VOLUME 31
NUMBER 4
FALL 2019

Journal of
APPLIED
CORPORATE FINANCE

The Fed and the Financial System

Columbia
Business
School

FinTech, BigTech, and the Future of Banks

by René M. Stulz, The Ohio State University*

In 1994, Bill Gates famously said that banks are dinosaurs. Since then, bank assets in the U.S. have more than quadrupled (from $3.7 trillion to $17.4 trillion) while the number of banks has fallen by more than 50% (from 10,453 to less than 5,000). Today, we have many fewer, but 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 many to claim, once again, that banks were on the verge of extinction and about to be replaced or fundamentally disrupted by FinTech firms. In 2018, for example, the Gartner group announced that "digitalization will make most heritage financial firms irrelevant by 2030."[1]

What is the market saying? Since 2013, when Google Trends shows that interest in FinTech took off, until this writing (fall of 2019), the Dow Jones U.S. Banks Index has more than doubled, and more than held its own with respect to the S&P 500. But if there is no evidence that the stock market has priced bank stocks as if banks were an endangered species, does this mean that we can ignore FinTech? Does it represent a competitive threat to banks? Are banks immune to disruption? Or is the stock market just confused about the prospects of banks? In this article, I examine how FinTech is likely to affect the future of banking and banks.

But first, what do we mean by "FinTech"? Let's start with the definition adopted by the Financial Stability Board: "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] Given 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. In 1992, Merton Miller wrote that "No 20-year period has witnessed such a burst of innovative activity," while noting that one of the causes of this burst was "the information revolution, and especially in the electronic computer." But for purposes of this article, there is a more appropriate definition: financial innovation that is 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, it is firms like Alibaba and Tencent. The Chinese counterparts of the U.S. firms have already made big inroads in financial services markets—but the U.S. firms have not. The challenges for banks posed 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 aims to wrest market share from banks, typically in a specialized segment of the credit market. BigTech firms, by contrast, 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.

To understand how FinTech and BigTech threaten banks, it is important to understand whether there is something distinctive or even unique about banks that makes it hard

*I am grateful for comments from Don Chew, Harry DeAngelo, Mark Johnson, Leandro Sanz, and Amin Shams.

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). Full citations are provided in the References at the end of the article.

3 See Frost, Gambacorta, Huang, Shin, and Zbinden (2019).

for nonbanks to compete with them. In this article, I begin by arguing that banks are indeed "special"—as some studies have called them—but that some aspects of their traditional competitive advantage are vulnerable to technological developments that predate the digital and big data revolution. Banks earn revenues from both sides of their balance sheet as well as from activities that do not show up on their balance sheets. In fact, a typical large bank is best viewed as a portfolio of activities. Most of these activities are or could be undertaken by nonbanks, so that banks compete with nonbanks in most if not (potentially) all of these activities. For instance, nonbanks, like consumer finance companies, hedge funds, and private equity funds, all make loans. However, nonbanks do not offer demand deposit accounts. With deposit accounts, banks offer *safe, liquid claims that are instantly redeemable*. To offer deposit accounts, banks must gain the trust of their customers that these deposit accounts will always be instantly redeemable. Deposit insurance helps them win and maintain that trust. Banks compete with nonbanks for deposits, but nonbanks cannot offer deposit accounts that have all the benefits of bank deposit accounts.

In large part because of their deposit-taking function, banks play a key role in the financial system. But as a brief look at the history of banking, particularly in the U.S., makes clear, they are fragile. At the first sign of weakness in a bank, customers can withdraw their deposits, leading to runs that can cause banks to fail. Bank failures can be contagious and endanger the financial system. Because of the fragility of banks and the potential systemic risk of bank failures, banks are heavily regulated.

For banks themselves, regulation is a mixed blessing. Bank regulation creates barriers to entry that contribute to banks' profitability and staying power, but such regulation also provides obstacles to banks' growth and increases their operating costs. FinTech firms that want to compete with banks without becoming one can do so 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 competing with banks by hamstringing the banks themselves. For instance, banks are subject to many regulations that force them to take steps to ensure that their customers are not using their services to "launder" money. FinTech firms do not have to follow the same regulations. Further, banks are subject to capital requirements, even though many bank activities, such as intermediating repo transactions or many types of payment activities, would require almost no capital to support them if conducted outside a bank. And because FinTech firms are not subject to capital requirements, they can conduct bank activities at lower cost. In short, regulation designed to protect the banking system ends up helping 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 that offer similar products because they already have huge "installed" customer bases, or "franchises." Nevertheless, there are at least two obstacles that may limit large banks' ability to replicate FinTech innovations.

The Achille's heel of large banks are IT systems that have been built not from scratch, but through a decades-long process of "add-ons." Such systems continue to rely on parts using computer languages that most IT people no longer know. Integrating FinTech innovation into such an IT platform can be problematic if not impossible.

And that brings us to the second big obstacle to innovation. Large banks are huge diversified financial conglomerates that have most of the "agency" problems, or internal conflicts of interest, that are known to reduce the efficiency and value of large nonfinancial conglomerates. Such banks often have territorial managers who will resist, and even work to suppress, innovations that could threaten the profitability and future of their own operations. Because of their size, diversity, and regulation, banks also have to rely on rules and organizational practices that make them more rigid.

In the pages that follow, I start by explaining why banks are special, but why these sources of competitive advantage have eroded over time. Next, I review the main areas in which FinTech firms are active and discuss why such firms are competing effectively with banks in many of their business lines and, by so doing, making banks even less special. At the same time, FinTech firms are developing new tools and approaches that have been appropriated by the banks themselves, enabling them to become more efficient and successful.[4] I close by discussing the more serious potential threat that BigTech (as opposed to FinTech) poses for banks.

Why Banks Are Special—But Not as Special as They Once Were

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

4 In this article, I devote only limited attention to the global dimension of FinTech and to the FinTech firms that develop products that help banks to become more productive or have better products.

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 riskless claims in the economy—claims that can be redeemed at par on sight. Banks offer such claims and invest the proceeds in ways that ensure they can pay for the costs of offering such claims. From 1896 to 2012, as reported by a recent study,[5] deposits have financed 80% of bank assets, on average. This percentage has been remarkably stable, reaching a peak slightly above 90% in the 1940s, dipping just below 70% in the 2000s before the global financial crisis (GFC), and rebounding very sharply thereafter. By contrast, the fraction of bank assets represented by loans has been much less stable. The norm has been around 60%, but it decreased in the 1930s to fall below 20% during World War II before rising above 50% again in the late 1960s.

Deposits are both a source of value and a source of fragility for banks.[6] They are a source of value because they are a source of cheap and stable funding. Deposits that are not insured are a source of fragility because their owners have both the incentives and the ability to withdraw them at the first sign of trouble at a bank. In banks where deposits are a major source of value, a critical role of management is to ensure that the combination of a bank's high leverage and interest rate, credit, and other risks does not threaten its deposit holders.[7] And this means that effective risk management is at the core of the success of most banks. Nevertheless, banks must earn enough on the funds they raise to be profitable. To manage risk, they have to invest in a diversified portfolio. Investing in safe marketable assets would not be a solution because the proceeds from such assets would not be enough for banks to make a profit. As a result, banks invest at least part of their assets in diversified portfolios of loans.

One reason banks invest in loans is that they have a comparative advantage in originating and monitoring them. Thanks to their deposit accounts, they accumulate information about their customers. And so when customers want to borrow from banks, banks have an information edge over nonbank lenders when it comes to making such loans. They also have an information edge in monitoring the credit quality of customers who are borrowers. This information advantage of banks can be important when making loans initially as well as when renewing them.

To build shareholder wealth from their deposits, banks have to increase their deposit bases. To that end, they can expand the range and quality of services they offer. Depositors are more likely to stay with banks that can fulfill most if not all of their various financial needs. Moreover, as banks acquire depositors with more complex needs, their range of services will increase, and they will find it worthwhile to have more product lines. Banks also try to offer services for corporate or individual depositors with cash overflows that might end up being used to generate higher returns. Along with savings accounts, they will offer investment products such as various types of mutual funds. They may also offer investment advice. Similarly, when banks compete for loans, they often offer other services, perhaps at first as "loss leaders," that corporate borrowers find valuable in part to discourage such borrowers from seeking relationships with other banks. As banks extend the scope of their services, they hope to earn profits on these services as well, so that each becomes valuable on a stand-alone basis.

Through this development, banks can evolve into financial services conglomerates from institutions that mainly just offer deposit accounts and make loans. It is well known that conglomerates can have both advantages and disadvantages over more specialized firms.[8] Banks can have economies of scale and economies of scope. The economies of scale arise because many banking activities have low marginal 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 banks have about their customers, but many banks have not been organized effectively 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.[9] 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 banks take advantage of when combining their different activities are sufficient to offset the costs of diversification is likely to depend on bank-specific attributes.

5 As shown by Hanson, Shleifer, Stein, and Vishny (2015).
6 Diamond and Rajan (2000).
7 As shown by DeAngelo and Stulz (2015).
8 Maksimovic and Philips (2013).
9 Stein (2002).

The existing evidence suggests that, on balance, banks do not gain from economies of scope in that diversified banks trade at a discount, on average,[10] to more focused banks, and that large banks are not valued more highly than smaller banks.[11]

Why the Value of the Bank Franchise Has Fallen

Although banks are special in some ways, what makes them special also tends to make them fragile, as Doug Diamond and Raghu Rajan argued in a seminal study.[12] As banks engage in new activities, such activities have risks that can make them even more fragile. In many countries, the fragility of banks has led to the creation of deposit insurance. But instead of discouraging risk-taking, deposit insurance can provide incentives for banks to take more risk, which means that more regulation is required to control these incentives.

Eventually, regulators decided that banks had to satisfy formal capital requirements. Following the GFC, a new wave of regulations was imposed. Nevertheless, 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 social goals and using banks to enforce various laws. For instance, banks are subject to rules that direct them to lend to underprivileged, but less qualified borrowers, and to other rules designed to deter money laundering.

Regulations have also fueled the growth of nonbank 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 of limiting the size of the balance of payments deficit while also protecting the savings and loan banks. These ceilings, which remained in effect until the 1980s, made it advantageous to start money market funds that offered higher rates than term deposit accounts at banks. The ceilings also fueled the growth of the euro-dollar market, which is a market for dollar-denominated offshore deposits not subject to ceilings and to various other regulations. And 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.[13]

Not surprisingly, therefore, nonbanks 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, nonbanks can offer attractive substitutes because they do not have to meet bank regulations.[14]

Importantly, technological developments have also reduced the comparative advantage of banks in information production as it has become easier to access information about business borrowers and retail loan customers, and as quantitative techniques have made it easier to screen borrowers. The information collected by an analyst 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, the main evidence that banks are special takes the form of the favorable stock-price reactions experienced by companies when announcing their successful arrangement of bank loans.[15] But this favorable market reaction has dissipated over time, which is consistent with a decrease in the value of the bank franchise. Indeed, as reported in a 2015 study,[16] the stock-price reaction to loan announcements fell over time such that, by the early 2000s, it was close to zero. Nevertheless, there is some evidence that the market reaction turned positive during and immediately after the GFC, suggesting that the information advantage of banks may become (more) valuable in crisis periods.

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 thus viewed as consumer friendly. It is perhaps not surprising that FinTech became an important search topic on Google only after the iPhone became available.

S&P Global, in its 2018 "U.S. Fintech Market Report," divides FinTech activities into six types: payments, digital lending, digital banking, digital investment management and personal finance, blockchain, and insurtech. I will ignore insurtech, the FinTech of the insurance sector, since its relevance for the topic of this article is too limited. I now discuss each of the other five categories in turn.

10 Laeven and Levine (2007).

11 Minton, Stulz, and Taboada (2019).

12 See Diamond and Rajan (2000). They present a purely economic argument for the fragility of banks. Calomiris and Haber (2015) show that bank fragility can have political causes as well.

13 See, for instance, Acharya, Schnabl, and Suarez (2013).

14 This type of competition reduces the value of bank franchises, as noted some 25 years ago by Gorton (1994).

15 See the seminal study of James (1987).

16 See Li and Ongena (2015).

1. **Payments**

The payment system is huge. For example, in 2014, total payments of $884 trillion passed through the Fedwire, which is the real-time gross settlement funds transfer system for financial institutions operated by the U.S. Federal Reserve Banks. The best-known payment company in the U.S. is Visa, which had a market capitalization of roughly $400 billion in August 2019. Its stock price increased more than tenfold in the last decade.

By far the largest number of FinTech firms is in the payments category. In the *Forbes* list of the 11 biggest FinTech startups in 2019,[17] the largest is Stripe, which at the time of the ranking was valued at $22.5 billion. Started as a service to help online sellers process payments, the company has moved into many other services related to payments. Statista, an online portal for statistics, estimated the total transaction value in the online payment processing in 2018 at $877 billion.

One especially popular component of that segment facilitates peer-to-peer payments—for instance one individual making a payment to another individual using a smartphone—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 that includes the largest U.S. banks, has developed a similar product called Zelle. In the third quarter of 2018, Zelle's payment volume was just over $30 billion and thus more than double Venmo's $15 billion.

2. **Digital Lending**

According to S&P, 16 prominent U.S. FinTech lenders originated loans for $41.1 billion in 2017. These digital lenders were focused on three types of loans: personal loans, small business loans, and student loans. The best-known of the group of 16 is LendingClub, which was founded the year before the iPhone was introduced. After experiencing serious growing pains, it 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, but its funding partner is a bank. Its decisions are often made within minutes using nontraditional data, such as shipping data for the business. It has made over $6 billion of loans to more than 150,000 businesses. At the beginning of 2019, it was a unicorn with a valuation of $1.2 billion. Another 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.

3. **Digital Banking**

Though some classifications of FinTech include digital lending as part of digital banking, S&P views it as a separate category. One way to think about digital banking is that it includes mobile banking and the infrastructure that supports it. Some FinTech firms are banks. One well-known example is the U.K.'s Atom Bank, which was set up in 2014 as a bank that would deliver services through a smartphone app. Today, of course, all large banks have digital banking of some sort; and the largest banks have extensive suites of app features. For instance, three of the world's four largest 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.

What's more, digital banking has attracted considerable funding in 2019. Nubank, which is a Brazilian online bank, is valued at $10 billion and received an infusion of $400 million this year from investors that include U.S. venture firms. N26 is an extremely successful German online bank that is adding 10,000 accounts a day and has customers in 24 countries.[18] Nevertheless, both N26 and some British challenger banks are being questioned by regulators about their risk management and compliance policies. As their policies become more like those of established banks, their costs will be higher and their advantage over these banks will diminish.

4. **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, cryptocurrencies, 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, which offers a menu of free services such as credit scores and help in improving such scores. The third one is Plaid, which connects payment apps to personal finance sites where individuals can aggregate their personal financial infor-

17 See "The 11 biggest fintech companies in America 2019," *Forbes*, February 4, 2019.

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

mation from various accounts. Robo-advisors also belong to this type of FinTech firms.

However, all the top asset management firms now have similar online offerings.

5. **Blockchain**

Two startups among the Forbes 11 are devoted to cryptocurrency trading and providing services for cryptocurrency investing and trading. This enthusiasm is surprising given that the main uses for cryptocurrencies are widely believed to be illicit transactions and speculative investments rather than as a store of value and a payment instrument for normal transactions.[19] Enthusiasm about 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—though often one that is private rather than public—has succeeded in generating enthusiasm even among cryptocurrency skeptics. 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 in 2017, IIN now comprises more than 70 banks that use a mutually accessible ledger to verify cross-border transactions. However, this technology predates the bitcoin blockchain by many years and lacks the features that blockchain proponents are most 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. Five of the top 10 for 2018 are Asian firms. Only three U.S. non-insurance firms are in the ranking. In countries with less developed banking 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. One recent study[20] shows that, among 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 financial development is lower and banks earn more rents.

The Impact of FinTech on Banks

Having just reviewed the various types of FinTech activities that are potential threats to banks, I now offer reasons why FinTech firms can be successful in attacking banks, but why this success also has obvious limits. I discuss three main reasons FinTech firms can be expected to take market share in some businesses that banks are active in: (1) the regulation of banks; (2) legacy IT systems; and (3) organizational frictions inherent in diversified firms.

I begin by focusing on the non-crypto FinTech firms and then discuss the crypto FinTech activity. The reason for drawing this line is that the non-crypto firms engage in activities that banks dominated before the advent of FinTech. Before FinTech, banks were facilitating payments, making loans, and advising investors, and retail and corporate clients. There were online banks before the iPhone. The first online bank in the U.S. was founded in 1994—perhaps, not surprisingly, in Palo Alto. In these activities, FinTech firms can compete with banks by offering cheaper and better products. Cryptocurrencies, by contrast, compete not with banks but with *central* banks. However, to complicate matters, the cryptocurrency FinTech sector also has technological innovations that are used more broadly within FinTech and can be used to challenge banks.

The FinTech Advantage

The digital and big data innovations made possible many new products and practices across the whole economy. Important innovations are not, of course, adopted instantly by all companies in an industry. There are first movers; and if the innovation turns out to be sufficiently important, eventually all firms in an industry adopt it. Those that don't are either acquired or cease to exist. In cases where implementing an innovation does not require large amounts of capital and a preexisting infrastructure, startups often have advantages in exploiting it. They have no past and organizational inertia to hold them back. 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.

What's more, FinTech firms generally have a different business model from banks. They can innovate rapidly. They are less fearful of mistakes. They are more open to letting customers guide them towards better products. They focus on the interface with customers to create the most satisfying customer experience. An important factor that enables innovating FinTech firms to move faster is that digital

19 See Foley, Karlsen, and Putnins (2019).

20 Navaretti, Calzolari, Mansilla-Fernandez, and Pozzolo (2018).

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 they tend to be heavily invested in and committed to their existing products and, hence, are much less inclined and slower to innovate. Part of the reason they are slow is regulation. The Silicon Valley ethos of moving fast and worrying about regulators later would not work for banks. FinTech firms do not have to fight vested interests within their firms, or get approvals from bureaucracies. They can choose the best adapted IT system for the products they want to create. FinTech firms also have the benefit of starting with no legacy systems or products. They can set up data collection for what they want to accomplish. In contrast to young firms, older firms find it more difficult to innovate; they have to overcome all kinds of rigidities.

Regulatory Costs

Consistent with Merton Miller's observation 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 FinTech activity is designed to find ways of bypassing regulations that affect banks. This does not mean that FinTech firms are completely unregulated. Many FinTech products still require authorizations at the state level, for instance. Nevertheless, banks have regulatory costs that FinTech firms do not, and such costs can be decisive.

Among the most important bank regulations are capital requirements. To the extent these capital requirements force banks to operate with higher levels of capital than market forces would dictate, they increase the cost of products for banks when these products involve balance sheet assets.[21] Before the global financial crisis, only the banking subsidiaries of bank holding companies were subject to both a capital requirement (called the "leverage ratio" requirement) that did not depend on the riskiness of the bank's assets as well as a "risk-based capital requirement" that did. More recently, however, U.S. bank holding companies themselves have become subject to a leverage ratio requirement, which is a capital requirement that is proportional to the size of the bank's assets (with some exceptions). This change has meant that the customer balances of a subsidiary are subject to a capital requirement in the case of 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 whether banks should be incurring these costs, but whether banks and FinTech firms face significant differences in regulatory costs for similar activities stemming from differences in regulations. Banks, for instance, have to make sure that they do not inadvertently help customers engage in money laundering or criminal activities. They have to organize their lending activities so that they not only do not discriminate—but don't even give the appearance of discriminating—against classes of borrowers. And at the same time, they must 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. set and imposed by different agencies at the federal level as well as from regulators at the state level. And in their international activities, they have to satisfy regulators in each country in which they operate or have customers.

Greater regulation of banks means that banks have higher costs than nonbanks. As shown in a recent study of the U.S. mortgage origination market, shadow banks such as ROCKET Mortgage by Quicken Loans have captured a large share of the agency mortgage market since the financial crisis, and the growth of FinTech firms' share in this market has been spectacular.[22] Moreover, the study attributes 60% of the increase in the market share of shadow banks to increases in bank regulatory costs, and 30% to technological advances.

These effects of regulatory costs suggest that if nonbanks were to offer exactly the same product as banks, they would eventually capture the whole market for that product. On the other hand, nonbanks do not have the benefits of a bank franchise, which includes a history of delivering products and services to a fairly large and reasonably stable set of corporate and retail customers. Such a franchise reassures customers and so creates "trust" in a way that nonbanks cannot easily replicate. As a result, one would expect the equilibrium for a product where both banks and nonbanks compete to be one where both banks and nonbanks have market share as long as the bank franchise has value.

In general, we would expect regulation that creates an uneven playing field in the supply of a given product to be reformed by the political and legislative process. More focus on regulation of products rather than firm types would lead to a more level playing field. Deregulation of banks for products supplied by nonbanks as well as banks would also lead to a

21 See, e.g., DeAngelo and Stulz (2015).

22 Buchak, Matvos, Piskorski, and Seru (2018).

more level playing field. Any such evolution would reduce the regulatory cost advantage of FinTech firms.

One good example of how FinTech firms exploit regulatory differences is in their use of float, which is a major source of profits for many of them.[23] They collect money upfront, generally pay no interest on it, and then put it to work in other ways. Take Libra's plan to invest funds from users to pay for the management of the currency and reward the founders—Facebook and its partners. When a bank captures float, it is regulated in the sense that it has to reserve capital and faces restrictions on how to invest funds. Float also creates interest rate risk for a bank, which banks manage by matching highly liquid assets with highly liquid liabilities. Without the advantages of unregulated float, many FinTech firms would lose a major cost advantage. It is hard to believe that this advantage is permanent. In some countries like China, this float advantage has already been reduced through recent regulation.

Legacy Systems

The technology budgets of large banks are enormous. The technology budget of JPMorgan for 2019 is $11.4 billion.[24] 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 comparison, JPMorgan's investment in technology for 2019 is the same amount as FinTech-based VC investments in the U.S. in 2018.[25] Nevertheless, a significant part of these budgets is being used to maintain and fix systems put in place more than 50 years ago.

Computers started to be used widely by U.S. banks in the 1960s and 1970s. Operating systems put in place then are still part of the IT infrastructure of many banks.[26] These systems are written in COBOL, which is a language mastered mostly by programmers close to retirement. Moreover, the fact that today's large banks were in large part built through acquisitions of banks with different IT systems has meant that several different IT systems are often operating within the same bank. And different divisions within banks, and different trading desks, have also built their IT systems differently. As an example of the complexity of bank IT systems, consider Deutsche Bank, which in 2015 had 45 operating systems. Both because of their age and complexity, the IT systems of banks are such that they lack the analytical power and 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 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."[27]

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. Nevertheless, such reluctance has not prevented 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. But, as long as banks rely on legacy systems for their core banking activities, they will be at a disadvantage.

The Costs of Diversification

Large banks are large diversified firms with 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 value 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 effectively is difficult, especially for a firm that is heavily regulated. A bank must be managed so it complies with laws and regulations. For each of today's largest banks, monitoring compliance is the work of thousands of employees. To ensure the right outcomes, a large firm has to have policies and procedures that ensure that the firm operates well, but such procedures also have the obvious cost of posing obstacles to innovation and limiting the firm's ability to respond quickly to changes in its environment.

Startups do not have a complex administrative apparatus and policy manuals. Such firms develop these attributes as

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

24 "Here's a breakdown of how much US banks are spending on technology," by Dan DeFrancesco, *Business Insider*, March 28, 2019.

25 See KPMG, The Pulse of Fintech – H2' 2018.

26 See Protivi (2019).

27 "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.

they mature and become more focused on harvesting the potential of existing assets than on developing new ones.[28] And as already noted, established banks in the financial industry have inherent advantages. They have large customer bases that are the foundation of their franchises. But part of the costs associated with managing—and protecting—such franchises is management's reliance on more formal rules, implicit as well as explicit, that are designed to guide behavior throughout the organization.

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.

Yet another problem with large diversified firms is that it encourages many top managers to develop fiefdoms that they defend and grow. Instead of working for the good of the bank and its shareholders, some top managers may want to protect and grow their fiefdoms. This can be a serious obstacle when introducing a new product. A bank may have a very successful product that would lose market share if the new product is developed and promoted by the bank. 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. For example, banks that do not already have branches are much more likely to support online banking. A FinTech firm that develops an online bank is in the enviable position of not having entrenched interests worried about the impact of the online bank on their own products and services.

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 of attracting millennials. But, as discussed in a recent article, the bank ended up converting the accounts from that app into traditional accounts. According to the article, Finn's failure can be traced to the lack of organizational buy-in, and to the fact that "Finn was established as separate from Chase's traditional consumer banking group."[29] That group was said to view Finn as a threat to Chase's traditional checking account, with the "two sides engaged in a zero-sum game in which a new account on Finn could mean a missed opportunity for Chase."

What About Crypto?

Up to this point, I have focused on the activities of FinTech that directly compete with banks. Cryptocurrencies do not compete with banks but with currencies issued by central banks. They do not compete effectively. A currency should have stable value and should be exchangeable for goods immediately and with no transaction costs. Bitcoin fails on all 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.

But, in practice, most blockchain applications that are discussed have turned out to be quite different from the bitcoin blockchain. Instead of a decentralized consensus mechanism, they are "permissioned" or "private blockchains." The technology for 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. But so far, the evidence of great successes is rather limited. Permissionless blockchains and smart contracts require "trust" in the software. When considering the grandiose claims made about these revolutionary technologies, it is useful to consider the observation of one FinTech entrepreneur that

28 Holmstrom (1989).

29 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.

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.[30]

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 that include suppliers of goods and purchasers of goods. The browsing and transacting of buyers and sellers on the platform create huge amounts of data that are extremely valuable. Such data make it possible for BigTech firms to understand how demand and supply for goods are evolving, and so 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, though they are becoming more so. This is in sharp contrast with their Chinese counterparts like the Alibaba group, which includes a financial services company called Ant Financial, whose subsidiary Alipay is the largest mobile payment company in the world with more than 700 million active users. Ant also operates a money market fund, Yu'e Bao, that is largest in the world with a NAV in excess of $150 billion, and owns an online bank called MYbank, an insurance company with a newly developed health plan with 50 million users. In 2018, Ant Financial raised $14 billion in venture capital, and thus not much less than the $15.9 billion total of all FinTech venture investments in Europe and the U.S. that year.[31] And Ant Financial's current valuation, at about $150 billion, is roughly equal to the sum of the market capitalization of Goldman Sachs and Morgan Stanley.

Ant Financial has demonstrated how a platform's data can be used effectively to grant credit. Through MYbank, it grants credit to small businesses that sell on Alibaba's Taobao platform. Ant Financial uses both historical data and real time sales data on the platform, including ratings by customers, to grant credit lines to small businesses.[32] 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 small businesses whose credit score exceeds a threshold. The sellers who are granted credit fill an online form to receive the credit, which becomes immediately available. 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 associated with this process, at 1.2%, is quite low.

The credit granting process of MYbank to platform sellers shows the advantages that BigTech can bring to bear when competing against traditional banks. BigTech firms are heavy investors in data analytics that can be used to deal with many problems. On the other hand, these data analytics are of little value in cases where data are scarce. The tech firms sit on huge amounts of data that they collect in real time. In the case of MYBank and Taobao, the data they use to make credit decisions clearly appear to enable them to make better decisions than if they just used traditional data. 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 would not have to rely on existing banks. It could have its own affiliated bank through which it could have deposit accounts, provide customers with credit cards, and enable them to use 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 know-how and up-to-date systems that FinTech firms aspire to. They have the scale of large banks. They have neither the legacy nor the organizational issues that banks have. And, finally—and perhaps most important—they have access to data that neither banks nor FinTech firms have.

Conclusion

FinTech firms compete with banks in specific activities. FinTech firms have the advantage of being less regulated, not part of big inflexible organizations, and not saddled with legacy IT systems. However, banks have some distinctive competencies and advantages that nonbanks are unlikely to succeed in replicating. FinTech firms can compete with

30 See "Blockchain is Not only crappy technology but a bad vision for the future," by Kai Stinchcombe, *Medium*, April 5, 2018.

31 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.

32 As described in Hau, Huang, Shan, and Sheng (2018).

banks on interface with consumers and convenience, but banks have the advantage of large established consumer bases, experience in dealing with regulators, and a broader set of product offerings. 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, and erodes some of their advantages, traditional banks are likely to take more risks in attempting to remain profitable with their current cost structures. 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. One 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."[33] At the same time, however, the strength of BigTech in banking is in consumer finance and lending to small businesses; it's not in investment banking. In sharp contrast to the losses of most FinTech firms still trying to gain market share, JPMorgan just earned a $123 million fee for advising Allergan in its recent acquisition by AbbVie. After having seen the U.S. banking system evolve towards the universal bank model, we may see it reverse course towards a system with large investment or merchant banks and consumer banks.

RENÉ STULZ is the Everett D. Reese Chair in Banking and Finance, at the Fisher College of Business of The Ohio State University, and a research associate at the National Bureau of Economic Research.

33 Cited in "The Future of Banking: Fintech or Techfin?" by Jim Marous, *Forbes*, Aug. 27, 2018.

References

Acharya, V. V., P. Schnabl, and G. Suarez, 2013. Securitization without risk transfer. *Journal of Financial Economics* 107, 515-536.

Buchak, G., G. Matvos, T. Piskorski, and A. Seru, 2018. Fintech, regulatory arbitrage, and the rise of shadow banks. *Journal of Financial Economics* 130, 453-483.

Calomiris, C.W., and S.H. Haber, S.H., 2015. *Fragile by Design: The Political Origins of Banking Crises and Scarce Credit*. Princeton University Press.

Carstens, A., 2017. Big tech in finance and new challenges for stability. Bank for International Settlements, Basel.

DeAngelo H., and R.M. Stulz, 2015. Liquid-claim production, risk management, and bank capital structure: Why high leverage is optimal for banks. *Journal of Financial Economics* 116, 219-236.

Diamond, D.W., and R.G. Rajan, 2000. A theory of bank capital. *The Journal of Finance* 55, 2431-2465.

Financial Stability Board, 2017. Financial stability implications from FinTech.

Foley, S., J.R. Karlsen, and T.J. Putnins, 2019. Sex, drugs, and bitcoin: How much illegal activity is financed through cryptocurrencies? *Review of Financial Studies* 32, 1798-1853.

Frost, J., L. Gambacorta, Y. Huang, H.S. Shin, and P. Zbinden, 2019. Big Tech and the changing structure of financial intermediation. Bank for International Settlements, Basel.

Gorton, G., 1994. Bank regulation when 'banks' and 'banking' are not the same, *Oxford Review of Economic Policy* 10, 106-119.

James, C., 1987. Some evidence on the uniqueness of bank loans. *Journal of Financial Economics* 19, 217-235.

Hanson, S.G., A. Shleifer, J.C. Stein, and R.W. Vishny, 2015. Banks as patient fixed-income investors. *Journal of Financial Economics* 117, 449-469.

Hau, H., Y. Huang, H. Shan, and Z. Sheng, 2018. FinTech credit and entrepreneurial growth. Mimeo, University of Geneva.

Holmstrom, B., 1989. Agency costs and innovation. *Journal of Economic Behavior and Organization* 12, 305-327.

James, C., 1987. Some evidence on the uniqueness of bank loans. *Journal of Financial Economics* 19, 217-235.

Laeven, L. and R. Levine, 2007. Is there a diversification discount in financial conglomerates? *Journal of Financial Economics* 85, 331-367.

Li, C. and S. Ongena, 2015. Bank loan announcements and borrower stock returns before and during the recent financial crisis. *Journal of Financial Stability* 21, 1-12.

Loderer, C., R.M. Stulz, and U. Waelchi, 2016. Firm rigidities and the decline of growth opportunities. *Management Science* 63, 3000-3020.

Maksimovic, V., and G.M. Phillips, 2013. Conglomerate firms, internal capital markets, and the theory of the firm. *Annual Reviews of Financial Economics* 5, 225-244.

Miller, M.H., 1992. Financial innovation: achievements and prospects. *Journal of Applied Corporate Finance* 4, 4-11.

Minton, B., A. Taboada, and R.M. Stulz, 2019. Are the largest banks valued more highly? *Review of Financial Studies*, forthcoming.

Navaretti, G.B., G. Calzolari, J.M. Mansilla-Fernandez, and A.F. Pozzolo, 2018. Fintech and banking: friends or foes? unpublished paper.

Protivi, 2019. Modernizing legacy systems at financial institutions. https://www.protiviti.com/US-en/insights/modernizing-legacy-systems-financial-institutions.

Stein, J., 2002. Information production and capital allocation: Decentralized versus hierarchical firms. *Journal of Finance* 57, 1891-1921.

Journal of Applied Corporate Finance (ISSN 1078-1196 [print], ISSN 1745-6622 [online]) is published quarterly by Wiley Subscription Services, Inc., a Wiley Company, 111 River St., Hoboken, NJ 07030-5774 USA.

Postmaster: Send all address changes to JOURNAL OF APPLIED CORPORATE FINANCE, John Wiley & Sons Inc., c/o The Sheridan Press, PO Box 465, Hanover, PA 17331 USA.

Information for Subscribers
Journal of Applied Corporate Finance is published in four issues per year. Institutional subscription prices for 2019 are:
Print & Online: US$803 (US), US$959 (Rest of World), €624, (Europe), £491 (UK). Commercial subscription prices for 2019 are: Print & Online: US$538 (US), US$643 (Rest of World), €418 (Europe), £329 (UK). Individual subscription prices for 2019 are: Print & Online: US$133 (US), $133 (Rest of World), €111 (Europe), £76 (UK). Student subscription prices for 2019 are: Print & Online: US$48 (US), $48 (Rest of World), €40 (Europe), £27 (UK). Prices are exclusive of tax. Asia-Pacific GST, Canadian GST/HST and European VAT will be applied at the appropriate rates. For more information on current tax rates, please go to https://onlinelibrary.wiley.com/library-info/products/price-lists/payment. The price includes online access to the current and all online back files to January 1, 2015, where available. For other pricing options, including access information and terms and conditions, please visit https://onlinelibrary.wiley.com/library-info/products/price-lists. Terms of use can be found here: https://onlinelibrary.wiley.com/terms-and-conditions.

Delivery Terms and Legal Title
Where the subscription price includes print issues and delivery is to the recipient's address, delivery terms are Delivered at Place (DAP); the recipient is responsible for paying any import duty or taxes. Title to all issues transfers FOB our shipping point, freight prepaid. We will endeavour to fulfil claims for missing or damaged copies within six months of publication, within our reasonable discretion and subject to availability.

Journal Customer Services: For ordering information, claims and any inquiry concerning your journal subscription please go to https://hub.wiley.com/community/support/onlinelibrary or contact your nearest office.
Americas: Email: cs-journals@wiley.com; Tel: +1 781 388 8598 or +1 800 835 6770 (toll free in the USA and Canada).
Europe, Middle East and Africa: Email: cs-journals@wiley.com; Tel: +44 (0) 1865 778315.
Asia Pacific: Email: cs-journals@wiley.com; Tel: +65 6511 8000.
Japan: For Japanese speaking support, Email: cs-japan@wiley.com
Visit our Online Customer Help available in 7 languages at https://hub.wiley.com/community/support/onlinelibrary

Production Editor: Shalini Chawla (email: jacf@wiley.com).

Back Issues: Single issues from current and recent volumes are available at the current single issue price from cs-journals@wiley.com. Earlier issues may be obtained from Periodicals Service Company, 351 Fairview Avenue – Ste 300, Hudson, NY 12534, USA. Tel: +1 518 537 4700, Fax: +1 518 537 5899, Email: psc@periodicals.com
View this journal online at wileyonlinelibrary.com/journal/jacf.

Statement on Research4Life
Wiley is a founding member of the UN-backed HINARI, AGORA, and OARE initiatives. They are now collectively known as Research4Life, making online scientific content available free or at nominal cost to researchers in developing countries. Please visit Wiley's Content Access – Corporate Citizenship site: http://www.wiley.com/WileyCDA/Section/id-390082.html

Journal of Applied Corporate Finance accepts articles for Open Access publication. Please visit https://authorservices.wiley.com/author-resources/Journal-Authors/open-access/onlineopen.html for further information about OnlineOpen.

Wiley's Corporate Citizenship initiative seeks to address the environmental, social, economic, and ethical challenges faced in our business and which are important to our diverse stakeholder groups. Since launching the initiative, we have focused on sharing our content with those in need, enhancing community philanthropy, reducing our carbon impact, creating global guidelines and best practices for paper use, establishing a vendor code of ethics, and engaging our colleagues and other stakeholders in our efforts.

Follow our progress at www.wiley.com/go/citizenship.

Abstracting and Indexing Services
The Journal is indexed by Accounting and Tax Index, Emerald Management Reviews (Online Edition), Environmental Science and Pollution Management, Risk Abstracts (Online Edition), and Banking Information Index.