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DIGITAL TECHNOLOGY AND ECONOMIC IMPACTS OF COVID-19: EXPERIENCES OF THE PEOPLE'S REPUBLIC OF CHINA

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Abstract

Digital technology has rapidly transformed the PRC's economy over the past decade, especially in areas of e-commerce and digital finance. In many ways, digital technology changes the pattern of economic operation, as it enlarges business scale, increases economic efficiency, improves user experiences, reduces operating costs, and controls financial risks. Digital technology served as an important economic stabilizer during COVID-19, by accurately tracking down confirmed infected cases, moving a lot of economic activities online and issuing consumption coupons by local governments. These not only enabled the PRC to be the first to come out of the pandemic and to achieve impressive V-shaped recovery, but also with 5G and other technological and infrastructural development, the digital economy in the PRC will likely grow more rapidly in the coming years, bringing about more fundamental changes. However, the authorities will also need to address a wide range of policy issues to ensure the smooth development of the digital economy, including the easing of the data inequality problem, protection of individual rights, and regulation of platform behavior.

Keywords: digital technology, digital economy, COVID-19, PRC

JEL Classification: G23, E60, O31

Contents

1. INTRODUCTION

Digital technology, which is the key driver of the fourth industrial revolution, is profoundly transforming the economic landscape in the People's Republic of China (PRC). This process started nearly 20 years ago, when *Alibaba* set up the first major e-commerce platform, *T-Mall*, in the country. But it really picked up the pace when the smartphone penetration rate jumped and the 3G telecommunication technology was built across the country. Today, digital economic activities are already an indispensable part of daily life, including shopping online, calling for a taxi, booking a hotel room, buying air and train tickets, ordering food delivery, participating in online conferences, attending webinars and even making a doctor's appointment. The PRC is already the largest player globally in some areas. In fact, digital economic tools, such as smartphones, have become so popular that people not using them often find it difficult to make payments or to connect with others. The so-called digital inequality problem emerged exactly because digital economy is almost everywhere in society.

In many ways, digital technology changes the way that the economy operates (Chen 2016; Xiao 2017; Huang 2018). For instance, some of the academic webinars attract millions of online viewers. Hundreds of millions of consumers buy products from the same e-commerce platforms. Some social media platforms simultaneously serve billions of users. Both the scale and speed of economic activities reached levels never seen before in human history. Promotion of financial inclusion, i.e., provision of financial services to disadvantaged customers, is extremely difficult for traditional financial institutions. But it is now made possible by the application of digital technology. Some digital lenders relying on big data, not financial data or collateral assets, to conduct credit risk assessment to grant millions of loans each year, without actually meeting the borrowers. This is a true economic revolution, brought about by digital technology.

The digital economy played a very important role when the PRC was hit by the once-in-a-century pandemic, COVID-19, in 2020. As social distancing and lockdown were the only effective ways to control the spreading of the virus, many economic activities suffered a sudden collapse. This was most visible in restaurants, theaters, theme parks, airports, etc. In some areas, however, digital technology helped move offline economic activities to online platforms. Therefore, food delivery increased, e-commerce surged, and online meetings and teaching jumped. Many companies continued to function by allowing their employees working from homes. In short, digital economy played an important role of macroeconomic stabilizer during COVID-19. If there were no digital economic activities, the collapse of the economy would have been far steeper for longer.

How did digital technology shape the economic impacts of COVID-19 in the PRC? This is the central question to be addressed in this paper. Specifically, the paper looks at three issues: (1) How is digital technology transforming the PRC economy? Discussion on the digital economy focuses on digital finance, or Fintech. The PRC's digital financial sector leads global development in this area, especially in terms of numbers of customers and value of transactions; (2) How did the digital economy help mitigate the impacts of COVID-19? Digital technology was useful not only in moving a lot of activities online, to ensure continuity of business during the lockdown, but also in tracking down people who had close contacts with confirmed cases of the coronavirus. The consumption coupons issued by some local governments through the mobile payment system also illustrate the importance of digital technology in assisting households during the pandemic; and (3), What are the post-COVID economic

prospects for the PRC? The PRC economy emerged quickly from COVID-19 due to two important factors—the pandemic factor and the policy factor. While growth outlook for 2021 looks quite upbeat, it remains to be seen if such "abnormal growth" could quickly and smoothly revert back to "normal growth."

Development of the digital economy in the PRC is still in its early stage, despite its already very important roles in the economy, especially during COVID-19. This is likely to accelerate in the coming years, supported by 5G technology, the Internet of Things and new digital infrastructure. One of the important contributions of digital technology could be to offset the trend of a declining labor force, as robots replace workers. In order to ensure smooth development of the digital economy, the PRC authorities need to address a series of policy issues, such as the data inequality problem, protection of data rights and the regulation of platform economies. This also requires a lot of innovations. For instance, traditionally, policymakers judge monopoly by looking at market shares. But one important feature of digital technology is long-tail, which means that large business size is a natural part of the technology. Instead of looking at market share, the regulators should probably focus on contestability. For the same reason, the breakdown of the digital economic institutions would not be sensible policy tools dealing with monopoly. Instead, policymakers should focus on increasing competition, ensuring fair transactions, and protecting consumers.

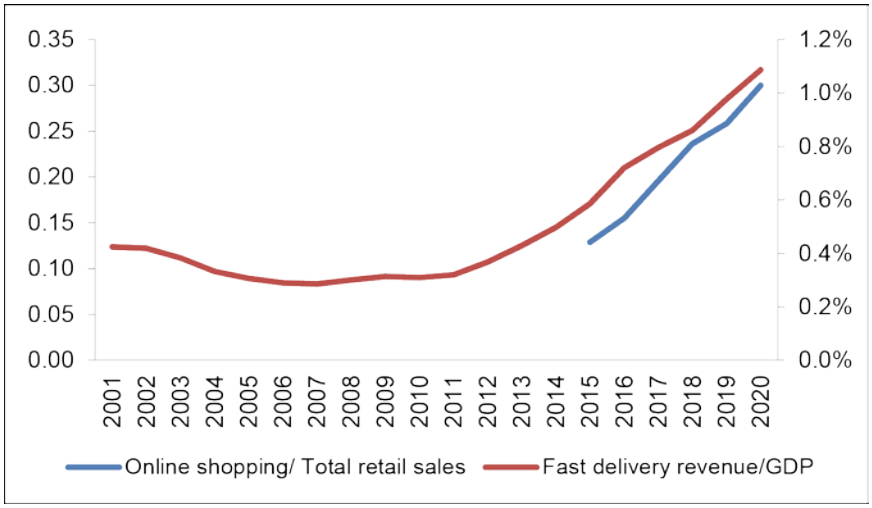
2. THE NEW DIGITAL ECONOMY

According to economic historian Angus Madison, income per capita remained largely stagnant for centuries until the first industrial revolution in the 1760s. Economic growth accelerated thereafter, as technological progress continuously lifted productivity. The current fourth industrial revolution, powered by digital technology, is again rapidly transforming the economic landscape. Large technology companies' (Bigtech) platforms, big data, artificial intelligence (AI) and cloud computing are changing the ways the economy operates. For instance, Bigtech platforms exhibit an important feature of long-tail. After incurring fixed costs of establishment, they are able to serve very large numbers of users at almost zero marginal cost. Existing Bigtech platforms, such as *Facebook*, *Amazon*, *WeChat* and *Alipay*, all have hundreds of millions and even billions of users. This allows unprecedented increase in sizes of businesses, in contrast to the traditional economic law of "decreasing return to scale." Big data and AI, coupled with cloud computing, enables provision of individualized services to platform users at very rapid paces. For example, Alipay can now comfortably handle more than 300,000 transactions per second. In summary, digital technology has the following potential effects – increasing scale, enhancing efficiency, improving user experience, reducing costs, and controlling risks.

Application of digital technology to economic activities led to emergence of "digital economy", which is defined as economic system achieving rapid optimization of resource allocation and high quality of economic development, through identification, selection, screening, storing and utilization of big data. The most visible digital economic activity is e-commerce. The PRC's first major e-commerce platform, *T-Mall* (*Taobao*), was established by *Alibaba* in June 2003. During remainder of the 2000s, the share of online shopping in total retail sales hopped around 5 percent (Figure 1). However, it started to jump rapidly after 2012. This structural change was mainly caused by progress of digital technology. The original form of online shopping was conducted on desktop computers, concentrated around breakfast and dinner times on weekdays. Invention of smart phones and development of 3G/4G telecommunication technology completely changed that pattern, as it became possible to do online

shopping almost anytime and anywhere. Without the new technology, it would not have been possible to see such rapid rise of e-commerce, now accounting for more than 30 percent of total retail sales in the PRC. Purchasing goods online has become an important part of daily life, from books to electronics, and from furniture to food.

Figure 1: Importance of Online Shopping and Fast Delivery in the PRC



Source: WIND.

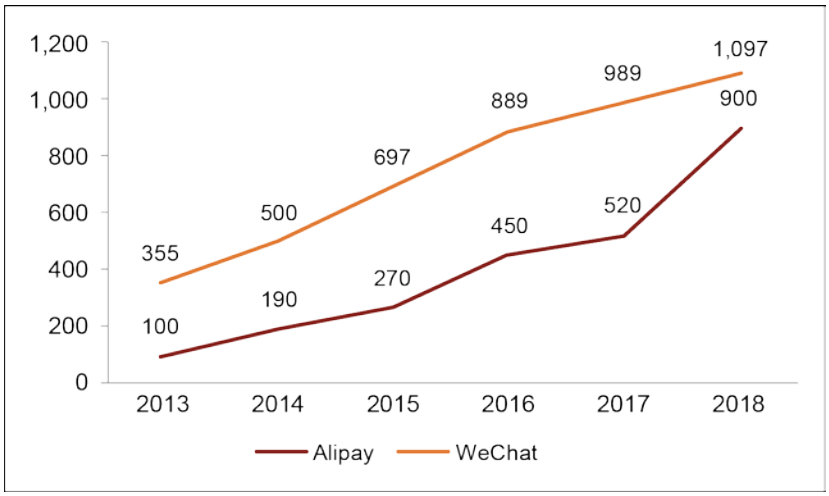
In addition to smartphones and telecommunication technology, several other infrastructure products also played vital roles in facilitating the rapid development of e-commerce. One is the logistics system, especially fast delivery service. During the past two decades, the PRC government made massive investment in infrastructure, particularly in highways, railways, and airports. The comprehensive and efficient transportation network makes it possible ship products from one part of the country to another, within a couple of days. And the fast delivery service ensures delivering to the doorstep. The two largest privately owned fast delivery companies, *Shunfeng* and *Shengtong*, were both established in 1993. *Shengtong*'s initial business was the same day delivery of custom declaration forms for exporters. Today, there are more than 20 nationwide fast delivery companies. "Riders" on electrical bikes rushing through streets delivering goods have become a common scene. In 2020, the number of delivered items reached 83.4 billion, up 31.2% from a year ago. This means that Chinese received an average of 60 delivered items per person in that year. And revenues of the fast delivery industry accounted for about 1.6% of GDP.

The other important infrastructure for e-commerce is mobile payment service. After the establishment of *T-Mall*, *Alibaba* found it quite difficult to close online deals. This was because buyers and sellers on its platform have never met before and will not meet in the future. Due to lack of trust, the two sides could not reach an agreement on which side should make the first move. Therefore, most of the deals conducted during the first months were same-city transactions. *Alibaba* then decided to provide a guarantee for such transactions: The buyer would first send money to *Alibaba*, then *Alibaba* would advise the seller to mail, for example the camera, to the buyer, and once the buyer had confirmed receipt of the camera, Alibaba would wire the money to the seller. The first such guaranteed payment transaction took place on 18 October 2003. A university student in Xi'an bought a second-hand Fujifilm camera for RMB750 on *T-Mall* from a Chinese student studying in Yokohama. Even with the guarantee, *Alibaba*'s customer officer still took hours to convince the buyer to proceed with the transaction. Those

transactions, however, were still handled manually by banks. As the daily number of transactions increased dramatically but the sizes of those transactions remained quite small, banks quickly became reluctant to continue this cooperation. At the end of 2004, *Alibaba* launched the individual account-based mobile payment service, *Alipay*.

This was the beginning of the PRC's mobile payment business and its FinTech industry. Today, the PRC's two leading mobile payment service providers, *Alipay* and *WeChat pay*, has around 1 billion users each (Figure 2). This was made possible by digital technology. The long-tail feature allows the mobile payment platforms to simultaneously service gigantic numbers of customers, which was impossible for the traditional banks' payment service. Mobile terminals, especially the smartphones, not only enabled mass access but also significantly improved user experience. Like in the case of e-commerce, before 2013, most users accessed online payment services from their desktop computers, which was slow and inconvenient. According to Klein (2019), this account-based payment service is an important innovation to the card-based payment service. He further argued that this new innovation was largely driven by market demand and that there was no need to develop a similar system in the United States, where the traditional payment service provided by banks are already quite sufficient. In the PRC today, the mobile payment service accounts for 80% of the total number of payment transactions but only 10% of the total value of payment transactions.

Figure 2: Numbers of Active Users of Alipay and WeChat Pay (million)



Source: Klein (2019).

Mobile payment service is an important "infrastructure" product for not only e-commerce but also Fintech industry. The key functions played by a mobile payment service includes provision of access and accumulation of big data. The first function is straightforward. One of main obstacles for promoting financial inclusion is the difficulty for traditional financial institutions to reach large numbers of individuals and enterprises. The small- and medium-sized enterprises (SMEs) and the low-income households (LIHs) are large in numbers, small in sizes and scattered in geographic locations. The traditional financial institutions have to build extensive physical networks across the country to reach these potential customers, which is extremely costly. The majority of the mobile service users are individuals. But there are also large numbers of online vendors. From 2017, both Alipay and WeChat pay rolled out a new product called Quick Response (QR) code payment to cover a large number of offline shops

and other businesses. In 2020, the total number of the so-called QR code merchants was close to 100 million. Furthermore, the mobile payment service providers created ecosystems around their mobile payment apps. Mobile payment users can now organize most of their daily activities within such ecosystems, including purchasing air tickets, paying electricity bills, booking hotel rooms, calling for taxis, shopping for groceries, and ordering food delivery. The ecosystems expand the value of the mobile payment to customers.

The other equally important function is the collection of big data. When users make a payment or undertake other online activities, they leave "digital footprints" on the platforms. By carefully analyzing big data, Bigtech players may be able to gain good understanding of the customer's financial position, social relations and personal preferences. They can then engage in a number of economic activities by taking advantage of these newly gained insights, such as direct sale of products, commercial advertisements and financial risk assessment. Use of big data, however, is a controversial issue. The key challenge is how to balance between efficiency gain from big data analysis and the protection of individual rights. Abuse of big data is quite common in the PRC today. Many tech companies collect and analyze big data without customers' consent. They even sell such data to make profits. Some also conduct discriminatory pricing based on their analyses of customers' habits.

So far, one of the most important innovations in using big data analysis is probably in Bigtech credit, in the form of the new Bigtech credit risk management framework (Huang 2021). This framework contains two main elements: the Bigtech platforms and associated ecosystems, and big data-supported credit risk assessment. The Bigtech platforms and associated ecosystems have at least three important roles this framework. First, taking advantage of the long-tail feature, the Bigtech lenders recruit rapidly very large numbers of customers at nearly zero marginal cost. This helps overcome the common difficulty of customer acquisition. Second, the Bigtech lenders then collect digital footprints left by customers on the platforms. Big data may then be used for two purposes: one is to monitor customers' online activities and behavior real time; and the other is to support credit risk assessment. And, three, since all customers operate on the Bigtech platforms and associated ecosystems, the Bigtech lenders can also design incentive schemes to manage loan repayments.

The Bigtech credit risk assessment is a new innovation. By combining big data with machine-learning models, it allows the Bigtech lenders to assess credit risks without sufficient financial data or adequate collateral assets. Comparative analyses of the Bigtech approach of credit risk assessment, relative to the bank approach, which relies on financial data and scorecard models, unveil two important findings (Table 1). The first is that the Bigtech approach is more reliable than the traditional approach in predicting loan default. The better performance may be attributable to both information advantage and model advantage. Compared with the scorecard model, the machine-learning model is more capable of capturing interactive effects among a large number of variables. Additionally, big data include both more updated real-time data and behavior information, which are better for predicting both ability and willingness to repay loans. The second is that, because they do not depend on financial data and collateral assets, the Bigtech lenders can serve many unbanked customers. In fact, the outperformance of the Bigtech approach compared to the bank approach is even greater for individuals with shorter data history and SMEs of smaller sizes. These confirm the salient feature of financial inclusion of Bigtech credit.

Table 1: AUCs for Different Credit Risk Assessment Approaches

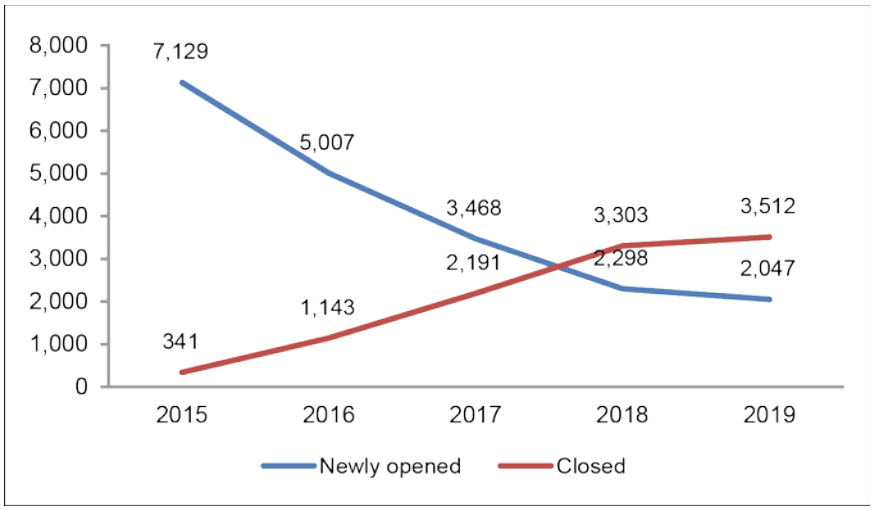
	Scorecard Method	Machine Learning Method
Traditional data	0.72	0.80
Big data	0.76	0.84

Note: This table reports the area under receiving characteristics curve (AUC) of different credit risk assessment approaches, which is widely used for evaluating reliability of the models. Here, the higher the AUC, the more reliable the model in predicting loan default. The results show that AUC for the Bigtech credit risk assessment approach (0.84) is much higher than that for the traditional bank approach (0.72).

Source: Adapted from Huang et al. (2020).

Another important area of digital transformation is digitalization of commercial banks. There are both pull and push factors for this process. On the one hand, the banks face increasing competition from new Fintech businesses. The online money market funds, for instance, could be an important alternative place for many depositors to keep their funds. Compared with a bank account, a money market investment account, such as Alibaba's *Yu'ebao*, is easier to manage, yields higher returns and does not have a minimum balance requirement. On the other hand, banks also find it beneficial to apply digital technology to the business processes. Today, more than 90% of the customers' transactions are handled online. As a result, the banks' advantage of having more branches across the country becomes a burden. In 2018, for the first time, the number of branches closed exceeded the number of new branches opened (Figure 3). Many of the large commercial banks also started to reduce their workforces in recent years, as a lot of transactions were moved online. Some banks set up Internet banking departments to start new businesses. Some others adopt more comprehensive strategies to completely transform their infrastructure and businesses. Some smaller banks also actively engage in cooperation with Fintech companies, seeking assistance in data collection, risk analysis, and other technological solutions.

Figure 3: Newly Opened and Closed Branches of Commercial Banks



Source: Xie (2020).

These are some of the examples of digital transformation of the PRC economy. The digital economy encompasses much broader areas. In short, digital technology is applied almost everywhere, such as online entertainment and teaching, digital farming, automatic driving.

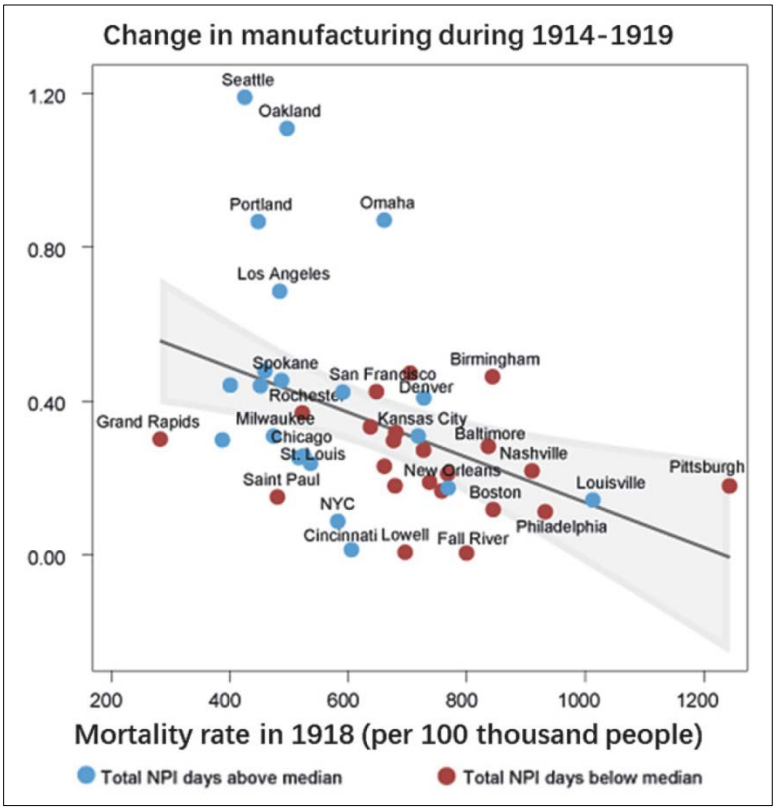
3. A MACROECONOMIC STABILIZER

The PRC economy grew by 6% in 2019. At the end of that year, economists had a heated debate on whether or not the government should try its best to prevent economic growth in 2020 from slipping below 6%. One camp argued that it could cause social and economic disasters if growth continued to slow, while the other camp believed that further moderation of growth should not be a major concern as long as the job market remained healthy and financial risks stayed contained. However, everything changed in late January 2020, when COVID-19 first hit Wuhan, a large city in central PRC, and then quickly spread to the rest of the country. It turned out to be the most serious pandemic after the 1918 influenza. After the initial confusion and fear, the PRC government took decisive measures to stop the spreading of the virus. Wuhan government declared lockdown on 23 January and did not open the city until 8 April. Other regions also implemented controlling measures from social distance to lockdown, depending on the seriousness of the pandemic.

The harsh lockdown measure was initially criticized by many both inside and outside of the PRC for interfering in individual freedom. While concern about personal rights is legitimate, the hard truth was that social distance and lockdown were the only effective ways of stopping the spread of the virus, at least before effective vaccines could be invented. This was confirmed by the United States' own experience during the 1918 influenza, according to a recent study (Correia, Luck and Verner 2020). In Figure 4, the horizontal axis shows the mortality rate during the pandemic, while the vertical axis represents growth of manufacturing jobs during 1914–1919. The authors divided all the states into two groups: one, depicted by blue spots, refers to the states adopting longer periods of nonmedical interventions; and the other, depicted by red spots, refers to the states engaging in shorter periods of nonmedical interventions. The key takeaway from this study is pretty straightforward: the states with more extensive interventions suffered from lower mortality rates and experienced faster manufacturing growth afterwards. Cross-country observations also confirmed that the countries adopting more effective social distancing and lockdown measures were able to bring the pandemic under control earlier. These include most East Asian countries, where the public is more accepting of the controlling measures. In the traditional advanced countries like the United States, the United Kingdom and many in western Europe, it was politically more difficult to enforce measures like wearing masks, let alone lockdown.

It took less than two months for the PRC to effectively stop the spread of the virus, although some small numbers of cases continued to emerge in parts of the country. Digital technology also played an important part in facilitating this success. The travel card and the health code, installed on individuals' mobile phones, help identify those with potential risks by analyzing the mobile phone holders' movement trajectories (Figure 5). The travel card was created by the central government, while the health codes were designed by provincial authorities. *Alibaba*'s programmers took a little over 24 hours to create the health codes for Zhejiang province. And *Tencent*'s programmers did the same for Guangdong province. Again, use of both travel code and health code falls into a sensitive area of privacy—people might not feel perfectly comfortable about letting others know his or her whereabouts. But it became compulsory to show the health codes when taking airplanes, trains, and buses and entering into office buildings, restaurants, and shopping malls.

Figure 4: Mortality Rates and Manufacturing Growth During 1918 Influenza in the United States



Source: Correia et al. (2020).

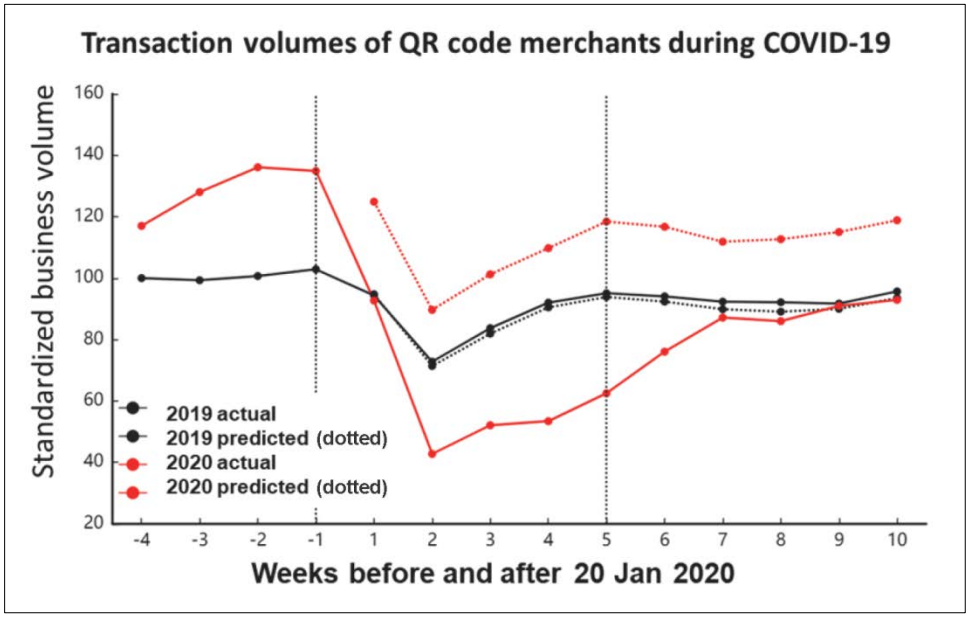
Figure 5: Travel Card (left) and Health Codes (right)

Note: The travel card reports where the individuals traveled to during the previous two weeks, while the health code is designed to identify individuals' risk levels of exposure to the pandemic. Green code means normal, yellow code refers to possible presence in some risk areas during the previous weeks, and red code indicates close contact with confirmed COVID-19 cases.

Source: Compiled by the authors.

Leaving aside the issue of social sensitivity, these controlling measures led to the complete or partial stop of economic activities. The International Monetary Fund (IMF) coined the term "Great Lockdown" to describe the collapse of the economy, paralleling the consequences of the "Great Depression" in 1929 and the "Great Recession" in 2008. In retrospect, countries without implementing tough lockdown measures suffered even more serious economic damages for longer periods. In the PRC, the beginning of the pandemic coincided with the Chinese New Year holiday, and the lockdown of Wuhan started on the day before New Year's Eve. Wang et al. (2020) took advantage of information of the close to 100 million QR code merchants—those street-side shops and vendors using a QR code payment system—to assess the economic impacts of COVID-19 (Figure 6). They divided the sample into two periods, before and after COVID-19, with the dividing line set on January 20. The red solid line shows the weekly actual standardized business volume in 2020 and the black solid line shows the same indicator in 2019. They also estimated the counterfactual business volume in 2020, assuming no COVID-19, which is represented by the red dotted line.

Figure 6: Transaction Volumes of QR Code Merchants During COVID-19

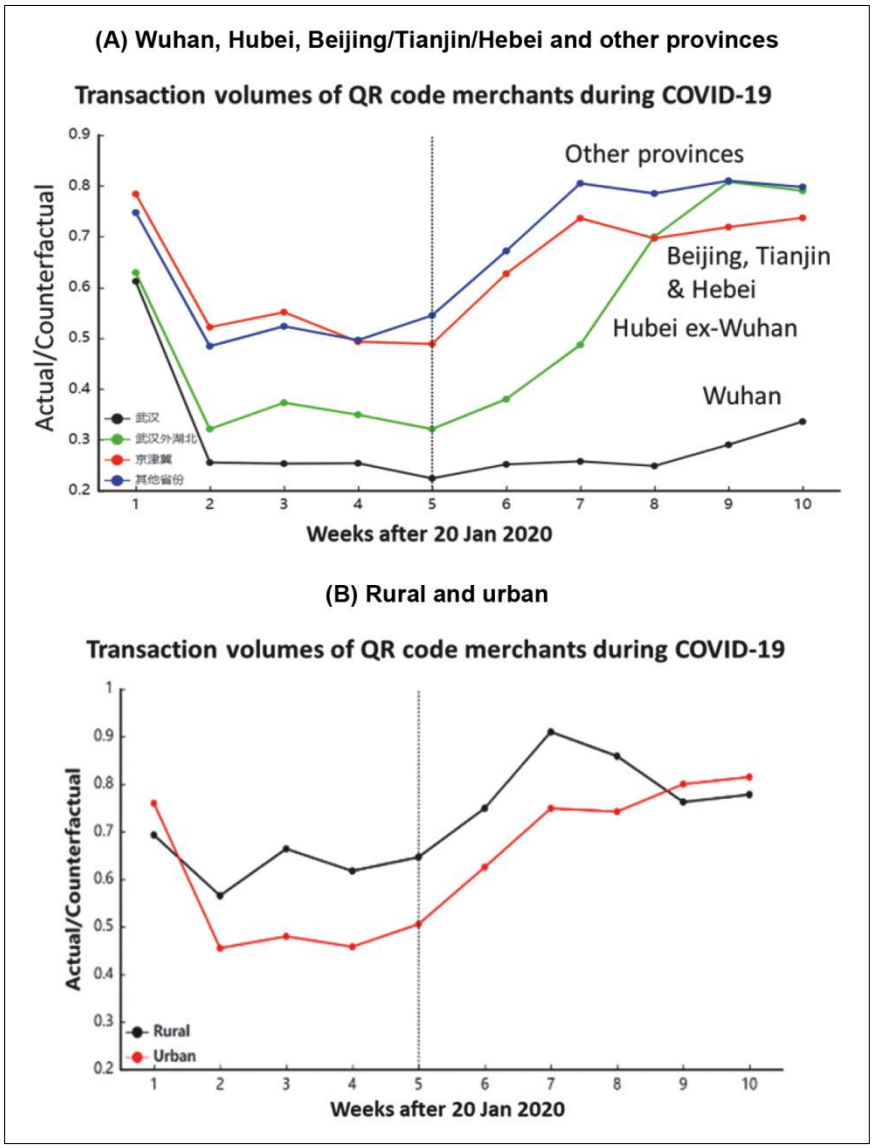


Note: Solid lines indicate the actual numbers, dashed lines indicate the predicted numbers.
Source: Wang et al. (2020).

The black line indicates a decline of QR code merchants' business activities during the two weeks following 20January, as the Chinese New Year's holiday in 2019 was slightly later than that in 2020, and then steadily recovered. The dip of business activity or the holiday effect was about 30%. In comparison, business activities declined by 70% during the first two weeks following 20 January in 2020. Surprisingly, business activities also started to recover after that. This observed dip in 2020 was the result of the combination of both the holiday effect and the lockdown effect. Within five weeks, i.e., before the end of March, business activities had already recovered back to the levels of 2019. This was quite impressive, given the seriousness of the shock. However, it is useful to keep in mind that the 2019 level should not be the normal 2020 level. The counterfactual estimates of the business activities for 2020, the red dotted line, are roughly 20% higher than the 2019 level. In other words, while the QR code

merchants' business activities returned to the 2019 level in April 2020, they were still at least 20% below where they should be.

Figure 7: Transaction Volumes of QR Code Merchants During COVID-19 by Regions



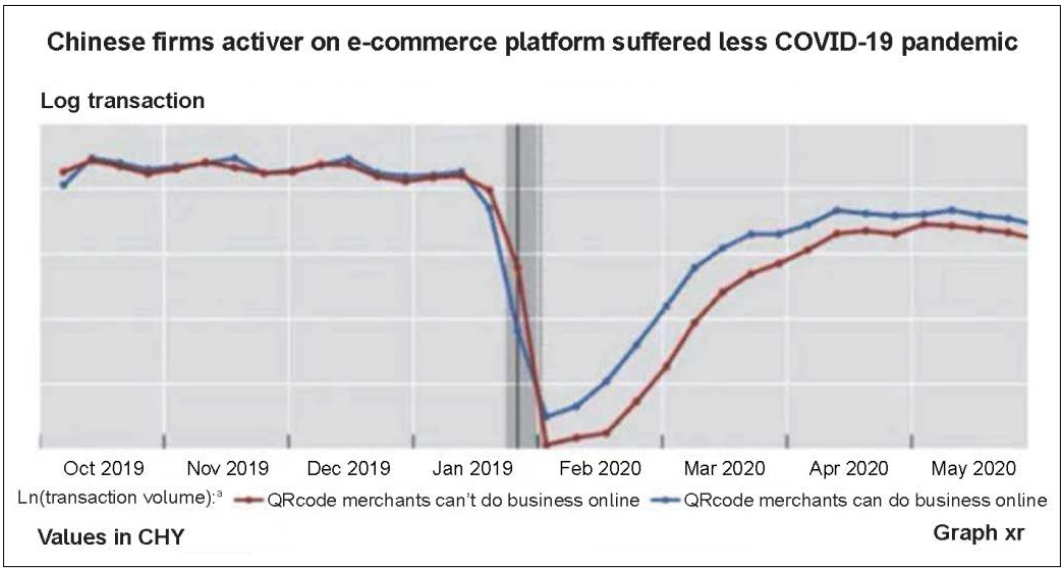
Source: Wang et al. (2020).

The geographic picture also reveals some interesting stories about the impacts of COVID-19 on QR code merchants' businesses (Figure 7). First, business activities were hardest hit in Wuhan, the city with the toughest lockdown measures. During the first week after January 20, actual business activities were only 60% of the counterfactual level (Figure 7(A)). This quickly dropped to around 25% during the second week. At the time when Wuhan declared the end of lockdown, actual business activities were still only about 35% of the counterfactual level. Second, the rest of Hubei province, of which Wuhan is the capital city, also suffered a major blow from COVID-19. During the fifth week after 20 January, actual business activities were about 35% of the counterfactual level. After that, however, the ratio rose quickly, and by

the end of March, they converged to the levels of the rest of the country. Third, the regions of Beijing, Tianjin, and Hebei suffered more damage than the country at large, probably due to stricter controls by the government out of political consideration. And, finally, the rural area, in general, suffered less than the urban area (Figure 7(B)). This was probably because the population density is lower and restrictions of people's movements were also less stringent in the countryside.

Rapid recovery of the QR code merchants' business was a result of quick control of the pandemic, which was, at least in part, supported by digital technology, such as the travel card and health code. A more exciting story, however, is the very active roles played by the digital economy. In February, for instance, most of the offline activities came to a sudden stop. These include airlines, trains, hotels and theme parks. At the same time, however, online activities surged, including online gaming and entertainment, video conferences, and teaching. In February alone, the restaurants' offline sales declined by 70%, while their online sales dropped by 40%. Although the overall business shrank, it was clear that, without support of online sales, the restaurants would suffer even greater shocks. One shoemaking company, the Red Dragon Fly, quickly shifted toward online sales, as all of its 4,000 physical shops had shut down. And the online sales value rose 600% from the previous year. The digital economy played an important role as macroeconomic stabilizer. Without it, the PRC economy would have declined even more. The QR code merchants' data confirmed the same finding. Business activities of those with online sales suffered smaller losses and recovered more than those without online sales (Figure 8). This is easy to understand—when most residents stopped visiting street-side shops and vendors, those who could take orders to deliver the products to doorsteps could continue their businesses, to a certain extent.

Figure 8: Business Activities of QR Code Merchants With and Without Online Sales



[a] Average value.

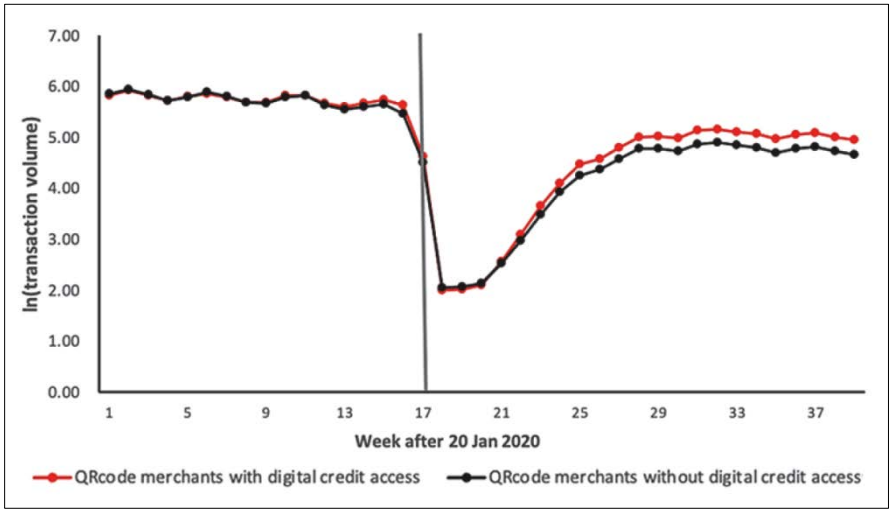
Notes:

1. The vertical line indicates 26 Jan 2020 (COVID-19 measures were effective from this date onwards). The shaded area indicates 24 Jan–2 Feb 2020 (Spring Festival).
2. The sample includes 8,800 randomly selected QRcodes of merchants which are used to construct weekly-firm level panel data. 4,400 QRcode mechants can do business channel and others don't.

Source: Beck et al. (2021).

The same is true for digital finance. Normally, it is very common to see people rushing to the banks to withdraw cash or to borrow money after big crises, because banks were often closed down during the crises. This did not happen in the PRC in 2020, either during or post COVID-19. The main reason for this was because Fintech companies and even traditional financial institutions continued to serve their customers, without opening their branches or offices. One very important reason why the digital economy functioned actively was because mobile payment services continued. As most of the bank accounts were linked to the mobile payment accounts, there was no need to withdraw cash. Some even argue that retail investors spent more time investing in capital markets from their mobile phones, which led to a boom of asset prices. The Bigtech lenders also continued their businesses. One virtual bank, XWBank located in Chengdu, received as many SME loan applications during the COVID-19 as before. Another new virtual bank, MYbank, granted more than 10 million loans during COVID-19, in cooperation with more than 100 commercial banks. Again, the QR code merchants' data showed that those who received Bigtech credit recovered somewhat better than those who did not (Figure 9). The seamless functioning of both mobile payment and Bigtech credit received attention from international organizations, such as the IMF.

Figure 9: QR Code Merchants' Businesses With and Without Access to Bigtech Credit



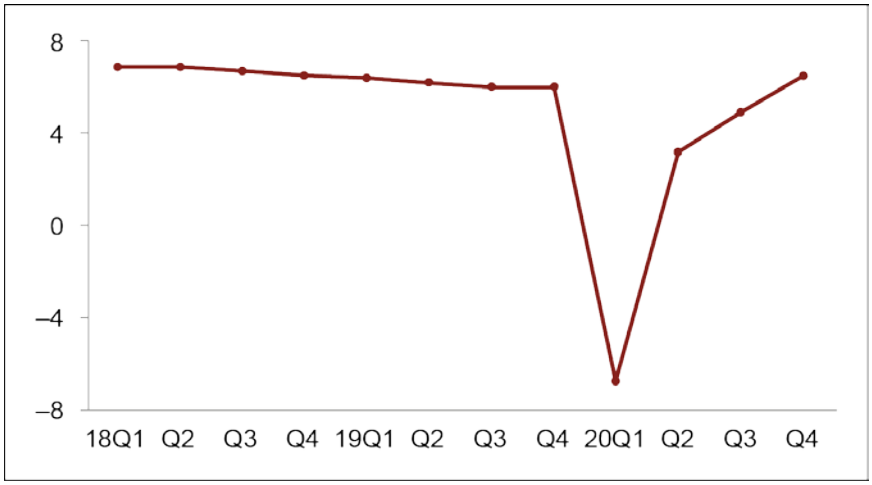
Source: Beck et al. (2021).

A very important feature of the digital economy and digital finance is contact-free. This was useful in normal times and becomes extremely valuable during COVID-19, as social distancing and lockdown were the only effective measures of controlling the pandemic. Therefore, the digital economy became an important macroeconomic stabilizer. This effect was not existent during the 1918 Influenza, the 1929 Great Depression and even the 2008 Great Recession. This new function was brought about by the fourth industrial revolution, powered by progresses in digital technology. And it will change the economy forever.

4. POST-COVID ECONOMIC PROSPECTS

In retrospect, the PRC economy performed much better than not only the rest of the world but also in terms of earlier expectations. It was the only major economy experiencing positive GDP growth in 2020, at 2.3%, while the world economy fell by 3.5%. In the meantime, experts debated about the possible shape of recovery trajectory, including U-shaped, W-shaped, and even L-shaped. It turned out to be a clear V-shaped recovery (Figure 10). While GDP collapsed by 6.8% during the first quarter, it rebounded quickly during the second quarter (3.2%) and the third quarter (4.9%), and reached 6.5% t during the fourth quarter, which was already above the pre-COVID-19 growth range. This sharp recovery was a result of: (1) enforcement of stricter controlling measures; (2) emergence of online economic activities; and (3) the support of proactive economic policies.

Figure 10: V-Shaped Recovery of the PRC's Economy in 2020



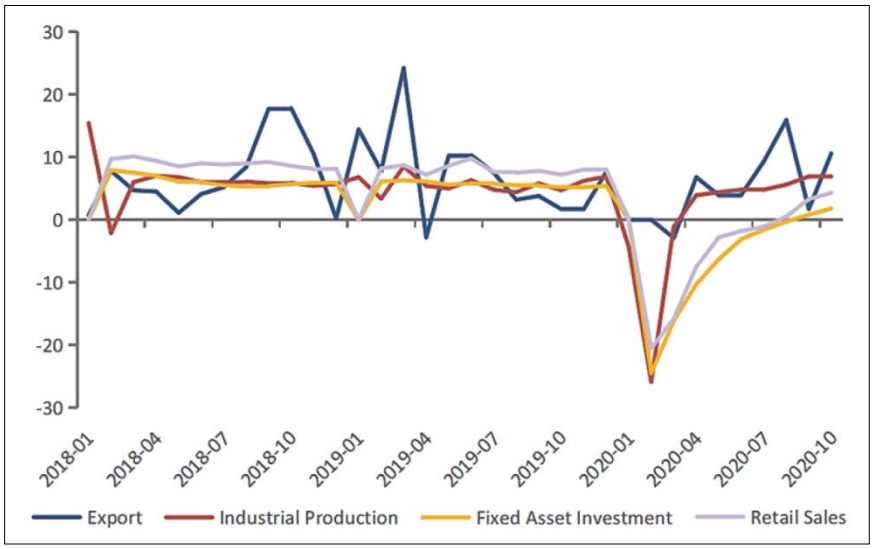
Source: State Statistics Bureau of the PRC.

However, this growth rebound has not been very balanced. Of the three main drivers of economic growth, exports were quite strong but investment and consumption were relatively soft (Figure 11). Investment for infrastructure and property grew more rapidly, while manufacturing investment remained weak. Similarly, consumption expenditure by high-income households rebounded sharply, especially spending on properties, automobiles, and luxury goods. But spending by low-income households picked up only slightly.

The unbalanced pattern highlights the "abnormal" feature of growth recovery in 2019, which was primarily driven by two unusual factors—the pandemic factor and the policy factor. The "positive" effect of the pandemic factor was reflected in strong export performance. Normal expectation is that the pandemic should hurt exports as global demand for imports weakens significantly. In 2020, however, because the PRC came out of the COVID-19 shock earlier than most other countries, it was able to fulfill export orders for many other countries. During the early stage of social distancing and lockdown policy, local governments in Zhejiang province, one of the main export regions, rented buses, trains, and even airplanes to bring more than half a million migrant workers back from their hometowns, where they were spending the Chinese New Year's holiday. This enabled Zhejiang manufacturers to pick up export orders from some other countries. Even though global demand collapsed in 2020, the PRC exports

still rose by 3.6%. In a way, this is a special result of the pandemic and, therefore, is unsustainable.

Figure 11: Unbalanced Recovery of Economic Activities
(% year-on-year)



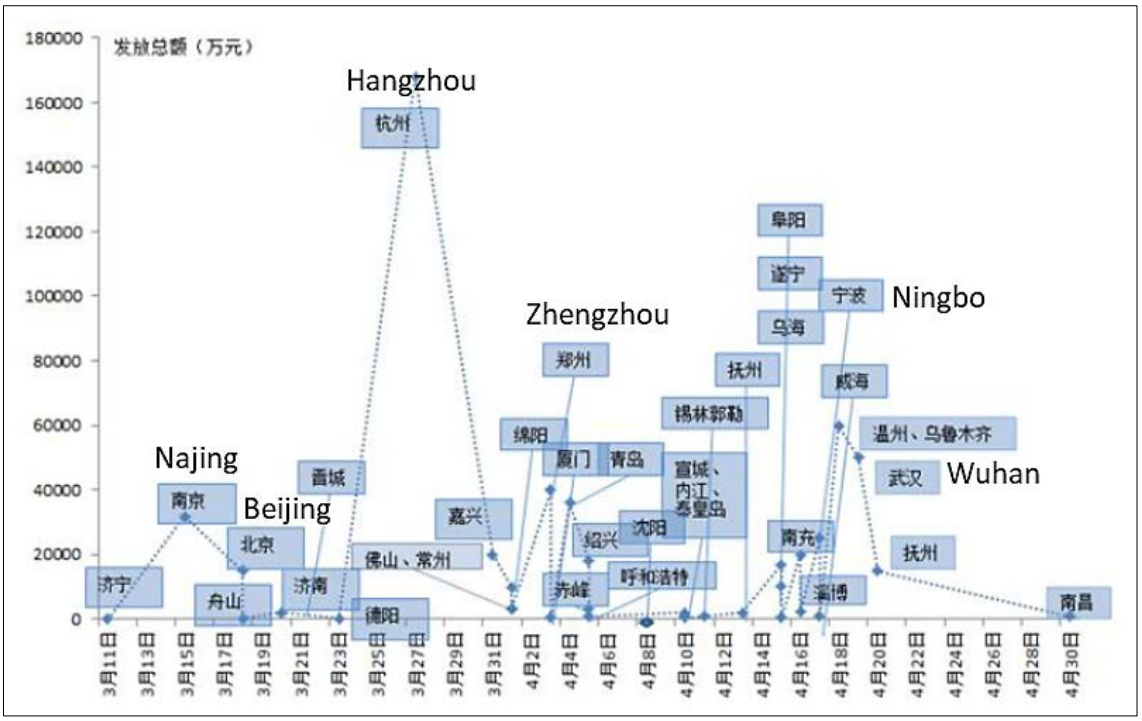
Source: State Statistical Bureau of the PRC.

The policy factor refers to the policies adopted by the government to stabilize the economy, including proactive fiscal policy, monetary policy and financial policy. These policies were quite similar to those adopted in late 2008. The difference was that the problem during the Great Recession centered around the financial institutions and financial markets, while that during the Great Lockdown centered around the SMEs and LIHs. Most of the policies aimed at assisting enterprises and households, as financial institutions' balance sheets were relatively healthy. The fiscal deficit exceeded 3% t of GDP for the first time in recent history. However, the PRC's fiscal spending pattern was quite unique. In most market economies, proactive fiscal policies in 2020 prioritized the job-retention schemes, unemployment benefits and direct cash payouts. This reflected the fact that the main targets of the pandemic were enterprises and households. In the PRC, however, fiscal expansion concentrated on infrastructure investment, tax relief for enterprises, and public health spending. The difference was primarily caused by the fact that the PRC government lacked effective channels of directly assisting the enterprises and households, while the social security system was not yet fully developed.

Here, again, digital technology provided valuable support in offering a direct channel to the households. From as early as March, some local governments started to issue consumption coupons to assist households, taking advantage of mobile payment accounts. By early May, about 170 municipal governments in 28 provinces had issued a total amount of such coupons of CNY 19 billion (Figure 12). In retrospect, such consumption coupons were useful in boosting consumer spending during COVID-19 (Lin, Shen and Sun 2020). However, it was not a coordinated policy effort. Therefore, only local governments in those relatively more developed regions, with more abundant fiscal resources, engaged in such policy. Households living in poor regions could not receive such benefit. And distribution of consumption coupons makes use of mobile payment system, not based on income levels of the households. Nevertheless, it was

still an impressive innovative step by the government to take advantage of digital technology in assisting households.

Figure 12: Consumption Coupons Issued by Some Local Governments



Source: Authors' compilation from media reports.

Another important policy was to encourage banks to grant more SME loans. The central bank provided targeted liquidity to facilitate SME lending. The regulators also made detailed requirements for commercial banks to lend to SMEs, including the growth of SME loans by 40% by six large banks in 2020. They also required the banks to rollover the loans until the end of March 2021, should borrowers have made such requests. The Ministry of Finance (MOF) also provided some interest rate subsidies to SME lending.

The IMF now expects the PRC GDP to grow by 8.1% in 2021. While this would still be significantly higher than the expected world average, 5.5%, the growth differential between the PRC and the rest of the world would be significantly narrowed. This may cause an important shift in investor sentiment, as world economic growth rebounded even more sharply. More importantly, the PRC economy still faces some hurdles in continuing economic growth in 2021. One, COVID-19 remains a serious risk. Although the PRC was very successful in bringing the virus under control in early 2020, some new cases still emerged from time to time, especially during the winter. Even isolated cases could cause serious effects on confidence and re-trigger harsh controlling measures. More importantly, if the PRC has to continue to rely on social distancing and lockdown to contain the virus, as its pace of vaccination is somewhat slower than the developed countries, it might put the PRC economy into an awkward position if the developed countries relax restrictions and open up sometime during the second half of 2021. Secondly, legacies of the 2020 macroeconomic policies may pose difficulties for the sustainability of economic growth in 2021. For example, the massive amount of new SME loans granted during COVID-19 could lead to a jump in nonperforming loans

later, especially as many of such loans had a strong feature of policy lending. The authorities, however, do not have a clear plan of how to share the potential financial burdens. Potential deterioration of asset quality could lead to financial instability. It may also raise questions about the banks' capability of supporting economic growth, especially growth of the SMEs, without the injection of additional capital and the provision of additional liquidity.

Therefore, the biggest challenge in 2021 is not to achieve a certain rate of economic growth. It should be to shift "abnormal recovery" in 2020 back to "normal growth." The recovery was largely supported by both the pandemic factor and the policy factor. "Normal growth" means that economic development can sustain in the absence of the pandemic and the policy factors. The PRC authorities will probably need to take several steps to move the economy in that direction. First, they should carefully balance between the control of the pandemic and maintenance of normal economic activities. While social distancing and lockdown measures are still vital in much of 2021, the priority should be to apply vaccine to the broad population. Second, macroeconomic policy supports are still necessary for continuing strong growth, as parts of the economic activity are still quite weak. Of course, as the economy gathers momentum, macroeconomic policies should start to fine-tune accordingly. But any drastic change should be avoided. Third, the authorities should re-emphasize the importance of structural reforms. The policymakers recently articulated the need to form a cooperative relationship between domestic and external economic circulation, the so-called "dual-circulation," with relatively more focus on domestic economic circulation. This essentially calls for more policy measures to both boost consumer demand and promote innovation while, at the same time, accelerating opening to the outside economy. Construction of "dual-circulation" will not be completed in 2021, but it is important to start this task. This should be helpful for both exiting from the pandemic and the policy factors and laying foundations for sustainable growth over the long run.

5. CONCLUDING REMARKS

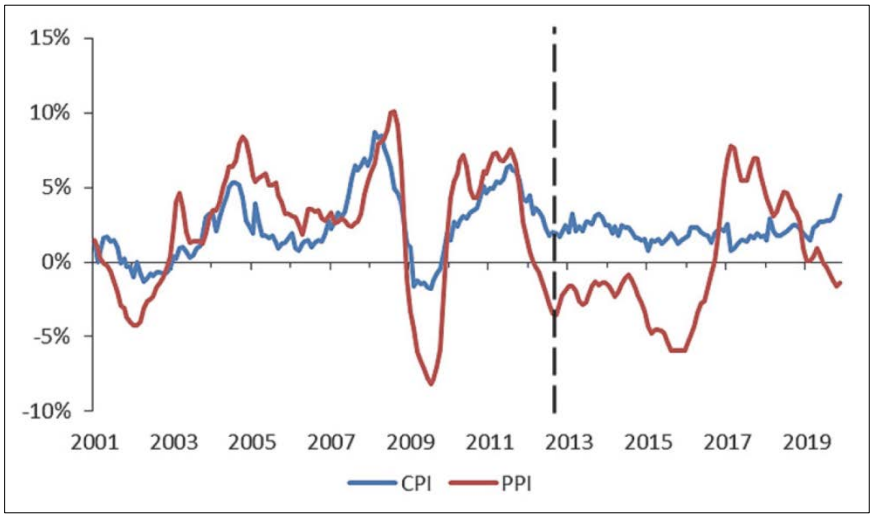
COVID-19 is the greatest pandemic in a century, measured by areas affected, human lives lost, and economic activities damaged. But as the "broken window theory" tells us, any disaster events may also contain some new opportunities, such as the fixing of the broken window. COVID-19 highlighted the unique value of the digital economy, especially its contact-free feature. Indeed, during the Great Lockdown, many economic activities continued. School semesters continued as students and teachers moved from offline to online classrooms. Webinars and video conferences replaced face-to-face discussions. In fact, most experts participated in more international discussions in 2020 than in any other year. Online payment, shopping, lending, and investment all became a very important part of daily life. In short, during COVID-19, the digital economy played a very important role as macroeconomic stabilizer. Without it, lives would have been much tougher. And this was only made possible by the recent rapid progress of digital technology. It was not possible during the SARS period in 2003.

Development of the digital economy started way before COVID-19. The exact date of the beginning may be defined in different ways, depending on different definitions of "digital economy." The popularly understood "digital economy" phenomenon began when *T-Mall* was set up in 2003 and when *Alipay* came online in 2004. While the digital technology brings about the fourth industrial revolution, just like the steam engine, electrical machines, and computers, respectively, brought about the previous three industrial revolutions, in some ways, the digital technology could change our understanding of some economic rules. For instance, the long-tail feature of the

Bigtech platforms challenges the common brief of "decreasing return to scale." And, again, big data analysis often focuses on the correlation among different variables, instead of causation, which is crucial in traditional econometric analysis. These imply that the conventional economic theory may have to be rewritten. And some "miracles" have already emerged in the PRC economy. The digital technology makes it possible to promote financial inclusion, providing financial services to gigantic numbers of customers at an extraordinary pace.

The digital economy could also change macroeconomic behavior. Chen, Huang and Qiu (2021), for instance, find that the consumer price index (CPI) suddenly became more stable after 2012 in the PRC, while the producer price index (PPI) remained volatile. According to Chen, Huang and H. Qiu et al. (2021), the significant reduction of CPI volatility was attributable to the rapid development of e-commerce, facilitated by both mobile payment and logistics. E-commerce has a number of channels of increasing CPI stability. An obvious one is the signal effect. A price online constrains the degree of variation of offline prices. For instance, price variability of a single pack of milk offline is much greater than the price variability of multipack milk, because there is no sale of single packs online. Another channel is to physically integrate the national market more closely. With well-developed transportation networks, logistics, and, especially, fast delivery to the doorsteps, the room for price volatility is significantly squeezed. Products can be shipped from places where their prices are lower to places where prices are higher within a matter of days. This arbitrage activity can quickly equalize the prices. And the third channel is better inventory management. In the traditional supply chain, information transmission from retailer to wholesaler to producer suffered from significant time lags, which could exaggerate inventory and price volatilities. With the digital technology, however, producers can monitor real-time demand and supply and adjust production plans accordingly.

Figure 13: Consumer and Producer Price Indices in the PRC
(% year-on-year)



Source: State Statistical Bureau of the PRC.

This is a good example of how the digital technology could assert significant influence on macroeconomic stability. And, by implication, this could also change the making and transmission of monetary policy.

Development of the digital economy is only at its early stage and its pace will likely accelerate in the coming decade in the PRC, given the adoption of 5G telecommunication technology, the building of "new" digital infrastructure across the country, partly as a policy response to COVID-19, and the wide implementation of the Internet of Things. In addition, a wide range of new activities, such as auto drive, distant medical treatment, robo investment advice, could mature and become parts of daily lives. One important function of the digital economy, in addition to scale, efficiency, and user experience, is to substitute for labor. This is particularly valuable as the PRC is rapidly ageing, with the old population (defined as 65 years old and above) doubling over the next 30 years and the old-old population (defined as 85 years old and above) tripling during the same period. According to Dollar, Huang and Y. Yao (2020), robots should be more than enough to offset the decline of the labor force as a result of ageing. This means that, with the support of digital technology, the PRC economy is more likely to sustain its strong economic growth over the coming decades.

The digital economy is also at the center of some policy controversies at the moment in the PRC. One relates to data policy. While big data analysis has been at the core of digital economic development, there is no proper protection of data rights. Illegal collection and analysis of data are quite common. The authorities will need to urgently draw together a comprehensive set of data policies on ownership and rights, standards, pricing, and exchange. The overall purpose should be to find a balance between the efficiency of big data analysis and the protection of individual rights. Another issue is the so-called data inequality problem. While the digital economy benefits the mass, it could make the lives of those that do not use digital tools and leave no data a lot tougher. And this requires serious policy efforts. And yet another is the regulation of Bigtech platforms. On the one hand, the Bigtech platforms have the natural advantage of becoming big because of economies of scale and scope, which could easily raise suspicion about monopoly. On the other hand, there are frequent complaints by consumers against the Bigtech platforms about their discriminatory behavior.

It is convenient to label the Bigtech platforms as monopolies, because of their sizes. However, because long-tail means economies of scale, large business sizes and even large market shares are actually natural outcomes of successful digital economic businesses. Instead of looking at the market share to judge the existence of monopoly, they should look at "contestability," i.e., whether new players could still enter to compete with incumbents. For the same reasons, it would be unwise to break down the digital economic institutions as an anti-monopoly measure. The regulators, instead, should look for ways to better strengthen competition and protect consumers.

In summary, digital technology is opening a new chapter of economic development. It creates a lot of new opportunities, such as helping the economy survive COVID-19. It probably also brings some new risks, which need to be carefully addressed.

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