combination of strong bank presence and a cheaper and more efficient network of debit card payments than in the United States. This was because of the earlier adoption of certain technology standards (credit card chips and contactless payment, for example) but also because of regulatory actions that capped credit and debit card fees. In addition, e-commerce did not develop as quickly as in the United States or Asia, so it was a less attractive entry point for new entrants. The success stories were more in the P2P space, with forms of money that replicate the working of pre-paid debit cards together with an electronic wallet via a smartphone app. As an example, this was the initial strategy of Monzo. Interestingly, the majority of such start-ups have ended up transforming themselves into full banks.

4.4.3 Disrupting the pipes and the processes in payments

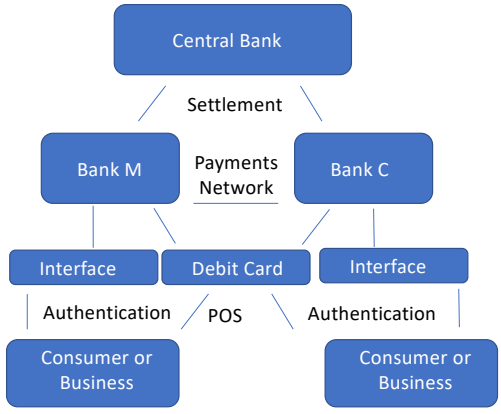
There are other forms of disruption that do not involve competing with banks for deposits. In the United States, instant payments or bank transfers have not developed at the same speed as in other countries, partly because of the slow reaction of the central bank. The private sector has stepped in with initiatives promoted by a consortium of banks. The Clearing House is a private settlement system running in parallel to central bank settlements. Zelle creates a digital payments network that allows for bank-to-bank transfers and attempts to mimic the P2P transfers created by new entrants (improving the payments network or the settlement process in Figure 31). Zelle facilitates instant payments via this digital network, but it also makes payments easier by allowing users to be identified by their mobile phone number as opposed to a long set of digits describing their bank account. About 50% of users with a bank account have access to Zelle and

236 Frost et al. (2019).
237 PayPal has owned Venmo since December 2013, but runs it as a separate service.

its network is being used by 70% of online US consumers.[238] From the perspective of banks, this allows them to offer a service and compete with new entrants with limited change to their business model. Customers do not need to create a separate account; the balance remains at their bank.

A different example of adding faster pipes connecting different parts of the financial system is offered by Plaid, a company that builds APIs for financial institutions to allow them plug into a network of partners. For example, lenders are able to collect information on the financial history of their applicants to better asses their risk. While this is not just about payments, it highlights the importance of networks connecting the different actors and also sharing information among them.[239]

Figure 31 Disrupting the 'pipes' of payments



A final example of innovation in the payments infrastructure has to do with authentication. Debit cards and credit cards traditionally relied on signatures, which can only be used in a physical store. This weak form of authentication is subject to large fraud risk, in particular when signatures are not allowed and the card is not present (i.e., online). Some regions moved quickly to cards with chips that required a PIN code for identification, with the extra safety reducing fraud risk. When it came to online purchases, where chip-and-pin cards were not a solution, improvements in authentication involved the use of more than one device (phone, email account) via two-factor authentication. As convenience in payments became an important feature, contactless payment technology became a reality. In some ways, this represented a backwards step in security, as there is no authentication of the user other than being in possession of the card.

All the above innovations in security were originally driven and controlled by credit card companies and banks. They did not challenge their business model and, if anything, they made it safer, more efficient and gave them a competitive advantage. Today, however, we are witnessing two developments affecting authentication and convenience in payments, which are the result of the displacement of the physical use of debit and credit cards in payments

238 See https://www.zellepay.com/press-releases/gift-giving-helps-zelle-wrap-2019-double-digit-growth
239 Visa announced the acquisition of Plaid on 13 January 2020.

in favour of electronic devices. Any electronic wallet or any payment done via online access to your bank account requires a device that modifies the current authentication methods. Authentication happens via a password managed by your device (a smartphone) or by a more secure, biometric method (fingerprint or face recognition technologies).

In some ways, this is no different from authentication of online banking that always require the user to be in possession of an electronic device (a computer or a smartphone). But as authentication moves to the electronic device, the control is passed from the banks to the companies that produce the hardware. Apple Pay, Samsung Pay and Google Pay are all payment methods that make use of strong authentication. To facilitate a payment, they have to connect to the infrastructure of credit and debit cards (to use Apple Pay, for example, you need a valid credit card) or they can also make use or any parallel payment infrastructure such as electronic wallets. While this might sound like a small technical change, it highlights the importance of the multiple parts involved in a payments system and who owns the most valuable piece of the network.[240]

Hardware companies like Apple can exploit the advantage of their ecosystem to enter payments systems even if they do not own any of the traditional elements of the network (they do not offer bank accounts or have a separate digital network of payments). They derive a monopoly power that they can exploit to extract rents from the payment fees and also control the data that are being exchanged. In some countries, such as Australia, banks blocked Apple Pay from accessing the payment system based on the argument that its hardware cannot be used by others to create alternative authentications systems, and requested regulatory changes.[241] Those changes did not happen, and Australian banks ended up providing access to the new technology, leaving Apple in control of the authentication process.

Finally, when it comes to in-store payments, the point-of-sale hardware, software and network can also be a bottleneck for innovation. Traditionally, there was one proprietary network controlled by the credit card companies or banks. In some countries multiple systems were developed, leading to confusion and increasing costs to the merchant. As electronic wallets developed, they needed access to the POS platforms to be used for in-store payments, but they did not want to deal with the intermediaries (and incumbents did not welcome the additional competition). The outcome was new and lighter solutions facilitated by the connectivity provided by the internet. The best examples are companies such as Square, which facilitate payments for merchants and are connected to the internet, and the increasing use of QR codes for payments. In both examples, almost no physical infrastructure is needed except for electronic devices that merchants and customers already own and are permanently connected to the internet.

240 The value of these technologies is now recognised by regulation. Legal limits on contactless payments differ depending on whether biometric authentication is used (as in the most recent implementation of the payment services directive in Europe).

241 See https://www.reuters.com/article/us-apple-australia-idUSKBN15R11I

4.5 Changes in the competitive landscape for banks

In Section 4.4 we highlighted the potential disruptions in payments coming from technology and provided examples of new entrants (FinTech start-ups and BigTech companies) making their way into digital money and payments. In this section, we take the banks' perspective and analyse how these changes are affecting their competitive landscape. Which lines of business are likely to be more disrupted? What potential strategies can banks follow to remain competitive?

4.5.1 Payments as an entry point for disruption

The competition from both FinTech and BigTech companies is likely to emerge in business segments that are profitable and where new technologies offer opportunities. These companies are likely to enter segments that can be easily separated from other bank business activities, attract customers and, as a result, reduce the profitability of banks.[242] The only way for banks to protect this erosion in profits is to remain competitive by becoming a low-cost producers in every product line where entry is feasible. This strategy might stand in contrast with the more traditional banking model that relies on bundling of both profitable and loss-making activities and strong customer relationships as a retention mechanism.[243]

Remaining competitive in those segments is partly about efficiency and low cost, but it is also about the need for a much more customer-centric view of their business rather than one based on products.[244] Technology has made banking a more fluid activity for consumers, and the priorities have shifted from safety and access to branches towards immediate and seamless mobile access to all services.

The segment where this threat seems to be the greatest, and possibly the one that has seen most entry to far, is payments. There are several reasons for this. Revenues from both local and cross-border payments are growing. Global payment revenues are expected to reach $2.5 trillion by 2028, which would represent a 150% increase on their 2010 level and more than a 70% increase relative to today.[245] Retail payments are likely to grow faster than wholesale payments. The growth in digital payments is also linked to the development of e-commerce, where cash and credit cards are at a disadvantage (as we discussed earlier). And while e-commerce payments are smaller than POS, they are expected to grow much faster in the coming years (10% annual growth over the years 2018-2023, versus 3% for POS). In addition, the growth in revenues from these payments will be greater for transactions (i.e. 'primary revenue') than for account maintenance, card fees and so on ('secondary revenue').[246]

A second reason for the interest in payments is the segment's high return on equity. In addition, it offers one of the highest levels of engagement with customers and access to data.[247]

242 Vives (2019).
243 PwC (2020).
244 Citi GPS (2019).
245 BCG (2019).
246 BCG (2019).
247 This is true in both emerging and advanced economies. Other similar activities with high engagement and high ROE are asset management and, to some extent, consumer finance. At the other extreme, capital markets and investment banking or commercial and transaction banking are the areas where engagement and ROE are the lowest (McKinsey, 2019b).

A final reason for the focus on payments is that this is the area where consumers have the highest expectations for a seamless and immediate mobile experience. Payments are a daily activity – by far the most frequent interaction of consumers with banks or with the financial system more generally. The increasing presence of digital interactions in our daily lives affects our perceptions and expectations regarding payments, and technological developments (such as electronic wallets) have allowed for these interactions to be possible, putting strong pressure on any other forms of payment.

In summary, given the size of global payment revenues, its connection to e-commerce and the possibility for consumers to separate payments from other bank activities, the threat of competition is large and most imminent. If banks do not react, their revenue at risk in the global payments segment could be in the order of $280 billion.[248]

Payments might be the most active segment for entry, but it can also be an entry point to full blown competition. This is the case in particular when entrants get access to some of the balances held at banks today. In this case, they can easily offer vehicles for savings, providing access to funds and other types of securities. And once the volume of savings is significant, entry into lending seems the natural next step. We have witnessed this evolution in China, with Alipay starting as a pure payment provider in 2003 and a decade later venturing into many other financial services through its rebranded name (the parent company), Ant Financial.

4.5.2 Banks' reaction

The new entrants are taking advantage of the weaknesses of banks when it comes to payments – in particular, the perception of high cost and difficulty as well as slowness when it comes to some of these transactions. Banks can react by making use of similar technologies to fight that perception. An obvious barrier is that banks rely on legacy systems that run across all their lines of businesses, and it might be hard to adapt quickly to match the agility of FinTech entrants. On the other hand, banks have the scale to invest in technology developments that take advantage of the established infrastructure. In addition, they could partner with some of the other traditional actors (credit card companies or the central bank to improve the current system of payments) or even with new entrants to remain competitive.

There are several examples of reactions by banks that have resulted in a strong defensive mechanism. A good example is the development of instant payment networks in many countries. These have been developed by, or in coordination with, the central bank and have resulted in a technology that allows for instant payments, available 24/7 at a very low cost. For example, the new TIPS system at the ECB charges €0.002 to banks, while the Unified Payments Interface (UPI) in India is typically offered to customers at zero cost. The number of central banks that offer instant payments technologies that can easily be integrated into the mobile banking experience of traditional banks is growing rapidly.[249] There are

248 Accenture (2019).

249 Offering the same technology might not always be enough to retain customers. The customers that are likely to be attracted by new FinTech offers tend to be digital-savvy customers – usually younger and more educated. To retain them or attract them as first customers, banks make use of branding and in some cases launch their own version of a 'digital bank'.

also private initiatives in countries where the central bank has not moved fast enough, such as in the United States. As mentioned earlier, Zelle, launched by a group of banks, has given those banks an instant payments technology that competes with the alternatives offered by new entrants such as Venmo.

In some countries, banks have found that other traditional players also under threat, such as credit card companies, can become partners in their race to become competitive. This is the case in the United States, for example, where the credit card culture is so strong and the incentives are designed in such a way that moving customers away from traditional payments channel becomes a challenge. This high barrier to entry is also supported by the pricing structure associated with payments and certain regulations. Payments involving credit cards can be expensive in the US market, but the customer – who is the one deciding how to pay for the transaction – does not see that cost. In fact, through the extensive use of reward programmes, customers often have an incentive to use the most expensive means of payment (from a social point of view). Displacing the incumbents with a new technology would require that merchants price their goods differently depending on the payment being used. In some countries this is not allowed by regulation; in others, merchants stay away from differential pricing for fear of confusion and a negative reaction from customers. The equilibrium, while inefficient from a social point of view, is hard to change.[250]

Other examples of partnering with the traditional players can be found in cross-border payments, an area where costs have remained high and the speed of transfers incredibly low. SWIFT, which is at the centre of cross-border payments, has been forced to introduce new digital technologies to match the much cheaper and faster processes introduced by new entrants such as TransferWise. SWIFT gpi[251] allows banks to execute same-day cross-border transactions, and is aiming to soon become an instant payments technology. SWIFT relies on the infrastructure of correspondent banks, but improves on the communication and tracking abilities of the new system to avoid unnecessary delays and errors.

One issue that should be stressed is that although banks are in some cases able to defend themselves, this does not mean that the threat does not impost a cost on them. The investment required to compete and the fact that they have to bring their prices down means that their profitability will suffer. For example, cross-border payments has traditionally been a high margin segment, but increasing competition from global efficient players (such as TransferWise) is reducing the profitability of these transactions.[252]

4.5.3 The stickiness of bank deposits

Despite the threat from FinTech innovation, we have yet not witnessed significant flight of deposits away from banks, especially in countries where banks are well established.[253] One of the reasons for this, discussed above, is the reaction by banks to match the products offered by new entrants. But there is also the fact that switching costs for deposits seem high, which creates a barrier to competition.

250 Klein (2019).
251 gpi stands for 'global payment initiative'.
252 McKinsey (2019b).
253 The volume of deposits is very large: in the euro area, overnight deposits are equal to €7.6 trillion; in the United States, checking deposits are equal to $2.2 trillion and saving deposits at banks about $8.2 trillion.

The fact that banks have some market power in retail deposit markets is documented in the academic literature.[254] This allows them to keep interest rates on deposits low and, as a result, obtain a cheap source of funding.[255] This stickiness is in part due to the multiproduct offering of banks that creates a broad relationship with their clients, but also to regulations that are designed to provide stability to banks. Deposit insurance, combined with the fact that full integration into all aspects of payments is restricted to new entrants, can give banks a competitive edge. For example, access to central banks can be a competitive advantage in a world where private closed-loop networks of payments compete (as in Figure 30).

Anecdotal evidence suggests that the resulting stickiness of deposits is a real barrier for the growth of new entrants, and this is more visible in countries where banks start in a strong position (such as in Europe or the United States). A recent survey of more than 600,000 users in the UK suggests that traditional banks have so far been able to retain the loyalty of their customers. In particular, these are the banks that are able to retain an exclusive audience (customers tend to bank only with Barclays or NatWest, for example). New entrants such as Revolut or Monzo, on the other hand, are typically dealing with customers who also have accounts at one of the traditional banks. About 80% of these two new banks' users also have other banking apps, mostly from traditional banks.[256] Similar evidence has be found in Singapore, one of the countries that is more open to FinTech innovation, where the recent opening of five digital banks has garnered limited interest. This is the result of the loyalty of bank customers, who do not seem too keen to look for alternatives.[257]

A final argument for the potential protective role of bank deposits is related to the regulations or specific decisions made by regulators that have the stability of the banking system as a priority. This is particularly relevant at times of financial or economic distress, when regulators and central banks will tend to protect banks by providing liquidity, taking assets from their balance sheets, providing very favourable financing conditions or relaxing stringent regulations. This is what we are observing today as a result of the economic crisis caused by the Covid-19 pandemic. While all financial institutions are suffering the consequences of this crisis, policymakers are focusing on saving the institutions where the majority of deposits and lending take place – the banks. What this teaches us is that there is an additional power that banks derive from being the main source of deposits. While FinTech companies might be gaining shares in the payment space, deposits remain central to the functioning of the financial system, and regulators will consider that when setting policies.

254 Drechsler et al. (2017).
255 Driscoll and Judson (2013).
256 See https://ftalphaville.ft.com/2019/12/18/1576674529000/FinTech-users-just-can-t-get-enough-of-traditional-banks/
257 See https://on.ft.com/38tLb0c

4.5.4 Disruption or business as usual?

There is no doubt that technology is changing payments in ways that may be disruptive to the traditional players, in particular banks. But what is the likelihood that banks, as we know them, will see a fundamental shift away from their current dominant position in payments and deposits? Our analysis has shown that in countries where banks are not as present, where developments in e-commerce have been fast and where regulators have not seen the innovation as a threat, we have already seen a significant redrawing of the competitive landscape for banks. This is particularly visible in China, where tech companies have used payments as an entry point to become big players in financial and banking markets.

However, we do not see the same dynamics in other countries or regions, such as Europe and the United States. Here, the initial position of banks was strong and they managed to defend that position with the help of powerful partners that include credit card companies and the infrastructure provided by the central bank. Regulators have been more reluctant to experiment, and bank stability remains their main concern. Despite this, we have seen some success stories among FinTech companies going after payments as a potential source of profits. Some of these have continued their growth (TransferWise, Revolut, PayPal) and they are certainly putting competitive pressure on the profits of banks through reduced fees and the additional investments that banks need to make to keep up with competition. However, their potential to completely change the banking landscape and cause a major shift of deposits away from banks seems limited.

But banks cannot take their current position for granted; profitability might remain an issue for many banks in some of these regions. They need to reduce their physical presence and in some cases consolidate, which might limit their ability to react to future competitors. In addition, a combination of open banking (still in its infancy) and the efforts of banks to build better and faster networks, even though it may be the natural reaction to competition, might represent a future threat to the business of banks. As technology improves and interoperability becomes the default, moving money in and out of bank accounts will become easier and faster. One can imagine a situation where payments are made via a technology controlled by non-banks, perhaps even using a unit of account (stablecoin or other) that is purely functioning as a vehicle currency. In this environment, banks will not take part in the payments system even if their customers still hold significant balances with them.

There is also no doubt that the stickiness of current deposits cannot be taken for granted. The zero interest rate world in which we live makes competition for deposits less obvious. In the United States, where short-term rates have been positive and around 2% for a couple of years, if the US Federal Reserve had been more open to a proposal to create a narrow bank that offered customers a market-based remuneration close to the interest rate on reserves at the central bank, it would no doubt have increased competition for deposits.[258] Low interest rates are here to stay for a long time, but if higher interest rates were to return and new entrants are given access to the central bank, we could see much greater disruption to bank deposits.

258 The Federal Reserve denied the application of The Narrow Bank (TNB) on the grounds that it would undermine its monetary policy operations.

Finally, banks cannot dismiss the potential threat from BigTech, which is possibly greater than the threat from FinTech. The network effects arising from the ecosystems and platforms controlled by some of these companies are large and while their efforts to enter financial markets have so far been limited, one can envision a successful payments technology integrated in the ecosystem of Facebook, WhatsApp or Instagram becoming widely used. The extent to which they will be able to use payments as an entry point into a broader set of banking activities is less clear. While the information advantages they might have can give them a competitive edge when it comes to other functions such as lending, the information contained in payments and the associated transactions, and the engagement of the users of their platform, could also be of enough value to them.

4.6 Conclusions

New forms of digital money and the innovations they bring to the financial industry are a potential source of rapid change and disruption. In this chapter, we have argued that digital money can only be understood in conjunction with the payments technology that allows it to transform digital assets into a medium of exchange. In the past, payments technology was dominated by banks. Bank deposits were at the centre of payments, and banks also controlled the payment network infrastructure through partnerships with credit card companies or exclusive access to central bank settlements.

Now, however, new technologies are allowing customers and merchants to connect through other channels, usually relying on the (always available) internet and an electronic device such as a smartphone. These new connections facilitate different forms of transactions and payments. New entrants that make use of these new technologies are more efficient and can bypass the use of the traditional intermediaries. Banks, stuck with old legacy systems and having to deal with the complexity a multi-product business, struggle to be as agile as these new FinTech companies.

Fortunately for banks, there are significant barriers to entry and to the mass adoption of these new forms of payment. There are strong network effects that limit the attractiveness of new payment networks. There is also the protective role of regulation that tends to be conservative and prioritises banks stability. And there is the market power that banks derive from their large deposit base, which is the result of the high switching costs for customers.

But challenges still exist. Even if banks manage to protect their territory, in part by mimicking the innovation of entrants, their profitability will suffer as competition goes after the most profitable segments.

As consumers become increasingly technology literate, as the increased use mobile devices – for convenience but also for authentication – shifts the power away from banks and as the pipes of the financial system become more interconnected and fast, banks might find it harder to compete with these new entrants. The sudden shift towards a more digital world that we are witnessing as a result of the confinement policies prompted by Covid-19 is a reminder that the speed of change can surprise us.

As new technologies spread, deposits will be less sticky. Customers will be more comfortable working with multiple financial institutions and will pick and choose those that are more flexible and cheaper.[259] We have already had a glimpse of this future in countries where the initial position of banks was weaker, with China being the best example.

The future strategy of banks is likely to depend on a combination of continued innovation and an ability to match new entrants into each of the segments in which innovation is taking place. Partnering with traditional partners (such as credit card companies or central banks) or engaging in joint ventures with FinTech start-ups might have to form part of this strategy.

259 Petralia et al. (2019).

5 Discussions

5.1 Discussion of Chapter 2, "Challenge to banks' business models", by Thorsten Beck

Chapter 2 takes stock of the challenges facing banks in Europe. It discusses the role of banks in modern market economies, different business models and the evolution of bank profitability over the past decade. Unlike in the United States, bank profitability has not really recovered in Europe, which is related mostly to post-2008 economic developments – the euro area crisis and persistently low, if not negative, interest rates – but also market structure and overbanking. The chapter then discusses three specific challenges. First is the low-interest rate environment, which might not hurt in the short term but certainly will in the long term, especially as interest rates turn negative. While central banks can mitigate the impact of negative interest rates – for example, through tiering policies (i.e., differential interest rates on different components on banks' reserves) – they cannot avoid a negative effect. Second, while increasing the quality and quantity of capital requirements has made the banking sector more resilient, it has also reduced its profitability and has shifted activities into the less regulated non-banking segment of the financial system. Finally, digital innovation gives rise to new intermediaries such FinTechs and BigTechs, which will further put pressure on banks.

The chapter is a concise and comprehensive stock take of where Europe's banking system stands and what its challenges are. I have few, if any, disagreements with the analysis. What I would like to do in my comments is to (i) push a bit further on some of the analysis and challenges, and (ii) extrapolate the analysis to the next decade, which will be dominated by the fallout from the Covid-19 recession or depression.

The reasons for lower bank profitability in Europe than in the United States are clear: first, the euro area crisis; second, a delayed and incomplete crisis resolution, with many banks still carrying non-performing legacy assets on their balance sheets; and, third, the low interest rates. But it seems that there is also quite some variation in bank profitability across countries and banks within Europe. And some of these differences seem counter-intuitive given the three factors just mentioned – for example, Intesa Sanpaolo has a higher price-to-book ratio than Deutsche Bank or Société Générale. It would be interesting to explore further the factors explaining this variation. It is related to the macroeconomic differences discussed above? Can some of these differences be explained by different bank business models (especially intermediation-focused versus fee-focused banks)? Or is it the structural differences across countries that can explain these differences, including market structure and competition, demographic evolution or demand-side factors? Most likely, the answer will be 'all of the above', but the relative importance of these different factors would be important to explore as it has important implications for bank analysts and policymakers.

This brings me to a related issue: the delay in moving towards a euro area banking market. Policymakers have established the basis of a regulatory banking union in the euro area, with the establishment of the Single Supervisory Mechanism and the Single Resolution Mechanism. Other elements are missing (such as a common deposit insurance scheme) or are still under construction (such as a common backstop). Ultimately, a euro area-wide financial safety net aims not just at making European banking more stable but also at cutting the doom loop between sovereign and bank fragility. While the regulatory structure has made progress, there is still no single market in banking, which would imply a move from national to a European banking system. Such a move would imply more cross-border mergers, but also a political decision to move away from national inference (as we observed, for example, in Germany in the case of merger talks between Deutsche Bank and Commerzbank).

Another important challenge for European banks is the low-interest environment. Here, I would like to point to an interesting recent paper by Altavilla et al. (2018), who use a variety of data sources and methodologies to show that monetary policy easing – i.e., a decrease in short-term interest rates and/or a flattening of the yield curve – is not associated with lower bank profits once the endogeneity of the policy measures to expected macroeconomic and financial conditions is controlled for. However, they also show that a protracted period of low monetary rates has a negative effect on profits. Given that interest rates have been zero or negative in the euro area for the past eight years, we are most likely in this negative-effect period already.

What will be the long-term repercussions of the Covid-19 crisis for the banking system? There is discussion on what to do in the short term both to mitigate the impact of the shock to the banking system and to possibly recapitalise the banking system if losses from the economic fallout are not sustainable.[260] But what will be the long-term repercussions? Obviously, they will depend on how the Covid-19 crisis plays out, what other sources of fragility might emerge in the wake of the crisis[261] and what policy measures will be taken. But one can envision several broad trends that seem likely.

First, low interest rates are here to stay for much longer. While there was hope that the ECB might eventually be able to follow the Federal Reserve and raise interest rates back into positive territory, it seems likely that rates will stay below or very close to zero for several years to come, if not the whole decade. This will certainly put further pressure on banks' profitability. While some of the other structural problems in Europe's banking system might be addressed in a post-crisis restructuring, zero interest rates will continue to put pressure on banks' profitability. Second, while a decision to 'stop the clock' on the implementation of the remaining Basel III reforms (including TLAC and MREL) seems likely, the crisis will most likely provide further impetus to strengthen the capital buffer of banks. It is clear that the post-2008 regulatory reforms have made the banking system more resilient, although it might not be able to avoid a shock like the one we are facing right now. The regulatory reforms have also enabled regulators in Europe to loosen capital requirements – countercyclical and conservation buffers as well as pillar 2 capital requirements – and thus to reduce the likely lending retrenchment we might see otherwise in a recession. Neither countercyclical

260 Beck (2020); Schularick and Steffen (2020); Boot et al. (2020).

261 One can argue that the euro area crisis was partly caused by governments' expansionary fiscal policy reaction to the Global Financial Crisis.

nor conservation buffers existed before Basel III. Finally, the trend towards digitalisation might increase even further in the wake of Covid-19, as social distancing (which should be renamed as 'physical distancing') might become the new norm and personal interactions between banks and clients carry even higher costs. In addition, BigTech companies are likely to come out of the crisis further strengthened, with a large cash pile and in a strong position (and possibly with strong appetite) to expand into financial services provision. This might put additional competitive pressure on banks in their core business lines. Let me just add one counterargument in favour of banks: relationship-based lending has proven very beneficial for companies, especially smaller ones, during crisis times[262] as they rely on their cumulative soft information to be able to assess clients' creditworthiness, unlike transaction-based lenders that only rely on hard data, which is less useful during crisis times. So, banks can play an important role during the current crisis that might provide them with loyalty franchise value going forward.

5.2 Discussion of Chapter 3, "The digital economy and banks' business models", by Amit Seru

This is an excellent chapter. The authors describe comprehensively the threats to the business models of banks in the last decade or so. One common theme across these threats involves technological advances and changes associated with challengers (FinTechs or BigTechs). This is most prominent in the area of payments, but also increasingly visible in the area of credit extension. The authors note that banks have responded to these threats in various ways – competing, collaborating or acquiring challenger firms. It has been difficult for banks to compete with BigTech firms, which have a unique ability to offer customised products and services using rich data from their e-commerce platforms that banks do not have access to.

The chapter then discusses policy and regulatory responses in these evolving times and focuses on three important elements. First, the authors urge regulators to level the playing field between BigTechs and incumbent banks. On the one hand, BigTechs enjoy a significant advantage due to their wide customer base, availability of information and broad-ranging business models. On the other hand, banks have access to a low-cost deposit base that BigTechs are excluded from. Balancing these considerations is important as regulators think about microprudential and macroprudential regulation in a new era with both banks and challengers. Second, the authors urge for more focus on competition and data policy. Both dimensions have significant implications for consumer welfare. Finally, given the global nature of banks and BigTechs (as well as many FinTechs), the authors emphasise the need to coordinate across regulators – not just financial ones but also those that regulate and set standards related to data exchange and privacy.

The authors have made several important points regarding regulation in this new era. I want to focus my discussion on two additional elements that extend the arguments made in Chapter 3. First, I will argue that the regulatory environment itself has shaped the nature of interactions between banks and

262 See, for example, Bolton et al. (2016) and Beck et al. (2018).

challengers. Second, I will argue that financial stability in this new era involves understanding the business model of FinTech shadow banks and traditional banks, the industrial organisation of the credit market and the equilibrium interaction of intermediaries. I will argue that policy analysis requires looking at the impact of policy on banks and shadow banks side-by-side.

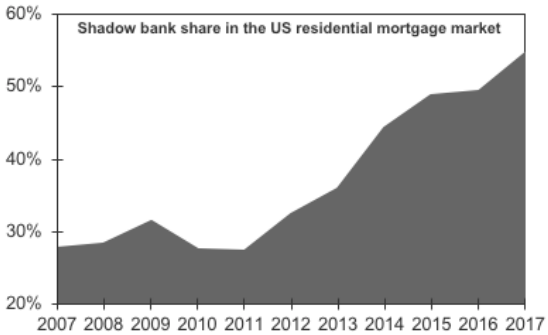
I want to start by pointing out that the consumer finance market has undergone a dramatic change. As a starting point, consider the case of mortgage credit in the United States. The US residential mortgage market in the constitutes the world's largest consumer finance market; more than 50 million residential properties currently have mortgages outstanding with a combined debt of about $10 trillion. The shadow bank market share in residential mortgage origination more than doubled from 2007 to 2017, as shown in Figure 1. A substantial portion of this growth is from online FinTech lenders that rely on technology. Using credit bureau data allows one to get a longer time series view. While shadow banks did increase their presence during the housing boom from 2001-2006, their growth in the last decade is unprecedented. This trend is not just visible in mortgage market but also in other markets such as the consumer personal loan market, small business lending, leveraged lending (loans to non-investment grade businesses), and commercial real estate consumer lending. Several of these patterns are also discussed in Chapter 3.

The growth of shadow banks and FinTech lenders has been attributed to two main factors: increased regulation on the financial sector, especially in the aftermath of Great Recession; and breakthroughs in technology related to big data and data analytics.

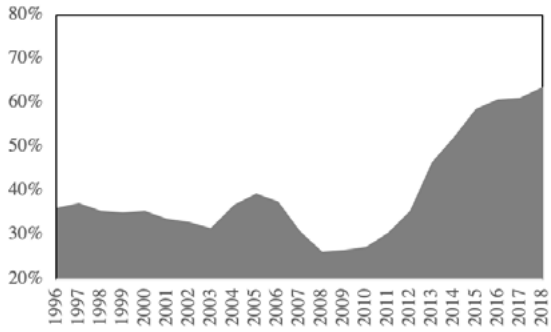
In the aftermath of the crisis, tightened regulation, increased supervision and heavy fines and penalties prompted banks to cut risky lending, invest in more liquid assets and maintain higher equity capital. As a result, banks were reluctant to lend to less-than-stellar credit users. Challenger banks (FinTech lenders), operating in a relatively lightly regulated environment, seized the opportunity and have fulfilled the pent-up consumer demand. This observational is not just anecdotal but is backed by empirical analysis. For instance, Buchak et al. (2018a) exploit regional variation in different types of regulatory and supervision pressure faced by banks engaged in mortgage lending over the period 2008 to 2016. The regulatory and supervisory actions they consider include regulatory capital raising, implementation of Basel III with respect to mortgage servicing rights, lawsuits arising from conduct prior and during to the crisis, and changes in supervisory agency monitoring the lender. They find that shadow banks increased their market share across regions during this time period. However, banks retreated from mortgage lending more in regions where regulatory and supervisory pressure on banks was higher. These regions were also the ones where shadow bank activity was the highest. This finding – that regulatory pressure on banks leads to growth of shadow banks – is evident beyond the US mortgage market.[263]

263 For instance, see Irani et al. (2018) for corporate loan market in the United States and Hachem (2018) for shadow banking related to wealth-management products (WMPS) in China.

Figure 1 Shadow banks in the US residential mortgage market



(a): Mortgage market



(b): Mortgage market (longer time series)

Notes: These figures show the shadow bank origination shares in the U.S. residential mortgage market. Panel (a) shows shadow bank origination shares as a fraction of total originations for all mortgages in HMDA between 2007 and 2017. The method used to construct this figure is based on Buchak et al. (2018a). Panel (b) shows the same plot for a longer time period. These data come from a large credit bureau.

On the technology front, the argument is that improvements in technology have allowed FinTech firms to provide banking services in ways that are different from traditional banks. Broadly, improvements in technology have allowed some FinTech firms to provide the same services more cheaply. Other FinTech firms have leveraged technology and improvements in data science to create new markets by expanding the pool of borrowers that they have provided services to. This has involved attracting consumers to banking services by using mobile phones and convenience apps as an entry point. For instance, consumer-to-consumer payment apps such as PayPal and Venmo have attracted millennials due to ease of transacting on the phone, and have eventually moved to providing deposit-like services.

Data science has also been shaping the lending market, opening previously closed doors to credit-constrained consumers with a limited or tarnished credit history. In the past, underwriters had only a few ways to assess borrowers' risk, which meant that many people were either turned away or charged a higher interest rate when not enough was known about their credit worthiness. With big

data and AI, FinTech lenders are able to use different information, such as digital footprints on social media, in the underwriting process to evaluate borrowers' likelihood of default. This has allowed credible borrowers to pay a lower interest rate as well as opening doors for many unbanked. Another new market that has been made possible due to technology and data science is 'peer-to-peer' lending. This breaks away from the conventional investor-borrower framework, drawing resources from large numbers of ordinary people to fund others with financial needs. Consumers can participate on both sides of the market, as investors or as borrowers.

Finally, FinTechs have leveraged technology and data science to provide new services to existing sets of customers. In particular, they have been able to offer 'convenience' to consumers who might have high willingness to pay for such services. For example, Venmo offers payment ability through mobile phones to consumers who want to make payments to other consumers swiftly without having to go through the cumbersome process of writing and cashing cheques or wiring money through banks. Similarly, Quicken Loans climbed to become the largest US residential mortgage lender by 2017 through the use of its convenient Rocket Mortgage product that enables a full online application process and allows consumer to provide all 'relevant' information quickly. This innovation brings significant convenience to customers and increases their satisfaction and overall efficiency. Buchak et al. (2018a) show that all this translates into Quicken being able to substantially cut the time it takes to originate and sell loans relative to traditional lenders. In addition, Fuster et al. (2019) show that FinTech lenders process mortgage applications faster and adjust supply more elastically than other lenders in response to mortgage demand shocks, which suggests that technological innovation may have improved the efficiency of financial intermediation in the mortgage market.

Buchak et al. (2018a) also emphasise that Quicken uses technology to employ different data than traditional lenders in their interest rate setting process. This allows them to find consumers with similar default risk as those offered loans by traditional banks. Strikingly, however, Quicken's customers are charged an interest rate premium for convenience.

Using information on prices and market shares and a structural model allows Buchak et al. (2018a) to decompose the growth of challenger banks in the two components: regulatory and technology. They find that about two-thirds of the increase in challengers to incumbent banks is a result of increased regulatory burden faced by banks, with only one-third attributable to technological superiority of new entrants. Thus, regulation of banks itself is responsible for the growth of shadow banking and FinTech lending and the changed landscape that banks find themselves in. How should regulatory policy that is targeted towards financial stability be designed in such an environment?

Following the spirit of the famous Lucas critique, I argue that such an endeavour needs to understand (i) the business model of FinTech shadow banks and traditional banks, (ii) the industrial organisation of the credit market, and (iii) the equilibrium interaction of intermediaries. This can help give a sense of what activities will migrate between banks and shadow banks in response to different policies. It will also allow a quantitative assessment of the volume of this migration will be and why. All of these elements are critical in predicting policy responses accurately.

Let me next illustrate the importance of these steps through the example of the US mortgage market, where data availability allows us to delve deeper into these issues.

Business model

As noted in Figure 1, the growth of shadow banks in this market in the last decade is unprecedented. To understand the respective positions of traditional banks and shadow banks in the mortgage market, one needs to get into their business models and the structure of the mortgage market. Traditional banks take deposits and use those funds to make loans, including mortgages. At the same time, they are heavily regulated and subject to strict requirements to hold capital against the loans they keep on their balance sheets. In the mortgage market, they have a choice: they can sell mortgages to the government-sponsored enterprises (GSEs), collecting an origination fee and, in some cases, a fee for servicing the mortgages; or they can hold mortgages on their balance sheets, collecting interest and principal until the loans are paid off, but taking the risk that borrowers will default. The better capitalised they are, the greater their capacity to keep mortgages.

By contrast, shadow banks don't take deposits and are lightly regulated. They don't have the balance sheet capacity to keep the mortgages they originate. Their business model is 'originate-to-distribute' – that is, to make mortgages and sell them to the GSEs. An easy way to see this is to compare the loans sold to GSEs by traditional banks versus shadow banks. In Figure 2, one can see that shadow banks sell all their loans to GSEs while traditional banks only partially do so.

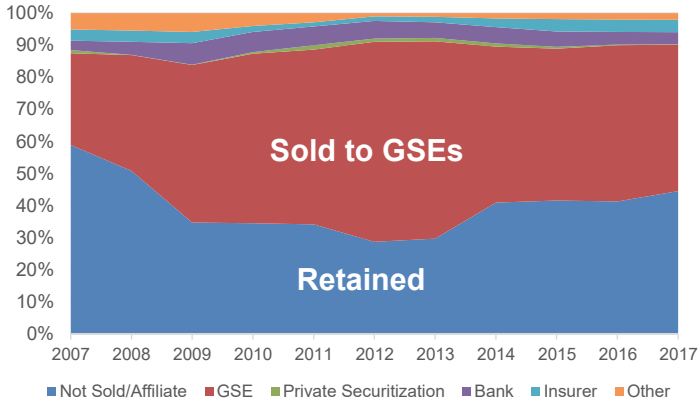
Industrial organisation

While the US residential mortgage market is the world's largest consumer finance market, its structure is unique and reflects the special role the federal government plays in promoting home loans. To make mortgages more widely available, Congress created Fannie Mae and Freddie Mac – private government-sponsored enterprises that buy home loans from lenders and package them as mortgage-backed securities (MBS) for sale to investors, guaranteeing payment if borrowers default. However, the GSEs only buy loans up to a 'conforming limit', which has varied over time and by geography. Mortgages above this limit are classified as jumbo loans and are not eligible for purchase by the GSEs. Before the financial crisis, these loans could be sold to private investors, including investment banks such as Lehman Brothers. However, the market for selling these loans has evaporated since the crisis. Instead, jumbo mortgages are usually held by lenders on their balance sheets.

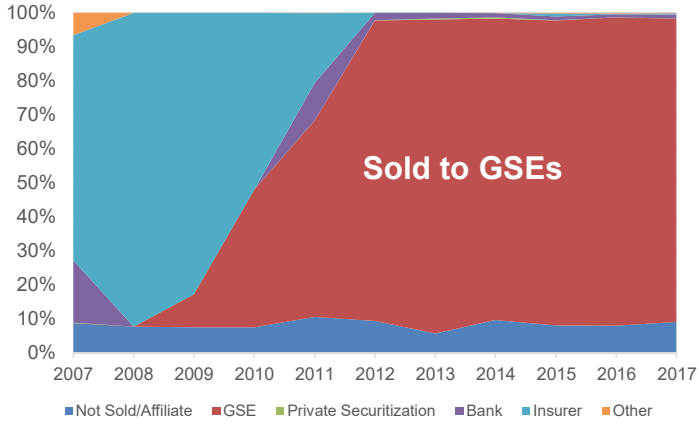
This structure and different business models have had important implications for where the growth of shadow banking sector has occurred. In particular, banks have lost a significant share to shadow banks in the confirming loans market. Shadow banks can compete with traditional banks in this part of the market because GSEs are available as buyers for loans they want to sell – given their 'originate to sell' business model. However, this is not the case in the jumbo loans market where, as noted earlier, the market for 'selling' the loans is non-existent. Figure 3 shows the evolution of bank market share in both the conforming loan market and jumbo loan market since 2007. One can see that bank share in the jumbo loan market remained relatively stable and only began to decrease slightly over the last five years.

Figure 2 Disposition of mortgages among traditional banks and FinTech shadow banks

a) Banks

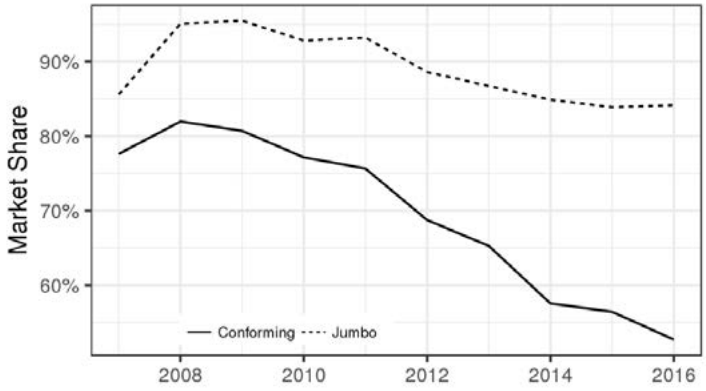


b) FinTech shadow banks



Notes: These figures show the disposition of loans among traditional banks and FinTech shadow banks, in particular, the percentage of originated loans by originator type sold to various entities within the calendar year of origination (including loans not sold). Panel (a) shows the buyer composition of traditional bank originations; Panel (b) shows the buyer composition of all FinTech shadow bank originations. Loans categorized as "not sold" are not sold within the calendar year of origination, although they may be sold some time later. The GSE category pools Fannie Mae, Freddie Mac, Ginnie Mae, and Farmer Mac. Calculations are based on HMDA data and follow method outlined in Buchak et al (2018a).

Figure 3 Bank market share on jumbo and conforming loan

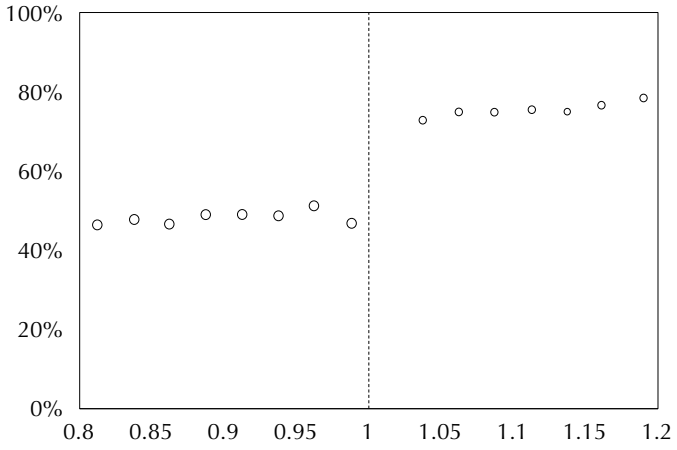


Notes: This figure shows bank market share (by dollars originated) in the confirming (solid) and jumbo (dash) markets. Conforming loans are defined as "conventional" (non-FHA) in HMDA with loan amounts below the conforming loan limit as discussed in Buchak et al. (2018b). As figure shows, the decline in bank market share is not uniform across different segments in the mortgage market. It is largely driven by the conforming market where GSEs buy loans of pre-specified characteristics from traditional banks and shadow banks.

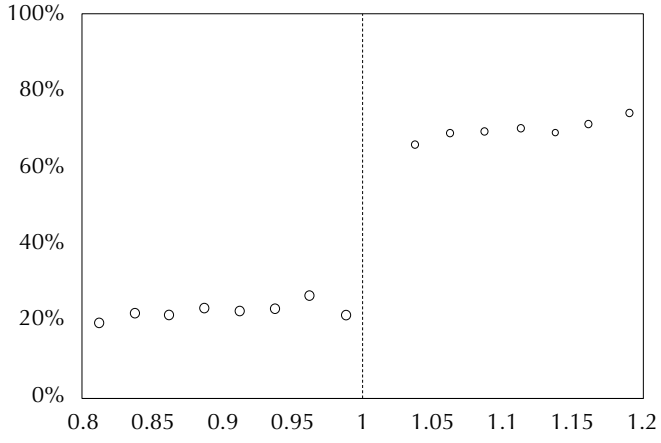
Figure 4 reconfirms this by looking at the data more finely. The left-hand panel shows the bank market shares in the total residential mortgage market, binned by percentage of the conforming limit. Where GSE financing is available, banks have a much lower share. The right-hand side panel shows a similar fact. When loans are below the conforming limit, the percentage of balance sheet financing is small. However, once GSE financing is removed from the picture, most loans are retained on the balance sheet and banks appear to have a significant advantage.

Finally, there is an interesting interaction of these patterns with the financial health of traditional banks. Figure 5 focuses only on traditional banks and shows that the retention of loans on bank balance sheets and the market share of banks in a market segment co-vary with bank capitalisation, holding regulation constant. The left-hand panel plots binned capital ratios versus the amount of loans retained on the bank balance sheet, controlling for time fixed effects. The right-hand panel looks at the same pattern, but this time uses within-bank difference by taking out bank fixed effects in addition to time fixed effects. The cross-sectional variation suggests that well-capitalised banks hold more loans on their balance sheets. We therefore see that traditional banks alter their business model – between selling and retaining loans on the balance sheet – as their capitalisation improves. This reinforce the claim that understanding the industrial organisation of the market and business models of banks and shadow banks is critical to gain insight into what activities move from traditional banks to shadow banks.

Figure 4 Bank market share and bank balance sheet financing of loans



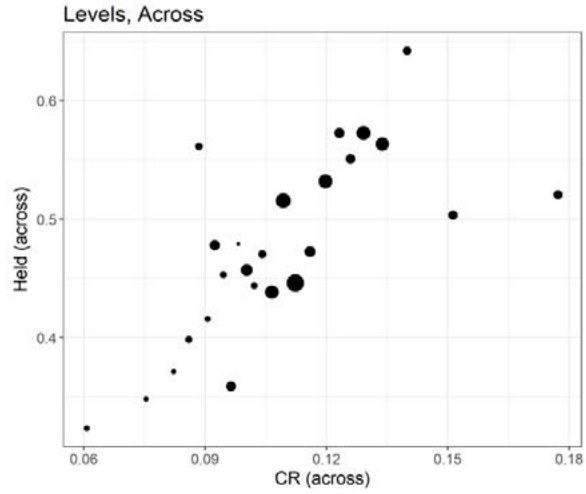
a) Bank market share around conforming limit



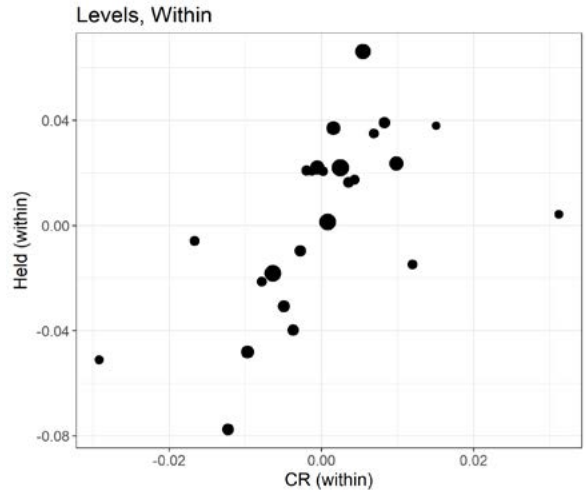
b) Share of loans on balance sheet around conforming limit

Notes: These figures show the bank market share and bank balance sheet financing of mortgages in the US. Panel (a) shows the percentage of originations that are done by banks around the conforming loan limit. Panel (b) shows the percentage of mortgage originations retained on balance sheet by the loan amount divided by the conforming loan limit in the county-year of origination. The cutoff is at 1, shown by a dotted vertical lone. Loan sizes are binned as a proportion of the conforming loan limit in 0.05 buckets, i.e., 0.91-0.95, 0.96-1.00, 1.01-1.05, and so on. Data are from HMDA and span 2007 to 2017 following method in Buchak et al. (2018b).

Figure 5 Bank capitalisation and balance sheet retention



(a): Across banks, levels



(b): Within banks, levels

Notes: This figure shows binned scatterplots (25 equal-sized bins) of bank percent of loans retained on balance sheet versus bank capital ratios. All bins are residualised taking out the effect of bank controls. Panel (a) is across banks by taking out time fixed effect; Panel (b) is within banks by taking out bank fixed effect.

Equilibrium interaction

Performing quantitative policy evaluation requires one to take the information on different business models and industrial organisation of lending and embed this in a framework where this equilibrium can be studied. On the supply side, one has to consider different type of lenders who compete for mortgage borrowers – i.e., we consider traditional banks, non-FinTech shadow banks and FinTech shadow banks. Following our discussion, these lenders differ along several dimensions: the regulatory burden, origination costs due to different funding structure and operations, and product quality (for instance, convenience). Traditional banks have advantage over shadow banks due to lower funding costs (deposits), but they also face regulatory costs. On the demand side, borrowers choose mortgages from the three types of lenders to maximise utility, which depends on mortgage interest rates and non-price attributes such as convenience/quality.

Equilibrium pricing by each lender and the markups are determined endogenously as lenders try to maximise their profits given the demand side. The business model considerations are important because shadow banks sell all the loans they originate, while traditional banks decide whether to sell or retain the loans on their balance sheet. This choice of traditional banks depends, among other things, on their funding costs – which are a function of their financial health. It also depends on the industrial organisation discussed earlier, with shadow banks competing on price and non-price attributes with traditional banks in some segments (conforming market) but not in others.

Putting these pieces together allows us to perform counterfactual policy analysis that is more complete than regulatory frameworks that focus only on traditional banks. The key elements of such an analysis based on our discussion above are as follows.

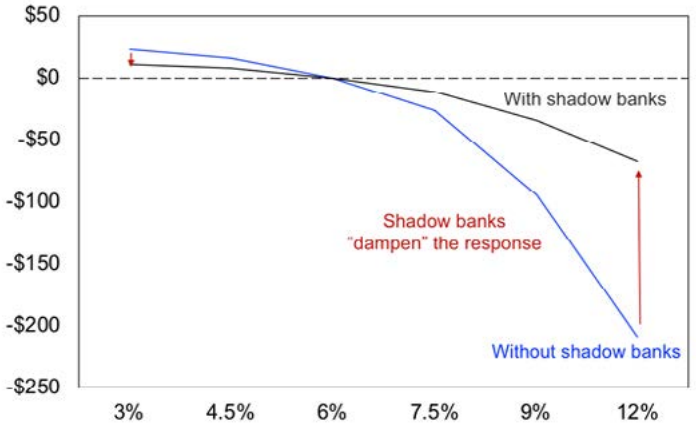
- Regulation and technology played a crucial role in the shadow bank market penetration in the mortgage lending market. These factors have driven the equilibrium interaction between traditional and shadow banks.
- Shadow banks strategically compete more in markets where they have a technological advantage and where traditional banks are hampered by regulatory burden. Shadow banks also compete with traditional banks in markets where they are able to operate their 'originate to distribute' model.
- Finally, banks exploit their comparative advantage of 'balance sheet capacity' by deciding whether to finance loans themselves or by following an 'originate to distribute' model like shadow banks.

Therefore, financial regulation needs to understand the business model of FinTech shadow banks and traditional banks, the industrial organisation of the credit market and the equilibrium interaction of intermediaries. This integrated view of financial intermediation is important for understanding policy responses on aspects such as financial stability. I will illustrate this by discussing their importance in the context of one important policy lever used in recent times.

Changes to bank capital requirements

As one illustration, consider the effects of changing bank capital requirements on risk inside the traditional banking system (loans retained on bank balance sheet) as well as overall lending in the economy. We performed such an experiment in Buchak et al. (2018b), where we used the integrated model of intermediation as discussed above. Raising capital requirements blunts comparative advantage of traditional banks and they shift from balance sheet lending to originate-to-distribute. Since selling of mortgages is only available for conforming loans, this change shifts bank lending from the jumbo to the conforming market and lowers the share of mortgages retained on bank balance sheets. If one measures success of the policy based on risk retained on bank balance sheets, one might conclude that that risk has fallen in the financial system. However, this would be an erroneous conclusion.

Figure 6 Counterfactual analysis: Lending response to changes in capital requirements for traditional banks



Notes: This figure shows the aggregate mortgage origination volume (in US$ billions) across various bank capital ratio requirements (in %) based on the model calibrations described in the text. The model follows Buchak et al. (2018b). The blue line is the mortgage origination by banks only, while the black line is the mortgage origination by banks and shadow banks together.

Considering bank behaviour alone overstates the reduction in overall mortgage volume for two reasons. As noted, tightening of capital requirements forces banks to move from loan retention to adopting the 'originate to distribute' model of shadow banks. In addition, the comparative advantage of traditional banks relative to shadow banks is reduced. As a result, significant lending activity also migrates from traditional banks to shadow banks. In Figure 6 we see the change in aggregate lending volume in response to changes in capital requirements for traditional banks. Consider, for instance, a capital requirement increase from 6% to 7.5%. We see a significant decrease in bank's balance sheet lending. However, most of the reduction is compensated by (i) banks moving from originating and holding to instead selling to GSEs (on conforming mortgage side) and (ii) shadow banking increasing lending volume. As a result, total lending decreases only by a

modest $13 billion. More broadly, an integrated view that considers behaviour of both banks and shadow banks side by side reveals a quantitatively large *dampened* effect of the policy relative to one that only focuses on effects of the policy on traditional banks.

One can also study policy that impacts the secondary market, such as central bank unconventional monetary policy. Following similar arguments as above, an integrated view that considers the behaviour of both banks and shadow banks side by side reveals a quantitatively large *amplified* effect of the policy relative to one that only focuses on effects of the policy on traditional banks.

Overall, the discussion shows that focusing only on the banks might result in an amplified or a dampened effect on outcome variables – such as aggregate risky lending in the economy – depending on the policy. In the context discussed above, focusing only on banks may overstate the true response to policies that impact funding of traditional banks directly. In contrast, focusing only on banks may understate the true response to policies that impact the secondary market.

I conclude by noting some themes that might be important but not part of the comprehensive chapter.

First, there is another element – political capture – that might shape the nature of regulatory policy that evolves in the intermediation sector in the near future. As BigTechs (such as Amazon) become even larger and 'too big to fail', aspects of regulation such as levelling the playing field and local and global coordination might become harder to implement and operationalise.

Second, there are additional considerations which might also be important. One is that many FinTech and BigTech firms might be encroaching on other dimensions that also infringe on the profitability of banks. In particular, many challenger firms in the payment space, while facing no regulation, are already competing for 'bank deposits'. This further impacts the viability of banks' business model. Another consideration is that the source of funding for many FinTech and shadow banks is primarily short-term bank loans.[264] Consequently, the risk in the traditional banking sector that is assessed just based on consumer credit that remains on bank balance sheets is incomplete for another reason. A more complete integrated view, like the one I outline in this discussion, also needs to consider the fact that banks might be, in large part, financing shadow banks.

Finally, while research has assessed the nature of risky lending done by shadow banks and traditional banks, most of this work has been during a low-default environment. How the changes in monetary policy or macroeconomic conditions might impact risky lending extended by shadow banks and traditional banks through various channels remains an open area of research.

264 Jiang et al. (2020).

5.3 Discussion of Chapter 4, "Digital money, payments and banks", by Dirk Niepelt

The chapter offers a rich overview of the dramatic changes in the world of money and banking that we have seen in recent years. Case-study like, it discusses various facets of that ongoing revolution – including developments in technology, the monetary architecture, the product space, and regulation – and draws conclusions for the competitive landscape that banks will have to navigate.

This landscape is going to differ across regions and segments. In countries with well-developed retail banks, FinTech and BigTech firms will continue to make inroads in the payments business, but less so in finance proper. Where central banks and commercial banks have worked to upgrade their payment systems (in the West, possibly with the exception of the United States), the incumbents will better be able to defend their market shares. In countries with less regulation or less developed banking systems, FinTech and BigTech will substantially change the industry structure if they have not already done so. China is the leading example.

In the process of motivating these conclusions, the chapter discusses many products, services, and firms that have emerged in the last few years. For the uninitiated who seek to connect the dots and to relate the daily news flow to the underlying trends, this is very helpful. I learned a lot. In my discussion, I will be much narrower. I want to focus on two themes in the chapter: the nature of money and how it relates to these developments, and the government's response to the structural changes we observe.

Money

Money is an asset, albeit a special one. Its price reflects a fundamental value as well as two bubble components. The fundamental value is strictly positive when money pays dividends in the form of some other security or commodity.[265] The first bubble component – I will call it the 'store-of-value bubble' component – may be strictly positive when the interest rates of alternative stores of value are low relative to the growth rate, or when risk is high.[266] And the second bubble component – I will refer to it as the 'liquidity bubble' component – reflects money's usefulness in providing liquidity, that is in relaxing means-of-payment constraints.[267] Only monetary assets feature a liquidity bubble. If the liquidity bubble is strictly positive, then this also affects the discount factor and therefore the fundamental value.[268]

Three points on how the observed changes in money and banking relate to these three components of the price of money. The first point concerns the practical importance of the legal tender concept. As discussed in the chapter, this concept is quite opaque since agents generally are not obliged to use government money to discharge their debts. More and more often, businesses rule out payment in government money (cash) for security reasons or to lower transaction costs. The

265 The price of the other security may itself contain a bubble component.
266 Samuelson (1958); Bewley (1980); Townsend (1980); Wallace (1980).
267 See, for example, Clower (1967). The liquidity bubble component can alternatively be viewed as a fundamental value where the dividends correspond to shadow values of liquidity constraints that the money helps to relax.
268 Brunnermeier and Niepelt (2019); Niepelt (2019).

most extreme instance of this development is that governments themselves no longer accept government money. A German journalist has challenged the public broadcaster in court to gain the right to pay his dues in cash – the legal tender. The Federal Administrative Court is sympathetic but has deferred the case and requested guidance from the European Court of Justice.[269]

Less extreme but in a similar vein, governments force consumers and businesses to use privately issued monies - typically bank liabilities – for payments whose amount exceeds a certain threshold, often less than a monthly salary. While these restrictions may be well intended (to fight money laundering, tax evasion, or terrorist financing) they have led to the absurd situation that the government outlaws the use of government money – the exact opposite of the premise of certain theories of money. According to these theories, it is crucial for the value of government money that everybody must accept it or use it for tax payments.

This leads me to the second, related point, which is on the role of trust. Both the store-of-value bubble and the liquidity bubble rely on expectations that the money will be accepted in the future. In some equilibria, agents hold these expectations and the expectations are confirmed; in others, the opposite holds true and the bubble components collapse to zero. What does it take to coordinate expectations on the 'good' equilibrium, especially when the legal tender concept does not provide much support?

This issue has become first-order for central banks like the Riksbank that worry about the prospect of a financial system in which consumers no longer come into contact with government money because cash has disappeared and only banks have access to digital government money. Does trust in government money require tangibility, or at least direct access? Or can central banks hope to steer monetary conditions even in a 'cashless limit' where consumers only use privately issued means of payment and banks need not hold minimum reserves? I have my doubts. The reaction of policy makers worldwide to the Libra project, which aims at a convenient global payment instrument, suggests that I am not alone.

My third point concerns the effect of technological change on money, a core theme in the report. The chapter is very clear about the fact that modern money is defined with respect to a payment technology. Accordingly, new payment technologies give rise to new forms of money. For example, when only specific distributed ledgers offer 'pseudo anonymity' for transactions, and such transactions create private value, then cryptocurrencies that operate on these ledgers may be valuable due to their liquidity bubble component. (Or they may not be valuable when investors fear that the pseudo anonymity is in danger or that a better coin is about to appear and conquer the market.) Similarly, cryptocurrencies might have value because of a strictly positive store-of-value bubble component if the currency constitutes the only available store of value subject to anonymity restrictions.

Convenience surely is a much more common factor for the valuation of new monies than pseudo anonymity. Since some novel payment technologies offer more convenience, FinTech businesses which push them have convinced consumers to store real balances with them, even if the financial return on these balances is dominated. But this process could revert. On the one hand, it is easier to create new monies when interest rates are low such that a small convenience

269 See https://norberthaering.de/en/my-ecj-courtcase-on-cash/timeline/.

yield (supporting a liquidity bubble component) suffices to compensate for the return disadvantage. On the other hand, new technology could (and already does) turn existing securities into monies and thereby undermine the demand for new forms of real balances.

To make this happen, technology must enable contracting parties to simultaneously settle two legs of a transaction, thereby eliminating credit and price risk. The seller and the buyer have to agree on the quantity of commodities or securities sold and on their price, expressed in some unit of account. They must define the time at which the transaction is to take place. And then it is up to the payment technology to charge the buyer whatever quantity of her securities corresponds to the contracted price at the agreed time. In the limit, the payment technology collapses to a smart contract tied to a database that registers ownership.[270]

Government response

The accelerating digitalisation of many areas in society reflects novel technological possibilities and shifting consumer preferences. It challenges governments in multiple ways, of which Figure 1 highlights a few areas. Without discussing them in detail, let me just mention some: legal aspects (e.g., related to the definition of identity and property); the cloud and its implications for contagion and national security; increasing returns to scale due to interoperability and the consequences for market structure, product quality, and regulation; skills and the risks due to digital illiteracy and unequal opportunities; and information, which becomes more and more abundant but partly also more asymmetric, affecting efficiency, liquidity, and privacy.

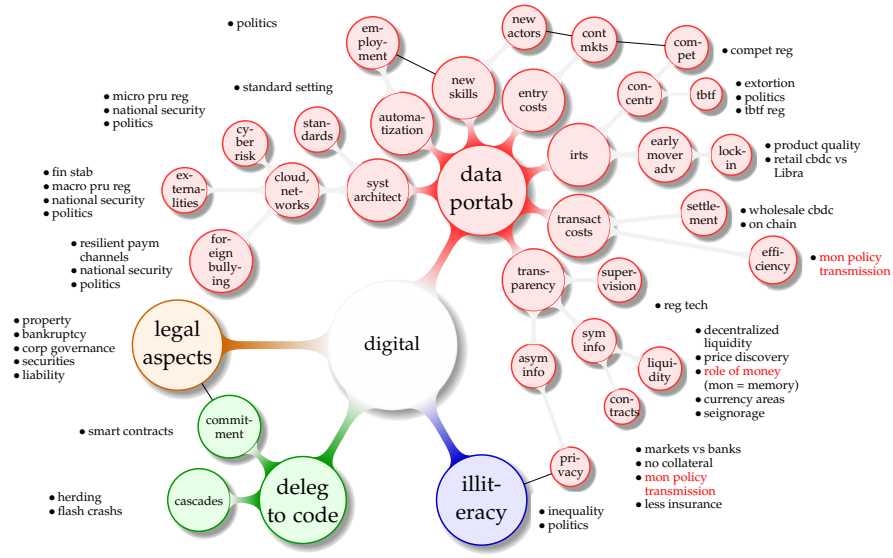
Against this background, it is not surprising that regulation in banking and finance has barely been able to keep up. This might have been a disadvantage for firms which are used to operating within the boundaries of a clear regulatory framework (think of banks). And it might have helped start-ups which are small enough to benefit from sandboxes or negligence and BigTech firms which have expanded their operations without being subjected to stringent new regulatory frameworks. The chapter discusses that the intersection between competition law and financial regulation warrants further attention. Similarly, the intersection between financial regulation and consumer protection, specifically concerning privacy, warrants such attention.

The time lag between the origination of new business models and the regulatory catch-up will give rise to permanent structural change in the banking sector. As the chapter discusses, some activities are less affected (e.g., the deposit-taking business) because the traditional players are well positioned to defend their market shares. Other activities (mainly in payments) are more vulnerable because the agile new entrants exploit synergies with platform businesses and social networks.[271] We will see more of that, specifically in regions with archaic payment systems.

270 Kocherlakota (1998).

271 An interesting question is why the incumbents do not respond in kind. Banks and credit card companies hold vast amounts of information about their clients but they do not exploit them in ways comparable to the technology firms entering their turf. Maybe banks and credit card companies simply lack technical expertise. Alternatively, they might be more constrained by the regulatory framework.

Figure 1



Among the many challenges that legislators and regulators face, the biggest might concern the question of whether central banks should issue central bank digital currency (CBDC) or, in my preferred language, 'reserves for all'. The chapter discusses several arguments in favour of CBDC. Let me expand a bit, because I believe that the issue is key.[272] Regulatory adjustments come and go, but 'reserves for all' would change the financial system fundamentally, at its core.

We have already encountered two arguments in favour of CBDC. First, if trust in a currency requires tangibility or, at a minimum, direct access, then CBDC is a prerequisite in cashless societies for citizens' trust in government money, and by implication for sound and stable money.[273] And second, CBDC would correct the awkward situation that many governments outlaw the usage of government money for common transactions. But there are more potential advantages.

CBDC would spur competition in the payment industry. This would also lower transaction costs for international payments where lack of competition (often due to regulation), not technology is the bottleneck.

CBDC would strengthen the monetary policy transmission channel. Changes in central bank policy rates would more directly feed through to the rates faced by households and firms. In contrast, today deposit rates barely respond to monetary policy.[274]

272 The following discussion partly draws on Niepelt (2020a).
273 Landau (2019).
274 Drechsler et al. (2017).

CBDC would reduce the 'too big to fail' problem. One motivation to support struggling banks derives from the fact that bank failure puts strain on the payment system – a key pillar of the economy. Since payment system failure is not an option, so is bank failure. If many households and firms transacted using CBDC rather than deposits, the social cost of bank failure would be lower and so would be the motivation to provide state support. With less need for state support, regulatory constraints on banks could be relaxed.[275]

Finally, CBDC would help to protect monetary sovereignty. True, it takes a lot for society to abandon the national currency. But if digital payment instruments issued by other monetary authorities (or a private intermediary like the Libra association) offer much more convenience or safety, a tipping point is reached and the local currency is dumped, as is well known from the "dollarization" experience in countries with weak monetary institutions.[276] Countries issuing their "own" CBDC (without restricting other payment options like cash transactions) likely are less prone to suffering from dollarization and its consequences, including losses in seigniorage, monetary autonomy, and national security.[277]

The risks of CBDC are not fundamentally macroeconomic in nature, although this is a common concern. When issuing CBDC (without simultaneously retiring other liabilities) the central bank raises funds and as a matter of accounting these funds must be invested somewhere.[278] One option is to pass them on to the banking sector, thereby insulating bank balance sheets even if households or firms shift funds from deposits to CBDC. In fact, the central bank can shield not only banks in this way but the whole economy, and in doing so need not get involved with credit allocation to main street. This holds true under broad conditions.[279] It entails that, at the margin, deposit-based payments can be substituted by CBDC-based payments and both means of payment require the same amount of resources. This seems plausible.

CBDC could change macroeconomic outcomes if the central bank chose not to pass the funds through to commercial banks but to invest them elsewhere, for instance due to political constraints or in order to discourage political interference.[280] After all, a longer central bank balance sheet could invite lobbying from special interest groups. And a pass-through policy would also make the distributive effects of the monetary system more transparent, which could strengthen the resistance against bank support or, to the contrary, the support for bank subsidies if they were perceived to relax funding constraints for households and firms.

There are more subtle political risks. Network effects might undermine the user base of cash once CBDC is introduced[281] and this might weaken the political support for cash. Some see this as a plus because the abolition of cash would let the central bank lower interest rates far into negative territory without triggering cash withdrawals, thereby empowering monetary policy.[282] Others who believe that cash provides a welcome protection against extreme monetary policies disagree.

275 Tobin (1985, 1987).
276 De Nicolo et al. (2005).
277 See also Brunnermeier at al. (2019) on digital currency areas.
278 Unless the central bank hands out CBDC for free, as a 'helicopter drop'.
279 Brunnermeier and Niepelt (2019).
280 Niepelt (2020b).
281 Agur et al. (2019).
282 See, for example, Bordo and Levin (2017).

Financial stability would be less at risk with CBDC, not more. If the central bank were to pass the funds raised from CBDC issuance through to the banking sector, as described above, it would simply render the implicit guarantees in today's monetary architecture explicit. In fact, since the central bank would become a large depositor it could internalise run externalities. Even if central banks were not to implement pass-through policies the risk of bank runs would not have to rise, for central banks could still implement measures to stem runs.[283] One should also not forget that households and firms can already today swiftly move funds from bank to government accounts – in the US through Treasury Direct; there is little concern that this could trigger bank runs.

In summary, the case for CBDC is stronger than what is often suggested. How strong it is, varies across countries and also depends on personal value judgements.[284] What is clear, however, is that the introduction of CBDC would constitute a bold step towards a modified monetary architecture. Accordingly, it should be for societies to decide about CBDC, not for central banks.

Concluding remarks

In last year's report, Vickers writes that "[a]nother banking crisis, within living memory of 2008, would be immensely damaging to central banks, all the more so given the reassuring tone projected by leading central bankers about Basel III".[285] At the time of this writing (March 2020) it is unclear whether we are already heading into another such crisis. What is apparent, however, is that the decidedly 'real' Covid-19 shock triggers as many questions about the stability of banks as about the robustness of logistic chains, and nearly as many as about break points in the healthcare system. This is disturbing. Finance, and especially payments, should work like basic utilities; they perturb us much too often.

Will the repercussions of Covid-19 be damaging to central banks, as predicted by Vickers? Or to those who defend today's financial architecture based on the argument that change would create uncertainty and new risks? The growth of private digital monies forces not only banks but society at large to confront broad questions about adequate institutions for intermediation and payments in the 21st century. Change will come for sure. We should push for change to the better.

283 See, for example, proposals by Kumhof and Noone (2018) and Bindseil (2020).
284 For a discussion of some trade-offs, see Niepelt (2020a).
285 Bolton et al. (2019, p. 121).

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The Covid-19 pandemic has induced a deep global economic crisis. Yet, in the middle of the financial turmoil over the past few months, banks were a source of resilience. Thanks to major reforms following the global financial crisis of 2007-2009, the much better capitalised and more liquid banks were not under immediate stress. In fact, banks are seen as useful to support the real sector's financing needs. But they will come under stress. Large-scale insolvencies among firms may arise. A wave of bankruptcies among households may follow. Banks could get caught up eventually, with stresses to exceed those envisioned in many tests.

The effects from the crisis come on top of the combination over the past decade of persistently low interest rates, regulatory changes, and competition from shadow banks and new digital entrants that challenged the traditional bank business model pre-Covid-19. The report tackles these crucial challenges, examines the competitive responses of the different players – both incumbents and new entrants – and the associated policy and regulatory issues. It argues that:

- In the short run, banks may enjoy a revitalisation of relationship lending as they channel funds to customers over the crisis and enjoy the protection of the safety net and access to deposit financing.
- However, the Covid-19 crisis will accelerate pre-crisis tendencies as subdued growth and low interest rates will persist for a long time. It will test the resilience of the financial system, the regulatory reforms implemented after the global financial crisis, and the limits of central bank intervention.
- While banks may enjoy temporary regulatory and supervisory relief, digitalisation will receive a large impetus, with new entrants challenging banks. Digitalisation will increase the contestability of financial services, but its long-term impact will depend on the market structure that prevails. Banking may move from the traditional oligopoly to a system with a few dominant platforms that control access to a fragmented customer base, with a few BigTech firms and some platform-transformed incumbents monopolising the interface with customers.
- Medium-sized banks will suffer since they cannot manage the cost efficiencies and IT investment that are crucial in the new environment. Consolidation could be an escape route for stressed banks, but in the post-Covid-19 world, political obstacles to cross-border mergers may resurface as states become more protective of their national banking champions, with banks considered strategic.
- Regulators must adapt to digital disruption by balancing facilitating competition and allowing the benefits of innovation with protecting financial stability. In order to so, they must coordinate prudential regulation and competition policy with data policies, navigating complex trade-offs.

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