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FINTECH, BIGTECH, AND THE FUTURE OF BANKS

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ABSTRACT

Banks are unique in that they combine the production of liquid claims with loans. They can replicate most of what FinTech firms can do, but FinTech firms benefit from an uneven playing field in that they are less regulated than banks. The uneven playing field enables non-bank FinTech firms to challenge banks for specific products whose success is not tied to what makes banks unique, but they cannot replace banks as such. In contrast, BigTech firms have unique advantages that banks cannot easily replicate and therefore present a much stronger challenge to established banks in consumer finance and loans to small firms. Both Fintech and BigTech are contributing to a secular trend of banks losing their comparative advantage as they have less access to unique information about parties seeking credit.

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1. Introduction.

In 1994, Bill Gates famously said that banks are dinosaurs. Since then, bank assets in the U.S. more than quadrupled (from $3.7 trillion to $17.4 trillion) while the number of banks fell by more than 50% (from 10,453 to less than 5,000). We have many fewer but now much larger banks. With the internet came many efforts to disrupt the banking industry, including the emergence of online banks. These banks did not supplant existing banks. Instead, existing banks made online banking available to their customers. After the global financial crisis, innovations made possible by digital technologies led to many claims that, again, banks were dinosaurs and would be replaced or fundamentally disrupted by FinTech firms. For example, a consulting firm announced in 2018 that "digitalization will make most heritage financial firms irrelevant by 2030."[1]

FinTech is defined by the Financial Stability Board as "technologically enabled financial innovation that could result in new business models, applications, processes, or products with an associated material effect on financial markets and institutions and the provision of financial services."[2] With this definition, one might be tempted to say that the golden age of FinTech was the 1960s when banks started to use computers extensively and introduced ATMs. A more appropriate definition of FinTech for this article is financial innovation based on the use of digital technologies and big data. The use of digital technologies makes it possible to provide many existing financial services more efficiently and to enhance these services.

BigTech firms are "technology companies with established presence in the market for digital services."[3] They are firms that have successful digital platforms. In the U.S., they are firms like Amazon, Facebook, and Google. In China, they are firms like Alibaba and Tencent. The Chinese counterparts of the U.S. firms have already made big inroads in financial services markets. The U.S. firms have not. The challenges posed to banks by the entry of BigTech into finance are quite different from the challenges posed by FinTech firms. The typical FinTech firm is a specialized firm that challenges a specific product line of banks. For instance, a credit FinTech firm tries to take away market share from banks for a specific segment of the

[1] "Gartner says digitalization will make most heritage financial firms irrelevant by 2030," press release by Gartner, October 29, 2018.
[2] See Financial Stability Board (2017).
[3] See Frost, Gambacorta, Huang, Shin, and Zbinden (2019).

loan market. BigTech firms have the ability to challenge banks across a large number of product lines, in other words, they can lead a frontal assault as opposed to attacking niches.

Despite all the excitement about FinTech and the dire warnings about the threat it poses to traditional banks, from 2013 to mid-2019, the Dow-Jones U.S. Banks Index more than doubled and more than held its own with respect to the S&P 500. There is no evidence that the stock market prices bank stocks as if banks were an endangered species. Does this mean that banks can ignore FinTech and BigTech? That they do not represent a competitive threat to banks? That banks are safe from disruption? Or is the stock market just confused about the prospects of banks? In this article, I examine how FinTech and BigTech impact the future of banks.

To understand how FinTech and BigTech can threaten banks, it is important to understand whether there is something unique about banks that makes it hard for them to be challenged by non-banks. In the first section of this article, I argue that banks are indeed special, but some dimensions along which they are special are at risk because of technological developments that predate the digital and big-data revolutions. Banks earn revenues from both sides of their balance sheet as well as by activities that do not show up on their balance sheets. It is best to think of a typical large bank as a large portfolio of synergistic activities. Most of these activities are or could be undertaken by non-banks, so that banks compete with non-banks in these activities. For instance, non-banks make loans to consumers and businesses. However, non-banks do not have demand deposit accounts (though they have substitutes like money market funds), which provide safe and liquid claims that are instantly redeemable. To offer deposit accounts, banks have to have the trust of their customers, which comes in part from access to deposit insurance.

Though banks play a key role in the financial system, they are fragile. They have on demand and short-term liabilities that can be moved by their owners to other banks rapidly, so that a given bank can suddenly be unable to fund itself. Because of the fragility of banks and the potential systemic risk of bank failures, banks are heavily regulated. Bank regulation is expensive, constrains banks, and creates barriers to entry and rapid growth. FinTech firms that do not have a bank charter can compete with banks by offering cheaper and better financial services than those offered by banks. Whereas regulation makes it difficult for FinTech firms to become successful banks, it benefits them when they compete with banks without acquiring a bank

charter. For instance, banks are subject to many regulations that force them to take steps to make sure that their customers are not using their services to launder money. FinTech firms do not have to follow the same regulations. Further, banks are required to hold minimum amounts of capital to satisfy existing regulations. Many bank activities could be carried on with almost no capital, but regulations force banks to hold capital for these activities. FinTech firms are not subject to capital requirements, so they can conduct bank activities at lower cost. Regulation designed to protect the banking system helps FinTech firms at the expense of banks.

Absent regulation, banks could imitate most FinTech innovations. Large universal banks would have a considerable advantage over FinTech firms if they offered a similar product because they have a huge customer base already. There are at least two obstacles that may hinder their ability to mimic FinTech innovations. The Achille's heel of large banks is that their IT has been built through add-ons. It relies on parts that use computer languages that most IT people don't even know anymore. Integrating FinTech innovation into such an IT platform can be problematic or infeasible. That's where the second obstacle comes in. Large banks are large complex diversified firms where innovation may be impeded because it reduces the profitability or size of existing activities, because of agency conflicts, and because of bureaucracy. These obstacles to the adoption of FinTech ideas by large banks can make it possible for FinTech firms to be successful in challenging banks even without the benefits they have from an uneven regulatory field. In contrast to banks, however, BigTech firms can adopt FinTech innovations much more easily as they already have a digital platform in which these innovations can be incorporated.

In this article, I devote only limited attention to the global dimension of FinTech. In many ways, FinTech firms play a bigger role in some foreign countries than they do in the U.S., but discussing that role is best left to others as doing so would be a distraction in this article. I further devote no attention to FinTech firms that do not challenge banks. Many FinTech firms develop products that help banks to become more productive or have better products. The ways they do so are interesting on their own, but again would distract from the main focus of this article.

This article proceeds as follows. I first explain why banks are special, but have become less so over time. Next, I discuss how FinTech firms that are not banks can compete with banks for many bank activities

that do not make banks special and can reduce the specialness of banks. In the process of doing so, I review the main areas in which FinTech firms are active. I then turn to a discussion of the potential threat of BigTech as opposed to FinTech. I explain why, in many ways, this threat is much more serious for the future of banking.

2. Where does the bank franchise come from and why has it fallen over time?

In this section, I explain what makes banks special and why they have become less special over time.

2.1. Why banks are special.

What is a bank? One answer is that banks are institutions that fall under the regulatory umbrella of banks. This umbrella covers institutions that offer insured deposits and their holding companies. Regulators do not treat institutions as banks because they make loans. The regulatory apparatus that restricts the actions of banks was built largely because banks offer deposits.

Deposits are at the core of what makes a bank on economic grounds as well. There is a large demand for liquid riskless claims in the economy. These are claims that can be redeemed at par on sight. Banks offer such claims and invest the proceeds so that they can pay for the costs of offering such claims. As shown by Hanson, Shleifer, Stein, and Vishny (2015), from 1896 to 2012 deposits have financed 80% of bank assets on average.

Deposits are both a source of value and a source of fragility for banks (Diamond and Rajan, 2000). They are a source of value because they are a source of cheap stable funding. Deposits that are not insured are a source of fragility because their owners have incentives to withdraw them at the first sign of trouble at a bank. To maximize shareholder wealth when deposits are a source of value, DeAngelo and Stulz (2015) show that, in a world where the only friction is that banks are needed to provide safe liquid claims, banks have high leverage and manage their risks in such a way that deposits are not at risk. This means that risk management is at the core of the success of banks. At the same time, however, banks must earn enough on the funds they raise so that they can be profitable. A simple way to think about this is that banks earn the spread between the return on assets and the interest paid on liabilities. Investing in safe marketable assets

is not a comprehensive solution because the returns earned on such assets are often not enough for banks to make a profit. As a result, banks invest at least in part in a diversified portfolio of loans.

Part of the reason that banks invest in loans is that they have a comparative advantage in doing so. Through their deposit accounts, they accumulate information about their customers. This means that when customers want to borrow from banks, banks have an information edge over non-bank lenders when it comes to making loans. They also have an information edge in monitoring the credit quality of customers who are borrowers.

To build shareholder wealth from its deposits, a bank will seek to increase its deposit base. To do so, it can expand the range and quality of services it offers. Depositors are more likely to stay with a bank if it can fulfill their various financial needs than if they have to go to another bank to fulfill some of their needs. As a bank acquires depositors with more complex needs, its range of services will increase. Another way to say this is that it will have more product lines. Banks also try to offer services and investment products that depositors will use when their deposit account balances become large. For instance, they will offer savings accounts and various types of mutual funds. They may also offer investment advice. Similarly, when banks have to compete to make loans, they offer services that borrowers find valuable to make it less likely that they will start a relationship with another bank. As banks extend the scope of their services, they hope to earn profits on these services as well, so that they can become valuable on a stand-alone basis.

With this evolution, banks become financial services conglomerates. It is well-known that conglomerates can have both advantages and disadvantages over more specialized firms (Maksimovic and Philips, 2013). Banks can have economies of scale and economies of scope. The economies of scale arise because many banking activities have low marginal cost but high fixed costs. Economies of scope arise when various activities are cheaper to implement together than individually. For instance, a bank's infrastructure can support many different activities. There are good reasons to believe that there are synergies across bank product lines in part because of the information that a bank has about its customers, but many banks have not been well-organized to take advantage of these synergies.

When many activities are housed within one firm, the firm incurs additional costs. In particular, it faces greater coordination costs. Firms with more activities generally have to be more hierarchical, so that

information is lost as it progresses to higher levels within the firm (Stein, 2002). Agency costs arise as those responsible for various activities want to protect their turf. Further, management may choose to build activities in which the firm does not have a comparative advantage. I will refer to these various costs as costs of diversification. Whether the synergies bank take advantage of by combining their different activities are sufficient to offset the costs of diversification is likely to depend on bank-specific attributes. Existing empirical evidence shows that, on average, banks do not gain from economies of scope in that diversified banks, on average, trade at a discount (Laeven and Levine, 2007), and that large banks are not valued more than smaller banks (Minton, Stulz, and Taboada, 2019).

2.2. Why the value of the bank franchise has fallen.

The fragility of banks led to the adoption of deposit insurance in a number of countries, including the U.S. Deposit insurance created incentives for some banks to take more risk, so that more regulation was required to control these incentives. Eventually, regulators decided that banks had to satisfy formal capital requirements. Following the global financial crisis (GFC), a new wave of regulations was imposed. Some of the banking regulations in the U.S. have little to do with protecting the insurance fund and much to do with achieving various societal goals and with using banks to enforce various laws. For instance, banks are subject to rules designed to make it less likely that their services are used for money laundering and to rules that increase lending to less privileged areas.

Regulations have also fueled the growth of non-bank financial institutions, often called shadow banks, that can deliver banking services without being subject to the costs of bank regulations. For instance, in the 1960s and 1970s, the U.S. put ceilings on the rates that banks could pay on various types of term deposit accounts. These ceilings had a macroeconomic goal to limit the size of the balance of payments deficit and also a goal of protecting the savings and loan banks. They remained in effect until the 1980s. The ceilings made it advantageous to start money market funds since they could offer higher rates than term deposit accounts at banks. They also fueled the growth of the euro-dollar market, which is a market for dollar-denominated offshore deposits that was not subject to ceilings and to various other regulations. Capital requirements played a role in the growth of securitization as leverage created outside of a bank through

various structured finance vehicles had much lower capital requirements for a bank than leverage created inside the bank (see, for instance, Acharya, Schnabl, and Suarez, 2013). Not surprisingly, therefore, non-banks can steal market share from banks in products that can be offered without a banking charter. Even for products that require a charter such as deposits, non-banks can offer attractive substitutes because they do not have to meet bank regulations. This type of competition reduces the value of bank franchises as noted more than twenty years ago by Gorton (1994).

Importantly, technological developments have also reduced the comparative advantage of banks in information production as it became easier to access information on business borrowers and retail loan customers and as quantitative techniques made it easier to screen borrowers. The information that an analyst can collect about a firm from public sources in a few hours might have taken weeks or months to collect in the past. In addition, better techniques and data have improved debt default prediction. These developments mean that the unique information available to banks has become less valuable.

In the academic literature, it is typically believed that strong evidence that banks are special is that companies experience favorable stock price reactions when they receive a bank loan (James, 1987). However, over time, this favorable stock price reaction has fallen, which is consistent with a decrease in the value of the bank franchise. As shown by Li and Ongena (2015), the stock-price reaction to loan announcements, which is taken as evidence of the specialness of banks, fell over time so that in the early 2000s it was close to zero. However, there is some evidence that the stock-price reaction was higher during and immediately after the GFC, suggesting that the information advantage of banks may be more valuable in crisis periods.

3. The state of FinTech.

In this section, I review the main types of FinTech. The key ingredients of FinTech are data, computing, and interface. The best way to see this is that many FinTech firms have products that can be used on a mobile phone and are consumer friendly. It is perhaps not surprising that FinTech became an important search topic on Google only after the iPhone became available.

Classifications of FinTech activities vary, but they tend to have similarities. S&P Global in its 2018 US FinTech Market Report divides FinTech activities into six types: payments, digital lending, digital banking, digital investment and personal finance, blockchain, and insurtech. Insurtech is the FinTech for the insurance sector. I will ignore this category as its relevance for the topic of this article is too limited. I discuss each other category in turn.

a) Payments.

The payment system is huge. For example, payments for $884 trillion passed through the Fedwire in 2014. The best-known payment company in the U.S. is Visa. Its market capitalization is $400 billion. Its stock price in August 2019 is more than ten times what it was ten years before. Payments has by far the largest number of FinTech firms. Forbes has a list of the 11 biggest FinTech startups in 2019.[4] The biggest FinTech startup according to that list is Stripe, which at the time of the ranking was valued at $22.5 billion. It started as a service to help online sellers process payments, but has moved beyond that with many other services related to payments. According to Statista, transaction value in the online processing segment in 2018 was $877 billion. A popular component of that segment facilitates payments from peer to peer, whether within one country or cross-border. Venmo is a well-known stand-alone FinTech firm that makes it possible for individuals to transfer cash immediately to other individuals. However, a network of banks has developed a similar product, Zelle. In Q3 2018, Zelle's payment volume was almost twice the payment volume of Venmo, with Zelle having a volume slightly in excess of $30 billion and Venmo slightly in excess of $15 billion.

b) Digital lending.

According to S&P, 16 prominent U.S. FinTech lenders originated loans for $41.1 billion in 2017. These digital lenders are focused on three types of loans: personal loans, SME-focused loans, and student loans.

[4] See "The 11 biggest fintech companies in America 2019," Forbes, February 4, 2019.

The best-known of the group of 16 is LendingClub, which was founded the year before the iPhone was introduced and is now a public company with a market capitalization in 2018 of $1.15 billion. LendingClub is a peer-to-peer lending company, but it also makes more traditional loans through a banking subsidiary. The peer-to-peer loans are for less than $40,000. However, the typical LendingClub loan is no longer peer-to-peer as it could be made by a bank or a hedge fund. In fact, digital lenders rely on banks for much of their funding. For instance, Kabbage provides lines of credit to small businesses with the help of a bank partner. Its decisions are often made within minutes using non-traditional data (such as shipping data for the business). It has made more than $6 billion loans to more than 150,000 businesses. At the beginning of 2019, it was a unicorn with a valuation of $1.2 billion. One of the top 11 most valued FinTech startups according to Forbes is Avant, which had a valuation of $2 billion in early 2019, and makes instant online loans.

c) Digital banking

Though some classifications of FinTech include digital lending as part of digital banking, S&P's does not. One way to think about digital banking is that it includes mobile banking and the infrastructure that supports it. Some FinTech firms are banks. A famous example is Atom Bank from the U.K. Atom Bank was set up as a bank that would deliver services through a smartphone app. However, at this time, all large banks have digital banking of some sort. The largest banks have extensive suites of app features. For instance, three of the top four banks have Apple Watch apps and all four offer peer-to-peer options. According to S&P, at least 15 banks make it possible for customers to access bank balances using Alexa. Digital banking is attracting considerable funding in 2019 outside the U.S. For instance, Nubank, which is a Brazilian online bank, is valued at $10 billion and received an infusion of $400 million this year from investors including U.S. venture firms. Likewise, N26 is an extremely successful German online bank that is adding 10,000 accounts a day and is present in 24 countries.[5] However, both N26 and the British

[5] "German fintech N26 appeases regulators as it eyes future IPO," by Tobias Buck and Olaf Storbechk, Financial Times, August 14, 2019.

challenger banks are being questioned by regulators for their risk management and compliance policies. As their policies become more aligned with those of established banks, their costs will be higher and their advantage over these banks will fall some.

d) Digital investment management and personal finance

There is a wide range of services offered by FinTech firms in this space. Three of the eleven most highly valued FinTech startups offer such services. Robinhood is a broker that offers commission-free trading of stocks, ETFs, crypto-currencies, and options through a mobile app. It grew quickly and has had a substantial impact on the investing world. Its valuation in early 2019 was $5.6 billion. Another startup in the list is Credit Karma that offers a list of free services such as credit scores and help in fixing credit scores. The third one is Plaid, which connects payment apps to personal finance sites where individuals can aggregate their personal financial information from various accounts. Robo-advisors also belong to this type of FinTech firms. However, all the top asset management firms have similar online offerings.

e) Blockchain

In Forbes' list of the 11 most highly valued FinTech startups, two are devoted to cryptocurrency trading and providing services for cryptocurrency investing and trading. This enthusiasm is surprising given that cryptocurrencies seem mostly useful for illicit transactions and speculative investments rather than as a store of value and a payment instrument for normal transactions (Foley, Karlsen, and Putnins, 2019). Enthusiasm for the use of blockchain technology is high as well. One of the top 11 startups is a firm that claims to use blockchain for settlement of transactions. Distributed ledger technology, which typically uses a blockchain but one that often is private rather than public, has often succeeded in generating enthusiasm even among cryptocurrency sceptics. One of the most successful and promising applications is a network of banks called the Interbank Information Network (IIN) started by JPMorgan, Royal Bank of Canada, and ANZ that includes more than 70 banks. It uses a mutually-accessible ledger to verify cross-border

transactions. However, this technology predates the bitcoin blockchain by many years and does not have the features that its proponents are enthusiastic about.

In this brief review of the state of FinTech, I have mostly focused on the U.S. However, FinTech is in some ways less developed in the U.S. than in many other countries. KPMG publishes a list of the top 100 Fintech firms. Of the top 10 for 2018, half are Asian firms. Only three U.S. non-insurance firms are in the ranking. In countries with less developed banking systems or more regimented banking systems, FinTech firms have been able to introduce financial services that were not available. As a result, some of the most successful developments in FinTech have taken place outside the U.S. For instance, the African sub-Saharan region is a leader in mobile money. Chinese technology firms have pioneered peer-to-peer transfers through mobile apps and the use of big data to screen borrowers. In an interesting paper, Navaretti, Calzolari, Mansilla-Fernandez, and Pozzolo (2018) show that across EEC countries, FinTech investment is higher in countries where banking is more concentrated, the spread between lending rates and deposit rates is higher, and where regulation is more lax. These findings are consistent with FinTech having more of an advantage in countries where banks earn more rents and financial development is lower.

4. The impact of FinTech on banks.

In Section 3, I reviewed the various types of FinTech activities that are potential threats to banks. In this section, I address reasons why FinTech firms can be successful in attacking banks and why this success has obvious limits. The three main reasons FinTech firms can be successful outside of banking are: 1) regulation of banks, 2) legacy IT, and 3) organizational frictions of diversified firms. For my discussion in this section, I first focus on the non-crypto FinTech firms and then discuss the crypto FinTech activity. The reason for this distinction is that the non-crypto firms engage in activities that banks were involved in before FinTech. Before FinTech, banks were facilitating payments, making loans, and advising investors and customers. There were online banks before the iPhone. The first online bank in the U.S. was founded in 1994 – perhaps not surprisingly it was located in Palo Alto. In these activities, FinTech firms can compete

with banks by offering cheaper and better products. Instead, crypto-currencies are not designed to compete with banks but with central banks. However, to complicate matters, the crypto-currency FinTech sector also has technological innovations that are used more broadly within FinTech and can be used to challenge banks.

4.1.a. The FinTech advantage.

The digital and big data revolutions make possible many new products and practices across the whole economy. Important innovations are not adopted and exploited instantly by all firms in an industry. Some firms are first. If the innovation is sufficiently important, eventually all firms in an industry adopt it – the ones that do not are acquired or cease to exist. When the implementation of an innovation is not capital intensive and does not require a pre-existing infrastructure, young firms have an advantage in exploiting it. They have no past and organization that gets in the way. The implementation of digital and big data technologies can often be done with almost no capital at all – the critical facilities can be rented at low cost by accessing cloud services.

FinTech firms generally have a different business model from banks. Contrary to banks, they have little to lose. They can innovate rapidly, do not fear mistakes, let customers guide them towards better products, and focus on interfaces that maximize customer experience. An important factor that enables innovating FinTech firms to move faster is that digital technologies have huge built-in economies of scale. With digital technologies, the marginal cost of one more customer is generally fairly trivial.

Banks can imitate all these characteristics, but banks are more product centric and slower at innovation. In part, they are slow because they are regulated. The Silicon Valley ethos of moving fast and worrying about regulators later is not one that can work for banks. FinTech firms also have the benefit of starting with no legacy systems or products. They do not have to fight with vested interests within the firm. They do not have to get approvals from a bureaucracy. They can choose the best adapted IT system for the products they want to create. They can set up data collection for what they want to do. In contrast to young

firms, older firms find it more difficult to innovate. They have to overcome a variety of rigidities to innovate (see Loderer, Waelchli, and Stulz, 2016).

4.1.b. Regulatory costs.

Miller (1992) pointed to regulation as a major driver of financial innovation. His view was that the financial regulation apparatus erected in the U.S. in the 1930s and 1940s offered substantial rewards to "those successfully inventing around the government-erected obstacles." Much of FinTech activity finds ways of bypassing regulations that affect banks. This does not mean that FinTech firms are not regulated at all. Many FinTech products still require authorizations at the state level, for instance. However, banks have regulatory costs that FinTech firms do not have and these costs are important. As discussed earlier, regulation is partly the result of the fact that banks are special. If banks are sufficiently special, they earn enough from their specialness to pay for the cost of regulation.

Banks have capital requirements. These capital requirements increase the cost of products for banks if these products involve balance sheet assets (see, e.g., DeAngelo and Stulz, 2015). Before the global financial crisis, only the banking subsidiary of a bank holding company was subject to a capital requirement that did not depend on the riskiness of assets, a leverage ratio requirement, in addition to a requirement that depended on the riskiness of assets, a risk-based capital requirement. More recently, however, bank holding companies have become subject to a leverage ratio requirement, which is a capital requirement that is proportional to the size of the assets of a bank (with some exceptions). This means that customer balances of a subsidiary are subject to a capital requirement for a bank, but not a Fintech firm.

It may well be that capital requirements are a less costly form of regulation than the various compliance costs banks incur. The concern when it comes to FinTech competition is not with whether banks should be incurring these costs, but with the fact that banks and FinTech firms face different regulatory costs for similar activities because they are subject to different regulations. For instance, banks have to make sure that they do not inadvertently help customers engage in money laundering or criminal activities. They have to organize their activities so that they do not give the appearance of discrimination or actually discriminate.

They have to convince regulators that their activities do not involve risk-taking that could be problematic. Banks have to make sure that they meet regulatory requirements in the U.S. from different agencies at the federal level as well as from regulators at the state level. In their international activities, they have to satisfy regulators in each country in which they are active.

Differential regulation of banks means that banks have higher costs than non-banks. For instance, a recent study looks at the U.S. mortgage origination market, where shadow banks have captured a large share of the agency mortgage market since the GFC. The study concludes that 60% of the increase in the market share of shadow banks comes from an increase in regulatory costs and 30% of the increase is accounted for by technological advances (Buchak, Matvos, Piskorski, and Seru, 2018). If non-banks were to offer exactly the same product as banks, eventually they would capture the whole market for that product. However, non-banks do not have the benefits of a bank franchise. This bank franchise creates trust in a way that non-banks cannot easily replicate. As a result, one would expect the equilibrium for a product where both banks and non-banks compete to be one where both banks and non-banks have market share as long as the bank franchise has value.

In general, we would not expect regulation that creates an uneven playing field in the supply of a given product to remain the same. More focus on regulation of products rather than firm types would lead to a more level playing field. Deregulation of banks for products supplied both by non-banks and banks would also lead to a more level playing field. Any such evolution would reduce the cost advantage of FinTech firms.

A good example of where FinTech firms exploit regulatory differences is their use of float. Float is a major source of profits for many FinTech firms.[6] They collect money upfront and use it, generally paying no interest on it. A vivid example of this is the plan for Libra where funds from users would be invested to pay for management of the currency and reward the founders. If a bank captures float, it is regulated in doing so and has to reserve capital. Float also creates risk for a bank, so that banks have to match highly

[6] See "Will fintechs sink or swim when floats are regulated?" by Izabella Kaminska, Alphaville, January 7, 2019.

liquid assets to highly liquid liabilities. Without the advantages of unregulated float, FinTech firms lose a major cost advantage. It is hard to believe that this advantage is permanent. In some countries, like China, this float advantage has been reduced through regulation recently.

4.1.c. Legacy systems.

It is noteworthy that the technology budgets of large banks are enormous. The technology budget of JPMorgan for 2019 is $11.4 billion.[7] Of that amount, half was targeted to disruptive technologies within the bank. The bank with the next largest budget, Bank of America, is planning to spend $10 billion. By way of comparison, JPMorgan's investment in technology for 2019 is the same amount as FinTech-based VC investments in the U.S. in 2018.[8] At the same time, however, part of these budgets is used to maintain and fix systems put in place more than fifty years ago.

In U.S. banks, computers started to be used widely in the 1960s and 1970s. Operating systems put in place then are still part of the IT infrastructure of many banks (see Protivi, 2019). These systems are written in COBOL, which is a language mastered mostly by programmers close to retirement. Today's large banks were built through acquisitions as well as through internal growth. Acquired banks typically had different IT systems from the acquiring bank. Different divisions of banks built their IT systems differently. At times, different trading desks had different IT systems. As an example of the complexity of bank IT systems, in 2015, Deutsche Bank had 45 operating systems in the bank. Both because of their age and of their complexity, the IT systems of banks are such that they lack the agility of systems constructed from scratch to support FinTech activities.

A related issue is that the data at large banks is not organized in a way that it can be mined using machine learning techniques. This means that to be able to use these techniques, banks have to massively reconfigure their data. Not surprisingly, these banks are trying to fix that problem, but it is not

[7] "Here's a breakdown of how much US banks are spending on technology," by Dan DeFrancesco, Business Insider, March 28, 2019.
[8] See KPMG, The Pulse of Fintech – H2' 2018.

straightforward to do so. As one JPMorgan executive put it: "We are in a massive process of making that data usable, in a very clean, consistent way (…) It takes time, money, and effort to really clean up all of that."[9]

Maintaining legacy systems is extremely expensive for banks – for a really large bank, the cost is in the hundreds of millions per year. However, replacing legacy systems involves a huge cost and entails massive risks. It is therefore not surprising that banks are reluctant to replace legacy systems. This does not prevent banks from taking advantage of the technologies that are used by FinTech firms, but makes it difficult to integrate the use of these technologies within their systems. For instance, one of the most successful new banks, Marcus, was set up as a greenfield bank by Goldman Sachs, so that it did not have to force it onto legacy systems. Banks can also partner with FinTech firms. Nevertheless, as long as banks rely on legacy systems for their core banking activities, they will be at a disadvantage.

4.1.d. The costs of diversification

Large banks are large diversified firms. They have many activities. In principle, these activities should have synergies, so that a bank engaging in one of these activities should have an advantage over a stand-alone firm engaging in only that activity. In practice, however, the size of the synergies is not always obvious. The reason is that large diversified firms are also complex firms with entrenched interests, huge policy manuals, and vast bureaucracies. Managing a diversified firm is difficult. This is especially so for a firm that is heavily regulated. A bank has to be managed so that it will comply with laws and regulations. For a large bank, monitoring compliance is the work of thousands of employees. To ensure the right outcomes, a large firm has to have policies and procedures. These policies and procedures ensure that the firm operates well, but they have the obvious cost of making innovation harder and hinder the firm's ability to respond quickly to changes in its environment.

[9] "JPMorgan is in the middle of a 'massive process' of cleaning up thousands of databases, and it's hoping to unleash AI once it's finished," by Dakin Campbell and Matt Turner, Business Insider, February 5, 2019.

Young firms do not have a complex administrative apparatus and policy manuals. Firms develop these attributes when they mature and are focused more on operating existing assets than on developing new ones (Holmstrom, 1989). Established banks in the financial industry have inherent advantages. They have a large customer base that is the foundation of their franchise. However, as a bank grows in size, management has to rely more on formal rules. The existence of such rules hinders innovation.

Compared to a FinTech firm, innovation at a large bank can be less profitable because it may cannibalize existing activities. For instance, large banks have large networks of branches. Online activity can mean less activity at branches. To the extent that branches have large fixed costs, online activity increases the average cost at branches and hence makes them less profitable. As a result, establishing an online bank is less profitable for an established bank than for a bank that has no branches in place. The existence of branches can therefore slow down innovation.

Another problem with large diversified firms is that many top managers have fiefdoms to defend and grow. Rather than working for the good of the bank, top managers may at times be tempted to protect and grow their fiefdoms. This is a critical issue when introducing a new product. A bank may have a very successful product that would lose market share if a new product is developed. If the new product is developed by an entity within the bank that differs from the one that is responsible for the existing product, the latter entity will resist development of the new product. It is much easier to have an organization support online banking if that organization does not have branches. A FinTech firm that develops an online bank is in the enviable position of not having entrenched interests that are worried about the impact of the online bank on their fiefdoms.

An example of the potential role of entrenched interests in the development of digital banking is the experience of JPMorgan. In October 2017, JPMorgan launched a digital-only banking app, named Finn, with the aim to attract millennials. Recently, it converted the accounts from that app into traditional accounts. An article discussing why Finn apparently failed argues that the lack of organizational buy-in was

crucial, stating that "Finn was established as separate from Chase's traditional consumer banking group."[10] According to that article, that group felt that Finn posed a threat to Chase's traditional checking account, stating that "The two sides were in a zero-sum game in which a new account on Finn could mean a missed opportunity for Chase."

4.1.e. What about crypto?

I have focused on the activities of FinTech that directly compete with banks. Crypto currencies do not compete with banks but with currencies issued by central banks. They do so poorly. A currency should have stable value and should be exchangeable for goods immediately and with no transaction costs. Bitcoin fails on these counts. It has been highly volatile, cannot typically be used as an instrument of payment, and transactions in bitcoins take time. For instance, exchanging bitcoins for dollars to pay for a cup of coffee may cost more than the cup of coffee. Individuals who want to transact bitcoin have to go through exchanges that have a checkered history. At one point, Mt. Gox was handling over 70% of the transactions in bitcoin. In 2014, it announced that 850,000 bitcoins belonging to customers and the exchange were missing and filed for bankruptcy.

Though the weaknesses of bitcoin and its competitors are widely recognized, many FinTech enthusiasts argue that the backbone of bitcoin, namely the blockchain, will lead to a revolution in finance. A blockchain is a record of transactions constructed in such a way that historical transactions cannot be tempered with and such that new transactions are added through a decentralized consensus mechanism. The original blockchain is the bitcoin blockchain. With bitcoin, new blocks are added to the blockchain through the work of miners who solve a complicated mathematical problem. Smart contracts can be integrated in the blockchain, so that some actions will be taken automatically if certain conditions are met. Most blockchain applications that are discussed are quite different from the bitcoin blockchain. Instead of a decentralized consensus mechanism, they are permissioned blockchains or private blockchains. The technology for

[10] See "JPMorgan's finance app for millennials was plagued with issues from the start. Here's the inside story of how Finn fell apart." by Dan DeFrancesco and Dakin Campbell, Business Insider, June 27, 2019.

permissioned blockchains predates bitcoin by many years. With such blockchains, agents who are authorized to make changes to a ledger can do so according to some rules.

As the columnist Noah Smith put it, it is hard to believe that such a technology would not end up having some uses. However, so far, the evidence of great successes is rather limited. Permissionless blockchains and smart contracts require trust. There has to be trust in the software, to start with. Though many grandiose claims are made about these revolutionary technologies, it is useful to take note of the perspective of a FinTech entrepreneur that "in less than a decade, three successive top bitcoin exchanges have been hacked, another is accused of insider trading, the demonstration-project DAO smart contract got drained, crypto price swings are ten times those of the world's most mismanaged currencies, and bitcoin, the 'killer app' of crypto transparency, is almost certainly artificially propped up by fake transactions involving billions of literally imaginary dollars."[11]

5. BigTech and the future of banks.

BigTech firms are technology companies whose business model is focused on exploiting digital technologies. Examples are Amazon in the U.S. and Alibaba in China. These companies are organized around two-sided platforms. They have suppliers of goods and purchasers of goods. The browsing and transacting of buyers and sellers on the platform create a huge amount of data. This data is extremely valuable. It makes it possible for the BigTech firms to understand how demand and supply for goods is evolving and to target advertising and product offers to those customers who are likely to be most receptive.

U.S. BigTech firms have not been very active in financial services, but they are becoming more so. This is in sharp contrast with BigTech firms in China. The Alibaba group includes a company called Ant Financial which is a financial services company. One of its subsidiaries is Alipay, which is the largest mobile payment company in the world. It has more than 700 million active users. It also operates a money market fund that is the largest money market fund in the world, Yu'e Bao, with a NAV in excess of $150

[11] See "Blockchain is not only crappy technology but a bad vision of the future," by Kai Stichcombe, Medium, April 5, 2018.

billion. It owns an online bank, called MYbank. It also has an insurance company. A newly developed health plan has 50 million users. In 2018, Ant Financial raised $14 billion in venture capital; by comparison, all FinTech investments in Europe and the U.S. amounted to $15.9 billion according to one estimate.[12] Its valuation is approximately the sum of the market capitalization of Goldman Sachs and Morgan Stanley together.

Ant Financial has demonstrated how a platform's data can be used effectively to grant credit. Through MYbank, it grants credit to SMEs that sell on Alibaba's Taobao platform. As described in Hau, Huang, Shan, and Sheng (2018), Ant Financial uses both historical data and real time sales data on the platform, including ratings by customers, to grant credit lines to SMEs. With the help of machine learning techniques, it uses the data available to assign credit scores to platform sellers. It has an automated process to offer credit lines to SMEs whose credit score exceeds a threshold. The sellers who are granted credit fill an online form to receive the credit. They can do so in a couple of minutes. The credit line is withdrawn if the score of the seller drops below a minimum threshold. The default rate is quite low at 1.2%.

The credit granting process of MYbank to platform sellers shows the advantages that BigTech can bring to bear to compete with traditional banks. BigTech firms are heavy investors in data analytics that can be used across many activities. More importantly, though, these data analytics are of little use if data is sparse. These firms sit on huge amounts of data that they collect in real time. In the case of MYBank and Taobao, the data used is clearly richer than the data that is traditionally used to make credit decisions. The data available to platforms could be used more generally for loans to customers as well.

BigTech firms have the customer base to operate a platform bank. A platform bank would not be competing with banks in a specific activity, but would be competing with banks across all customer-oriented activities, from deposits to payments and wealth management. In their current activities, FinTech firms typically rely on banks for many of their services. They put cash in bank accounts, have bank lines of credit, use banks for payments, and so on. A BigTech firm with a platform bank does not have to rely on

[12] See "China's Ant Financial raised almost as much money as all US and European fintech firms combined," by John Detrixhe, Quartz, January 30, 2019.

existing banks. It could have its own affiliated bank through which it could have deposit accounts, provide customers with credit cards, and provide them with e-cash. It could also make available to its customers a great variety of financial services from third parties. It could help them make choices among these services. BigTech firms have potentially big advantages compared to banks and to FinTech firms. They have all the technical knowhow and up-to-date systems that FinTech aspires to. They have the scale that large banks have. They have access to data that banks and FinTech firms do not. They have neither the legacy nor the organizational issues that banks have.

4. Conclusion.

FinTech firms compete with banks for specific activities. FinTech firms have the advantage of less regulation, of not being part of big inflexible organizations, and of not being saddled with legacy IT systems. However, banks are unique in a way that non-banks cannot replicate. FinTech banks, which are online banks, can compete with banks on interface with consumers and convenience, but legacy banks have the advantage of a big consumer base, of experience in dealing with regulators, and of offering a broader set of products. FinTech firms can make banks better as they have to compete harder, but greater competition does not make banks safer. As greater competition makes banks less special, they are likely to take more risks to attempt to be profitable with their current cost structure. If they cannot take more risks, they will have to reduce their costs sharply and become more like utilities.

BigTech firms have unique advantages that allow them to replace traditional banks. A well-known blogger and author summarizes the difference between FinTech firms and BigTech firms (sometimes called TechFin firms) as follows: "fintech firms are making faster horses whereas techfin firms are working with airplanes."[13] At the same time, however, the strength of BigTech in banking is in consumer finance and lending to SMEs. It is not in investment banking. JPMorgan earned in 2019 a $123 million fee for advising Allergan in its acquisition by AbbVie. This is in sharp contrast to the losses of most FinTech firms trying

[13] Cited in "The future of banking: Fintech or techfin?" by Jim Marous, Forbes, Aug. 27, 2018.

to gain market share. After having seen the U.S. banking system evolve towards the universal bank model, we may see it evolve towards a system with large investment or merchant banks and large consumer banks. Such an evolution could be problematic as a strong deposit base was an asset for banks during the global financial crisis and is likely to be so in other periods of stress.

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