

INTERNATIONAL FINANCE FORUM (IFF)
**GLOBAL FINANCE
AND DEVELOPMENT
REPORT 2022**

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國際金融論壇
INTERNATIONAL
FINANCE FORUM
Since 2003



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The International Finance Forum (IFF) is an independent, non-profit, non-governmental international organisation founded in Beijing in October 2003, established by financial leaders from more than 20 countries and regions, including China, the United States, the European Union, emerging countries and leaders of international organisations such as the United Nations, the World Bank and the International Monetary Fund (IMF). The IFF is a long-standing, high-level platform for dialogue and communication and multilateral cooperation and has been upgraded to F20 (Finance 20) status.

The International Finance Forum (IFF) advocates an international and market-oriented operation mechanism to advance the supportive role of finance in sustainable development through its platforms of strategic dialogue, co-operation, communication, practice and innovation, research and training programme.

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Upholding the spirit of “Comprehensive and Sustainable Development – New Capital, New Value, New World”, since the founding in 2003, the International Finance Forum (IFF) has been committed to building itself into a world-class academic think-tank and multilateral dialogue platform with strategic insight.

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The International Finance Forum (IFF) operates based on an open, transparent and fair mechanism to ensure its independence, objectivity, foresight and inclusiveness and to facilitate global financial co-operation and exchanges. Through in-depth research on global finance, IFF is committed to promoting sustainable development of China and the world economy. Our targets include:

1. International Financial Strategic Dialogue Platform
2. International Financial Cooperation & Exchange Platform
3. International Financial Innovation & Practice Platform
4. International Financial Strategic Think-Tank Platform
5. International Financial Talents Platform

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The International Finance Forum (IFF) started to publish the Global Finance and Development Report in 2021 to conduct research on and stay on top of major global issues. It is also an effort by the IFF to accelerate economic recovery and promote sustainable development. Armed with global economic data, the report, released during the IFF Annual Meeting, offers an annual assessment of global economic trends and prospects, financial development and innovation, as well as long-term challenges and policy issues.

The IFF Global Finance and Development Report 2022 comprises two sections. The first part, the Global Economic Outlook, includes a global economic outlook for 2023, a mapping of major risks for the global economy, and broad and practical policy recommendations. The second part focuses on digital finance, which has taken off in recent years thanks to technologies such as artificial intelligence (AI), big data and cloud computing and their wide applications. Digital finance helps create a new financial ecosystem, upgrade financial business models, and inject new vitality into the world's real economy. Opportunities aside, it also generates risks and challenges in privacy protection, information security, financial stability etc. The report offers an in-depth look at digital finance from three perspectives, i.e. its definition and history, opportunities and challenges, as well as risks and regulations.

Since its inception, the IFF has positioned itself to promote international exchange, academic research and strategic dialogue in the financial realm. Supported by more than 200 political and financial leaders around the world, the IFF has established partnerships with over 50 countries and regions as well as more than 50 international and regional organisations.

The IFF's goal is to build Finance 20 (F20) through joint efforts. It has demonstrated its commitment to being a force for economic recovery and prosperity. The IFF strives to be the world's leading think tank and a multilateral platform for global financial dialogues, communications and cooperations, innovation, research and talent development.



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Chapter 1: Global economic outlook, risks and policy priorities*

Global economic growth slowed significantly in 2022 due to multiple shocks, including rapidly rising inflation, the reversal of monetary policy direction across the world, the Russia-Ukraine war, resurgence of COVID-19 outbreaks in parts of the world, and continued supply-side disruptions. The global economy is now projected to grow 3.1% this year, down from 6.0% in 2021, with the advanced countries combined growing 2.4% and developing economies as a group expanding 3.7%. In 2023, with tight monetary policy and financial conditions set to continue, global growth is expected to remain weak at 2.8%, with the advanced countries growing 1.2% and developing economies expanding 3.9%.

Global inflation accelerated in 2022 on the back of rising demand, driven partly by lagged effects of large-scale fiscal and monetary stimuli introduced in many countries since the pandemic started; continued supply-side bottlenecks; and increases in world commodity prices, partly fueled by impacts of the Russia-Ukraine war and sanctions on Russia by Western countries. Global consumer price inflation rate is projected to reach 9.0% in 2022, up from 4.6% in 2021. In 2023, as supply-side bottlenecks ease further, commodity prices soften somewhat, and monetary tightening slows down demand growth, global inflation is projected to moderate to 6.4%.

But this outlook is subject to several significant downside risks. Compared with

current expectations, inflation pressures could turn out to be more persistent, impacts of the Russia-Ukraine war on global markets and economy could be greater, and financial condition tightening could lead to more severe and widespread debt distress in the developing world. Furthermore, the COVID-19 outbreak could worsen again. If these risks materialize, global growth could be lower and global inflation higher, and the possibility of the global economy falling into recession or stagnation cannot be ruled out. To reduce the risks and support global recovery, it is critically important that the global community work together to (i) end the pandemic; (ii) continue the fight against inflation and ensure a soft landing for the global economy; (iii) end the trade war; (iv) accelerate the transition to a green economy; and (v) strengthen international cooperation to address multiple challenges.

1.1 Economic outlook

The global growth has slowed down significantly this year due to multiple shocks, and is likely to remain weak in 2023

After a strong rebound in 2021, the global economic growth has slowed significantly this year due to multiple shocks, including rapidly rising inflation, the reversal of monetary policy direction across the world, the Russia-Ukraine war, resurgence of COVID-19 outbreaks in parts of the world, and continued supply-side disruptions. The Group

* This report was prepared by Juzhong Zhuang, IFF Academic Committee member. The cutoff date for the data used throughout the report is by late October 2022.

of 20 (G20) countries, which represents about 80% of the global economy, grew at a seasonally-adjusted rate of 0.5% in the first quarter of 2022 and contracted by 0.4% in the second quarter, from their respective previous quarter. The same growth rates were -0.4% and -0.1% for the United States (US), implying a technical recession; 1.4% and -2.6% for China; 0.7% and 0.7% for the European Union (EU); and 0.1 and 0.9% for Japan, respectively.

As a result, many investment houses and international organizations have downgraded their growth projections for 2022 and 2023 for a large number of economies. The consensus view now is that the global economy will grow about 3.1% this year, down from 6.0% in 2021 (using country weights at the PPP exchange rates) (Table 1.1).⁹ The advanced economies combined will grow 2.4% and developing economies as a group will expand 3.7%. But there are large variations in the pace of growth across countries, reflecting differential impacts of the shocks highlighted above, differences in the scale of fiscal and monetary stimuli introduced in response to the pandemic and in the pace of policy normalization, the strength of the economic recovery in 2021, and some country-specific developments. At these rates, the advanced economies will contribute 33% of the global growth in 2022, and developing economies will contribute 67%. Across regions, developing Asia will contribute 49%, the EU 15%, Middle East and North Africa 13%, North America 10%, Latin America and Caribbean 7.3%, high income Asia 5.7%, Sub-Saharan Africa 3.6%, while developing Europe will subtract global growth by 4.2%, due to impacts of the Russia-Ukraine war. Across countries, China will remain the largest source of global growth, contributing about 20%, followed by India at 16%, and the US at 8.2%.

Global recovery is set to continue in 2023, but remains weak. With most countries choosing to live with COVID-19, its disruptions to the economy and society will be further contained. However, monetary tightening to keep inflation under control in developed countries will further weaken their growth momentum, while tighter financial conditions for many developing countries will limit the pace of their recovery. Against this background, the global economy is projected to grow 2.8% in 2023, with the advanced economies combined growing 1.2% and developing countries as a group expanding 3.9%.

Among major groups of economies, developing Asia is to grow 4.4% in 2022 and 5.0% in 2023; high income Asia 2.1% and 2.3%; developing Europe -2.5% and zero; the EU 3.2% and 0.7%; Latin America and Caribbean 3.1% and 1.5%; Middle East and North Africa 5.1% and 3.6%; North America 1.8% and 1.0%; Sub-Saharan Africa 3.6% and 3.8%; ASEAN 5.0% and 4.9%; BRICS countries 3.4% and 4.2%; the G20 group 3.1% and 2.5%; and one-belt-one-road economies 3.3% and 3.6%, respectively.

Among major economies, the US is projected to grow 1.6% in 2022 and 1.0% in 2023, down from 5.7% in 2021. The slowdown mainly reflects significantly weaker momentum in private consumption, in part reflecting the erosion of household purchasing power because of rapidly rising inflation, and in private investment, due to tighter financial conditions associated with a steep tightening in monetary policy. To control inflation, the Federal Reserve (FED) started to raise the interest rate and stopped net asset purchase last March, and started to trim its balance sheet last June. The FED will continue its fight against inflation, by trimming the balance sheet and keeping the interest rate

⁹ In this report, 2022 and 2023 growth and inflation projections are based on the latest forecasts by international organizations (including the IMF, OECD, ADB, EBRD and EIB) as of the late October 2022, the October issue of Focus-Economics country reports, and analysis of International Finance Forum (IFF).

at a high level not seen for many years. On a positive note, labor market remains robust and will offset somewhat negative impacts of monetary tightening.

The EU is projected to grow 3.2% in 2022 and 0.7% in 2023, down from 5.2% in 2021. The slowdown was mainly due to high inflation reducing household purchasing power, impacts of the Russia-Ukraine war on energy supply and prices as well as the uncertainty it has brought, and monetary tightening. In response to rapidly rising inflation, the European Central Bank (ECB) ended net asset purchases last March and started to raise interest rates in July. Among the three largest EU member economies, Germany is projected to grow 1.4% and -0.3%, France 2.5% and 0.6%, and Italy 3.2% and 0.2%, in 2022 and 2023, respectively. The ECB is expected to tighten monetary policy further. But a healthy labor market and the disbursement of Next Generation EU funds will support growth.

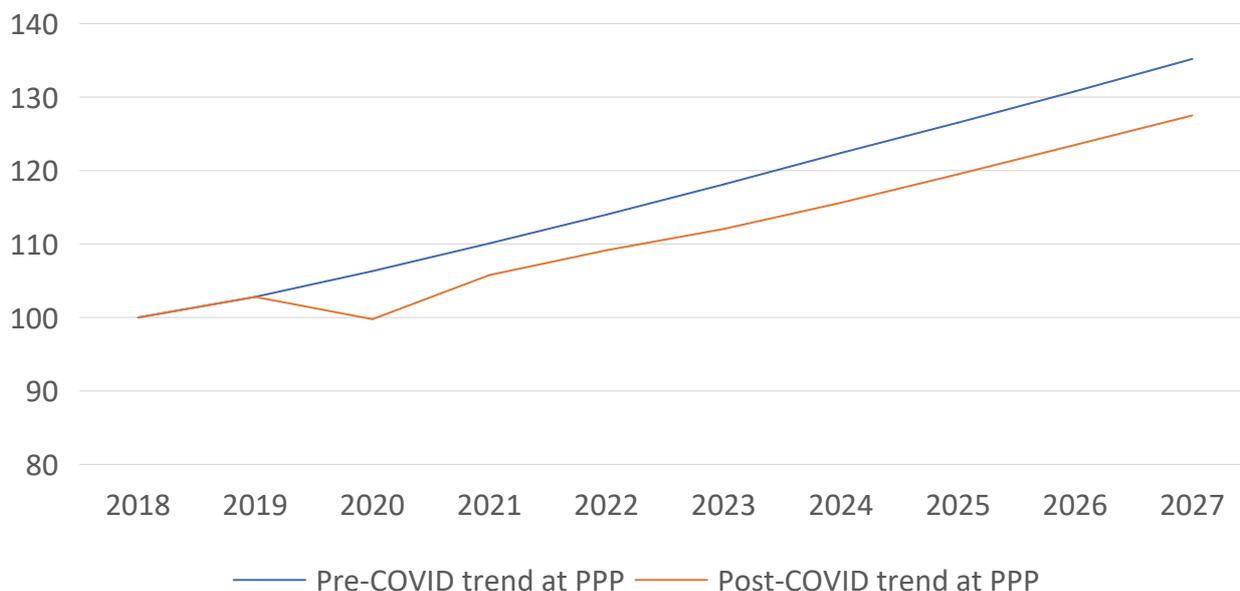
China grew 3.9% in the third quarter from a year earlier, beating the market expectation. The economy is now projected to grow 3.3% in 2022 and 4.6% in 2023, down from 8.1% in 2021. The slowdown in 2022 is partly due to COVID-19 outbreaks and strict lockdown measures to contain the outbreaks, as well as a property sector downturn. The government is expected to continue its dynamic zero-COVID policy for the time being, but local governments will learn to adopt smarter and more targeted lockdown measures to control outbreaks, to minimize their disruptions to production and consumption. Measures of stabilizing the economy introduced by the government last May, covering six areas including fiscal support, monetary measures, investment and consumption, food and energy security, supply chains, and household livelihood, and follow-up measures unveiled last August, will support growth in the short term. The broad economic policy directions highlighted at the 20th Chinese Communist Party Congress in October, including pursuing high-quality development, deepening reform and opening to the outside world, and letting

market to play a decisive role in resource allocation, will help sustain robust growth in the medium to long term.

ASEAN as a group is projected to grow 5.0% in 2022 and 4.9% in 2023, and it is one of the few economies that see growth going up this year. Consumption and investment growth has rebounded on the gradual lifting of COVID-19 mobility restrictions and reopening of markets and borders. Manufacturing and services sectors have staged a healthy recovery in most economies, creating jobs and lifting household incomes. Tourist arrivals are picking up, albeit slowly. But Southeast Asian countries face the challenges of higher energy and food prices, rising global interest rates, continued supply-side disruptions and weaker external demand amid slowing global growth. Central banks have tightened monetary policy in several large economies—Indonesia, Malaysia, the Philippines, and Thailand—to contain inflationary pressures, although modestly. Many countries have rolled out fiscal measures to protect vulnerable groups from elevated energy and food prices. But fiscal space is constrained by rising fiscal deficits and debt.

Most economies will see GDP returning to their pre-pandemic levels in 2022. Last year, this report projects that the global economy is expected to return to its pre-pandemic trend level by 2025. However, because of the multiple shocks that have weakened growth, the global GDP is now unlikely to return to its pre-pandemic trend level any time soon. According to IMF's medium-term projections, global GDP will remain as much as 5% lower than its pre-pandemic trend level by 2027 (Fig. 1.1). The pandemic is likely to leave a lasting scar in the growth trajectory for many countries around the world.

Figure 1.1: The size of the global economy (2018=100)



Note: The pre-COVID trend growth rate is assumed to be 3.4%, which is the world's average annual growth rate during 2014-2019.

Sources: IMF and IFF staff analysis.

Inflationary pressures will remain elevated globally, but moderate somewhat in 2023 amid tight monetary conditions.

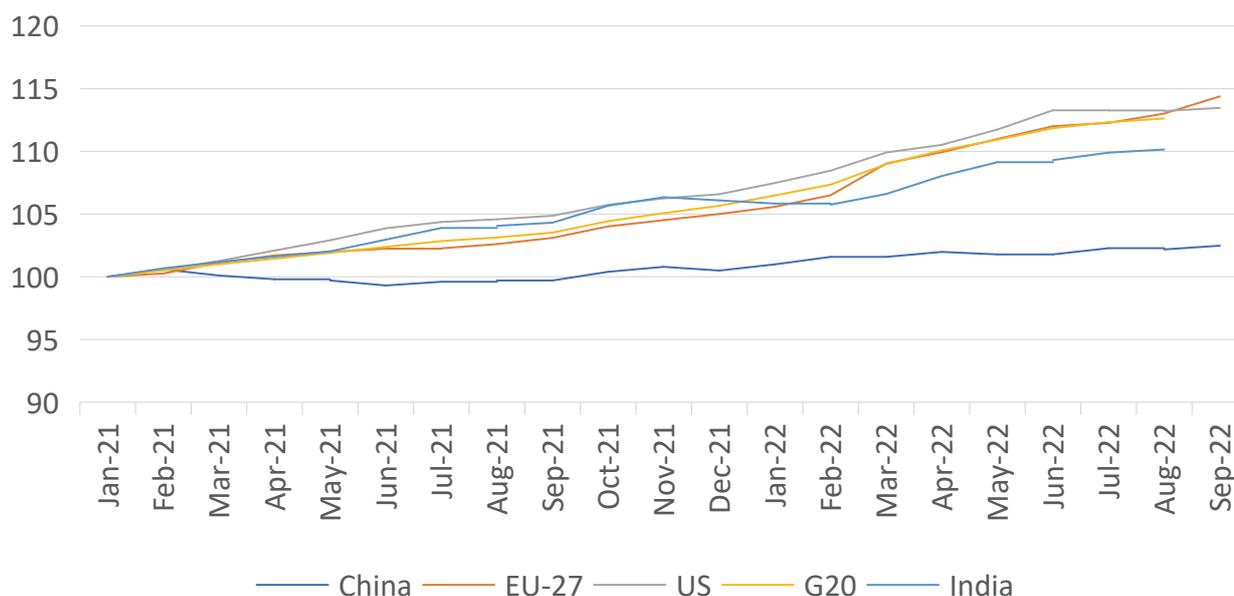
The global inflation accelerated in 2022 (Fig. 1.2). In the first 8 months, the consumer price index (CPI) increased by 6.6% for the G20 countries combined, or at more than 0.8% per month on average, compared with the average month-on-month increase of about 0.5% in 2021. The price increases were driven mainly by developed countries. The CPI of the US and EU rose by 6.2% and 7.6%, respectively, in the first 8 months, while that of China and India, the two largest developing economies, only rose by 1.7% and 3.8%. In August 2022, the year-on-year (y-o-y) monthly inflation rate reached 9.2% for the G20 countries as a whole. It was 10.1% for the EU, 8.3% for the US, 5.9% for India, and 2.5% for China. In September, the y-o-y inflation rose further to 10.9% for the EU, stayed at 8.2% for the US, and edged up to 2.8% for China.

The acceleration of inflation reflects multiple factors, including rising demand, partly driven

by large fiscal and monetary stimuli since the pandemic started; continued supply-side bottlenecks; and increases in world commodity prices, partly fueled by impacts of the Russia-Ukraine war and sanctions on Russia by Western countries. In some emerging markets, currency depreciations have caused import prices to rise. The consensus view is that global consumer price inflation rate is to reach 9% in 2022, up from 4.6% in 2021, with that of advanced economies recording 7.1%, up from 3.0%, and of developing countries reaching 10.5%, up from 5.8% (Table 1.2).

Among the major advanced economies, inflation in 2022 will be the highest in the UK, reaching 9.1%, followed by Italy at 8.6%, Germany at 8.5%, US at 8.1%, Canada at 6.9%, Australia at 6.5%, France at 5.9%, Korea at 5.1%, and Japan at 2.1%. Among developing economies, Argentina and Turkey will continue to experience a double-digit inflation in 2022, reaching about 73% and 72%, respectively, partly due to large currency depreciations. Inflation in Russia

Figure 1.2: CPI Index (Jan 2021=100), G20 and selected economies



Source: OECD Statistics website. Accessed 21 October 2022.

will also accelerate to more than 13.1% due to the impact of its war with Ukraine. Annual consumer price inflation rate will stay at a little over 9% in Brazil, and reach 8.0% in Mexico, 6.8% in India, 6.7% for South Africa, 4.4% in Indonesia, 2.6% in Saudi Arabia, and 2.2% in China.

In 2023, inflation pressures are expected to remain elevated, but the consensus view is that the global inflation will moderate somewhat for a number of reasons. First, further relaxation of social distancing measures to contain outbreaks of COVID-19 across the world will ease supply side bottlenecks. Second, commodity prices are likely to soften somewhat next year because of moderating demand growth. Third, the tightening of monetary policy around the world will contain inflationary pressures. Against these considerations, the global consumer price inflation is projected to taper off to 6.4% in 2023 (Table 1.2). Inflation will moderate from 7.1% to 4.1% for advanced economies and from 10.5% to 8.2% for developing economies.

Among the advanced economies, the US inflation is projected to soften from 8.1% in

2022 to 3.6% in 2023 and the EU from 8.8% to 6.3%. Among developing economies, inflation is expected to remain at a two-digit level in Argentina and Turkey, as the two countries continue to face macroeconomic challenges, and Russia, which will continue to be affected by the war and Western sanctions. Inflation is expected to moderate to 4.7% and 5.2% in Brazil and India respectively. China's inflation in 2023 is expected to remain low at 2.3%.

1.2.Risks to the outlook

But there are significant downside risks to this outlook. If the risks materialize, global growth could be lower, global inflation could be higher, and the possibility of the global economy falling into recession or stagnation cannot be ruled out.

First, inflation pressure could be more persistent.

The consensus view is that global inflation will peak this year and return to near pre-pandemic levels by 2024 or 2025. However, several factors could cause it to remain elevated

in 2023 and beyond. Major central banks may act too much in monetary tightening, leading to stagflation, that is, a combination of recession and rising inflation. Or they may act too little, thereby failing to contain domestic demand and rising prices, risking de-anchoring of long-term inflationary expectations, and, in view of tight labor markets in major developed countries, triggering a wage-price spiral. A more protracted Russia-Ukraine war could cause continued shocks to global energy and food markets, an emergence of more deadly COVID-19 variants and resurgence of outbreaks could lead to renewed supply-side disruptions, and both can make inflation pressures more persistent (see more discussions below). Lastly, globalization in the past several decades has helped to keep inflation low in advanced economies. However, deglobalization policy measures introduced by several advanced countries in recent years, such as hiking tariffs, imposing non-tariff trade barriers, and reshoring production home, and responses by the targeted countries in retaliation, have inflationary consequences. If these policies continue or accelerate, monetary policy in advanced countries may need to be tightened more than otherwise to keep inflation under control, or it may take longer for global inflation to return to the pre-pandemic levels.

Second, impacts of the Russia-Ukraine war on the global markets and economy could be greater than anticipated.

The Russia-Ukraine war and sanctions against Russia by Western countries have caused a major shock to world commodity markets by reducing supplies of energy and grains from two of the world's major commodity exporters. The price of Brent crude surged to above \$120 per barrel immediately after the outbreak of the war. Since then, it has fluctuated widely, and drifted below \$100 per barrel in recent months. The IMF now projects the world oil price to reach \$98 per barrel in 2022, which is about 40% higher than last year. For 2023, the world oil price is expected to moderate to \$86 per barrel. These projections assume supply-side disruptions

ease somewhat and demand grows more slowly next year amid weaker GDP growth. However, if oil supply disruptions worsen due to the escalation of the war or Western sanctions, or production outside Russia fails to rise to offset the shortfall of the Russian supply or even declines in the light of the recent decision by the Organization of the Petroleum Exporting Countries (OPEC) to slash production, world energy supply could be tighter and prices higher, with adverse implications not only for global inflation, together with heightened uncertainty, for global growth as well. In an unlike event when the Russia-Ukraine war escalates into a Russia-NATO war, its impact on the global economy would be catastrophic.

Third, tight financial conditions may lead to deeper and more widespread debt distress in developing economies.

As central banks in advanced economies raise interest rates and unwind their balance sheets to fight inflation, financial conditions worldwide have tightened and will continue to tighten, with significant implications for macroeconomic and financial stability in developing countries. Increases in foreign borrowing costs and capital outflows put pressure on their international reserves, cause currency depreciations, and make their foreign debt servicing more difficult. In the first 10 months of 2022, the dollar value of the national currency declined by more than 17% for Poland, 12-13% for the Philippines, Czech Republic, Thailand, South Africa, and Chile, a little over 11% for China, and close to 10% for India (notably the currency depreciation against the US dollar is even greater for the developed countries on average, see Figure 1.3 (a) and (b)). Governments around the world have spent aggressively to help households and firms to weather economic and social impacts of the pandemic. The average ratio of gross public debt to GDP—a key measure of a country's fiscal health—rose to a record 64% last year for emerging market and developing countries. Currency depreciations will inflate government external

Figure 1.3 (a): Change in the dollar value of selected developing country currencies, early Jan - late Oct, 2022

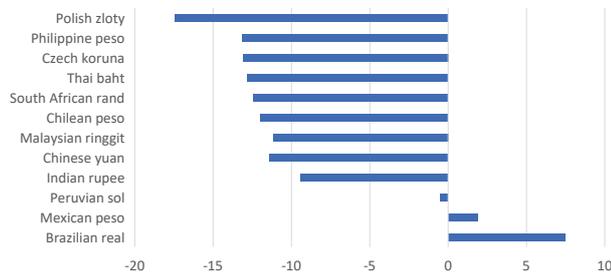
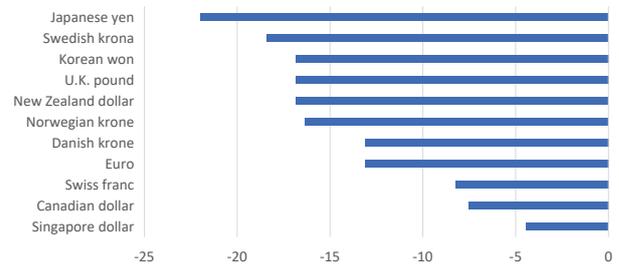


Figure 1.3 (b): Change in the dollar value of selected developed country currencies, early Jan - late Oct 2022



Source: IMF. Accessed 24 Oct 2022.

debt in domestic currency, making public financial positions more stretched, leaving less room for fiscal policy support. According to the IMF estimates, 60% of low-income countries are now in or at a high risk of government debt distress (debt restructuring or accumulation of arrears).⁹ Deeper and more widespread debt stress in developing countries, by undermining investor and consumer confidence and constraining both demand and supply, could reduce global growth through their direct impacts on developing countries themselves and indirect impacts on developed countries, even if not triggering financial crises.

Last but not the least, the COVID-19 outbreak could worsen again.

After almost three years since its first outbreak was reported, the virus is still causing widespread illness and deaths across the world. In the late October 2022, the global daily infections stood at about 400,000 and global daily deaths from the infection stood at more than 1,000. With these numbers, it's clear that the COVID-19 pandemic is not over and remains a significant risk to the global economic outlook. Further, despite news

about the virus' new variants has waned somewhat in recent months, many researchers believe that continued virus mutation leading to more deadly variants and more outbreaks cannot be ruled out. Vaccines and boosters for COVID-19 have played a critical role in containing infections and reducing deaths globally, and remain the most effective way to live through the pandemic. However, the pace of vaccination is highly uneven across countries. According to the data collected by the World Health Organization (WHO), as of the late October 2022, the number of persons with booster shots per 100 population reached 46.7 for high income countries and 40.7 for upper middle-income countries, but it was only 16.5 for lower middle-income countries and 2.3 for low-income countries.¹⁰ The low levels of vaccination make these countries vulnerable to the resurgence and worsening of outbreaks.

⁹ IMF. Fiscal Monitor October 2022. Accessed 24 Oct 2022.

¹⁰ WHO. <https://covid19.who.int/table>. Accessed 24 October 2022.

1.3. Policy priorities

To reduce risks to the economic outlook and support global recovery, the global community should work together to (i) end the pandemic; (ii) continue to fight inflation and ensure a soft landing for the global economy; (iii) end the trade war; (iv) accelerate the transition to the green economy; and (v) strengthen international cooperation to tackle the multiple challenges.

Working together to end the pandemic.

Despite the impact of COVID-19 has lessened in much of the world in recent months and more and more countries are relaxing social distancing and containment measures, the pandemic is not over. WHO has recently indicated that while the end of the COVID-19 pandemic is "in sight"—citing recent declines in the numbers of COVID-related infections and deaths, countries should not lose momentum in fighting against the virus, as "the risk of more variants, more deaths, more disruptions and more uncertainty" remains real. To assist national and global efforts to end the COVID-19 emergency worldwide, WHO has called on policy makers to implement a range of essential actions, including continuing to offer COVID-19 testing followed by isolation of positive cases; integrating COVID-19 clinical care pathways into primary health care systems; achieving vaccination targets; maintaining infection prevention and control measures in health care facilities; building public trust through risk communication and community engagement; and managing the COVID-19 infodemic.⁹ To achieve vaccination targets, WHO has called for strengthening globally-coordinated efforts and funding to ensure equitable vaccine distribution within and across countries and to bridge the vaccine divide. It has also called on countries to invest

in research and development of vaccine products with improved attributes. These policy recommendations provide a useful approach for the global community to work together to end the pandemic.

Fighting against inflation and ensuring a soft landing for the global economy.

Central banks around the world have started to tighten monetary policy in recent months to control inflation. The US Fed has hiked its policy rate five times this year, raising it from 0-0.25% in March to 3.00-3.25% in September (Fig. 1.4), and is expected to raise the target range further during the rest of this year, in order to achieve the 2% inflation target. The quantitative easing (QE) program, which led the Fed's balance sheet to more than double from about \$4 trillion prior to the pandemic to nearly \$9 trillion at the start of 2022, was ended in March and started unwinding in June. In Europe, the European Central Bank has hiked its base rate twice this year, raising it from zero to 1.25%, and is expected to raise the rate further, because inflation is considered to be far too high and likely to stay above the 2% medium term target for an extended period. It also ended its QE program in March, although has not started to shrink the balance sheet. Many developing countries have also raised interest rates to control inflation, as well as to relief pressures on their exchange rates due to rising interest rates in the advanced countries and resulting capital outflows. The financial markets have reacted violently to monetary tightening, with stock markets falling and volatility increasing and currencies depreciating against the US dollar around the globe.

In the coming months, central banks will have to walk a fine line—they need to ensure

⁹ WHO. n.d. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/covid-19-policy-briefs>. Accessed 16 September 2022.

Figure 1.4 (a): Central bank policy rate (%) advanced economies

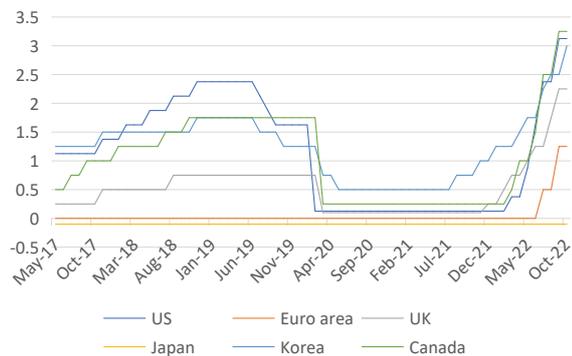
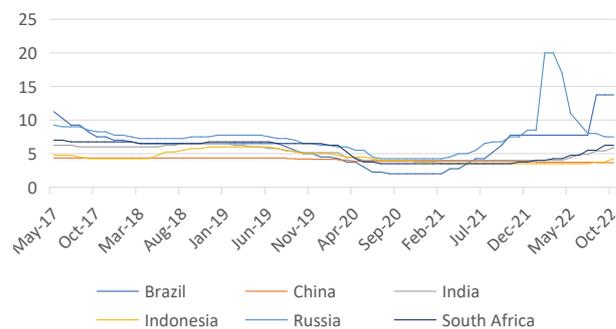


Figure 1.4 (b): Central bank policy rate (%), deoing economies



Source: Bank for International Settlements. <https://www.bis.org/statistics/cbpol.htm> (accessed 21 Oct 2022).

that monetary tightening is not too much to lead to a hard landing, or too little to make inflation out of control. To avoid large market reactions to policy changes, policy messages need to be carefully communicated. With highly integrated global financial markets, policy makers—especially in advanced economies—will have to consider not only impacts of policy changes on their domestic economies, but also spillovers to other markets, especially in developing countries. Developing economies, on the other hand, should continue to strengthen their macroeconomic fundamentals and reduce vulnerability to external shocks, and use macroprudential policy tools in disposal including temporal capital control when necessary. Advanced and developing countries should work together to fight inflation and achieve a soft landing for the global economy.

Ending the trade war to boost global recovery.

The trade war, started by the US under its previous administration, is not over. According to the estimates of Peterson Institute of International Economics (PIIE), a Washington-

based think tank, by the mid-2022, 66.4% of Chinese exports to US were still subject to US tariffs of 19.3% on average (compared with 3% US tariffs on imports from the rest of the world), while 58.3% of US exports to China were subject to Chinese tariffs of 20.7% on average (compared with 6.1% Chinese tariffs on imports from the rest of the world). Despite the expectation that the concerns over the inflationary impact of the trade war may induce the Biden administration to roll back tariffs on Chinese goods, and China will take reciprocal actions to reduce its tariffs on the US goods, there are no signs as yet these will happen soon. Continued trade tensions between the world’s two largest economies undermine consumer and investor confidence and are not conducive to fighting inflation and sustaining global recovery. According to PIIE researcher estimates, removing tariff hikes on imports from China would lower US’ CPI inflation by 1.3 percentage points (including direct effects on import prices and competitive effects on prices of domestic goods); removing tariffs hikes and barriers on imports from other countries (such as steel and aluminum) would generate additional reduction in inflation.⁶ While the world is watching closely at how the US-China trade relations will evolve under the Biden

⁶ https://www.piie.com/blogs/realtime-economic-issues-watch/fight-inflation-cutting-tariffs-china-only-start#_ftn1.

administration, an early ending of the trade war will help to alleviate inflationary pressures in the US and boost the global recovery. Countries should resolve trade disputes through rules-based multilateral trading system.

Accelerating transition to the green economy.

2022 has been a year of climate catastrophes around the world, including droughts, floods, mega-fires, typhoons, and more, demonstrating that climate change and its risk to human society are real and pointing to the need for more urgent actions to address these. The pandemic has delayed actions to address longer-term development issues in many countries as resources were diverted to respond to the health crisis. One of these issues is addressing climate change and making transition to the green economy. The Paris Agreement in 2015 set the global climate goal—limiting the temperature rise below 2°C above pre-industrial levels and pursuing efforts to limit it further to below 1.5°C—to avoid the catastrophic impacts of climate change. In 2021, at the 26th United Nations (UN) Conference of Parties (COP) in Glasgow, United Kingdom, nearly 200 countries reaffirmed their commitment to the Paris Agreement and to accelerating climate actions. Keeping global warming below 2°C

requires global anthropogenic carbon dioxide emissions to reach net-zero around 2070, and limiting it to below 1.5°C implies targeting net-zero emissions by 2050. Achieving carbon neutrality requires rapid, far-reaching, and unprecedented transformations in energy and industrial systems, infrastructure, and land use, and large investments in renewable and low-carbon energy sources and green technologies. Countries should accelerate green investments and promote green recovery.

Strengthening international cooperation to address multiple challenges.

The multiple challenges the world is facing make international cooperation even more important. To end the pandemic, the global community must ensure that vaccination be scaled up and the vaccination target set by WHO achieved in every country as quickly as possible. High-income countries should assist low-income countries in access to vaccines and other tools to prevent and control the resurgence of COVID-19 outbreaks. To achieve a soft landing for the global economy, central banks should coordinate monetary policy more closely. Policy coordination through global processes such as G20 may enable the world's major central banks to achieve the goal of controlling inflation at a lower cost than when each acts in isolation.⁷ It will



⁷ <https://www.project-syndicate.org/commentary/fighting-inflation-by-coordinating-monetary-policy-by-shang-jin-wei-2022-09?barrier=accesspaylog>.

also enable developing countries to better prepare for weathering external shocks.

International cooperation in areas of coordinating climate policy, mobilizing green finance, developing and sharing green technologies, and building capacity is critical to accelerating the transition to the green economy and meeting the global climate goal. Closer international cooperation will also help to address trade tensions and end the trade war. Lastly, closer international cooperation is needed to help fiscally stressed low-income and lower middle-income countries to manage their fiscal difficulties through debt relief or restructuring. The global community should work together to ensure these countries also have needed financial resources to vaccinate their entire populations, make significant progress in achieving SDGs, and take climate actions, by providing more bilateral and multilateral funding support.

In the past several decades, rapid technological progress and globalization have been accompanied by rising income and wealth inequality in large parts of the world. The COVID-19 pandemic has made the inequality even worse, requiring effective policy responses. Policy discussions on responding to rising inequality in recent years have highlighted the importance of promoting financial inclusion. Digital finance has a huge potential to make finance more inclusive. Next chapter of this report is devoted to digital finance, focusing on its recent development, its role in promoting economic growth and social inclusion, financial risks and regulatory challenges it has brought, and policy recommendations to make digital finance to better serve the global development.

Table 1.1: Annual GDP growth (%)

	2019	2020	2021	2022	2023
				Projection	
World (at PPP)	2.8	-3.0	6.0	3.1	2.8
Major groups of economies					
Developed economies	1.7	-4.4	5.2	2.4	1.2
Developing economies	3.6	-1.9	6.6	3.7	3.9
Developing Asia	5.2	-0.7	7.1	4.4	5.0
High income Asia	0.9	-2.8	3.7	2.1	2.3
Developing Europe	3.1	-2.9	5.2	-2.5	0.0
Euro area	1.6	-6.0	5.1	3.1	0.6
Latin America and Caribbean	0.2	-6.6	6.6	3.1	1.5

	2019	2020	2021	2022	2023
Middle East and North Africa	1.6	-2.1	7.2	5.1	3.6
North America	2.3	-3.5	5.5	1.8	1.0
Sub-Saharan Africa	3.2	-1.7	4.7	3.6	3.8
ASEAN	4.7	-3.2	3.0	5.0	4.9
BRICS	4.6	-0.8	7.6	3.4	4.2
European Union	2.0	-5.4	5.2	3.2	0.7
G20	2.9	-3.0	6.2	3.1	2.5
One-belt-one-road economies	3.8	-1.2	6.4	3.3	3.6
Major economies					
Argentina	-2.0	-9.9	10.4	3.7	1.0
Australia	2.0	-2.1	4.9	3.8	2.0
Brazil	1.2	-3.9	4.6	2.4	0.9
Canada	1.9	-5.2	4.5	3.3	1.4
China	6.0	2.2	8.1	3.3	4.6
France	1.9	-7.9	6.8	2.5	0.6
Germany	1.1	-3.7	2.6	1.4	-0.3
India	3.7	-6.6	8.7	6.9	6.5
Indonesia	5.0	-2.1	3.7	5.2	5.0
Italy	0.5	-9.0	6.6	3.2	0.2
Japan	-0.4	-4.6	1.7	1.6	1.6
Korea	2.2	-0.7	4.1	2.7	2.1
Mexico	-0.2	-8.1	4.8	2.0	1.4
Russia	2.2	-2.7	4.7	-4.0	-2.5
Saudi Arabia	0.3	-4.1	3.2	8.1	4.5
South Africa	0.3	-6.3	4.9	1.9	1.3
Turkey	0.8	1.9	11.4	4.9	2.9
UK	1.7	-9.3	7.4	3.5	0.2
US	2.3	-3.4	5.7	1.6	1.0

Sources: Growth rates for 2019-2021 are from the IMF; growth projections for 2022 and 2023 are based on the latest forecasts by international organizations (including the IMF, ADB, OECD, EBRD, and EIB) as of the late October 2022, the October 2022 issue of Focus-Economics country reports, and IFF analysis.

Table 1.2: Annual CPI inflation (%)

	2019	2020	2021	2022	2023
				Projection	
World (PPP)	3.6	3.3	4.6	9.0	6.4
Major groups of economies					
Developed economies	1.4	0.7	3.0	7.1	4.1
Developing economies	5.3	5.3	5.8	10.5	8.2
Developing Asia	3.5	3.5	2.6	4.7	4.4
High income Asia	0.7	0.2	1.2	3.5	2.4
Developing Europe	4.1	3.1	6.2	11.4	7.2
Euro area	1.2	0.3	2.5	8.0	5.4
Latin America and Caribbean	8.3	6.5	9.9	14.4	11.9
Middle East and North Africa	9.2	9.7	12.3	26.8	19.3
Sub-Saharan Africa	9.3	13.3	11.5	15.8	12.9
ASEAN	2.2	1.5	2.0	4.9	4.1
BRICS	3.6	3.5	3.2	5.0	3.7
European Union	1.4	0.7	2.8	8.8	6.3
G20	2.8	2.5	3.5	7.0	4.6
One-belt-one-road economies	4.2	4.2	4.7	9.9	7.4
Major economies					
Argentina	53.3	42.0	48.4	73.0	76.0
Australia	1.6	0.9	2.8	6.5	4.4
Brazil	3.7	3.2	8.3	9.1	4.7
Canada	1.9	0.7	3.4	6.9	4.0
China	2.9	2.4	0.9	2.2	2.3
France	1.3	0.5	2.1	5.9	4.8
Germany	1.4	0.4	3.2	8.5	6.7
India	4.8	6.2	5.5	6.8	5.2
Indonesia	2.8	2.0	1.6	4.4	4.7
Italy	0.6	-0.1	1.9	8.6	4.9
Japan	0.5	0.0	-0.2	2.1	1.6

	2019	2020	2021	2022	2023
Korea	0.4	0.5	2.5	5.1	3.4
Mexico	3.6	3.4	5.7	8.0	5.3
Russia	4.5	3.4	6.7	13.1	5.9
Saudi Arabia	-2.1	3.4	3.1	2.6	2.6
South Africa	4.1	3.3	4.6	6.7	5.4
Turkey	15.2	12.3	19.6	72.0	43.5
United Kingdom	1.8	0.9	2.6	9.1	7.2
United States	1.8	1.2	4.7	8.1	3.6

Sources: Inflation rates for 2019-2021 are from the IMF; inflation rate projections for 2022 and 2023 are based on the latest forecasts by international organizations (including the IMF, ADB, OECD, EBRD, and EIB) as of the late October 2022, the October 2022 issue of Focus-Economics country reports, and IFF analysis.

Chapter 2: Definition and Development of Digital Finance

In recent years, with the development of artificial intelligence (AI), big data, cloud computing and other emerging information technologies (IT), global digital finance has made rapid achievement. The continuous spread of the COVID-19 pandemic has further accelerated the pace of digital finance. The main implications are, on the one hand, emerging IT technologies have received wide attention from the capital market, and the activities of investment and financing, M&A and IPO of FinTech companies have increased year by year, with the number of FinTech patent application also increasing accordingly; on the other hand, the proliferation of FinTech applications has given rise to new financial businesses such as digital currency, digital payment and digital bank, and the development of digital finance has reshaped the original profit-sharing distribution of the financial industry, intensified competition of the industry, and urged traditional financial institutions to upgrade their businesses, prompting finance to return to its original goal of serving the real economy and injecting new vitality into the global economic development. Given this, countries around the world have successively introduced relevant policies to support digital financial innovation, laying a positive institutional foundation for the development of digital finance. However, at the same time, the development of digital finance also brings challenges in terms of financial stability, information security and privacy protection. In facing the digital financial era, it is necessary for national regulatory authorities to accurately understand the nature of digital finance and ensure its sustainable and steady development by building a efficient regulatory system.

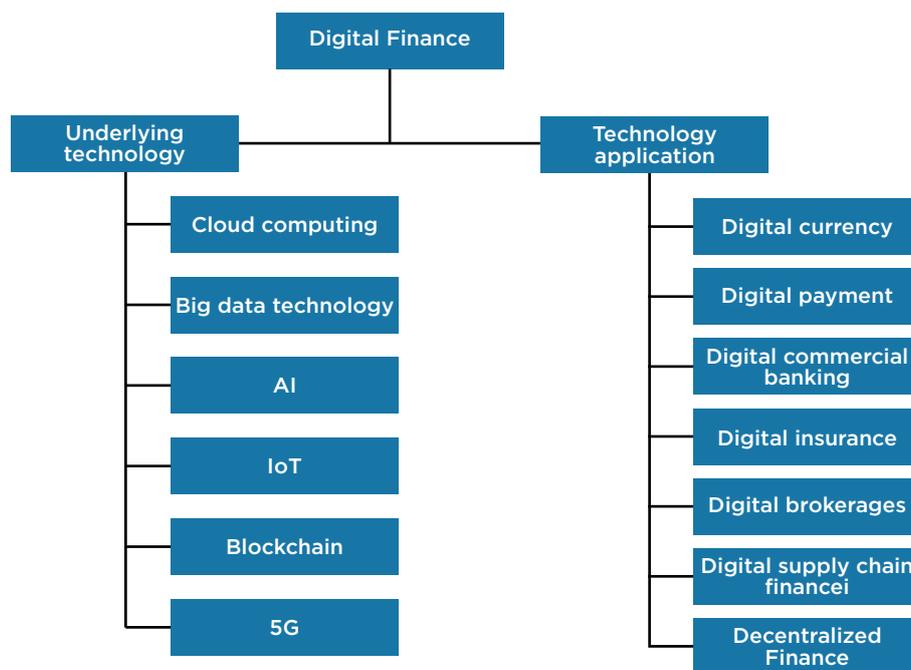
2.1 Definition

The concept of digital finance has been defined differently by different countries and institutions around the world. The European Commission considers digital finance to be a term used to describe the impact of new technologies on the financial services industry. It includes a variety of products, applications, processes and business models. The Digital Financial Services report released by the World Bank in April 2020 identifies digital financial services as financial services which rely on digital technologies for their delivery and use by consumers. According to the U.S. Agency for International Development, digital financial services represent a new approach to financial inclusion. They give poor families access to an array of affordable resources that make financial transactions cheaper, more secure and transparent. At the same time, they help build a lasting, inclusive economic infrastructure that improves governance and provides a foundation for innovative business models that offer relevant services to poor and underserved populations, helping create more resilient and self-reliant communities.

In general, digital finance reflects the mutual integration and interpenetration of digital technology and traditional finance and is a new technology and new business model based on traditional finance. It represents not only a new financial business format and a new financial development stage but also a continuation of the sustainable development of the financial industry. Compared with traditional finance, digital finance is more



Figure 2-1: Scope of digital finance



information-driven powered, internet-based and intelligent. Data and information technologies are transforming platforms, means of production, and the economic and financial structure, improving the economy and financial system. Specifically, digital finance includes the technology dimension and the application dimension (see Figure 2-1). The development of digital technology is the premise and driving force of digital finance, with frontier technologies which has been widely used in the financial sector such

as cloud computing, big data, AI, Internet of Things (IoT), blockchain, 5G communication technology. The continuous expansion of the depth and breadth of digital application scenarios in the financial industry has not only promoted the digital transformation of traditional financial institutions, but also given rise to new financial business forms such as digital currency, digital bank, digital insurance, digital payment and DeFi (decentralized finance).

2.1.1 Underlying technologies

- **Cloud computing**

Cloud computing is a form of distributed computing, which refers to breaking down huge data computing and processing programs into countless small programs through the network “cloud”, and then processing and analyzing these small programs through a system containing multiple servers, with the result being returned to the user. At present, cloud computing can be categorized into three general types, i.e., public cloud, private cloud and hybrid cloud. With the technical iteration of cloud computing and the continuous improvement of its functions, more companies gradually go to the cloud. Cloud computing technology not only facilitates the collection of aggregated data on cloud-based platforms but also enables the processing of tens of thousands of pieces of data in a very short time, thus significantly reducing the cost of data-based operations for various market players. What’s more, cloud computing is a prerequisite for applications of big data and AI.

- **Big data technology**

According to the McKinsey Global Institute, big data refers to datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyze. It is characterized by sheer volume, high velocity, diverse varieties, and low-value density. The application scenarios of big data in the financial industry include various aspects such as risk control, operation, investment and marketing, which greatly promote the digital and intelligent transformation of the financial industry.

- **AI**

AI refers to the ability of a computer or machine to perform human-like feats of cognition including problem-solving and decision-making. AI technology was first initiated by Alan Turing in his seminal book, *Computing Machinery and Intelligence*, published in 1950. In the book, Alan Turing raised the question, “Can machine think?”, and proposed the concept of The Turing Test, in which a computer is asked to impersonate a human being, and if the machine makes no more than 30% of the miscalculations on average per participant, then the machine passes the test and is considered to have human intelligence. In 2004, John McCarthy pointed out in his paper, *What is Artificial Intelligence?* that AI refers to “the science and engineering of making intelligent machines, especially intelligent computer programs”. In the financial sector, AI continues to empower a variety of financial institutions engaging in banking, insurance and securities, and enrich the application scenarios of business and technology integration, helping financial institutions to improve the efficiency and accuracy of business operations while also saving the costs of the labor force. For example, the deep learning frameworks represented by Tensorflow,^① Pytorch^② and Keras^③ allow developers to quickly call the appropriate modules to set up corresponding AI programs based on customers’ requirement. In terms of specific applications, convolutional neural networks^④ using the above frameworks allow for higher efficiency in financial text analysis, financial risk assessment and stock price prediction.

① A deep learning framework developed by Google Brain.

② A deep learning framework supported by Facebook AI Academy, occupying a leading position in the field of AI academic research.

③ A deep learning framework written purely in Python based on Tensorflow with cleaner code, which is more suitable for beginners.

④ A type of feedforward neural network that includes convolutional computation and has a deep structure. It is one of the representative algorithms of deep learning. This algorithm extracts the input features with the help of convolution and then feeds the extracted features into a fully connected network for recognition and prediction.

- **Internet of Things technology**

The IoT technology refers to endowing “intelligence” to objects by means of the radio frequency identification, sensors, QR code, etc., installed on various objects, which is connected to a wireless network through interfaces, so as to achieve communication and dialogue between people and objects, as well as objects and objects. Along with the growing maturity of the IoT technology, we are now ushering into the era of the Internet of Things, where all things are connected, and the IoT has gradually blurred the boundary between the digital world and the physical world. Mobile communication is no longer exclusive to smartphones, and any terminal can be used as an Internet interface. The booming development of the IoT ecosystem not only enriches data sources but also lays an important foundation for blockchain technology to confirm, store and measure value information.

- **Blockchain technology**

Blockchain is a shared database with multiple blocks connected in a “chain”, which brings together a number of technologies including distributed storage, cryptographic algorithms, peer-to-peer transmission, etc. Blockchain technology is essentially decentralized, tamper-evident and traceable, which facilitates the formation of a trust-based consensus mechanism among multiple entities. With the continuous development, blockchain technology is no longer limited to the underlying technology of Bitcoin and other digital currencies. On the one hand, blockchain technology can be deeply integrated with finance and help to solve the problems of low trust, high risk and low efficiency in financial transactions; on the other hand, it has shown the potential to empower the real economy. It can strengthen the collaborative relationship among different entities in the traditional industry, enhance the security and trustworthiness of business transactions, and reduce transaction costs,

thereby improving the efficiency and level of the traditional industry and optimizing the development mode and logic of the traditional industry.

- **5G**

5G, the fifth-generation mobile communication technology, is the latest iteration of cellular technology with prominent performance goals of high speed, low latency, large system capacity and massive device connectivity. The data transfer rate of 5G is up to 10GB per second, which is 100 times faster than the previous 4G LTE (Long Term Evolution) cellular networks, with network latency of less than 1ms, compared to 4G’s 30-70ms. Based on the above characteristics of 5G, applications that originally required fixed bandwidth can now be delivered with the support of wireless communication. This will enhance the output efficiency of external scenarios, promote the remote and accurate production as well as real-time and fine support of digital technology, and create a convenient, efficient and open ecosystem. The high efficiency, low latency and wide coverage of 5G further extend the depth and breadth of the application of digital technologies such as AI, big data and blockchain, accelerating the pace of digital transformation in the financial industry.

2. 1.2 Technology application of digital finance

- **Digital currencies**

In December 2015, the Committee on Payments and Market Infrastructures of the Bank for International Settlements defined digital currency for the first time as “assets in digital form” and referred to some of them as Cryptocurrency, which mainly refers to “digital currencies that use cryptography to verify issuance and transaction”. An IMF report published in 2019 creates a “Money Tree” to classify digital currencies based on four attributes, type, value, backstop and technology. According to means of payment, the report first classifies digital currencies into “object”, which are similar to cash transactions, where transactions are completed instantaneously and do not require the interaction of information flow, and “claim”, which are similar to debit card transactions, where transactions are completed through value transfer statements and require the interaction of information flow. “Claim” is classified into fixed-value redemptions and variable-value redemptions. Digital currencies with fixed value redemptions includes debit cards, cheque and wire transfers backed up by government agencies (B-money) as well as centralized means of payment such as Alipay, WeChat Pay, M-Pesa and decentralized means of payment such as USDC, TrueUSD and Paxos backed up by private companies (E-money). Digital currencies with variable value redemptions include Libra, Gold Coin and other means of payment that, upon redemption, can be converted into other currencies of different values (I-money). “Object” includes central government digital money and cryptocurrency. The former refers to central bank digital currencies that use national legal tender units, while the latter refers to digital currencies that use their own units of account, such as Bitcoin and BasisCoin. To sum up, in terms of issuing entities, digital currencies can be divided into central bank digital currencies and private

digital currencies; from the perspective of function, private digital currencies can be further subdivided into platform coins, DeFi coins, metaverse coins, NFT coins, animal coins, inter-chain coins, storage coins, Layer2 coins, synthetic asset coins, etc.

- **Digital payment**

Digital payment refers to electronic money payments through mobile clients installed in electronic products such as cell phones, mainly divided into basic transfer payments, mobile bill payments, wireless application protocol (WAP) payments, application payments and near field communication (NFC) payments. The latter two are the most noteworthy areas of digital payments today. Application payments are a means of payment made by installing an APP on a smartphone device. This means of payment also involves new technologies such as face recognition payment and QR code payment. Near field communication (NFC) payments are often used in physical stores or transportation facilities. Consumers must use a mobile phone equipped with a smart card and place the mobile phone in front of a sensor module. Most transactions do not require additional authorization, but some require a password or fingerprint authorization before the close of the deal. The amount paid may be deducted from a prepaid or bank account or included in a telecom charge.

- **Digital bank**

Today, there are many concepts of new banking around the world, such as digital bank, virtual bank, e-bank, Internet bank and direct bank, all of which are closely related to digital bank. The Basel Committee on Banking Supervision refers to e-banking as “the provision of retail and small value banking products and services through electronic channels as well as large value

electronic payments and other wholesale banking services delivered electronically.” The Hong Kong Monetary Authority defines a virtual bank as a bank which primarily delivers retail banking services through the internet or other forms of electronic channels instead of physical branches. According to Christ Skinner’s Digital Bank, the key difference between digital banks and traditional banks is that, whether the branches are established or not, they no longer rely on physical branches and outlets, but use the digital network as the core of the bank to provide online financial services to customers through cutting-edge technology, with services more customized and interactive and the banking structure flatter. Some industry insiders also believe that the essential difference between digital banks and traditional banks lies in the service concept and approach, not simply a transition from offline to online banking. Digital bank differs from traditional banking in terms of systems, channels, products, processes, and interactions with users. The new technologies and lower operating costs enable digital banks to provide more affordable and user-friendly services to long-tail (under-served)

customers than traditional banks. In this way, digital bank can not only effectively promote financial inclusion, but also stimulate the digital transformation of the banking industry, thereby improving the overall services quality of the banking sector.

- **Digital insurance**

Digital insurance emerges as a combination of insurance and digital technology, i.e., all participating entities in the insurance industry make comprehensive use of emerging technologies such as big data, cloud computing, blockchain and AI to achieve full penetration into insurance business processes, to enhance business efficiency, change product forms, improve ways of services and interactions, and further spawn new business models and build an insurance ecosystem. For example, consumers can check the insurance status directly on major websites, mobile software, and small programs, and obtain the insurance without going to offline outlets. Once the insurance has been taken out, the buyers can also report the case online and upload the claim information directly.



- **Digital brokerage**

Digital brokerage refers to the comprehensive use of big data, AI, cloud computing and other technologies by all participating entities in the securities industry to fully empower all business lines in the chain and realize process automation, intelligent operation and refined management around the whole value chain of each business, such as retailing, institution, investment banking and capital management. The realization of digital transformation is not only limited to the technical level, but also the change and exploration of business models. There are mainly two modes of digital brokerage:

(1) Internet brokerage focusing on online businesses.

Internet brokerage manifests an innovation of securities business under the development of FinTech. It is a financial services platform enabling securities and other online derivatives trading, mainly engaged in the brokerage business and the marketing of financial products while less involved in the investment banking business. Compared with traditional brokerage which highlights offline marketing, Internet brokerage uses digital trading platform systems to integrate their services, providing users with more investment choices and reducing the operating costs of traditional brokerage, which allows them to offer lower commissions and transaction fees to their customers.

(2) Digital transformation of traditional brokerages,

which means that the traditional securities industry uses various digital technologies to empower businesses, reduce costs and increase efficiency, thus improving customers' experience with quality service.

- **Digital supply chain finance**

Digital supply chain finance refers to the use of emerging digital technologies to empower enterprises engaged in supply chain finance in a systematic approach and inject digital elements into the players of supply chain finance, to realize online business operations,

the interaction of information, transferable trust and early warning of risks, solve the risk control problems caused by incomplete and asymmetric information, effectively resolve the bottle-neck problems existing in businesses such as information sharing, trust transfer and risk management in supply chain finance, and improve the function and service efficiency of supply chain finance. For example, at the execution level, data is collected by IoT or shared by the digital supply chain to ensure the authenticity and controllability of businesses; in terms of ledger data, blockchain can ensure the security, trustworthiness, traceability, automatic performance of data storage and guarantee the incentives for all parties; at the decision-making level, the application of "big data + AI" helps to tap into potential risks and needs.

- **Decentralized finance**

Decentralized finance (commonly known as DeFi) is a type of finance that live on the blockchain, which does not rely on financial institutions such as brokerages, exchanges or banks to provide financial instruments, but instead uses smart contracts on the blockchain (such as Ethereum) to conduct financial activities. DeFi, as defined by Investopedia, is an emerging financial technology based on secure distributed ledgers similar to those used by cryptocurrencies. The system removes the control of banks and institutions on money, financial products and financial services. DeFi currently includes different categories such as Lending, DEXes, Assets, Payments, and Derivatives.

2.2 Development of Global Digital Finance

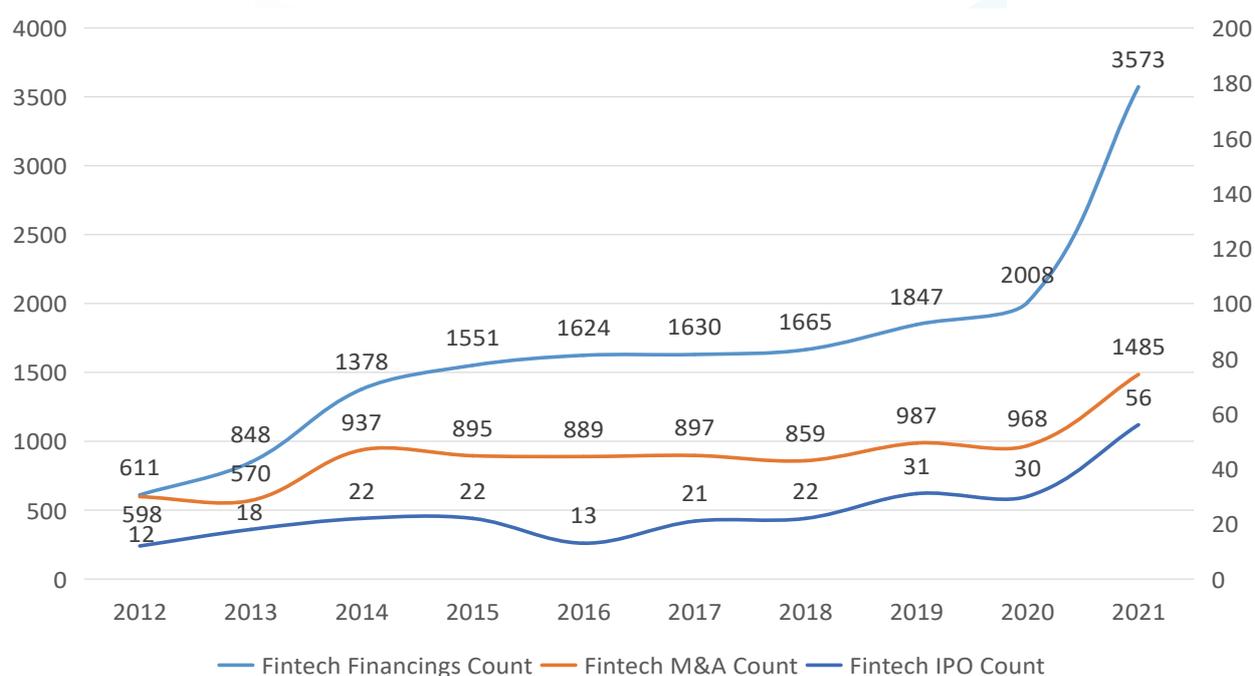
2.2.1 Digital technology

The maturity of emerging information technologies such as AI, big data and cloud computing has led to the rapid development of global digital finance. On the one hand, as a key carrier of these information technologies, FinTech companies play an important role in driving the development of digital technology; on the other hand, with the global rise of digital technology, various institutions, including financial institutions, Internet technology companies, traditional financial IT service providers, etc., have been laying out technologies such as AI, blockchain, cloud computing and big data around the digital transformation of the financial industry, leading to the number of patent applications to mushroom, and patents, as an important yardstick for the innovation achievements of FinTech, serve as a fair reflection of the current status of global digital technology development.

• Investment, financing and capital market situation

Digital finance has the characteristics of huge capital input and lagging output in the early stage, so absorbing external financing is a significant foundation for the development of digital finance. The situations of investment and financing as well as the capital market can serve as a fairly comprehensive mirror of the development stage and performance trend of digital technology. The Statistic of FT Partners shows that the investment and financing activities of private FinTech companies have seen a year-on-year increase worldwide in recent years, with a spike in global FinTech financing in 2021, raising a total of USD141.6 billion in 3,573 rounds of financing activities. Looking at the capital market, M&A and IPO activities of FinTech companies have also shown a growing trend worldwide year on year, with both reaching record levels in 2021.

Figure 2-2: Equity financing, M&A, IPO of global private FinTech companies from 2012 to 2021



Data source: FTPartners

By region, North America, Europe and Asia are more active in the global FinTech development, especially North America, which has always been the backbone of the global FinTech development. According to the statistic of FT Partners, from 2012 to 2021, the investment and financing activities of FinTech companies in North America accounted for more than 50% of the global total, among which the U.S. led the way with 1,477 rounds of financing and USD71.8 billion in total financing, accounting for 91% of the total financing amount of the entire North American region and 51% of the global financing, marking its unshakeable leading position in the development of FinTech. In addition to European and American countries, with their large population base and huge demand for digital finance, emerging economies (such as China, India, Indonesia, etc.) have also received the favor of capital, registering rapid growth in recent years. In particular, China's Ant Group raised USD4.5 billion and USD14 billion through financing in 2016 and 2018, respectively, playing a key role in driving the FinTech development in Asia.

- **FinTech patent analysis**

According to Zero One Think Tank, from 2017 to June 2021, more than 50 countries

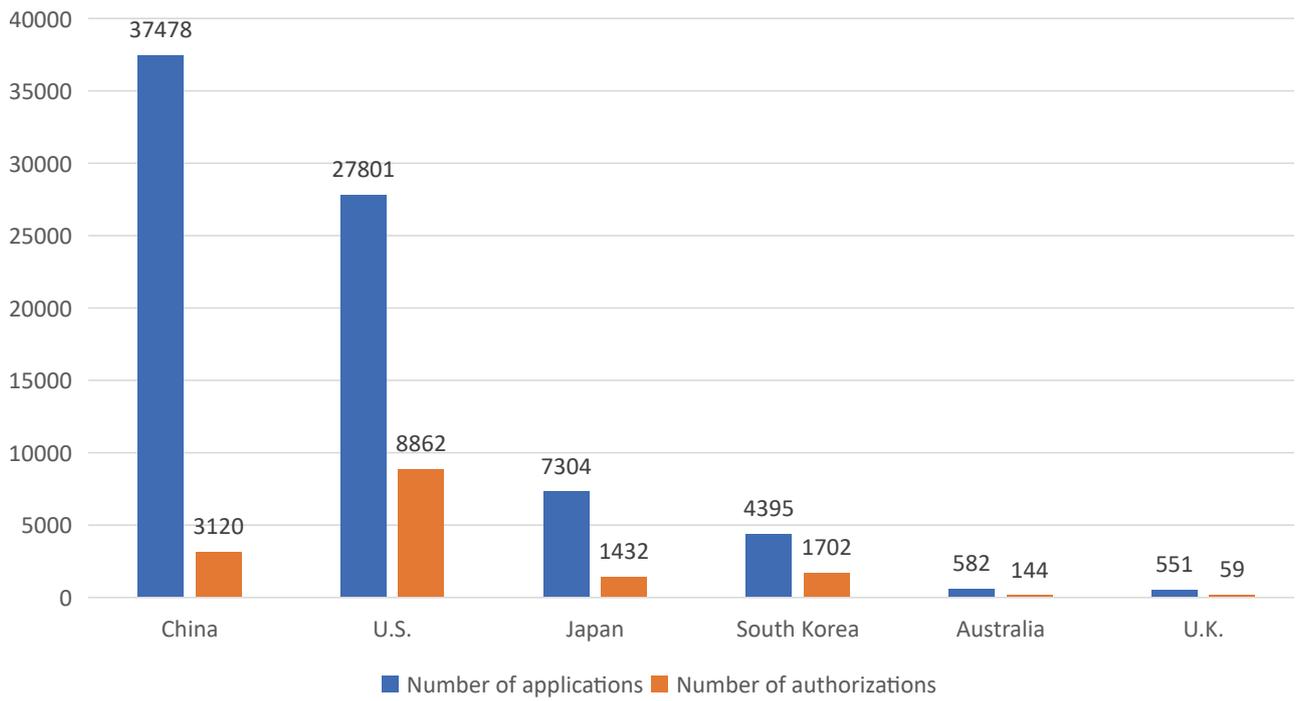
and regions in the world applied for FinTech patents. Among them, the three countries with the highest number of patent applications are China, the U.S. and Japan, with 37,500, 27,800 and 0.73 million patent applications respectively (see Figure 2-3). Considering the number of patent applications, China has become a major FinTech patent power, overtaking the U.S.. However, from the perspective of patent quality, although China is a large patent country, it has not yet reached the level of patent efficiency due to the imbalance between “quality” and “quantity” of patents.

- **Global 5G development**

The high efficiency, low delay and wide coverage of 5G further extend the depth and breadth of the application of digital technologies such as AI, big data and blockchain, accelerating the pace of digital transformation in the financial industry. Meanwhile, from the perspective of global strategic layout, the 5G battle has become the focus of competition among the world's major powers in the high-tech field. According to Viavi Solutions Inc.'s (VIAVI) latest report on the State of 5G Deployments, as of the end of January 2022, a total of 72 countries had 5G networks in place, with Argentina,

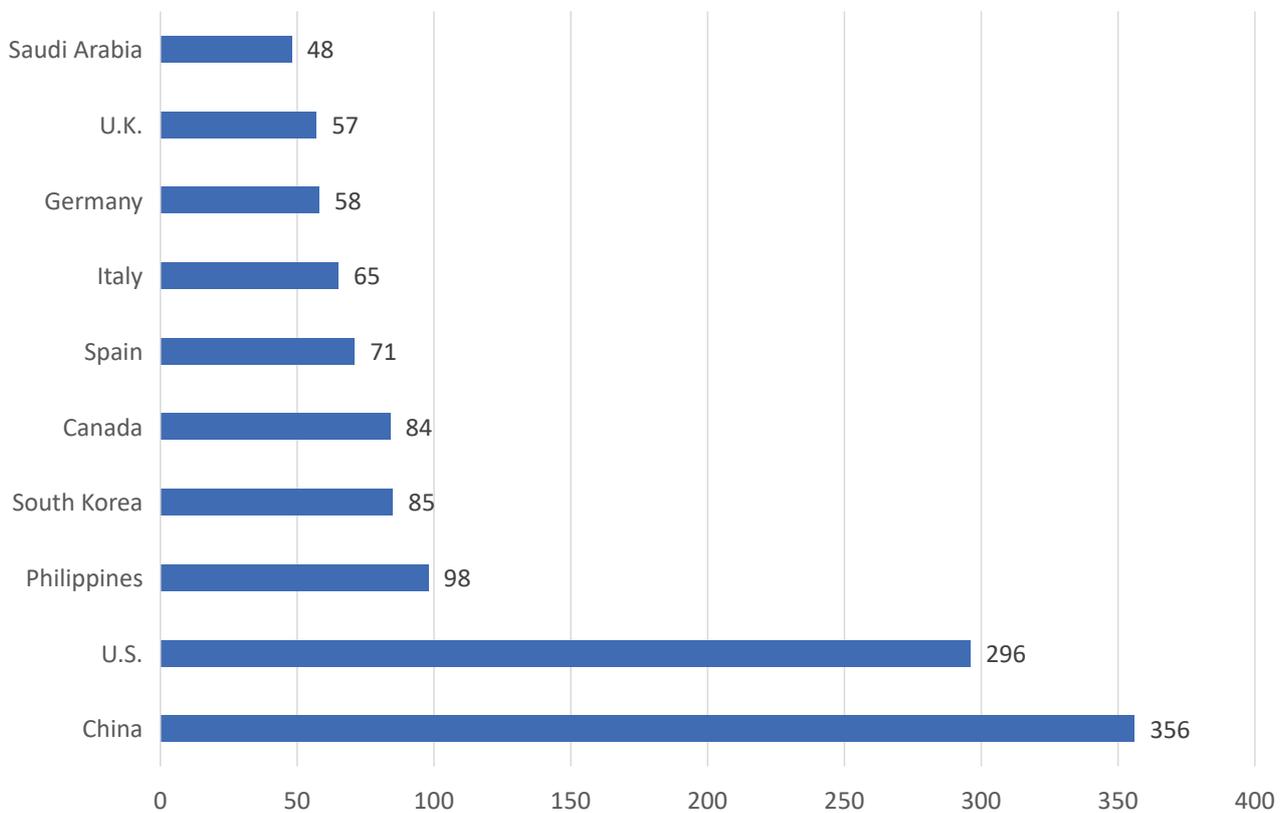


Figure 2-3: FinTech patent applications from 2017 to Jun. 2021 (TOP 6)



Data source: Zero One Think Tank

Figure 2-4: Number of 5G cities in selected countries worldwide (TOP10)



Data source: Viavi Solutions Inc



Bhutan, Kenya, Kazakhstan, Malaysia, Malta and Mauritius as the latest comers, all of which had 5G available in the second half of 2021. According to VIAVI, 5G is now available in 1,947 cities. Europe, the Middle East and Africa (EMEA) have surpassed the Asia Pacific, which includes Greater China (APAC), as the region with the most 5G cities, at 839. There are 689 5G cities in the Asia-Pacific region and 419 in the Americas. The two largest economies in the world, the U.S. and China, are now the countries with the most 5G cities, with 356 5G cities in China and 296 in the U.S. The Philippines ranks third in the world with 98 5G cities (see Figure 2-4).

• **Summary**

Digital technology is the premise and driving force of the development of digital finance. However, since digital technology is characterized by huge capital input and lagging output in the early stage, the availability of sufficient external financing becomes a significant foundation for its development. On the one hand, the investment and financing activities of global FinTech companies and the situation of the capital market show that digital technology has made tremendous development globally in recent years. On the other hand, European

and American countries are currently leading the FinTech sector, attracting the vast majority of global investment, but at the same time, with large population base and huge demand for digital finance, emerging economies (such as China, India, Indonesia, etc.) have also received the attention of the capital market. In particular, the rise of China's Ant Group in the FinTech sector has given a major boost to the development of digital finance in Asia. Moreover, in the development of digital finance, technology-based innovation and application are the leading factors of company competitiveness, as well as the most important bargaining chip in the competition in digital finance. In terms of global FinTech patents, China marks the best performance besides the U.S., holding a huge growth potential in digital finance. In addition, as a catalyst for digital technology applications such as AI, big data, and blockchain, 5G has become the focus of competition among the world's major powers in the high-techfield. The competition for industry standards, voice and market share in the 5G sector among technological powers and regions represented by China, the U.S., Europe, South Korea and Japan have entered a feverish pitch.

2.2.2 Digital currency

As one of the important innovation products of FinTech, digital currencies have brought a more far-reaching impact on the whole financial industry and its regulatory field. Digital currencies initially emerged in the form of private digital currencies which changed the form, circulation and means of payment of traditional money and were endowed with different intrinsic values depending on their design. In parallel with the development of private digital currencies, central banks are also testing sovereign digital currencies, with a view to reducing the cost of money issuance while achieving convenience and security, improving the efficiency of payment and clearing & settlement, and enhancing the control over supply and circulation.

- **Development of central bank digital currency**

Central Bank digital currency (CBDC) refers to the digital money issued by the central bank. At the moment, countries are refraining from conceding the central bank's fully control of digital currencies and are exploring the possibility of a digital currency issuance framework while adhering to the centralization of digital currencies. Looking at the U.S., in May 2020, the Digital Dollar Foundation and Accenture, a global consulting firm, released a white paper, the Digital Dollar Project. The white paper shows that the issuance rights of the digital dollar are owned by the Federal Reserve, which is responsible for the full lifecycle management of the digital dollar. As far as Europe is concerned, the European Central Bank (ECB) released the report - Exploring Anonymity in Central Bank Digital Currencies in December 2019, announcing the launch of the PoC (Proof of Concept) project called the EURO chain. The project clearly states that the ECB is the only institution allowed to issue CBDCs and is responsible for the supervision and management of CBDCs. Now nearly 50 central banks have already launched the designs or prototypes of

CBDCs (Auer & Boehme, 2021). More than a third of the world's surveyed central banks indicated that issuing CBDC is a medium-term possibility (Boar et al., 2020). Among all kinds of CBDC projects, most of them are still in the research or trial stage, and only the central banks of Bahamas and Nigeria and the Eastern Caribbean States have officially issued CBDCs. Notably, China has recently introduced CBDC of RMB in retail usage. Other central bank digital currency projects that progressing fast include Canada's Jasper project and the ECB's Stella project.

In October 2020, the Central Bank of the Bahamas announced the official launch of its central bank digital currency, "Sand Dollar", on October 20, making it the first country in the world to officially launch a central bank digital currency. The highly developed digital economy, internet penetration and high willingness of residents to use electronic payments serve as the basis for Bahamas' central bank digital currency program to progress much faster than other major economies around the world, and the nature of the Bahamas as a decentralized archipelago further increases the country's willingness to issue a central bank digital currency. Later on October 25, 2021, in view of the successive depreciation of Nigeria's sovereign currency and the high willingness of residents to use the US dollar and Bitcoin as means of payment, the Central Bank of Nigeria (CBN) announced the official launch of "eNaira", the central bank digital currency program, in order to combat the risks of cryptocurrencies and the dollarization of the economy, thereby curbing illicit transactions and maintaining financial security, making Nigeria the second country in the world to officially launch a central bank digital currency project.

- **Development of private digital currency**

Private digital currency refers to the digital currencies that are privately issued, mainly

including Bitcoin, Ethereum, Litecoin, Ripple, etc. These private digital currencies are also known as cryptocurrencies. Unlike CBDCs, private digital currencies represented by Bitcoin have a higher degree of decentralization and are likely to become an important part of the global payment system. For example, in the field of cross-border payments, the adoption of blockchain technology can realize peer-to-peer payments without multi-level intermediaries and correspondent banks, which is more convenient and efficient.

In terms of the market scale of private currencies, since Satoshi Nakamoto's invention of Bitcoin in 2008, the global market scale of private digital currency has shown an exponential growth. According to CoinMarketCap, as of 10:00 a.m. on June 21, 2022, there are 19,940 private digital currencies in the world, which is about 15 times the number of fiat currencies in the world, and about 9,000 exchanges for online digital currencies trading; the total market capitalization of digital currencies across the globe reached USD0.9 trillion, with vast disparities in market capitalization between different digital currencies. Among them, the benchmark currency, Bitcoin, dominates with a market capitalization of 43.5%, essentially accounting for half of the global total market. Ethereum, Tether and USDC accounted for 15.12%, 7.45% and 6.16% of the market capitalization respectively, with the top 10 digital currencies reaching a combined market capitalization of 83.82%.

From the distribution of countries available for private currencies, most of them are concentrated in developing countries such as Vietnam and India rather than developed countries in Europe and America. The main reason may be that Europe and America, as the issuing and trading hubs of the world currencies, the US dollar and the Euro, are more inclined to maintain the stability of the traditional sovereign currency system, so their willingness to participate in the issuance of cryptocurrencies are relatively weak. On June

9, 2021, El Salvador's parliament even passed a bill approving Bitcoin as the country's legal tender. In September 2021, the Resolution 215 of 2021 issued by Cuba's Central Bank (BCC) recognized the validity of Bitcoin and other cryptocurrencies, which are now the legal payment instrument for commercial transactions in Cuba.

• **Summary**

As one of the important innovation products of FinTech, digital currencies have brought a more far-reaching impact on the whole financial industry. Digital currencies are divided into central bank digital currencies and private digital currencies depending on the issuing entity. With a view of improving financial efficiency and maintaining financial stability, central banks around the world are testing sovereign digital currencies. However, among all kinds of CBDC projects, most of them are still in the research or trial stage, and only the central banks of Bahamas, Nigeria and the Eastern Caribbean States have officially issued CBDCs. China has recently tested its RMB CBDC on retail basis. Private digital currencies have seen exponential growth in recent years and have been recognized by many developing countries, with El Salvador even adopting Bitcoin as its national legal tender.

2.2.3 Digital payment

• **Status quo of global digital payment development**

Digital payment refers to electronic money payments through mobile clients installed in electronic products such as cell phones. It establishes an effective connection among the Internet, terminal devices and financial institutions to form a new payment system. According to the statistics from Juniper Research, the current top five digital payment companies in the world are Alipay, PayPal, WeChat Pay, Google Pay and UnionPay China. Three of the top five digital payment

companies in the world are from China, indicating that China is leading the trend of global digital payment.

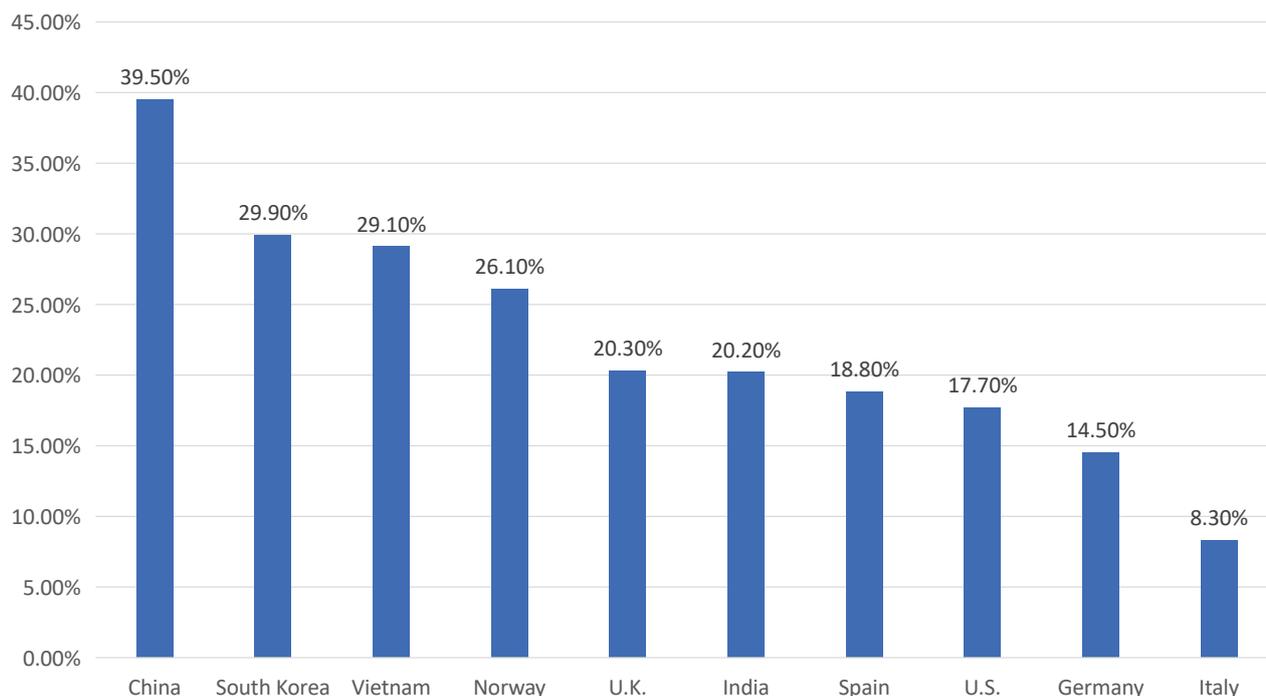
In terms of the penetration rate of digital payment, according to Statista, China, South Korea and Vietnam are the countries with the highest penetration rates of digital payment in 2021, reaching 39.5%, 29.9% and 29.1%, respectively, while more developed countries in Europe and America, such as the U.K., the U.S. and Germany, have relatively low penetration rates (see Figure 2-5). This may be because developed countries in Europe and America set an early foot in the development of credit card systems and have formed a relatively developed system, therefore, the willingness of these countries to use digital payments as a convenient alternative payment is relatively low. However, China and Vietnam, as emerging economies, and South Korea, as an East Asian economy that crossed the threshold of developed countries relatively late, are left behind in financial development. As a result, along with the tide of digital financial development, the above-mentioned countries can jump over

the stage of credit card payment and head directly to digital payment. Furthermore, the less use of digital payments in traditional developed countries in Europe and America may be related to the greater importance that their citizens attach to private security.

- **Difference between CBDC and digital payment**

On July 16, 2021, the Central Bank of China released the *Progress of Research & Development of E-CNY in China*, marking that the development of CBDC officially entered the fast lane. In 2020, the scale of digital payments in China reached USD24.9 billion, being able to meet the needs of most ordinary users in financial facilitation. Some critics thereby argue that the CBDC is a duplicative innovation. However, there are still some major differences between CBDCs and traditional digital payments. Alipay and WeChat Pay are mainly divided into balance payment and quick payment. The process of balance payment is to transfer the user's money from their personal bank accounts to the corresponding accounts of Alipay or WeChat Pay before spending, while

Figure 2-5: Global ranking of digital payment use by country in 2021



Data source: Statista



the quick payment is the transfer of money through banks. Both require money transfers through banks or financial institutions, while e-CNY is positioned as M0 and does not have to be transferred through banks. Therefore, e-CNY is more reliable than digital payment without risks of the bank run, and e-CNY has the status of legal tender, which means that no one can refuse to accept it, making the future circulation and convenience of e-CNY inevitably more promising than a digital payment.

- **Digital payment instruments based on private digital currencies**

In addition, running a full node to receive and send digital currencies remains difficult for ordinary users, therefore, in order to improve the convenience of digital currency transactions and payments, mobile payment instruments for digital currencies are also sprouting up, including centralized wallets and decentralized wallets. Among them, centralized digital currency wallet includes various exchange wallets, such as Coinbase wallet, OKEx wallet, etc., which can be

used for quick currencies trading within the exchange and quick conversion with the fiat currency, suitable for short-term digital currency investors and centralized digital currency derivatives trading. The trading fees charged within the exchange are generally low, but the security is also relatively low. Hence, decentralized wallets based on open-source code are now the mainstream for the long-term storage of large amounts of private digital currencies. At present, Ethereum wallets are dominated by Metamask, which allows quick connection and login with various NFT marketplaces such as OpenSea. Other general-purpose digital currency wallets include imToken, TokenPocket, etc., which support different kinds of digital currencies.

- **Summary**

Digital payment is one of the technologies that started early in the development of digital finance and is more mature. For developing countries such as China and Vietnam, which have lagged behind in financial development, the rise of digital finance has enabled more prominent

performance in digital payment in these countries. However, countries in Europe and America have formed their own developed financial systems and attached great attention to privacy protection, so the development of digital payment there is relatively backward. In addition, given the continuous development and improvement of digital payments developed by private companies, there is a growing concern in society about the potential monopoly problems in digital payments, so governments are stepping up their support for the development of CBDCs. At the same time, however, some critics have argued that current digital payments are already able to meet the financial facilitation needs of most ordinary users and that the CBDC is a duplication of innovation. However, traditional digital payments are completed with money transfer through banks or financial institutions, while the CBDC is positioned as M0 and does not need to be transferred through banks, so there is an essential difference between the two. CBDCs are entitled to the status of legal tender, which makes their future circulation and convenience inevitably outperform digital payment. Finally, as digital currencies continue to evolve, digital payment instruments based on private digital currencies are also springing up, mainly categorized into centralized wallets and decentralized open-source wallets.

2.2.4 Digital Bank

Information and mobile technologies have revolutionised the banking industry. Thanks to technologies including encryption, distributed ledger, biometrics, artificial intelligence and big data, digital bank provide more economical, reliable, convenient and bespoke banking services. By changing customer experience, infrastructure and credit analysis, digital bank has attracted a broad customer base. According to data from Statista, digital bank has brought more convenient banking services to 1.7 billion customers who would

otherwise have no access to traditional banking services. It has also offered more diversified financial services to more than 213 million small and medium-sized enterprises.

- **Overview of global digital bank development**

Digital banks first appeared in Britain and Europe saw a rapid growth of digital banks. Digital banks like Atom Bank, Tandem, Monzo, Starling Bank, Revolut and N26 have attracted \$420 million in financing and more than 30 million customers since 2014. These banks then spread from Australia to Asia and America. According to the report by Exton Consulting, the number of digital banks globally quadrupled from 60 in 2018 to 256 in 2020. The market value of these banks reached \$34.8 billion in 2020, which would grow 47.7% and reach \$7.2 trillion by 2028. With 72 newly founded banks, the growth of digital banks peaked in 2019. Data by Stegmeier showed that 30 digital banks have filed for bankruptcy since 2015.

However, the development of digital banks is far from grinding to a halt. New digital banks keep emerging despite the Covid-19 pandemic. The Monetary Authority of Singapore granted licences to four digital banks in December 2020. And Korean digital bank Kakao Bank started trading in the Korean stock market in July 2021, becoming the first Asian digital bank to go public. In the same year, Minna no Ginko in Japan, Woli from Greece, Vybe in France, AlexBank in Australia, Rakuten International Commercial Bank and LINE Bank in Taiwan started to operate in 2021. Figure 2-7 listed major digital banks globally.

- **Global development of digital banks-geographically**

Europe, where digital banks first emerged, has been dominating the market - with 111 digital banks, Europe accounts for 40% of the total digital banks globally. The flourishing of digital banks in Europe was not only due to their strong digital infrastructure but favorable policies adopted by European

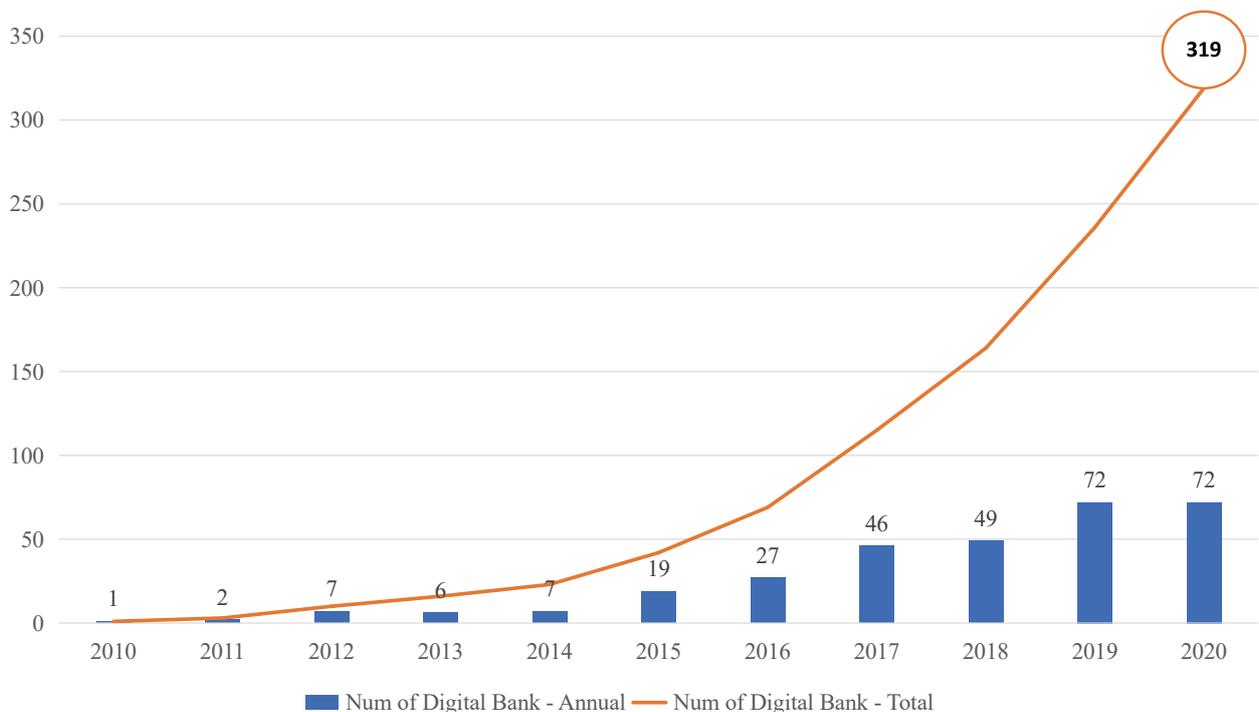
regulators to support financial technology innovation. For instance, the European Commission and the European Council passed the Revised Payment Services Directive in 2015 which stipulates that banks have the obligation to reveal data to an authorized third party. Meanwhile, Britain, the Netherlands and Switzerland issued regulatory sandboxes which allow regulators to test products and services and grant temporary exemptions to products. But since traditional banks could meet almost all financial service demands in Europe, which leave little room for improvement or financial alternatives. Most European digital banks are FinTech start-ups, European digital banks are generally of small scale and have chosen to provide alternative and more flexible financial services.

In the US, both the federal and state governments regulate the financial system. Most digital banks didn't get licenses since different levels of regulators failed to reach a consensus. As a result, digital banks

collaborate with traditional banks by offering banking as a service (BaaS) - traditional banks help manage the accounts of digital banks while digital banks provide technology support for traditional banks. Of the five major digital banks, only Varo Money got licensed to become a national bank. Most digital banks operate by collaborating with licensed banks. With their mobile application, Chime, for instance, offers near-fee-free online banking services. Meanwhile, digital bank in the US has attracted customers in the lower-income middle class and rural communities, which has promoted financial inclusion in those communities. Data showed of the digital bank customers, only 20% had more than \$1000 in savings, 45% of the customers have less than \$100 in their accounts and only 25% of digital bank users have a bachelor degree.

Most Latin American countries still rely heavily on cash and lack payment alternatives. With weak regulation and institutional support, the region does not have many financial service

Figure 2-6: Statistics on global digital banks



Note: The figure includes statistics on digital banks that are no longer in operation and the number of 2020 includes digital banks that were founded before July 2020 and plan to go onto the market before the end of 2020 Data source: Exton Consulting

Figure 2-7: Major digital banks around the world



Data source: collection of public data

options. As the region has a great number of internet users and a fast-developing e-commerce market, digital bank has been booming in recent years. The region boasts many FinTech startups with most startups in countries like Brazil, Mexico and Argentina. FinTech unicorn Nubank, founded in 2013, is the biggest and most valuable FinTech company in Latin America. According to its IPO prospectus, Nubank has 48.1 million users by September 30 2021, 73% of which are monthly active. These users make up 28% of Brazilians that are 15 and older. Nubank saw more than 2 million new monthly users in Brazil, Mexico and Columbia. Latin America now has nearly 50 digital banks. Founded in 2017, Ualá in Argentina has raised \$544 million in funding and was valued at \$2.45 billion.

Apart from Singapore, the financial system in ASEAN countries and South Asia is not well developed and the region lacks regular banking services. For instance, 60% of the

population in ASEAN countries does not have a bank account. Credit card holders takes less than 2% of the total population in countries like Indonesia and the Philippines. Southeast and South Asia have the biggest potential for digital banks. Most digital banks in the Asia Pacific region were started by tech juggernauts or big financial institutions which have the huge financial strength and technological capabilities - Tencent founded WeBank while Ant Financial started MyBank. With 60% of the world's total population and high adaptability and openness, Asia is leading the FinTech revolution.

• Summary

Digital bank is a direct product driven by information technology and an inevitable result given traditional banks barely meet customer needs. At low cost and being highly efficient, digital banks have been attracting more and more customers and bring innovation and competition to traditional banking. Globally, with state support for FinTech innovation,

digital banks boomed and started to saturate. Digital banks in America and Europe are more developed and are leading the race on digital bank thanks to their well-established digital infrastructure. But since traditional banks have already met most customer needs, digital banks in these areas are generally of small scale and have little market space. Markets like Brazil and Southeast Asia which have low financial inclusion have huge potentials for digital banks.

2.2.5 Digital Insurance

Many countries around the world have closed their borders and many cities have gone under lockdown since the Covid-19 pandemic, which has severely disrupted the world's economy and financial system. The insurance industry has been under enormous strain. Between 2016 and 2019, global insurance rates have been steadily growing and 2018 saw insurance rates jump by 24%. But at \$6.1 trillion, insurance income in 2020 dropped 3.1% because of the pandemic. The pandemic,

however, also offered new opportunities for digital insurers, with increased demands for digital and online insurers.

- **Overview of global digital insurance development**

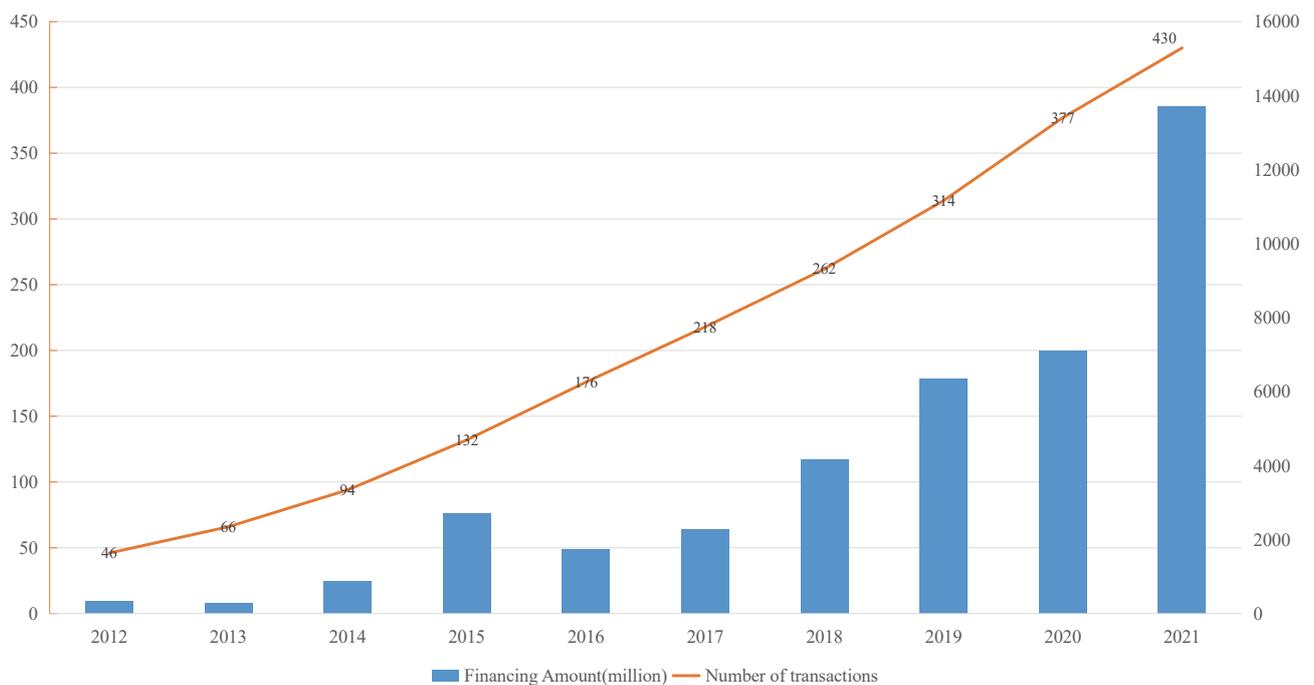
Fundraising for digital insurers grew substantially in recent years. Fundraising for digital insurers grew fast in 2021 as the frequency and amount of funds being raised reached records in 2021 according to data by Crunchbase. Via 430 financing transactions, insurers raised \$13.1 million, doubled that of 2020.

- **Global development of digital insurance-geographically**

Digital insurance is going global in an unstoppable trend. Europe and America as well as emerging markets in Asia are at the pole position of the market. The followings are some characteristics of the market.

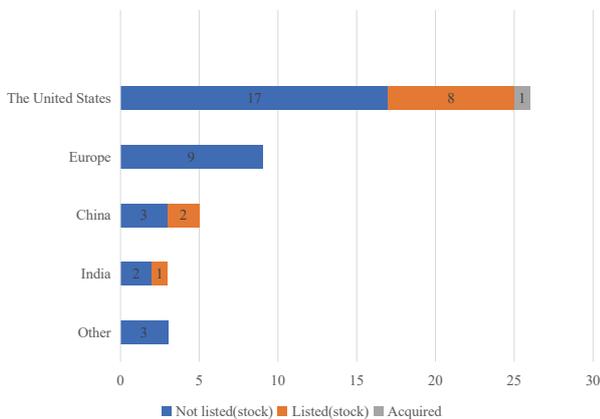
First, the digital insurance market has been favored by venture capital. Total financing

Figure2-8: Trends of fund raising of the digital insurance between 2012 and 2021 H1



Data source: Willis Towers Watson, crunchbase

Figure 2-9: The geographical distribution of insurtech unicorns

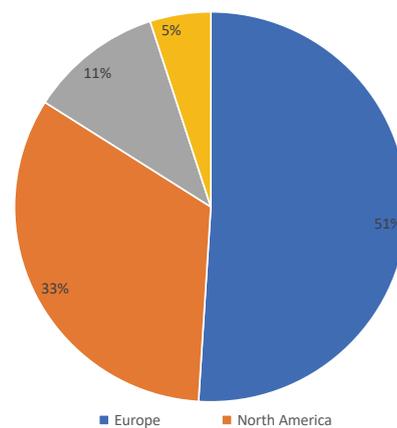


Data source: ZeroOne and Chinese Insurer

transactions jumped from \$276 million in 2013 to \$7.1 billion in 2020, according to data from Willis Towers Watson. Half of the financing happened in America. Five of the ten biggest funds raised in 2021 are for American insurers and the total amount raised reached \$1.23 billion. And digital insurance startups have raised 1.8 billion Euros from venture capital in the first five months of 2021, more than ten times of that raised in 2016, according to data from Dealroom. The total valuation of the digital insurance startups reached 23 billion euro by the end of 2021, a fivefold rise from that of 2016.

Second, digital insurance startups have been growing fast with a number of insurtech unicorns. According to calculation by Chinese ZeroOne and *Chinese Insurer*, a magazine, the world boasts more than 46 insurtech unicorns by the end of the first half of 2022, of which 26 are American (eight have already gone public and one was bought up), five are Chinese (two went public already), three are from India (one went public) and nine unicorns are from Europe (six are British, two are French and one German). Chile, Singapore and Israel each has one insurtech unicorn. The global trend for the industry has been that big money creates insurtech juggernaut. American insurtech startups have the most funding, some of which have grown to the world's biggest unicorns. Compared to 2020,

Figure 2-10: Global distribution of InsurTech100



Data source: FinTech Global

America saw 12 more new insurtech unicorns, the world's biggest increase. Europe saw 6 new insurtech unicorns, the world's second biggest increase. India had two more unicorns while China, Singapore and Israel each had one new unicorn. America and Europe still have the most insurtech unicorns whereas digital insurance startups have been growing elsewhere too. And in the InsurTech100 2021 ranking published by FinTech Global in Britain, 51 companies are from Europe, 23 of which are British; 33 are from North America, 30 of which are from the US; 11 are from Asia, six of which are from Israel, two from India and two from Hong Kong; the rest are from Australia, Latin America and Africa.

Digital insurance has huge market potential in both developed and developing markets, but for different reasons. Apart from the long history of insurance and policy support in Europe and the US, the rapid ageing of their population, which drives up demands for insurance, has propelled the growth of digital insurance industry in these areas. In comparison, the quick growth of digital insurance in emerging Asian markets is due to low market penetration and the fast growth of their economies and the benefits of a young population. Japan, however, is a peculiar case because, despite its ageing population and it being the world's third largest economy, Japan does not have any



lead in digital insurance. Moreover, FinTech in Japan is at a low-level development stage. That is because

a) stringent regulations - the Japanese government strictly regulates the finance industry and the government's low-interest rates have driven people to choose credits over insurance. As a result, the market has easy access to credits and little demand for finance innovation;

b) concerns over safety and privacy - a survey by the Japanese Bankers Association suggested that less than 20% of Japanese use online banking and most people chose not to use digital financial services out of distrust. Bank counters and ATM are still part and parcel of Japanese financial services;

c) conservative consumer behaviors - the Japanese are relatively conservative when it comes to spending. Most people would restrain from overspending and are object to FinTech to a large extent;

d) a lack of startup ecosystem - startups are rarities in Japan which put FinTech in a bind. Big state-owned conglomerates have access to most of the resources which leave little room for startups.

• **Summary**

Technology, capital, regulations and demands are all factors that impact the development of digital insurance. First, technological advancement is the propellant for the emergence of new commercial modes of digital insurance. The more mature and the more widely applicable the technology is the more drive technology provides for digital insurance. Second, capital is key to the boom and maturity of insurtech companies, of which the quick development of digital insurers in Asian emerging markets is strong proof. Third, despite strong regulations, digital insurers have got strong backing from governments, be it in Europe and America where the insurance industry has a long history or in emerging Asian markets where market penetration of insurance is relatively low. Last but not least, demands are the fundamental driving force for digital insurance. Demands for insurance are high in Europe and America because of high medical costs mostly in the United States and a rapidly ageing population in Europe. In emerging Asia, the sheer number of its population and the low penetration of insurance has driven up demands. In the meantime, digital insurance should solve the problems of high costs and low efficiency that have been haunting the insurance industry.

2.2.6 Digital brokerages

Digital brokerage comes in two forms - digital brokers whose businesses are mostly online and traditional brokerages that are undergoing digital transition. Digital brokerages didn't attract as much funding and financing in the capital market as digital banks and insurers. As a result, traditional brokerages still dominate the market thanks to their brand names and long history and there have not been many brokerage startups and unicorns. Financial technology has been applied to brokerage in recent years. Brokerages have been using FinTech to innovate. Technology has become the new force driving brokerage transition and business upgrades. Many brokerages have identified FinTech as their core competitiveness.

- **The development of online brokerages**

Online brokerage emerged in America, Japan and Europe. And as the birthplace of online brokers, America boasts many leading online brokerages. For instance, Interactive Brokers, the world's largest online brokerage, went listing on Nasdaq in May 2017. The company

brokers stocks, options, forex, futures, bonds and ETFs from more than 100 stock markets in 24 countries. The company manages more than 14% of the world's total stock and bond transactions. It has been ranked first in Barron's magazine's "Best Online Brokers" for many years in a row. (Table 2-1)

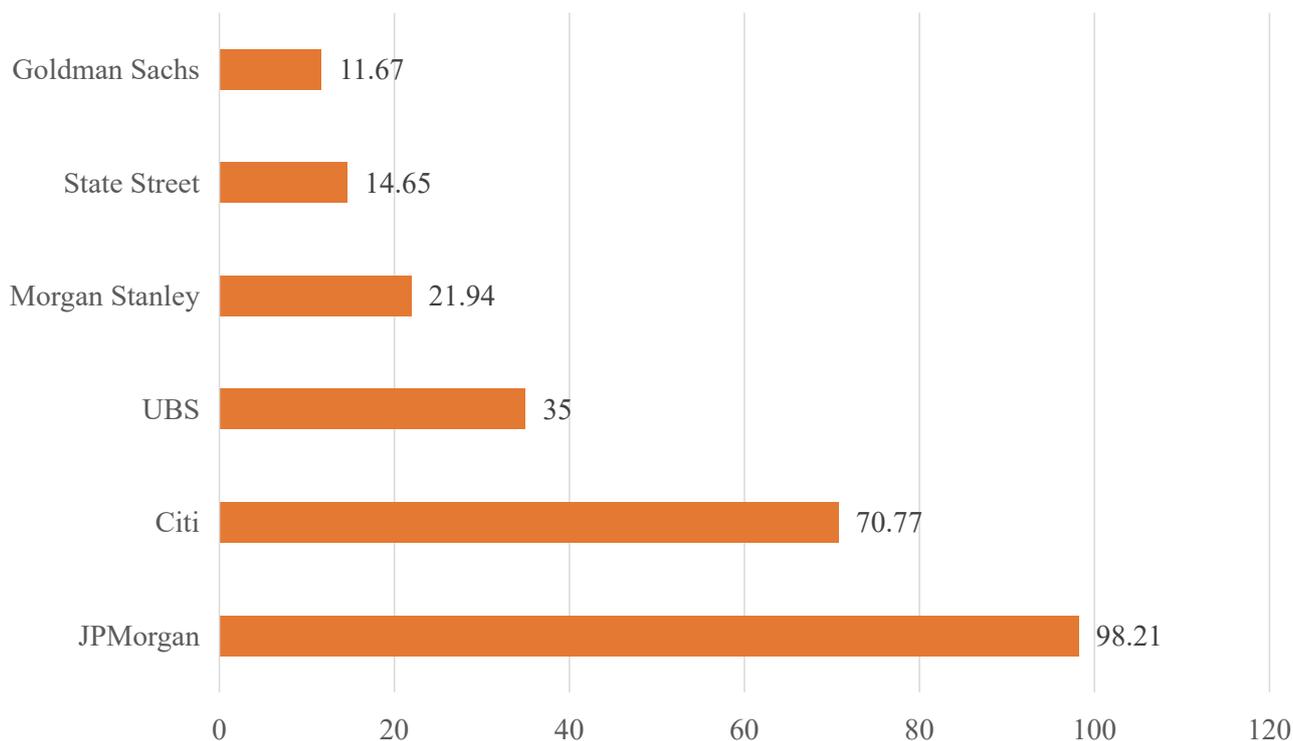
Quite a number of online broker unicorns have emerged in recent years, including American online brokerage Robinhood, WeBull (already IPO), which is funded by Chinese capital, Tiger Brokers which has been trading in American and Hong Kong stock exchanges, and German online broker Trade Republic. These brokerages offer smart services at lower costs, which have helped them attract new customers and disrupted the traditional broker market. For example, Robinhood generates revenues through rebates from market makers and trading venues, margin interest, stock loans and income generated from cash and premium subscription. It is the first to offer commission-free trading and is very popular among the youth in America. Robinhood

Table 2-1: Barron's Best Online Brokers in 2020 and rating

Rank	Brokerage	Rating
1	Interactive Brokers	5
1	Fidelity International	5
3	E-TRADE	4.5
4	TD Ameritrade Holding	4
4	Charles Schwab	4
6	Tastyworks	3.5
6	Merrill Lynch	3.5
8	Ally Investment	3
9	Sogo Trade	2.5
10	TradingBlock	None

Data source: Barron's Rating

Figure 2-11: World top brokerages' investment in technology in 2019



Data source: Archforce Technology

disrupted American broker market because it is good at using internet business thinking to improve customer experience and attract more customers via its online platform. The company's customer acquisition costs have been going down since 80% of its customers are from Robinhood Referral Programme.

• **Traditional brokers' digital transition**

The digitalization of the capital market is an unstoppable trend. With the wide application of blockchain technology, cloud computing and artificial intelligence, market players have prioritized digitalization. From open banking to open brokering, the brokerage industry has improved its digitalization, intelligence and ecology. According to statistics from Mckinsey, brokerages' investment in technology grew 33% between 2017 and 2020, which makes up for 9.1% of their revenues, up from 4.2%. And top brokerages' investment in technology grew by 40% between 2017 and 2020, higher than the industry average. JPMorgan Chase

invested nearly \$10 billion in technology in 2019, leading the investment race; Citigroup invested \$7.08 billion in technology; the investment in technology by UBS, Morgan Stanley, State Street and Goldman Sachs all exceeded \$1 billion, according to statistics from Archforce Technology (Figure2-11). It's worth mentioning that there is a yawning gap in terms of investment in tech between Chinese brokerages and the world's top ones. The annual investment by top brokerages are way higher than Chinese brokerages' revenues. Huatai Securities invested \$204 million in 2019, the biggest investment by Chinese brokerages, which only makes up for 1/48 of that of JPMorgan Chase.

• **Summary**

With lower costs and more convenient services, online brokerages have disrupted the traditional brokerage market. But as the market enters into a commission-free era and traditional brokerages speed up their digitalization, online brokerages should seek

new services to keep the profits growing, which requires higher level digitalization of online brokerages. Traditional brokerages should use the digital transition to offer more services, improve efficiency and lower costs so as to provide top-notch services for investors, which is the only way for these brokerages to successfully digitalize. Top brokerages could afford to invest in technology and use all the available technologies on the value chain since they are of large scale and have a strong customer base. Small and medium-sized brokerages should invest in technology within their budget. They should work to lower costs, particularly operation costs, improve productivity and retain customers.

2.2.7 Digital supply chain finance

Traditional supply chain finance is low in efficiency because, on the one hand, it is difficult to collect key finance and information flow data which are controlled by core companies, on the other hand, it is hard to integrate data from different companies on the supply chain. Financial technology offers new momentum for the supply chain finance ecosystem. By getting financial institutions, core businesses, suppliers and third-party partners onto one platform, digital supply chain finance integrate resources like information, funds and logistics, which improves the efficiency of funds utilization. It adds value for all parties involved, reduces risks and creates a win-win ecosystem on the supply chain.

- **Global development of digital supply chain finance**

European and American markets are taking the lead in the development of global digital supply chain finance, which is quickly developing in some Asian countries too.

Worldwide, America is leading the digital supply chain financing. In the World's Best Supply Chain Provider ranking, seven companies are from America, making up 58% of the total companies; one is from Spain, one from France; one provider comes from China, one from Singapore and one from Japan.

There are several reasons for the rapid growth of supply chain finance in America and Europe.

First, digital supply chain finance has been developing in these regions for many years and has become a well-established way of financing. Supply chain finance first emerged in Europe and America around 1980. In the 1990s, Walmart, Carrefour, and BMW are among the first companies to use supply chain financing. Major banks started to dominate the market around 2000. And after the financial crisis in 2008, a number of tech companies emerged as third-party platforms for supply chain finance. After a few stages of development, supply chain finance is relatively well-developed in America and Europe.

Second, traditional business giants have very advanced supply chains. In the Gartner Supply Chain Top 25 for 2021²³ companies are from Europe and America. At 16, American companies take up 64% of the 25; Europe has seven, representing 28% while only two are from China.

Third, America and Europe have made significant investments in information technology and boast many tech unicorns, which have helped these areas to transition to digital supply chain finance. America and Europe are at the forefront of the world's financing, mergers and acquisition and IPOs. Blockchain unicorns like Coinbase and Ripple were born when a lot of funds were sloshing around in the capital market.

²³ Gartner Top 25, in its 17th year, is a renowned annual ranking of the world's superior supply chains. The ranking is used to benchmark performance and maturity. The Top 25 are selected from the Fortune 500 and the Forbes Global 2000 companies, whose annual revenues are higher than \$12 billion.

Fourth, policy support has also helped supply chain finance's growth. Countries like America, Germany and Britain have long realized the importance of supply chains in the economy. Supply chains have become part of national strategies and global management. They see supply chains as an important means of elevating the countries' competitiveness and economic strength and achieving multilateralism. The UK government issued *Strengthening UK manufacturing supply chains- An action plan for government and industry*, signifying increasing manufacturing competitiveness has become its national strategy.

China and Singapore also have had significant development in digital supply chain finance.

The rapid growth of digital supply chain finance in Singapore was largely thanks to

a) Singapore is Asia's most important hub for finance, trade and maritime shipping. Its port is the world's second-largest. And because of its unique geographical location, it has advantages over logistics. As a result, Singapore has a high level of supply chain planning and operation;

b) FinTech is growing fast in Singapore (Singapore took the third place in Findexable's 2021 ranking of the global FinTech index). Its advanced technology has facilitated the supply chain finance's digital transition;

c) government support - the Monetary Authority of Singapore (MAS) announced the FinTech Regulatory Sandbox in 2016, which encourages blockchain companies to conduct experiments and research in the country. FinTech companies that have applied for the sandbox will get regulatory support with relaxed specific legal and regulatory requirements. The MAS further launched 5 Gartner Top 25, in its 17th year, which is a renowned annual ranking of the world's superior supply chains. The ranking is used to benchmark performance and maturity. The Top 25 are selected from the Fortune 500 and the Forbes Global

2000 companies, whose annual revenues are higher than \$12 billion. Because of these favorable policies, a large number of blockchain companies have set Singapore as their regional headquarter and business hub, which, to a certain extent, has helped Singapore's supply chain finance transition.

Favored by capital from around the world, China has seen tremendous growth in FinTech in recent years and quite a number of unicorns. The country is also leading the world in the number of registered intellectual property in FinTech. Digital supply chain finance has been growing fast in China thanks to widely applied new technologies, the sheer size of the Chinese economy and policy support. According to data from Lanfanglian, 30% of China's supply chain is digitalized and 60% to 70% of the payment will be made via blockchain in the next five years. And the total amount of funds raised via blockchain could reach 3.6 trillion yuan by 2025.

• **Trends in digital supply chain finance**

Digital supply chain finance will not only have traditional financial institutions and big enterprises with ecosystems, but a well-integrated service web of data, credit, capital and new cooperation that are connected by FinTech. In 2020, Centrifuge, a finance initiative based on blockchain, launched decentralized finance (DeFi) protocols. Centrifuge's Tinlake, which is based on Ethereum, offers a platform where investors and businesses can get financing by sourcing crypto liquidity. Asset originators can provide financing by minting an NFT representing real-world collateral. Binance launched Injective Protocol, the first layer 2 DeFi Protocol of the industry, which can be used for cross-chain derivatives trading across a plethora of financial products such as perpetual swaps, futures and spot trading. This protocol enables traders to create, enter into, and execute decentralized perpetual swap contracts and CFDs on any arbitrary market. With the technology stack that ensures safe and decentralized trading, the layer-2 protocol makes exchange and



payment much faster. Injective allow users to create and trade cross-chain derivatives.

- **Summary**

Traditional supply chain finance fails to solve financing difficulties that many small and medium sized companies face since traditional supply chain finance relies heavily on the businesses' credit and stable business relations, which relies on trust. Digital supply chain finance, however, transfers that trust to the digitalization of companies' businesses and behaviors, which will objectively and truthfully reflect the operation of the whole supply chain and the ability of all the parties involved. Based on these reflections, businesses can make more rational decisions. Therefore, supply chain finance should be based on the digitalization of the supply chain, which needs policy support from the government.

2.2.8 Decentralized Finance

Decentralized Finance (DeFi) is one of the hottest areas in the blockchain ecosystem. With blockchain technology, DeFi tries to solve problems of the traditional centralized system like bureaucratic red tape, lack of transparency, and potential transaction risks like bad debts. It has been seen as an

innovation that has disrupted the finance world. Since the launch of MakerDAO in 2015, DeFi services spring up like mushrooms. The industry only took off in 2020 when many services found their market niche. DeFi has only grown into considerable scale by the end of 2021. The total value locked (TVL) in the DeFi protocols rose to \$101.4 billion and the number of users has also reached new high, according to statistics from The Block. But according to data from Grayscale, DeFi is still at an early stage since the total market value in DeFi ecosystem only accounts for 1.6% of the total market value (\$8 trillion) of the world's financial industry. The market capitalization of JPMorgan Chase is five times greater than that of the total value of the DeFi ecosystem. But DeFi has huge potential for growth if it eats into the traditional financial market.

DeFi provides decentralized lending, algorithmic stablecoins, decentralized trading, and decentralized derivatives. Table 2-2 shows the ranking of different DeFi protocols based on their Total Value Locked. Aave, Maker and Compound are the top three protocols. Maker first launched DeFi lending, which allows users to make loans based on DAI, a stablecoin on the Ethereum and offers more collateral. The Compound makes assets

Table 2-2: DeFi projects ranking

Ranking	NAME	CHAIN	SECTOR	TVL (USD)
1	Maker	Ethereum	Lending	\$14.30B
2	Aave	Multichain	Lending	\$10.85B
3	Curve Finance	Ethereum	DEXes	\$10.23B
4	Convex Finance	Ethereum	Assets	\$9.61B
5	Uniswap	Ethereum	DEXes	\$7.04B
6	Compound	Ethereum	Lending	\$6.19B
7	InstaDApp	Ethereum	Lending	\$5.39B
8	yearn finance	polygon	Assets	\$2.53B
9	Balancer	Ethereum	DEXes	\$2.19B
10	Bancor	Ethereum	DEXes	\$1.84B
11	Liquity	Ethereum	Lending	\$1.48B
12	SushiSwap	Ethereum	DEXes	\$1.46B
13	dYdX	Ethereum	Derivatives	\$987.2M
14	Rari Capital	Ethereum	Assets	\$894.1M
15	Alpha Homora	Ethereum	Lending	\$763.1M
16	Flexa	Ethereum	Payments	\$630.6M
17	Tornado Cash	Ethereum	Payments	\$559.8M
18	Quickswap	polygon	DEXes	\$542.4M
19	DeFi Saver	Ethereum	Lending	\$501.4M
20	TrueFi	Ethereum	Lending	\$481.3M

Data source: DeFi Pulse



lending more popular and offers more token lendings. When lending locked in Compound, users get cTokens. Aave competes with Compound by offering more diverse token lending and the users' total collateral rate being as high as 75%. The second most used protocols are decentralized exchanges (DEXes). We believe that the reason why the two types of DeFi protocols have developed fastest and are most popular is that with P2P lending and cryptocurrency exchanges experiencing "crash" and cash withdrawal difficulties, the credit of centralized financial institutions is gradually questioned, while decentralized DeFi protocols have higher credibility.

However, DeFi technologies are not well developed yet. There have been many incidents where hackers stole digital assets. The first half of 2021 alone has seen 78 incidents of security issues in blockchain, among which around 50 securities incidents concerning DeFi. On August 10, 2021, hackers attacked Polygon, a crypto venture, by stealing \$611 million worth of cryptocurrency, which includes Ethereum tokens that are worth \$273 million, \$253 million worth of

tokens on Binance Chain and \$85 million worth of USDC. The amount lost to the hack was the world's largest so far. The security issue has been the focal point for the DeFi market.

- **Summary**

As a novel way of providing financial service, DeFi has made financial services more transparent by using digital protocols that take effect automatically, which, compared to traditional financial services, reduces risks and lower costs and the rate of bad debts. DeFi is growing rapidly in a short period of time but DeFi ecosystem is still at an early stage in terms of its scale and has considerable potential for growth. DeFi provides financial services including stablecoin, lending, DEXes and derivatives. Lending and DEXes are the most widely used services. But DeFi is prone to hacker attacks and security loopholes since the technologies for DeFi are not well developed and it lacks a well-established regulatory system. On top of that, the volatility of cryptocurrencies has made DeFi trading more vulnerable.

Chapter 3: The Opportunities and Impacts of Digital Finance



The lack of financial services to the real economy is an important factor restricting the development of the global economy, especially for countries and regions with backward financial development (such as Latin America, Southeast Asia, etc.). Because of financial exclusion, traditional finance, led by bank credit, cannot meet the capital needs of small and medium economic entities (such as households, small and micro enterprises, etc.). Thus, it is difficult to give full play to its role in helping the real economy and promoting industrial upgrading. The problem faced by traditional finance needs to be solved by innovative financial models in the new era. Digital finance combines traditional finance and modern technology. Through algorithm technology and product innovation, digital finance can reduce the cost of financial services and increase the supply channels of financial services, which

can effectively reach the areas where lacks the supply of traditional financial institutions, allowing financial services to cover more small economic entities. Digital finance, characterized by inclusiveness, low threshold and wide use of information, is helping global economic development by assisting SMEs and improving the efficiency of financial institutions. In addition, different from other fields of digital finance, digital currency is a brand-new financial service. It has the potential to challenge the existing financial system and plays a unique role in promoting economic development. The following section explores the opportunities and challenges that digital currencies bring to global economic growth.

3.1 The Opportunities and Challenges of Digital Currency

3.1.1 The Opportunities of CBDCs

In digital financial development, the central bank digital currency (CBDC) is a special component. Unlike most digital financial tools run by the private sector, such as digital insurance, digital bank, and digital payment, CBDC is endorsed by the central bank and issued by the government. As a result, CBDC will have an impact on the whole economic system. Although most CBDCs are still in trial, policymakers care about what opportunities the issuance will bring to the economy. It is generally believed that CBDC has an impact on monetary policy, cross-border payments, economic output and social welfare. Also, it plays an important role in promoting currency internationalization and enhancing the competitiveness of sovereign currencies.

- **Optimizing monetary policy transmission**

CBDC issuance may affect monetary policy transmission (Kiff et al., 2020). Interest-bearing CBDCs can be used as a direct monetary policy tool and can give the central banks more direct control of the money supply (Lee et al., 2021). Also, it can further apply negative interest rates (Grasselli & Lipton, 2019). But this happens only when physical cash were abolished altogether. High negative interest rates could generate criticism from the public and substantially undermine public confidence in the central bank (Mersch, 2020). Davoodalhosseini et al. (2020) stated that the issuance of CBDCs can improve monetary policy transmission in three ways. First, an interest-bearing and universally accessible CBDC could be a versatile instrument that would improve monetary policy by allowing more direct implementation and transmission. Second, it can allow monetary policy to break below the effective lower bound (ELB) and execute negative interest rate policy effectively. This

would require removing cash or restricting cash holdings. Third, CBDCs could help maintaining the effectiveness of monetary policy by reducing the incentives of the public to adopt alternative means of payment. This is because the widespread adoption of competing means of payment not denominated in domestic currency (including foreign currency and cryptocurrencies) could imperil the central bank's ability to achieve its current monetary policy objectives. Bergara & Ponce (2018) set forth that central banks can use more accurate and timely transaction information to strengthen monetary policy making and macro-economic prediction. Lee et al. (2021) also claimed that the use of CBDCs may assist the central bank to more accurately account for the money supply, its structure, velocity, multiplier, time and space distribution, thereby improving the accuracy of monetary policy operations. CBDCs would change the demand for base money and its composition in unpredictable ways. They might also modify the sensitivity of the demand for money to changes in interest rates (Carstens, 2019).

- **Improving cross-border payments efficiency**

Even though CBDCs can only be used within borders, it can have an impact across the border. This makes the coordination between different CBDCs the most important part of the project. The coordination of CBDC designs, if successful, could lead to more efficient cross-border payments (BIS Innovation Hub, 2021). Specifically, through interoperating CBDCs, multi-CBDC (mCBDC) arrangements can be formed to improve the efficiency of cross-border payments (Auer et al., 2021b). Central bank digital currencies (CBDCs) could also reduce current frictions

in cross-border payments (Auer et al., 2021c). Carstens (2021) held that blockchain technology can be used in CBDCs to lower the cost of cross-border payments. It is calculated that settling a cross-currency payment through CBDC yields a reduction in transaction costs of 51% (Ginneken, 2019). Digital currencies may also cause an upheaval in the international monetary system: countries that are socially or digitally integrated with their neighbors may face digital dollarization¹⁵ (Brunnermeier et al., 2019). Lu & Zhang (2021) insisted that before putting CBDCs in cross-border payment, legislative and regulatory issues should be considered in advance. Four key aspects should be focused on: building regulatory cooperation, complying with bilateral currency transfer agreements, implementing macro-prudential supervision and modifying the legal framework for currency settlement.

• **Increasing economic output**

Many scholars have calculated and stated that the issuance of CBDCs can help increase economic output. Barrdear & Kumhof (2016) found that CBDC issuance could permanently raise GDP by as much as 3%. Chiu et al. (2019) declared that a CBDC can raise U.S. economic output by 0.108%. Yao Qian (2019) stated that comparing to general economic output, an issuance of CBDC can increase the economic growth rate by 0.01 percentage points.

• **Social welfare**

Apart from the economic output, many scholars did research on the issuance's impact on social welfare. Kim et al. (2020) estimated that the introduction of a CBDC can improve consumer welfare on average by 0.60 CAD to 1.63 CAD. However, according to Williamson (2019), CBDCs can increase welfare for

households with no bank account, but it could that of households with bank accounts. Davoodalhosseini (2018) also confirmed that having both cash and CBDC available may result in lower welfare than in cases where only cash or only CBDC is available. Williamson (2019)'s analysis was based on Interest-bearing CBDCs. Thus, although interest-bearing CBDCs may bring extra policy tools for central banks (Williamson 2019), when the future impact is unclear, it should be carefully considered to attach interest to CBDCs to prevent possible welfare losses.

• **Internationalization of currency**

Many scholars believe that CBDCs can promote the internationalization of the country's sovereign currency. Cong & Mayer (2022) modeled the dynamic global competition among fiat currencies, cryptocurrencies, and CBDCs and highlighted that through the launch of CBDC, the existing weaker currencies may challenge the dominance of stronger currencies. If it poses a threat to the dominance of the stronger currency, the implementation of CBDC by weaker currency countries increases the incentives of the stronger country to launch CBDC too, giving rise to strategic complementarity in CBDC issuance. The report from Center for Strategic and International Studies released in April 2022 also pointed out that China's e-CNY program has begun to attract widespread interest from developed countries including U.S., EU, Japan, etc.¹⁶ The Biden administration is stepping up scrutiny of China's e-CNY program amid concerns it could overturn the U.S. dollar's status as the world's dominant reserve currency.¹⁷

¹⁵ The issuance of CBDCs from strong countries may lead to citizens of other countries that are socially or digitally highly integrated with the strong countries to use their CBDCs.

¹⁶ CSIS(2022) China's Progress Towards a Central Bank Digital Currency <https://www.csis.org/blogs/new-perspectives-asia/chinas-progress-towards-central-bank-digital-currency>

¹⁷ Bloomberg 2021 "Biden team eyes potential threat from China's digital yuan" <https://www.bloomberg.com/news/articles/2021-04-11/biden-team-eyes-potential-threat-from-china-s-digital-yuan-plans>

3.1.2 The Challenges of CBDCs

Although CBDCs can bring the above merits, they may also undermine the current bank system. A CBDC amounts to giving consumers the possibility of holding a bank account with the central bank directly (Fernandez-Villaverde et al., 2021). As a result, a CBDC could have profound implications for the banking system, increases the direct relationship between citizens and central banks and removing the need for the public to keep deposits in fractional reserve commercial banks (Raskin & Yermack, 2016). Many researchers explored CBDCs' impact on the bank system, and most summarized it as negative. First, issuing a CBDC may make the central bank arising as a deposit monopolist, attracting all deposits away from the commercial banking sector (disintermediation). This might endanger maturity transformation and other intermediations of financial institutions (Fernandez-Villaverde et al., 2021). Carapella & Flemming (2020) also claimed that introducing CBDCs may have an impact on bank deposits, monetary policy and financial stability. Keister & Sanches (2019) stated that while a digital currency tends to increase efficiency in exchange, it may also crowd out bank deposits, raise banks' funding costs, and decrease investment. What's more, some scholars warn that digital fiat currency is a bad idea because it allows the central bank to be responsible for the entire money supply (Kirkby, 2018). The issuance of CBDCs has the potential to address the zero lower-bound constraint of monetary policy implementation. But in extraordinary times, a bank run is more likely to happen (Masciandaro, 2018).

3.1.3 The Opportunities of Private Digital Currency

- **The decentralization of monetary system**

The biggest benefit of private digital currencies represented by Bitcoin and Tether is that it challenges the international monetary system dominated by US dollar settlement.

Its characteristic of decentralization, which is new to the traditional system, provides opportunities for countries sanctioned by the United States. After the outbreak of the Russian-Ukrainian conflict, the fact that Western countries excluded some Russian banks from the SWIFT further confirms the potential risks of an over-centralized inter-currency settlement system. The existence of private digital currencies such as Bitcoin has greatly reduced the effectiveness of financial sanctions from Western countries because Bitcoin does not have any centralized management, so there is no agency that can be sanctioned. Countries sanctioned by the United States, represented by North Korea, Iran and Russia, have invested in digital currencies, creating opportunities for evading sanctions.

- **Business opportunities of non-fungible token (NFT)**

Private digital currencies also provide a platform for NFT transactions. Due to the data reproducibility of NFT, for a long time, there have been widespread problems including piracy infringement and difficult ownership verification. The emergence of private digital currency Ethereum uses smart contracts to confirm rights and conduct transactions with Ether (ETH). This provides a new opportunity for NFT transactions in the digital economy. At present, some of the large-scale NFT trading platforms are Opensea, SuperRare, etc.

- **The future of the metaverse**

In addition to NFT, private digital currencies are widely used in the construction and settlement of the metaverse. Currently, the most well-known metaverse projects, Decentraland and The Sandbox use self-issued private digital currencies MANA and SAND respectively, to settle digital asset trading such as metaverse land and item purchases. All data in Decentraland and The Sandbox are stored in the Ethereum public



chain in the form of smart contracts, and the immutability of the blockchain ensures that the confirmation of digital asset property rights in the metaverse is not controlled by any centralized organization. Therefore, metaverse investment is gradually attracting the attention of major financial institutions. In July 2022, the Islamic bank Warba announced its presence and buying two plots of virtual land in the metaverse. In September 2022, DBS Bank, Singapore’s largest commercial bank, also announced that it would purchase virtual land in the metaverse.

3.1.4 The Challenges of Private Digital Currencies

Although private digital currencies can bring the above opportunities, it also brings new challenges like unregulated cybercrime, overuse of energy, and impairing financial and monetary payment systems.

- **Cybercrime**

Digital currency is based on blockchain technology. Not being restricted by borders makes it one of the world’s largest unregulated markets. According to Foley

et al. (2019)’s estimation, approximately one-quarter of Bitcoin users are involved in illegal activity. Also, around \$76 billion of illegal activity per year involve Bitcoin (46% of Bitcoin transactions). However, the high volatility of Bitcoin and its open ledger make it not the best currency for market transactions. Therefore, different Bitcoin mixers have been developed to conceal user’s identity. Other stablecoins continue to appear in the market, like Monero, which has better anonymity compared with bitcoin, and Tether, which maintains a stable currency value while ensuring anonymity. All the above has brought greater challenges to supervision of digital currency.

- **Hindering green development**

The generation of mainstream private digital currencies such as Bitcoin is based on the Proof of Work (POW) mechanism, which has problems such as large power consumption, complex verification process, high transaction costs, and congested bookkeeping rights competition. In the early stage, some programmers could use the computing power of ordinary personal computers to win the bookkeeping rights and mine a large amount of Bitcoins. However, with the rise of

Bitcoin price and the entry of more investors, the difficulty of mining has continued to rise. According to the Cambridge Bitcoin Electricity Consumption Index (CBECI), the annual electricity consumption of Bitcoin mining has grown from 2.12 TWh on December 1, 2014, to 143.85 TWh on May 13, 2021, an increase of 67.85 times. Therefore, the digital currency generation system based on POW obviously does not meet the long-term goal of carbon neutrality.

- **Impairing financial and monetary payment systems**

Traditional private digital currency has high risks, and the damage to the financial and monetary payment system is obvious. Its high volatility may lead to the bursting of asset bubbles, which can be transmitted to financial and monetary payment systems. However, unlike traditional private digital currencies, stablecoins attempt to stabilize the value of private digital currencies, thereby exhibiting different characteristics that pose a greater threat to the payment system. Stablecoins mainly include crypto-collateralized stablecoins such as Tether (USDT), USD Coin (USDC), Binance USD (BUSD), and algorithmic stablecoins such as DAI, MIM, FRAX, and UST (TerraUSD). Crypto-collateralized stablecoins' issuance is based on centralized smart contracts. They

are exchanged 1 to 1 with fiat currencies, and regularly publish audit reports to announce collaterals. So, they are more stable, but are excessively centralized. Algorithmic stablecoins are based on intelligent algorithms that dynamically adjust the supply and demand between cryptocurrencies and stablecoins to keep the currency value stable. It has a higher degree of decentralization, but there is no independent reserve to support its value. The President's Working Group on Financial Markets (PWG) of the United States released Stablecoin Report in November 2021. It further pointed out that the trend of the increased potential in stablecoin as a payment method may lead to instability of payment system operation, even suspension, and an excessive concentration of economic power. Gorton & Zhang (2021) thought that issuers of stablecoins are essentially unregulated banks. Moreover, because the issuer of stablecoins has limited knowledge of the risks it bears, there is a risk that most depositors run out suddenly. Nández-Alonso et al. (2021) also mentioned that stablecoins may not be able to provide stable value, while bringing other risks. In May 2022, the price of a major algorithmic stablecoin UST (TerraUSD) has plummeted and the exchange ratio with the US dollar has been lost. This further intensified the above concerns.



3.2 Digital Finance Assists Global Economic Development

The impact of digital finance on economic growth can be seen mainly in the following aspects. First, its impact on households. Compared with traditional finance, the popularization of digital finance can enhance the liquidity of households' funds, provide easier payment methods, enhance the frequency of payments, and stimulate economic growth by promoting consumption. Second, its impact on companies. The development of digital finance can promote the innovation capabilities of small and medium-sized companies by easing the constraints of funds required for innovation and improving financing efficiency. Third, its impact on economic structure. Digital finance plays an important role in industry and finance ecology, trade financing, cross-border payment, transaction costs, etc. In addition, digital finance has also promoted the development of a green and shared economy to a certain extent.

3.2.1 Digital Finance Improves Households' Consumption Ability

Digital finance relies on digital technologies such as big data and cloud computing to generate new digital financial business models such as financing, payment, and investment, which play an important role in easing households' liquidity constraints, improving payment convenience, reducing precautionary savings, and raising income. It is a new opportunity to release residents' consumption potential and promote economic growth.

- **Digital finance and liquidity constraints**

Through reasonable and effective distribution of resources, financial development can alleviate consumers' liquidity constraints, and encourage households' consumption

(Campbell and Mankiw, 1991). First, as a combination of digital technologies and finance, digital finance has greatly expanded the scope of financial services, enabling residents who were originally excluded from financial services to achieve intertemporal consumption smoothing through financial services, reducing the liquidity constraints of households, and then effectively increase the demand of residents (Yi and Zhou, 2018). Compared with developed economies in Europe and America, developing countries are less financially inclusive. Thus, the role of digital finance in promoting consumer demand is more obvious.

Take Brazil as an example. As the most populous country in Latin America, Brazil has the largest number of Internet users in the area. By the end of 2020, the number of Internet users in Brazil has exceeded 150 million, ranking the 5th globally after Indonesia, the United States, India and China. However, Brazil's overall banking service coverage rate is low and service fees are high. There are 55 million people in Brazil who are not covered by any banking services at all, accounting for about 1/4 of the total population. At the same time, although the average net interest margin of banks has maintained a downward trend year by year, it is still at a high of 26.85%, nearly 10 times that of China. With the development of digital finance, many digital banks, as represented by Nubank, have emerged in Brazil, which effectively fills this gap and has a positive impact on Brazil's economic growth.

- **Digital finance and payment convenience**

Digital finance can provide easier payment methods and thus encourage households' consumption. First, the consumption level is constrained by the use of cash. The more dependent on cash, the lower the consumption level (Ljungqvist and Sargent, 2004). Brito and Hartley (1995) studied credit cards and found that credit cards lowered the cost of carrying of cash. Easier payment methods help consumption growth. Digital



Image source: official website of the United Nations

finance with mobile payment as the main payment method relaxes the restriction of cash on consumption, which not only reduces the transaction cost and time cost of financial services (Yi and Zhou, 2018), but also improves the convenience of payment. This brings households a better consumption experience, which can promote consumption (Zhang et al., 2020). At the same time, the change of payment method has also changed the mode of exchanges in goods and services, encouraging offline businesses to go online, bringing in more businesses, and enriched the choices for consumers. Frequent online shopping further improved people's consumption level. Especially during the COVID-19 pandemic, the global consumption pattern has changed. More consumers choose to purchase online. This change has accelerated the decline of cash payment, promoting the increase in the global transaction volume of digital payment, and made digital wallets, Apple Pay, Google Pay, Wechat pay, gift cards, etc. more popular payment methods. According to a report, the State of the Union: Global Digital Payments and FinTech Ecosystem, issued by S&P Global Market Intelligence in 2021, the pandemic has accelerated a shift in payment behavior,

with one-third of users globally using digital payments from 2020, more than half (52%) of consumers shifting all or most of their in-store purchases online, and 59% of consumers have used at least one digital payment service.

- **Digital finance and precautionary savings**

Household consumption may also be affected by precautionary savings. According to the theory of precautionary saving, preparing for future income and expenditure uncertainty is an important reason for household savings (Caballero, 1990). The development of digital finance may affect household consumption by affecting precautionary savings. As one of the core businesses of digital finance, digital insurance utilizes digital technologies such as e-commerce platforms and big data to ensure the consumption level of households while simplifying business processes such as insurance application and claim settlement, thereby reducing premiums and improving the inclusiveness of insurance products and operational efficiency. The optimization and upgrading of the insurance products have greatly lowered the insurance threshold, and is not limited by time and space to meet the diversified and personalized digital insurance needs of households. Digital insurance plays



Image source: official website of the United Nations

an important supporting role in spreading risks and reducing losses to provide households with less uncertainty, which helps enhance households' resilience, reducing the uncertainty of future cash flow. As a result, it can increase households' consumption.

- **Digital finance and income level**

Households' consumption may also be affected by income levels. First, from the micro-level perspective, the development of digital finance improves the effectiveness of household financial asset portfolios by increasing investment convenience and financial information access, and strengthening resilience, thereby increasing investment returns and promoting consumption levels (Wu et al., 2021). For example, the development of digital banks has broken through the dependence of traditional financial transactions on physical outlets, providing easier ways for household investment, with no limits in time and space. Relying on outstanding information and model advantages, digital banks create more diverse financial and wealth management products that meet the personalized needs of customers, which broadens the channels for appreciation. At the same time, the development of digital finance has also lowered service costs and the entry of financial management, allowing

more long-tail consumers to use financial and financial management services, which helps raise households' investment returns and promote consumption. From the meso-level perspective, Zhang et al. (2021), based on the China Family Panel Studies (CFPS), found that digital finance has driven employment to move from agriculture to non-agriculture, which can increase the income of households and agricultural business income. From the macro-level perspective, the development of digital finance helps to achieve inclusive growth of residents' income by promoting the equality of entrepreneurial opportunities (Zhang et al., 2019).

In addition, from the perspective of the macro mechanism of the growth of consumption driven by the development of digital finance, the development of digital finance helps enterprises to reduce the costs of production, circulation and transactions, increase the quality and quantity of production, and further expand the breadth and depth of household consumption. For example, the parallel development of digital finance and e-commerce has brought about new consumptions and services, which has introduced new demands for digital financial services and further stimulated the consumption of households.

3.2.2 Digital Finance Promotes the Development of Small and Medium-sized Enterprises

Small and medium-sized enterprises (SMEs) are widely regarded as important drivers of economic growth, social employment and innovation. However, the problems of difficult, expensive and slow financing for SMEs have existed for a long time, and in fact, have caused great obstacles to their development.¹⁶ The emergence of digital finance has well transformed the traditional financing methods and further improved the allocation efficiency. Although it has put pressure on the traditional financial market to a certain extent, it has also prompted a comprehensive transformation in the traditional financial market. With the help of emerging information technology, digital finance has gained traits of inclusiveness, precision and efficiency to bring new opportunities for the development of SMEs.

A key reason for digital finance to play its role is that digital technology is used to reduce the problem of information asymmetry. Information asymmetry is the fundamental reason for the difficult, expensive and slow financing of SMEs. When financial institutions do not know the financial status and credit information of enterprises, enterprises can only obtain loans and financial support through guarantees. Due to the small size of SMEs and insufficient collateral assets, it is difficult for them to obtain credit support from traditional financing channels. Digital finance utilizes cutting-edge information technology to comprehensively improve the ability of financial institutions to obtain, integrate and utilize information (Song et al., 2021). First, digital finance has more channels to obtain information, with diverse dimensions and more comprehensive coverage. Unlike traditional financial

institutions that rely on "hard information" such as income and financial statements to make loan decisions, digital finance can use data such as daily consumption and industrial transactions of the borrower in bank network terminals and other scenarios. Also, information technology has also improved the speed, scale and accuracy of information processing by financial institutions. Berger et al. (2011) shows that digital inclusive finance uses big data, cloud computing, artificial intelligence and other technical means and P2P, third-party payment and other payment systems to build a digital financial platform. This platform integrates and shares the financial statements, credit scores, tax payment data and other information of technology-based SMEs. Using quantitative calculation models, the credit status and credit risks of technology-based SMEs can be accurately assessed from multiple perspectives. The mutual communication and understanding between financial institutions and SMEs can be promoted, and information asymmetry reduced. The improvement of information problems makes digital finance more inclusive, accurate and efficient than traditional financial institutions, which eases the financing constraints of SMEs.

- **Digital finance broadens financing channels for SMEs**

Under the circumstance that the internal financing channels of SMEs are limited, the rich sources of funds provided by digital finance diversify their external financing, broaden the financing channels for SMEs, and increase the possibility of their access to credit funds. New financing models such as Internet lending platforms, online crowdfunding and digital banks are favored by SMEs. On the one hand, compared with the traditional financing model, the new financing model breaks the limits of time and space, and can match borrowers and

¹⁶ According to the World Bank report (2017), 20% of small and micro enterprises in high-income countries, 28% in middle-income countries, and 44% in low-income countries have the similar situation.

lenders online. Lower financing thresholds, multi-channel options, and standard and simplified operating procedures have greatly improved the possibility of SMEs obtaining credit funds. On the other hand, the rise of digital finance has broken the original competition pattern in the financial market and promoted healthy competition in the banking industry. The original rigid credit model and the loss of many long-tail customers have forced commercial banks to re-examine their value, and take the digital finance to innovate their business models. Many commercial banks have set up SME credit departments, developed SME credit products and expanded the coverage of SME credit business in order to gain market share.

- **Digital finance reduces financing costs for SMEs**

Digital finance can reduce the financing cost of SMEs. Specifically, according to the theory of information asymmetry, the reason why SMEs face the "expensive financing" problem is the information asymmetry between borrowers and lenders. Due to the credit information asymmetry, the cost of pre-loan information search, supervision and monitoring of post-loan process are relatively high. The lender transfers the high

cost to SMEs in the form of higher interest rate, resulting in the "expensive financing" problem. Under the traditional financial model, when commercial banks and other financial institutions provide credits for SMEs, they will raise loan interest rates due to high credit risks such as insufficient collateral. Also, the cumbersome process and complicated procedures of traditional credit business need to be completed manually in offline bank outlets, and this operating cost will also be passed on to SMEs in the form of interest rate. However, digital finance can analyze the credit status of SMEs through technical means such as big data and cloud computing, using the traces of SMEs' operations and transactions on the Internet, e-commerce and other platforms. Under the circumstance that SMEs generally don't have enough collaterals, effective network traces such as corporate transaction flows and capital transaction records screened by big data can be used as credit endorsements. This not only relieves the pressure of collaterals for SMEs but also reduces the cost of information collection for lenders such as banks. What's more, most of the credit process operations can be completed online based on the digital financial development system, which can reduce offline costs and thus financing costs for SMEs.





- **Digital finance improves the financing efficiency of SMEs**

Digital finance enhances the matching efficiency between borrowers and lenders. On the one hand, with the help of digital technology and the application of mobile terminals, the time for information matching between banks and enterprises is shortened, and the cost of collecting, searching and processing enterprise information is reduced. On the other hand, the big data risk control models and the big technology ecosystem are used to monitor, evaluate and predict customers, establishing a credit risk management model under big technology credit to lower the threshold for corporate financing, and improve the accuracy and inclusiveness of financial services (Song et al., 2021). SMEs have an urgent need for funds and often want to simplify the financing process and obtain funds quickly. For those that want to simplify the credit process, they can quickly complete a number of standardized approvals by submitting materials online through digital financial services. This can also effectively reduce errors of manual reviews. For these SMEs that need a small amount of fund and are relatively short on time, using digital finance for financing not only simplifies procedures,

but also improves financing efficiency and shortens financing time. Fuster et al. (2019) used loan-level data on mortgage applications and originations, and found that FinTech lenders process mortgage applications 20% faster than other lenders, while this faster processing does not come at the cost of higher defaults. Huang et al. (2018) used Ant Financial's micro-loan data and found that, relying on financial technology, the company reduced the traditional bank loan review and issuance time from up to several months to 3 seconds.

3.2.3 Digital Finance Promotes Industrial Upgrading

In the process of economic development, financial development has driven the changes in the allocation of resources and industrial structure, contributing to the upgrading of industrial structure (Sasidharan et al., 2015). On the one hand, the technology of digital finance is more advanced, providing lessons for traditional financial institutions. Traditional financial institutions can promote their own digital transformation by learning from their product forms, service innovations, and advanced technologies, so that they can reach out to more customers and improve service efficiency. On the other hand, the development of digital finance intensifies the competition, and forces traditional financial institutions to upgrade their business. This prompts finance to better serve the real economy, thereby reducing corporate financing costs and optimizing the allocation of credit funds (Song et al., 2021), and help promote the upgrading of the industrial structure (Bruhn and Love, 2014). In addition, as an innovation and extension of traditional finance, digital finance has a unique advantage. It realizes cost reduction, efficiency increase and smooth circulation from channels that are not easily accessible by traditional finance, thereby promoting the upgrading of industrial structure:

- **"Digital Finance + Industry" Coordinated Development System**

With the application of digital technology, financial services have developed service platforms online and scenario-based, and relying on information flow, commodity flow, and capital flow to create a "digital finance + industry" coordinated development system. By improving the efficiency of capital use, creating value and reducing risks for all parties, this system can form a win-win industry and finance ecosystem. In particular, the application of the blockchain technology enables both suppliers and demanders to access necessary transaction information

in real time. Each step of the supply chain process is time-stamped and verified by all parties, which means that the information is accurate, cannot be tampered with, or lost. Increased visibility could also mean that businesses will have more accounts receivable financing solutions available as well. For example, based on the transparency and consensus mechanism of the blockchain technology, the authenticity of revenue accounts or contracts can be recorded and verified. Financial institutions can be more confident that, even without collaterals, the company can obtain funds in the future. Replacing the old verification and inspection steps, digital finance can greatly increase the chances of obtaining financing.

- **Blockchain platforms and trade financing**

Difficulties in trade financing have exacerbated the cash flow problems of companies, severely restricting the development of enterprises (especially for SMEs that want to seek trade financing overseas for overseas expansion), and are not conducive to the upgrading of the industrial structure. The Asian Development Bank forecasts that the global trade finance gap is currently \$1.5 trillion, accounting for 10% of the merchandise trade volume, and is expected to grow to \$2.4 trillion by 2025. The development of digital finance has brought hope to the trade financing of SMEs. In recent years, many blockchain platforms serving SMEs have emerged in the capital market. For example, We.Trade, jointly initiated by 12 banks including CaixaBank, DeutscheBank, ErsteGroup, etc., is a blockchain-based trade finance network developed using IBM blockchain technology, aiming to make it easier for SMEs to conduct business with companies in Europe. This project integrates information from all relevant parties (i.e., buyer, buyer bank, seller, seller bank and transporter) to track and ensure the authenticity of domestic and international trade transactions, thus simplifying the trade finance process for SMEs. A study jointly released by the World Economic Forum and



Bain & Company points out that blockchain can make up for a \$1 trillion gap in global trade financing for emerging market SMEs, showing that blockchain technology is expected to become the economic engine of the 21st century.

- **Digital payment and transaction costs**

With the continuous and in-depth development of artificial intelligence, big data, and the digital economy, companies are also seeking new breakthroughs in using the technologies to further reduce costs and increase efficiency. Payment services can be found in all aspects of the operation, and high transaction costs hinder enterprise transformation and upgrading. The innovation of digital payment significantly reduces the impact of spatial distance on resource exchange, expands the scope of transactions from physical space to Internet space, greatly reduces transaction search and transportation costs. Thus, digital payment allows companies to allocate resources more quickly in a wider space. The reduction of transaction costs creates a favorable environment for the development of enterprises and is conducive to the optimization of the worlds' industrial structure according to each country's

comparative advantage. Therefore, the upgrading of the industrial structure is also the gradual deepening of the division of labor (Yuan and Tang 2015). With the refining of digital payment, fragmented yet fast payment has further refined the social division of labor, and the degree of commercialization of human society has been greatly deepened, thereby industrial upgrading is promoted.

- **Digital currency and cross-border payment**

The traditional cross-border payments still mainly rely on the Society for Worldwide Interbank Financial Telecommunication (SWIFT) and the New York Clearing House Interbank Payment System (CHIPS), and are mainly settled in US dollars. The traditional cross-border settlement method mainly has the following defects. First, the cross-border settlement system relying on agent accounts is expensive and time-consuming, and it cannot effectively conduct cross-border transactions, resulting in user losses. Second, the difference in transaction time causes the risk of settlement. The lack of synchronization may cause the risk. Due to the time difference, there are risks of not being able to receive the currency due to the bankruptcy of the counter party, and the risk of money

laundering because of the anonymity of cash. The development of digital currency has solved the above problems to a certain extent. First, the real-time settlement of digital currency does not require third-party intermediaries. Point-to-point transactions improve efficiency and reduce transaction costs, effectively solving the long, opaque and inefficient problems on the transaction chains of traditional cross-border payment. And digital currency combined with Distributed Ledger Technology (DLT) can allow different jurisdictions to manage their own payment networks, while allowing tight integration with other payment networks. This provides easier and faster cross-border payments. In addition, the transparency and immutability of the blockchain allow regulators to track down all relevant information through the whole process of digital currencies, which can help conduct a more effective and accurate supervision of money laundering, tax evasion, corruption and other crimes. Therefore, digital currency effectively overcomes the drawbacks of the traditional cross-border system and provides a more secure and stable cross-border payment method, which is beneficial for enterprises to carry out international trade, thereby promoting the upgrading of worlds' industrial structure.

- **“Scenario-based” finance and consumption upgrade**

From the demand side, the new formats, new products and new models presented in the development of digital finance can motivate the release of financial consumption potential. The development of digital finance has built a “Finance+” scenario-based financial development model, categorizing different financial situations of industrial financial scenarios and personal financial scenarios, further integrating finance into social and economic development, so as to better meet the financial demands of residents and enterprises, and promote financial consumption upgrade and demand structure optimization. In this way, the competitiveness and innovation power of the industrial sector

is stimulated to promote the transformation and upgrading of the industrial structure.

3.2.4 Digital Finance and Green Development

- **Digital finance promotes the construction of a green financial system**

Digital technology is an important means of building a green financial system. For example, the use of big data, cloud computing and other digital technologies can collect massive amounts of information. By establishing SME carbon accounts, personal carbon accounts, etc., the carbon emission reduction behavior of enterprises and individual customers can be converted into credit data for green credit. With the help of these technologies, green financial services can effectively reach and include the “long tail” and the green industry chain customers, and form innovative models such as “green finance + inclusive finance”, “green finance + supply chain finance”, etc., to contribute to the development of a green economy.

- **Digital finance promotes the development of sharing economy**

Relying on Internet technology, the sharing economy cooperates with other industries that have realized “Internet +”. This is an economic activity that recycles resources, reduces recourse loss and increases resource utilization & efficiency. Its rapid rise partly depends on digital technology, so that the time occupied by and the cost of use of items can be accurately measured, making it possible to convert property rights transactions into sharing of use rights. Also, the rapid popularization of digital payment also enables the accurate measurement of who’s using the item and how often they use it. Transaction costs are greatly reduced, which also lays the foundation for the development of the sharing economy.



- **Digital finance drives digital economy development**

The rapid development of a new round of scientific and technological revolution has made the digital economy, which integrated information technology and economy deeply, a global economic development trend. According to the prediction of the International Data Corporation (IDC), by 2023, the output value of the digital economy will account for 62% of the global GDP. The world has gradually entered the era of the digital economy. With the gradual application of digital technologies and digital solutions such as artificial intelligence, big data, cloud computing, and blockchain to all walks of life, industry productivity and enterprise operating efficiency have been greatly improved, and industrial energy consumption has also decreased subsequently. According to data from the World Economic Forum, by 2030, information and communication technology (ICT) will reduce carbon emissions by 12.1 billion tons, 10 times the emissions of the ICT industry itself.

In the era of the digital economy, it is inevitable to require corresponding financial service capabilities. The financial industry is a pioneer in the application of information technology, and it is also one of the industries with the most complete information infrastructure and richest data resources. It has the basic resources for the

application of new technologies such as big data analysis, and has good conditions to promote digital transformation. The digitization, intelligence, specialization, and coordination of various financial tools enable the inclusive digital financial supply system to provide more timely, diverse, and high-quality financial services, thereby guiding more financial resources to support digital technology innovation and digital economic development. For example, industrial digital finance is an indispensable part of the digital economy. It is a new type of finance based on the industrial Internet, using data as the production factor, and data credit as the core feature. The financing needs generated by the implementation of various industrial digital solutions such as smart manufacturing, smart medical care, smart logistics, and digital villages can be deeply integrated with industrial digital finance, thus giving birth to new models and new businesses like industrial chain finance, Internet of Things finance, green finance, rural digital finance and technology innovation finance. These provide a wider range of producers and operators with smarter financial services, more accurate product pricing, and lower financing costs. In addition, digital finance is greener finance. Through digital technology, the energy consumption of the financial industry can be reduced, making the industry greener and more environmentally friendly.

3.2.5 Digital Finance and Sharing Economy

- **Digital finance increases the inclusiveness of services**

Financial inclusion is a key trait of digital finance. In the era of the Internet, by reaching out to more people in society and providing inclusive financial products and services, digital financial inclusion helps to promote inclusive growth shared by all walks of life. For those groups that are usually excluded by traditional financial institutions, such as low-income people, young people who is not participating in work, and rural residents, platforms of digital finance can use big data technology and other financial technologies to provide digital financial services such as credit for consumption, P2P lending and crowdfunding.

- **Digital finance reduces resource allocation costs**

With the in-depth development and integration of finance and technology, digital

finance breaks through the limitations of space and time. Remote and poor areas and developed and affluent areas can share resources in a fair, real-time and transparent manner. In this way, digital finance can fully meet the demand of developed areas, and can also strongly support the access to financial services in less developed regions. Digital finance can provide financial services specifically for rural residents, solving the problem of "financial exclusion" in rural areas. To a certain extent, digital finance rebalances financial services of urban and rural areas. This will promote the entrepreneurship of rural residents, increase the household income of rural residents, and narrow the income gap between urban and rural areas (Zhang et al. 2019).



3.3 Global Digital Finance Development Policy

Through the integration and innovation of information technologies, such as big data, the Internet, cloud computing, artificial intelligence, and traditional financial services, digital finance has changed the medium, channel, technology and efficiency of financial transactions, and made up for the shortcomings of traditional finance. The inclusiveness and high-efficiency of digital finance not only bring more personalized and smart financial services to consumers, but also find new growth opportunities for global economic development. However, as a new financial model and a new stage of financial development, digital finance cannot step forward without the support of the policies. Countries and regions should seize the historical opportunity of a new stage of information development to accelerate and standardize digital finance. It is of great significance to transform and upgrade the financial industry, cultivate new financial development drivers and competitiveness, and better serve the real economy. In recent years, some countries and regions have successively introduced policies to support the development of digital finance, including regulatory sandbox practices that support financial innovation, and digital financial infrastructure construction.

3.3.1 The Practice of Regulatory Sandbox

In recent years, digital finance driven by technology has been on the rise and has had huge and profound impacts on traditional financial services such as service concepts, business models and product design, effectively improving the quality and effectiveness of financial services and expanding their reach; while risks hiding in financial innovation and the lack of proper regulation make financial innovation a new source of financial instability. For national

financial regulators, striking an effective balance between supporting financial innovation and preventing financial risks is always a critical challenge. To effectively address the regulatory challenges brought by digital finance and to properly deal with the conflict between supporting innovation and preventing and managing risks, the regulatory authorities of the United Kingdom have innovated the concept of a financial “regulatory sandbox” and implemented a model system in 2015. The regulatory authorities in Singapore, Australia, Japan and Thailand echo the movements. The financial regulatory sandbox has become a new trend in international digital financial regulation (Zhu, 2018). According to the Regulatory Sandbox Database of the World Bank, by November 2020, 57 countries and territories worldwide are implementing regulatory sandboxes, with 73 regulatory sandbox projects.

The regulatory sandbox is a new regulatory approach to promote financial innovation and FinTech development. It allows some licensed financial institutions or technology-based start-ups to test new financial products, financial models or business processes, within limited time and among chosen costumers. During the process, the regulator may lower the entry barrier and relax regulatory restrictions on the tested items. Some researchers have compared the differences in regulatory sandboxes in major countries and regions. Christensen (2018) pointed out that regulatory authorities cooperated with financial service providers and adapted proactive approaches and measures to encourage financial service providers to improve the financial ecosystem via innovative technologies. Although there are differences in the practices, most European countries have been synchronous in the practices of regulatory sandbox. In Asia, the most typical examples of regulatory sandbox practices are in Singapore and Hong Kong. Huang and Jiang (2017), and Bian and Shan (2017) conducted a comparative analysis of the regulatory sandboxes in Singapore,

Australia and the UK, as well as in Taiwan and Hong Kong, respectively. They concluded that although the various sandboxes differed in terms of policy settings, business scope, institutional arrangements and supporting measures, they all focused on encouraging innovation, risk control and consumer protection, reflecting the concept of relative balance in financial regulatory policy objectives.

The regulatory sandbox system pays more attention to initiative, flexibility and clarity of regulatory decisions. On the one hand, this innovative regulatory model greatly shortens the time and reduces the cost of innovative products entering the market, providing an effective and reasonable channel for innovations by enterprises, thus effectively promoting the rationality and efficiency of financial innovation. On the other hand, the regulatory sandbox enhances the convenience and accessibility of financial services and enables consumers to obtain more cost-effective financial services in a secure environment (Huang and Zhang, 2018). However, there are some problems with regulatory sandboxes in practice. For example, it lacks certainty in rules (clear testing periods, evaluation criteria, exit mechanisms, etc.) and compatibility with traditional financial rules.

3.3.2 The Trending of New Infrastructure Construction

Digital finance is inextricably linked to the development of information technology, such as 5G, artificial intelligence, industrial internet, IoT and other new infrastructure construction. These technologies are the basis for the rapid development of digital finance and are also the driving force behind the economic development of many countries. The new infrastructure construction is rapidly developing around the globe in recent years. The battle for 5G has become the focus of high-tech competition among the world's major powers.

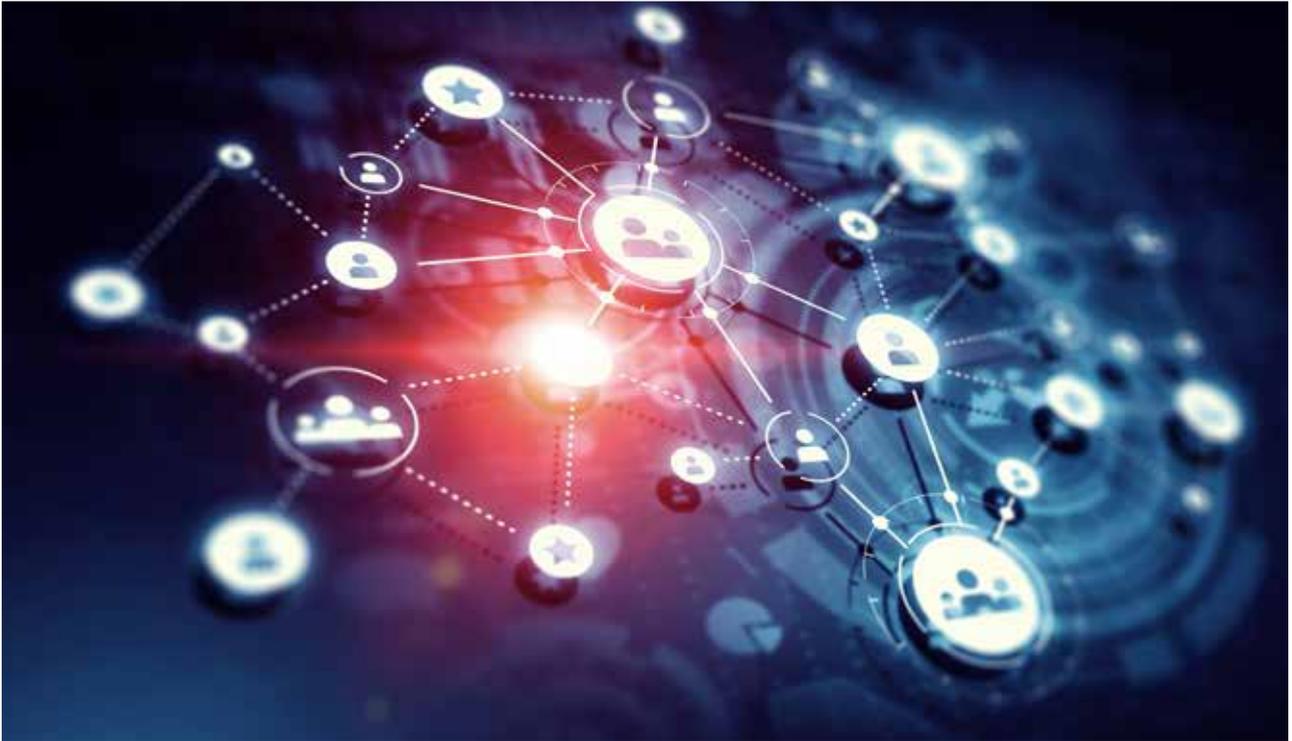
- **The European Union**

The EU's new infrastructure development policies focus on 5G, IoT and artificial intelligence. The construction of 5G networks has become a key area for building a digital Europe, and 5G research and development is considered a strategic initiative to compete for the high ground of future Industry 4.0. Specifically, the European Commission first proposed the creation of the 5G Infrastructure Association (5GIA) and the 5G Public-Private Partnership (5G PPP) in 2013, followed by the 5G for Europe: An Action Plan in 2016, which sets out a clear road-map for public and private investment in 5G infrastructure in the EU. The EU also released the goal of launching 5G services in all EU member states by the end of 2020. In terms of IoT, in 2014, the EU released the Horizon 2020 Plan, which identifies that the EU will invest nearly 500 million euros in IoT-related research between 2014 and 2021. Subsequently, to further support IoT research and innovation and establish a European IoT ecosystem, the European Commission created the Alliance for IoT Innovation (AIOTI) and released the IoT-European Platforms Initiative (IoT-EPI) in 2015 and 2016. In terms of artificial intelligence, in April 2018, 25 EU members signed the Declaration of Cooperation on Artificial Intelligence to jointly face the opportunities and challenges of AI development. In December 2018, the European Commission published the Coordinated Plan on Artificial Intelligence to promote the coordination and development of AI across member countries.

- **The United States**

The US policies on new infrastructure focused on 5G, big data and artificial intelligence. Maintaining a leading position and voice in related areas is the most prior motivation for issuing the policies. Also, The US is the first developed country to propose and systematically implement a national strategy for 5G.

Since 2016, the US 5G policy has leaned



towards maintaining national security. The US National Security Strategy released in 2017 raised the strategic importance of 5G to "ensuring US national security". In January 2020, the US House of Representatives voted to pass the Promoting US International Leadership in 5G Act and the Promoting US Leadership in Wireless Act, which proposes to enhance its international leadership in the field.

The US attaches huge importance to the application of big data. For example, in 2012, the Office of Science and Technology Policy of the White House released the "Big Data Research and Development Plan" and set up the "Big Data Senior Steering Group" to enhance the federal government's ability to collect data, analyze data and forecast the economy. In March 2012, the office released the Big Data Research and Development Initiative, announcing an investment of more than US\$200 million to improve the US government's ability to extract information from big data.

In terms of AI, the US, to strengthen its global leadership and to promote and protect its

AI technology and innovation, introduced a series of policies, including the National AI R&D Strategic Plan, Preparing for the Future of AI, and On Maintaining US AI Leadership.

- **China**

China has focused on new infrastructure construction in recent years by releasing more policies and clarifying the developing road map to meet the demand for economic development and find new economic engines while making up for weaknesses. The government has been announcing new infrastructure constructions. The announcement of the Central Economic Work Conference held in December 2018 highlighted the need to accelerate the pace of 5G commercialization and strengthen the construction of new infrastructures such as AI, industrial internet and IoT. It was the first time the Chinese central government adapted new infrastructure construction in its official document. After that, the central and local governments released a series of new policies to promote the new infrastructure construction of 5G, AI, IoT and technology innovations, strengthening the existing promoting policies.



In 5G, for example, in January 2016, the Ministry of Industry and Information Technology of China (MIIT) issued the "Opinions on the Use of Frequency for Mobile Communication Systems (5G)", which officially announced the launch of 5G R&D experiments. The 5G R&D experiments have three phases, key technology verification, technology solution verification and system solution verification for implementation. Nearly 20 policies were issued in five consecutive years from 2017-2021 to accelerate the pace of 5G development.

3.3.3 Narrowing the Digital Divide

In recent years, the rapid development of digital finance has widened the coverage of financial services. However, the digital divide has also become an increasing problem in the process, mainly on the access of information technology and tools and the skills of using them. Therefore, the government should strengthen the digital financial infrastructure, while providing training in digital technology and financial literacy.

Being one of the countries with the rapid development of digital finance, China has a severe challenge of the digital divide. According to the Statistical Report on the Development of the Internet in China, as of March 2020, among people of aged 60 and above, only 6.7% are internet users. Older people in rural areas often lack adequate digital knowledge and awareness, even do not know about the internet. These users are isolated on the other side of the digital divide and kept away from digital finance services.

At the same time, however, China has been effectively solving the problem by providing access to the internet to an increasing number of low-income groups through large-scale information infrastructure development. According to data released by China's Ministry of Industry and Information Technology on May 14, 2021, China has built more than 819,000 5G base stations, accounting for 70% of the world's total, and 280 million 5G mobile phone end-user connections, accounting for more than 80% of the world's total.

At the policy level, in January 2022, the China Banking and Insurance Regulatory Commission (CBIRC) issued Guidance on the Digital Transformation of the Banking and Insurance Industry to promote the digital transformation of personal financial services, improve the digital management system and push forward the resolution of the "digital divide". However, relevant policy documents are still very general in describing the governance of the digital divide. Policies should have clarified and refined objectives to address the challenge.

The number of internet users in the US has steadily increased over the past two decades, leading to a rapid shift towards online consumption, with a particularly marked increase in internet usage among seniors aged 65+ from 40% in 2009 to 73% in 2019, according to the statistics of Pew Research Center. This is one reason the US is a leading country in digital finance. Nonetheless, the US is also facing a huge digital divide during the development of digital finance.

The Harvard Business Review (USA) considers the digital divide to include four areas:

(1)Infrastructure: Internet speed, terrestrial broadband coverage, and smartphone use.

(2)Inclusiveness: affordability of broadband,

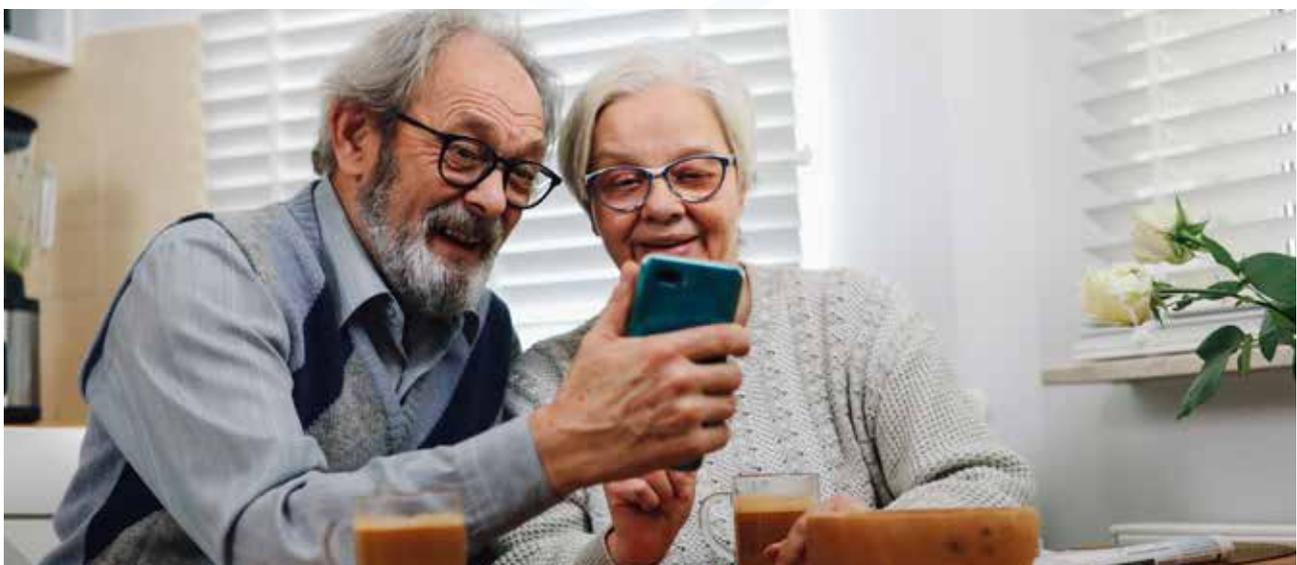
equity of broadband access across income groups, actual use of the Internet at broadband speeds.

(3)Institutions: political prioritization of broadband strategies, government best practice in implementing technology for public services, restrictions on alternative local broadband solutions, e.g., municipal networks.

(4)Digital capability: how well people can navigate the digital world, depending on demographic profile, education level, political tolerance and level of skepticism towards news from social media.

Based on this, the Harvard Business Review further identifies several recommendations to address the digital divide:

- (1)Use a 'Romer' tax to close the budget gap
- (2)Coordinate locally appropriate solutions
- (3)Recruit large technology companies and Internet Service Providers (ISPs) to help close the gap
- (4)Identify areas of disparity and invite public-private solutions
- (5)Updating and expanding existing affordability programs
- (6)Building for the future
- (7)Investing in digital literacy



Chapter 4: Risks and Supervision of Digital Finance

The rapid development of digital finance has assisted financing of small, medium and micro enterprises who are difficult to access, and face high-cost and slow process in the traditional financial market. It also has promoted the development of inclusive finance, which is the inevitable direction for the future of the financial industry. However, it is also a fact that digital finance, as an emerging financial industry, has accumulated many problems and risks in the process of its emergence and development and many illegal acts that stray from the edge of traditional regulation are hard to detect and control promptly. Therefore, the financial risk may accumulate, spread and threaten the safety and soundness of the financial system. The construction of a scientific and reasonable supervision and regulatory system is to ensure the stability of the financial market and maintain social equity and justice, as well as a necessary step to ensure the healthy and steady development of digital finance. The construction of such a regulatory system requires a better understanding of the necessity of regulation in the financial sector and a clearer understanding of the particularity of digital financial regulation.

4.1 Risks of Digital Finance

4.1.1 Characteristics of Digital Finance Risks

- **Driven by data + technology**

The development of digital finance is connected tightly with technologies such

as big data, AI, blockchain and cloud computing, which all revolve around data collection, analysis and storage. Connections with technologies make digital finance a new financial industry driven by data + technology and show the following characteristics in its risks: Firstly, data is the core element of digital finance. Along with the increase in data value and the involvement of information technology, the data-related risks increase accordingly. If some financial institutions have over-collected, leaked, lost or maliciously tampered with user information, that will create compliance risks for related businesses. Also, inaccurate credit information collection may lead to deviation in subsequent information analysis, which will reduce the value of credit information and undermine the industry's decision-making, thus, generating huge potential financial risks.

Secondly, as a combination of finance and technology, digital finance has risks introduced by high technology. The overlap of technology and original financial risks will amplify the potential risk of digital finance. Compared to traditional finance, digital finance faces cyber-attacks and break-in activities directly, which are commonly used by hackers. For example, in 2016, the decentralized financial platform Badger DAO was hacked, resulting in over US\$120 million loss. The Yam protocol was rushed online after only ten days of development and quickly attracted a large amount of liquidity. It locked in US\$500 million after. Unfortunately, hackers discovered a vulnerability in just one day. They increased the token issuance by eight times and triggered a slump in price. Technologies such as cloud computing, big

data and blockchain enable digital financial products with virtual quality that can break the limits of time and space and accelerate the spread beyond the industry boundaries, making digital finance more prone to systemic financial risk.

Moreover, digital finance is to achieve equal and effective access to financial services for all. However, financial exclusion caused by the digital divide is a serious obstacle to the accessibility of financial services. In the transformation from the "rule of man" into the "rule of code", new inequality may arise. For example, the "algorithmic black box" of AI exacerbates information asymmetries in AI. What's more, because of the human behind technology, there is a risk that some people will plant their biases and personal motive in the algorithm, thus potentially reinforcing discrimination. Apart from this, because the algorithmic programs established by AI do not differ significantly overall, they may lead to near-identical analysis. So, decisions made by different financial firms based on the same range of data will result in the influence of a market signal being reinforced and deviating from the market norm.

- **Scene + Finance**

The continuous development of digital finance has given rise to the "scene + finance" model, where different scenes may integrate with various demands of financial services. That enabled the financial supply to meet and adapt to the multi-level needs of the real economy and continuously improve the effectiveness of financial supply services, which is widely merging into people's daily life. However, the scene-based structure with more complexity in process and participants may exacerbate the risk problem of the social crimes such as illegal interests via gang cooperation, fraud, money laundering, swiping, crashing, fraudulent lending, and information trafficking (Yin and Cheng, 2019). On the other hand, the endless innovation of the financial industry and new transaction behaviors challenge the existing

legal framework for effective regulation, thus posing compliance risks.

In addition, metaverse may be the new breakthrough of the development of the financial industry. By integrating the virtual and real worlds, metaverse will help a financial institution to extend reality into digital twins to achieve spatial and temporal expansion. From scenes, interactions and consumption, metaverse technology will be applied in more scenarios. For example, with the support of virtual reality, virtual financial centers may provide an immersive environment and effectiveness in acquiring customers and marketing. On Nov 29 2021, Kookmin Bank of South Korea partnered with VR content developer Sharebox to build a virtual branch, allowing customers wearing VR headset to visit the bank. The head-mounted display (HMD) device's user interface and interaction support provide a differentiated customer experience, such as one-on-one consultation capabilities. On Dec 30, 2021, CITIC aiBank Corporation Limited introduced its first virtual digital employee AIYA. Unlike other intellectual customer services, AIYA is a virtual brand officer of the aiBank, standing 165cm tall and weighing 48kg, with short hair. At the same time, AIYA has powerful AI algorithms to support its financial and conversational skills. The future development of the financial industry will change from a "traditional financial industry" to "online and offline coexistence" to a "virtual and real business system" with the development of metaverse technologies.

- **Networking**

The application of cutting-edge technologies, represented by big data and blockchain, in financial services scenarios exhibits highly segmented and intersecting characteristics, which will blur the boundaries of different financial institutions. Meanwhile, the continuous spreading of Internet services not only connects financial institutions within a country but also forms an interconnected world. As a result, it may accelerate the

spread of financial risks transcending time and space.

- **Border crossing**

In recent years, fast-growing IT companies have continued to reach out to the financial sector, using the customer data accumulated from their long-term services and emerging big data processing technologies to change the traditional financial services ecosystem. However, it has not fundamentally changed the essential characteristics of the financial industry, which continues to face credit risk, liquidity risk, maturity and currency mismatch risk and has created some new ones. These include monopoly and unfair competition, blurred product and business boundaries, data leakage and privacy issues, etc.

- **High speed iteration**

Due to new technology, new financial models, which are essentially different from traditional financial businesses and products, are emerging. Digital financial products can hardly corporate into the regulatory system on time or apply to existing regulatory policies, resulting in ineffective regulatory legal policies.

4.1.2 Challenges for Digital Finance in Practice

- **Challenges on maintaining financial stability and preventing systemic financial risks**

While the extensive use of information technology has improved the operational efficiency of financial institutions, it has also made the complexity, contagiousness, concealment and suddenness of systemic financial risks more prominent, with endogenous risks building up in the system. Digital finance is a product of the integration of finance and technology. High-tech in digital finance may bring new risks, overlapping with and amplifying the existing financial risks. At the same time, the use of the Internet has accelerated the transmission of risks in

cross-sector and cross-regional manner. In terms of factors influencing systemic risk, the application of cutting-edge technology in financial services scenarios, represented by big data and blockchain, has shown highly segmented and cross-cutting business characteristics, which will blur the boundaries of different financial institutions. The Internet has also led to closer ties between financial institutions in various regions, increasing the breadth and depth of linkages among financial institutions and amplifying systemic risks. As an impact, digital finance may disguisedly promote the marketization of interest rates, but banks still tend to choose assets with higher risk to compensate for the losses caused by the rising costs on the liability side (Qiu et al., 2019). Overall, FinTech may have increased systemic risk in the banking sector.

- **Challenges on regulatory system**

First, inclusive digital finance, with its cross-border nature, blurs the regulatory boundaries in various sectors. The emerging business models of digital finance cover a wide range of businesses, including investment and finance, mortgage guarantees, payment transfers and many other digital financial services.

Second, the virtual nature of digital financial inclusion products accelerates the spread of risk. The technologies of cloud computing, big data and blockchain allow digital inclusive financial products to have virtual qualities, which crack through time and space restrictions and industry limits to spread. As a result, this places greater demands on the existing regulatory system, in terms of the technical and business capabilities of regulatory personnel. In recent years, in the name of digital finance innovation, some platform technology companies breaching rules on compliance, risk management and legitimacy in online services and products. Given the financial nature of these online services and products from a functional point of view, these innovations may bring about the issue of fair competition and risks in

terms of financial stability. One of the typical cases in recent years on this point is China's Ant Group.

The Ant Group is the parent company of Alipay, China's largest mobile payment platform and the world's leading open financial technology conglomerate. The company is committed to using technology to drive the digital upgrade of the global modern service industry, including the financial services industry, and working with partners to provide inclusive, green and sustainable services to consumers and micro and small enterprises. Since the start of Ant financial services in 2014, the company has disbursed a total of \$2.1 trillion in loans, most of which are credit loans. Unlike P2P lending providers, mostly trapped deeply in unpaid debts, the Ant Group relies on the big data provided by Ali Cloud and Alipay to achieve an accurate match between users and financial services. Via successful matchmaking, the company has improved its success rate and reduced risks. The Ant Group has carefully avoided unpaid debt issues and achieved rapid growth till now. On the other hand, as a technology company,

the Ant Group escaped from the traditional financial regulatory framework and created RMB 300 billion in loans with its merely RMB 3 billion registered capital, which posed a tremendous systemic financial risk.

On 20 July 2020, Ant Financial Services of the Ant Group announced its IPO plan. With over RMB 2 trillion market valuation, the company became the largest unicorn company for global investors, who were very optimistic about its future. However, on 3 November 2020, the Shanghai Stock Exchange suspended the IPO process of the company. After that, the People's Bank of China, the central bank, and the China Banking and Insurance Regulatory Commission (CBIRC) jointly issued the Notice on Matters Concerning the Regulation of Internet-based Personal Deposits of Commercial Banks, which triggered a series of rectifications among the Internet financial platforms. The notice clearly stated that commercial banks were not authorized to conduct deposit business on the Internet. It also asked all online financial platforms to regulate their business to increase the safety of the Internet financial market.





- **Challenges on information security**

The construction of digital financial platforms is based on digital technology, which helped to build a multidimensional open network bridging the supply and demand sides and concealed many risks of information leakage. For example, big data stores large amounts of data centrally, making the potential gains of criminal attacks on digital finance platforms huge. So some cybercrime groups may target digital finance platforms with various means. Any security vulnerability in information systems may result in failure in defense against external attacks, posing an threat to personal privacy and customer interests. As the average financial consumer has limited knowledge and weak awareness of safety issues, they are most likely to become victims of cybercrimes, such as online financial fraud, information security phishing, account hacking and data theft.

The globalization of digital finance also brought concerns about national financial

security, such as finance sovereignty among countries. Information security risks have become one of the top threats hindering the development of digital finance. Japan, for example, as the world's third-largest economy, is lagging in developing digital finance services. In Japan, in addition to strict regulations, low credit demand, especially for financial services innovation, and concern for information security are other reasons for the slow development of digital finance. A public opinion survey by the Japanese Bankers Association shows that less than 20% of people in Japan use online banking. Most Japanese people do not use internet financial services due to concerns about personal information security, and bank windows and ATMs remain indispensable financial services channels for Japanese consumers.

- **Challenges on clarify the ownership of data**

With the rapid development of technology, such as big data, AI and blockchain, more and

more financial sectors are experiencing digital transition. Compared with traditional finance, digital finance largely relies on various data elements to build financial service scenarios. For example, in traditional operations, banks mainly obtain customer information via face-to-face interviews. However, in the business model of digital finance, banks get data through other means to draw a user portrait and then precise marketing, which is identifying customers through data analysis.

In the new business model, data is increasingly important. Some financial institutions are not only "over-collecting personal information" but also conducting their business in a way that poses compliance risks. There are calls for further regulatory efforts to strengthen the protection of personal information and consumer rights in China. However, to achieve comprehensive and deep regulation of financial data, the most urgent issue to address is data ownership. Currently, the laws of many countries do not yet accurately define the attribution of property rights to data. Therefore, there is a need to clarify data ownership as soon as possible, create data pricing mechanisms, promote the fair commercial use of data and, most importantly, prevent a few companies from monopolizing data income by virtue of technical advantages. It is not only necessary to protect the financial rights of consumers but also to maintain fairness and justice in the market.

- **Challenges of the digital divide**

With the gradual maturity of digital technology and the continuous development of digital technology, the digital divide has become an obstacle to the accessibility of digital financial services among low-income people, rural users, and elderly groups, as digital finance uses new hardware, applies new technologies and builds new scenarios. As a result, these disadvantaged groups of customers who are slow to adapt and accept digital tablets were left behind in digital life. The financial exclusion caused by the digital divide not only runs counter to the policy

objective of achieving equal and effective access to digital inclusive financial services but also hinders the accessibility of finance services around the world. In addition, the digital divide also harms economic development and education levels, especially in emerging countries.

4.2 Overview of Global Digital Finance Regulation

In response to challenges posed by digital finance, international financial regulatory institutions and national financial authorities have been actively studying the evolutionary approach, risk aspects and impact on the financial system and regulation of digital finance from different perspectives. They also carried out various ways to improve the regulation of FinTech companies and businesses.

4.2.1 Progress of International Regulatory Organizations

- **The International Monetary Fund (IMF)**

In 2018, the International Monetary Fund (IMF) and the World Bank presented the Bali FinTech Agenda (BFA). The Bali FinTech Agenda is a set of 12 policy elements aimed at helping member countries to harness the benefits and opportunities of rapid advances in financial technology that are transforming the provision of banking services, while at the same time managing the inherent risks. The 12 policy elements are as follows:

- (1) Embrace the Promise of FinTech.
- (2) Enable New Technologies to Enhance Financial Service Provision.
- (3) Reinforce Competition and Commitment to Open, Free, and Contestable Markets.
- (4) Foster FinTech to Promote Financial Inclusion and Develop Financial Markets.
- (5) Monitor Developments Closely to Deepen Understanding of Evolving Financial Systems.

(6) Adapt Regulatory Framework and Supervisory Practices for Orderly Development and Stability of the Financial System.

(7) Safeguard the Integrity of Financial Systems by identifying, understanding, assessing, and mitigating the risks of criminal misuse of FinTech.

(8) Modernize Legal Frameworks to Provide an Enabling Legal Landscape with greater legal clarity and certainty regarding key aspects of FinTech activities.

(9) Ensure the Stability of Domestic Monetary and Financial Systems by considering the implications of FinTech innovations to central banking services and market structure, while, safeguarding financial stability.

(10) Develop Robust Financial and Data Infrastructure to Sustain FinTech Benefits.

(11) Encourage International Cooperation and Information-Sharing across the global regulatory community.

(12) Enhance Collective Surveillance of the International Monetary and Financial System and the adaptation and development of policies to support inclusive global growth.

Subsequently, the IMF and the World Bank conducted a questionnaire survey of central banks, ministries of finance and other relevant institutions in 189 countries on topics covered by the BFA, and received 96 responses. Based on the survey, The IMF published a report, *FinTech: The Experience So Far*, on 27 June 2019, listing the current state of global FinTech development and making relevant recommendations for cooperation between governments and international organizations.

• **The Basel Committee on Banking Supervision (BCBS)**

The Basel Committee on Banking Supervision (BCBS) has established a working group on FinTech focusing on the impact of FinTech on the banking sector’s market position, business model and systemic risk, as well as the challenges for banking supervision. In February 2018, the BCBS published the “Implications of FinTech developments for banks and bank supervisors” a report that presents the results of an analytical assessment of FinTech risks

and related regulatory challenges, and makes 10 implications and considerations:

(1) The nature and scope of banking risks as traditionally understood may significantly change over time with the growing adoption of FinTech. While bank supervisors must remain focused on ensuring the safety and soundness of the banking system, they should be vigilant for opportunities to enhance both safety and soundness and financial stability while monitoring for current practices that might unduly or unintentionally hamper beneficial innovations in the financial industry.

(2) Key risks associated with the emergence of FinTech include strategic risk, operational risk, cyber-risk and compliance risk. These risks were identified for both incumbent banks and new FinTech entrants into the financial industry.

(3) Banks, service providers and other FinTech firms are increasingly adopting and leveraging advanced technologies, such as artificial intelligence (AI), machine learning (ML), advanced data analytics, distributed ledger technology (DLT), cloud computing and application programming interfaces (APIs). While these innovative technologies present opportunities, they may also pose new sources of risks. Banks should ensure they have effective IT and other risk management processes and control environments that effectively address new sources of risk.

(4) Banks are increasingly relying on third-party service providers for operational support of technology-based financial services. While operations can be outsourced, the risks and liabilities associated with those operations remain with the banks.

(5) FinTech developments are expected to raise issues that go beyond the scope of prudential supervision, as other public policy objectives may also be at stake. Where appropriate, safety and soundness and financial stability can be enhanced by bank supervisors communicating and coordinating with relevant regulators and public authorities.

(6) Many FinTech firms, currently operate at the regional or national level. However, with

de technology development, some FinTech firms have high potential to expand their cross-border operations.

(7) FinTech-related changes may require bank supervisors to reassess their current supervisory models and resources in order to ensure continued effective oversight of the banking system.

(8) Supervisors should explore the potential of new technologies to improve supervisory efficiency and effectiveness.

(9) Supervisors should by attention to regulatory vacuum and over-regulation.

(10) Supervisors need to strike a balance between financial safety and financial innovation.

• The Financial Stability Board (FSB)

The Financial Stability Board (FSB) focused on the potential impact of FinTech on financial stability and established the Financial Innovation Network Working Group, which is primarily responsible for FinTech-related research. The FSB has published the report “Financial Stability Implications from FinTech”, which classified FinTech according to economic functions and business activities, assesses the potential macro and micro risks, and analyses its positive and negative impact on financial stability. FSB also proposes relevant recommendations and follow-up actions to prevent FinTech risks, providing a complete regulatory framework for how national regulatory authorities assess FinTech risks.

The Report recommends that countries integrate FinTech into existing risk assessment systems and regulatory frameworks and evaluate regulatory frameworks to reduce the potential risks of FinTech and improve regulatory effectiveness. Based on various studies and policy inventories, the FSB concluded that, currently, FinTech does not have a direct impact on financial stability. The study identified 10 areas that deserve the attention of regulatory authorities. Addressing these issues is seen as key to ensuring financial stability, promoting innovation and helping national supervisors

in their efforts to build inclusive systems. The ten areas are:

(1) Managing operational risks from third-party service providers.

(2) Mitigating cyber-risks.

(3) Monitoring macro financial risks.

(4) Cross-border legal issues and regulatory arrangements.

(5) Governance and disclosure frameworks for big data analytic.

(6) Assessing the regulatory perimeter and updating it on a timely basis.

(7) Shared learning with a diverse set of private sector parties.

(8) Further developing open lines of communication across relevant authorities.

(9) Building staff capacity in new areas of required expertise.

(10) Studying alternative configurations of digital currencies.

4.2.2 The Status Quo of Supervision in Major Countries and Regions

In the era of digital finance, the financial industry has seen an unprecedented increase in data collection capabilities and explosive growth in the volume of data. However, while driving the transformation and upgrading of the industry, digital technology may also be used in breaching customers' data rights. As major players in the sector, large technology companies improved the efficiency of financial services, reduced operational costs and optimized user experience. However, these companies have also accumulated user data in their respective fields through continuous innovation and rapid expansion. Some companies have excessively collected, leaked, lost or maliciously tampered with user information, which has posed a challenge to personal privacy and data security. In addition, some companies have used their monopoly position in unfair competition to seek high profits. As a result, personal data security and privacy protection, as well as monopolistic practices of large technology

companies, have become the focus of the attention of national regulators.

- **The European Union**

There is a strong awareness of privacy protection in European civil law countries, which has led to an EU model of data regulation based on human rights logic and a commitment to protecting the human rights of data subjects through a comprehensive and uniform regulatory policy (Strahilevitz, 2012). Compared to China and the US, where market volumes of the digital economy are huge and advanced, the EU has a more forward-looking legal system, stringent in personal privacy protection, data security regulation and anti-monopoly (targeting large technology companies).

In terms of data privacy, in May 2015, the European Commission proposed the Digital Single Market strategy to ensure that data flows within the EU and across sectors, complying with European rules on privacy, data protection, competition law and other regulations. The strategy also ensures data access is fair, practical and clear.

The General Data Protection Regulation (GDPR), the most stringent data protection law ever enacted in the EU, defines in detail the data rights of individuals as data subjects with the right to know, the right to forget, the right to rectification and the right to benefit, thus making the protection of personal data more operational. The GDPR came into force in May 2018, marking the establishment of a harmonized personal data protection regime in the EU. Since its implementation, it has caused a great shock at both economic and social levels with cumbersome and complex compliance requirements and staggering penalties for non-compliance. It also served as a reference for other countries in formulating relevant policies. Many multinational companies, such as Google and Facebook, have been heavily fined by EU countries for sharing user data or failing to provide users with clear and unambiguous information in violation of the General Data Protection Regulation.

In addition to data privacy protection, improving data trustworthiness is essential for the healthy development of digital finance. On March 10 2021, the EU Data Protection Board (EDPB) and the European Data Protection Supervisory Authority (EDPS) released the Data Governance Act (DGA), which aims to promote the availability of data by increasing trust in data intermediaries and strengthening data sharing mechanisms across the EU. In particular, the DGA aims to increase the availability of data used in public sectors with the help of "personal data sharing intermediaries", data sharing between companies and green-light the use of personal data.

In the antitrust field, in addition to the General Data Protection Regulation (GDPR), the European Commission introduced two draft Digital Services Acts and Digital Marketplace Acts on 15 December 2020. The two acts aim to overhaul the content and regulation of large online platforms (with 45 million or more monthly active users) in the EU, such as Amazon, Google, Facebook and Apple, to curb their dominance in the data sector and force them to be more transparent and orderly in terms of hosted content, dissemination of advertising and deletion of information, to maintain consumer safety and a level playing field among the major online platforms. The Digital Services Act regulates in-platform services, including data compliance, personal information protection, algorithmic transparency and advertising distribution, and imposes additional obligations on large platform companies. The Digital Marketplace Act complements traditional antitrust law by regulating competition on platforms, specifically targeting big data platforms for restricting competition, self-preferential treatment and price distortion. Both Acts impose significant fines for non-compliance. Companies violating the Digital Marketplace Act will be fined up to 10% of their global revenues and companies violating the Digital Services Act will be fined up to 6% of their global revenues. The EU will label big tech



companies fined three times in five years as "repeat offenders", and have the power to take action to break them up. Both Acts also provide a coherent set of rules for large online platforms that can be followed across the EU, demonstrating the EU's ambition to be a global leader in digital regulation.

- **The United States**

The common law systems generally do not favor a systematic codified form but use single-line laws and regulations. The internal logic of the relevant legislation in the US is individual-centered, based on market and industry self-regulation. The basic ideology is market and individual-centered economic liberalism.

As a result, the US has introduced relatively liberal and flexible policies compared to the EU. In terms of data, the US does not have a single, all-encompassing data protection statute like that in the EU. The US has a decentralized model of sectoral legislation, separating data protection laws and regulations at the federal level for specific industries, combined with state legislation to protect citizens' data. The "notice and choice" model is a key element of some US state laws. This model based on 'privacy self-management, where people can weigh the costs and benefits of data collection,

use or disclosure for themselves (Solove, 2013), with an emphasis on encouraging individual consumers to express their market preferences.

In June 2022, some US House and Senate Commerce Committees jointly released a draft of American Data Privacy and Protection Act (ADPPA). In particular, the draft introduces the concept of a duty of loyalty, further strengthens personal data protection for children and teenagers, and establishes more stringent compliance obligations for large data holders. However, the US Data Privacy and Protection Act differs fundamentally from the EU GDPR in that it is featured a high degree of freedom and a focus on unlocking value above the bottom-line protection of personal data. The EU GDPR prohibits the processing of personal information in general unless there is a corresponding basis of lawfulness. The US Data Privacy and Protection Act has the opposite logic of protection and does not require a lawful basis for data processing, but sets out the restrictions on personal data processing activities in specific circumstances. For example, the collection, processing and transfer of sensitive personal data to third parties require the express consent of the individual concerned; targeted advertising to individuals under 17

is prohibited. Data should not be collected, processed or transferred in a discriminatory manner by a covered entity.

In addition to this, the US Data Privacy and Protection Act also provides general exceptions to restrictive processing. Building on this high degree of freedom, the Data Privacy and Protection Act further provides that a Covered Entity may not collect, process or transmit more data than is reasonably necessary, proportionate and required by the Act. A "covered entity" is any entity supervised by the US Federal Trade Commission Act.

In the antitrust arena, on 20 January 2022, the US Senate Judiciary Committee considered and passed two bills, the American Innovation and Choice Online Act and the Open App Markets Act. The American Innovation and Choice Online Act aims to protect innovation and limit self-preference, including by prohibiting dominant platform companies from prioritizing their products and services and disadvantaging their competitors. The criteria for platforms covered include "platform companies with an annual market capitalization or annual net sales in the United States of more than \$550 billion or an average of more than 50 million monthly active users in the United States", targeting mainly the four major US tech giants. The Open App Markets Act, which allows for application side loading (downloading applications outside of the app shop), aims to break the monopoly power of app shops over applications and will have a significant impact on Apple and Google's app shop business models. In addition, the US is unifying the financial businesses involved in large technology companies into the existing financial regulatory system by their function. The US House of Representatives passed the FinTech Protection Act in 2019, establishing the Independent FinTech Task Force to Combat Terrorism and Illicit Finance, creating the Office of Financial Innovation and the FinTech Directors Advisory Council to strengthen the regulation of FinTech

startups. On 28 March 2022, the US House of Representatives published The Electronic Currency and Secure Hardware (ECASH) Act, which requires the US Treasury to develop and pilot an electronic version of the US dollar to protect privacy and anonymity in transactions. In addition, the Consumer Financial Protection Bureau (CFPB) has launched a series of investigations in the FinTech sector as technology giants extend their tentacles outside the financial sector and out of concern for the expanding power of the platforms. Amazon, Apple, Facebook (now known as Meta), Google, PayPal and Square (now known as Block) are among those being investigated and the CFPB has also said it will look into the operations of Alipay and WeChat Pay in China.

- **China**

In recent years, data security vulnerabilities and misuse of data on China's internet platforms have led to data regulation policies focusing mainly on data security governance and gradually elevating it to the strategic level of national security governance. China began implementing the Cybersecurity Law in June 2017 to control data security on the Internet. As a complementary law to the Cybersecurity Law, China's Cryptography Law has been in force since 1 January 2020, and the Chinese Civil Code, enacted on 28 May 2020 and implemented on 1 January 2021, protects privacy and personal information for the first time as part of citizens' personality rights, and enhances the scope and intensity of protection based on the Cybersecurity Law. On 1 November 2021, the Chinese version of the GDPR "Personal Information Protection Law" came into effect, which clarifies the rules of personal information processing, the rights and obligations of individuals in personal information processing activities, and the departments that perform the duties of personal information protection, etc. However, the definitions of relevant concepts are relatively vague, which on the one hand gives more room for judicial interpretation in specific judicial practice, and on the other hand, abstract definitions can also increase

the difficulty of judicial practice. On 30 September 2021, the People's Bank of China issued the Measures for the Administration of Credit Business, which came into effect on 1 January 2022. The Measures state that credit business and its related activities shall protect the legitimate rights and interests of information subjects, safeguard information security, prevent credit information from being leaked, lost, destroyed or misused, and shall not endanger state secrets or violate personal privacy and commercial secrets.

The introduction of laws, regulations and departmental rules such as the Cybersecurity Law, the Personal Information Protection Law and the Measures for the Administration of Credit Business have laid the institutional foundation for China's digital finance to move steadily forward.

The regulatory challenges posed by international technology giants present a different scenario in China than in Europe and the US. The market share of the leading European and US technology companies in the market share in China is small, and the resulting problems of monopolistic operations, information leakage and national security threats are not serious. However, China is unique in that it has produced several technology giants such as Alibaba, Tencent, Baidu, Byte Jump and Meituan. While the internationalization of these companies is relatively limited, the security, compliance and social issues posed within China are also becoming increasingly prominent.

In the booming digital finance sector in China, some FinTech companies engage in financial business without a license or operate beyond their business scope, payment business irregularities, and unfair competition through monopoly positions.

Chinese supervisors introduced many policies and rules to regulate the financial business of technology companies. These rules include Measures for the Administration of Payments via Non-financial Institutions, Measures for

the Administration of Network Payments by Non-bank Payment Institutions and Interim Measures for the Administration of Business Activities of Online Lending Information Intermediaries.

However, Chinese regulatory authorities generally continue the logic of institutional regulation to implement financial supervision for FinTech companies and determine the regulatory authority for different types of FinTech companies or businesses according to the traditional division of financial supervision (Yuan and Tang, 2021), this makes the business supervision of FinTech companies somewhat regulatory. The business regulation of FinTech companies has certain regulatory loopholes. Ant Group is a typical example from the regulatory perspective that Ant Technology is a loan company, which should be under the jurisdiction of the CBRC and PBOC, but ABS is under the jurisdiction of the SFC, allowing Ant Technology to arbitrage its micro-finance business for a long time through ABS. However, the suspension of Ant Technology's IPO and the subsequent promulgation of the Interim Measures for the Administration of Online Microfinance Business signaled a further tightening of regulation of FinTech companies by the Chinese regulatory authorities and the gradual improvement of the regulatory system.

In general, the relevant initiatives of the Chinese regulatory authorities focus on the following three regulatory practices: First, finance is a licensed industry, so finance businesses and operations must be licensed. Second, supervisors should establish appropriate firewalls to avoid financial risks spreading across sectors and industries. Third, supervisors should disconnect inappropriate connections between financial and commercial information to prevent the closed-loop effect of "data-network effect-financial business" from creating monopolies (Yi, 2021).

4.3 Suggestions on Digital Finance Regulation

Building a sound regulatory system is the premise of ensuring financial stability and maintaining social fairness and justice, and is also an inevitable measure to ensure the healthy and steady development of digital finance. Digital finance, in essence, is finance, so the goal of the regulation of digital finance is still to contain financial risks, maintain the stability and security of the financial system, uphold fair play and improve financial efficiency. Among them, risk management is always the most important lifeline of finance and the bottom line of the development of digital finance. Regulatory authorities should make adaptive adjustments from three dimensions: regulatory philosophy, measures and strength.

First of all, in terms of regulatory philosophy, regulators need to properly understand that regulation plays an essential role in the financial sector, and more importantly, recognize the particularity of the regulation of digital finance which demonstrates dependence on scenes and networks and cross-boundary characteristics. Consequently, financial conducts and product structures of digital finance are more complex and intertwined, and the generation and forms of digital finance risks are different from traditional financial risks. Therefore, it is necessary for regulatory authorities to have an accurate picture of the essence of digital finance, redefine financial institutions and financial conduct, and balance the requirements of technology, finance and social ethics so as to design the overall structure of digital finance regulation. Moreover, the conventional regulatory methods and models cannot adapt to the rapidly evolving digital finance that is based on usage scenes and networks. The digitalization of finance calls for the digitalization of regulation. The regulatory authorities should acknowledge the core role of technologies, and detect risks in a

comprehensive real-time manner through big data and AI and other innovative technologies, and promote the application and development of regulatory technologies. In addition, the regulatory authorities should take targeted measures and strengthen governance and supervision of key areas. With the increasing value of data and the evolution of information technology, personal privacy and data security have been greatly challenged. Improving the dynamic balance among data collection, governance, use and security, privacy and ethics is fundamental to better supporting innovation and development in the digital finance. The rapid rise of big platform technology companies in recent years has also added new risk factors in the direct or indirect participation in the financial market, and has posed new challenges to the regulatory authorities, including engagement in financial services without license or beyond licensed business scope, unfair competition by monopolies, threats to personal privacy and information security, and challenges to the business models and competitiveness of the traditional banking. Therefore, stronger governance and supervision should be implemented for big platform technology companies.

4.3.1 Need to have the new regulatory concept, and improve the regulatory framework for digital finance

The current financial regulatory rules are mainly developed for the traditional financial sectors, in which there haven't been significant changes in the types of financial firms, operating territories, and business scopes for a long time. Consequently, in the face of the innovation and development of digital finance, the traditional regulatory mechanism has shown weaknesses such as lagging and ineffective supervision. Therefore,

improving the regulatory framework for digital finance and building a sound digital finance regulatory system is the key to promoting the healthy development of digital finance.

However, the establishment of the digital finance regulatory framework has multiple dimensions and threads. First and foremost, the regulatory authority should have the right regulatory concepts. Specifically,

(1) It should **accurately understand the essence of digital finance**. Digital finance is the combination of finance and technology. Technology is only transforming the way finance is provided, and doesn't change the essence of finance. So, the basic idea and rationale of financial regulation should remain focused on the three areas: capital, conduct and protection of investors and consumers (Chen, 2021).

(2) It should **fully acknowledge the special characteristics of digital finance regulation**. With the increasing application of digital technology in the finance industry, financial innovations speed up and new business models and application scenarios continue to be created. Through the close combination of technologies and various scenarios, digital finance evolves and takes on new characteristics such as increased specialization and networking, and therefore is different from the traditional financial services industry from the perspectives of regulation and service features.

(3) It should **differentiate financial risks and technical risks, and implement regulations accordingly**. After tech companies enter the financial industry, different parts of the finance industry are exposed to different kinds of risks, and financial risks and technical risks should be managed differently.

(4) It should **pay attention to the efficiency and suitability of regulation**. Regulators should consider the different needs of technology development, financial services

and social ethics and keep a equilibrium among them, and take into account the systematic risk prevention and control of digital finance and the healthy development of the digital industry.

4.3.2 Innovate regulatory measures and develop regulatory technology

In the context of digital finance, financial risks are able to spread rapidly across regions in a hard-to-detect manner through the Internet. It's challenging to use traditional regulation methods like the onsite investigation to mitigate risks effectively in time. Take the bust of P2P platforms in China as an example. In 2006, the first P2P platform was founded in China. The P2P lending industry boomed between 2013 and 2016. Then in 2016, "Ezobao", a top P2P lending platform, collapsed. In 2018, a number of P2P lending platforms were closed and went into liquidation with the legal persons missing. The scams and controversy of P2P lending platforms in China were a result of a lack of oversight and reflected insufficient regulatory capacity. For instance, the credit reference system cannot meet the increased need for risk control.

To successfully adapt to the digitalization of finance, regulators must innovate the way regulation is implemented. Digital finance is providing financial services through innovative technology, so the traditional manual oversight should also shift to technology-based regulation. There isn't a universally accepted definition of the term regulatory technology or RegTech. The Financial Conduct Authority (FCA) in the UK described RegTech as new technology that facilitates the delivery of regulatory requirements. The Institute of International Finance called it "the use of new technologies to solve regulatory and compliance requirements more effectively and efficiently". In a nutshell, regulatory technology represents the regulatory

approach based on technology that provides real-time collection of regulatory data through big data and artificial intelligence, applies data minging and model analyses and forecasts, monitors payments transactions, and identifies customers and legal persons (Arner et al., 2016), so as to realize the comprehensive continuous monitoring of risks and prevent and resolve major financial risks as early as possible.

At present, the technological approach to regulation is widely accepted by regulatory authorities around the world. RegTech is used in risk control, anti-fraud, anti-money laundering and addressing insider trading. For example, the UK's Financial Conduct Authority (FCA) provides "Digital Regulatory Reporting (DRR)" to regulators through machine learning technology. The U.S. Securities and Exchange Commission (SEC) combines big data and machine learning to monitor potential fraud and violations. China Banking and Insurance Regulatory Commission (CBIRC) has developed a relatively open data analysis platform which on-site inspectors can access for data screening, extracting, modelling, mining and analysis. The Central Bank of the United Arab Emirates (CBUAE) has made plans to implement robotic process automation (RPA) in AML inspections. The Monetary Authority of Singapore (MAS) has started to use a machine learning tool called Apollo to assist law enforcement officers to detect financial fraud. The Bangko Sentral ng Pilipinas (BSP), the central bank of the Philippines, has an application programming interface (API) in place for transaction submission and surveillance data visualization. Technological progress and financial innovation will continue. Prohibition is not a lasting solution. It's necessary to advance regulatory technology to transform into technology-based regulation.

However, the regulatory technology is not fully developed. Regulators around

the world are faced with problems like insufficient capabilities of data collection and data sharing, and lack of coordination in technology implementation, information processing and collaboration mechanisms.^① This Report suggests that regulators should take the following steps to promote the development of regulatory technology.

(1) Regulators should *partner with third-party technology companies to improve the digital infrastructure of the financial regulation*. Tech companies are undoubtedly better at utilizing technology than regulators. So, regulators can work with third-party tech companies in the reg-tech project design to lower the cost of building the regulatory infrastructure and break data barriers in a short time, but at the same time keep watch on the risks associated with outsourcing and potential conflicts of interest.

(2) Regulators should *enhance capacity building, and update the knowledge and areas of specialization of regulatory officials*. Regulators need to understand not just the basic principles of relevant technologies and also how technologies combine with the development of financial services.

(3) Regulators should *set up and improve the data-sharing mechanism, enhance data interconnection, and break down the data barriers between markets and institutions*. For instance, improve the interconnection of data standards, statistical methods, and systems among financial institutions, between financial institutions and regulators, and among regulators. In addition, in the context of the globalization of digital finance, it's important to establish and improve the data coordination mechanism between national financial regulators.

^① Fan Wenzhong. Digital Economy and Financial Innovation [M]. China Financial Publishing House. 2022.

4.3.3 Improve consumer protection and data privacy and security

In the digital finance, data is the core competitive element, and the reg-tech is implemented through data collection and analysis. As data creates tremendous value, there are a number of risks and challenges around data security.

(1) From the perspective of data rights protection, the boundaries of data ownership are not clear. Coupled with the low cost of online data replication and the difficulty of detecting the secondary use and transmission of data, traditional protection methods often fail to address the excessive collection and illegal transaction of data and the problem of “authorize once, use many times”.

(2) In terms of data use, there are challenges around the authenticity and integrity of data, which highlight the information technology risks. All of the above have raised concerns about data security and data privacy.

Data security and privacy are essential to personal security, industry development and national economic security. In particular, as the digital economy grows rapidly and data is increasingly implemented in the economy, there is a rising concern among countries and regions around data protection, data utilization, identity authentication and other issues. It has been widely accepted by the international community to strengthen data regulation. According to the statistics of the United Nations Conference on Trade and Development (UNCTAD) as of April 2, 2020, 132 out of 194 countries had put in place legislation to secure the protection of data and privacy, accounting for 66% of all countries. Notably, on the one hand, it's necessary to protect data security and consumer privacy, and on the other hand, the data industry needs to develop. It's important to use big data and other information technologies to develop the digital finance and the digital economy to accelerate digital

transformations. Therefore, in the context of the rapid development of the digital economy, keeping a balanced relationship between the development of digital finance and the protection of consumer privacy is the key to the sound, rapid and sustainable growth of the digital finance industry.

At present, the data regulations in various countries aim to safeguard personal interests and adopt different logics. The EU data regulation model is based on the protection of human rights. By putting in place a comprehensive law, the EU regulation protects data privacy as well as other human rights. In the US, industrial interests are highlighted, it's encouraged to explore personal data utilization, the laws and regulations governing data protection are less stringent, and the market-oriented approach is adopted with a focus on industry self-discipline. Drawing on the experience of the EU and the US, China took national security governance as the starting point, gradually strengthened the governance and protection of personal information, and laid the institutional foundation for the development of digital finance.

Europe and the US have been at the forefront of the legislation of protecting consumer privacy, and have valuable experience for other countries on the protection of data and privacy. Most notably, the EUGDPR that went into effect in May 2018 serves as a milestone and a reference point for global regulators. Drawing upon the GDPR and global digital financial development, this Report suggests that the legislation of personal privacy protection pay attention to the following aspects:

(1) Give clear definitions of terms. Relevant legislation should state clearly who it shall serve and apply to, and what is mandatory, and what are the punishments for violations to ensure the feasibility in the judicial practice.

(2) Improve rights and obligations of relevant subjects. GDPR defines personal data rights



in detail. Individuals as data subjects have the right to be informed, the right to be forgotten, the right to rectification, the right to data portability and other rights, which make the protection of personal data rights more implementable.

(3) Improve the supervision and management mechanism and establish a regulatory agency specialized in personal data protection. The "EDPB+SA" regulatory model set by GDPR not only emphasizes the independence of regulators, but also highlights the cooperation among institutions to ensure the consistency of the GDPR implementation in member countries and prevent differences in the degree of data protection and enforcement capabilities of member countries.

(4) Improve the system for the cross-border transfer of personal data. For example, the GDPR has different requirements for the cross-border transfer of personal data depending on the degree of data protections of the country or region where the recipient is provided that it complies with the GDPR data processing principles and is necessary for cross-border processing.

(5) Increase the punishment for violations. The GDPR has caused a great shock in the economy and the society due to its complicated compliance requirements and alarming punishment for violations. Many

multinational companies, such as Google and Facebook, have been severely punished by the EU for violating the GDPR because they shared users data or failed to provide users with sufficiently clear and explicit notifications.

(6) Balance the relationship between innovation and privacy protection, and encourage the application of new technology models to maximize the ability and vitality of market players, and promote the sustainable and sound development of digital finance. For example, conduct the virtual integration of data on the basis of no persisting, no trace, no storage and no transmission. It can bring out the full potential of the productivity of data, and also protect consumer privacy and fully realize the availability and invisibility of data.

(7) Strengthen the governance and supervision of data authenticity and improve the availability of data. It is of great importance to investigate and deal with data fraud, and strengthen the governance of incomplete and scattered data, so as to ensure the reliability and authenticity of data.

(8) Strengthen the protection of kids' data. GDPR has made special provisions for the protection of kids' data in terms of the legal basis, the right to be informed, and protective measures.

4.3.4 Strengthen the supervision of large platform tech companies

As new subjects in the financial market, the development of platform financial technology has a positive socio-economic impact. It not only makes up for the shortcomings of traditional financial services and supports the development of the real economy, but also leads the improvement of customer experience and expands the use of behavior data. It has promoted credit cultivation and the popularity of credit reporting, and also has promoted the digitalization of the entire financial system (Wu, 2021). Meanwhile, the platform tech companies bring new risks and new challenges to the regulatory authorities as they directly or indirectly participate in the financial market, including engagement in financial services without a license or beyond the licensed scope, unfair competition as a monopoly, threat to personal privacy and information security, and challenge to the business model and competitiveness of the traditional banking industry.

In recent years, countries around the world have gradually realized the necessity of the regulation of large platform technology companies, and have issued a series of laws and regulations to supervise the misconduct of large platform technology companies. With reference to the relevant policies issued by the EU, the US and China, this Report believes that large platform technology companies should pay attention to the following aspects:

(1) Adhere to the principle of licensed operation. Finance is a highly specialized industry with strong externalities, so it is necessary to adhere to the principle of licensed operation. All institutions engaged in financial services need to obtain corresponding business licenses and should be incorporated into the corresponding regulatory framework. This is conducive to promoting fair competition among practitioners, compliance with unified regulatory standards and preventing regulatory arbitrage. Also, it will help

protect the legitimate rights and interests of consumers and help effectively identify institutional and business risks. But at the same time, the development of digital finance has refined the original business processes and pushed further the division of labor. A single comprehensive license is likely to constrain the natural evolution of division of labor and cooperation. In order to keep enough space and flexibility for digital finance, we can adopt classified multi-level license and qualification management methods, and issue corresponding business access licenses according to the actual type of business operated by technology companies. If specialized functions and posts facing the public are involved, strict qualification management is required.

(2) Insist on supervision according to the nature of risks. Based on the analysis and judgment of the business model, the regulatory authority should peel off the "coat" of technology, select appropriate legal frameworks and take corresponding regulatory measures according to its financial nature, and similar businesses should follow unified regulatory rules.

(3) Increase anti-monopoly reviews and punish violations. Large platform technology companies have accumulated a large number of data resources and users in their respective fields through continuous innovation and rapid expansion, and have huge market influence. Some of them are "too big to fail", and even maintain their monopoly position or seek high profits to carry out the unfair competition, which has seriously damaged the rights and interests of consumers and privacy security. Therefore, the regulatory authorities should strengthen the anti-monopoly reviews of anti-competitive strategies, discriminatory pricing and other aspects of technology companies, increase the punishment for violations, and eliminate the high revenue and low cost of platform data, algorithmic collusion and other incidents, to effectively protect the interests of data related parties.



⑩ Currently, the mainstream bitcoin mixers in operation include Kutbit registered with the Russian host operator REG. RU LLC, Coinmixer registered with the Spanish suffix domain name ES, Bitblender registered with the suffix domain name CC in the Cocos Islands Territory (Australia), and Chipmixer registered with the Hong Kong domain name service provider “Eranet International Limited”.

(4) Strengthen the algorithm-based behavior supervision, increase the algorithm transparency, prevent algorithmic discrimination, and protect personal privacy.

The behavior of technology companies is mostly realized through algorithms. The regulatory authorities can consider incorporating the algorithm regulation into the platform regulation, and set up a detection mechanism in the algorithm model in terms of regulatory requirements, ethics and anti-monopoly.

(5) Establish and improve consumer protection legislation concerning large platform technology companies.

Restrain the misconduct of large platform technology companies in collecting, storing and using users’ information, and effectively protect the legitimate rights and interests of financial consumers.

4.3.5 Strengthen digital currency supervision

Different from digital bank, digital insurance and other digital financial industries that have been mature and developing for a long time and have physical regulatory objects, digital currency is the fastest growing, most controversial and most difficult to supervise in the field of digital finance, and may have a disruptive impact on the existing financial system, so it needs to be discussed separately. Many scholars discussed the necessity of digital currency regulation. Filip (2018) believes that because of the private nature of Bitcoin, it is beyond the supervision of any authority. Especially, the anonymity of Bitcoin makes it possible to be used for money laundering and terrorist activities. Nabilou (2019) believes that the current Bitcoin regulations are facing many

difficulties. The dilemma it brings to the legal system is that it is almost impossible to supervise the distributed network in a centralized way, because the decentralized cryptocurrencies don't fit in the existing centralized structure of the monetary and financial regulation.

According to the statistics of our Report, up to September 2022, the RMB trading zone of mainstream digital currency exchanges such as OKex and Gate.io are in normal condition. Although OKex introduced stricter KYC certification measures at the beginning of 2022 in response to measures of strengthening centralized platform supervision, the emergence of decentralized exchanges based on smart contracts represented by Paxful and Local Cryptos makes the platform supervision difficult.

We believe that even for the platforms, it is still difficult to completely prohibit Bitcoin transactions based on its technical nature. The focus of the digital financial supervision should be the traceability of digital currency and the KYC certification of digital currency accounts. The nature of decentralized distributed ledgers makes it impossible for regulators to prohibit digital currency transactions under any circumstances. The best regulatory strategy should be the ex post accountability of offline entities. The real-name nature of the fiat money account makes the fiat money-digital currency link the most important part of the digital currency regulation. For example, blockchain big data enterprises like OKLink are providing "Chainintelligence" services based on digital currency transaction data, that is, providing early warning on digital currency transaction addresses suspected of illegal activities, tracking and identifying user entities behind relevant digital currency accounts, and providing forensic support and technical support for the police.

However, the effectiveness of the above regulatory measures is based on the premise

that Bitcoin is traceable, and ultimately the fiat money-digital currency transaction can be identified, and then the true identity of offline entities can be found. However, the traceability of Bitcoin may be weakened by Bitcoin mixers.^⑩In China's judicial practice, there are no cases of suspected Bitcoin mixers services, and relevant laws and regulations are not established yet. In the Westlaw database, there are many cases fighting against bitcoin mixers in the US.. China and other developing countries should actively draw upon the US experience in digital currency regulation with a focus on combating illegal activities such as bitcoin money laundering, instead of unduly cracking down on reasonable investment demand.

Conclusion

It has always been the core issue that the financial industry is committed to solving to bridge the information gap between financial institutions and other sectors to achieve the balance between financial supply and demand. Therefore, relying on the rapid technological progress, the global financial industry has been utilizing data, algorithms, models and other technologies to address the asymmetric financial information problem. In recent years, thanks to favorable policies, strong demand and other reasons, the global digital finance has made great progress.

On the whole, benefiting from sound digital infrastructure and advanced information technology, Europe and the US lead the development of the digital finance, but their traditional financial industry basically meets the financial needs of society, leaving less space for digital finance. In contrast, with large population and huge digital finance demand, some emerging markets with low financial inclusion (such as China, Brazil, and India) contain huge opportunities, which may be potential growth opportunities of global digital finance in the future.

Specifically, in the field of digital currency, the global private digital currency market has shown exponential growth. As Europe and the US may be inclined to maintain the stability of the traditional sovereign currency system, and have relatively low willingness to participate in the issuance of cryptocurrencies, the private digital currencies are mainly used by Vietnam, India and other developing countries. While private digital currencies are developing, most countries have tried sovereign digital currencies for the purpose of improving financial efficiency and maintaining financial stability. However, most of the central bank's digital currency projects are in the research or operation stage, and only the central banks of the Bahamas, Nigeria and the Eastern Caribbean have officially issued CBDC. China

has only recently experimented using RMB CBDC in retail area.

In the field of digital payment, developing countries which relatively lag behind in financial development such as China and Vietnam have achieved rapid development in the digital finance in the short term. In particular, with the innovation and investment of technology enterprises such as Tencent and Alibaba and the huge user base, China has achieved rapid progress in the digital payment. Digital payment companies represented by Alipay and WeChat Pay are leading the trend of global digital payment. Although the digital payment can meet the financial transaction needs of most ordinary users, it needs to go through banks or other financial institutions. However, there is an essential difference between CBDCs and the digital payment. The former, classified as M0, can be circulated without any intermediary. Moreover, the CBDCs as legal tender will inevitably bring more liquidity and convenience than the digital payment. In the field of digital bank, Europe, as the birthplace of digital banks, dominates the whole market, accounting for 40% of the global digital banks in number. However, as most European digital banks were set up by financial technology start-ups, and the existing banking industry can meet mostly the financial needs of the society, European digital banks are generally small in size, and do not have obvious capital and technological advantages. In contrast, in Latin America and some countries in Southeast Asia with relatively less developed financial systems and huge financial needs, a large number of digital banks have emerged in recent years, such as top Brazilian Unicorn Nubank and Tencent's WeBank. In addition, the United States is also a pioneer in digital bank with strong advantages in the number of digital banks, technological level, and service capability. However, under the two-tier regulatory framework, different regulators have not reached a consensus on the issuance of digital bank licenses. So, most digital banks provide services through cooperation with traditional banks holding banking licenses.

In the field of digital insurance, leaders are the developed markets represented by Europe and the United States and emerging markets in Asia. These regions have attracted most of the global investment in digital insurance, and incubated fast growing start-ups and many great Unicorn companies. The reason is that Europe and the United States need to deal with expensive medical costs (the United States) and the serious problem of population aging (Europe and Japan), and that emerging markets in Asia have a wide range of financial needs resulting from the huge population and low insurance penetration rate.

In the field of digital securities, online securities companies have accumulated a large number of users in the short term with lower costs and more convenient services. However, the traditional securities companies are still the mainstream in the securities market because they have a longer history and sound brand reputation coupled with the accelerated digital transformation in recent years. For online securities companies, the key to future development is how to create new services to maintain profit growth to cope with the impact of the zero commission. Traditional securities companies should pay attention to combining their capital strength and development path to achieve digital transformation as soon as possible.

In the field of digital supply chain finance, the United States is in an absolute leading position, not only because of the rapid development and application of emerging information technologies, but also because of its highly developed supply chain financing model and supply chain. Also, most European countries and the US recognized the irreplaceable role of the supply chain in the economic development relatively early, and have provided extensive strategic policy support. With the in-depth application of the blockchain technology, the development of the supply chain finance in the future will not be centered on core enterprises, but will adopt a new service model that effectively integrates data, credit and capital from the

perspective of industrial interconnectedness.

Finally, in the field of Decentralized finance (DeFi), as a disruptive innovation in the financial industry, it addresses the weakness of the traditional/centralized finance, and has achieved rapid growth in a short time. However, in terms of the scale, the DeFi ecosystem is still in its early stage and has great growth potential. Attention should be paid to risks and security issues in its future development.

The lack of access to financial services for the real economy is an important factor restricting the global economic development. Especially for countries and regions with backward financial development (such as Latin America and Southeast Asia), due to the problem of financial exclusion, the traditional finance dominated by bank credit is difficult to meet the capital needs of small and medium-sized economic entities (such as families, small and micro enterprises, etc.), which seriously hinders economic development. In the context of digital finance, traditional financial institutions have accelerated the digital transformation to cope with the complex and changing competitive environment and make finance serve the real economy. At the same time, the emerging financial models also have a unique advantage different from traditional finance to boost economic growth from the channels not easily accessible in the traditional finance, and bring new development opportunities to developing countries and backward regions.

This report mainly explains the role of digital finance in promoting economic growth from the perspectives of households, enterprises and industries. First of all, from the perspective of households, digital finance plays an important role in easing their liquidity constraints, improving payment convenience, reducing preventive savings, and improving income levels through new financing, payment, and investment models, thereby releasing households' consumption potential and promoting economic growth.



Image source: official website of the United Nations

From the perspective of enterprises, in the context of digital finance, new financing models (crowdfunding, digital bank, etc.) have broadened the financing channels of SMEs. With the in-depth application of information technology, the problem of information asymmetry has been alleviated, which has helped lower financing costs and improve financing efficiency. This has effectively addressed the problems of difficult, expensive and slow financing facing SMEs, and injected new vitality into the global economic development. From the industrial perspective, digital finance improves the financing environment of upstream and downstream enterprises in the supply chain by using digital technology to establish an industry finance ecosystem. Also, the efficiency of trade financing and cross-border payment has been significantly improved, and the related transaction costs have been reduced, thus alleviating the cash flow problem in enterprise operation and accelerating the industrial restructuring. In addition, digital finance also plays a role in

promoting green and inclusive development. Of course, the development of digital finance cannot be done without policy support. In recent years, some countries and regions have introduced policies to support the development of digital finance, including setting up regulatory sandboxes and digital financial technology facilities.

However, it cannot be ignored that digital finance, as an emerging financial industry, has also accumulated many problems and risks. Many illegal acts taking advantage of the limitations of the traditional regulation are difficult to be detected in time and effectively controlled, resulting in the concentration and diffusion of financial risks, and thus affecting the security and stability of the financial system. The international organizations on financial regulation and financial regulators of various countries have actively responded to the regulatory challenges brought by digital finance, and studied its evolution mode, risks and the impact on the financial system and regulation from different angles, and

then explored various ways to improve the financial technology regulation. In terms of international organizations, the IMF released the Bali Fintech Agenda in 2018, which encouraged countries to actively embrace fintech and provided a basic framework for countries to formulate relevant regulatory policies. The Basel Committee on Banking Supervision (BCBS) has established a working group on financial technology to focus on the impact of financial technology on the market position, business model and systemic risk of the banking industry, and the challenges for banking supervision. The Financial Stability Board (FSB) focuses on the potential impact of financial technology on financial stability and sets up a financial innovation network working group mainly responsible for the financial technology research.

At the national level, given the particularity of the development of digital finance, in major countries and regions including Europe, the US and China, the relevant regulatory policies mainly focus on protecting the personal data security and privacy and combating the monopoly of large technology enterprises. In general, Europe has adopted comprehensive and unified regulatory policies, and introduced proactive and stringent legislation, showing the EU's ambition to become a global leader in digital regulation. The United States, instead of formulating an all-inclusive unified data protection regulation like the EU, has adopted a decentralized approach, and formulated relevant laws and regulations on different industries at the federal level. China adopted the legislative principle of combining the top-down and bottom-up approaches, and introduced flexible policies and gradually tightened them, which was an important factor for China to achieve rapid development in the field of digital finance.

Building a scientific and sound regulatory system is the premise to ensure the stability of the financial market and maintain social fairness and justice, as well as an inevitable measure to ensure the healthy and steady development of digital finance. This requires

a correct understanding of the necessity of regulation in the financial field, and acknowledgement of the particularity of digital financial supervision. On the one hand, the digital finance is essentially finance, so the goal of the digital financial supervision is mainly to prevent and resolve financial risks, maintain the stability and security of the financial system, and protect fair competition and improve financial efficiency. On the other hand, with the increasingly in-depth application of digital technology in the financial field, the trend of financial innovation continues to accelerate, and new business models and application scenarios keep emerging.

After the in-depth combination of technical means and various scenarios, the digital finance has evolved (such as division of labor and access through internet), so it is different from the traditional financial industry in the regulatory dimension and business characteristics. First of all, in the context of digital finance, the data collection ability of the financial industry has improved unprecedentedly, and the volume of data has shown an explosive growth. Data has become the core competitive element of the financial industry, but it also brings challenges to data security and personal privacy. At present, the data regulation in various countries is based on safeguarding personal interests, but follows different logics. For example, the EU data regulatory model is based on human rights and protects personal privacy through the establishment of comprehensive and unified laws. In the US, industrial interests are highlighted, it's encouraged to explore the personal data utilization, the laws and regulations governing the data protection are less stringent, and the market-oriented approach is adopted with a focus on industry self-discipline. It is true that data security and data privacy have an important impact on personal security, industry development and even national economic security. It's important to use big data and other information technologies to develop digital finance and digital economy to accelerate

the digital transformation. Therefore, how to handle the relationship between innovation and privacy protection, achieving the balance between data value release and data privacy protection, to maximize the ability and vitality of market players, are the key to determine whether the future digital financial industry can develop healthily, rapidly and continuously.

Second, The inherent way and mode of supervision can no longer cope with the development of digital finance which tends to be scene based, networked and rapidly iterated. The regulatory authorities should innovate the regulation model to adapt to the evolving digital financial industry. The foundation of digital finance is the utilization of new technologies in finance, and the regulation should also transform from manual regulation to the technology-based regulation. In the development of the regulatory technology, national regulatory authorities should gradually improve the financial infrastructure and enhance the capacity of data collection and data sharing. In addition, the rapid rise of large platform technology companies in recent years has also brought new risk factors in the process of direct or indirect participation in the financial market, bringing new challenges to the regulatory authorities, including engagement in financial services without license or beyond licensed scope, unfair competition by monopolies, threats to personal privacy and information security, and challenges to the business models and competitiveness of the traditional banking. Therefore, stronger governance and supervision should be implemented for big platform technology companies. National regulatory authorities should pay attention to adhering to the principle of licensed operation and the principle of risk-based supervision, and strengthening algorithm-based behavior supervision.

Finally, the decentralized digital currencies make it impossible to completely eliminate transactions for the platform supervision

technology. In digital currency supervision, countries should actively learn from the experience of the United States, focusing on combating illegal money laundering businesses such as bitcoin mixers, and protecting legitimate investment needs. In addition, the big data technology like "Chainintelligence" can be used to accurately identify the offline entity identities of Bitcoin addresses.

Digital finance is a new financial model and a new stage of financial development, and also a continuation of the development of the financial industry. It brings rare development opportunities to developing countries and backward regions, promotes the reform of the international financial system, and enables countries and all walks of life to share the benefits of inclusive finance. From a global perspective, digital inclusive finance embodies the people-oriented principle and is consistent with the trend of the global inclusive development. At present, poverty is widespread all over the world. Some people have difficulty obtaining effective financial services, and the gap between the rich and the poor is enormous. Countries around the world should seize the opportunity in the new stage of information development, accelerate and standardize the development of digital finance, so that digital inclusive finance will play a greater role and make more contributions to the world economic growth.

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IFF Global Finance and Development Report (IFF GFDR) 2022

The IFF Global Finance and Development Report 2022 comprises two sections. The first part, the Global Economic Outlook, includes a global economic outlook for 2023, a mapping of major risks for the global economy, and broad and practical policy recommendations. The second part focuses on digital finance, which has taken off in recent years thanks to technologies such as artificial intelligence (AI), big data and cloud computing and their wide applications. Digital finance helps create a new financial ecosystem, upgrade financial business models, and inject new vitality into the world's real economy. Opportunities aside, it also generates risks and challenges in privacy protection, information security, financial stability etc. The report offers an in-depth look at digital finance from three perspectives, i.e. its definition and history, opportunities and challenges, as well as risks and regulations.

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