

Digital disruption in banking

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July 2019

Abstract

This paper surveys the technological disruption in banking examining its impact on competition and the potential to increase efficiency and customer welfare. It analyzes the possible strategies of the players involved, incumbents, FinTech and BigTech firms, as well as the role of regulation. The industry is facing a radical transformation and restructuring, as well as a move towards a customer-centric platform-based model. Competition will increase as new players enter the industry but the long run impact is more open. Regulation will influence decisively to what extent BigTech will enter the industry and who will be the dominant players. The challenge for regulators will be to keep a level playing field striking the right balance between fostering innovation and preserving financial stability. Consumer protection concerns raise to the forefront.

Keywords: FinTech, BigTech, digital currencies, blockchain, big data, bank strategy, competition, regulation, financial stability

* This paper is a revised version of a document prepared for the OECD Competition Committee FinTech roundtable of June 5, 2019. I am grateful to Ania Thiemann for very detailed comments, to Patrick Bolton and Antonio Capobianco for useful suggestions that improved the paper, and to Giorgia Trupia and Orestis Vravosinos for excellent research assistance.

1. Introduction

Since the 2007-2009 financial crisis the banking industry has been faced with low interest rates, deleveraging and/or low credit growth, increased regulation and compliance requirements, as well as damaged reputation. Along with the appearance of these threats major changes have taken place in the banking sector in recent years. A decade ago the ten largest banks by assets were based in Europe or the US, whereas currently the top ten is dominated by six Asia-based banks. The reason behind this shall not be traced only to the crisis and the rise of Asia; banks have had to deal with all the threats arising after the crisis as well as digital disruption stemming from increased competition in retail from FinTech (short for Financial Technology) and platform-based competitors. The profitability of the sector has been threatened with European and Japanese banks barely covering their cost of capital. A legitimate question is how the top ten list will look like in a decade. Let us note here that the capitalization of the large technological companies such as Amazon or Google is more than double the one of JP Morgan.

Banking is being transformed from being based in branches (i.e. brick and mortar) to using intensively information technology and big data, together with highly specialized human capital. Even before that, banks and markets have become intertwined, with a higher proportion of intermediary activities becoming market-based. Banks face increased competition from other intermediaries, increasingly digital, in their core business, such as payment and advisory services. A change in the use of technology in developing new services and business models has been unfolding with the rise of the FinTech sector, which can be understood as the use of innovative information and automation technology in financial services. The speed of adoption of the different new digital technologies and of the acquisition of users associated to them has accelerated markedly. Indeed, the major change now comes from the digital disruption of the sector that leaves incumbents with potentially obsolete legacy technologies (like the mainframe) and overextended branch networks to serve the new standards of service that new competitors can provide. Customers have a new service expectation in terms of friendliness of the interface and transparency. In Asia and Africa technological leapfrogging has extended banking services to previously unbanked segments of the population.

The impact of digital technology will be a game changer in terms of increasing competition and contestability of banking markets with potentially a large impact. Banking will move towards a customer-centric platform-based model and incumbents will have to restructure.¹

The digital disruption provides a great potential to improve efficiency with innovation, enhanced supply diversity, and a more competitive financial system that yields market extension augmenting financial inclusion. This disruption will put pressure on the margins of incumbents, enticing perhaps increased risk taking, and start a contest to capture the rents in the sector. For the efficiency potential to be realized, the restructuring of the incumbents must happen simultaneously with the entry of the new competitors, and new dominant positions should not become entrenched. The new entrants (FinTech and BigTech²) should gain market share because of efficiency gains instead of bypassing regulation or monopolizing the interface with customers. Furthermore, regulators must strive to detect new threats to financial stability from new forms of systemic risk derived.

The plan of the paper is as follows. Section 2 describes the technological disruption to banking/financial sector. Section 3 deals with the interaction between the new entrants and incumbents. Section 4 considers the impact of regulation and Section 5 the financial stability implications. Concluding remarks follow in Section 6 and open research issues in Section 7.

¹ Traditionally, banks have been focused in the provision on products while digital companies have moved the business model towards a more holistic approach solving the problems of clients and setting up new standards of service and customer experience. Customer-centric “is an approach to doing business that focuses on creating a positive experience for the customer by maximizing service and/or product offerings and building relationships” (<https://www.investopedia.com/terms/c/client-centric.asp>). See Vives (2016, 2019) for an overview of competition in banking with attention to recent developments.

² BigTech refers to large technology companies that expand towards the direct provision of financial services or products. Typically, they are platform-based such as Amazon, Google or Apple.

2. The technological disruption and efficiency

Banks perform several important functions in the economy. The core one is maturity transformation and liquidity provision, taking deposits short term and making loans long term. This function is accompanied by the monitoring of opaque loans that would have trouble being funded by the market. A second function is payment and transaction services. Both functions rely on information processing of both hard information, verifiable and codifiable, and soft information based on relationship banking. The digital revolution increases greatly the weight of codifiable information and the tools that are available to process it, artificial intelligence (AI) and machine learning (ML) using big data mostly. Therefore, the functions more exposed to information processing will be affected more, payment and transaction services being a good example.³

We look first at the supply and demand drivers of digital disruption and then at the impact of FinTech on efficiency.

2.1 Supply and demand drivers of digital disruption

Digital disruption in the financial sector is driven by factors both on the supply side, mostly technological developments, and on the demand side, with changes in consumer expectations of service.⁴ On the technological supply side, relevant factors are internet APIs⁵, cloud computing, smartphones, digital currencies, and blockchain technology.

APIs have allowed for service improvements especially offering increased immediacy in payments as well as provided support for greater unbundling of services. They have become the standard for data sharing in “open banking” applications.⁶ Those applications allow third party access to consumers’ bank data (with their consent) and are becoming a fundamental tool of digital disruption. They enable software applications

³ See Section 3.1 in Vives (2016) for an overview of banks’ functions.

⁴ See Carstens (2018) and FSB (2019).

⁵ Application programming interface (API) is a set of rules and specifications followed by software programs to communicate with each other and exchange data directly without the need for human inputs, and an interface between different software programs that facilitates their interaction.

⁶ Open banking yields a secure way to providers to collect financial information of customer accounts of a financial institution. In this way it enables third parties to provide services to the customer of a bank.

to share data and functionality and represent a remedy for markets with high switching costs, increasing contestability as they help consumers to compare product and service offers.⁷ Cloud computing refers to the practice of using a network of remote servers, typically accessed over the internet, for the provision of IT services, and for the storage and sharing of data. It has the advantage of flexibility in delivering services and cost effectiveness. It has been used for customer relationship management, human resources, and financial accounting and is under way for consumer payments, credit scoring, statements and billings. Both APIs and cloud computing, if not securely managed or properly monitored, can give rise to new risks endangering market structure stability. In this respect, the EU, the UK, Singapore, Japan and Hong Kong have been developing frameworks for the application of APIs.

Mobile devices have become a key aspect of consumers' daily lives in many jurisdictions by expanding the availability of financial services and becoming a platform for third-party developers. They capture the client interface with multiple functions including payments (wallet), money transfers and online shopping. Digital wallets are gaining ground as one of the fastest-growing technology markets. The integration is highly advanced in Asia, where payment apps are currently serving one billion users and are part of a bundle with e-commerce, chat, deliveries and food-ordering, and ride-hailing.⁸ Even though traditional or high-street banks, Visa and MasterCard are still the leaders of the market for transaction payments, nonbanks such as PayPal, Apple, or Google and new entrants such as Revolut, N26 or Transferwise are often behind payment innovations. For example, mobile-based payment schemes have a considerable effect in jurisdictions where the share of the population owning a current account is low. This is often the case in African countries, where only one quarter of the population has a bank account, but many more people have access to a mobile phone.⁹ New payment systems

⁷ See e.g. OECD (2018)

⁸ Examples are applications offered by firms such as Alibaba and Tencent in China (see the China box) and Grab in South-East Asia.

⁹ See The Economist (2015). For example, M-Pesa is a mobile-payment service based in Kenya, launched by telecoms companies Safaricom and Vodafone in 2007. M-Pesa offers common financing and microfinancing services such as deposits and bill payments, and in partnership with Kenyan banks interest-bearing accounts, loans, and insurance. It became popular for instant and cheap money transfers through air-time, that is pre-paid mobile-phone minutes that can serve as currency. Following the initial success in its home

as well as loans targeted to consumers with short credit history are often tested in such geographical areas. It is worth noting the technological leapfrogging that represents for people not having a bank account to be provided banking services through the mobile phone.

Traditional payment systems and banking may also be disrupted by digital currencies. Cash is being used less and less.¹⁰ The traditional functions of money are a medium of exchange, store of value, and unit of account. There are many examples already of digital currency such as Alipay and WeChat Pay in China or M-Pesa in Kenya, or the project of the Libra sponsored by Facebook, as well as cryptocurrencies and stablecoins.¹¹ There is no agreed definition of e-money but basically it is akin to bank money (e.g. deposit or debit card) but in principle without the backstop of the government.¹² (See the box below.)

country - three-quarters of Kenya's people are registered users – M-Pesa expanded in Tanzania, South Africa, Afghanistan, India, and Romania. (See Kenya FinAccess household survey (2019), by [Central Bank of Kenya](#), [Kenya National Bureau of Statistics](#) and [FSD Kenya](#) CGAP, “Infographic: Tanzania’s Mobile Money Revolution” (Washington, DC: Consultative Group to Assist the Poor, 2014): <https://www.cgap.org/research/infographic/tanzanias-mobile-money-revolution>.)

¹⁰ In the EU, as elsewhere, there is an increasing trend in contactless payments (see EBA 2019 and <https://www.ecb.europa.eu/pub/pdf/ecbu/eb201806.en.pdf?f0f55f1b4f767b3ac0030de809c181c3>).

¹¹ In cryptocurrency systems, encryption techniques control currency units' generation with the use of blockchain technology, typically of the permissionless type. This distributed ledger technology allows transfers of monetary amounts peer-to-peer with transactions authenticated by many computers (of users around the world) without the need for any intermediary. It is a collective bookkeeping system consisting of a continuously growing list of tamper-proof public transaction records. See Nakamoto (2008), Geneva Reports on the World Economy 21 (2018) and the collection of articles in Fatás (2019). The Libra is the coin proposed by Facebook and the Libra Association on June 18, 2019. The Libra would be denominated in a basket of currencies and backed by bank deposits and short-term government bonds. The Libra could be exchanged into domestic currencies according to the value of the basket of currencies.

¹² According to the ECB: “Electronic money (e-money) is broadly defined as an electronic store of monetary value on a technical device that may be widely used for making payments to entities other than the e-money issuer. The device acts as a prepaid bearer instrument which does not necessarily involve bank accounts in transactions.” The European Commission defines e-money as “a claim on the issuer which is issued on receipt of funds for the purpose of making payment transactions.” Adrian and Mancini-Griffoli (2019) define it as “electronically stored monetary value denominated in, and pegged to, a common unit of account such as the euro, dollar, or renminbi, or a basket thereof.” According to the EU Payment Services Directive II (2015), by becoming a Payment Services Provider or an Electronic Money Institution a firm can offer payment services; the counterpart in the US is a Money Services Business.

Digital currencies such as the Bitcoin have inherent drawbacks (such as the time and cost to perform transactions and regulatory uncertainty due to their capacity to help criminal activity and money laundering)¹³ that make them a speculative investment instead of a store of value and/or means to transact. However, blockchain technology could enhance the new entrants' disruptive effects, since FinTech and BigTech platforms can possibly better exploit the potential cost-saving innovations allowed by this technology. This technology provides means to achieve a decentralized consensus and potentially enlarges the space of potential contracts with "smart contracts" which can be enforced without the need of a third party.¹⁴ The disruptive impact is exacerbated by the fact that traditional banks have specialized in intermediation activities, the need for which is potentially reduced by the blockchain technology. Smart contracts can lower contracting and verification costs and reduce informational asymmetries. However, the information distribution they entail to achieve consensus may induce collusion.¹⁵

Digital currencies

Different means of payment can be classified according to Adrian and Mancini-Griffoli (2019) as being an *object* such as cash, central bank digital currency, or cryptocurrencies such as bitcoin or other digital coins, or a *claim* such as money issued by banks or other intermediaries issuing e-money (Alipay, WeChat Pay, M-Pesa or blockchain-based monies such as Paxos or USD Coin). Those claim-based monies can be distinguished in turn depending on whether their redemption is at fixed value (as bank money or e-money) or at variable value (e.g. the Libra which may have exchange rate risk when converted into domestic currency). Another important distinction is whether the redemption is guaranteed by the government (as bank money) or, in principle, not as

¹³ See Auer (2109) for a survey of the technical problems with the "proof-of-work" system in Bitcoin.

¹⁴ "Smart contracts are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code. The code and the agreements contained therein exist across a distributed, decentralized blockchain network. Smart contracts permit trusted transactions and agreements to be carried out among disparate, anonymous parties without the need for a central authority, legal system, or external enforcement mechanism. They render transactions traceable, transparent, and irreversible". (<https://www.investopedia.com/terms/s/smart-contracts.asp>)

¹⁵ See Cong and He (2019).

e-money, and whether settlement is centralized (as cash, bank or e-money), or decentralized (as cryptocurrencies).

A key issue is how stable are digital currencies. We have witnessed the wild fluctuations in the value of the Bitcoin. At the other extreme central bank digital money would be perfectly stable (in nominal terms). E-money is exposed to liquidity, default and market risk (including foreign exchange risk) which can be minimized by the issuers with prudential measures. Nowadays e-money issuers typically hold bank deposits not protected by deposit insurance because those deposits are wholesale. Despite those limitations e-money may gain ground, as it has done in China and Kenya, because of its convenience, low transaction costs (in particular for cross-border payments), complementarity with blockchain technology, and the power of network effects.

Digital currencies may pose a particular threat of disintermediation to the banking sector if retail deposits were to move to e-money providers in a substantial way. A key aspect then is whether e-money providers will have access to central bank reserves, deposit insurance and/or the Lender of Last resort (LOLR). Some central banks such as those in India, Hong Kong and Switzerland allow e-money providers to hold central bank reserves under some conditions and in China Alipay and WeChat have to hold the funds of the clients as reserves in the central bank (see Adrian and Mancini-Griffoli 2019). In the extreme of disintermediation, deposits would go to e-money providers that invest in very safe short-term assets and may have even access to central bank reserves, becoming narrow banks, and finance companies would give loans and finance themselves in the wholesale market. This disintermediation would represent a radical change ending the fractional system by unbundling the main banking functions as in the so-called "Chicago plan" that goes back to Fisher (1936). A cohabitation scenario of banks and e-money providers is more likely where e-money providers complement bank's offers, either because they cater to geographical and/or population segments not covered by banks or form partnerships with banks. An intermediate scenario would have cohabitation but with banks and e-money providers competing for funds and forcing banks to respond by improving terms and improving service to retain customers. For example, by making payments faster and cheaper or by offering higher interests on deposits.

To the above technological factors, we should add market structure and regulation considerations, to be discussed later, that may favor disruption such as concentration in banking product markets, and attenuated competition and uneven regulation.

Demand side drivers are linked to the enhanced consumer service expectations of the mobile generation. Increased customer expectations are driven by the digitization of commerce and real-time transacting capability of internet-connected devices offering higher convenience, speed, and user-friendliness of financial service that have been set by Uber and Amazon and the likes. Fintechs have taken advantage of unmet customer needs in payments and transfers (such as international remittances), credit, and investment advice. Demographic factors and the decline in the reputation of incumbents also play a role with young generations which are more likely to adopt FinTech products from digital banks.¹⁶ Furthermore, some consumers might perceive FinTech credit, and especially peer-to-peer (P2P) lending, as more socially responsible and of greater social value than conventional banking.¹⁷

The digital revolution has changed the demand for financial services and moved the sector to be customer-centered with an upgraded customer experience. On the supply side it has left incumbents with obsolete technologies, such as overreliance on rigid mainframes, and an overextended branch network when new generations want to bank with the mobile phone. The sector has overcapacity and, what may be worse, the wrong kind of capacity. The industry is facing a deep restructuring in a context of low interest rates and profitability (in particular in the eurozone and Japan).

FinTech innovations: P2P lending and robo-advising

P2P lending platforms, where individuals and companies invest in small businesses, make possible the provision of credit without bank intermediation. Those platforms

¹⁶ According to Raddon, 85% of millennials in the US (e.g. those born between 1981 and 1996) used mobile banking, and the prediction is that the share will be higher for the generation born after 1996. See The Economist (2019).

¹⁷ See for example EY (2017), IMF (2017), and FSB (2019).

match borrowers and lenders directly: some allow the lenders to choose the borrowers, while others form packages of loans, and online auctions are often used. It is frequently the case that these platforms provide risk rankings of the business to borrowers, obtained by algorithms using big data. P2P lending is prominent in China and growing fast in the United States (with LendingClub and Prosper as leaders, targeting both retail and institutional investors) and the UK (with Funding Circle as leader). Other leading European countries for P2P consumer lending are Germany, France, and Finland. The number of crowd-funding platforms (a version of P2P lending that allows projects to raise capital from a large pool of investors through an online platform) has increased significantly in EU countries, with France, the Netherlands, Italy, and Germany taking the lead, although in general the role of P2P lending is limited in the EU.

Another example of FinTech innovation is provided by “robo-advisors”. These are computer programs that generate investment advice according to information they have about customers. Using machine-learning tools, they are a cheap alternative to human wealth advisors. If programmed properly, they may contribute to the alleviation of the usual conflicts of interest widespread in the banking sector. Nevertheless, robo-advising is still very incipient and small in relation to overall financial advising; this is particularly true in Europe where assets under “robo-management” amount relatively to much less than those in the United States.

2.2 FinTech and efficiency

The use of new technology has important welfare implications potentially leading to lower financial intermediation costs in lending, payment systems, financial advising, and insurance, as well as providing improved products for consumers.¹⁸ Through online

¹⁸ See Philippon (2018), who emphasizes that the unit cost of financial intermediation has not gone down substantially despite technological progress, and Vives (2017).

origination technology fintechs provide more convenience to their borrowers. FinTech is a driver for efficiency in several aspects:

- i) FinTech can help screen more effectively candidate borrowers via statistical models based on big data, and in this way it can help overcome information asymmetries which are at the root of the banking business. Importantly, information may be a substitute for collateral and therefore FinTech-based entities may be able to provide loans to firms and households without posting collateral (real state often). Furthermore, FinTech entities may provide immediacy in the approval of loans as the Ant Financial MYbank 3-1-0 loan application app demonstrates.¹⁹
- ii) FinTech reduces the need for personnel (e.g. loan officers and tellers) and for an extended branch network (since customers use the mobile phone to bank).
- iii) It allows much more targeted price discrimination. For example, FinTech lenders employ interest rate-setting models for mortgages of superior performance compared to those used by non-FinTech institutions, since a larger part of the variation in prepayment outcomes across borrowers can be attributed to interest rates in the case of FinTech loans. Furthermore, the convenience of online origination allows fintechs to charge higher rates, especially to borrowers of low risk, who are more likely to be less price sensitive and more time-sensitive. Last, refinances of mortgages are 7% to 10% more likely to originate from fintechs compared to traditional banks.²⁰
- iv) Fintechs can increase financial inclusion by opening the door to financial services for less developed countries as well as parts of the population²¹ and

¹⁹ Launched in 2018, the 3-1-0 lending app enables borrowers to complete their online loan applications in 3 minutes, and obtain approval in 1 second with 0 human involvement. Under borrowers' authorization, MYbank analyzes real-time transactions to gain insights into their creditworthiness. By leveraging massive data of 16million SMEs in China in its portfolio, MYbank in its four years of operation had lent out around \$290 bn almost instantly at a stunning (so far) 1% default rate (see Jack's Ma \$290 bn loan machine is changing Chinese banking, Bloomberg News, July 28, 2019).

²⁰ See Buchak et al. (2018).

²¹ An example is provided by the service offered by International Smart Card (ISC) in Iraq, one of the most financially underserved regions of the Middle East, where according to the World Bank less than one-quarter of citizens held a bank account by 2017. ISC, partially owned by two public banks, started over as an electronic payments system but is gaining momentum for the electronic disbursements plan of

small and medium sized firms (SMEs) currently unserved or underserved by banks. In particular, many SMEs in developing markets typically will not fulfil the requirements for a loan application (e.g., they do not have their accounts audited).

- v) Finally, FinTech and BigTech firms have no legacy technologies to deal with and are characterized by a culture of efficient operational design. This along with their often-smaller size in the case of fintechs allows them higher innovating capacity than traditional entities.

Cloud-computing is another source of efficiency for new entrants. The adoption of cloud computing by financial incumbents has been slow compared to other sectors, which can be attributed to high transition costs, security concerns, and regulatory compliance complexities. An advantage emerges for both FinTech and BigTech companies, which can benefit from designing systems on the cloud from the beginning instead of having to work on top of legacy IT systems.

Fintechs have changed the structure, provision and consumption of financial services, but have not managed to acquire a dominant position in the market. For example, fintechs have not made important inroads yet in corporate lending to medium-large and large firms. Despite its continuous growth FinTech credit still represents a small share of total credit, even in China (with the greatest share of total credit activity) where it accounted for only 3% of total credit outstanding to the non-bank sector in 2017. FinTech credit tends to be more important in countries with higher income per capita, and a less competitive banking system. Total FinTech credit per capita is high in the UK, the US, Korea and China. In Korea and Argentina, bigtechs provide a majority of the FinTech credit.²²

Although starting with the aim to replace traditional banks in their position as leaders in the market, many fintechs have settled to forming partnerships with incumbents when faced with difficulties in increasing scale and customer numbers. Even though they have successfully led innovation efforts and moved customer expectations to higher levels via innovations like rapid loan adjudication, customer willingness to

government salaries and benefits through a debit card to some 7m Iraqi. (Iraq's financial inclusion drive boosted by homegrown FinTech, Financial Times, April 24, 2019.)

²² See Claessens et al. (2018) and Frost et al. (2019).

switch away from incumbents has not met expectations, as switching costs and consumer inertia are high and incumbents have been adapting to fintechs' innovations.²³

An exception holds for geographical locations where incumbent service providers were absent and with market segments where customer needs were not met; in these cases new entrants have managed to attain significant scale. China (see box) and Kenya are good examples.²⁴ Another limitation fintechs have been faced with is building new infrastructure and introducing new financial services ecosystems. They have rather built upon traditional ecosystems and infrastructure. Although fintechs have not managed to change the competitive landscape, they have made some first steps future disruption. The accelerating pace of innovation implies that the agility of the business model and the capability of fast formation of partnerships, which traditional banks are weak in, are key to a financial institution's success.

The UK, the US, Singapore, Germany, Australia and Hong Kong are the leading FinTech hubs based on talent, access to funding, government policies and demand for FinTech services.²⁵ The FinTech and BigTech impact has been more pronounced in China whose case is worth examining. Indeed, the Chinese BigTech giants (Alibaba, Baidu and Tencent) are active in financial services provision (see the China box).

Overall, fundamental advantages of FinTech are the operation of leaner businesses, benefiting from state-of-the-art technologies with no rigid legacy systems that allow a fast and flexible response to changing consumer preferences. FinTech is flexible enough to be able to work with legacy technologies. It allows the provision of a satisfactory mobile and digitally focused customer experience focusing on the banking activities with higher ROEs such as payments, advice, and distribution of financial products. At the same time FinTech possess a regulatory advantage given that they are funded with much more equity than traditional banks. Last, but not least, FinTech companies are able to attract

²³ See WEF (2017). An example of incumbent adaptation is Bizum, a mobile payments joint venture of most Spanish bank institutions (with some exceptions such as ING). It allows to send and receive funds in real time for individuals so far. It connects customers' current bank accounts by linking them to their mobile phone number without the use of the IBAN code being necessary.

²⁴ Other areas where expansion is significant is Southeast Asia and Latin America.

²⁵ See EY (2016).

talent from bright and mainly young people in relation to incumbents.²⁶ On the other hand, the absence of an installed, loyal customer base, limited access to soft information about potential customers, the lack of reputation and brand recognition as incumbents have, and a relatively high cost of capital are challenges they will try to overcome. Table 1 displays a comparison of the advantages and disadvantages of FinTech.

Table 1. FinTech advantages and disadvantages

Advantage	Disadvantage
Superior technology free of legacy systems; leaner operation	Absence of an installed, loyal customer base
Friendly consumer interface and new standard of consumer experience	Limited access to soft information
Focus on activities/business segments with higher ROEs	Lack of reputation and brand recognition
More equity funding	High cost of capital
Able to attract best talent	Lack of regulatory and risk management experience and expertise. No access to the central bank backstop without a banking license

BigTech platforms have most of the advantages of fintechs with practically none of the drawbacks. They have an established loyal customer base and large amounts of customer data, high reputation and lobbying capacity, strong brand name, can exploit network effects, and can fund their activities with a low cost of capital. Bigtechs have in particular access to valuable business data and can benefit of their scale to provide financial services at lower costs in large volumes. Bigtechs with a focus on internet search

²⁶ See <https://www.economist.com/special-report/2017/05/04/banks-are-finding-it-harder-to-attract-young-recruits>

(e.g. Google) gather information about customers from search activity; those with focus on social media (e.g. Facebook) have direct personal data on users and their connections; those with focus on e-commerce (e.g. Amazon) have data on both sellers and buyers and their habits. The complementarities of BigTech business with financial services will depend on the type of data gathered: for social media/search companies, data will be good for distributing and pricing financial services while for e-commerce platforms data will be good for credit assessment.²⁷

Bigtechs have already a captive ecosystem with high switching costs for customers and can exploit economies of scope and efficient technologies to provide financial services. Therefore, BigTech companies are potentially much more disruptive for the traditional banking business burdened by legacy systems. In contrast to incumbents that face stricter regulatory limits on activities and user data, bigtechs can exploit the information collected in their platforms by non-financial activities to design new services in banking. BigTech platforms have penetrated more less developed banking markets (in particular ones with high mobile penetration) with payments services²⁸ and money market mutual funds (such as Yu'eobao for users of Alipay in China) and insurance offerings. With regard to lending, bigtechs tend to lend more in countries with a less competitive banking sector and less strict regulation. Furthermore, evidence from Mercado Libre in Argentina shows that BigTech lenders may have better predictive power of loan repayment prospects using big data ML and AI techniques (e.g., on platform transactions and reputation of sellers) than usual methods using credit bureau information.²⁹

However, both fintechs and bigtechs still miss the large experience and expertise in risk management that represent one of the strengths of large banks. Indeed, incumbents already provide a large number of financial products, some of them quite complex, and

²⁷ Freedman, S. and Jin, G. Z. (2017) show, for example, that data from social media need not replace the information contained in credit scores.

²⁸ In developed banking markets, Apple Pay, Google Pay or PayPal rely on third-party infrastructures (e.g. retail payment systems or credit cards) while Alipay or M-Pesa rely on proprietary systems in less developed ones.

²⁹ See Frost et al. (2019). As pointed out by the authors, however, this does not mean that this superior performance can be generalized considering the soft information that banks use and contemplating full business cycles.

have access to cheaper funding due to their banking charter. Furthermore, they have information capital accumulated with a long history of relationship banking and a reputation for preserving the privacy of data of customers.

The case of China

China serves as a primary example of the large effect FinTech and BigTech firms can have on the banking sector. Its mobile-based connectivity ecosystem along with the scarcity of consumer-targeted bank offerings and the innovation-friendly regulatory framework have allowed large tech companies to seize large market shares. P2P lending and mobile payments are well developed in China.

Bigtechs' activities in finance are prevalent in China, especially in mobile payments for consumption, which have been increasingly popular constituting 16% of the country's GDP. (Comparing with less than 1% of GDP in the US and the UK.) China's most prominent online commerce company, Alibaba -taking advantage of the not so developed payments system- in 2003 and 2004 introduced Alipay (later renamed Ant Financial) as a third-party online payment platform. Alipay has been instrumental in Alibaba's success. It now offers payments, wealth management, lending, insurance, and credit scoring services counting more than 520 million users and managing money at the same level as China's big four traditional lenders. The platform has managed to cover more than 50% of the \$5.5 trillion Chinese mobile payments sector with tech giant Tencent (which owns the dominant messaging and social network app WeChat) as its only major competitor and the two firms accounting for 94% of the market. WeChat is also used to make payments both online and in physical stores (often being the only form of payment to be offered) and to settle utility bills. The total value of e-money transactions in China go above those of the combined network of Visa and Mastercard worldwide.

The online money market fund (MMF) Yu'e Bao of Ant Financial commanded US\$ 200bn assets in September 2018, the largest MMF in the world. Ant Financial is also a key provider of insurance services holding a majority stake in Cathay Insurance China and a founding stake in ZhongAn insurance, China's first online-only insurance firm with 535

million insured customers. At the same time, China is the largest market for FinTech credit with 2,525 FinTech credit platforms by the end of June 2017 and FinTech credit volumes steadily growing with cumulative lending having reached RMB 1.359 trillion (\$215 billion) in the first half of 2017. The search engine Baidu has also moved into banking and financial services.

Overall, smart phones have evolved into a major platform for the provision of alternate services in China. Single platforms integrate online shopping, as well as mobile phone wallet and money transfer capabilities.

(See WEF 2017, Carstens 2018 and FSB 2019.)

The impact of both types of non-banks is expected to be significant in payment solutions and in the provision of advisory services in capital markets, as well as in reshaping consumer expectations. In other retail banking markets, in particular in the origination and distribution of consumer and SME lending, the effect is less clear cut. Digital technology transforms in general processing (back office), customer management and data analytics.

There is no doubt that FinTech will increase the contestability of banking markets and increase competition in the short term. The question is whether the entry of BigTech platforms will entrench large players with dominant positions and whether it may raise systemic risk concerns.

3. New entrants and incumbents: competition or cooperation?

FinTech competitors are encroaching on the traditional business of banks, despite the efforts of the latter to adapt to the digital world. On the supply side, new competitors are able to use hard (codifiable) information to erode the relationship between bank and customer, which is commonly based on soft information (derived from the knowledge

gained from the relationship between bank and customer). That is, technologically able entrants are able to process large amounts of data of consumers (e.g. with machine learning techniques) and use it while incumbents were using this data, if at all, with personal contact and interpretation. However, so far quite a few new competitors stay clear of asking for a banking license in order to avoid compliance costs while they try to skim profitable business from banks and profit from regulatory arbitrage.³⁰ On the demand side, new entrants try to profit from the mistrust towards banks of millennials by offering digital services with which the younger generation is comfortable with.³¹

While banks have traditionally focused on the product, new entrants place the emphasis on the customer putting pressure on the traditional business model of the incumbents. Entrants have to focus on the customer because this is the very essence of their business while incumbents come from a tradition where the customer was already with the bank and was sold products. Indeed, a competitive advantage of retail banks, which may be eroded by the new entrants, is that banks enjoy privileged access to a stable customer base that can be sold a range of products. The presence of deposit insurance may facilitate the entry of new competitors as digital banks, but in this case the entrants will have to pay the costs of bank compliance which, together with banking licenses, weigh heavily on smaller firms.

It is interesting to note that in the US mortgage market, banks have a somewhat lower shadow cost of funding and provide higher quality products than shadow banks but still have lost market share because of their increased regulatory requirements.³² FinTech outlets have profited from the situation at the same time that they relied on both explicit and implicit government guarantees (in this case mortgage loans) since they have been able to unload their risk in government sponsored enterprises (GSE), as we will discuss in Section 5.

³⁰ See EBA survey (2019).

³¹ See e.g. WEF (2017).

³² See Buchak et al. (2018). Shadow banks are financial institutions outside the regulatory perimeter of depository entities. Fintechs are shadow banks unless they have applied for a banking license as N26 in 2016 or a specialized license for Revolut in 2018 (with no investment services offer) for example.

The bottom line is that new entry in the intermediation business will depend very much on how regulation and government guarantees are applied. The UK has built an environment to facilitate the entry of fintechs and mobile-only “neobanks” such as Monzo, Revolut or Starling (with a single regulator, the Financial Conduct Authority, FCA, with a sandbox³³ and open banking) while in the US there are many more barriers (fragmented regulators and rules that imply the need to have presence in branches). Furthermore, strict regulations for banks (enhanced capital requirements, for example) move activity to the shadow bank sector and an increasing proportion of non-banks are digital.

A crucial question is whether and to what degree the emergence of new nonbank competitors will intensify competition in retail banking. First, the lighter regulation of fintechs will play a central role in the competition between banks and new entrants. Second, exogenous and endogenous frictions and switching costs affect online banking. For instance, institutions may respond to enhanced Internet search facilities with obfuscation strategies increasing frictions in order to restore margins.³⁴ The result of such strategies can be loss-leader and bait-and-switch tactics. For example, online financial providers may try to attract customers offering very low mortgage rates but with hidden restrictive additional conditions with the aim of persuading them to pay a higher rate with more lenient conditions.³⁵ In general, the enhanced price transparency which is made possible by the Internet can have unclear dynamic pricing effects as has often been seen in the analysis of transparency.³⁶

³³ “A regulatory sandbox is a ‘safe space’ in which businesses can test innovative products, services, business models and delivery mechanisms without immediately incurring all the normal regulatory consequences of engaging in the activity in question.” (UK Financial Conduct Authority, 2015).

³⁴ See Ellison and Ellison (2009).

³⁵ Sometimes these practices have had the aim to exploit behavioral biases of consumers who may be overoptimistic or pay little attention to contracts offering, for example, attractive initial conditions like teaser rates for credit card borrowing. Consumers then may sign a contract with an overvalued perception. See Section 4.3.2 in Vives (2016).

³⁶ Transparency from the point of view of the consumer tends to be procompetitive, but dynamic effects are ambiguous. While it is more tempting to undercut a collusive agreement when there is more consumer transparency (because it increases the effective demand elasticity of the bank), more severe punishments for the deviants are possible also. Transparency from the point of view of banks is always good for collusion because it facilitates to detect price cuts. See Schultz (2005) and Chapter 4 in Vives (2016).

The strategies for new entrants and those of incumbent banks will depend on whether investment makes a firm tough or soft in the competition and on whether competition in the market place involves strategic substitutes or complements; that is, whether an increase in the action of a rival (for example price) leads to a decrease or increase, respectively, in the action of the firm. Thus, depending on the underlying industry characteristics an incumbent may decide to accommodate or prevent entry.³⁷ Accommodation may be accomplished for an entrant with non-aggressive strategies such as a commitment to remain small or form a partnership with the incumbent. For an incumbent the best commitment not to be aggressive may be to have a large installed customer base. In other cases incumbents may try to prevent entry by shutting out entrants from infrastructure. For instance, should new entrants need to rely on the payment infrastructure of the incumbent banks to offer services, the latter may choose not to offer access to their infrastructure.³⁸ Another way for traditional banks to prevent entry is to degrade the interconnection of the candidate entrants' with their infrastructure, thus raising the costs for entrants.³⁹ The latter strategy is analogous to what has been observed in the case of ATM networks, where large banks have chosen to limit compatibility.

The incumbents may also use bundling and tying strategies to respond to entry. A stylized representation has an incumbent present in adjacent market segments, holding substantial market power in segment A (e.g. personal accounts and mortgages) and facing competition in B (e.g. insurance products and credit cards).⁴⁰ The bank may either integrate those activities or try to leverage its market power in segment A by tying product B. This strategy is not effective when the goods are independent and B is produced competitively at constant returns to scale, which is the classical Chicago School

³⁷ See Fudenberg and Tirole (1984) and Section 7.4 in Vives (1999).

³⁸ In relation to this issue, the Payment System Regulator in the UK, a subsidiary of the Financial Conduct Authority, may impose requirements regarding system rules and require operators to provide direct access to payment systems. An example of attempted foreclosure of entrants is the case brought by Brazil's competition authority (CADE) against Bradesco for restricting the financial management app GuiaBolso from accessing its customers' data. GuiaBolso allows the banks customers to compare credit offers from several financial institutions. (Matt Richards, Brazil launches another FinTech probe, *Global Competition Review*, May 1, 2019.)

³⁹ See Salop and Scheffman (1987) and Economides (1998).

⁴⁰ See Rey and Tirole (2007) for the general framework.

doctrine. Tying may serve as a deterrence strategy or as an accommodating strategy. As a deterrence strategy, it increases the aggressiveness of the incumbent and requires the entrant to succeed in both markets. Tying can be effective in foreclosing entry when it is irreversible and the degree of complementarity between A and B is not too high and when there are cost links between markets, or when entry in B is uncertain since then tying makes entry more costly and uncertain given that the entrant has to succeed in both complementary markets.⁴¹ As an accommodating strategy, it may serve as a price discrimination device among heterogeneous customers. Most often, tying by the incumbent will decrease innovation incentives of the rival but increase those of the incumbent. As stated, innovations in payments systems are primarily generated by new entrants.

In summary, the incumbents may partner with the new entrants, buy them up partially or totally, or decide to fight them. The details of each segment of the market will matter for the decision and so will do the extent of legacy technologies in each institution. Indeed, the response of institutions is likely to be heterogeneous according to their specificity. The new entrants may decide to enter at a small scale and grow from there or may attempt, the Internet giants in particular, large-scale entry by controlling the interface with customers. Indeed, BigTech may leverage its dominance in certain segments such as search or online retail by tying financial services to its core offer. In any case, banking is moving from being relationship-based where soft information is crucial, to market-based and data-driven, where hard information predominates.

3.1 Strategies of players: incumbents and fintechs

Incumbents may accommodate entry in some market segments and try to prevent it in others. In the presence of high switching costs for customers, an incumbent bank will behave as a peaceful “fat-cat” to protect the profitability of its large customer base. This may allow an entrant to enter and attract, for example, technology-savvy customers or even unbanked consumers. Banks may prefer accommodation of entry because they gain interchange fees paid to them by new service operators and because the cut in revenues to banks for each purchase may be more than compensated by the increase in aggregate

⁴¹ See, respectively, Whinston (1990), Carlton and Waldman (2002), and Choi and Stefanidis (2001).

transactions performed by customers.

On occasion, the entrant may want to commit to remain small so as not to elicit an aggressive response from the incumbent.⁴² For instance, P2P lending is a way to perform a small-scale entry if it mostly caters to unbanked segments of the population. Partnerships between entrant and incumbent may be formed because incumbents benefit from IT knowledge, as well as regulatory arbitrage by having a partnership with new entrants, as the latter experience lighter regulation, or reach new customers.⁴³ At the same time, fintechs may benefit from established brand, economies of scale and distribution channels of incumbents, as is the case with ING and Scalable in Germany. For another example, TransferWise, a retail foreign exchange platform offering an alternative to high bank transaction fees, has recently begun operating with banks, such as N26 in Germany, Starling in the United Kingdom and LHV in Estonia, in order to expand its customer base. However, the case of new (licensed) banks' entry may be less likely given the high compliance costs involved.⁴⁴ Obviously, established banks may also launch their own fully online banks.⁴⁵ Table 2 displays a comparison of the potential strategies of incumbents and fintechs.

⁴² This is the concept of judo economics developed by Gelman and Salop (1983) and corresponds to the "puppy dog ploy" in the terminology of Fudenberg and Tirole (1984).

⁴³ Examples are LevelUp, Simple, and Lending Club. LevelUp, launched in 2001 in Boston, established a partnership with Bank of America to allow payments at the point-of-sales with a mobile phone. There are no interchange fees and LevelUp receives income when consumers see ads on the phone. Simple is a US non-bank entity offering online deposit services without physical branches. It used to function splitting interchange fees and interest collected with Bankcorp in exchange for deposit facilities. It was acquired by BBVA in 2014. Lending Club has collaborated with Citigroup in loan-financing.

⁴⁴ An early example of new entrant profiting of online banking was ING in the 1990s. An example of a new entrant in the UK using branches and outsourcing the IT platform to reduce costs is METRO Bank, but it has had trouble expanding and becoming profitable.

⁴⁵ Examples are Open Bank in Spain, owned by Santander, or Boursorama in France, owned by Société Générale.

Table 2. Strategies: incumbents and fintechs

Incumbents' strategies (Discriminate by segment)	Fintechs' strategies
Accommodate ('fat-cat') <ul style="list-style-type: none"> • In the presence of high switching costs • To gain interchange fees paid to them by new service operators 	Commit to remain small ('puppy-dog ploy') <ul style="list-style-type: none"> • No banking license • E.g. with P2P lending that serves unbanked segments of population → Form partnership
Fight, prevent entry ('top dog') <ul style="list-style-type: none"> • Shutdown/degrade access to infrastructure 	Entry as a (licensed) digital bank <ul style="list-style-type: none"> • Less likely given the high compliance costs involved. → Consolidate or sell to incumbents
Launch their own fully online banks	

In any case the strategies of both incumbents and entrants will be conditioned by regulation. In the UK the FCA has facilitated entry while in Singapore the government has pushed incumbents to upgrade digitally.⁴⁶

3.2 Strategies of players: incumbents and BigTech platforms

BigTech platforms' primary business is technology and data and, contrary to small fintechs, they also have important scale and scope economies, large installed customer bases, established reputation and brands, deep pockets from retained earnings and unfettered access to capital markets. Thus, they can compete head-to-head with incumbent banks in principle either by becoming banks (intermediaries) and exploiting economies of scope bundling their existing offerings with traditional banking products

⁴⁶ The largest Singapore bank, DBS, has moved more than 80% of his computer capacity from the mainframe onto the cloud while fintechs in Singapore have moved from serving consumers to providing digital services to banks. See The Economist (2019).

and profiting from economies of scope, or as multi-sided platforms (marketplaces) focusing on the most profitable banking activities.⁴⁷

Bigtechs may become banks and leverage superior information about consumer preferences, habits and conduct, they can control the shopping experiences of many consumers and recently the distribution and commercialization of many suppliers. Not only do they have these superior big data but they also have an advantage over the tools (e.g. AI algorithms) to analyze them for understanding customers' needs and influencing them. Bigtechs may also be able to offer new services by bundling their existing services (such as e-commerce and online advertising) with traditional banking products. The provision of small loans would be a first way to go for giant e-commerce platforms (as Ant Financial and JD.com in China) that hold masses of accurate data on spending habits of their customers. Combined with strong financial positions and access to low-cost capital, BigTech firms could achieve scale and scope in financial services very quickly especially in market segments where network effects are present, such as in payments and settlements, lending, and insurance. However, BigTech platforms may opt not to accept deposits as this would constrain their innovation capability by imposing the same regulatory obligations that the incumbents have to fulfill. Furthermore, by trying to establish banks they may run afoul of the separation rules between banking and commerce and industry in several jurisdictions.

Acting as market places, platforms (either FinTech or BigTech) will offer the ability to deal with different financial institutions. Platform delivery of financial products may well become the dominant distribution model. As multi-sided platforms, bigtechs can target the most profitable business segments of incumbents. For example, according to a McKinsey report, they could claim a share of the banks' distribution business (which generates 47% of their revenues and 65% of their profits, with ROEs of up to 20% compared to average ROE which may be below 10%).⁴⁸

⁴⁷ See WEF (2017) and de la Mano and Padilla (2018).

⁴⁸ As cited by de la Mano and Padilla (2018). Bigtechs are already encroaching on the banking business: Amazon provides lending and factoring services for SMEs, and Rakuten issues credit cards and offers brokerage and mortgages. Amazon profits from the vast information it has on its sellers and this allows cherry-picking the best borrowers.

Bigtechs can use a “platform envelopment” strategy to exclude other intermediaries using their data superiority (since they have complementary sources of data about customers from other lines of business). This strategy is a version of the “embrace and extend” strategy initially used by Microsoft to control the web browser business by doing what the rival (Netscape) can do and more. The strategy is more likely to succeed when the users of the platform have a large overlap with the intermediary that wants to be excluded and when economies of scope are high. Note that consumers served by a specific platform, for example Android or iOS, are likely to use this platform for many of their banking needs. This means that the platform will be the gatekeeper of a fraction of customers and that banks will have to be present in the different competing platforms/ecosystems.⁴⁹ Furthermore, BigTech platforms may cross-subsidize financial and non-financial products and obtain a competitive advantage.

The source of market power of BigTech platforms is a feedback loop which generates vast amounts of customer data with the activity of the platform, process the data with artificial intelligence and machine learning techniques, exploits network externalities, and generates in turn more activity and more data (with dynamic economies of scale since more data leads to better algorithms and prediction capacity).⁵⁰ This feedback loop consolidates an ecosystem with high endogenous switching costs for customers to change platforms. Financial services may complement and reinforce the platform business model. A first natural step in this direction is the offer of payment services. This would come in the mature phase of the development of the BigTech business. Table 3 displays the potential strategies of incumbents and bigtechs.

⁴⁹ According to Eisenman et al. (2011) “*Through envelopment, a provider in one platform market can enter another platform market, and combine its own functionality with that of the target in a multi-platform bundle that leverages shared user relationships. Envelopers capture market share by foreclosing an incumbent’s access to users; in doing so, they harness the network effects that previously had protected the incumbent*”. See de la Mano and Padilla (2018) for a forceful argument on how BigTech may change radically the banking industry.

⁵⁰ See Brynsjolfsson and McElheran (2016) for the importance of scale in scope in data-driven decision making. In the digital environment, entrants that are more efficient at processing information will grow faster than incumbents since they have incentives to produce more data for which they are better processors (Farbodi et al. 2019). Bajari et al. (2019) study how bid data helps in forecasting retail demand at Amazon.

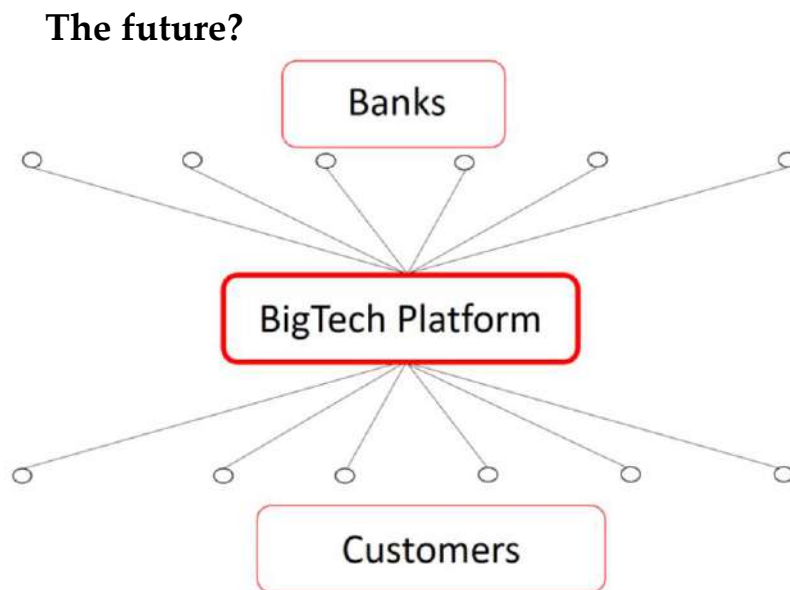
Table 3. Strategies: incumbents and bigtechs

Incumbents	Bigtechs
<p>Accommodate</p> <ul style="list-style-type: none"> • Cooperate with partnerships • Provide specialized unique banking products and services 	<p>Accommodate</p> <ul style="list-style-type: none"> • Partnerships
<p>Fight/Compete head-to-head by becoming platform/marketplace</p> <ul style="list-style-type: none"> • Profit from superior trust (?) from customers and data security • Better regulatory navigation skills and similar lobby power than BigTech • Cannot match bigtechs' bundling/cross-subsidization strategy with complementary financial and non-financial products (despite enjoying some network effects) 	<p>Compete head-to-head</p> <ul style="list-style-type: none"> • Become banks/intermediaries bundling their offerings and exploiting economies of scope <ul style="list-style-type: none"> • Opt not to accept deposits to avoid regulation • Multi-sided platform (marketplace) <ul style="list-style-type: none"> • Platform envelopment • Gatekeeper: Monopolize interface with customers

BigTech platforms, when dominant, have discriminated successfully in favor of their own upstream or downstream affiliates in their central platform (as claimed by the European Commission, in a string of three antitrust cases against Google in the EU, because of its use of dominance in search to favor its own vertical business in two instances and in another instance because of trying to protect the dominance of its search engine by leveraging its dominance in operating systems with Android).⁵¹ It is not

⁵¹ All cases involved large fines. In 2017 Google was accused and fined €2.42 bn by the EC of anticompetitive behavior using its online search engine to give an illegal advantage to its own online shopping service while demoting those of competitors. In 2018, a record fine of €4.3 bn was imposed because Google forced with contracts manufacturers of Android devices and mobile network operators to pre-install the Google search engine as a condition of using Google Play, the smartphone store app. In 2019 the EC reported that Google had imposed a number of restrictive clauses in contracts with third-party websites across the European Economic Area between 2006 and 2016 and fined the company for 1.49 bn. Its misconduct was

farfetched to think then that through technology and their extended customer bases bigtechs could monopolize the interface with customers controlling loan origination and the distribution business with the incumbents taking deposits and investing in products distributed by bigtechs (see a schematic representation in the figure).⁵² A related prospect is that through the exploitation of network effects and the benefits of access to massive amounts of data of a first mover unregulated e-money provider could monopolize digital payments by denying or making difficult interoperability with other e-money providers.⁵³



Hence, BigTech firms are likely to lead to increased competition but in the long run this effect could be overturned if they dominate the customer interface. In markets with network externalities once a critical market share, a tipping point, has been attained by

based on blocking rival online advertisers by using again its dominance in search through Google's AdSense business. The result was also to favor the vertical business of the company versus the competitors'. (European Commission. Case AT.39740, Google Search (Shopping). http://ec.europa.eu/competition/antitrust/cases/dec_docs/39740/39740_14996_3.pdf; European Commission. Case AT.40099, Google Android. http://europa.eu/rapid/press-release_IP-18-4581_en.htm; European Commission. Case AT.40411, Google Search (AdSense). http://europa.eu/rapid/press-release_IP-19-1770_en.htm)

⁵² This is the thesis defended by de la Mano and Padilla (2018).

⁵³ See Adrian and Mancini-Griffoli (2019).

an operator this firm may gain dominance.⁵⁴ History has shown that when bigtechs enter industries with long vertical value chains, using their comparative advantage they can monopolize the segments where they operate and then expand their monopoly power to other layers of business through network effects as the saga of abuse of dominance antitrust cases brought by competition authorities (mostly in the EU but also the US) against Microsoft, Google and Apple makes clear. A greater market share of BigTech may be associated with unchanged or higher concentration, along with a change in composition away from traditional players. A striking example is the mobile payments market in China, where two firms account for about 94% of the overall market.

On the side of the incumbents' strategies there are a couple of possibilities. Matching the bigtechs' bundling strategy is not one of them. This is so since it is very difficult to dispute the dominant positions of bigtechs in non-financial products and services that can be bundled with banking products and services. The alternative strategy is to cooperate with other third parties. Banks would have to transform their proprietary business into an open platform, shared with other banks and financial intermediaries, to benefit from the co-investments of all platform participants. Platforms may steer business away from some sellers (e.g. banks) to favor others who are either part of the same business group or may pay for prominence. As they cannot directly imitate the bundling strategy of bigtechs, they may develop into open platforms also offering products of rivals. They may choose to compete head-to-head with bigtechs (since they enjoy some limited network effects) or cooperate with partnerships. In the latter case the question of who will control the interface with customers is crucial; if it is bigtechs, then banks will experience reduced profit margins with their businesses commoditized and they may opt to specialize to specific customer groups. Partnerships may be formed as has been the case with Amazon and JP Chase or the newly announced one of Apple and Goldman Sachs in the offering of credit cards, or Amazon and Bank of America in loan provision.

⁵⁴ Bigtechs start by attracting a critical mass of users to the platform usually with no charges for customers, add functionalities to enhance the experience of the users and create an ecosystem in order to increase the costs of switching to other platforms. In the growth phase they exploit economies of scale and network externalities to reach the tipping point. In the mature phase they exploit economies of scope across products and services and make heavy use of big data analytics.

Indeed, there are scenarios where there may be no other viable option for traditional banks but to cooperate with BigTech platforms.

In any event, incumbents will have to restructure and the current overcapacity together with the need to invest heavily in information technology in a low profitability environment will lead to consolidation. Small banks may be able to survive provided that they are able to outsource their IT needs using cloud services for example. Incumbents may benefit from superior data security and better skills in navigating the regulatory maze.

3.3. Summary

There is no doubt that a first impact of the digital disruption will be to erode the margins of incumbents and increase competitive pressure and contestability of banking markets. The long run impact is not so clear cut although in a central scenario competition will also increase. The long run impact will depend on the extent of the entry of BigTech and on whether a few bigtechs (perhaps including some platform-transformed incumbents) manage to monopolize the interface with customers and appropriate the rents in the business.

Incumbents have a narrow path to stay successfully in business if bigtechs enter full force in the banking sector. They can either become a platform and compete directly with bigtechs trying to compensate their data superior capabilities with possibly superior trust from customers and security (banks are good at keeping secrets) as well as better navigation abilities of the regulatory maze, or become specialized in unique financial products that the bigtechs cannot offer and therefore cannot be commoditized. In any case they will have to restructure and a consolidation process will be under way.

Fintechs will fork into specialized service firms with no banking license and digital banks. The former will form partnerships with the incumbents while the latter will consolidate or sell to the incumbents. BigTech will enter into banking services, it is already doing so, since the complementarities of financial services with the knowledge of customers they have and with the products they offer are high (e.g. what is happening in China starting from a much lower banked based of customers). The question is how far they will go and this depends very much on the regulatory treatment.

4. Competition and the role of regulation

What are the regulatory consequences of digital disruption? How should BigTech and FinTech firms be regulated? It is clear that regulation will influence the type of competition between incumbents and entrants. A main issue is whether regulation should aim at a level playing field or it should favor entrants in order to promote competition.

The 2007-09 financial crisis has given rise to new approaches with respect to competition in the financial services sector. A case in point is the UK reform where in 2015 the UK Financial Conduct Authority gained concurrent powers for enforcement of competition policy. Supervisory authorities of several countries now hold some competition-related powers.⁵⁵ Concurrent powers between supervisors and competition authorities add some complexity but it is beneficial that consumer and investor protection are under the same roof than competition in the financial sector. This is so since the aim of consumer protection and competition is common: the welfare of consumers.⁵⁶

Despite the fact that most current supervisory frameworks predate the emergence of FinTech, several examples of post-financial crisis regulatory initiatives are worth mentioning.⁵⁷ The revised EU Payment Services Directive (PSD2) is a regulation aiming to enhance competition granting open access to certain types of customers' banking data for non-bank licensed providers of Payment Initiation Services (PIS) and Account Information Services (AIS).⁵⁸ The initiative aims to make the usage of internet payment

⁵⁵ For example, the Irish Central Bank (the prudential supervisor) was conferred powers to introduce mortgage rate caps. See Carletti and Smolenska (2017).

⁵⁶ See Section 7.1 in Vives (2016).

⁵⁷ See FSB (2019).

⁵⁸ Under PSD2, banks cannot refuse the providers of the latter access to information regarding personal online banking accounts if customers allow it. From the FAQ of the Directive on to what extent the providers will have access to information on a payment or bank account: *“These new providers will only be allowed to provide the services the payer decides to make use of. In order to provide these services they will not have full access to the account of the payer. Those offering payment instruments or payment initiation services will only be able to receive information from the payer’s bank on the availability of funds (a yes/no answer) on the account before initiating the payment (with the explicit consent of the payer). Account information service providers will receive the information explicitly agreed by the payer and only to the extent they are necessary for the service provided to the payer. The security credentials of the payment service user shall not be accessible to other third parties and will*

services safer and more convenient, safeguard customers against fraud, abuse and payment issues and, at the same time, promote innovative mobile and payment services. For instance, PSD2 mandates that customers be able to use one app to see a list of all their accounts, even those with other banks.

Such examples are not only found in the EU. In 2017, Japan revised the Banking Act, which now includes provisions encouraging banks to open their APIs and facilitating the acquisition of or collaboration with FinTech firms by banks; this has aimed to foster innovation and enhance banks' efficiency. In 2017 the Canadian competition authorities also completed a review of the payment services, lending, crowdfunding, as well as investment dealing and advice sectors. In 2018 Mexico approved a FinTech Law introducing requirements for financial entities also pertaining to fintechs, and novel models (for instance, a regulatory sandbox) to grant access to data to third parties via APIs. Fees can be required for access, which financial authorities need to first approve, so that excessive fees are prevented.⁵⁹ Last, the Australian government has declared the enforcement of a "consumer data right" initiative sector by sector starting from banking, which will grant customers the right to ask that their data be shared with third parties they trust.⁶⁰

All these regulation initiatives will influence the type of competition between the incumbents and the new entrants. If regulation manages to ensure a level playing field, then the likelihood of head-to-head competition potentially rises. On the other hand, policies that imply asymmetric regulation between FinTech-BigTech companies and traditional banks can encourage entry, augment contestability through lower switching costs, and enhance market transparency. This increase in competition in the short term needs to be balanced nevertheless, as there is a potential long term risk of monopolization by bigtechs (and even by platform-transformed incumbents). The PSD2 Directive discussed above mandates that bank allow authorized Third-Party Providers (TPPs)

have to be transmitted through safe and efficient channels to the bank servicing the account. A dynamically generated code only valid for that specific transaction (linked to the amount and recipient) will have to be used in the authentication process." See also EY (2018).

⁵⁹ See FSB (2019).

⁶⁰Australian Competition and Consumer Commission (ACCC), <https://www.accc.gov.au/focus-areas/consumer-data-right-cdr-0>.

access to customer data; notably, banks are obliged to provide customer data to authorized competitors free of charge. A similar scheme has been developed under the UK Open Banking initiative. On the other hand, under the EU's General Data Protection Regulation (GDPR), TTPs –including BigTech platforms– have to facilitate data portability only in cases where it is technically feasible. The GDPR aims to give customers control over their data and requires active consent for data sharing. All this may place banks in a disadvantageous position relative to BigTech platforms benefiting from the non-reciprocal access to valuable data.⁶¹ It is worth noting that since bigtechs are the ones that can gain most to access the data of bank customers, because of economies of scale and scope with their already large database, they will be willing to pay more for this data and their dominance may be reinforced.⁶²

The playing field can be made even more uneven to the extent that BigTech platforms remain unrestricted by risk and compliance obligations as they enter retail banking. Regulatory authorities, in particular when there is cooperation between incumbents and new entrants, will have to answer the question that arises regarding who will bear the burden of operational and security risks, as well as regulatory compliance.

The policy debate on technological and financial innovation according to Andrea Enria, former head of the European Banking Authority has commonly been led by two opposing views: “regulate and restrict”, often proving ineffective, versus “let things happen”, implying heightened risks in shadow banks. The EBA has argued in favor of a combined approach in the supervision of fintechs. The main pillar of this approach is a tiered regulatory structure where each firm needs to fulfill different regulatory requirements based on the risks it is faced with, who its customers are, the financial sector and the economy in general. This aims to impose the same rules for activities of similar

⁶¹ This point is emphasized by de la Mano and Padilla (2018) and highlighted among the concerns of financial institutions in the EBA (2019) survey.

⁶² Competition authorities are starting to worry about data as a source of market power. An example is provided by the Bundeskartellamt, in February 2019 it prohibited Facebook from combining the user data from WhatsApp and Instagram. An important general issue is who has ownership of customer data. If left undefined bigtechs will have control over the personal data even if they do not own it. In principle, the welfare-optimal solution according to Coase is to give property rights to customers and let them trade in a competitive data market. Obviously, things are more complicated in practice since the market need not be competitive.

levels of risk. It can be achieved through monitoring of innovation, assessing risks in relation to the public interest and also selectively making use of the existing rulebook. This can be a challenge for regulators, since it implies a higher degree of complexity in regulatory operations, and of commitment to be shown by the authorities, as well as extensive dialogue with firms and integrated approaches within the EU Single Market. However, the approach has advantages since it aims to control specific risks in a flexible way and, hopefully, may be better suited for changing financial markets.

The main recommendations of the EBA for FinTech regulation out of a general consultation is to follow a pan-European approach to ensure equal treatment as well as allow a large domestic market for fintechs to achieve scale and be able to compete globally. In an EBA consultation, more than 30% of the fintechs were reported to be unregulated and incumbents would argue for financial institutions offering the same type of services and being exposed to the same risks having the same regulatory and supervisory requirements.

The policy tension is between extending the perimeter of bank regulation to all financial service providers and thus constraining financial innovation (and implicitly extending a state protection umbrella to the new entrants) on the one hand, and keeping the new entrants out of the perimeter completely and tilting the playing field in their favor, on the other hand. A balance must be found to allow the regulatory perimeter to cover all activities that have systemic risk potential, while being more lenient otherwise. It should be noted also that entities, and not activities, are those that are subject to failure and that may generate systemic risk. There is a tradeoff between regulating by activity, which fosters a level playing field, a protecting against systemic risk of failed entities. The center of gravity of the regulatory perimeter should be the institutions that provide the banking core activity of the joint provision of deposits and loans.

The European approach tends to impose the same rules and supervision to the same services regardless of what the institution offering them is.⁶³ However, this is difficult to implement, as regulation and supervision is mostly focused on institutions rather than products and services. So far the tendency is to regulate new FinTech services by offering

⁶³ See Demertzis et al. (2018) and EBA (2017).

a regulatory sandbox giving firms the opportunity to experiment without the regulatory burden which the traditional banking sector is faced with. This also gives regulators the chance to look for the most effective ways to safeguard stability while encouraging innovation.⁶⁴ The UK pioneering experience is considered positive for both the FCA and the firms among other things because it has shown that the regulator can have a role in fostering innovation.⁶⁵

Furthermore, regulation needs to account for interconnectedness and “step-in” risk arising, for example, from activities seemingly outside of the traditional banking model but connected to banks through ownership, partnership or sponsorship which may imply guarantees. This may apply to the new partnerships between incumbents and entrants. Also, regulations should be technologically neutral allowing for the substitutability of technology, not restricting firms to vertically integrated technology monopolies. A challenge is to develop standards to favor market integration while not imposing a specific technology.

Consumer protection is of paramount importance in an open banking environment since consumers should be assured of the integrity of the process, and this requires that their transactions be traceable so that liability can be assigned if there is any breach. Consumer welfare needs to be protected or enhanced allowing a wider spectrum of providers to choose from, increased accessibility and quality, respect for data privacy, while risks of confusion and cyber-attacks are mitigated.⁶⁶

Regulatory authorities need to consider also that cross-border asymmetries in data protection regimes may lead to market fragmentation and impede international business operations. Specifically, there is a risk that firms based in countries with restrictive data protection regimes may be denied operation in other jurisdictions on the grounds of the

⁶⁴ The FCA has been a pioneer in the development of sandboxes with three main objectives: i) reduce the time to market of a new product; ii) improve access to finance; and iii) encourage innovation. The FCA offered four different ways to engage consumers in the sandbox. See Arner et al. (2017).

⁶⁵ See Deloitte (2018).

⁶⁶ Regulatory authorities are taking seriously data privacy issues. Witness the fine of \$5bn imposed by the Federal Trade Commission on Facebook for data privacy violations for commercial gain (related to the Cambridge Analytica affair) as well as the requirement to follow stricter rules in the management of data of the social network users.

firms' inability to undergo effective supervision from the foreign country's regulatory agencies. The desiderata of supranational regulation and supervision is not foreseeable given ring-fencing and security concerns, but still it is something worth to start working on in international fora. The money laundering concern with FinTech is paramount and will drive regulatory international cooperation.⁶⁷

Apart from giving rise to all these questions, digital technologies can also provide regulatory authorities with answers, improve both regulation and supervision, and help both regulators and firms to decrease the costs of compliance. New technology can be utilized in achieving more efficient delivery of regulatory and compliance requirements. This approach is known as "RegTech", which the Institute of International Finance defines as "the use of new technologies to solve regulatory and compliance requirements more effectively and efficiently". RegTech has to come to terms with the supervision of data sharing starting from who owns the data to the supervision of FinTech algorithms (for example, robo-advisors) for consumer protection and market integrity purposes.

The Canadian Competition Bureau's assessment of FinTech

The Canadian Competition Bureau (2017) has recently provided an assessment of the FinTech phenomenon coming up with some key policy recommendations. They are a good example of how regulators are anticipating change in the banking sector. Regulation should:

1. Be technology-neutral and device-agnostic. Rules that a financial entity must comply with often refer to the technology used at the time of the development of the rules (e.g., a 'wet' signature or in person collection of information requirement). Although such regulation may have been effective in the past, rules that can foster innovation and the development of yet-to-be developed technologies are necessary.

2. Be principles-based. That is, it should be based on expected outcomes and not on specific procedures to achieve those outcomes. For example, instead of prescribing the

⁶⁷ This will be particularly true in KYC (know your client) provisions.

exact method of identification verification, regulation can simply require that the service provider verify identity, so that it allows for new more effective ways of doing so.

3. Be function-based, so that all firms face the same regulatory burden and consumers have the same protections when dealing with competing service providers.

4. Be proportional to the risks that need to be mitigated. This way non-bank entrants will compete on a level playing field with incumbents providing similar types of services and the risk of regulatory arbitrage will be limited.

5. Be harmonized across geographic boundaries, as differences in regulations across geographical areas can increase the compliance burden impeding FinTech development.

6. Encourage collaboration. More effective collaboration among regulators will allow for a clear and unified approach to risk, innovation and competition.

7. Introduce a specialized body which other agencies can refer to; it will also serve as a one-stop resource for information and promote investment in innovative businesses and technologies in the financial sector.

8. Facilitate access to core infrastructure and services. For instance, access to the payments system will allow new entrants to deliver new overlay services such as bill payment and foreign exchange services.

9. Promote “open” access to systems and data through APIs, which can allow fintechs to innovate creating applications that facilitate competitive switching.

10. Consider the potential of digital identification verification, which can reduce the cost of customer acquisition for new entrants (and incumbents), and the customers’ switching costs, as well as facilitate regulatory compliance where identity verification is required.

11. Continue to review their regulatory frameworks ensuring that they remain effective in endorsing competition as new technologies emerge.

[https://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/FinTech-MarketStudy-December2017-Eng.pdf/\\$FILE/FinTech-MarketStudy-December2017-Eng.pdf](https://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/FinTech-MarketStudy-December2017-Eng.pdf/$FILE/FinTech-MarketStudy-December2017-Eng.pdf)

5. Financial stability implications of digital disruption

There are several sources of risk that emerge with the entry of FinTech and BigTech firms in the banking sector. A main effect is that to the extent that this new entry reduces the profitability of the incumbents, the latter may start taking excessive risks in an effort to counterbalance the downward pressure on their profits.⁶⁸ In fact, the response of regulators to the rise in contestability and enhanced risk-taking may be then to raise banks' prudential requirements, which in turn may raise the incentives to bypass regulation and foster an increase in shadow bank activity. We would have then a self-feeding increase in shadow bank activity outside the regulatory perimeter. For example, macroprudential regulation tries to limit systemic risk but the limits to leveraged lending imposed to banks may increase non-bank leveraged lending. This is exactly what happened with the leverage guidance provided in the US by the Financial Stability Oversight Council (FSOC).⁶⁹

The danger that heightened regulatory pressure will cause a rise in shadow banking activities is always present as exemplified with the mortgage market in the US post crisis.⁷⁰ The post-subprime crisis tightened regulatory scrutiny in the US has led to a fast expansion of shadow banking. The market share of shadow banks in mortgages has nearly tripled in the eight-year period after the crisis with the rise in shadow banking accompanied by a change of origination from physical stores to online intermediaries in a relevant amount. For example, in 2007, FinTech lenders originated less than 5% of residential loans, while by 2015 this share had climbed to more than 12%. The increased regulatory burden on traditional banks can explain about 55% of shadow banking growth in the examined period, while 35% of the expansion in shadow banking activities can be

⁶⁸ Banks have excessive incentives to take risk in the presence of limited liability and moral hazard on the investment side. The effect is reinforced by deposit insurance (with premia not sensitive to risk) or implicit insurance with bailouts and TBTF policies. Strong competition may worsen the problem of excessive risk taking, because profits provide a buffer and increase the bank's charter or franchise value. In a nutshell, a bank with more market power enjoys higher profits and has more to lose if it takes more risk, fails, and its charter is revoked (see Keeley 1990, Matutes and Vives 2000). Similarly, banking competition erodes the rents of relationship banking (see Besanko and Thakor 1993).

⁶⁹ See Kim et al. (2017).

⁷⁰ See Plantin (2015) on how capital regulation should be designed under regulatory arbitrage.

attributed to the use of financial technology.⁷¹ Furthermore, shadow bank lenders, of which FinTech are more than a third of loan originators, have prospered particularly in borrower segments and areas where regulation made the activities of traditional, deposit-taking banks more difficult. This includes the Federal Housing Administration borrower segments characterized by high risk and low levels of creditworthiness, as well as areas with low average income and high shares of minority populations. Importantly, shadow/FinTech banks rely on guarantees provided by government sponsored enterprises (GSE) by unloading the loans they originate onto the GSE. The composition of shadow bank funding shifted from bank, insurance company (FinTech in particular), and other capital in 2007 to an 85% of mortgages sold to GSEs after origination in 2015. The result is that the US has gone from providing a housing subsidy via cheap deposits and private label securitization to a subsidy to shadow/FinTech banks by allowing the latter to unload the loans they originate onto the GSEs, thus relying on guarantees provided by them.

The extent of regulatory burden imposed on new entrants and the guarantees that the public sector offers to them will be key in their competitiveness vis à vis established incumbents. For example, if e-money providers have access to central bank reserves then they would not suffer from market and liquidity risk and become the facto narrow banks posing a formidable competition challenge to banks to attract funds.⁷² This may have advantages such as fostering innovation, facilitating cross-border payments, avoiding the potential monopolization of e-money provision, and making monetary policy transmission more effective⁷³ but would hurt banks and make their deposit base less stable. Furthermore, banks should respond by improving service and increasing interest on deposits to retain customers, diminishing their profitability. The erosion of the

⁷¹ See Buchak et al. (2018).

⁷² See Section 5.4 in Vives (2016) for an assessment of the consequences of narrow banking.

⁷³ Adrian and Mancini-Griffoli (2019) discuss those potential advantages and point that e-money providers access to central bank reserves implies the creation of central bank digital currency (CBDC), which they call “synthetic” since the central bank would offer only settlement services to e-money providers. Keister and Shanches (2018) show that CBDC promotes efficiency in exchange but crowds out bank deposits, raising the cost of funding for banks. Brunnermeier and Niepelt (forth.) show that the introduction of a CBDC need not alter allocations, credit and the price system provided that a “pass-through” mechanism is in place according to which the “reserves for all” principle only affects the composition of bank funding but does not reduce it. See also the contributions in Fatás (2019).

franchise value of deposits (as may have been the case with money market mutual funds) would limit its hedging value of interest rate risk and therefore the capability to provide credit.⁷⁴ Furthermore, in a crisis the full insurance of e-money providers may induce a flight to safety of bank deposits above the deposit insurance limit.

If e-money providers do not have access to central bank reserves then they would be subject to market and liquidity risk even if they deposit the funds of the clients in the banks as wholesale deposits. This would make the system less stable since e-money holders would have an incentive to run to obtain the deposit insurance offered by banks if they fear instability of the investments of the e-money providers. Furthermore, the funding of banks may be made less stable also since they would have a higher proportion of volatile wholesale deposits.⁷⁵

Other sources of risk associated to the new entrants are the implications of the digital disruption on information asymmetries and the potential impact on systemic risk.

With regard to asymmetric information problems, platforms have a potentially ambiguous impact on moral hazard and adverse selection problems and therefore on financial stability. To the extent that platforms have low stakes in the loans they help to originate but not retain, moral hazard problems may arise. As platforms take a central role mostly in the screening process for loans, thus caring mainly about maximizing the loan volume and fee revenue, they may choose to let the quality of the loans drop. This effect can be exacerbated by their having scarce soft information in which traditional banks have the advantage.⁷⁶ Moral hazard may also increase even when the platforms fund the loans they originate (as bigtechs may do), since they will have incentives to expand credit in order to bolster their other platform businesses – i.e. to sell additional products or services on their e-commerce platforms or to acquire complementary data to monetize through their advertising platforms.

⁷⁴ Market power on the deposit side allows banks to pay low deposit rates which do not increase very much when interest rates go up. This hedging value has been checked empirically by Drechsler et al. (2018).

⁷⁵ See Skeie (2019) for a model-based discussion of runs in a digital currency environment.

⁷⁶ See Vallée and Zeng (2019).

Adverse selection issues also emerge. The double-blind nature of P2P lending renders adverse selection by borrowers more likely in online lending. It has been observed that among consumers of comparable credit scores, default rates on P2P loans are higher relative to those on other types of credit.⁷⁷ Nevertheless, it could be also that there is self-selection of less trustworthy borrowers in P2P lending with credit scores imperfectly measuring trustworthiness. Furthermore, BigTech platforms may engage in cream-skimming using their superior customer data and technology allowing them to screen out low-quality loans more effectively than both FinTech start-ups and traditional banks. As a result, traditional banks might end up bearing increased credit risk and adverse selection problems. The increase in competitive pressure may lead banks to take even on more risk trying to recover profitability.

In short, it is possible that the development of FinTech and BigTech, despite the potential to reduce information asymmetries, ends up exacerbating informational differences between informed and uninformed investors since those accumulating massive amounts of data and technical ability to interpret and analyze it will come ahead and may induce other lenders to be passive. Consistent with this hypothesis, there is evidence of a reintermediation process of P2P lending marketplaces because of their accumulation of information advantage.⁷⁸

It is worth noting also that asymmetric regulation may limit information sharing among financial service suppliers (e.g. on credit records) and consequently the efficiency of credit markets may be compromised given that consumers and firms can borrow from both banks and platforms.

⁷⁷ See Balyuk and Davidenko (2018).

⁷⁸ Balyuk and Davidenko (2018) state that: *“The peer-to-peer loan market was designed to allow borrowers and lenders to interact online without banks as middlemen. Yet we document that, in contrast to other trading venues, P2P lending platforms over time have become new intermediaries, and now perform essentially all tasks related to loan evaluation. By contrast, lenders are overwhelmingly passive and automatically fund almost all loans offered by the platform, forgoing potential benefits of active loan selection. The dominant role of lending platforms with little skin in the game makes the market vulnerable to moral hazard, checked by the threat of institutional investors’ withdrawal. Our findings suggest that in markets without private information reintermediation may arise naturally as the platform’s expertise in data analysis crowds out that of investors”*. This reintermediation process may increase the chances that P2P lending platforms end up tapping the safety net when they get into trouble.

With regard to potential impacts on systemic risk, there are several sources of concern:

i) The first one is the danger of development of a parallel payments system not adequately monitored by central banks, which can take place if bigtechs deposit customer funds directly with banks as is the case in China.⁷⁹

ii) The second concern arises if a proportion of financial institutions rely on a BigTech firm (or a few of them) that provides third-party services (say data storage, transmission or analytics), some of them in the cloud. In this case a cyber-attack or operational failure may pose a systemic risk.

iii) The very development of large online money market funds (MMFs), such as Yu'e Bao in China, which are not in principle insured, leaves them vulnerable to runs (which are possible as we learned in the 2007-09 financial crisis in the US).⁸⁰ On the bright side, FinTech startups may manage to operate with less leverage than traditional banks.⁸¹

iv) Finally, if BigTech enters into the core of banking then systemic concerns increase since trouble in the non-bank business of the firm may contaminate the bank, which is very likely to be systemic. The prudential principles that call for separation of banking from commerce and industry apply here.

Regulators have to come to terms with a complex environment where incumbent banks compete with nimble fintechs and established bigtechs, and where new forms of systemic risk may arise. A key to prevention is early detection and new technology should develop continuous monitoring tools profiting from big data that serve as early indicators of risk. Those tools should be added to the developing measures of systemic

⁷⁹ Not only can this compromise financial stability but also render prevention of illegal activities such as money laundering more difficult to achieve. Bigtechs in China have to clear payments on a state-owned clearing house and must keep customer balances in a reserve account with the central bank (see the box on digital currencies).

⁸⁰ Chinese authorities have introduced a cap on instant redemptions for MMFs and restricted bigtechs to finance them to limit the risk of runs.

⁸¹ See Philippon (2018).

risk base of market data and the network structure of links between financial intermediaries.⁸²

6. Summary and conclusion

The digital disruption in banking promises to bring a general increase in efficiency and service by helping in overcoming information asymmetries (using big data and AI/ML techniques and the blockchain technology), providing a friendly consumer interface and a higher standard of service, and leading to the replacement of obsolete technology. Banking will move to a customer-centric model. All this presents formidable challenges to incumbents since they have to update their technological platforms (from the relatively rigid mainframes to the more flexible cloud) and reduce branch overcapacity in the current low profitability environment (particularly in Europe and Japan where there are still legacy assets to dispose of), and try to reach the new standard of service competing with the new entrants that encroach on the most profitable lines of business. They will have to restructure deeply and consolidation will happen. Incumbents face a heavy regulatory scrutiny and compliance duties and have to overcome the tremendous reputational damage suffered because of the 2007-09 financial crisis. They face the dilemma of whether to compete head-to-head or cooperate with entrants. The dilemma is resolved with fintechs by acquisition or partnership.

With bigtechs the dilemma posed for incumbents is sharper. The main threat to incumbents is that bigtechs try to control the interface with customers using their superiority in customer base (data) by being a gatekeeper to the distribution of financial products. If this were to happen, incumbent banks would be relegated to product providers on platforms they do not control: their businesses would be commoditized. Some banks have already perceived this threat and offer open platforms that may incorporate products from other financial providers or have formed partnerships with bigtechs. In any case, incumbents have some strengths that they can leverage, such as customer trust to keep their data secure, and accumulated knowledge on how to deal

⁸² See Section 3.1.2 in Vives (2016).

with complexity and intrusive regulatory environments. Incumbents that will do well will have managed to transit from the mainframe to the cloud, be lean in bricks but heavy on human capital, and either become digital platforms to keep the interface with the client, or have unique products to feed the platforms that will distribute the products to the customers.

BigTech will enter into financial services because of the complementarities of those services with the customer data they possess and the products they offer as the China example shows. The extent of their entry will depend very much on the regulatory treatment. Indeed, prudential regulators may not allow bigtechs to acquire a full banking license because of the possible contamination of bank and non-bank activities generating systemic risk. In general, most new entrants are reluctant to ask for a banking license because of the compliance costs this entails. Banks have access to cheaper funds, because they can take deposits under the umbrella of explicit or implicit public insurance schemes, but they are subject to tight scrutiny.

There is no doubt that the immediate impact of the digital disruption will be to erode the margins of incumbents and increase the contestability of banking markets. The long run impact will depend on what market structure ends up prevailing. Banking could move from the traditional oligopoly to a new form with a few dominant platforms that control the access to a fragmented customer base if a few bigtechs together with some platform-transformed incumbents monopolize the interface with customers and appropriate the rents in the business. A key to keep the market sufficiently competitive will be to have data ownership and portability for individuals, and data interoperability between platforms so that switching costs for customers are subdued.

As long as efficiency advantages such as superior information, screening technologies, leaner operation, and less leverage are the main drivers of BigTech entry, the financial sector can become more efficient and feature higher financial inclusion. This effect will be especially pronounced if as a response to their entry incumbents become more efficient by restructuring and adopting more advanced technologies. Nonetheless, should the forces behind BigTech entry have to do with market power, taking advantage of regulatory loopholes and bandwagon effects of network externalities for exclusionary purposes, then the banking system's efficiency could suffer in the long run.

The digital disruption also poses a formidable challenge to regulators. They must adapt to the digital world by facilitating competition and allowing the benefits of innovation to permeate the system while protecting financial stability. Regulators must coordinate prudential regulation and competition policy so that compliance does not become a barrier to entry and entry does not become destabilizing. Light regulation of entrants into the industry may foster competition, but at the potential cost of destabilizing incumbents, by decreasing their profitability and increasing their risk-taking incentives, and transferring the generation of systemic risk to non-bank entities. As we have seen in the US, for example, shadow banks (including fintechs) are taking already the lion's share of mortgage loans originations. We know that in most financial crises, from the panic of 1907 in the US to the global crisis in 2007-2009, a shadow banking system was at its origin.

Regulators must keep a level playing field fostering innovation and maintaining stability. However, to keep a level playing field dominant players (be it incumbents or bigtechs) have to be treated differently than small entrants in terms of regulatory compliance requirements. Lighter requirements on small non-systemic institutions will foster competition and innovation without endangering stability as long as those entities do not correlate their strategies. Furthermore, maintaining a level playing field is easier said than done if one witnesses the asymmetry in customer information sharing requirements in open banking in the EU between PSD2 (applying to incumbents) and GDPR (applying to non-bank entrants). Key to maintaining a level playing field is to allow data interoperability between product and service providers.

Regulators must be alert also to new forms of systemic risk. For example, if banking moves towards a platform-based system, the risk of systemic problems deriving from cyber-attacks and massive data leaks will be prominent. Furthermore, the possibilities of contamination of bank and non-bank activities in generating systemic risk increase as well as the risk of failure of third-party providers. The decision on what activities to keep inside the banking regulatory perimeter will have consequences since regulating according to activities may foster innovation and a level playing field but entities, not activities, are those that fail and that may generate systemic risk. Regulatory sandboxes may help at small FinTech scale but it is not obvious that they will work for large BigTech or incumbent scale.

Consumer protection concerns come to the forefront. Regulators must, for example, establish who controls the data (here the EU seems to be ahead) and ensure security when transacting in platforms. They have to take into account also that digital technology allows enhanced price discrimination capacity and therefore calls for also enhanced consumer protection. Particular attention must be given to fostering the use of digital technology in a transparent way that attenuates the possible behavioral biases of consumers and investors. The transparency in the conditions when dealing with customers is and will be a competitive advantage of digital banks that should permeate the whole sector.

In conclusion, regulation needs to rise to the challenge of ensuring that the welfare-enhancing disruptive capability of new technology and platforms materializes delivering benefits to consumers and firms without endangering financial stability.

7. Some open issues

The new digital world leaves many issues open for research. Here is a sample of them. A fundamental one is: what is a bank today? Can the core bank function of producing jointly deposits and loans be unbundled? What is the optimal policy of the central bank with respect to digital currencies? Should the central bank supply its own digital currency or allow private digital currency providers to access reserves? Will the new digital world attenuate or exacerbate the asymmetric information problems at the root of financial intermediation? How will blockchain technology and smart contracts change financial contracting and impact competition? How will the new digital marketing and price discrimination techniques interact with the behavioral biases of consumers and investors? What role will new entrants play in providing credit to people and firms who cannot post collateral? Will innovation be favored? How to avoid the entrenchment of dominant positions in a platform-based banking world? To what extent dynamic economies of scale and scope will lead to a natural oligopoly structure in banking? How to assign property rights on data and data portability rules to maximize welfare? How to design systemic risk indicators for cyber exposures?

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