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**FINTECH DEVELOPMENT IN THE
PEOPLE'S REPUBLIC OF CHINA AND ITS
MACROECONOMIC IMPLICATIONS**

Yiping Huang

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Yiping Huang is a Sinar Mas Professor of Economics and Finance at the National School of Development and Institute of Digital Finance of Peking University.

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Please contact the authors for information about this paper.

Email: yhuang@nsd.pku.edu.cn

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Asian Development Bank Institute
Kasumigaseki Building, 8th Floor
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500
Fax: +81-3-3593-5571
URL: www.adbi.org
E-mail: info@adbi.org

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Abstract

FinTech has been transforming the financial landscape in the People's Republic of China. Its leading FinTech businesses such as mobile payment services and big data-based online lending are at the frontier of global development. At the same time, it also creates new problems, illustrated by the rise and fall of the peer-to-peer lending industry. The soon-to-be implemented central bank digital currency/electronic payment (DC/EP) may also bring about fundamental changes to the financial system. Overall, the FinTech development not only makes financial inclusion an achievable goal but also has important implications for financial and macroeconomic stability.

Keywords: FinTech, financial inclusion, financial risks, macroeconomic stability

JEL Classification: G23, O31, E60

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1. INTRODUCTION

The People's Republic of China (PRC) successfully maintained macroeconomic stability during much of the reform period. Until recently, the PRC's GDP growth stayed within a relatively narrow band while inflationary pressure remained very modest. Stable macroeconomic conditions are often regarded as one of the key factors contributing to the PRC's economic miracle (Dollar, Huang, and Yao 2020). However, over the last few years, the situation has started to change. For instance, GDP growth decreased steadily from 10.6% in 2010 to 6.1% in 2019. Financial risks also emerged in various parts of the economy. Many different factors probably caused these recent changes. In this paper, we intend to take a close look at the latest development of financial technology (FinTech) in the PRC and draw implications for its macroeconomic stability.

FinTech is currently revolutionizing the world's financial landscape at an extraordinary pace (Gomber et al. 2018; Goldstein, Jiang, and Karolyi 2019). This transformation is even more profound in the PRC (Chen 2016; Xiao et al. 2017; Huang and Huang 2018). Each of the two leading Chinese mobile payment service providers, Alipay and WeChat Pay, has around one billion active users. Many of these users organize their daily lives around payment ecosystems, from making doctor appointments to purchasing air tickets, and from paying electricity bills to investing in financial products. Each of the three main online banks, WeBank, MyBank, and XWBank, with between 1,000 and 2,000 staff, extends around 10 million loans annually for individuals and/or small and medium-sized enterprises (SMEs). FinTech development in the PRC has attracted widespread international attention (see, for instance, Frost et al. 2019; Klein 2019).

In many ways, the PRC's FinTech sector looks different from those in the developed world. While in North America and Western Europe much attention is placed on cryptocurrencies and cross-border payment, in the PRC, most of the headline news covers mobile payment and online lending. The PRC's FinTech landscape is dominated by a small number of unicorn players such as Ant, Tencent, Baidu, and JD Digits.¹ Unlike many of their developed country counterparts, most Chinese FinTech companies directly offer financial services by utilizing digital technology, i.e., big platforms linking large numbers of mobile terminals, cloud computing, and big data analysis. This often generates productive results but, at times, also causes serious problems, such as privacy invasion. Perhaps the most striking feature of the PRC's FinTech industry is its "inclusion" – it improves access to financial services by small and medium-sized enterprises (SMEs) and low-income households on scales never seen before in human history (Huang and Huang 2018; Chong et al. 2019).

The PRC's FinTech sector also evolved dramatically over time. It started in December 2004 when Alipay first came online, although the real boom didn't begin until June 2013, when Ant Financial successfully launched its online money market fund Yu'eobao. From 2014, the Government Work Report, which is delivered by the Premier at the National People's Congress at the beginning of the year, mentioned "internet finance" (the Chinese term for FinTech) almost every year, but the tune gradually shifted from appraising innovation to warning of risks. The PRC once developed the world's largest online peer-to-peer (P2P) lending industry, with more than 6,000 platforms

¹ Ant Group is affiliated with the e-commerce giant Alibaba, owns Alipay, and sponsors MyBank. Tencent started business in online games. But it is probably most widely known for its social media service WeChat, on which it also built WeChat Pay and sponsored WeBank. Baidu specializes in search engines in Chinese texts, owns a financial arm, Duxiaoman, and also formed a joint venture bank, Baixin Bank, with Citic Bank. JD Digits, which was previously known as JD Financial, is affiliated with the e-commerce giant JD and owns numerous financial licenses.

cumulatively. After the government started to introduce proper regulation from late 2015, however, the industry gradually collapsed (Wang, Shen, and Huang 2016). One failed P2P, E'zobao, involved almost one million online investors. It became a source of social tension as well as financial stress.

While the PRC's FinTech sector has achieved unprecedented successes in improving financial services, it has also created serious financial risks and social problems. The sector as a whole is still in its early stage of development. Many of the business models are not yet well developed. Some newly invented risk control approaches, such as big data-based credit scoring models, still need to be tested through full financial cycles. The authorities are yet to bring the sector under full coverage of financial regulation and to formulate new methods of regulation in order to balance between innovation and stability. And all these changes will likely have important implications for macroeconomic stability in the PRC.

The remainder of the paper is structured as follows. In the next section, we take stock of the recent FinTech development in the PRC, with special attention being paid to the development of mobile payment services and data-based online bank lending. In the third section, we document the key financial risks in the FinTech sector, by focusing on the peer-to-peer (P2P) lending industry as a case study, and draw some implications for financial regulation. In the fourth section, we briefly introduce the People's Bank of China's (PBC's) digital currency/electronic payment (DC/EP) – its design, key features, and likely impact on the FinTech sector and the broad financial industry. In the fifth section, we discuss the likely implications of FinTech development for macroeconomic stability, followed by some concluding remarks in the final section.

2. RECENT FINTECH DEVELOPMENT

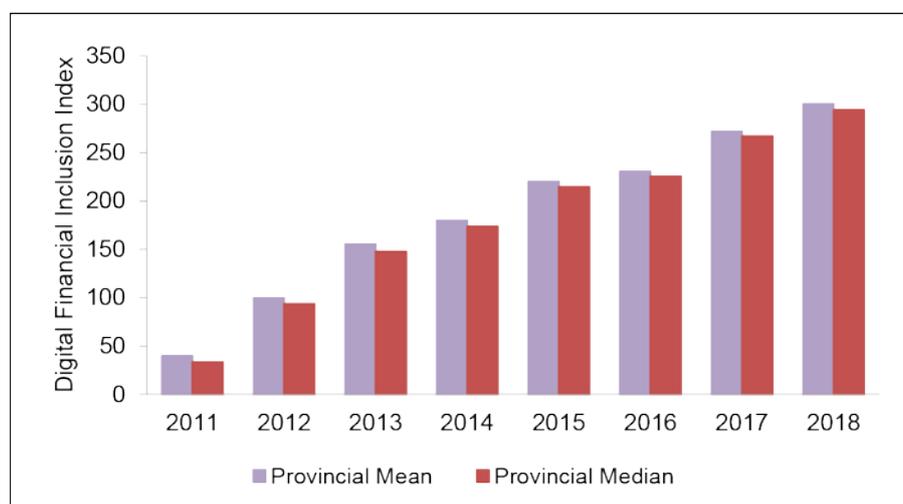
The PRC's first online payment transaction took place on 18 October 2003. A university student in Xi'an bought a second-hand Fujifilm camera for RMB750, on Alibaba's newly established e-commerce platform T-Mall, from a Chinese student studying in Yokohama. But it was difficult to complete the transaction because of a lack of trust between the buyer and the seller. In the end, Alibaba had to provide a guarantee for the transaction: The buyer would first send money to Alibaba, then Alibaba would advise the seller to mail the camera to the buyer, and once the buyer had confirmed receipt of the camera, Alibaba would wire the money to the seller. Even with this guarantee, Alibaba's customer officer still took hours to convince the buyer to proceed with the transaction. This was the beginning of the PRC's FinTech development, which confirms that most FinTech products are created to satisfy real demand. And the rest, as they say, is history.

Today, the PRC is already a global leader in many FinTech businesses. According to the 2018 edition of "Fintech100," Chinese companies occupied three of the top five places, with Ant Financial, JD Finance, and Baidu in first, second, and fourth place, respectively.² To proffer a bird's-eye view of FinTech development in the PRC, we first introduce the Peking University Digital Financial Inclusion Index of China (PKU-DFIIC), which quantifies annually the PRC's FinTech development, disaggregated at provincial, municipal, and county levels as well as for different businesses including mobile payment, online lending, digital insurance, online investment, and other digital financial

² "Fintech100: The World's Leading Fintech Innovators," by H2 Ventures and KPMG, 2018. See information at <https://home.kpmg/xx/en/home/insights/2018/10/2018-fintech-100-the-worlds-leading-fintech-innovators-fs.html>

services (Guo et al. 2019).³ The index reveals at least two important characteristics. One is extraordinary growth. The median of provincial indices was 33.6 in 2011, and rose to 294.3 in 2018, implying an average growth of 36.4% per annum (Figure 1). As a comparison, the newly increased total social finance of the formal financial sector rose from RMB12.8 trillion to RMB19.3 trillion during the same period, recording an average growth rate of 6%.

Figure 1: Provincial Means and Medians of Digital Financial Inclusion Index, 2011–2018



Source: Guo et al. (2019).

And the other is clear trend of convergence. The highest-to-lowest provincial index ratio dropped from 50.4 in 2011 to 1.4 in 2018, revealing dramatic narrowing of provincial gaps. Data at the municipal level also show that the inland regions caught up with the East Coast region rapidly between 2011 and 2018, exhibiting an important quality of inclusion (Guo et al. 2020).

In 1935, a Chinese economic geographer, Hu Huanyong, drew a line on the map of the PRC from Heihe in Heilongjiang to Tengchong in Yunnan, which later became known as the “Hu Huanyong Line” (Hu 1935).⁴ On the right side of this line, about 46% of the total land area supported 96% of the population. Western PRC lags in economic development, even today. However, recently, with the help of technology and innovation, FinTech crossed the Hu Huanyong Line for the first time and moved rapidly into many regions in the western part of the country (right chart in Figure 2).

At the disaggregated level, FinTech development has been more successful in mobile payment, online lending, digital insurance, and online investment funds. Due to concern about money laundering and financial instability, the authorities banned trading in cryptocurrencies and initial currency offerings (ICOs). Currently, however, the People’s Bank of China (PBC) is actively exploring issuance of its own version of sovereign digital currency – digital currency/electronic payment (DC/EP).

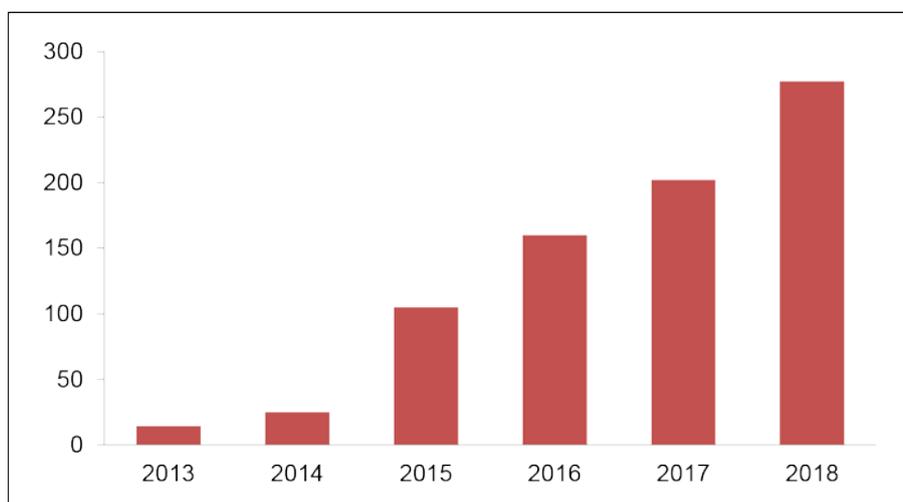
³ The PKU-DFIIC was developed by Peking University’s Institute of Digital Finance, in collaboration with Ant Financial: <https://en.idf.pku.edu.cn/docs/20190610145822397835.pdf>

⁴ HU Huanyong elaborated first presented the idea of this HU Huanyong Line in the journal article “Distribution of China’s population” in *Journal of Geographical Sciences* (in Chinese) in 1935.

Mobile payment is the most prominent FinTech business in the PRC, and started as a means to support e-commerce. It benefited from a rapid increase in the penetration rate of smartphones, which makes it possible to use mobile payment services anywhere, any time. The success of Ant Financial’s money market fund Yu’eobao, which was launched in June 2013, significantly boosted the society’s awareness of, and enthusiasm about, FinTech, including mobile payment. Distribution of red (cash) envelopes on WeChat Pay during the Chinese New Year holiday in 2014 helped attract hundreds of millions of new users. And adoption of the Quick Response (QR) code for mobile payment, starting from 2017, made it possible for any businesses, formal or informal, to use the mobile payment service by printing out the code on a piece of paper.

The last few years witnessed rapid expansion of the PRC’s mobile payment business, in terms of users and transactions. The number of active users of Alipay increased from a little over 100 million in 2013 to 900 million in 2018, while that of WeChat Pay grew from about 350 million to 1.1 billion during the same period. The total transaction value jumped from RMB14.5 trillion in 2013 to RMB277.4 trillion in 2018, recording an annual growth rate of 80% (Figure 2). The share of mobile payment in total noncash payment value rose from less than 1% to 7.4% during the same period, while the share of mobile payment in the total number of noncash payment transactions increased from 3.3% to 27.3%.

Figure 2: Transaction Value of Mobile Payment in the PRC, 2013–2018
(RMB trillion)



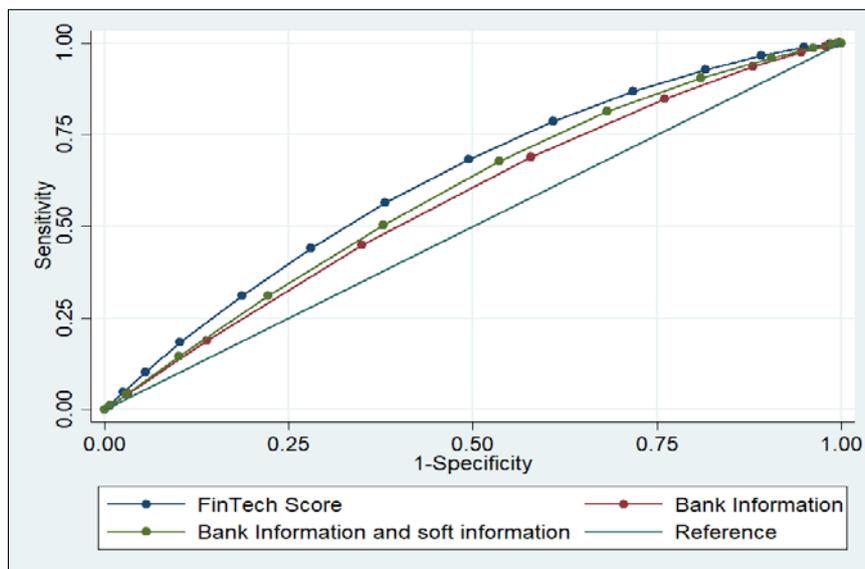
Source: CEIC, PBoC.

Perhaps the most impressive development concerning mobile payment is the ecosystems built around it. Today, users can organize their daily lives around the payment app. These ecosystems not only make people’s lives easier, but also bring about significant changes to the broader financial sector and the economy. Facilitated by mobile payment, e-commerce now accounts for more than 20% of total retail sales, with major consequences for offline supermarkets and department stores. Commercial banks also started to reduce the number of branches and lay off employees.

Another prominent FinTech business is online lending. Here, there is a tale of two online lending models – one refers to the peer-to-peer (P2P) lending platforms and the other points to the new online banks. In general, the former largely failed while the latter is functioning well so far. These two types of institutions are distinguishable in a number of ways. While the online banks are licensed from the beginning, most of the P2Ps are not properly regulated. According to the current regulation, the banks can engage in credit intermediation, while a P2P can only serve as an information intermediary. The most important distinction between the two, however, lies in their abilities to assess and control financial risks. Most of the P2Ps do not have the necessary means of controlling either the adverse selection problem or the moral hazard problem.

The online banks, WeBank, MyBank, and XWBank, all created their own credit scoring models based on machine learning and big data analyses (Gambacorta et al. 2019). They provide loans to SMEs and low-income households, which often lack historical data, fixed assets, and government guarantees. In 2017, MyBank had a total of 377 employees but extended 5 million SME loans. WeBank was built on social media data, MyBank started with e-commerce information, and XWBank simply established an open banking system to connect with other existing platforms. For instance, WeBank assesses creditworthiness by looking at one’s work office environment, residential property quality, close social media friends, and other digital footprints. In a similar way, MyBank invented the so-called “310 model” – it takes the customer 3 minutes to apply, the approved loan amount is in the borrower’s account within 1 second, and there is no human interference in this whole process. Existing evidence suggests that FinTech credit scoring models based on big data and the machine learning method outperform the traditional bank approaches, as illustrated by a higher receiving operating characteristic (ROC) curve for the FinTech credit model than others (Figure 3).

Figure 3: Receiver Operating Characteristics (ROC) Curve for Credit Scoring Models



Source: Gambacorta et al. (2019).

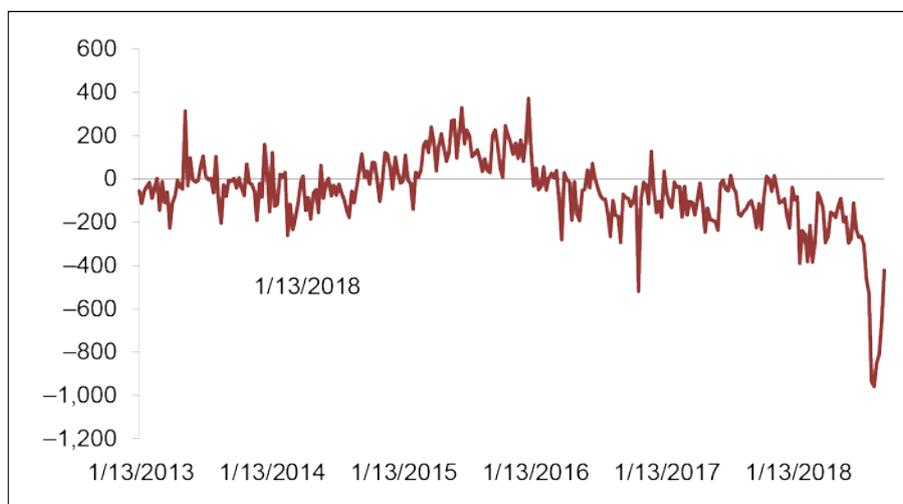
Other prominent FinTech businesses include digital insurance and online investment. During the last few years, a number of financial institutions and FinTech companies have tried hard to develop a robo-advisor service for individual investment and crowdfunding but they have made very limited progress so far.

3. EVOLVING FINANCIAL RISKS

In retrospect, three main factors probably contributed to the unusual success of the PRC’s recent FinTech development. The first factor was a supply shortage in the traditional financial industry. After 40 years of economic reform, the PRC has already built a gigantic financial industry. But some economic entities, especially SMEs and low-income households, are not well serviced financially. For instance, only about 20% of Chinese SMEs have ever borrowed from the banks, compared to 50% in the United Kingdom. Therefore, the new FinTech products have often been enthusiastically embraced by the market. The second factor is the rapid development of digital technology, particularly the BigTech platforms, cloud computing, and big data analyses. By connecting to hundreds of millions of users and reducing information asymmetry, FinTech business models help mitigate two important problems in financial transaction – one is adverse selection and the other is moral hazard problems. And the third factor is tolerant financial regulation. Seeing the potential benefits of FinTech products in filling gaps in the markets, the regulators did not go out to end these practices abruptly. This provided the window for FinTech companies to experiment with their innovation.

This last factor was likely also behind the very volatile sentiment in the FinTech industry (Figure 4). During much of the past decade or so, the Fintech industry was largely unregulated. For instance, Alipay first came online in December 2004, but it did not obtain the official payment license from the central bank until May 2011. And again, the first P2P, PPD, was established in June 2007. In the following years, thousands of platforms joined PPDs. The authorities adopted the first temporary regulation of P2Ps in August 2016. For many years, the FinTech players were left alone to do almost whatever they wanted. Such a regulatory environment led to risky business practices and even Ponzi schemes.

Figure 4: Peking University Fintech Sentiment Index



Note: The sentiment was measured by both positive and negative subindices, using 18 million news articles during the period covered. And the measure plotted in this figure is the net sentiment.

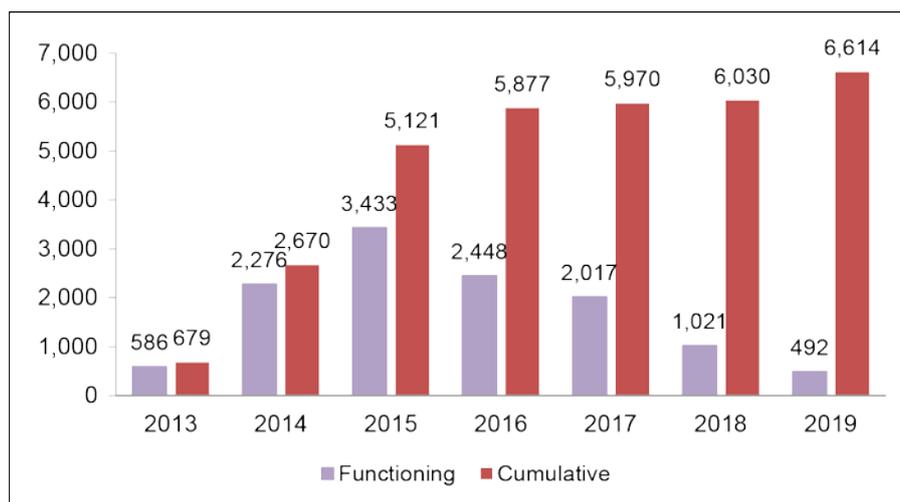
Source: Institute of Digital Finance, Peking University; Wang and Huang (2018)

The discussion here focuses on the P2P sector as a case study, which shows that the development trajectory of P2P was actually a result of dynamic interactions among real economic demand, credit culture, and the regulatory environment. Like its counterparts in the United States and the United Kingdom, PPD was initially set up as an information intermediary. This means that the platform did not provide any guarantee or pool the funds. Lenders and borrowers can transact directly on PPD's system. And this sounded like a revolution, as most of the borrowers would not be able to obtain loans from the banks and the lenders can now receive higher returns. Since the interest rates were not regulated by the central bank, such transactions could also be viewed as a de facto method of interest rate liberalization. There is only one small problem with such a seemingly wonderful financial innovation: How to control financial risks? The borrowers and the lenders never met before. The platforms could not access the central bank's credit scoring system and could not engage in risk intermediation. It is impossible for the lenders to evaluate and control adverse selection and moral hazard problems (Wang, Shen, and Huang 2016).

In order to continue the business, P2P operators were forced to change their business practices, by pooling the funds and providing guarantees. These activities literally turned the P2P platforms into de facto banks. But they were not regulated as banks, as they are not subject to the usual capital adequacy and reserve requirement regulations. These made the P2P platforms excessively vulnerable for a number of reasons. One, because they are not properly regulated, public sentiment toward the platforms was very volatile. Any bad news could result in runs on the platforms. Two, the platforms often did not have much capacity to withstand losses of funds because they did not have the capital or liquidity buffers. And three, most platforms did not have effective ways to collect debts from the borrowers. If a borrower decided not to repay the debt, the costs for the platform to recover the debt would be very high. Zhang and Huang (2018) even discovered what they described as a "reversal run" on the platform. By looking at individual borrowers' data, they found that "low credit score" borrowers were more likely to borrow when the platform appeared to be vulnerable, in the hope that nobody would collect the debt from them if the platform collapsed.

It is, therefore, not difficult to imagine, when the temporary regulation was announced in 2016, which required the P2Ps to only function as information intermediaries, that most of the platforms had to find ways to exit from the industry. The collapse of P2Ps was unfortunate. But the total outstanding loan in the peak year, 2017, was RMB1.2 trillion, which was only about 1% of the total outstanding loans by commercial banks. However, the social impact was much greater, as the sector involved a very large number of investors. Most of these investors did not have the ability to both understand and accept investment risks. In a way, the collapse of P2Ps in many Chinese cities is a bigger concern for social stability than for financial stability.

This all suggests that, in the current Chinese credit environment, P2P is probably not a viable business model. This conclusion could change if the platforms could effectively reduce information asymmetry by either accessing the central bank's credit data or independently analyzing credit risks. This implies that probably only a small number of platforms can exist in the Chinese market. However, because of the absence of regulation, the number of "cumulative" platforms reached more than 6,000 (Figure 5). After 2016, the number of "functioning" platforms declined sharply. In 2019, it fell to 492. But even this number is not sustainable, as most of them still do not satisfy the regulatory requirements.

Figure 5: Total Number of P2P Platforms in the PRC, Functioning vs. Cumulative

Source: WDZJ.com.

The experiences of P2Ps and other FinTech businesses during the past decade or so offer some important implications for regulation. Currently, the Chinese financial regulatory framework consists of four core institutions: the central bank, the banking and insurance regulator, the security regulator, and the local financial regulation bureaus. Each regulator is responsible for regulating a set of financial institutions, coordinated by the State Council Financial Stability and Development Commission. This system is incompatible with the current financial practice in the PRC, especially the FinTech businesses. In fact, there are a number of lessons to be learned from the experiences of FinTech development in terms of financial regulation.

The first lesson is that all financial transactions need to be regulated. The industry-segregated approach of regulation often leaves out many financial activities that do not fall into the traditional categories of financial institutions. Shadow banking and FinTech were very important new financial activities in the PRC but were unregulated or underregulated. Financial activities need to be closely regulated because financial risks often change quickly, with economy-wide amplifying consequences. Given the reasons already discussed, most of the P2Ps should not have existed. This probably requires the regulators to change their institution-focused approach to an institution- and function-focused approach. Anybody who wants to engage in financial services should have the necessary qualities and apply for a license.

The second lesson is that a new regulatory framework needs to be devised to adapt to a de facto universal banking business model. All of the leading FinTech players in the PRC, Ant Financial, JD Financial, Baidu, and Tencent, all own multiple financial licenses. This does not necessarily mean that the PRC should combine all the financial regulators. For instance, the United States adopts a segregated regulatory system while the United Kingdom adopts the twin-peak framework. But they are both able to monitor and regulate cross-industry fund flows and risk transmission. In the case of the PRC, one urgent task is to improve the coordination of regulatory policies.

The third lesson is that the regulators also need to use policy tools to monitor and regulate financial risks. With FinTech, especially BigTech platforms, the speed and breadth of risk spreading is unprecedented. Routine reports by financial institutions, or on-site/off-site inspections, are not sufficient to grasp the problems. Regulators also need to apply digital technologies to improve their regulatory capability. Regulatory technology

(RegTech) should be capable of benefiting regulators in many ways (Sheridan 2017). Zhu and Zhou (2016) reveal that digital technologies such as blockchain help solve the problems of regulatory compliance and security of fund management by developing a distributed voting system for crowdfunders. Beijing's local financial regulatory bureau also created a "smoke index," which monitors the risks of P2Ps in real time.

And the final lesson is that the regulators should try to find a balance between innovation and stability. Good innovations can bring huge benefits, while bad innovations can cause immense damage. But it is not always crystal clear whether an innovation proposal is good or bad. One of the practices adopted by regulators in other countries is the so-called "sandbox." A regulatory sandbox is an experimentation space that allows a firm to make its advice platform available to a limited number of financial consumers, and by reducing time and cost, as well as enabling greater access to finance for innovators, it helps to deliver more effective competition in the interests of consumers (FCA 2015). To engage with the fast-paced developments in the FinTech industry, it is necessary to rationally evaluate the costs and benefits of FinTech market innovations by adopting a regulatory sandbox regime in the PRC. In this way, Chinese regulators will have a more optimal and informed context in which to navigate their regulatory priorities and build a regulatory environment where such new FinTech business models will thrive in appropriate approaches.

4. DIGITAL CURRENCY/ELECTRONIC PAYMENT

While the authorities banned trading of cryptocurrencies and initial currency offerings (ICOs), due to concerns about money laundering and financial instability, the People's Bank of China (PBC) began to study central bank digital currency from as early as 2014. In 2017, it established its own Institute of Digital Currency. And in late 2019, senior PBC officials disclosed that the central bank had completed top-level design, standard setting, function development, and operational testing of the digital currency and had actually started implementing trials in certain areas. In fact, the digital currency could be rolled out in the perceivable future (Fan 2019).

The PBC's digital currency is a hybrid system of digital currency and electronic payment (DC/EP), which is a loosely coupled payment instrument, issued by the central bank, operated and exchanged by the authorized operators. The key features of DC/EP may be summarized as follows. First, DC/EP is a legal tender, i.e., a digital version of RMB, and substitutes only for M0. A legal tender is different from electronic cash offered by commercial banks and mobile payment providers. It is almost impossible for DC/EP to default, but commercial banks and mobile payment providers could, potentially. The fact that DC/EP is a substitute only for M0, but not for M1 or M2, implies that it would not become a means of credit. For now, the PBC would not pay any interest to DC/EP. But it can be conveniently used in retail transaction and daily payment.

Second, DC/EP will be operated through a two-tier system, and the PBC will not directly interact with the public. Like any other sovereign currency, DC/EP is the liability of the central bank. It functions through a two-tier system, in which the central bank creates and issues the digital currency to the authorized institutional operators, and then the general public exchange cash for digital currency from the authorized financial institutions (Figure 6). The fact that the central bank does not directly interact with the public helps avoid competition with existing financial institutions, which otherwise could lead to financial disintermediation. DC/EP is 100% reserved, meaning that authorized financial operators must deposit one-to-one reserve with the central bank. The operators can then issue DC/EP to the general public in the same way they issue paper notes. The

central bank will likely also set a ceiling for the amount of transaction and account balance. The purpose of this is to avoid the possibility that the public exchange all of their deposits into digital currency, and, therefore, to prevent the potential risk of a bank run. It also ensures limited anonymity in payment transactions. More importantly, the authorized institutional operators should have the necessary information about the owners of these digital wallets.

Figure 6: Illustration of the Two-Tier System of DC/EP



Source: PBC.

Third, DC/EP is a loosely coupled and value-based account, i.e., it is token-based. The value transfer can be achieved without an account. In comparison, the credit card, Alipay, and WeChat Pay are all account-based and all require linking to bank accounts. But DC/EP is a stand-alone set of passcodes, like cash. Peer-to-peer payment can take place without linking to the internet.

So why does the PBC create a DC/EP but ban the trading of cryptocurrencies such as Bitcoin and Ethereum? Cryptocurrencies have two distinctive features: the value of anonymity and a lack of intrinsic value. They are neither precious metals nor sovereign currencies guaranteed by the states. So they do not have all three key functions of money: means of payment, unit of accounting, and vehicle of investment. This is why cryptocurrencies are often regarded as digital assets, not digital currencies. The anonymity creates concerns for policy makers, especially in countries where management of cross-border capital flows is common and corruption is widespread. These are the key reasons why it is hard for the Chinese regulators to tolerate onshore active trading of cryptocurrencies.

There must be many reasons why the PBC made so much effort to roll out DC/EP. One possible reason is to promote financial inclusion – one does not require a bank account to have a digital currency account and enjoy the basic financial services. The loosely

coupled digital currency and payment account make it possible for those previously underserved by the financial system. With the support of the DC/EP system, foreigners could have a digital wallet without a bank account in the PRC and enjoy the convenience of mobile payment. This could seriously reduce the burdens of anti-money laundering (AML) and certificate in finance and technology (CFT) processes. In a way, this is an important step forward from the current mobile payment system, which still requires linking to a bank account to be operable.

Clearly DC/EP is only the first step of the PBC's digital currency ambition, although nobody knows when the central bank will take further steps, such as paying interest on the digital currency. For now, since it only substitutes for M0, it might have limited impact on the PRC's macroeconomy. At the end of December 2019, the PRC's M0 was RMB7.72 trillion, which was only about 3.9% of the broad money supply M2, RMB198.65 trillion. Therefore, even if DC/EP completely replaces M0, it still does not constitute a significant part of the country's financial operation.

However, DC/EP could potentially have a very significant impact on the FinTech sector. Most of the PRC's FinTech businesses are built around its mobile payment system. Mobile payment facilitated the boom of e-commerce, which created the initial business area for digital insurance for the delivery and return of goods. It also opened the opportunities for online investment and online lending. In fact, almost the entire FinTech ecosystem is built on the mobile payment facility.

The mobile payment system offers two unique features: connectivity and data. The mobile payment platforms attract hundreds of millions of users and thus substantially reduce the costs of acquiring customers. More importantly, transactions with payment and other services leave a gigantic amount of digital footprint on those platforms. Equipped with extraordinary analytical capabilities, the mobile payment platforms are then able to provide a wide range of financial services, such as digital insurance and online lending. Without the mobile payment services, the PRC's FinTech industry would probably be much more modest in terms of scale and complexity.

To be fair, the policy makers have some legitimate concerns about this business model. Since the FinTech business is concentrated so much in a small number of unicorn players, any risks that occur to them could be systemic risks. At the same time, abuse of data by big FinTech platforms, such as invasion of individual privacy, is also quite common.

It is too early to be sure about the exact impact of DC/EP on the FinTech industry. But now the public has an alternative to mobile payment, DC/EP, which can also carry out payment transactions but does not leave a digital footprint with a private company, then it is quite possible that many will substitute mobile payment accounts with DC/EP. If this happens, then the consequences for the FinTech industry could be game-changing.

5. IMPLICATIONS FOR MACROECONOMIC STABILITY

How does this exciting FinTech development affect the PRC's macroeconomic stability? Our tentative assessment so far arrives at the following three takeaways:

- The FinTech space is still rapidly changing, and thus the shape of the FinTech industry and its macroeconomic implications could continue to evolve in the coming years;

- In many ways, the use of digital technology, especially FinTech, could improve macroeconomic stability by reducing the short-term volatility of economic activities and prices;
- But it could also give rise to new risks and magnify existing risks, especially if regulation does not keep pace with innovation.

The PRC's FinTech industry is probably entering a new phase of development. In the past, many tech companies engaged directly in the provision of financial services. This was partly because there was no strict requirement for a license then. This, however, could change as financial regulation tightens. Clearer division of labor could emerge between tech and fin players, with financial institutions focusing on providing financial products, and tech companies specializing in offering technological solutions. Even Jack Ma, founder of Ant Financial, said that the unicorn FinTech player aims to become a Techfin institution, concentrating only on the tech part of financial transactions. One likely scenario is that traditional financial institutions could become the main providers of financial services. But a large number of small tech companies might emerge to provide specialized tech services to these financial institutions. The unicorn tech companies, such as Ant Financial, Tencent, Baidu, and JD Digits, could become platforms for financial products, just like Taobao for goods. While the form of the FinTech industry could change, the essence of using digital technology to improve financial transaction should not.

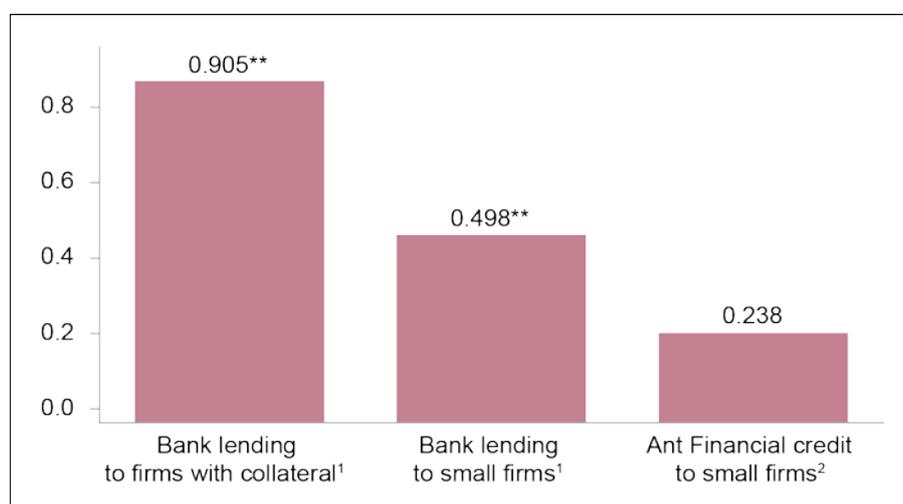
One potential wild card that could substantially transform the PRC's FinTech landscape is the PBC's DC/EP, alongside tighter regulation. If, as some suggest, DC/EP offers a more attractive alternative to the current mobile payment service, because DC/EP does not depend on bank accounts and maintains a certain degree of anonymity, then it is quite possible that DC/EP could serve as a negative shock to mobile payment businesses and, more fundamentally, undermine unicorn BigTech companies' function of accumulating and analyzing digital footprints. Since connectivity and data are the backbones of the existing FinTech businesses, DC/EP could potentially weaken BigTech companies' position in the FinTech space. Furthermore, if the PBC decides to grant more functions to its digital currency, such as making it interest-bearing and a means of credit, then even the traditional financial institutions, including commercial banks, could experience a major "earthquake." This, however, will probably not happen in the perceivable future.

There is preliminary but important evidence confirming that FinTech could actually improve macroeconomic stability. The first piece of evidence is illustrated by Figure 2, which shows rapid convergence of regional FinTech development – the lagging regions developed at faster paces than the leading regions between 2013 and 2018. More importantly, tentative analysis of the regional growth pattern shows that, while, in general, growth is still diverging in the PRC, the FinTech variable facilitates growth convergence across regions. If this effect can be confirmed, then FinTech development is definitely helpful for improving macroeconomic stability, since regional economic development could become even greater as a result of the spreading of FinTech businesses.

The second piece of evidence relates to unsecured loans provided by several online banks, using data instead of collateral in risk assessment. In fact, this method can also be applied by traditional commercial banks. As discussed earlier, the FinTech credit scoring models, based on big data and the machine learning approach, often performs better than the traditional bank models, especially for SME loans. Such unsecured loans have the additional benefit of delinking credit decision from asset price. The elasticity of collateralized bank loans with respect to housing price is 0.91, that of banks' SME loans

is 0.50, while that of MyBank's unsecured SME loans is insignificant (Figure 7). This breakdown of connection between loan growth and housing price takes out the so-called "financial accelerator," which was often behind financial crises through the formation of a vicious cycle among asset price, credit policy, and real economic activities. Therefore, the data-based credit scoring models should help improve financial and macroeconomic stability.

Figure 7: Elasticity of Bank Credit with Respect to Housing Prices in the PRC



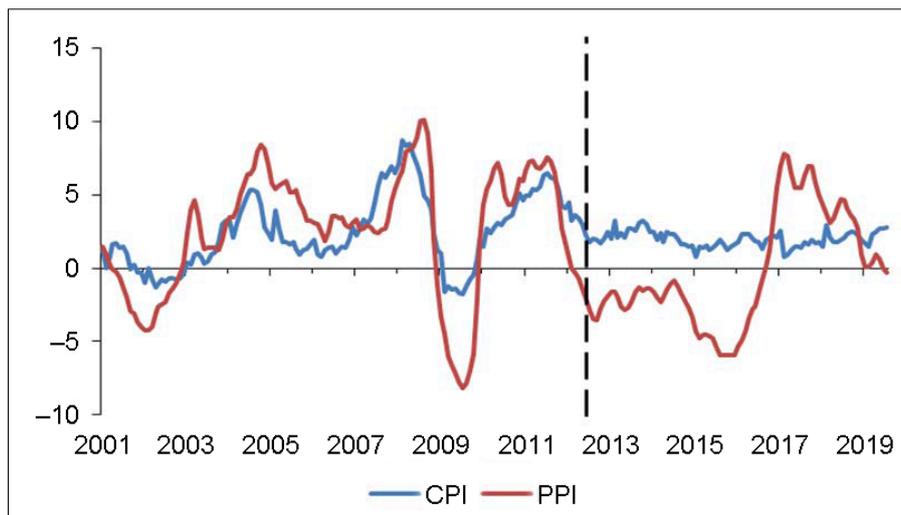
Note: ¹Data from traditional banks and ²Data from MyBank.

Source: Gambacorta et al. (2019).

The third piece of evidence can be observed from the current Chinese economy suffering the devastating novel coronavirus (2019-nCoV) – the FinTech-supported new economy serves as a macroeconomic stabilizing force. Like the severe acute respiratory syndrome (SARS) that haunted the PRC in early 2003, 2019-nCoV is infectious and deadly, restricts people's mobility, and reduces consumption demand, especially for restaurants, shopping, and other tourism activities. Compared with 2003, what is different this time round is the greater role of the new economy. Online shopping already accounts for more than 20% of all retail sales. A tentative look at Alipay's data confirms that, during the Chinese New Year holiday this year, which coincided with the heightened 2019-nCoV warning, transactions with offline vendors declined by almost 10%, while transactions with online vendors were up by 10%. Clearly, the new economic activities help mitigate negative shocks such as disease. More generally, there are also tentative research findings confirming that the mobile payment service helps to improve risk sharing among households (Wang et al. 2019).

And the final piece of evidence is still only a hypothesis, which needs to be verified by rigorous analysis. Figure 8 plots both CPI and PPI for the period 2001–2019. There was an observable structural break in 2013 for CPI, but not for PPI. One possible explanation is the growing e-commerce. One might recall from earlier discussion that Alipay was initially created to facilitate online transactions on Alibaba's e-commerce platform Taobao. The real FinTech boom, however, did not happen until June 2013 when Yu'e Bao came online. This also led to extraordinary expansion of e-commerce. The growing e-commerce helped integrate different regional markets and significantly reduced price volatility.

Figure 8: Consumer Price Index and Producer Price Index in the PRC, 2001–2019
(%)



Source: National Bureau of Statistics of China.

But clearly, FinTech would also pose new risks to macroeconomic stability. Any financial innovation, including FinTech, could magnify or even create financial risks, as well as improving financial efficiency. The most striking example is the derivative product, which was initially created to manage exchange rate volatility after the breakdown of the Bretton Woods system. However, it caused the subprime crisis. Similarly, FinTech businesses should help to improve both financial inclusion and financial efficiency, but it could also generate new financial risks. For instance, the PBC has issued a total of more than 200 payment licenses in recent years. With the exception of a couple of the largest players, most of the license holders suffer from financial problems. Fortunately, the sizes of these institutions' businesses are quite small. With the help of digital technology, FinTech businesses adjust very rapidly. This presents a serious challenge to the existing regulatory system, which normally requires the financial institutions to disclose information periodically. Without also applying digital technology in regulation, it is hard to monitor and control FinTech risks. In addition, the BigTech firms sometimes result in greater concentration of market shares, and are able to further concentrate market power. They have the potential to give rise to new financial systemic risks (Frost et al. 2019).

6. CONCLUDING REMARKS

While it is too early to make any accurate assessment at the moment, it is quite clear that FinTech is rapidly changing the financial industry, with important implications for macroeconomic stability. Therefore, we need to monitor and study this new development very closely. Tentative analyses suggest that, while FinTech could provide some stabilizing forces, it could potentially also become a major threat to macroeconomic stability. In order to maximize the benefits, while keeping the risks under control, we make the following policy recommendations:

First, the regulators need to develop new techniques such as “sandbox” in order to balance between FinTech innovation and financial stability. All financial transactions need to be regulated and all financial service providers need to obtain proper licenses. The experiences of the regulated P2Ps should not happen again. Following the practices

in the United Kingdom, Singapore, and many other countries, the PBC also started a practice similar to “sandbox.” Under this new scheme, regulators first call for proposals of new FinTech businesses. If they meet certain criteria, such as strengthening financial access, improving financial efficiency, and managing financial risks, then the proposals may be tested under the regulators’ close watch. If the experiment turns out to be successful, then the business could be formally licensed.

Second, the regulatory framework needs to apply digital technology, i.e., RegTech, in regulating FinTech and other financial businesses. The FinTech businesses, in particular, have the typical features of large numbers of customers and very rapid transmission of risks. The traditional regulatory approach, however, would not win the race with financial risks, either in terms of breadth or speed. Using big data analytical tools, the regulators should be able to monitor real-time data and detect any irregular symptoms.

Third, the macro-prudential policies also need to be upgraded to incorporate the new features of FinTech. For instance, simply judged by asset size, some of the key FinTech players such as Ant Financial and Tencent might not qualify as “systemically important institutions.” But these two players are behind almost all new economic activities. If there is a collapse of the mobile payment system, or simply a power blackout, a large part of the economy will become dysfunctional, with serious macroeconomic and financial implications.

And finally, the central bank will have to take into account these new FinTech features when making monetary policy. Although the full implications still need to be studied and appreciated, we tentatively found that data-based online bank lending responds to monetary policy more aggressively than collateral-based traditional bank loans. Likewise, we also found that CPI becomes a lot more stable during the age of FinTech and the new economy. This would have serious implications for monetary policy making, especially with an explicit or implicit inflation targeting scheme. If CPI becomes much more stable because of technology, then there is the question of whether monetary policy expansion might lead to the accumulation of financial risks, such as the subprime risks in the early 2000s in the United States.

The bottom line is that the PBC, the financial regulators, and academics should spend a lot of time trying to follow the development of the FinTech industry and understand its implications for macroeconomic stability.

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