

Beck, Thorsten et al.

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Will video kill the radio star? Digitalisation and the future of banking

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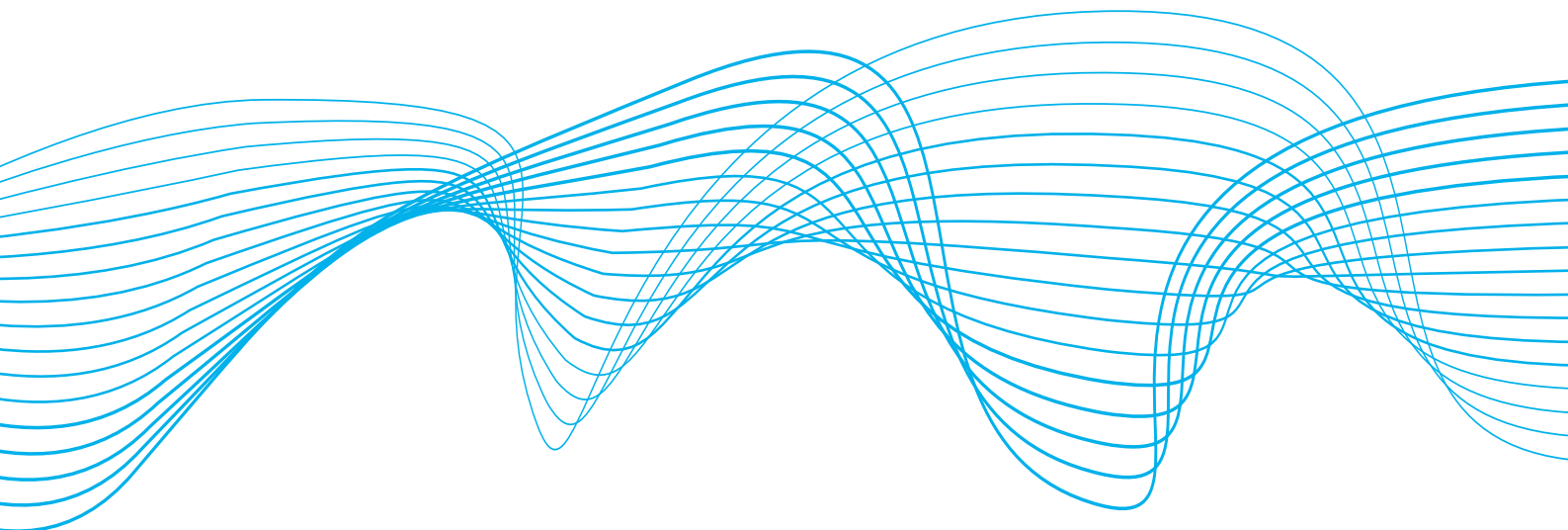
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Reports of the Advisory Scientific Committee

No 12 / January 2022

Will video kill the radio star? – Digitalisation and the future of banking

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Executive summary

Taking into account the many forces currently affecting the EU banking system, this report considers how digitalisation may change the way financial services are provided in the future, identifying financial and non-financial risks and forming possible policy responses to them.

The European banking system is confronting fundamental structural changes and challenges that are going to shape its future and ability to serve the financial needs of the real economy. Some, such as overbanking and the legacy of non-performing loans (NPLs), have been present for several years and can be seen as legacy problems dating back to the global financial and European sovereign debt crises. Against a background of a bank-centric financial system, the EU banking system has experienced contained growth and strong deleveraging since the global and sovereign debt crises. In parallel, the non-bank financial sector has materially increased its assets under management, often intensifying activities typically associated with banks.¹ Other challenges, such as digitalisation and climate change, are forward-looking in nature and relate to societal changes beyond the banking and financial systems. On top of that, the COVID-19 pandemic may be affecting economic structures, exerting an impact on the banking system that may touch the core business models and operations of European banks.

Financial innovation has been a defining feature of the financial sector over the centuries, in the shape of new products (e.g. new types of securities), new technologies (e.g. credit scoring, automated teller machines (ATMs)) and new institutions (e.g. venture capitalists, mutual funds). While financial innovation poses regulatory challenges and might create new sources of systemic risk, it has the potential to result in cheaper and more convenient services, more efficient and less costly delivery and greater competition and contestability in the financial system. The current wave of financial innovation is being supported by specific technological advances, involving: (i) smart phone technology, the internet and application programming interfaces (APIs); (ii) artificial intelligence (AI) and big data technology; and (iii) distributed ledger technology (DLT).

The recent wave of financial innovation, though no different from past waves, has come mostly from outside the incumbent banking system in the form of new financial service providers, either in competition or cooperation with incumbent banks but with the potential for substantial disruption. Across the globe, fintechs have shown impressive growth and are typically small and specialised in specific services (although, in aggregate, they cover a large diversity of financial services). Big techs, usually operating through platforms, derive advantages from data analytics, network externalities and interwoven activities, and follow an envelopment strategy moving from non-financial into financial services.

As a result, incumbent banks face competition across different business lines, and disintermediation may result in losses of scale and/or scope economies. Banks typically expect fintechs not to threaten their incumbency, albeit with some need to buy out innovators to sustain this position. With big techs, however, incumbent banks could react in different ways, depending on

¹ The development of the non-bank financial sector can be beneficial from a macroprudential point of view, as it can increase risk sharing across the financial system. It can also have detrimental effects on financial stability, because financial risks, including liquidity risks, that are inherent to the provision of financial intermediation services by banks could shift to areas of the financial system that are not typically as highly regulated as the banking sector.



how big techs go about expanding into financial service provision: by establishing subsidiaries or cooperating with incumbent banks. The former approach would constitute a direct challenge for incumbent banks, which might react by increasing their risk profile to defend their position. Cooperation seems less disruptive, although it would also likely erode the rents that incumbent banks have enjoyed until recently, potentially rendering many of them unviable in their current business model.

In this process, new risks may emerge and existing risks may be reshaped. New providers entering with bank-like intermediation models would be exposed to the known risks in banking (liquidity risk, credit risk, market risk, etc.), affecting, in turn, system-wide risk. While more competition could enhance stability over the long term, concentration (particularly with big techs) could result in new too-big-to-fail institutions, and a stronger focus on transaction-based intermediation could make the system more procyclical. Furthermore, incumbent banks may take greater risks to compete with new providers. Cooperation between big techs and incumbent banks might lengthen intermediation chains, moving them towards the originate-and-distribute model, which raises concerns about incentives and risk distribution.

In addition to financial risk, digitalisation also poses significant non-financial risks, both for banks and for fintech and big tech companies. These risks stem from (i) greater concentration on providing basic services, such as cloud computing; (ii) broader use of AI in finance; (iii) overly automated or IT-oriented services that may be more prone to cyberattacks; (iv) trust in a leading technology that might suddenly turn obsolete; and (v) a false sense of security from overleveraging insights from AI.

The contribution of financial and non-financial risks to the overall level of risk in the system depends on (i) the current state of the EU banking system (which, in the aggregate and compared with banking sectors in other major advanced economies, cannot be characterised as strong)² and (ii) how incumbent banks interact with fintechs and big techs in the future, an area still dominated by uncertainty. Consequently, this report uses three alternative scenarios for the EU financial system in 2030 as a basis for discussing the appropriate macroprudential policy responses:

1. In scenario 1, incumbent banks continue to dominate and maintain their central role in money creation and financial intermediation. They aggressively counter the competitive threat through technological adaptation, acquiring fintech companies and lobbying. Fintechs continue to focus on specific niche markets, while big techs offer payment services but do not have access to central bank clearance and payment systems (they might cooperate with incumbent banks). The banking system renews itself by incorporating new providers and new products.
2. In scenario 2, incumbent banks retrench, while big techs offer financial services through regulated subsidiaries and capture the hard data, transaction-based lending market. Incumbent banks increasingly focus on relationship-intensive services, at both the high end (investment banks) and low end (community banks) of the market. The banking system shrinks, especially

² The EU banking system currently has a predominant position in funding the real economy, with a relatively strong presence of legacy assets from the previous crisis and a structurally low level of profitability. The Annex provides a more detailed description of the EU banking system, including a comparison with banking systems in the United States and Japan.



because mid- and small-sized banks are no longer able to exploit scope economies. This scenario leads to a structural change in the financial system.

3. In scenario 3, issuance of retail central bank digital currencies, under certain intermediation models, leads to a very different structure of the financial system. Incumbent banks face higher funding costs and a more volatile funding base, as the traditionally stable retail deposit clientele might switch to the digital currency. Financial intermediation moves away from incumbent banks, while the central bank plays an increasing role as an intermediary. Other financial service providers (including fintechs and big techs) offer tailor-made and specialised services in lending, asset management and risk management. The traditional banking system would no longer play the role of a stable anchor.

Given that developments in financial system are endogenous to regulatory responses and adjustments, especially during potentially disruptive transformations, this report proposes several policy actions to address financial and non-financial risks. Some of these actions would apply to all three scenarios, while others would be more relevant if only one of the three scenarios materialises. Critically, the regulatory response will be a key driver of which of the three scenarios materialises.

These policy actions can be grouped as follows:

- The first covers the issue of the definition and possible expansion or adaptation of the regulatory perimeter, and of the conditions for accessing the safety net. If performing bank-like financial activities, fintechs and big techs should have access to the safety net. In parallel, a prudential framework should be developed, also including consumer protection and anti-money laundering. This becomes more important in the scenarios of bank retrenchment and central bank digital currencies.
- Global cooperation may need to be enhanced here, since most fintech and big tech companies may operate on a global scale with no permanent establishment in most jurisdictions where they are present. To avoid undesired and untimely discussions, mechanisms for cooperation should be put in place *ex ante*.
- The financial intermediation activities of big techs may need to be ring-fenced and therefore provided through a subsidiary that falls within the regulatory perimeter. This policy may require profound organisational changes in big techs and substantially reduce the appeal of entering the financial intermediation business, greatly decreasing the probability of the second scenario (banks' retrenchment).
- The extended use of non-financial providers of services, which may fall under a different regulatory authority (e.g. telecom regulator), may require enhanced cooperation between regulators in different sectors and jurisdictions. Such cooperation might also be required across borders, given the global nature of most big techs. As the regulatory and legislative approaches towards platform companies (i.e. big techs) change at EU level, such changes should involve close cooperation with financial sector regulators.
- Increased digitalisation in financial services may require a change in regulatory and supervisory practices, which were defined when digitalisation was in its infancy and non-financial risks were not high on the regulatory agenda. Digitalisation may increase the



importance of non-financial risks (many of them currently under the umbrella of operational risks), and a more accurate reflection of them in the prudential framework may be required. This would also apply to the skills of staff in regulatory and supervisory authorities.

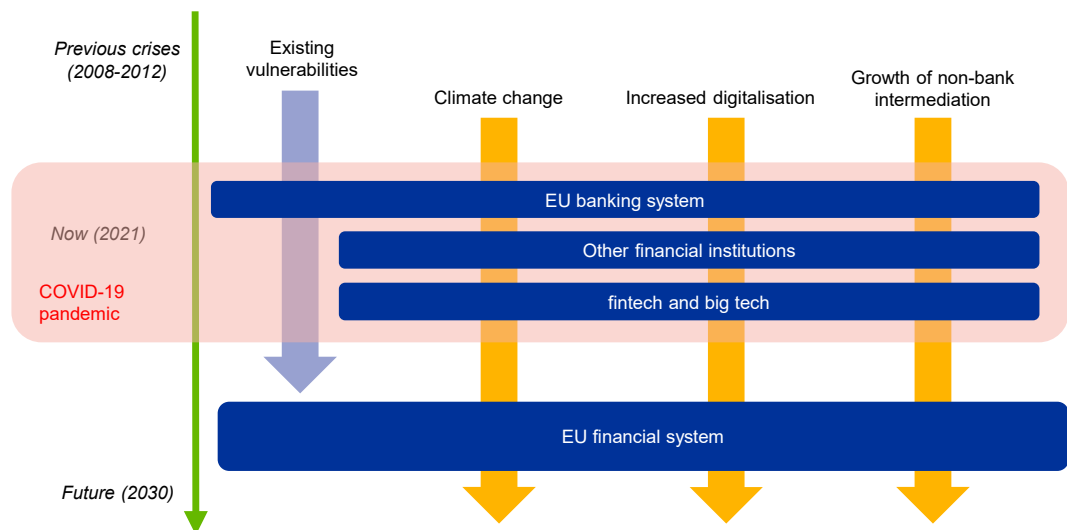
- Political decisions on the issuance of central bank digital currencies to retail customers have to carefully balance efficiency gains with any stability risks this poses to the incumbent financial system. Issuing digital currencies can give customers more options and result in more competition. However, it is important to consider the medium to long-term implications for the structure of the financial system, in terms of both efficiency and stability, and as tentatively discussed under scenario 3.
- The support framework for an orderly exit and capacity reduction of incumbent banks should be strengthened as, under all the scenarios, they will face increased competition and even tighter profit margins. This will necessarily result in incumbent banks reducing capacity and possibly exiting the market, a process that can cause fragility. This process can also be proactively supported, avoiding government support for inviable banks, facilitating mergers, easing barriers to market exit and liquidation, and completing the banking union.



1 Introduction

The European banking system is confronting fundamental structural changes and challenges that are going to shape its future and its ability to serve the financial needs of the real economy (Figure 1). Some of these challenges have been present for several years and can be seen as legacy problems dating back to the global financial and the European sovereign debt crises. Overbanking and NPLs would be two such cases. Other challenges are forward-looking in nature and relate to societal changes beyond the banking and financial systems (for example, digitalisation and climate change). On top of that, the COVID-19 pandemic may be affecting economic structures, exerting an impact on the banking system that may touch the core business models and operations of European banks. How banks (and prudential authorities) respond to these changes and challenges may greatly determine the future of banking (and finance) in the EU.

Figure 1
Schematic diagram of fundamental structural changes and challenges facing the EU banking system



Notes: Previous crises refer mainly to the global financial crisis and the European sovereign debt crisis. Schematic diagram for presentational purposes only and not intended to be exhaustive.

After the global financial and European sovereign debt crises, the European banking system received increased attention from regulators and market participants. In the aftermath of the global financial crisis, an ambitious regulatory reform was implemented to address the flaws and vulnerabilities revealed by the crises, resulting in the Basel III prudential framework for banks (King and Tarbert (2011); Basel Committee on Banking Supervision (2021a)). The regulatory reform has extended over nearly a decade as some of its elements, such as the supplementary leverage ratio requirement, the output floor and the Fundamental Review of the Trading Book, came into force only recently. The European sovereign debt crisis quickly revealed the close links between banks and their sovereigns, and their potential to cause and amplify systemic risk (European Systemic



Risk Board (2015)). Until recently, the consequences of both crises were still noticeable in the balance sheets of some European banks, with the share of NPLs and sovereign exposures remaining abnormally high in some. In the macroeconomic environment of low growth, low interest rates and low inflation that has prevailed in the aftermath of these crises, existing vulnerabilities in the business model and the efficiency of European banks have come to the forefront (European Systemic Risk Board (2016a, 2016b and 2021b); Committee on the Global Financial System (2018)).

Against the background of a bank-centric financial system, the EU banking system experienced contained growth and strong deleveraging after the global and sovereign debt crises. Compared with other advanced economies, EU banks play a greater role in providing financial services to the real economy. Evidence suggests that European “overbanking” (Pagano et al. (2014)) leads to lower growth and higher systemic risk, as also revealed by the global financial and the sovereign debt crises. While the EU banking sector reduced its balance sheet size significantly in the aftermath of both crises, there is still a perception that the provision of financial services to the European economy relies excessively on the banking sector.

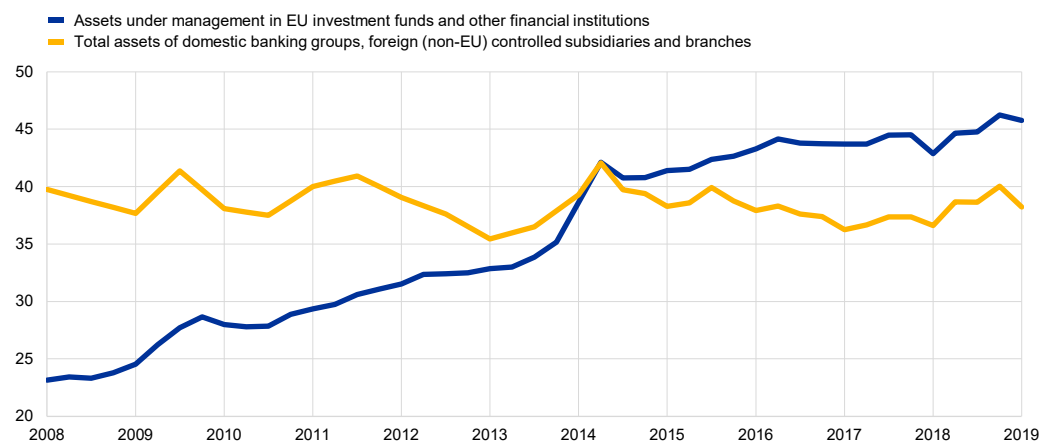
In parallel, the non-bank financial sector increased its assets under management, often undertaking more activities typically associated with banks. The role of non-bank financial intermediaries has been increasing since the global financial crisis, with assets under management more than doubling between 2008 and 2019, while the size of the EU banking system has remained roughly constant (Chart 1). Non-bank financial intermediaries have absorbed functions historically associated with banks, such as providing households and firms with liquid saving instruments and credit intermediation. For example, bond funds play an important role in corporate bond markets, providing credit intermediation between the savers who invest in their shares and the issuers of those bonds. Depending on their redemption policy, bond funds also perform varying degrees of maturity and liquidity transformation. Specialist financial corporations engaged in lending (including leasing, factoring, mortgage lending and consumer lending companies) focus on asset financing for households and non-financial corporations (European Systemic Risk Board (2020b)).



Chart 1

Assets under management of EU investment funds and total assets of EU banks

(EUR trillions)



Sources: European Systemic Risk Board (2020b), ECB and ESRB Secretariat calculations.

Notes: The blue line represents assets under management of EU investment funds and other financial institutions, as reported in the 2020 Non-Bank Financial Intermediation Risk Monitor. Data on the size of the banking system are taken from consolidated banking data, including from domestic banking groups, stand-alone banks and foreign (non-EU) controlled subsidiaries and branches, irrespective of their accounting framework. Consolidated banking data have been reported quarterly only since 2015, so linear extrapolation has been used for values before that year. Both time series end in 2019 to keep a constant sample of EU countries.

The development of the non-bank financial sector can be beneficial from a macroprudential point of view, as it can increase risk sharing across the financial system (European Systemic Risk Board (2020b)).

As a result, however, niches of banking business models that were seen as stable and secure for banks are currently facing increased competition from non-banks. Furthermore, financial risks, including liquidity risks, that are inherent to the provision of financial intermediation services by banks could shift to areas of the financial system that are not typically as highly regulated as the banking sector. The capital markets union initiative launched by the European Commission in 2014 aims to expand access to non-bank sources of funding, which will affect the future of banking in the EU. The ultimate objective of capital markets union is to establish a genuine single capital market in the EU where investors can invest their funds across borders without hindrance and businesses can raise the required funds from a diverse range of sources, irrespective of their location.

The increased digitalisation of advanced economies is affecting the way banks produce and provide financial services to their customers, as well as bringing new fintech and big tech players into the production and provision of financial services. This has potential implications for incumbent financial institutions and, most notably, traditional banks.³

The most recent wave of digitalisation has been triggered by advances in telecommunications and information technology. The capacity to process information and the ability to connect with economic agents are two important results of this process. Chart 2 shows the cross-country

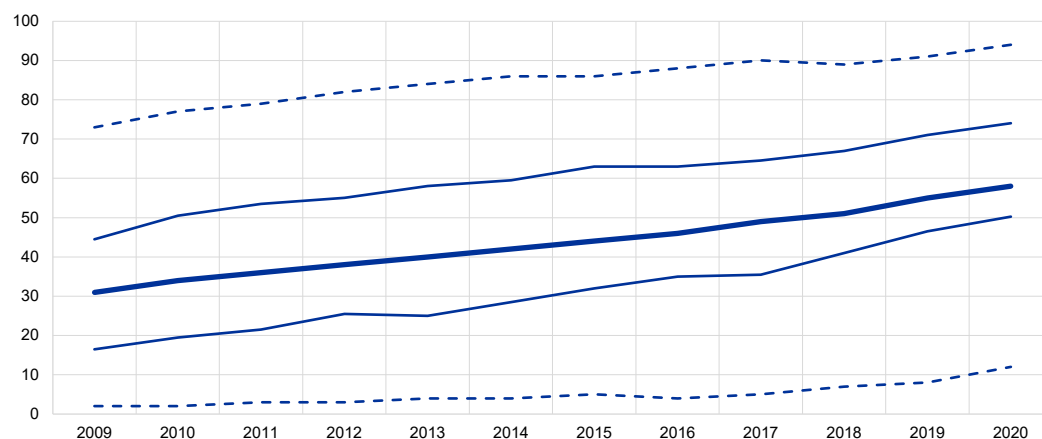
³ While there is no one widely accepted definition of either, we define fintech firms as new technology-driven players aiming to compete with traditional financial institutions in the delivery of financial services and big tech firms as platform firms, such as Google, Facebook, Apple, Amazon, Alibaba and Tencent. We will return to this differentiation in Section 2.2.



percentage distribution of EU households using the internet for online banking services. The EU as a whole has seen steady growth since 2009, with usage in some countries approaching 100%. However, the heterogeneity across countries can be important, especially for households and small businesses, not all of whom may be prepared for and thus benefit from the digital delivery of financial services. For traditional banks, digitalisation may lead to offering new products and services, potentially improving the customer experience.⁴ Banks have been intensive users of IT systems for decades, with the largest US banks each spending an average of USD 10 billion per year on IT.⁵ In the EU, the IT costs of almost half of the banks under European banking supervision ranged from 3% to 8% of operating income in 2020 (Chart 3).⁶ As a comparison and based on consolidated banking data of the European Central Bank (ECB), staff expenses typically represent between 25% and 35% of total operating income. The need, therefore, to confront new IT expenses related to digitalisation is not per se new or so disruptive. The challenges of digitalisation come more from the redefinition of banking business and the reorganisation in the financial system that it might imply. If digitalisation breaks or substantially reduces the importance of physical proximity between a bank and its customers, competition may drastically change, affecting incumbent banks and shaping the future structure of the banking market (Vives and Ye (2021)). Similarly, if digitalisation reduces the value of banks' data on clients compared with data that other potential financial service providers have available (such as big tech companies), this might reduce traditional banks' franchise value.

Chart 2
Percentage of individuals using the internet for online banking across EU Member States

(percentages)



Sources: Eurostat and ESRB Secretariat calculations.

Notes: The thick blue line represents the average for the EU27 (excluding the United Kingdom), while the thinner blue lines represent the countries at the first and third quartiles. Maxima and minima are shown with dotted blue lines.

⁴ The customer experience can also benefit from more efficient data processes in the back offices of banks.

⁵ See Shevlin (2019), Butcher (2021) and Moise and Franklin (2021).

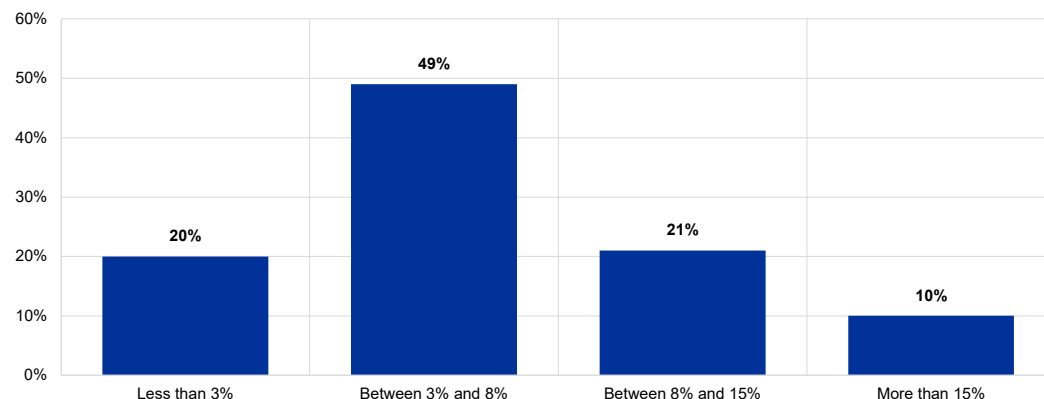
⁶ See De Haan (2021) for a more detailed analysis of the IT costs of European banks.



Chart 3

Distribution of IT costs as a share of total operating income

(percentages)



Sources: European Central Bank Banking Supervision (2021a).

Increased awareness about climate change is also affecting the financial system. In recent years, society has gained a better understanding of the consequences of climate change for the planet. Providers of financial services may be affected. For example, assets in the balance sheets of financial institutions (or assets of borrowers or bond issuers that financial institutions are exposed to) may become stranded, or insurance corporations may face increased claims from natural catastrophes. From a financial stability perspective, the challenges posed by climate change that need to be addressed include considering how it may affect banks' risk management and performance, how banks should model the risks associated with climate change and how to address their regulatory treatment (e.g. relying on internal models vs. adjusting risk weights), and how credit rating agencies should incorporate climate risk in their ratings. These are important areas of work that regulatory authorities, including those with a macroprudential mandate, are starting to consider (Gros et al. (2016); Bolton et al. (2020); European Systemic Risk Board (2020a and 2021c); Basel Committee on Banking Supervision (2021b)). While acknowledging the importance of these developments, this report will not address the specific challenges posed by climate change for the future of banking.

Finally, the COVID-19 pandemic can be seen as a factor accelerating some of the structural changes outlined above. As a result of the health measures taken to prevent contagion and the collapse of health systems after the outbreak of the COVID-19 pandemic, remote working, remote shopping and remote access to all sort of services became widespread. For banks, in particular, it meant an impulse to the already significant and growing use of remote banking services, mainly through the internet. Fernandez et al. (2020b) have already shown some evidence on this, together with an overall high satisfaction with the provision of banking services through the internet. Beyond the macroeconomic impact of the COVID-19 pandemic on banks,⁷ digital transformation in banking may have been accelerated by the outbreak of the COVID-19 pandemic. The combination of banks being forced to accelerate the digital transition with their important role in providing support to the

⁷ For a broader discussion of the impact of the COVID-19 pandemic on the banking sector, see, among others, European Systemic Risk Board (2021a) and McKinsey and Company (2020).



economy during the lockdowns, together with the later recovery, might have pushed some banks to accelerate and/or consolidate their transformation process.

Against this background, we aim to discuss the impact of digitalisation on incumbent banks' business models and the future of the EU banking sector, highlighting the implications for financial stability and, in three hypothetical risk scenarios, the range of possible policy options for addressing the challenges that macroprudential authorities face.

Given the many forces currently affecting the EU banking system, we consider how digitalisation may change the way financial services are provided in the future, identifying financial and non-financial risks and forming possible policy responses to them. The rapid development and adoption of new technologies, as well as the growth of fintechs and the financial intermediation⁸ activities of big techs, highlight the timeliness of addressing these issues from a financial stability perspective. At the same time, however, there is uncertainty as to how incumbent banks will interact with fintechs and big techs in the future. For example, fintechs and big techs could seek to channel significant amounts of credit, but they might do it separately from banks (thus substituting their traditional intermediary role) or in some form of vertical or horizontal relationship with them (potentially complementing this intermediary role). The policy implications of the former situation can be quite different from those of the latter. Consequently, the report uses three alternative scenarios for the EU financial system in 2030 as a basis for discussing the appropriate macroprudential policy responses.

The report is organised as follows. Section 2 discusses in detail the challenges posed by digitalisation to the traditional business models of banks, considering the increasing financial intermediation roles of fintechs and big techs, as well as the possible response of banks and its implications for the future of the banking sector. Section 3 elaborates on how existing risks may be reshaped and new risks may emerge throughout the process. Section 4 considers three scenarios for the evolution of the financial system by 2030. Section 5 identifies policies that might contribute to a well-functioning, efficient and stable EU financial sector in 2030.

⁸ In the context of this report, we refer to financial intermediation as liquidity and maturity transformation by banks and other financial institutions.



2 Digitalisation as a challenge for banks' business model

In this section we discuss how digitalisation can affect the business model of incumbent banks, in view of competition from new entities with different technological and strategic capabilities.⁹ We start by reflecting on the innovations brought about by digitalisation in recent years, then describe the two main new competitors of banks in this new environment: fintechs and big techs. We finish by discussing the possible reaction of banks to the emergence of these new competitors and its implications for the future structure of the banking sector.

2.1 Financial innovation – is this time different?

Financial innovation has been a defining feature of the financial sector over the centuries, referring to new products (e.g. new types of securities), new technologies (e.g. credit scoring and ATMs) and new institutions (e.g. venture capitalists and mutual funds). Financial innovation can take place within existing institutions (e.g. new types of derivatives developed by investment banks) or in combination with new institutions (e.g. venture capitalists). While statements that “this time is different” are common, what seems to be unique about the current wave of financial innovation is the extent to which it focuses on telecommunications and information technology, which we refer to in this report as “digitalisation”. In the banking sector, recent advances in telecommunications and information technology have led to new delivery channels (e.g. via the internet and mobile/smart phones) and providers, in the expectation of not only improving customer propositions but also creating significant disruption and reorganisation in the financial system. These innovations and the accompanying disruption could create or add to different financial and non-financial sector risks, some of which are systemic in nature.

While financial innovation poses regulatory challenges and may create new sources of systemic risk, it is important to stress that technology-induced financial innovation has the potential to result in cheaper and more convenient services, more efficient and less costly delivery and more competition and contestability in the financial system. While stability concerns are therefore of primary concern for prudential authorities, it is important to keep in mind the positive effects that financial innovation and disruption can have for users of financial services and the economy at large. An extensive literature has provided evidence of both the growth-enhancing and stability-threatening role of financial innovation.¹⁰ In addition, new technology-enabled competitors have the capacity to grow faster across borders, which can help increase competition in financial services, generate scale economies and smooth out geographical differences in the cost of capital for firms and households.

⁹ In the following, we often refer to (incumbent/traditional) banks vs. fintech and big tech companies. It is important to note that the latter can also have banking licences. We thus do not focus on the contrast/competition between banks and non-bank financial institutions (a legal/regulatory distinction) but rather between traditional bank providers of financial services and new providers that use financial technology to offer cheaper and possibly more customer-friendly products.

¹⁰ For the innovation-growth view, see, among others, Berger et al. (2005), Laeven et al. (2015) and Lerner and Tufano (2011). For the innovation-fragility view, see, among others, Gennaioli et al. (2012), Henderson and Pearson (2011), Keys et al. (2010) and Dell'Ariccia et al. (2008).

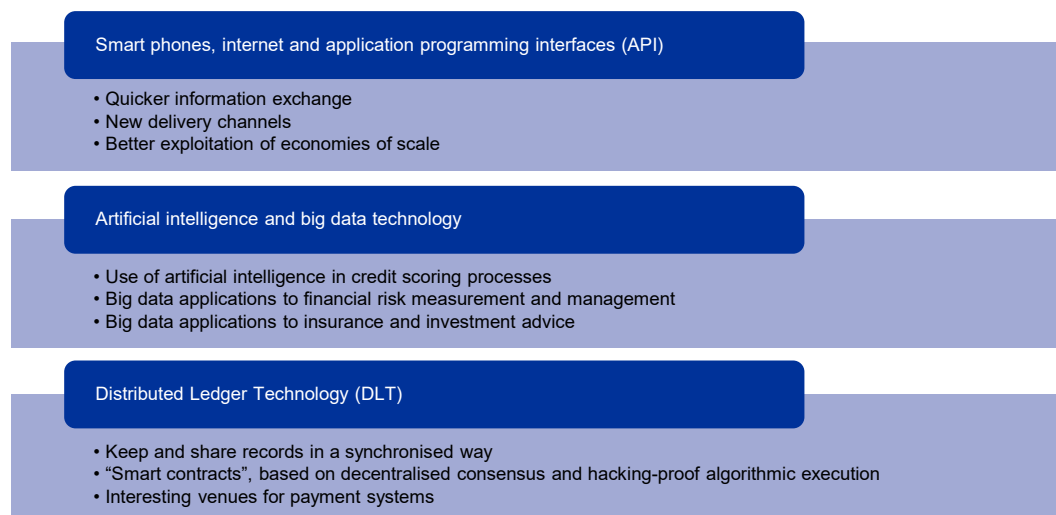


The current wave of financial innovation is supported by specific technological advances.

Moving from the broader impact of technology on banking to the most recently perceived technological advances, we identify three that are likely to affect the core of the banking business model moving forward. They involve (a) smart phone technology, the internet and APIs, (b) AI and big data technology, and (c) DLT (Figure 2).

Figure 2

Technological advances supporting the current wave of financial innovation



Sources: ESRB.

First, mobile phones (especially smart phones), the internet and APIs have enabled quicker information exchange, new delivery channels and better exploitation of economies of scale.

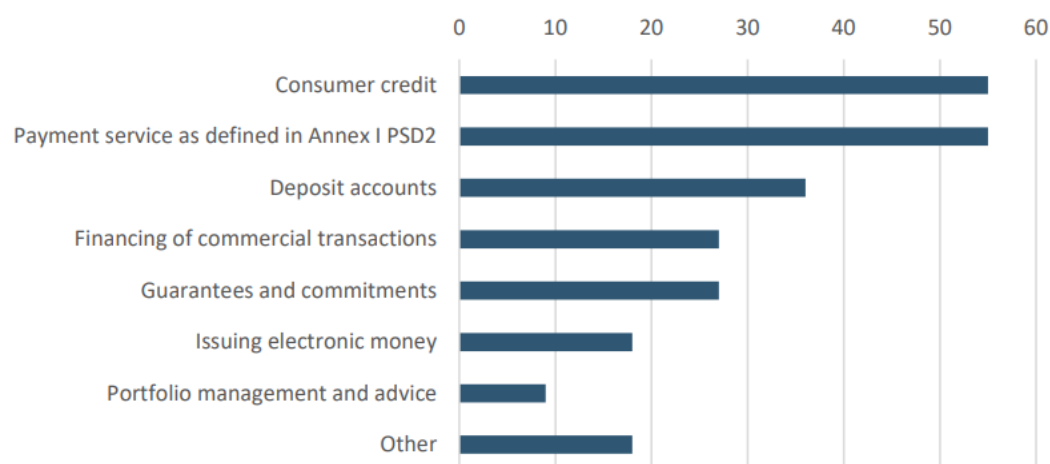
This has allowed new delivery channels, a move away from the traditional brick-and-mortar branch models and the entry of new payment service providers, such as mobile phone companies offering mobile money and fintech companies offering digital wallets. The internet has also enabled more competition, allowing customers to compare products and prices of different financial services across providers, with platforms enabling customers to shift deposits across different banks as conditions change. Chart 4 shows the different products marketed or distributed through digital platforms, with consumer credit and payment services coming top. As payment services yield valuable data, they can also be used as an entry point for new providers and for collecting data (our next point). APIs can also contribute to more secure interoperability and interconnectivity between systems and applications of different service providers, especially in the context of cross-border interactions.



Chart 4

Financial services marketed or distributed via a digital platform

(percentage of respondent financial institutions reporting use)



Sources: European Banking Authority (2021).

Second, the information technology revolution, including the rise of cloud computing, has facilitated the creation, processing and use of big data and applied statistics for measuring and managing financial risk. AI and machine learning allow an improvement of screening and monitoring models over existing techniques, such as traditional (mostly static) credit scoring models. In lending, such technology should lower loan origination costs and possibly reduce asymmetric information between borrowers and lenders, thus expanding available credit supply and the range of customers to whom it can be supplied. Several studies have shown big data to be more useful in predicting default patterns than more traditional approaches, such as banks merely relying on credit registry data.¹¹ AI and big data may also play a role beyond credit scoring in operational and broader risk measurement and management activities, such as fraud and cyber incident monitoring, anti-money laundering and compliance checks.

Big data can also be used for other financial services, including insurance and investment advice (insurtech and robo-advising).¹² Big data can be used for measuring underlying insurance risk more precisely, enabling more insurance contracts to be issued at lower costs, thus completing markets and expanding insurance markets both on the intensive and extensive margins. Customers can thus access a wider range of better tailored products and services, but the more effective risk assessment might also exclude riskier applicants from the insurance markets. Insurers can also use such data for monitoring purposes, developing more effective protection against operational risks and preventing insurance fraud and money laundering. Replacing human advisers, robo-advising leverages data provided by investors to construct and manage a tailored

¹¹ See, for example, Björkegren and Grissen (2020) on mobile phone call records, Berg et al. (2020) on “digital footprint” data used by a German e-commerce company, Frost et al. (2019) on data from Mercado Libre in Argentina, an e-commerce platform, and Jagtiani and Lemieux (2018), who compare loans made by LendingClub, a large fintech lender, with similar loans originated by traditional banks and show that LendingClub credit scores are more informative for loan performance than FICO scores.

¹² Thakor (2020) briefly discusses the development in insurtech, the combination of fintech with insurance services.



and appropriate investment portfolio for them. It can reduce the effects of behavioural biases shown by traditional human financial advisers (Foerster et al. (2017)), as well as the cost of financial advice. However, it does not necessarily eliminate conflicts of interest and might even increase them, as argued by Ji (2017), since algorithms can be programmed to reflect a firm's existing conflicts of interest.

While access to proprietary data across different financial services has given traditional banks an important advantage, big data has reduced, if not eliminated, this advantage.

Specifically, online non-financial service providers have access to a wealth of personal data and the capacity to use these data to more accurately assess a client's borrowing capacity and risk profile than publicly available information or even proprietary information of banks allow. This advantage is even more true for big tech companies, platform companies that are active across a variety of markets and social media. We will come back to these institutions in the next section.

A third innovation is DLT, which describes decentralised data architecture and cryptography and allows the keeping and sharing of records to be synchronised while ensuring their integrity through the use of consensus-based validation protocols.

The most prominent DLT has been blockchain, based on Nakamoto (2008), who introduced it as a method of validating ownership of the crypto-asset bitcoin.¹³ Blockchain is a decentralised distributed database that maintains a continuously growing list of records locked into a chain of hacking-proof "blocks". Among its defining characteristics are that there is no centralised authority, with changes based on consensus instead; that it has a perfect memory, i.e. a complete chronological record of transactions that is all but impossible to change; and that users have to obey the rules in order to participate. Less commonly highlighted characteristics are that the practical inability to change a blockchain without the consent of the parties involved also normally extends to third-party authorities, such as courts, and that ownership is typically recorded within some form of digital wallet, which is difficult or impossible to access if the key to the wallet is lost, forgotten or stolen. However, users capturing more than 50% of the computing power can hijack the consensus mechanism and go backwards in the blockchain.¹⁴

Ledger technology also allows "smart contracts", contracts based on decentralised consensus and (almost) hacking-proof algorithmic execution.

Such contracting allows inter-temporal transactions (both financial and real) where trust between agents is very low and enforcement of contracts by courts or other government agencies is deficient.¹⁵ It reduces reliance on relationships and/or collateral and broadens the universe of possible arms-length transactions.¹⁶

While decentralised and permission-less networks have caught more of the public's attention and fascination (also in the context of private crypto-assets), permissioned and closed systems offer interesting venues for payment systems, including international ones.

¹³ Strictly speaking, crypto-assets do not have the same functions as currencies (e.g. unit of account, value storage), so using the term "cryptocurrencies" to refer to them is conceptually misleading.

¹⁴ See [Investopedia - 51% attack](#).

¹⁵ Smart contracts have been used in [supply chains insurance](#), cross-border payments using [escrow accounts](#) and invoice financing.

¹⁶ Tinn (2018) develops a theoretical model of contract design where blockchain eliminates the need for costly verification, as incoming revenue is split between the lender and the borrower according to a dynamically adjusting splitting rule that depends on the history up to that point. The optimal financing contract would make external funding as cheap as internal funding.



Take the example of BitPesa, which uses blockchain technology for cross-border payments between African countries without requiring the US dollar as an intermediary currency. This reduces transaction costs, as well as regulatory costs associated with the US dollar payment system. DLT can also be used for combating money laundering and terrorist financing (AML/CFT), containing information about individuals that can be shared broadly and thus facilitating access to financial services. More generally, DLT allows a higher degree of transparency (of transactions, ownership, etc.), which is often seen as important for expanding financial systems both at the intensive and extensive margins. For example, by increasing transparency, DLT has the potential to increase market liquidity and efficiency (Yermack (2017)). Major central banks and stock exchanges have been exploring using DLT in payments, clearing and settlements, as detailed by Mills et al. (2016), although DLT's rather slow speed might prevent adoption of this technology.

Although crypto-assets have caught the attention of many investors, stablecoins and central bank digital retail currencies have more prominent implications for the future of incumbent banks. Over the past years, there have been hundreds of initial coin offerings (ICO), which are launches of a crypto-asset through crowdfunding, but the value of these crypto-assets has been very volatile, undermining their claim to being alternative currencies to fiat money. More recently, there has been a trend towards stablecoins – crypto-assets that are pegged to another asset (such as the US dollar, other national currencies and commodities) and whose value is guaranteed by holdings of sufficient reserves in these assets, similar in construction to a currency board. In addition to, as well as in reaction to, the increasing importance of private crypto-assets, central banks around the world have started exploring the value of central bank digital currencies for retail customers.

The current wave of financial innovations seems to have potential to be particularly disruptive for incumbent banks and for how and by whom financial services will be provided in the future. While previous waves of financial innovations have led to disruptions in the financial system (e.g. the introduction of ATMs was a trigger for lifting branching restrictions in the United States), the current wave could be particularly disruptive for three reasons. First, it removes incumbent banks' quasi-exclusive data advantage over other potential providers of financial services, especially big tech companies; second, there is less need for human contact and face-to-face interaction than under the traditional brick-and-mortar branch model, which implies large cost savings, including for traditional banks; third, it allows for screening and enforcement with less reliance on relationships, collateral and reputation than bank lending requires. However, banks are not standing still, as we will discuss in the following. And as we will argue in sections 4 and 5 below, the extent of the disruption will critically depend on the regulatory reaction.

2.2 Incumbent banks' new competitors: fintech and big tech

The recent wave of financial innovation has come mostly from outside the incumbent banking system in the form of new financial service providers, either in competition or cooperation with banks, but with the potential for substantial disruption. Again, this is not a new phenomenon. Financial history has been characterised by the emergence of many new institutions and intermediaries over the centuries, often addressing new demands or regulatory



constraints. The United States saw the rise of investment banks in the early 20th century to fund railroad expansion, while money market funds emerged in the 1960s in response to Regulation Q, which prevented banks from paying interest on demand deposits. Digitalisation, in addition to enabling banks to work almost entirely through the internet and with a very limited number of branches, has brought new intermediaries in the form of, for example, peer-to-peer lending platforms and new payment service providers. But it also allows non-financial companies to enter the financial service markets, with mobile network organisations and big tech companies (such as Ant Financial, Amazon and Facebook) being prime examples.

Across the globe, there has been impressive growth in fintech firms, together with a large diversity of implied services. Fintech activities encompass a wide range of financial services. The European Banking Authority (2017) classifies them in four clusters (Table 1).¹⁷ Most fintech companies are smaller players, often start-up companies that focus on specific services. Payment and lending activities are the segments that have attracted the largest number of entrants in the euro area and globally, followed by traditional intermediation business. Chart 5 confirms this insight, at both the global level (left-hand side bars) and euro area level (right-hand side bars). Interestingly, lending activities have declined slightly for fintech firms in the most recent periods, as shown by Cornelli et al. (2020) and by Cambridge Centre for Alternative Finance, World Bank and World Economic Forum (2020). The decline in lending activities during 2020 may be explained by a deterioration in asset quality indicators (most likely related to the recession caused by the COVID-19 pandemic), while other performance indicators for the global fintech sector have grown (Chart 6).

¹⁷ Other classifications are also possible. See, for example, Appendix C1 in Cambridge Centre for Alternative Finance, World Bank and World Economic Forum (2020).



Table 1

Fintech activity clusters

Credit, deposit, and capital raising services (Cluster A)	A1 Taking deposits; A2 Taking other repayable funds (i.e. funds other than deposits); A3 Lending, including, inter alia, consumer credit, credit agreements relating to immovable property, factoring, with or without recourse, financing of commercial transactions (including forfeiting); A4 Financial leasing; A5 Guarantees and commitments; A6 Credit intermediation under Article 4(5) of Directive 2014/17/EU (MCD); A7 Money broking; A8 Any other financial services of a kind within in this cluster
Payments, clearing and settlement services (Cluster B)	B1 Provision of payment accounts; B2 Services enabling cash to be placed on a payment account as well as all the operations required for operating a payment account; B3 Services enabling cash withdrawals from a payment account as well as all the operations required for operating a payment account; B4 Execution of direct debits including one-off direct debits; B5 Execution of payment transactions through a payment card or a similar device; B6 Execution of credit transfers; B7 Issuing of payment instruments; B8 Acquiring of payment transactions; B9 Money remittance; B10 Issuing and administering means of payment other than those referred to in Article 4(3) of Directive 2007/64/EU (e.g. travellers' cheques and bankers' drafts); B11 Services to initiate payment orders at the request of the payment service user with respect to a payment account held with another payment service provider; B12 Services to provide consolidated information on one or more payment accounts held by the payment service user with another payment services provider; B13 Operation of a payment system; B14 Ancillary services to payment and/or e-money services (Article 16(1)(a) of PSD); B15 Issuance of e-money; B16 Distribution of e-money; B17 Redemption of e-money; B18 Currency exchange; B19 Any other financial services of a kind within this cluster
Investment services/Investment management services (Cluster C)	C1 Trading for own account or for account of customers in any of the items referred to in point 7 of Annex I to Directive 2013/36/EU; C2 Participation in securities issues and provision of services relating to such issues; C3 Advice to undertakings on capital structure, industrial strategy etc. (e.g. as referred to in point 9 of Annex I to Directive 2013/36/EU); C4 Portfolio management and advice; C5 Safekeeping and administration of securities; C6 Safe custody services; C7 Advisory services (e.g. under Article 7 of Directive 2014/17/EU); C8 Any other financial services of a kind within this cluster
Other financial-related activities (Cluster D)	D1 Credit reference services (e.g. as referred to in point 13 of Annex I to Directive 2013/36/EU); D2 Comparison services; D3 Compliance services related to know your customer/AML; D4 Compliance services – other; D5 Any other services of a kind within this cluster

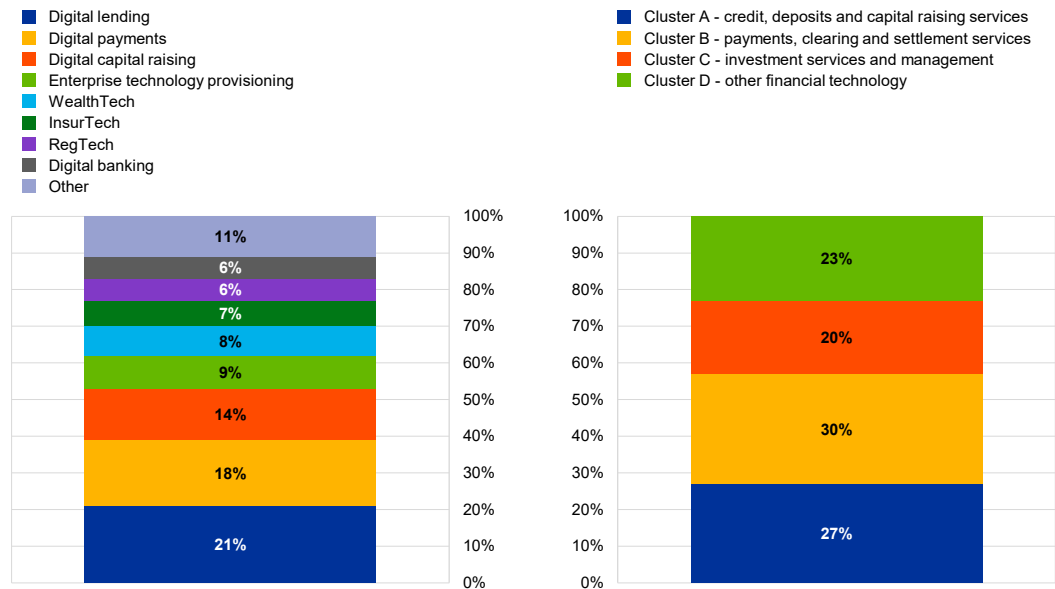
Source: European Banking Authority (2017).



Chart 5

Distribution of fintech firms globally (left-hand side) and in the euro area by cluster of activity (right-hand side)

(percentages)



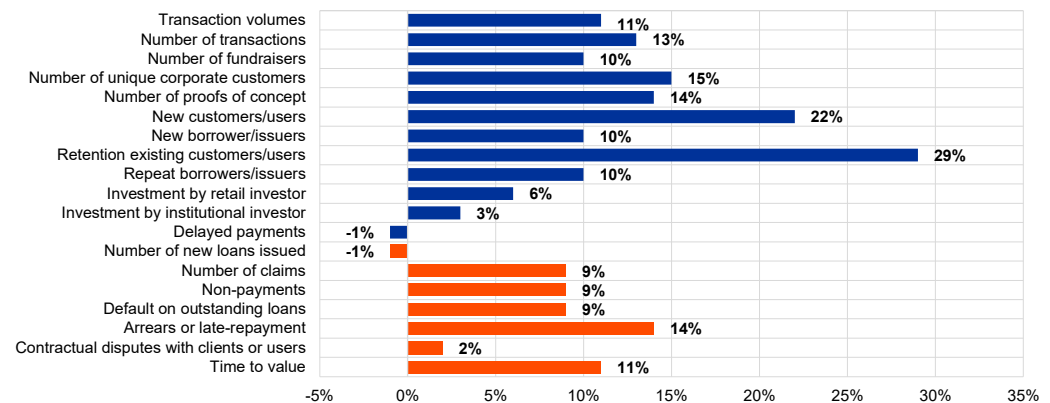
Sources: European Central Bank (2020) and Cambridge Centre for Alternative Finance, World Bank and World Economic Forum (2020).

Notes: On the left bar, "Other" includes alternative credit & data analytics, digital identity, digital asset exchange, digital savings, and digital custody. On the right bar, the data are based on an ECB experimental collection. Clusters of activities as in European Banking Authority (2017). One entity is allocated to one cluster only.

Chart 6

State of global fintech by market performance indicator

(percentage change, year-on-year, Q1 and Q2 2019 and 2020)



Sources: Cambridge Centre for Alternative Finance, World Bank and World Economic Forum (2020).

Notes: positive impact (blue bars) refers to an increase of an indicator related to the activities of fintech or to an improvement in asset quality, while negative impact (red bars) refers to a decrease of an indicator related to the activities of global fintech or to a deterioration of asset quality.



Fintechs typically use digital technology to offer a specific financial service targeted at a specific clientele, which they perceive as under- or non-served by incumbent financial service providers (see Box 1 for a discussion of lending platforms). Although initially regarded as competitors to incumbent banks, they seem to be increasingly seen as a complement, with banks offering start-up fintech accelerator hubs and investing in or even acquiring fintechs. Covering a sample of 78 countries, Hodula (2021) finds that in less concentrated, more liquid and more stable banking sectors, banks and fintechs are more likely to act as complements (with fintechs serving up borrowers that are not serviced by traditional banks), while fintechs could substitute for banks in less stable and highly concentrated banking sectors. From the banks' viewpoint, the advantage of buying fintech solutions in the form of start-ups, rather than developing such solutions in house, is that innovative activity often requires a different culture than that prevalent in a large incumbent organisation.

Box 1 Lending platforms

The past decade has seen the emergence of P2P lending platforms that match lenders/investors with individuals or small firms looking for external funding. Under the traditional model, applicants register on the platform and undergo standardised screening (including credit scoring and platform-specific proprietary scoring), and investors choose whether or not to fund the various requests and for how much. Lending platforms work primarily as a conduit and generally have no direct exposure themselves to the credit risk of the loans. They principally generate revenue from loan origination and servicing fees. Originally it was mostly individual investors who were active on these platforms, but nowadays most of the funding is provided by institutional investors.¹⁸

Fintech lenders, however, can take many different forms, as discussed in Financial Stability Board (2017), partly driven by existing market structures and partly by different regulatory regimes. In the traditional model – described above –, individual loan contracts are established between borrowers and creditors, and funds and contractual loan repayments are segregated from the platform's own account. The platform operator earns its revenue from fees levied on the transacting parties, such as fees for account setup, loan origination and ongoing loan repayment. In the notary model, the platform also offers a matching service, but the loan is originated by a partnering bank. In the guaranteed return model, the platform operator guarantees the creditors' principal and/or interest on loans, which – if combined with the right to withdraw on short notice – therefore gets close to the traditional bank model. Balance sheet lending platforms originate and retain loans on their own balance sheet, akin to the usual business model of a non-bank lender. Fintech "invoice trading" platforms offer recourse factoring for start-ups and small businesses, providing more flexible services than traditional players in this segment. Another increasing trend is the "buy now pay later" business model for services that some fintech firms facilitate for retail customers, which seem to appeal to certain demographics.

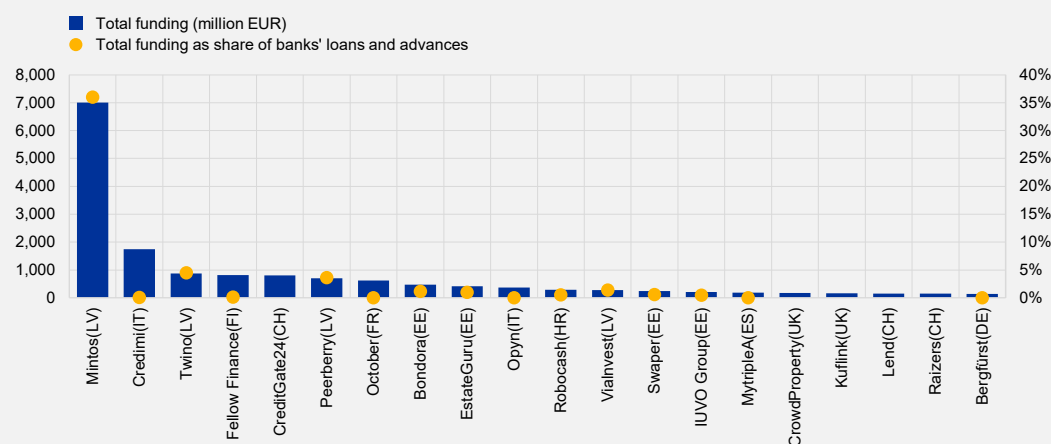
¹⁸ Balyuk and Davydenko (2019) document with data from the two largest P2P platforms that less than 10% of P2P funding is provided by retail investors and that platforms have moved towards "reintermediation", with platforms picking borrowers and loans rather than investors deciding through an auction process.



Overall, P2P lending in Europe is relatively small compared with bank lending, the Baltic States being an exception (Chart A). Except for Mintos, which seems to be dominant, P2P platforms in Europe do not raise substantial amounts of funds for financing the real economy. It is only in the Baltic States, and particularly Latvia, that P2P platforms seem to be directly competing with banks for lending to the real economy. While still relatively small, the P2P platforms sector is growing more rapidly in Europe than in other jurisdictions (Swaper (2021)).

Chart A
Size of P2P lending in Europe

(left-hand side: EUR millions; right-hand side: %)



Sources: P2PMarketData, ECB and ESRB Secretariat calculations.

Notes: Total funding as reported to P2PMarketData, as of 31 August 2021. Banks' loans and advances taken from the ECB's consolidated banking data, with reference date of Q4 2020 and including stand-alone and domestic banks, as well as foreign branches and subsidiaries reporting under FINREP. No consolidated banking data are available for Switzerland or the United Kingdom.

Looking ahead, P2P lending platforms are facing two important challenges, which will determine their evolution over the last decade. First, P2P lending platforms during the upward phase of the cycle and their performance have not been observed over a whole business cycle. The recession caused by the COVID-19 pandemic could provide interesting insights in this regard. Second and perhaps more importantly, P2P lending platforms seem to suffer from severe adverse selection, as their borrowers are those who cannot get a loan from banks (de Roure et al (2021)).

Many fintechs have focused on innovative payment solutions, including on cross-currency transactions. Some of these companies have achieved a high market capitalisation, e.g. Revolut, which offers accounts featuring currency exchange and virtual cards, Apple Pay and commission-free trading of stocks, crypto assets and commodities. In general, these new payment providers aim to provide cheaper, mobile/smart phone-based and thus more convenient account and payment services. Data from the Global Findex Database show that, in the EU as well as in other advanced economies, the vast majority of the adult population (aged 15 years and above) had made or received digital payments in the previous year (Chart 7), digital payments being one of the main clusters of activity of fintech providers. Many of these providers hold banking licences but do

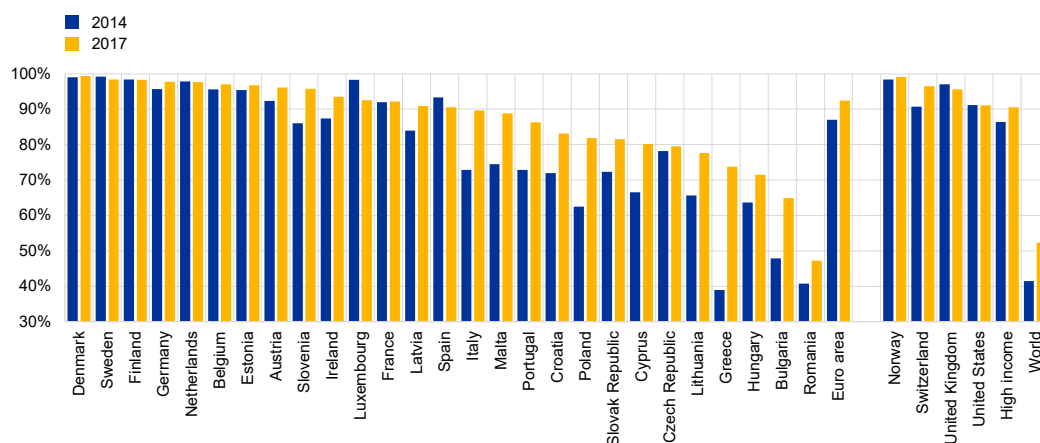


not have traditional brick-and-mortar branches. While often offering cheaper and more convenient services (as well as targeting a younger clientele estranged from traditional banks), there have received several customer service-related complaints.

Chart 7

Percentage of adults (age 15 +) who made or received digital payments in the previous year

(percentages)



Sources: Global Findex Database 2017.

Notes: EU Member States are ranked according to the values reported in 2017.

The European Union reacted to the challenge of digital payment services and new providers with the revised Payment Services Directive (PSD2) in 2015. PSD2 sets out security

requirements for electronic payments and protecting consumers' financial data, guaranteeing safe authentication with the aim of reducing the risk of fraud, increasing the transparency of conditions and information requirements for payment services, and clarifying the rights and obligations of users and providers of payment services. The directive also aims to open up the EU payments market to companies offering consumer or business-oriented payment services based on access to information about the payment account (holder), and to strengthen consumer rights through reduced liability for non-authorized payments, stronger refund rights and the removal of surcharges for using a consumer credit or debit card.

While the overall share of fintech lenders in lending markets is still small, in some countries, they have achieved a significant share in specific business lines. As shown in Chart 8, the

weight of fintech and big tech credit in total credit in advanced economies is still small, at less than 0.5%. However, there are specific segments where fintech accounts for a larger proportion of total credit. For instance, online lenders like Quicken Loans now account for about 8% to 12% of new mortgage loan originations in the United States and Quicken Loans became the largest US mortgage lender by originations at the end of 2017.¹⁹ Fintech lending accounts for about a third of personal unsecured loans in the United States (Balyuk (2019), citing TransUnion data). One of the attractive characteristics of fintech lenders is that they can process loan applications more quickly

¹⁹ For further discussion, see Buchak et al. (2018a) and Fuster et al. (2019). It is important to note that Quicken is a broker that warehouses the loans before securitising them.

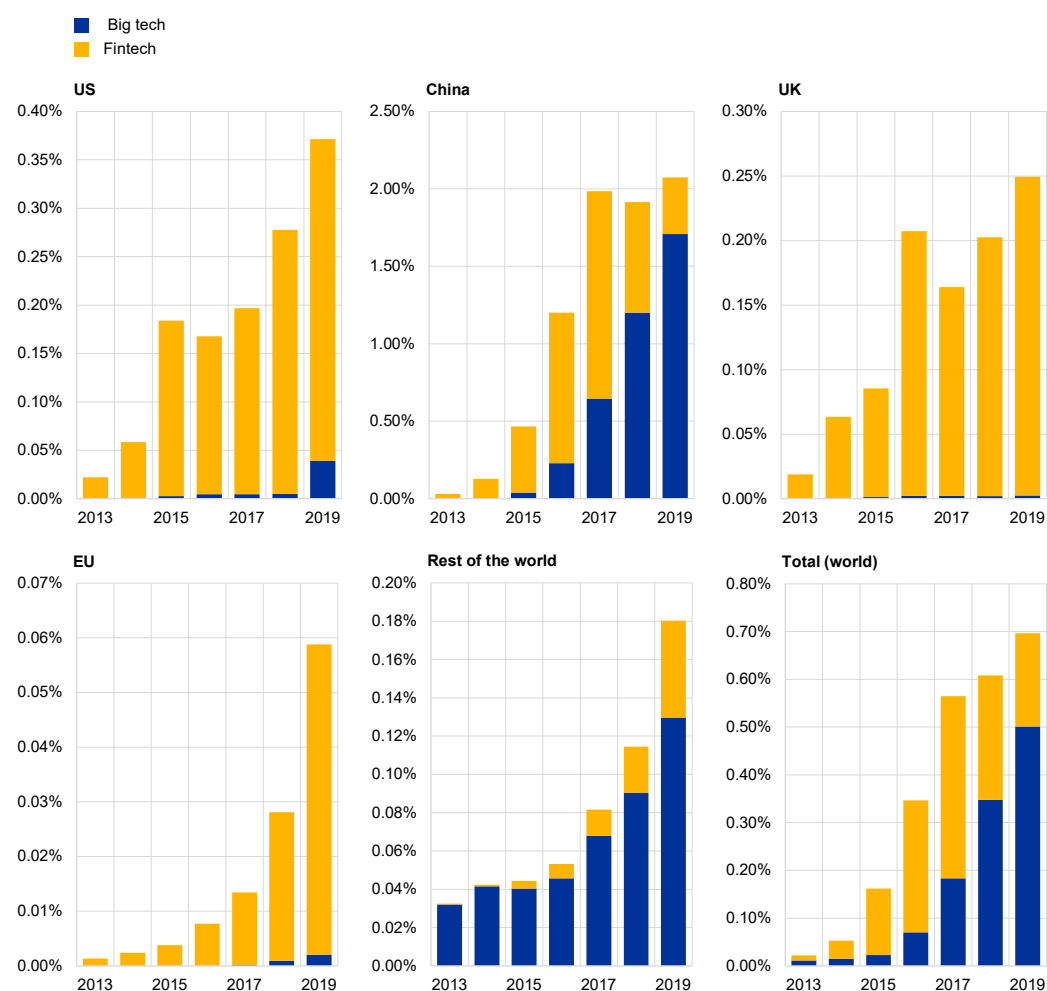


and have a more elastic loan supply (Fuster et al. (2019)), although banks have also adopted this technology. An additional reason for the focus of fintech lenders on mortgages in the United States is that they can be easily sold to government-sponsored enterprises (e.g. Fannie Mae, Freddie Mac) if below the conforming loan threshold (USD 510,400 in 2020 in most parts of the United States). More generally, Buchak et al. (2018b) find that the post-2008 increased regulatory burden on traditional banks explains up to 55% of the recent growth of non-banks in the US mortgage market. And as Braggion et al. (2019) show for China, platform lending can be used by mortgage borrowers to circumvent loan-to-value restrictions on regular bank borrowing if the regulatory framework is not adjusted accordingly.

Chart 8

Share of fintech and big tech credit of total domestic lending by the financial sector

(percentages)



Sources: Cornelli et al. (2020) and own calculations.

Notes: Data on total lending by the financial sector are not available for 2019 in Cornelli et al. (2020), so the values for 2018 are used to compute the ratios for 2019.



While fintechs are start-ups that use technological innovations to provide specific financial services in a more effective, customer-friendly and swifter way, big techs are large companies originally focused on developing and/or exploiting digital technologies for non-financial usage, on a massive scale. Unlike fintechs, big techs (or techfins) are thus incumbent, non-financial platform companies that expand into financial service provision. Examples include Mercado Libre in Latin America, an e-commerce platform with growing financial activities, and in the United States payment services offered by Amazon, Apple, Facebook and Google (Frost et al. (2019); Zetzsche et al. (2017)). However, it is China where big techs have so far gained the largest market share. 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 USD 16 trillion mobile payments market (Carletti et al. (2020)). Ant Financial's subsidiary MyBank, Tencent's (part) subsidiary WeBank and Baidu's (part) subsidiary Du Xiaoman provide lending to millions of small and medium-sized firms (Frost et al. (2019)).²⁰ It is important to note that although there are no Europe-headquartered big techs so far, seven big techs have subsidiaries authorised in an EU Member State to carry out financial services: three are authorised as payment services institutions, five as electronic money institutions and one as a credit institution (European Banking Authority (2021)).

Big techs have potentially big advantages compared with banks and fintechs; they not only have all the technical knowhow and up-to-date systems that fintechs aspire to, but also the scale (financial capacity, existing customers) that large banks possess. Other than these benefits, they also have access to a wide range of data out of reach of banks and fintechs and can enter into financial intermediation without the legacy or organisational problems of incumbent banks (although also without their accumulated experience in financial trading). These advantages of big techs vis-à-vis fintechs and banks can be captured by data analytics, network externalities and interwoven activities (called their "DNA" by Bank of International Settlements (2019)). There are strong network externalities as a participant's value from participating on one side of a platform (for example, as an online merchant) grows with the number of users on the other side of the platform (for example, buyers). At the same time, a larger number of users allows more data to be collected and analysed. Such analysis, in turn, can improve existing services and attract further users. This also makes big techs a dominant provider in their respective business line and allows them to extend into new business (including financial services) through a platform envelopment strategy (De la Mano and Padilla (2018)). AI, including machine learning, allows them to turn the vast amount of data, including soft information, into (credit) scores and targeted and tailored offers to clients.

2.3 The funding of fintechs and big techs vs banks

The critical advantage that banks enjoy within the financial system is their privilege of private money creation. Over 90% of monetary liabilities are created by banks. The privilege to create private money in the form of commercial bank liabilities is critical for banks' funding structure. According to Federal Deposit Insurance Corporation (FDIC) data, nearly 90% of bank liabilities in the United States take the form of deposits, while deposits represent around 70% of the

²⁰ See Bank of International Settlements (2019) for an overview of big techs that have moved into financial service provision.



liabilities of European banks, according to ECB consolidated banking data.²¹ Deposits are thus a very important source of funding for banks. The financial safety net and (mostly) explicit government guarantee provide a funding advantage for regulated banks, but often also for non-bank financial intermediaries that are closely linked to the banking system, either being sponsored by banks or linked to banks within larger financial conglomerates. This funding advantage also extends to fintechs and subsidiaries of big techs with bank licences.

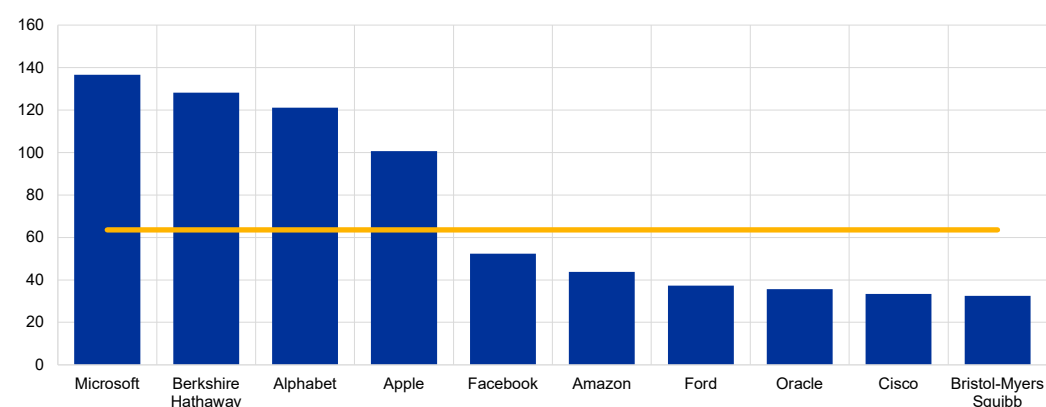
Fintechs without bank licences rely primarily on market funding (be it equity, debt or mezzanine), without the benefits of the financial safety net. Unless applying for bank licences or linking themselves closely to a bank, fintechs do not enjoy the privileges of banks in terms of funding sources and will thus be unable to move into financial intermediation. This may limit the scope of fintech activities to providing specific non-intermediation services.

Big techs, on the other hand, rely on high liquidity buffers accumulated through their platform services (Chart 9). While their main advantage is the value of big data on their existing customer base that can be used for providing financial services, their healthy financial positions also favour their involvement in such activities. They can use liquidity buffers accumulated through the free cash flows from their other activities, without needing to raise new funds in financial markets. While this can make their funding cheap, at least to some degree, they still cannot benefit from government guarantees under the financial safety net. In addition, big techs increasingly use partnerships with banks to enter the market for financial service provision, a point we will come back to in Section 4.

Chart 9

Top-10 US non-financial corporations with highest cash and short-term investments in Q3 2019 and market capitalisation of the largest EU bank at the end of 2020

(USD billions)



Sources: Stevens (2019), based on FactSet, S&P Global and ESRB Secretariat calculations.

Notes: Market capitalisation of BNP Paribas (orange line) is expressed in USD, using the EUR/USD exchange rate at the end of 2020.

²¹ Under US accounting standards, derivatives in the balance sheet are netted out. Excluding derivatives from the computation of European banks' liabilities increases the share of deposits to 75% of total liabilities.



The planned issue of stablecoins, such as Libra/Diem, which are crypto-assets backed by safe assets, might be a first way for some big tech companies to enter financial intermediation. The creation of such stablecoins, to be used as payment instruments (perhaps first within a specific platform but later on a wider basis), can undermine banks' intermediation business (insofar as it rests on deposit funding and the payment services attached to bank accounts) and governments' seignorage revenue. Stablecoins can also create new sources of systemic fragility, e.g. runs to safety creating large flows in and out of banks, as well as across borders.²² Reducing banks' franchise value might also have negative effects on banking system stability, a point we will return to in Section 4.4.

2.4 The reaction of incumbent banks to their new competitors

As discussed in the previous section, incumbent banks face competitive threats across the different financial services they provide:

- **Payment services:** by offering more convenient payment solutions, fintech firms can undermine an important revenue source for banks. This reduces banks' access to critical payment data.
- **Lending services:** the capacity of big tech companies to tap into a vast amount of personal data and turn soft into hard information undermines the information franchise value of banks.
- **Asset, wealth and risk management services:** access to a wealth of data on individuals allows new players (fintech and big tech companies) to provide quicker and more tailored advisory services.

What a simple list of different services does not show is that the bundling of different financial services allows banks to exploit scope economies, cross-subsidise between different services and target customers with specific offers. Seeing competitors chip away at markets for some of these services might therefore have negative effects on banks' capacity to survive as universal providers of financial services.²³

Incumbent banks in developed western markets typically seem to expect fintech companies not to threaten their existing position as incumbents (albeit with some need to buy out innovators to sustain this). Incumbents do not generally expect to have their industry radically upended around them. Chart 10 shows that European banks do not perceive fintech activities to represent large threats to their business lines, except for payment systems. Furthermore, working together with existing firms, through different organisational arrangements, seems to be the preferred form of engagement of European banks with fintechs (Chart 11). Besides, fintechs operating in the banking sector might also address customers' specific needs that go beyond financial services, such as legal and financial advice, semi-automatic accounting or customer

²² For a detailed discussion on crypto currencies and financial stability, see International Monetary Fund (2021).

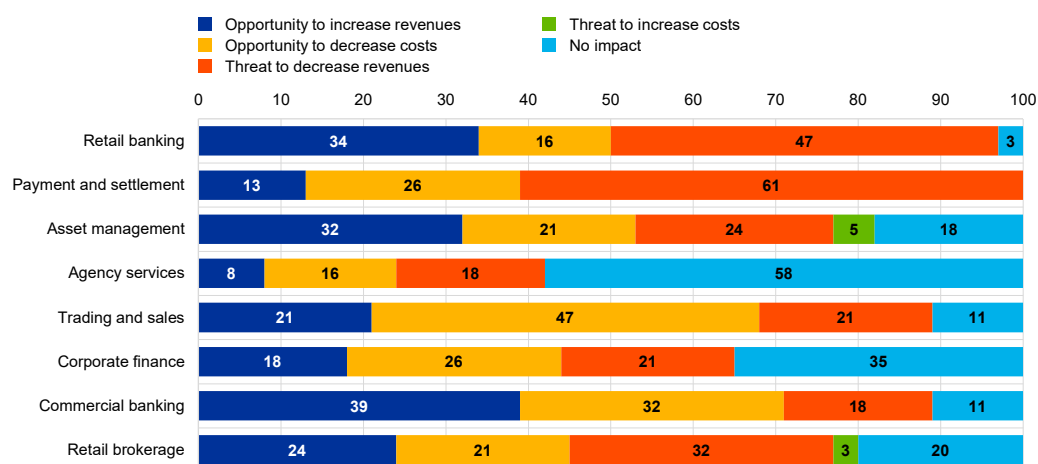
²³ At the same time, these scope economies provide a natural advantage to firms (such as traditional banks) that offer a bundle of financial services rather than each one on a stand-alone basis.



relationship management. Other financial sectors, e.g. insurers, see potential in partnering for expanding the range of activities they (or rather their associates) might become involved in. PWC (2018), for example, suggests that insurtech is increasingly moving its focus away from making existing insurance business models redundant towards supporting and partnering with insurers to expand beyond their existing value propositions into new industries. The talk is of developing an ecosystem that brings together adjacent industries to provide an improved customer service proposition. Relevant adjacent industries to banking could potentially include agriculture, health, cybersecurity, the sharing economy, wealth management and transport, as banks and incumbents in these industries could partner and provide their services jointly.

Chart 10
Summary of responses by European banks to the question “How do you see fintech affecting the current business model of your bank?”

(percentages)

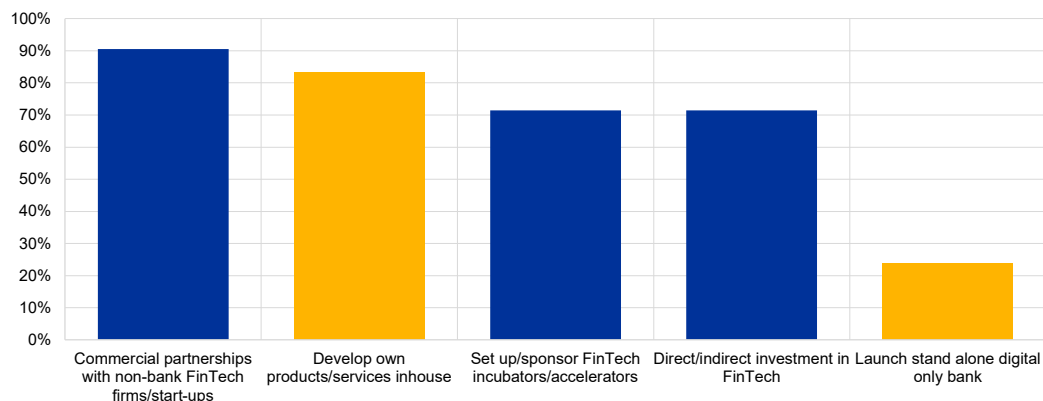


Sources: *Baba et al. (2020), based on the 2019 EBA Risk Assessment Report.*



Chart 11
Current form of engagement by European banks with fintech

(percentages)



Sources: European Banking Authority (2020b).

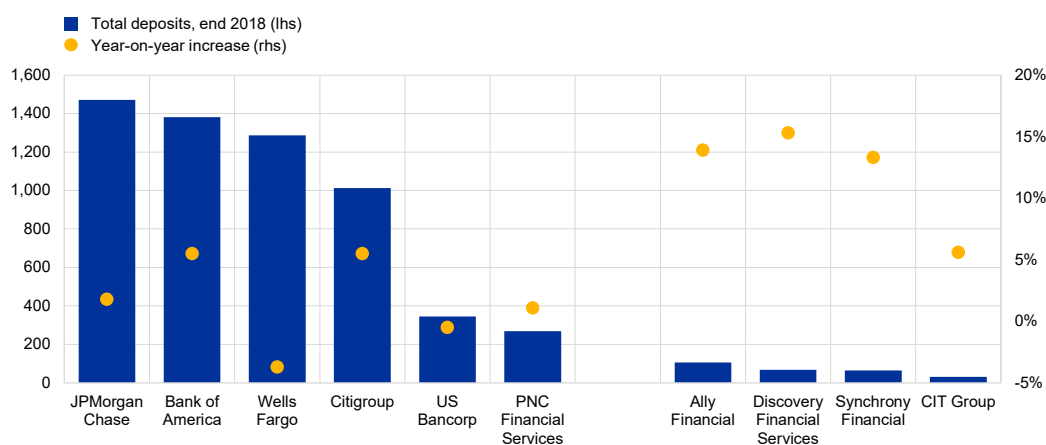
Notes: The blue bars refer to options entailing a degree of collaboration with fintechs, while the yellow bars refer to non-cooperative alternatives. More than one answer was possible in the questionnaire, so the percentages do not sum up to 100%.

Within the banking sector, incumbent banks with a traditional business model also face competition from banks that conduct their activities almost entirely digitally.

Deposits in online banks are growing at a higher pace than in traditional banks, slowly eroding the latter's market share (Chart 12, showing data for the United States). As a result, incumbent banks, particularly larger ones, are developing their own online banking subsidiaries. Recent studies show a heterogeneous picture across traditional banks in terms of efficiency and services covered by their online banking, and they are typically unable to directly compete with online banks (D-Rating (2020)).

Chart 12
Deposits in the largest US banks and US online banks, end-2018

(left-hand side: USD billions, right-hand side: percentages)



Sources: S&P Global Market Intelligence (2019), taken from *Deposits flocked to digital bank accounts in 2018*.

Notes: Data according to GAAP for the six largest US banks and four US online banks.



The traditional funding model of banks might be challenged by digital currencies, especially those issued by central banks.

A critical function of banks is transforming sight deposits into long-term assets, which is also the basis for their intermediation-related profits. This stems from their privileged position within the payment system and ability to create transferable claims.²⁴ A scenario with successful digital alternatives to deposits as a liquid savings instrument and payment instruments for households and firms might imply higher funding costs for banks. One important determinant of the extent of competitive pressure will be whether digital currencies will be directly issued by central banks (as currently explored by the ECB under the digital euro project) and accessible to the general public (with greater pressure on banks to tap alternative funding sources) or whether they will gain importance in the form of stablecoins. The degree to which crypto-assets would achieve the same fungibility as bank deposits is critical to the assessment of their impact on banks' traditional funding model. We will come back to this question in the third of our three scenarios below.

There are several ways for incumbent financial institutions to react to an expansion of big tech companies into financial service provision; such reaction, however, depends primarily on how big tech companies go about expanding into financial service provision.

First, big tech companies could expand directly into financial service provision, either by establishing subsidiaries or buying up banks. The latter option might be less attractive given that this might burden acquirers with legacy IT systems and legacy assets. The former option would constitute a direct challenge for incumbent financial institutions. Threatened with losing market share and margins to big tech-related new entrants, banks might increase their risk profile to defend their market position. At the same time, however, larger banks have been aggressively developing faster and cheaper payment systems to compete with new fintech providers or are acquiring fintech companies offering such systems. But there could also be a wave of deleveraging to adjust banks' balance sheets to their reduced market share, which is a different source of fragility. Second, big tech companies might choose to cooperate with banks, with banks offering their balance sheets for risk taking and big tech companies offering their platforms for attracting customers, as well as screening and monitoring them. While the cooperation route seems less disruptive, it would also likely erode the rents that incumbent banks have enjoyed until recently, potentially rendering many of them unviable in their current business model.

²⁴ The wide acceptance of bank deposit transfers as a means of payment creates a privilege of "money creation" for banks, which is not shared by other financial institutions, such as money market funds.



3 Emergence of new risks and reshaping of existing risks

This section considers how digitalisation and the related challenges to incumbent banks can define new risks or alter existing risks. It starts with a description of risks of a financial nature, mainly related to fintech and big tech. In the second section, it then discusses non-financial risks, which are expected to grow significantly in the coming years. It is important to differentiate between risks facing individual incumbent financial institutions and those facing the financial system. In the following, we focus more on the latter, in line with the ESRB's macroprudential mandate.

3.1 Financial risks from new providers

Non-bank financial institutions, including fintech and potentially big tech companies, face similar risks and can also affect the overall risk in the financial system by influencing the behaviour and performance of other players and market dynamics. In the following, we discuss the risks that the new financial services providers face and may help generate or amplify.

Old risks with a new skin

Financial intermediaries are subject to an array of different sources of risks; the maturity/liquidity transformation role of banks and bank-like financial institutions (e.g. money market funds) exposes them to liquidity risk. Matching short-term liabilities with longer-term assets makes financial intermediaries susceptible to liquidity runs. Credit risk (or asset performance risk in broader terms) can undermine the solvency of financial intermediaries, as can different types of price risks, including interest rate, exchange rate and asset price risks.

For example, while many lending platform models do not involve leverage or liquidity, some models (guaranteed return and balance sheet models) are more like that of a bank or bank-like financial institution and are therefore subject to similar risks as deposit-taking banks.

This is especially the case if the platforms allow investors to withdraw their funds on demand in an easy and/or costless manner. Further, platforms rely on maintaining the confidence and trust of their investors and need to attract new borrowers, so there is a trust channel that can greatly amplify their susceptibility to interest rate, credit and legal risks.

The robustness of the business models of many fintech lenders remains untested, as in most markets (except China) they have not gone through a whole cycle. In fact, the Financial Stability Board (2017) notes several high-profile failures among lending platforms, some of them with features resembling Ponzi schemes.



The impact on system-wide risk

There are reasons to argue that the entry of new providers, which creates a more diversified and competitive financial system, can reduce systemic risks (Financial Stability Board (2017)). First, lower prices can reduce risk taking by borrowers, resulting in a positive relationship between competition and stability. Second, the increasing importance of fintech credit platforms may help diversify sources of credit in the economy, thus providing alternative funding options for borrowers if their main lender fails; this chimes with what is sometimes called the “spare tyre” hypothesis. Third, if there is limited interconnectedness between platforms and between this segment and other segments of the financial system, platforms may remain operational when a crisis hits other segments of the system (and vice versa), thus strengthening the overall resilience of the financial system.

At the same time, if the new landscape concentrates financial service provision in a few big techs, these companies would be new too-big-to-fail players and a new source of systemic fragility. Such a risk can arise whether big tech companies serve purely as platforms or move directly into intermediation, if they are involved in providing a significant share of essential services. Further, in the platform economy, disruption and winner-takes-all dynamics may cause the rapid collapse of a platform in favour of another, which involves risk during the transition process.

If the new players rely less on relationships and soft information and more on hard (or hardened) information than the old players, their lending might be more procyclical.

Research has shown that transaction lenders are more likely to pull back during “bad times” than relationship lenders (Beck et al. (2018)). If there is a general move towards more hard and less soft information (especially during a crisis), lending cycles could become more pronounced. A similar effect might arise if fintech investments become susceptible to investors’ fad-like behaviour and swings in their credit risk appetite. This stability risk is to be balanced against the advantages of easier access to credit for borrowers entering the market without the relevant relationships (but with the “right” hard information).

The impact on incumbent banks’ risk profile

One long-standing debate in banking has been on the relationship between competition and fragility. The competition-fragility hypothesis posits that higher competition (such as from new entrants) reduces incumbent banks’ franchise value and thus incentivises them to take on more risk. Entry by new providers, including big tech companies, can thus trigger such aggressive risk taking and increase bank fragility. However, there might also be counter-effects. If scalable, transaction-based, arms-length lending is taken over by new providers, such as fintech companies, incumbent banks will have a stronger incentive to focus on information-intensive relationship lending, which might be the source of larger franchise values (per unit of activity), thus reducing fragility in the traditional banking system itself, while shifting risk towards other segments of the financial system (Boot and Thakor (2000)). A third option is that the entry of new players does not result in more competition, but rather in cooperation between regulated banks and, for example, big tech companies. Some examples of such cooperation are Amazon loans in partnership with Goldman Sachs, Apple’s consumer credit card, also in partnership with Goldman Sachs, and



Google finance in partnership with Synchrony Bank. This can create a different kind of fragility, which we discuss next.

New cooperation – new risks

The cooperation between banks and big tech companies could lengthen intermediation chains and alter the incentives and transparency of credit intermediation, which is a potential new source of fragility. One possible form of cooperation is where the big tech platforms serve primarily as a conduit in loan origination, bringing together lenders (i.e. banks and other financial institutions) and borrowers but with no risk for the platforms. If big tech revenues in this context were volume-based, there would be a clear incentive for aggressive origination, possibly leading to overlending.²⁵ Alternatively, if big tech companies enter financial service provision themselves (acquiring banking licences for this purpose), they will most likely focus on low unit-cost, scalable lending activities, where franchise value has little importance and assets can be easily securitised and sold off. Both cases result in longer intermediation chains and something closer to the originate-and-distribute model, which raises concerns about incentives and risk distribution, as evidenced in the run-up to the global financial crisis.

The regulatory perimeter and financial risks

The growth of the fintech sector will raise the need for regulators to decide its placement within the perimeter of prudential regulation. Over the past ten years (partly as a reaction to the global financial crisis), expanding the regulatory perimeter towards shadow banks has been high on the agenda. Recent financial innovations might pose new challenges in this respect. For instance, lending platforms that connect investors/lenders and borrowers are currently outside the perimeter of prudential regulation. On the one hand, lending platforms are not deposit-taking institutions and thus not formally covered by the financial safety net. So far, their potential failure essentially raises issues of investor protection. As reported by the Association of Banking Supervisors of the Americas and IDB Lab (2019), peer-to-peer lending platforms can provide fertile ground for fraudulent schemes long prohibited in traditional banking. But what if the investor population and lending base on these platforms grow to a size that makes them all but “too many to fail” or “too big to fail”? The failure of a large P2P lending platform in China in 2016, Ezubao, affected almost one million customers, with losses exceeding USD 9.2 billion. Three years later, another wave of failures closed over 380 P2P platforms in that country. If one of these events reaches systemic relevance, the pressure to extend the perimeter of prudential regulation over the involved entities will be hard to resist. A more proactive approach towards possible prudential regulation of fintech companies with large retail investors basis is therefore called for.

Similarly, big tech companies might pose a similar challenge for regulators as they move into financial service provision and their role in such provision becomes increasingly important. Even if services are provided via a regulated subsidiary, there are risks of spill-over

²⁵ Under certain cooperation agreements between banks and big techs, the latter may take over the entire credit scoring process (to exploit their advantages in big data), and banks might only provide a banking licence and bear the credit risk of the borrowers.



from the non-regulated non-financial part of the business to the regulated financial part, which raises the question of possible firewalls between financial subsidiary and big tech parent. An additional concern is that many big tech companies operate internationally, while financial sector regulation is – with few exceptions – national in nature. At least within the euro area/EU, multinational regulation should become the norm. This is also important because currently the dominating big tech companies are all non-European.

Beyond the question of whether to bring non-bank fintech and big tech financial service provision under the perimeter of prudential regulation, their exclusion from it raises level playing field concerns, as it puts more regulated intermediaries at a potential disadvantage.

While arguably being under the regulated perimeter also has advantages (e.g. in the case of banks, access to deposit insurance and lending facilities of central banks), the private burden of regulation might enable unregulated entities to compete more fiercely over the provision of close substitutes to the services provided by regulated entities. Over time, this could shift significant volumes of intermediation (and their implied risks) out of the regulated perimeter, while forcing traditional intermediaries to shrink more and faster.

3.2 Non-financial risks

In addition to financial risk, digitalisation also poses significant non-financial or operational risks, both in the banking sector and in fintech and big tech companies. Modern IT development leverages heavily on core infrastructures (e.g. the internet), standardised products with mass users (e.g. the Windows, Android and iOS operating systems) and associated methodologies and technologies (e.g. encryption standards). This is expected to continue, as there are economic and network benefits to standardisation. As noted above, digitalisation might increase the risk of malicious attacks, i.e. cyber risk. Or rather, it might increase the severity of attacks that do succeed, if system providers successfully eliminate simpler flaws, leading to increased user complacency, but fail to eliminate the deepest vulnerabilities.

Five major non-financial sources of vulnerability

First, concentration in the provision of basic services, such as cloud computing (Financial Stability Board (2019a and 2019b)), is rising. Many fintech firms and increasingly banks build their own IT business structures on top of the same concentrated group of cloud services providers, because of the added business flexibility such an IT approach offers, coupled with cost minimisation. Financial institutions using fintech services may therefore appear exposed to a diffuse set of IT risks, but these exposures may still ultimately funnel into the same small cohort of major tech providers. On the one hand, cloud computing can reduce costs through scale economies and automation benefits and improve resilience for individual financial institutions. Cloud computing may also allow individual financial institutions to scale up more quickly, improve automation, operate more flexibly and reduce costs (because of economies of scale available to cloud service providers). On the other hand, operational incidents at third-party service providers can create temporary outages affecting services the financial institution provides to its customers. Cyberattacks and governance issues could result in data breaches, compromising private data of



millions of clients and resulting in high fraud costs. It may be harder for the financial institution to tell if the service is being delivered in line with legal and regulatory obligations, and central authorities may find it harder to access critical data and services, if required to do so, e.g. when exercising step-in rights in resolution. As explained in Financial Stability Board (2019a and 2019b), there are several sorts of cloud service business models (e.g. infrastructure as a service, platform as a service, software as a service, business process as a service) and types of deployment (e.g. public cloud, private cloud, hybrid cloud). There is therefore also scope for financial institutions to misunderstand the risks being introduced by the specific sorts of cloud services they may be consuming.²⁶

Second, the extensive use of AI in finance may create challenges from a financial stability perspective (see also Buckmann et al. (2021)). In particular, many fintech firms seek to leverage insights from AI. AI algorithms are often complex to understand and analyse and may include subtle look-back biases, feedback loops where AI models jointly bolster trends (similar to herding behaviour) and other weaknesses, so they appear likely to work better than then proves to be the case. Financial institutions may therefore be lulled into a false sense of security about their output and misprice services that rely on robust output from such models. Other sorts of biases and errors (e.g. erroneous data) can also creep in via such algorithms and create reputational and in some cases actual contractual losses. In the area of consumer protection, the biases created by AI models could also lead to severe discrimination against customers. Overall, the consequences of the use of AI models therefore highlight the importance of supervisory authorities building strong expertise in this field as well as specific control tools and supervision methodology of AI models.²⁷

Third, APIs allow different software applications to communicate with each other and can support service unbundling and increase the number of services provided to underserved niches (e.g. peer-to-peer, small businesses). But if they are not deployed well and managed securely, they could also lead to additional risks of operational failure or vulnerabilities to cyberattacks, which might propagate very quickly, increasing market structure fragility. Such risks are also arising because existing services are being adapted to mobile devices. Combined with APIs, smart phones have more and more functions built into their operating systems, such as payment capabilities. With any IT redeployment, however, comes the risk of introducing errors and added vulnerabilities, which need managing properly.

Fourth, and more generally, although converting legacy to modern IT systems can eliminate latent vulnerabilities, services that are too exclusively automated or IT-oriented can be more prone to cyberattacks. For example, screen, web and data scraping, a technique to collect financial users' transactional data to assess creditworthiness, is subject to this risk. This risk also affects incumbent banks and is further exacerbated in unsupervised parallel payment systems. Chart 13, based on a sample of large euro area banks under European banking supervision, shows a significant increase in certain types of cyber incidents in 2020 compared with 2019 (i.e. denial of services, unauthorised access, malicious script injection). Further, excessive reliance on automation and IT might offer new scope for money laundering, as some mobile payments

²⁶ The financial institution may also face a risk of lock-in with the service provider, due to the high cost of switching to another service provider.

²⁷ See, for example, Dupont et al. (2020).

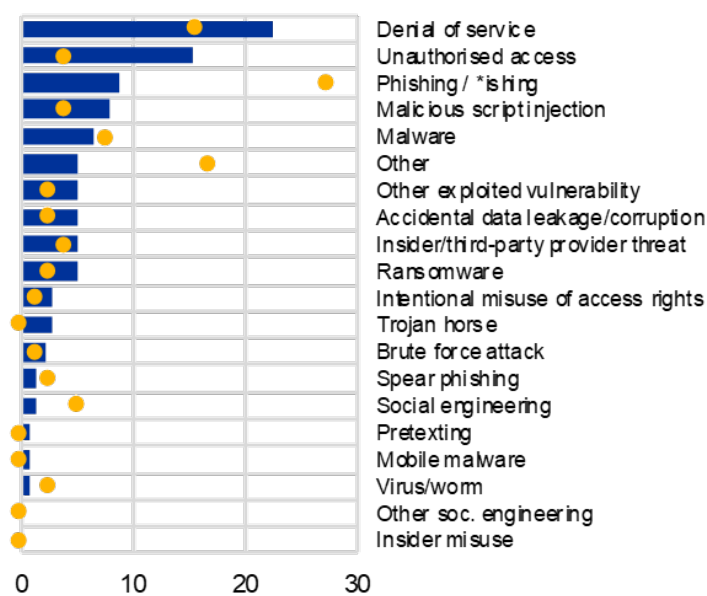


networks in some jurisdictions may operate in ways that potentially make it harder for authorities to trace money flows and identify money laundering and tax evasion.

Chart 13

Split of cyber incidents in 2019 (yellow dots) and 2020 (blue bars) by type

(percentages)



Sources: ECB Financial Stability Review, May 2021, Chart 3.8 (ECB supervisory data, ECB cyber incident reporting framework and ECB calculations).

Notes: Based on a balanced sample of 93 large banks. Insider misuse means intentional misuse of access rights by an insider.

Fifth, trust in management or in control of a process by a central authority is replaced by trust in a leading technology that might suddenly become obsolete.

Concerns about incumbent financial service providers losing relevance is an example of the sort of structural challenge that can arise through this mechanism. This could happen if the legacy IT systems of traditional intermediaries fail to keep up with more modern and advanced systems provided by fintech and big tech competitors. But looking forward, even currently leading IT technologies may in time lose relevance, creating other risks further down the road. For example, modern financial payments systems rely heavily on a small range of encryption technologies, some of which depend on the difficulty of factoring large integers. The speed at which this can be done might be dramatically improved by the development of quantum computers, which might necessitate a significant shift in how payment processing is made secure. While we hope that those facing such challenges in the future will rise to them successfully, the relevant technological developments might happen too quickly to make this practical. This could lead to a widespread loss of confidence in the reliability of money transfer processes that rely on superseded technologies. In the case of a means of payment, the structural risk from potential technological obsolescence is probably greatest in situations where users are principally placing their trust in technology rather than in the existence of a central authority that might be expected to stand behind the form of money in question. For example, some blockchain technologies, such as bitcoin, depend on it being difficult



or expensive to carry out certain mathematical manipulations using computers. But suppose an organisation somehow identified a way in which these manipulations could be done very much more quickly than at present. Unless there is a central body able to control what happens in such circumstances, an organisation that identifies this technological advance might be able to take over the blockchain, which could lead to a widespread loss of confidence in its usefulness as a means of payment.

In addition to the five non-financial risks described above, data ownership and governance may become particularly important for consumer protection, with a potential impact on financial stability. In a digital economy with large volumes of information exchanged across multiple entities, issues around ownership and governance of data arise and need to be handled with care (e.g. through data protection regulations). In banking, the availability of customer data has traditionally given banks an advantage over other institutions that could potentially engage in lending activities. However, the entry of big techs into the provision of financial services, as well as developments in “open” data (i.e. data that can be freely shared with other institutions), may have repercussions on the supply of financial services (see, for example, He et al. (2020)).



4 Three scenarios for the financial system in 2030

In this section we discuss different scenarios on how the emergence of fintech and big tech companies could influence the structure of the financial system and thus the future of the current banking system. The scenarios take as a starting point the situation of the EU banking and financial system in 2020 (Section 4.1) and develop this over a long-term horizon (around ten years). The three scenarios do not cover all the possible paths of the EU banking system until 2030. They have been selected on the basis of their implications for the interaction of banks with fintechs and big techs (scenarios 1 and 2) and of the impact of central bank digital currencies (scenario 3). The first and second scenarios are orthogonal (they could not happen simultaneously), while the third scenario could occur in combination with one of the other two and is one of the many possible outcomes of the efforts recently launched in the area of central bank digital currencies. Scenarios 1 and 2 are directly related to the five forward-looking scenarios for the banking system designed by the Basel Committee of Banking Supervision (2018). It is important to stress that we do not attach probabilities to the likelihood of the different scenarios and – most importantly – that these scenarios are endogenous to regulatory responses that are still to be defined.

4.1 Starting point: the EU banking system before the COVID-19 pandemic

Concerns about the long-term sustainability of the EU banking system were frequently heard in the immediate aftermath of the global financial crisis. Before the outbreak of the COVID-19 pandemic (end-2019), the EU banking system was affected by several intertwined factors related to structural, economic and policy developments: the overly prominent role played by banks in funding the real economy in Europe (usually referred as “overbanking”, Pagano et al. (2014)), legacy issues from the global financial and sovereign debt crises, and bank profitability and cost inefficiencies. The following paragraphs discuss each of these factors, using as benchmarks the US and Japanese banking systems, the former being a dynamic and profitable banking system that coexists with strong market funding and the latter an oversized and unprofitable banking system. The Annex provides further details on these factors.

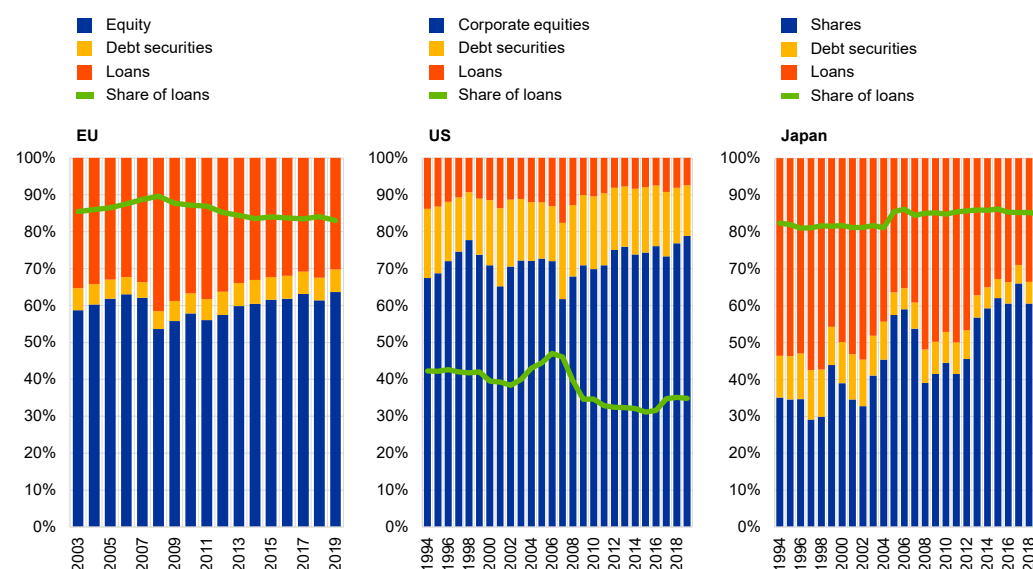
Banks play a crucial role in providing financial services to the real economy in the EU and maintain a predominant position in the financial system. Pagano et al. (2014) provide initial findings on the capacity of the EU banking sector, showing Europe’s banking system to be large relative to the size of its economy, whether measured by income or household wealth, and large relative to other sources of financial intermediation, such as bond and equity capital markets. Chart 14 shows that equity capital markets are the main source of funding for non-financial corporations in the EU and the United States, but of lesser importance in Japan. Looking only at debt securities and loans, however, and despite the reduction in the size of the EU banking system since 2015, European non-financial corporations largely rely on loans to finance their activities, as



do their Japanese peers. Conversely, US non-financial corporations mainly source funding from the issuance of debt securities.

Chart 14
Main liabilities of non-financial corporations in the EU, US and Japan, 1994-2019

(percentages)



Sources: Eurostat, Board of Governors of the Federal Reserve System, Cabinet Office of Japan, Haver Analytics and ESRB Secretariat calculations.

Notes: The bars represent the share of liabilities of non-financial corporations in the form of equity, debt securities (bonds) and loans during the period 1994-2019 (for the EU, 2003-2019). The green line (share of loans) represents the ratio of loans on the liabilities side of non-financial corporations to the sum of debt securities and loans.

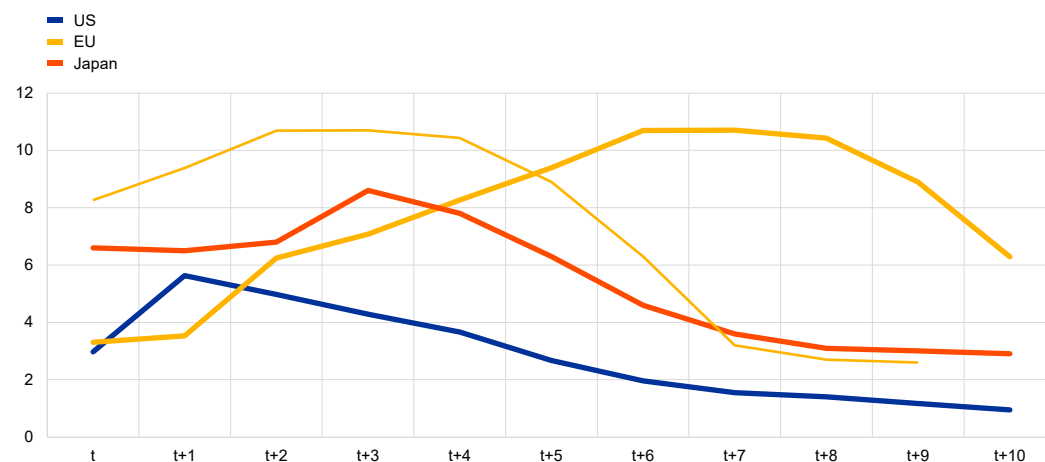
In the aftermath of the global financial crisis, ratios of NPLs to total loans remained elevated in the EU, with some banks showing ratios above 5% and as high as 10% in 2018. Following the global financial and the sovereign debt crises, NPLs in the balance sheet of EU banks peaked in around 2016 at over €1 trillion EUR.²⁸ This prompted a comprehensive policy action in July 2017 (Council of the EU (2017)), which has been implemented almost completely. Components of that package included a provisioning calendar and several actions to foster the secondary market for NPLs in Europe. While the total stock of NPLs stood at €468 billion at the end of 2020 and the aggregate EU ratio of NPLs for significant institutions declined from 6.5% in December 2014 to 2.6% in December 2020, several banks still exhibited high NPL ratios and a slow reduction of the stock of NPLs in their balance sheets. Some of these banks have been operating with NPL ratios exceeding 5% and as high as 10% since the global financial crisis. In an international comparison (Chart 15), the ratio of NPLs in the EU banking system was much higher at the peak than in the United States over the same period and Japan during its “lost decade”. The reduction of NPLs after their peak was also slower in the EU than in the United States and Japan.

²⁸ For a review of the impact of NPLs on the banking system, see, for example, Council of the European Union (2017), European Systemic Risk Board (2017 and 2019b) and Suarez and Sánchez Serrano (2018).



Chart 15
Ratio of non-performing loans after major financial crisis

(percentages)



Sources: International Monetary Fund Financial Soundness Indicators, Federal Financial Institutions Examination Council, Federal Reserve Bank of St. Louis, Japanese Financial Services Agency, European Banking Authority, Haver Analytics and ESRB Secretariat calculations.

Notes: The thick blue and yellow lines represent the yearly ratio of NPLs to total loans for the EU and the United States, with a starting date of 2007 (latest year is 2017). The thin yellow line takes 2011 as the starting point for the EU, with the three latest observations from the Risk Dashboard of the European Banking Authority. Data for Japan start in 1998, towards the end of the Japanese "lost decade", and finish in 2008. The EU ratio is the average ratio of NPLs reported by all EU countries, except Germany (no data) and including the United Kingdom (member of the EU at that time).

The profitability of the EU banking sector has been rather low over the last 40 years (Chart 16)²⁹, the causes of which have been widely discussed (European Central Bank Banking Supervision (2018b)). In the years leading up to the global financial crisis, extensive use of leverage enabled European banks to report profitability levels similar to those of their US peers and substantially above the profitability of Japanese banks. However, in the aftermath of the global financial crisis, bank regulation was broadened with the introduction, among other requirements, of a binding leverage ratio, which introduced, indirectly, a cap on return on equity. The low equity market pricing observed for the EU banking sector may be read as a signal of relatively little market confidence in its medium-term profitability prospects, which are linked to the macroeconomic environment going forward, as well as to the existence of unaddressed vulnerabilities and inefficiencies. The persistence of low profitability across EU banks over such a long period of time may signal the existence of structural factors, which may relate to the macroeconomic environment (i.e. low level of interest rates) but also to the heavy cost structure of EU banks. Furthermore, many EU banks struggle with outdated IT systems and face significant infrastructure challenges. According to several studies, the technology at the core of most European banks around the world dates from the 1960s, placing them at a disadvantage vis-à-vis new competitors (Flinders (2015),

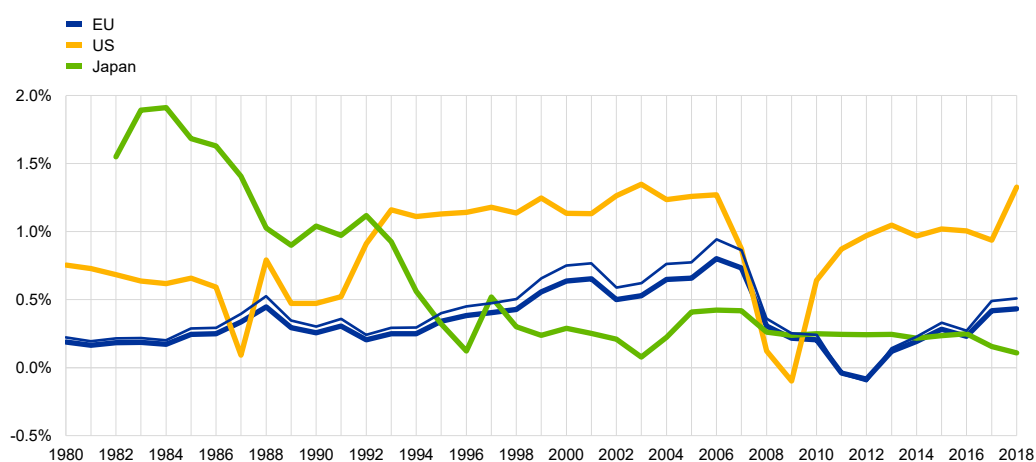
²⁹ To be more accurate, Chart 16 shows the return on assets of surviving EU, Japanese and US banks. The observed differences across jurisdictions may be explained by the crises faced by each jurisdiction over the sample period (Savings & Loans crisis in the United States, Japanese lost decade, etc.) and by bank survival rates. As noted in Chart A2 in the Annex for the global financial crisis, bank survival rates tend to be higher in the EU than in the United States during financial crises.



Butcher (2018), Chowdhury (2018), Stulz (2019), Pogson (2019)).³⁰ The Single Supervisory Mechanism has conducted several reviews of the functioning of banks' IT systems and has raised severe concerns, showing that risk data aggregation capabilities and risk reporting practices within the sample of significant institutions were unsatisfactory (European Central Bank Banking Supervision (2018c and 2019)). Outdated IT systems may create an obstacle for banks to generate income efficiently, manage risks and steer their businesses towards the most profitable innovations. Banks generate income more efficiently when they digitalise back office and document management, automate credit decisions and apply big data analytics in sales (see, among others, Caldo et al. (2014)). Some surveys also report that around 40% of banking executives cite their complex legacy IT environment as the greatest barrier to driving digital transformation (Banking Circle (2019)). The European Banking Authority (2020a) shows that only a small percentage of European significant institutions use solutions like big data analytics for some business purposes.

Chart 16
Return on assets of EU, Japanese and US banks

(percentages)



Sources: OECD, ECB consolidated banking data, Federal Deposit Insurance Corporation, Federal Reserve Bank of St. Louis (Fred database) and ESRB Secretariat calculations.

Notes: The data for the EU show the median for the EU Member States in the OECD Banking Database (AT, BE, CZ, DK, EE, FI, FR, DE, IE, IT, LU, NL, PL, SK, SI, ES and SE) until 2009. From 2010 onwards, ECB consolidated banking data are used. US data refer to commercial banks only. The blue line shows the return on assets of EU banks with netted derivatives.

4.2 Scenario 1: incumbent banks continue their dominance

In the first scenario, banks maintain their central role in money creation and financial intermediation. Fintech companies will continue to focus on specific niche markets, cooperating with (or being acquired by) banks, becoming part of the larger financial sector ecosystem. When necessary, banks will aggressively counter the competitive threat from outside the incumbent

³⁰ In an interesting study, albeit referring to the United States, Protiviti (2019) shows that 43% of US banks still use COBOL in their core IT systems, a programming language created in the 1960s and today regarded as outdated, which co-exists with more modern technologies.



banking system through technological adaptation, acquisition of fintech companies and lobbying to limit access to central bank clearance and payment systems to banks. As in past decades, a significant non-bank financial intermediation segment (previously known as shadow banks) operates with links to banks, but with an evolving structure.

Big tech companies will offer payment services but will not be able to access central bank clearance and payment systems, which is only accessible to commercial banks. Some big tech companies will enter intermediation services through financial subsidiaries, while it is possible that some fintech companies will acquire banking licences. Cooperation with banks by big techs offering their platforms for customers to choose financial service providers will increase competition among banks, but might also result in misalignment of incentives, as discussed above. There is also the possibility of increasing partnerships between traditional banks and big tech companies for lending services, with the former providing their balance sheet and big tech companies their data for screening and monitoring. Consumer protection will have to change its focus, as personal data will become more and more important as a basis for credit, insurance and other financial service provision. Both ownership of and access to personal data will be important for financial service providers and customers alike. Current rules that force banks to share personal information but do not allow them to gain access to data that big tech companies have seem lopsided and will have to be changed.

In summary, in the first scenario the banking system will renew itself by incorporating new providers and new products. Fintech solutions will become part of the banking system. Financial risks will continue to be concentrated in the banking system, as well as in non-banking financial institutions linked to the banking system. However, an increasing number of non-financial risks will be located in a small number of IT service providers, which can result in new sources of risks. Regulatory responses will have to focus on the interlinkages and cooperation between banks, on the one side, and fintech and big tech companies, on the other; adjust macroprudential monitoring and policy tools to different incentive structures of platforms; and focus more strongly on non-financial IT service providers as systemically important.

4.3 Scenario 2: incumbent banks retrench

The second scenario will see an increasing role for fintech and big tech companies in payment services. Big tech companies will offer financial services through regulated subsidiaries and capture the hard data, transaction-based lending market. Traditional banks, on the other hand, will increasingly focus on relationship-intensive services, both at the high end (investment banks) and the low end (community banks) of the market. This implies that incumbent banking systems will shrink, especially affecting mid- and small-sized banks, which will no longer be able to exploit scope economies due to the unbundling of financial services and/or scale economies due to their limited size.³¹ This will also affect smaller banks that do not have close

³¹ This phenomenon has already started to happen. Both in the United States and in the EU, the number of small banks has been decreasing since the aftermath of the global financial crisis. According to ECB consolidated banking data, the number of small domestic and stand-alone banks in the EU fell from 2,793 to 1,859 at the end of 2019.



community ties. The transition to a smaller traditional banking system will create fragility risks due to the necessary deleveraging and market exit by incumbent banks.

The shift in financial service provision will create new sources of financial risks and challenges for macroprudential regulation, some of which we have already discussed above.

First, there will be an increasing number of investment opportunities for retail depositors, some inside and others outside the financial safety net. Investor runs on financial institutions outside the regulatory perimeter could cause fragility, lead to disruption inside the regulatory perimeter and put pressure on authorities to expand the safety net on an ad hoc basis. Second, an increasing role for big tech (i.e. platform) companies could result in concentration and too-big-to-fail risk, as well as in transition risk, as one dominant platform firm is replaced with another. Third, a general move towards more hard and less soft information could make lending cycles even more pronounced and pose additional challenges for macroprudential policymakers.

In summary, in the second scenario, there will be a structural change in the financial system, with traditional banks retrenching and fintech and big tech companies playing a greater role.³²

Financial risk will be distributed over a more diverse set of players, and the issue of firewalls between the financial and non-financial parts of big tech and similar companies will become important. Non-financial risk related to IT will assume an even more important role, and concentrated provision of such services could create additional interlinkages between banks and non-bank providers, which otherwise have no connections. The changing financial structure will require a rethinking of supervisory practices, data collection and micro- and macroprudential tools. In this scenario, regulation of fintech and big tech will be a key issue, as well as access by the new players to lender of last resort facilities and coverage by deposit insurance.

4.4 Scenario 3: central bank digital currencies

The third scenario is designed on the premise that the issuance of retail central bank digital currencies could lead to a different structure of the financial system.

Central banks could issue retail digital currencies in different ways. They can be an anonymous bearer instrument or be registered with a named owner. There can be quantity restrictions on an individual's holdings, or supply can be elastic. Supply can be restricted to residents of the issuing jurisdiction eligible to hold it (through caps on holdings) or it can be open to anyone. Finally, central bank digital currencies could have a zero interest rate like cash, or it can be interest-bearing. To be transformative, however, such central bank digital currencies cannot be anonymous, have to be supplied elastically and must not be only available to residents of the issuing jurisdiction, as such a restriction would amount to capital controls. These are the characteristics of central bank digital currencies that we consider in this specific (possibly very hypothetical) scenario. It is important to note that while our scenario implies a loss in the intermediation function of banks, other scenarios – where banks maintain their intermediation function in the financial system – are possible.³³ The ultimate

³² The retrenchment of incumbent banks could also occur if fintechs and big techs – as experts in the provision of customer experiences – rapidly become the preferred intermediary for customers regarding financial products. Therefore, incumbent banks, deprived of customer relationships, would depend on these intermediaries for the distribution of traditional banking services and would only be carrying financial risks.

³³ See Bindseil et al. (2021).



transformative effects of central bank digital currencies on the financial system greatly depend on the intermediation model chosen and on potential holding limits that could be implemented.

In our hypothetical scenario where a financial system with a central bank digital currency able to massively attract retail depositors, commercial banks would be placed in a radically different situation, especially if the digital currency is interest-bearing. Banks would face higher funding costs and a potentially more volatile funding base, as the traditionally stable retail deposit clientele might switch to the digital currency (either directly issued by the central bank or by authorised narrow banks).³⁴ Banks would still maintain a certain amount of deposits, as a result of the possibility to combine deposits and loans for their customers. Given the shift of money creation from commercial banks to the central bank (or the new authorised narrow intermediaries), a process of disintermediation away from the incumbent commercial banks would take place and the central bank would play an increasing role as an intermediary, which will have to allocate the funds attracted by the digital currency.³⁵ At the same time, a diverse set of alternative financial service providers – including fintech and big tech companies – will offer tailor-made and specialised services in lending, asset management and risk management. Under our hypothetical scenario, incumbent banks would be left diminished and turning into riskier and more volatile intermediaries.

Regulation under such a hypothetical scenario would have to deal with both scaled-up central bank intermediation and a diverse set of financial service providers with riskier profiles and higher exposure to runs. While the central bank might create stability through its dominating role as money creator, its lending role might expand significantly, replacing a more decentralised, market-based process for the allocation of credit. The traditional banking system would no longer have the role of a stable anchor (outside systemic crisis periods) within the financial system, dominated by the central bank and the new players in such hypothetical scenario. The existence of digital currencies, however, might exacerbate bank runs during systemic banking crises, as there is now a safe alternative to bank deposits. There could also be major cross-border outflows from countries whose currency is no longer regarded as trustworthy. At the same time, banks would have to rely more on wholesale funding and/or more expensive retail funding for loan origination, which in crisis times could result in (i) runs among other holders of short-term liabilities of the intermediaries and (ii) a “crunch” in the intermediary’s lending capacity.

³⁴ While incumbent banks would also be able to offer such accounts, these accounts would not be the basis for creating additional digital currency, as bank deposits would.

³⁵ The central bank would also need to comply with regulatory requirements, including AML/CFT, which could be quite burdensome.



5 An EU macroprudential policy response

This last section considers some policy actions in view of the challenges and opportunities posed by digitalisation to the banking sector, the emergence of new risks and the reshaping of existing risks. The analysis is based on the three scenarios discussed in the previous section.

Some of the possible policies would apply to all three scenarios, while others would be more relevant if only one of the three scenarios materialises. Critically, the regulatory response will be a key driver of which of the three scenarios materialises.

In general, developments in the financial system are endogenous to regulatory responses and adjustments, and even more so when confronting potentially disruptive transformations. The increased importance of technology in the provision of financial services and the entry into the sector of fintech and big tech companies can become potentially disruptive, as outlined in the previous sections. Possible policy actions as outlined below will be discussed in the context of the three scenarios in Section 4: they could apply to all three scenarios in some cases, or they may only be necessary if one of the scenarios materialises.

A common issue across all three scenarios is the definition and possible expansion/adaptation of the regulatory perimeter and the conditions for accessing the safety net. Reliance on demandable deposits is one of the main rationales for the prudential regulation of banks. Banks, in return, gain access to the protection of the financial safety net (i.e. lender of last resort facilities and deposit insurance). Over the past decades, however, non-bank institutions (such as money market funds) have offered deposit-like products. While formally not covered by the safety net, the exposure of these institutions to liquidity risk (e.g. the risk of runs) and their interconnectedness with the rest of the financial system have led them to receive ad hoc support from the safety net (e.g. through central bank facilities such as those put in place at the onset of the COVID-19 pandemic). Looking ahead, similar challenges can arise for certain fintech and big tech providers of financial services if, despite offering bank-like services, they (or their relevant financial subsidiaries) are not regulated like banks. Access to the safety net (including to the market-maker of last resort facilities) must go hand in hand with the development of a prudential regulatory framework for fintechs and big techs, particularly in the scenarios of bank retrenchment and central bank digital currencies. Besides prudential regulation, particular attention should be paid to consumer protection and anti-money laundering, two areas where fintechs and big techs may not spend as many resources as incumbent banks and where these new providers have not been subject to the same scrutiny as incumbent banks.

An important consideration in this area would be to enhance global cooperation on the regulation of the financial activities of fintechs and big techs, as well as the access of these companies to the safety net. One of the characteristics of digitalisation in finance is that it helps overcome physical boundaries; it greatly facilitates customers in one country accessing financial services in a different jurisdiction, with positive implications for competition and risk sharing. Moreover, fintech and big tech companies might easily operate on a global scale with no permanent establishment in most of the jurisdictions where they operate. This can be problematic in situations where fintechs or big techs must make use of the safety net, as the authorities from both the home and the host jurisdictions might fear that their support ends up helping customers or



supporting activities in a different jurisdiction. The collapse of Icelandic banks in 2008 provides an example of how developments can turn sour in situations where resources from the home country are called on to support customers mostly based in foreign jurisdictions. To avoid undesired and untimely discussions, mechanisms for cooperation should be put in place ex ante at the global level. On a related note, consumer protection policies may need to be strengthened in the case of some cross-border big techs and fintechs, to raise awareness among customers of issues related to accessing the safety net. Within the EU, the benefits of digitalisation should spur efforts towards further market and regulatory integration, but also a Single Market/banking union-level approach to these possibly disruptive developments.

A second related issue is the possible ringfencing of the financial intermediation activities developed by big techs, as these might be forced to be provided through a subsidiary that would fall within the regulatory perimeter. Even under such a configuration, the possibility of intragroup transactions between the parent or other non-financial subsidiaries and the financial subsidiary might leave room for regulatory arbitrage or opportunistic behaviour. In the EU, non-financial subsidiaries of banks are excluded from the scope of current prudential regulation (CRD/CRR), so the prudential relevance and regulatory treatment of intragroup transactions might deserve further attention. In the past, such risks have been tackled by applying regulation and supervision at the level of financial subsidiaries. For example, many car manufacturers in Europe have a subsidiary with a banking licence for their sales of cars by credit, with these subsidiaries, but not the ultimate parent, subject to prudential supervision and regulation.³⁶ But forcing the financial activities of big techs to occur through regulated subsidiaries might require profound organisational changes in big techs and may substantially reduce the appeal of entering the financial intermediation business at a large scale. If that were the case, the probability of the second scenario occurring (banks' retrenchment) would substantially decrease.³⁷ In the case of non-intermediation activities (take the example of advisory services), all providers should be subject to the same regulation and supervision.

A third area for policy action would cover non-financial providers of services, which may be under a different regulatory authority (e.g. telecom regulator). There are two different streams to consider here: (i) the provision of non-financial services by a non-financial provider to financial institutions,³⁸ and (ii) the provision of financial services by a non-financial provider. The first case would cover situations where several banks make use of a software platform to perform some activities or use the same provider of back office services, while the second situation would consider the provision of ancillary financial services by institutions outside the regulatory perimeter. In both cases, the border of the regulatory perimeter blurs and that may require enhanced cooperation between regulators in different sectors and jurisdictions. Such cooperation might also be required across borders, given the global nature of most big techs. As the regulatory and legislative approaches towards platform companies (i.e. big tech companies) change on the EU level (driven by the Directorate General for Competition (DG Competition)), such changes should involve close cooperation with financial sector regulators.

³⁶ For example, Volkswagen Bank GmbH is under the supervision of the ECB under the Single Supervision Mechanism (see [SSM - list of supervised entities](#)).

³⁷ However, it could also be possible that big techs use their financial resources to purchase or create a financial subsidiary.

³⁸ See also European Banking Authority (2019a).



In general, the increased digitalisation in financial services may also call for a change in regulatory and supervisory practices. The current approach to prudential regulation of banks is based on a business model where digitalisation was in its infancy and, consequently, where physical contact between financial institutions and customers was required in all cases. As such, non-financial risks were not high on the regulatory agenda compared with financial risks (namely, credit and market risks). However, digitalisation may bring increased importance to non-financial risks, many of them currently under the umbrella of operational risks. For example, the FSB Financial Stability Surveillance Framework (Financial Stability Board (2021)) explicitly mentions cyberattacks as an operational vulnerability and the ESRB has developed an analytical framework to assess how cyber risk can become a source of systemic risk to the financial system (European Systemic Risk Board (2020c)). In view of the foreseen expansion of digital activities in the financial sector, a more accurate reflection of non-financial risks in the prudential framework may be required. This would also apply to the skills of staff working in regulatory and supervisory authorities, which may also need to be upgraded to face the new challenges.

Political decisions on the issuance of central bank digital currencies to retail customers have to carefully balance efficiency gains with stability risks this poses to the incumbent financial system. Issuing digital currencies can give customers more options and result in more competition. However, it is important to consider the medium- to long-term implications for the structure of the financial system, in terms of both efficiency and stability, and as tentatively discussed under scenario 3.

Finally, the support framework for an orderly exit and capacity reduction of incumbent banks should be strengthened. Under any of the scenarios discussed in the previous section, incumbent banks will face increased competition and even tighter profit margins. This will necessarily result in incumbent banks reducing capacity and possibly exiting the market, a process that can cause fragility. Supervisory and resolution authorities must be well prepared for this process, but this process can also be proactively supported. This includes avoiding government support for inviable banks, but also facilitating mergers, including across borders, and easing barriers to market exit and liquidation. A premium should therefore be put on efforts to complete the banking union as a necessary condition for more cross-border bank mergers.



References

- Association of Banking Supervisors of the Americas and IDB Lab (2019), "**Regulation for Responsible and Competitive Financial Sector Innovation**", December.
- Baba, C., Batog, C., Flores, E., Gracia, B., Karpowicz, I., Kopyrski, P., Roaf, J., Shabunina, A., van Elkan, R. and Xu, X.C. (2020), "**Fintech in Europe: promises and threats**", IMF Working Papers, No 20/241.
- Balyuk, T. (2019), "**Financial Innovation and Borrowers: Evidence from Peer-to-Peer Lending**", Federal Deposit Insurance Corporation Papers.
- Balyuk, T. and Davydenko, S. (2019), "**Reintermediation in FinTech: Evidence from Online Lending**", Federal Deposit Insurance Corporation Papers.
- Bank of International Settlements (2019), "**III. Big tech in finance: opportunities and risks**", BIS Annual Economic Report 2019.
- Banking Circle (2019), "**How banks can combat issues with legacy infrastructure**", 22 May.
- Basel Committee on Banking Supervision (2021a), "**The Basel Framework**", January.
- Basel Committee on Banking Supervision (2021b), "**Climate-related risk drivers and their transmission channels**", April.
- Berg, T., Burg, V., Gombović, A. and Puri, M. (2020), "**On the Rise of FinTechs: Credit Scoring Using Digital Footprints**", Review of Financial Studies, Vol. 33, Issue 7, pp. 2845–2897.
- Berger, A.N., Frame, W.S. and Miller, N.H. (2005), "**Credit Scoring and the Availability, Price, and Risk of Small Business Credit**", Journal of Money, Credit and Banking, Vol. 37, No. 2, pp. 191-222.
- Bindseil, U., Panetta, F. and Terol, I. (2021), "**Central Bank Digital Currency: functional scope, pricing and controls**", ECB Occasional Paper Series No. 286, December.
- Björkegren, D. and Grissen, D. (2020), "**Behavior Revealed in Mobile Phone Usage Predicts Credit Repayment**", The World Bank Economic Review, Vol. 34, Issue 3, pp. 618–634.
- Bolton, P., Després, M., Pereira da Silva, L.A., Samama, F. and Svartzman, R. (2020), "**The green swan – Central banking and financial stability in the age of climate change**", January.
- Braggion, F., Manconi, A. and Zhu, H. (2019), "**Can Technology Undermine Macroprudential Regulation? Evidence from Peer-to-Peer Credit in China**", CEPR Discussion Papers, No 12668.
- Buchak, G., Matvos, G., Piskorski, T. and Seru, A. (2018a), "**Fintech, regulatory arbitrage, and the rise of shadow banks**", Journal of Financial Economics, Vol. 130, Issue 3, pp. 453-483.
- Buchak, G., Matvos, G., Piskorski, T. and Seru, A. (2018b), "**The Limits of Shadow Banks**", NBER Working Paper Series, No. 25149.



- Buckmann, M., Haldane, A. and Hüser, A-C. (2021), "**Comparing minds and machines: implications for financial stability**", Bank of England Staff Working Paper Series, No 997.
- Butcher, S. (2018), "**Inside Deutsche Bank's "dysfunctional" IT division**", efc, 20 April.
- Butcher, S. (2021), "**Here's how much banks spend on tech vs. Amazon and Google**", efc, 17 June.
- Carletti, E., Claessens, S., Fatas, A. and Vives, X. (2020), "**The Bank Business Model in the Post-Covid-19 World**", Future of Banking 2, CEPR and IESE.
- Caldo, G., Hoene, M. and Olanrewaju, T. (2014), "**How winning banks refocus their IT budgets for digital**", McKinsey Digital, December.
- Cambridge Centre for Alternative Finance, World Bank and World Economic Forum (2020), "**The global Covid-19 FinTech market rapid assessment report**".
- Chowdhury, H. (2018), "**Banks face continued IT woes as legacy infrastructure holds them down**", The Telegraph, 8 October.
- Committee on the Global Financial System (2018), "Financial stability implications of a prolonged period of low interest rates", CGFS Papers. No 61, July.
- Council of the European Union (2017), "**Report of the FSC Subgroup on Non-Performing Loans**", Brussels, 31 May.
- Cornelli, G., Frost, J., Gambacorta, L., Rau, R., Wardrop, R. and Ziegler, T. (2020), "**Fintech and big tech credit: a new database**", BIS Working Papers, No 887.
- D-Rating (2020), "**The Digital Proposition of retail banks in Europe: 14 click & mortar banks compete with the top neobanks within D-Rating's EURO-58**", December.
- De la Mano, M. and Padilla, J. (2018), "**Big Tech Banking**".
- De Haan, J. (2021), "**Low IT spending by banks: Reason for concern?**", In-depth analysis requested by the ECON committee of the European Parliament, June.
- de Roure, C., Pelizzon, L. and Thakor, A.V. (2021), "**P2P lenders versus banks: cream skimming or bottom fishing?**", SAFE Working Paper Series No. 206.
- Dell'Ariccia, G., Igan, D. and Laeven, L. (2008), "**Credit Booms and Lending Standards: Evidence from the Subprime Mortgage Market**", IMF Working Papers, No 08/106.
- Deutsche Bank Research (2010), "Direct fiscal cost of the financial crisis", 14 May.
- Dupont, L., Fliche, O. and Yang, S. (2020), "**Governance of Artificial Intelligence in Finance**", ACPR Discussion document, June.



- Enria, A. (2019), "**Is less more? Profitability and consolidation in the European banking sector**", presentation at the CIRSF (Research Centre on Regulation and Supervision of the Financial Sector) Annual International Conference, Lisbon, 4 July.
- European Banking Authority (2017), "**Discussion paper on the EBA's approach to FinTech**", August.
- European Banking Authority (2019a), "**Final report on EBA Guidelines on outsourcing arrangements**", February.
- European Banking Authority (2019b), "**Notifications on resolution cases and use of DGS funds**".
- European Banking Authority (2019c), "**EBA Report on potential impediments to the cross-border provision of banking and payment services**", October.
- European Banking Authority (2020a), "**Report on big data and advanced analytics**", December.
- European Banking Authority (2020b), "**Risk assessment of the European banking system**", December.
- European Banking Authority (2021), "**Report on the use of digital platforms in the EU banking and payments sector**", September.
- European Central Bank (2020), "**Financial integration and structure in the euro area 2020**", March.
- European Central Bank Banking Supervision (2017), "**SREP Methodology Booklet**".
- European Central Bank Banking Supervision (2018a), "**SREP Methodology Booklet**".
- European Central Bank Banking Supervision (2018b), "**SSM thematic review on profitability and business models**", September.
- European Central Bank Banking Supervision (2018c), "**Report on the Thematic Review on effective risk data aggregation and risk reporting**", May.
- European Central Bank Banking Supervision (2019), "**Supervisory expectations on risk data aggregation capabilities and risk reporting practices**", June.
- European Central Bank Banking Supervision (2021a), "**SREP 2020 aggregate results**", January.
- European Central Bank Banking Supervision (2021b), "**Guide on the supervisory approach to consolidation in the banking sector**", January.
- European Systemic Risk Board (2015), "**ESRB Report on the regulatory treatment of sovereign exposures**", March.
- European Systemic Risk Board (2016a), "**Macroprudential policy issues arising from low interest rates and structural changes in the EU financial system**", November.



European Systemic Risk Board (2016b), “**The impact of low interest rates and ongoing structural changes on the banking system: assessment of vulnerabilities, systemic risks and implications for financial stability**”, Technical Documentation Section B.

European Systemic Risk Board (2016c), “**The ESRB issues eight Warnings on medium-term residential real estate vulnerabilities and a Recommendation on closing real estate data gaps**”, November.

European Systemic Risk Board (2016d), “**Vulnerabilities in the EU residential real estate sector**”, November.

European Systemic Risk Board (2019a), “**ESRB issues five warnings and six recommendations on medium-term residential real estate sector vulnerabilities**”, September.

European Systemic Risk Board (2019b), “**Macroprudential approaches to non-performing loans**”, January.

European Systemic Risk Board (2020a), “**Positively green: measuring climate change risks to financial stability**”, June.

European Systemic Risk Board (2020b), “**EU Non-bank Financial Intermediation Risk Monitor 2020**”, October.

European Systemic Risk Board (2020c), “**Systemic cyber risk**”, February.

European Systemic Risk Board (2021a), “**Financial stability implications of support measures to protect the real economy from the COVID-19 pandemic**”, February.

European Systemic Risk Board (2021b), “**Lower for longer - macroprudential policy issues arising from the low interest rate environment**”, June.

European Systemic Risk Board (2021c), “**Climate-related risk and financial stability**”, July.

Fernandez, S., Jenkins, P., and Vieira, B. (2020b), “**Europe’s digital migration during COVID-19: Getting past the broad trends and averages**”, McKinsey Digital, July.

Financial Stability Board (2017), “**Financial Stability Implications from FinTech: Supervisory and Regulatory Issues that Merit Authorities’ Attention**”, June.

Financial Stability Board (2019a), “**FinTech and market structure in financial services: Market developments and potential financial stability implications**”, February.

Financial Stability Board (2019b), “**BigTech in finance: Market developments and potential financial stability implications**”, December.

Financial Stability Board (2021), “**FSB Financial stability surveillance framework**”, September.

Flinders, K. (2015), “**The diagram that scares the next generation of banking IT professionals**”, Computer Weekly, 18 Jun.



- Foerster, S., Linnainmaa, J.T., Melzer, B.T. and Previtro, A. (2017), “**Retail Financial Advice: Does One Size Fit All?**”, *Journal of Finance* Vol. 72, Issue 4, pp. 1441-1482.
- Frost, J., Gambacorta, L., Huang, Y., Shin, H.S. and Zbinden, P. (2019), “**BigTech and the changing structure of financial intermediation**”, *Economic Policy*, Vol. 34, Issue 100, pp. 761-799.
- Fuster, A., Plosser, M., Schnabl, P. and Vickery, J. (2019), “**The Role of Technology in Mortgage Lending**”, *Review of Financial Studies*, Vol. 32, Issue 5, pp. 1854–1899.
- Gennaioli, N., Shleifer, A. and Vishny, R. (2012), “**Neglected risks, financial innovation, and financial fragility**”, *Journal of Financial Economics*, Vol. 104, pp. 452–468.
- Gros, D., Lane, P., Langfield, S., Matikainen, S., Pagano, M., Schoenmaker, D. and Suárez J. (2016), “**Too late, too sudden: Transition to a low-carbon economy and systemic risk**”, *Reports of the Advisory Scientific Committee*, No 6, February.
- He, Z., Huang, J. and Zhou, J. (2020), “**Open banking: credit market competition when borrowers own the data**”, *NBER Working Paper Series* No. 28118.
- Henderson, B.J. and Pearson, N.D (2011), “**The dark side of financial innovation: A case study of the pricing of a retail financial product**”, *Journal of Financial Economics*, Vol. 100, Issue 2, pp. 227-247.
- Hodula, M. (2021), “**Does Fintech credit substitute for traditional credit? Evidence from 78 countries**”, *Finance Research Letters*, forthcoming.
- International Monetary Fund (2021), “**Global Financial Stability Report**”, October.
- Jagtiani, J. and Lemieux, C. (2018), “**The roles of alternative data and machine learning in fintech lending: Evidence from the LendingClub consumer platform**”, *Financial Management*, Vol. 48, Issue 4, pp. 1009-1029.
- Ji, M. (2017), “**Are Robots Good Fiduciaries? Regulating Robo-Advisors Under the Investment Advisers Act of 1940**”, *Columbia Law Review*, Vol. 117, No. 6.
- Keys, B.J., Mukherjee, T., Seru, A. and Vig, V. (2010), “**Did Securitization Lead to Lax Screening? Evidence from Subprime Loans**”, *Quarterly Journal of Economics*, Vol. 125, Issue 1, pp. 307–362.
- King, P. and H. Tarbert (2011), “**Basel III: an overview**”, *Banking & Financial Services Policy Report*, Vol. 30, No. 5, pp. 1-18.
- Mills, D., Badev, A., Baird, M., Brezinski, T., Chen, C., Ellithorpe, M., Fahy, L., Kargenian, V., Liao, K., Malone, B., Marquardt, J.C., Ravi, A., Ng, W. and Wang, K. (2016), “**Distributed Ledger Technology in Payments, Clearing, and Settlement**”, *Finance and Economics Discussion Series*, Board of Governors of the Federal Reserve System (United States), No 2016-095.



- Laeven, L., Levine, R. and Michalopoulos, S. (2015), "**Financial innovation and endogenous growth**" Journal of Financial Intermediation, Vol. 24, Issue 1, pp. 1-24.
- Lerner, J. and Tufano, P. (2011), "**The Consequences of Financial Innovation: A Counterfactual Research Agenda**", NBER Working Paper, No 16780.
- McCauley, R., Bénétrix, A., McGuire, P. and von Peter, G. (2017), "**Financial deglobalisation in banking?**", BIS Working Papers No 650.
- McKinsey and Company (2020), "**Banking system resilience in the time of COVID-19**", July.
- Moise, I. and Franklin, J. (2021), "**US banks ramp up spending on pay and technology**", Financial Times, 17 July.
- Nakamoto, S. (2008), "**Bitcoin: a peer-to-peer electronic cash system**", mimeo.
- Pagano, M., Langfield, S., Acharya, V., Boot, A., Brunnermeier, M.K., Buch, C.M., Hellwig, M.F., Sapir, A. and van den Burg, I. (2014), "**Is Europe Overbanked?**", Reports of the Advisory Scientific Committee, No 4, June.
- Pogson, K. (2019), "**Why banks can't delay upgrading core legacy banking platforms**", Tapestry Networks, EY, 18 Jun 2019.
- Portes, R., Beck, T., Buiter, W., Dominguez, K., Gros, D., Gross, C., Kalemli-Ozcan, S., Peltonen, T. and Sánchez Serrano, A. (2020), "The global dimensions of macroprudential policy", Reports of the Advisory Scientific Committee, No 10, February.
- Protiviti (2019), "**Modernizing Legacy Systems at Financial Institutions**".
- PWC (2018), "**InsurTech Insights: How InsurTechs are transforming (re)insurers**".
- S&P Global Market Intelligence (2019), "**Deposits flocked to digital bank accounts in 2018**".
- Shevlin, R. (2019), "**How much do banks spend on technology? (Hint: It would weigh 670 tons in \$100 bills)**", Forbes, 1 April.
- Stevens, P. (2019), "**Investing: here are the 10 companies with the most cash on hand**", CNBC, 7 November.
- Stulz, R. M. (2019), "**Fintech, BigTech and the future of banks**", NBER Working Paper 26312, September.
- Swaper (2021), "**19 P2P Investing Statistics You Need to Know for 2021**", 22 February.
- Thakor, A.V. (2020), "**Fintech and banking: What do we know?**", Journal of Financial Intermediation, Vol. 43.
- Tinn, K. (2018), "**Blockchain and the Future of Optimal Financing Contracts**".
- Vives, X., and Ye, Z., (2021), "**Information Technology and Bank Competition**", IESE Business School Working Paper, June.



Yermack, D. (2017), "**Corporate Governance and Blockchains**", Review of Finance, Vol. 21, Issue 1, pp. 7–31.

Zetsche, D.A., Buckley, R.P., Barberis, J.N. and Arner, D.W. (2017), "**Regulating a Revolution: From Regulatory Sandboxes to Smart Regulation**".



Annex: The EU banking system compared with the US and Japanese banking systems

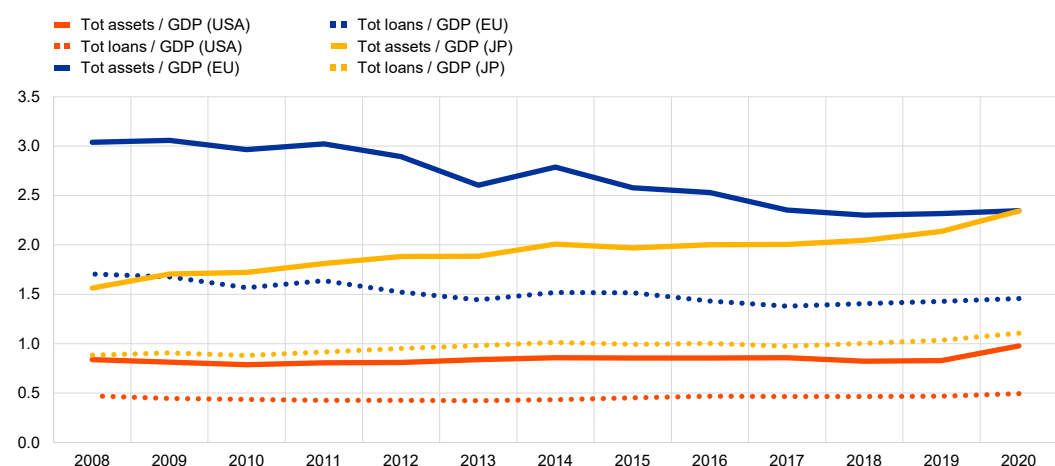
This Annex provides further information about the EU banking system at the end of 2019, complementing and extending the main ideas of Section 4.1. It starts with a reflection of the size of the banking system in the EU in the last years, particularly related to the issue of overbanking. It then shows some additional evidence on asset quality and NPLs, focusing on how weaker banks came out from the global financial and the sovereign debt crises. Then detailed information on bank profitability is shown.

Since 2015, the size of the banking sector, compared to GDP, remains significantly higher in Europe than in the United States, though on a declining trend. While the size of the US banking system seems to have remained constant since 2008 at levels around 80% of GDP, the EU banking system has experienced a marked decline, being now closer to 200% of EU GDP (Chart A1). However, taking total bank loans as a metric, this declining trend in the EU is not as acute, suggesting that EU banks may have been disposing other ancillary activities within their groups, including activities in non-EU countries. After the global financial crisis, European banks lost market share in global banking, particularly in investment banking activities (McCauley et al. (2017); Portes et al. (2020)). The Japanese banking sector seems to have followed an opposite path, increasing its weight in relation to the total economy since 2008. The main takeaway from Chart A1 is that the banking sector in the EU is still large compared with the size of the economy.

Chart A1

Total assets and total loans of EU and US banks as a share of GDP

(ratio to GDP)



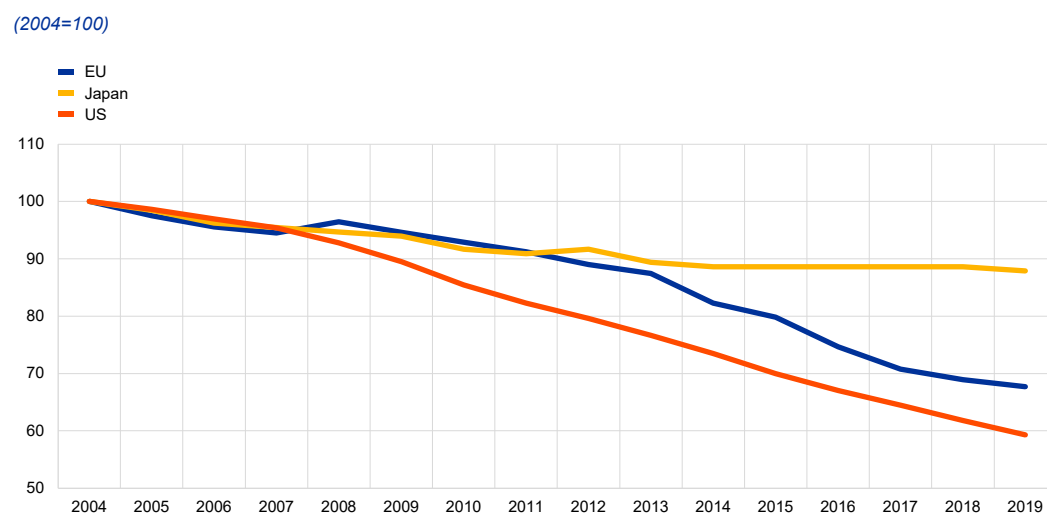
Sources: ECB consolidated banking data, Federal Deposit Insurance Corporation, European Commission, Federal Reserve Bank of St. Louis (Fred database), Haver Analytics and ESRB Secretariat calculations.

While the number of credit institutions and local branches has declined since 2014, banking density remains high in the EU compared to other advanced economies. In line with the



declining trends in total assets, the number of banks in the EU has decreased by around one-third since 2004, and this declining trend seems to have accelerated since 2014 (Chart A2). Country-level data show that the physical capacity of the banking sector, measured by the number of local branches, declined between 2014 and 2019 in every EU country (Chart A3). However, the density of the EU banking services remains high in international comparisons. For example, considering indicators based on demographic factors linking bank branches and bank employees to population sizes, several EU countries had values higher than other advanced economies (i.e. the United States) at the end of 2019.³⁹ This points to the existence of structural factors in the European financial system that would explain the existence of such a large banking capacity. These structural factors could relate, among others, to the existence of global financial hubs (particularly when the United Kingdom was a member of the EU), to the extent to which bank customers use new technologies and to the distribution of populations between urban and rural areas.

Chart A2
Number of credit institutions and commercial banks in the EU, US and Japan



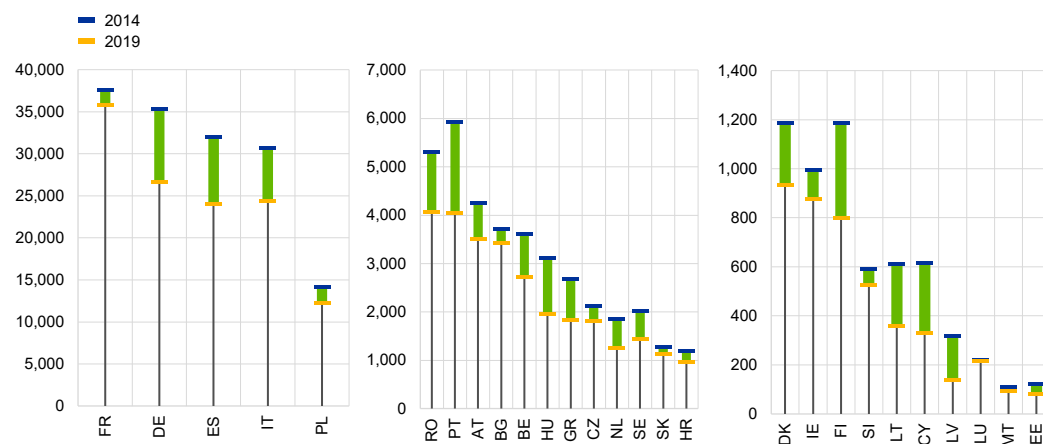
Sources: ECB, Federal Deposit Insurance Corporation, Federal Reserve Bank of St. Louis, International Monetary Fund and ESRB Secretariat calculations.

³⁹ See [The Global Economy Rankings](#).



Chart A3
Number of local branches in EU countries

(units)



Source: ECB (EU Structural Financial Indicators, available at [link](#)).

Note: The chart shows the number of local units (branches) per country in 2014 and 2019 (green bars denote declines and a red bar would signal increases).

Although many EU banking systems have reduced their stocks of NPLs since 2014 (Chart A4), bank resolution has been employed very seldomly, with many banks receiving support from the public sector and/or relying on central bank funding instead. Financial support to stressed institutions during the global financial crisis has already burdened many EU countries with significant costs. However, few European banks have been resolved in the aftermath of the global financial and sovereign debt crises (Deutsche Bank Research (2010); European Central Bank, (2009 and 2015)).⁴⁰ In comparison, the number of resolutions conducted in the US banking system during the global financial crisis was relatively high, amounting to 140 failures in 2009 and 160 failures in 2010, according to FDIC. At the same time, only a limited number of institutions identified in 2014 as weak have exited the market in recent years (Table A1). Most of the banks indicating vulnerabilities at the time of the EBA stress test exercise of 2014 have continued to operate with relatively high NPLs and/or high costs, yielding low profits and relying on support from the public sector.

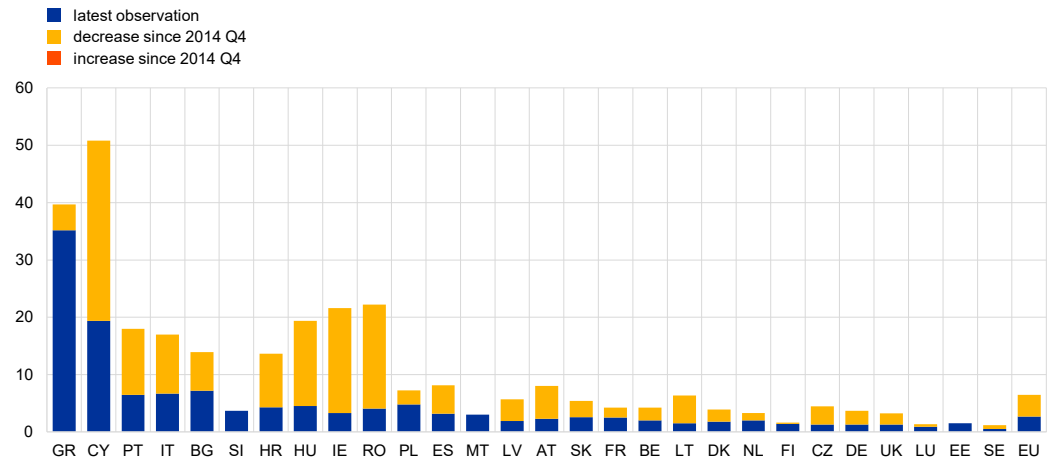
⁴⁰ For more details, see the database in European Banking Authority (2019b).



Chart A4

Ratio of NPLs and advances to total gross loans and advances, end-2019

(percentages of total gross loans and advances)



Sources: EBA Risk Dashboard and ESRB Secretariat calculations.

Notes: The chart shows the weighted average ratio of NPLs and advances to total gross loans and advances for banks in EU countries as at 4Q 2019 (blue bars). It also shows the decrease (yellow bars) or increase (red bars) since 4Q 2014. The data are based on a sample of 134 banks for 4Q 2014 and 182 banks for 4Q 2019.



Table A1

Resolution and public support of weak EU banks

Weak banks in 2014 according to EBA Stress Test, nonperforming loans and cost-to-income ratios		Overall		EU Averages for significant institutions					
		9 (of 45)	8 (of 45)	0.2	0.4	6.6	3.2	63.6	64.6
Bottom 15 in 2014 EBA Stress test		Resolved	Public support	Return-on-assets (%)		Nonperforming loans (%)		Cost-to-income (%)	
Country	Bank			2014	2018	2014	2018	2014	2018
Cyprus	Co-operative Central Bank	1	1	0.3	-	55.9	-	50	-
Greece	Eurobank Ergasias	0	0	-1.6	0.2	-	37.0	58	50
Italy	Banca Carige	0	1	-1.3	-1.1	24.0	20.3	84	113
Cyprus	Hellenic Bank	0	0	-1.8	3.1	58.1	32.4	44	70
Greece	National Bank of Greece	0	1	0.1	-0.1	-	-	81	73
Italy	Banca Monte dei Paschi di Siena	0	1	-2.8	0.2	-	17.7	79	83
Ireland	Permanent tsb	1	0	-0.3	0.0	26.9	10.0	128	79
Cyprus	Bank of Cyprus	0	0	-1.1	-0.5	70.4	37.2	35	64
Austria	Oesterreichische Volksbanken-AG	1	0	-2.6	-0.2	-	-	-	234
Italy	Veneto Banca	1	1	-2.7	-	-	-	78	-
Germany	Münchener Hypothekbank	0	0	0.0	0.1	1.1	0.3	76	58
Portugal	Banco Comercial Português	0	0	-0.1	0.6	11.5	6.4	55	50
Italy	Banca Popolare di Vicenza	1	1	-1.7	-	-	-	66	-
Belgium	AXA Bank Europe	0	0	-0.1	0.2	-	-	75	75
Italy	Banca Piccolo Credito Valtellinese	0	0	-1.2	0.1	24.2	8.7	59	95
Bottom 15 in 2014 according to nonperforming loans		Resolved	Public support	Return-on-assets (%)		Nonperforming loans			
Country	Bank			2014	2018	2014	2018		
Greece	Piraeus Bank	0	1	-2.2	-0.3	42.5	32.7		
Greece	Alpha Bank	0	0	-0.5	0.1	35.2	34.3		
Slovenia	Nova Ljubljanska banka d. d.	0	1	0.5	1.7	31.4	8.2		
Germany	HSH Nordbank	1	0	0.1	0.1	22.7	-		
Italy	Banca Popolare Dell'Emilia Romagna	0	0	0.0	0.6	22.6	12.4		
Spain	Liberbank	0	0	0.2	0.3	21.5	4.9		
Hungary	OTP Bank	0	0	-1.0	2.3	19.1	8.6		
Spain	Banco Popular Español	1	0	0.2	-	18.5	-		
Slovenia	Nova Kreditna Banka Maribor d.d.	0	0	0.5	1.5	18.2	4.1		
Ireland	Bank of Ireland	0	0	0.6	0.5	17.7	6.4		
Spain	Cajas Rurales Unidas	0	0	0.3	0.2	17.1	7.8		
Italy	Intesa Sanpaolo	0	0	0.2	0.5	16.9	8.5		
Italy	UniCredit	0	0	0.3	0.5	16.0	7.1		
Italy	Unione Di Banche Italiane	0	0	-0.6	0.4	14.6	10.0		
Italy	Banca Popolare di Sondrio	0	0	0.4	0.3	14.2	12.2		
Bottom 15 in 2014 according to cost-to-income		Resolved	Public support	Return-on-assets (%)		Cost-to-income (%)			
Country	Bank			2014	2018	2014	2018		
Austria	Raiffeisenlandesbank Niederösterreich-Wien	0	0	-0.8	0.8	326	45		
Germany	Hypo Real Estate Holding	1	0	-1.0	-	300	-		
France	Société de Financement Local	0	0	0.0	0.1	156	60		
Germany	Wüstenrot Bausparkasse	0	0	0.0	0.1	98	102		
UK	Royal Bank of Scotland Group	0	0	-0.3	0.3	88	66		
Germany	Deutsche Bank	0	0	0.1	0.0	85	92		
Germany	Landesbank Berlin Holding	0	0	0.0	0.0	84	84		
Poland	BANK BPH	0	0	0.4	-	82	-		
Germany	Bayerische Landesbank	0	0	-0.5	0.4	80	66		
Germany	Wüstenrot Bank	1	0	0.0	0.0	80	196		
France	La Banque Postale	0	0	0.3	0.3	80	79		
Germany	HASPA Finanzholding	0	0	0.1	0.2	79	79		
Luxembourg	Precision Capital S.A.	0	0	0.4	-	78	-		
UK	Lloyds Banking Group	0	0	0.2	0.6	77	63		
Germany	Landesbank Baden-Württemberg	0	0	0.2	0.2	77	73		

Sources: SNL Financial, EBA and ESRB Secretariat calculations.

Notes: The sample encompasses 123 EU significant institutions, as identified in the EBA stress test 2014. For NPLs, data were available for only 77 out of these 123 institutions, while for cost-to-income data were only available for 117 institutions. The bottom 15 according to the EBA stress test 2014 include institutions ranked 123 to 109 for CET 1-shortfall in the adverse scenario. For subsequent tables on NPLs and cost-to-income in 2014, overlap among categories was excluded.

While the risk-weighted capital ratio of EU banks has increased overall since 2008, the leverage ratio, computed in non-risk-weighted terms, has remained stable since 2015.

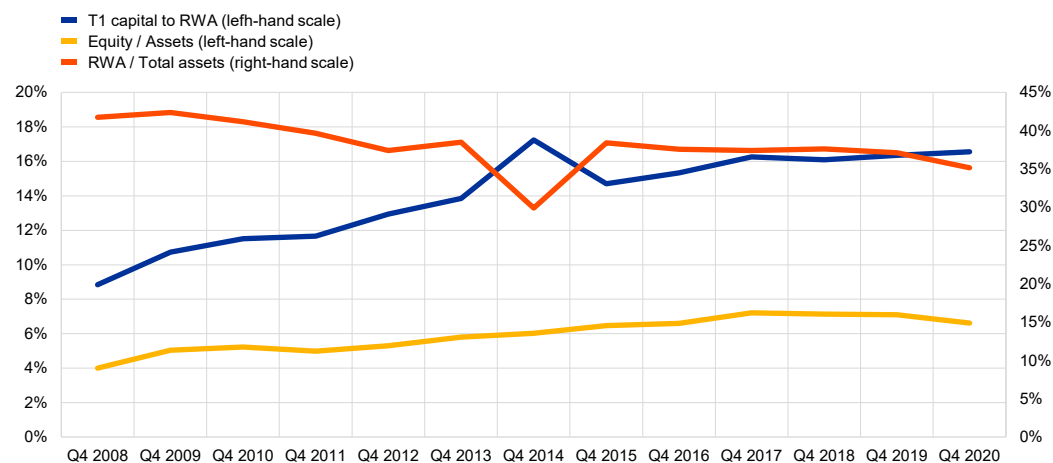
According to ECB consolidated banking data, risk-weighted capital ratios have been steadily increasing at the EU aggregate level since 2008 (Chart A5). The build-up of risk-weighted capital ratios in the EU banking system relates to both increasing capital (own funds) and declining total risk exposure amounts. However, the leverage ratio, which gives the level of capital (own funds) as a share of total non-risk-weighted assets, has increased from around 3% before the global financial crisis to around 6% at the end of 2014, displaying a certain stabilisation since then. For



comparison, the ratio for US banks has remained above 10% since the global financial crisis.⁴¹ The difference in capitalisation between European and US banks can be largely explained by lower risk weighting in the EU banking system⁴²: average risk weights were around 35% for EU banks but slightly above 55% for US banks at the end of 2020.⁴³

Chart A5
Capitalisation of EU banking sector

(percentages)



Source: ECB consolidated banking data.

Note: The average risk weights are approximated by dividing the risk exposure amounts by total assets. Data refer to domestic and stand-alone banks, regardless of the accounting framework applied.

An assessment by microprudential supervisors reveals that a substantial part of the banking sector under their jurisdiction operates with weak business models. According to the Supervisory Review and Evaluation Process (SREP) scores for business models by the ECB Banking Supervision (Chart A6), the number of banks receiving lower scores (3 and 4) has been relatively high and stable since 2016. While this also reflects the challenging macroeconomic environment for banks (European Systemic Risk Board (2016a and 2016b)), it can also be read as a reflection of unaddressed legacy issues from the last financial crises in the EU.

⁴¹ See Federal Reserve Bank of St. Louis ([link](#)).

⁴² Note that many countries with low risk weights have recently received a warning from the ESRB about the vulnerabilities in the residential real estate sector, which may suggest that the risk weighting there could be too low (European Systemic Risk Board (2016c, 2016d and 2019a)).

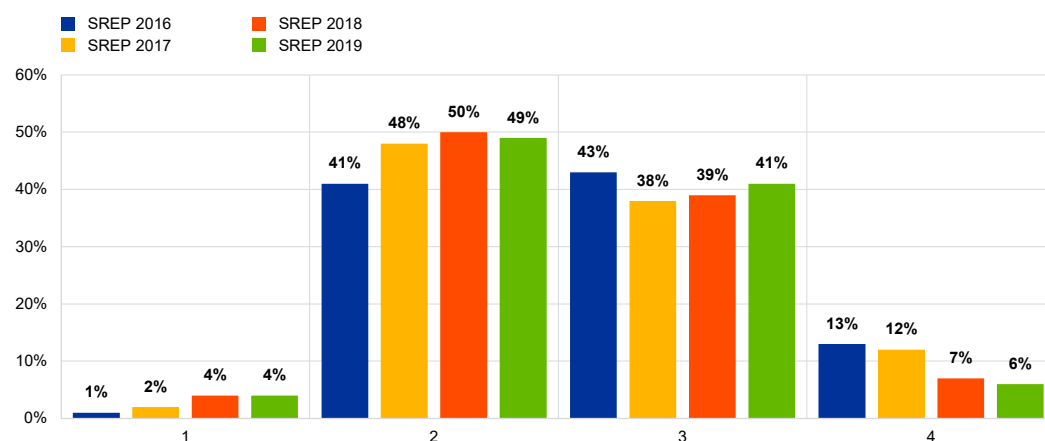
⁴³ See Federal Reserve Bank of New York, Quarterly Trends for Consolidated U.S. Banking Organizations ([link](#)).



Chart A6

Scores from the business model assessment within the SREP of ECB Banking Supervision for significant institutions

(SREP score, 1 is the highest score, 4 is the lowest score)



Source: ECB Banking Supervision.

Notes: The charts are from the 2017 and 2018 editions of the SSM SREP Methodology Booklets. The 2019 chart is produced using the SSM 2019 SREP results.

Financial market performance by EU banks has been relatively weak since the global financial crisis, falling behind banks in other advanced economies and likely reflecting concerns about future profitability.

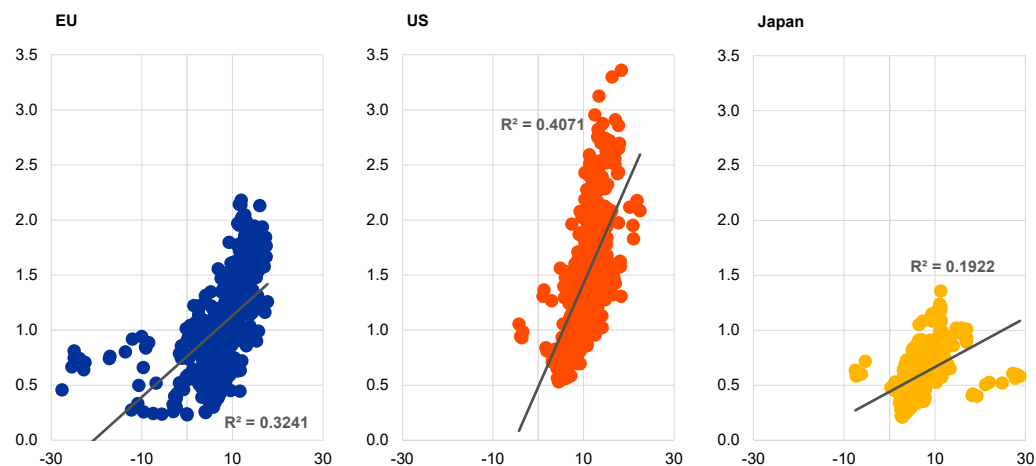
The observed low equity market pricing of the EU banking sector may be read as a signal of relatively little market confidence in its medium-term profitability prospects, which are linked both to the macroeconomic environment going forward and the existence of unaddressed vulnerabilities and inefficiencies. In an international comparison, the price-to-book ratios of EU banks are lower than those of US peers and slightly above those of Japanese banks (Chart A7). As shown by the scatter plots in Chart A7, heterogeneity within EU banks is also much larger than within the other two jurisdictions considered. Potential factors behind the low investor appetite for EU banks include a macroeconomic environment of low growth and low levels of interest rates, which have a negative effect on bank margins, hampering profitability over the long term (European Systemic Risk Board (2016a, 2016b and 2021b); Committee on the Global Financial System (2018)), in a situation where bank profitability has remained weak in the EU for several years. As noted by European Systemic Risk Board (2021b), “[...] as lending rates have continued to fall since 2016, the net interest margin has dropped further, with many market rates turning negative”.



Chart A7

Return on equity (x-axis) and price-to-book ratio (y-axis) of EU, US and Japanese banks

(price-to-book ratio: units, return on equity: percentages)



Sources: Bloomberg and ESRB Secretariat calculations.

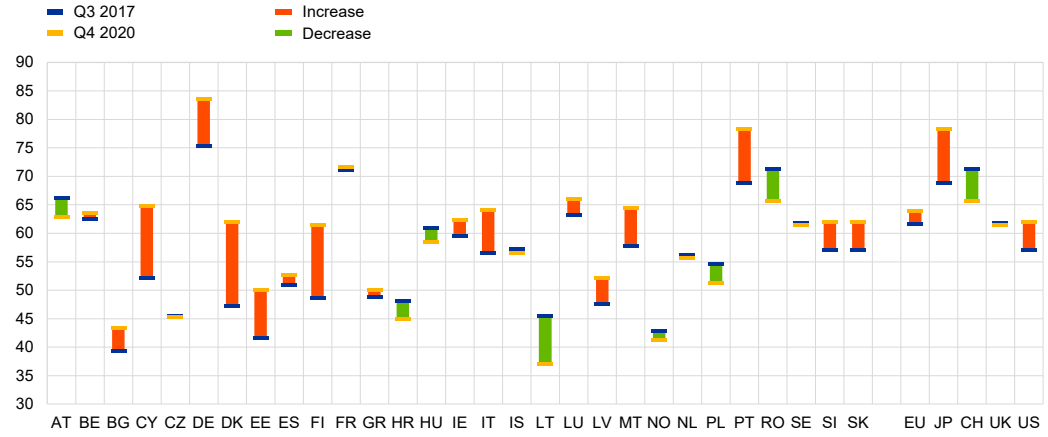
Notes: Based on a sample of the 20 largest banks by market capitalisation in each region. The quarterly observations cover the period from Q4 2013 to Q4 2019. Each circle represents the price-to-book ratio and the return of equity of a bank at the end of the quarter.

Evidence suggests that EU banks are lagging global peers in terms of effective provision of financial services to their customers. The structural low profitability of EU banks cannot be solely attributed to low interest rates, as they are also present in other advanced economies around the world. A distinguishing feature of several (large) EU banking systems is their heavy cost structure, with ratios of cost-to-income higher than in other EU and non-EU countries (Chart A8). Recent attention by the regulatory and supervisory community to cross-border consolidation in the EU is, at least partially, motivated by reaching for synergies and optimising the cost structure of EU banks (Enria (2019); European Banking Authority (2019c); European Central Bank Banking Supervision (2021b)).



Chart A8
Cost-to-income ratio in the EU and other advanced economies

(percentages)



Sources: EBA Key Risk Indicators, ECB consolidated banking data, Japanese Bankers Association, Haver Analytics, Federal Deposit Insurance Corporation, Swiss National Bank and ESRB calculations.

Notes: The left-hand chart shows the weighted average of the cost-to-income ratios for significant EU, CH, JP, CH and US banks. The first observation for IS is Q4 2017 and 2017 for CH and JP. The last observation for CH and JP is 2019. The red (green) bars denote an increase (decline) in the indicators over the corresponding period.



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For specific terminology please refer to the [ESRB glossary](#) (available in English only).

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