

International Monetary Review

April 2023, Vol. 10, No. 2

Dong Jinyue and Xia Le

Understanding Economic Messages Contained in China's 2023 "Two Sessions"

Herbert Poenisch

Putting the Economy Back on Track and Remaining Risks: Work of the NPC and CPPCC Sessions

Pierre-Olivier Gourinchas

Global Economy to Slow Further Amid Signs of Resilience and China Re-opening

Andrew Sheng and Xiao Geng

China's Impact on the Fate of Global Balance Sheet

Mark Sobel

Silicon Valley Bank Collapse Reverberates through Financial System

Gary Smith

Central Banks are Reassessing Foreign Exchange Reserves

Li Bo and Nobuyasu Sugimoto

Crypto Contagion Underscores Why Global Regulators Must Act Fast to Stem Risk

Introduction to the International Monetary Institute (IMI)

Established on December 20, 2009, IMI is a non-profit academic institution affiliated to China Financial Policy Research Center and the School of Finance of Renmin University.

Following the "general theory of macro-finance", IMI aims to become a world-class think tank, focusing on the studies of international finance, in particular the international monetary system and RMB internationalization. Despite its relatively short history so far, IMI has established itself as a leading research institution and important forum, where industry leaders, policy makers and academic experts from home and abroad share their insights and expertise.

Advisory Board: (in alphabetical order of surname)

Edmond Alphandery	Yaseen Anwar	Lord Neil Davidson	Han Seong-soo	Steve H. Hanke
Li Yang	Ren Zhigang	Nout Wellink		

Editorial Board: (in alphabetical order of surname)

Steven Barnett	Ben Shenglin	Chen Weidong	Chen Xinjian	Ding Jianping
Robert Elsen	E Zhihuan	Fan Xiwen	Feng Bo	Tomoyuki Fukumoto
Fariborz Ghadar	Thorsten Giehler	Yuksel Gormez	Guan Wei	Guan Qingyou
Guo Jianwei	Guo Qingwang	Huang Jinlao	Jiao Jinpu	Jin Yu
Jaya Josie	Rainer Klump	Kees Koedijk	Wolfgang Koenig	Iikka Korhonen
Il Hounq Lee	David Marsh	Juan Carlos Martinez Oliva	Pang Hong	Jukka Pihlman
Qu Qiang	Qu Qiang	Alfred Schipke	Shi Bin	Anoop Singh
Song Ke	Sun Lujun	Tan Songtao	Wanda Sung-Hwa Tseng	Tu Yonghong
Wang Changyun	Wang Fang	Wang Guangyu	Wang Guogang	Wang Yongli
Xiao Geng	Yang Tao	Zhang Chengsi	Zhang Jie	Zhang Ming
Zhang Zhixiang	Zhao Xijun	Zhou Daoxu	Zhou Guangwen	Zhou Yueqiu
Zhuang Enyue				

Name of Journal: International Monetary Review

Frequency of Publication: Quarterly

Sponsor: International Monetary Institute of Renmin University of China

Publisher: Editorial Office of *International Monetary Review*

Editor-in-Chief: Ben Shenglin

Associate Editors: Song Ke, Qu Qiang, Xia Le

Managing Editor: Herbert Poenisch

Associate Managing Editor: Dong Xijun

Assistant Editors: Zhang Yulan

Editorial Office:

International Monetary Institute, Renmin University of China

Room 605, No. 59 Zhongguancun Avenue, Beijing 100872, China

Tel: 86-10-62516755

Email: imi@ruc.edu.cn

Website: www.imi.ruc.edu.cn/en/



WeChat

We only share the most valuable
financial insights

CONTENTS

Special Column on China's Two Sessions and Economic Outlook for China

Understanding Economic Messages Contained in China's 2023 "Two Sessions"

----- *Dong Jinyue and Xia Le*/01

Putting the Economy Back on Track and Remaining Risks: Work of the NPC and CPPCC Sessions

----- *Herbert Poenisch*/05

Excessive Consumer Credit Not Good to Boost Consumption ----- *Li Jianjun*/12

How Will the Chinese Yuan Fare in 2023 as Fed Keeps on Tightening? ----- *Guan Tao*/14

Global Economy

Global Economy to Slow Further Amid Signs of Resilience and China Re-opening

----- *Pierre-Olivier Gourinchas*/16

Looser Financial Conditions Pose Conundrum for Central Banks

----- *Tobias Adrian, Christopher Erceg, Fabio Natalucci*/21

Everything Everywhere All at Once - Responding to Multiple Global Shocks

----- *Fabio Panetta*/26

Accelerating Productivity Growth can Save the Global Balance Sheet ----- *Jan Mischke*/41

China's Impact on the Fate of the Global Balance Sheet ----- *Andrew Sheng and Xiao Geng*/43

Cross-border Payments have Reached an 'Inflection Point' ----- *Lewis McLellan*/45

House Prices Continue to Fall as Borrowing Costs Rise

----- *Hites Ahir, Prakash Loungani, Karan Bhasin*/47

Recent Financial Stability Crisis

Silicon Valley Bank Collapse Reverberates through Financial System ----- *Mark Sobel*/48

Reform of International Monetary System

Central Banks are Reassessing Foreign Exchange Reserves ----- *Gary Smith*/50

Markets Exploring Alternative Currencies despite Dollar Dominance ----- *Julian Jacobs*/52

Financial Regulation

Big Techs in Finance: Forging a New Regulatory Path ----- *Agustín Carstens*/54

Crypto Contagion Underscores Why Global Regulators Must Act Fast to Stem Risk

----- *Li Bo and Nobuyasu Sugimoto*/58

Effective Crypto Regulation Starts at Layer 1

----- *Michael Kanovitz*/62

Sustainable Growth

Scaling up Climate Finance for Emerging Markets and Developing Economies ----- *Li Bo*/64

Carbon Finance is at the Core of Climate Goals ----- *Marcus Pratsch and Frank Scheidig*/67

Working Paper

Dancing with Dragon: the RMB and Developing Economies' Currencies

----- *He Qing, Liu Junyi and Yu Jishuang*/69

Digital Financial Capability and Household Entrepreneurial Performance

----- *Luo Yu, Peng Yuchao and Zeng Lianyun*/92

Special Column on China's Two Sessions and Economic Outlook for China

Understanding Economic Messages Contained in China's 2023 "Two Sessions"

By JINYUE DONG AND LE XIA*

China's annual "two sessions", namely the National People's Congress (NPC) and the Chinese People's Political Consultative Conference (CPPCC) officially concluded, which have always been the top priority in China's political agenda every year. It usually commences in Beijing in March every year and lasts for around one week.

In the week-long sessions, delegates from around the country reviewed the Government Work Report by Premier Li Keqiang that discussed the most important issues concerning various dimensions of national affairs, ranging from the summary of last year's pandemic control endeavors and economic achievements to the announcement of 2023 key economic targets and policy stimulus; from concluding the past year's accomplishment of the second year of the 14th Five-year Plan to outlining the blueprint of China's long-term new growth model etc.

The "two sessions" of this year have specially attracted global attention due to a confluence of factors, including the ongoing global economic downturn, China's recovery in the post-Covid era, and the reshuffling and reforms of China's State Council, the country's chief administrative authorities. The market expects the new stimulus package by means of expansionary monetary and fiscal policy initiatives to support growth after China lifted its three-year-long "zero Covid" policy at the end of 2022. However, amid global growth slowdown due to aggressive central bank interest rate hike to curb historical high inflation, external demand for China in 2023 will be particularly weak. Under this circumstance, how to stimulate domestic demand, especially domestic consumption and investment, at the same time to secure real estate market soft-landing and to repair damaged household and enterprises' balance sheet become the key challenge of Chinese authorities in the post-pandemic era.

The market is particularly concerned about the following questions in this year's "two sessions": (i) Amid slowdown of external demand in 2023, how to stimulate domestic consumption and investment; (ii) How to stimulate real estate activities and reposition real estate sector for Chinese economy; (iii) What will be the growth target in 2023 and the other related economic targets; (iv) What measures will be announced to boost FDI, portfolio inflows and exports, and ultimately financial liberalization and RMB internationalization? (v) How to describe China's long-term "new growth model" and how to balance short term growth stimulus with long-term debt overhang and financial stability; and at the same time, how to deal with a series of long-term challenges, such as geopolitical risks, aging society, structural reforms, technology self-reliance as well as transformation of "new growth model"?

* Jinyue Dong is Senior Economist at BBVA Research; Le Xia is Asia Chief Economist at BBVA Research.

The main takeaways of this year's "two sessions" include below important perspectives: 2023 growth target and a series of other key economic targets; 2023 monetary and fiscal policy outlook; and the State Council institutional reforms.

In general, the "around 5%" growth target and other economic targets are in line with the market expectations, considering the challenges to rebuild market sentiments and repair households and enterprises' balance sheets after lifting three-year "zero Covid" policy. Amid the US Fed interest rate hike cycle, monetary policy is described as prudent and "targeted", excluding possibilities of LPR cut in the rest of the year; while the expansionary fiscal policy remains the main growth stimulus. Finally, a series of reshuffling and restructuring of State Council departments in technology, financial regulation and data bureau indicate the authorities' determinations to deal with China-US technology war, technology self-sufficiency, financial stability concerns as well as national security.

Altogether, the new generation of top political leadership in China together with the new structured State Council is anticipated to promulgate more policy stimulus in various perspectives to secure a strong economic rebound and housing market soft-landing after lifting "zero Covid" at end-2022.

Here are some highlights of the main takeaways of this year's "two sessions" and the 2023 Government Work Report:

Institutional Reform of the State Council: The authorities have conducted some important institutional reforms of the State Council which is the country's chief administrative authorities. The State Council reforms will cement President Xi's control of the entire state apparatus to tackle different kinds of domestic and international challenges. Three important highlights of the State Council reforms include:

(i) The "two sessions" announced to establish the super regulator for the financial sector- National Financial Regulatory Administration to replace and unify the previous China Banking and Insurance Regulatory Commission (CBIRC), consolidating financial system regulation and oversight, which aimed at closing loopholes with multiple agencies monitoring different aspects of financial industry. The setting up of the new super financial regulatory body comes as the authorities seeks to rein in large corporate and financial institutions that may bring systemic financial risks through regulatory arbitrage among previous multiple authorities. Meanwhile, we need to pay attention that China Securities Regulatory Commission (CSRC) will be maintained and its next step's policy focus will be to press ahead registration-based IPO system.

(ii) In the high-tech area, the authorities restructured its Science and Technology Ministry to concentrate resources on achieving technology breakthroughs and self-sustained supply chain as well as to meet the challenges from other countries' high-tech sanctions and potential decoupling, amid the long-lasting China-US technology war and the US's efforts to block China's access to key technology.

(iii) The "two sessions" also announced to establish National Data Bureau, which will be run by the National Development and Reform Commission (NDRC), and will absorb some of the functions of the Office of the Central Cyberspace Affairs Commission that oversees China's internet. The new data bureau will cover the exchange of information resources across industries and promote smart cities. In recent years, China has strengthened oversight on data with the belief that data has become a strategic economic resource, and concerned that unchecked collection by private firms could allow rivals to weaponize information on national securities. Except for dealing with national security issue, the establishment of National Data Bureau is also in line with the "new growth model" and "new infrastructure" investment in a bid to prioritize digital economy in China.

GDP growth target for 2023 is set to be at "around 5%" and other economic targets are promulgated. The "around 5%" growth target is in line with our expectation, which takes into account China's recent reopening of its economy at end-2022 thus there are many challenges ahead to stimulate domestic demand and to rebuild market confidence after three

years of “Zero Covid” policy. It is also in line with IMF’s China 2023 growth forecasting at 5.2% and market consensus forecasting at 5.1%. While a faster growth rate is expected, there are other policy targets announced, including sustainable and high-quality growth instead of pursuing the growth figure per se. Other economic targets of 2023 were also promulgated in the Government Work Report are listed below:

(i) The employment target is to create over 12 million new urban jobs this year, and a surveyed urban unemployment rate is set at 5.5%.

(ii) The inflation target is set to be around 3%, which in our opinion is easy to achieve given the current domestic deflationary environment and dipping global commodity prices.

(iii) Household income growth is set to be in line with nominal GDP growth which is around 7% based on our forecast.

(iv) The economic targets also include a more balanced Balance of Payments (BoP) in 2023 and to promote export quality and growth.

(v) The Government Work Report also highlights the determination of reducing carbon emission, controlling the consumption of fossil fuels and reducing the energy consumption per GDP unit.(Table 1)

Expansionary fiscal policy and prudent monetary policy to support growth recovery after lifting “zero Covid”. Several key figures on fiscal expansion in 2023 include:

(i) Fiscal budget is announced to be 3% of GDP which is higher than the previous year’s deficit budget at 2.8%.

(ii) No tax cut and fee reduction figures were announced in this year’s “two sessions”, but it mentioned tax cut and fee reduction policy will continue from the previous year.

(iii) The special-purpose local government bonds issuance quota is set to be RMB 3.8 trillion in a bid to support infrastructure investment, higher than the previous year’s RMB 3.65 trillion announcement but lower than last year’s actual total local government bond issuance at RMB 4.15 trillion.

From the monetary policy perspective, M2 and total social financing annual growth is announced to be in line with the nominal GDP growth rate which we estimate will be around 7%. In addition, the monetary policy will be more “targeted” and refrain from resorting to a deluge of strong stimulus policies, considering the FED interest rate hike and the financial instability risks such as debt overhang, RMB depreciation and capital outflows etc. Under this circumstance, we anticipate there will be no LPR cut throughout 2023 and 1-2 RRR cut this year after FED actually stops rate hike in the second half of this year. The authorities also re-emphasize the targeted easing measures, that means more structural and quantitative monetary policy tools instead of price tools will be deployed in 2023.

In sum, the achievements of 2023 “two sessions” indicate not only a smooth political transformation, but also a more stable and united political environment for China to focus on economic development and structural reforms. Looking ahead, there are still challenges in both short term and long term.

2023 will be the “Year of China” amid global recession fears in the US and EU due to the aggressive central bank’s interest rate hike. The hike also triggered financial market instability such as the recent failure of Silicon Valley Bank (SVB) and related banks in the US, which might have spillover effect to the financial system in the US and other vulnerable emerging markets. After lifting “zero Covid” policy at end-2022 as well as promulgating housing market stimulus and the expansionary fiscal and monetary measures to support growth, we expect 2023 China GDP growth will reach 5.2%, compared with “around zero” growth in the US and EU.

However, several caveats are noteworthy for Chinese economy both in the short term and in the long term.

In the short term: first, external demand in 2023 will be very weak which we forecasts -2% export growth in 2023, thus how to stimulate growth by domestic demand, particularly consumption and housing investment will be the key to economic success; second, rebuilding

market confidence and repairing household and enterprises' balance sheets will also be essential in 2023. After three years of lockdown, China experienced “balance sheet recession” both in enterprises and households as households are reluctant to borrow to consume and enterprises are reluctant to borrow to invest amid economic slowdown. Thus, expansionary fiscal policy and more targeted monetary easing are anticipated in 2023 to support economic recovery and housing market soft-landing.

A series of long-term issues will center on aging, debt overhang, geopolitics, carbon neutrality and China's new growth model. For instance, how to achieve China's long-term “new growth model” which is underpinned by technology self-sufficiency, carbon neutrality and common prosperity. In addition, how to balance short term growth policy stimulus with long-term debt overhang and financial stability will also remain to be the challenge for Chinese authorities.

Table 1. COMPARISON OF 2022 AND 2023 TARGETS SET ANNOUNCED BY THE GOVERNMENT WORK REPORT

	2022 target	2022 actual	2023 target
GDP	5.5%	3%	Around 5%
CPI	3%	2%	3%
M2	In line with nominal GDP growth	In line with nominal GDP growth	In line with nominal GDP growth
Total social financing	In line with nominal GDP growth	In line with nominal GDP growth	In line with nominal GDP growth
Fiscal Deficit	-2.8%	-3.2%	-3%
Special Government Bond	No issuance	No issuance	No issuance
Local Government Special Bond	RMB 3.65 trillion	RMB 4.15 trillion	RMB 3.8 trillion
Survey unemployment rate	5.5%	5.6%	5.5%
Urban employment	11 million	12.06 million	12 million

Source: BBVA Research and 2022, 2023 Government Work Report

Putting the Economy Back on Track and Remaining Risks: Work of the NPC and CPPCC Sessions

By HERBERT POENISCH*

By the end of 2022 China's economy seemed to be faltering, far below the targeted 5.5% of growth envisaged in last year's 2 sessions.

This article will look at the reasons for the bad performance, the U turn envisaged to alleviate economic woes and finally the risks remaining for the new outlook.

1. Which factors dragged down growth in 2022

After the 20th CPC Congress the outlook for China's economy seemed rather bleak. The zero covid19 policy with repeated lockdowns caused disruptions in production and distribution of commodities, for domestic consumption as well as for exports. This affected not only big enterprises but mostly MSMEs which had already drawn down their savings cushions during the first two years of covid. Private consumption of goods and services had been stagnant already as households had no income and were not able to physically consume.

Private investment had been adversely affected by the excessive regulatory crackdown and ideological castigation of private profits in favour of common prosperity. Clear signals were given at the 20th CPC Congress, that state enterprises would be the backbone of the Chinese economy, for growth as well as for employment. The private sector had already been bruised by pressure from the authorities on top of the scandals which had plagued the real estate sector. The housing bubble of the previous years had given way to excess housing supply and over indebted property developers.

Both these features, zero covid19 policy and stagnation of the real estate sector has pushed local governments to their debt limitations. They had to shoulder the costs of the zero covid19 policy by financing all the preventive measures, such as testing and quarantine. In addition, the stagnation of the real estate sector has deprived local governments of essential income from the allocation of building land. They had to resort to special bond borrowing and local government financing vehicles (LGFV).

The foreign community had not only been bruised by repeated lockdowns of expat residents but also by increasing negative sentiment of foreign investors. They not only reversed their capital inflows into China in the form of equity and bonds during 2022, but even foreign banks withdrew funds rather than the traditional lending to Chinese entities, government, banks and financials, as well as enterprises. The perceived decoupling from the West has fundamentally shaped sentiments.

The EU Chamber of Commerce has stated that China's standing as an investment destination has been eroded because of three new policy directions. These were echoed in a speech by EU President Van der Leyen on the evening of her China visit in early April 2023.

1) China's predictability is being eroded by the frequent, erratic policy shifts that have taken place in recent months, such as the unexpected disruptions to power supplies that took place in 2021, and the sudden mass lockdowns that were imposed in an attempt to contain COVID. The surprise crackdowns on the technology and education sectors have also made it clear to business that certainty can no longer be taken for granted and have left many wondering which industry will be targeted next.

2) China's reliability is increasingly being questioned. The inability to carry out independent third-party audits of China operations means the country is no longer viewed as a

* Herbert Poenisch, Former Senior Economist of BIS.

stable sourcing destination. External factors such as new globally-binding regulatory measures have added additional layers of complexity.

3) China's efficiency is being undermined as companies decouple parts of their China operations from global operations, both to hedge against potential global shocks and to remain compliant in both China and their home markets. At the same time, structural advantages that the country had previously capitalised on to great effect, such as its 'demographic dividend', are rapidly fading, leading to a loss of productivity.

These observations have manifested themselves in the following areas:

SOE reforms have stalled, and policymaking has become more ad hoc

COVID policy has become inflexible and inconsistently implemented

Diversity is dwindling and opportunities for knowledge-exchange are scarce

Business is becoming increasingly politicised

Supply chain strategies have been disrupted and are shifting

The American Chamber of Commerce echoed some of these concerns. Their survey listed the following major concerns:

Rising tensions in US-China relations

Covid19 prevention measures

Inconsistent regulatory interpretation and unclear laws and enforcement

Rising labour costs

Regulatory compliance risks

Even the IMF notes various negative trends in its annual consultations:

China's growth is slowing in the face of both cyclical and structural headwinds.

Amid the sharpening trade-off between growth and protecting lives, the authorities started relaxing COVID policies.

The property crisis has intensified during 2022.

Structural policy trends are clouding medium-term growth prospects.

Growth remains under pressure and lacks balance as private consumption continues to underperform.

External tailwinds are fading, with increased capital outflow and exchange rate pressures.

Weak demand has resulted in labour market strains and muted inflation pressures.

Macroeconomic policies appropriately turned expansionary again, but provided little support to rebalancing.

The unbalanced recovery and extreme weather events have made the achievement of China's near-term climate goals more challenging.

Real estate developer restructuring continues to be slow, despite a very large share of the sector being in financial distress.

Despite the broadening policy response, the crisis has continued and the need for large-scale restructuring remains.

Risks are tilted to the downside.

2. China's U-turn to focus on the economy and to address inadequacies

Now that the annual meetings of the National People's Congress and China Peoples' Consultative Conference have been concluded in Beijing with a lot of fanfare, the necessary decisions to boost the economy have been taken. These include spelling out the government's economic priorities, plans for reforming the administrative structure and changes to leadership. These decisions have been taken clearly as domestic necessity but they also address some international concerns above.

This is a welcome confidence boost for China and the world economy. It comes after a dismal performance in 2022, zero Covid-19 policy, regulatory crackdown and ideological orientation set in the 20th CPC Congress. It shows that the Chinese leadership has put the welfare of the people above everything else. It was clearly stated that domestic demand, private consumption and employment are top priorities.

In his report, Premier Li Keqiang acknowledged that in 2022 China's economy was impacted by Covid-19 and other domestic and international factors beyond its expectations. China was confronted with new downward pressure on the economy.

Overcoming great difficulties and challenges, China succeeded in maintaining overall stable economic performance. Amid a complex and fluid environment, China was able to generally accomplish the main targets and tasks for the year. To address lack of effective demand, China adopted a combination of measures to expand investment, stimulate consumption, and stabilize foreign trade.

Consumer spending was hit hard last year, and investment also suffered. In response, China launched several major projects set out in the 14th Five-Year Plan ahead of schedule. China adopted financial measures to meet people's demand for buying their first home or improving their housing situation and took concrete steps to ensure that overdue housing projects were completed and delivered.

In response to significant employment pressure, China boosted policy support to stabilize and increase employment. Despite high global inflation, China kept overall prices at a comparatively low level. Supporting the policy on expanding unemployment insurance coverage, China provided unemployment benefits to over 10 million people in total and also provided price subsidies for more people on low incomes, benefiting about 67 million in all.

In response to a succession of grave challenges, including mounting protectionism and the Covid-19 pandemic, China adopted new ways of conducting macro regulation and avoided overreliance on investment as a means of achieving economic growth. It employed a wide range of policies including fiscal and monetary policies, made them more targeted and effective, and responded to market changes directly. It stayed focused on helping market entities overcome difficulties and grow and thus kept employment stable and ensured people's wellbeing.

China channelled more financial resources toward lower levels of government, with the share of transfer payments to local governments rising to about 70 percent of central government expenditures. It introduced direct allocation of central budgetary funds to prefecture- and county-level governments and made it a regular practice.

China made flexible policy adjustments in view of new developments and maintained reasonably sufficient liquidity. It made good use of policy instruments such as required reserve ratio reductions and re-lending to increase effective support for the real economy and alleviate the difficulties faced by MSMEs in accessing affordable financing. Using market- and law-based means, it took targeted steps to deal with the risks of several large enterprise groups and made steady headway in defusing risks in high-risk small and medium-sized financial institutions.

China continued reforms to develop the socialist market economy and struck a proper balance between the government and the market. This enabled the market to play a decisive role in resource allocation and the government to better play its role, thus promoting both an efficient market and an effective government.

While delegating power, China also improved regulation by strengthening ongoing and ex post oversight. It saw to it that regulatory responsibilities were strictly fulfilled, that no regulatory vacuums were left, and that no power was delegated at the expense of regulation. It took stronger action against monopolies and unfair competition, fully implemented the system of fair competition review, and reformed the system for enforcing anti-monopoly laws.

The tasks set out in the three-year action plan for SOE reform were completed and the modern corporate structure was improved, thus enabling SOEs to upgrade and restructure their operations so as to focus on their primary responsibilities and core business and enhance quality and performance.

To increase China's strength in strategic science and technology, it launched a number of major sci-tech innovation projects and stepped up efforts to secure breakthroughs in core technologies in key fields.

China expanded effective investment to shore up weak links, promote structural adjustments, and sustain growth momentum. Innovations were made in investment and financing systems and mechanisms, and nongovernmental investment increased several times over under the guidance and drive of central government budgetary investment. China increased the scale of local government special-purpose bonds, with a high priority given to the development of sectors such as transportation, water conservancy, energy, information, and other infrastructure as well as projects for the people's wellbeing. China also encouraged nongovernmental capital to participate in the construction and operation of such projects, and this stimulated investment from nongovernmental sources.

China made further progress in building up the national security system and capabilities. Cyber security, data security, and personal information protection were strengthened.

In spite of these achievements, many difficulties and challenges still remain.

Uncertainties in the external environment are on the rise. Global inflation remains high, global economic and trade growth is losing steam, and external attempts to suppress and contain China are escalating.

Domestically, the foundation for stable growth needs to be consolidated, insufficient demand remains a pronounced problem, and the expectations of private investors and businesses are unstable. Many MSMEs and self-employed individuals face great difficulties. The task of maintaining employment stability is challenging, and the budgetary imbalances of some local governments are substantial. There are many risks and hidden dangers in the real estate market. The operating risks of some small and medium financial institutions have been exposed.

There are still many institutional barriers hindering development. China's capacity for scientific and technological innovation needs to be further improved. It still has a long way to go in protecting the environment. There are still major weak links in urban and rural infrastructure for disaster prevention and mitigation and other purposes. Weak links also persist in areas important to the people's lives.

Regarding the administration, pointless formalities and bureaucratism remain acute issues. Some local governments have used one-size-fits-all approaches or taken excessive measures when implementing policies. Some officials fail to fulfill their duties, act arbitrarily, or work in an oversimplified way. Some are detached from reality, go against the public will, or disregard the legitimate rights and interests of the people. Corruption remains a common problem in some fields, sectors, and localities.

For the current year the following priorities were set:

It is essential to prioritize economic stability and pursue progress while ensuring stability. Confronted with a situation in which strategic opportunities, risks, and challenges are concurrent and uncertainties and unforeseen factors are rising, China should keep policies consistent, stable, and targeted and see that they are carried out in a more coordinated way to create synergy for high-quality development do doing the following:

- 1) Expanding domestic demand***
- 2) Accelerating the modernization of the industrial system***
- 3) Unswervingly consolidating and developing the public sector and unswervingly encouraging, supporting, and guiding the development of the non-public sector***
- 4) Intensifying efforts to attract and utilize foreign investment***
- 5) Effectively preventing and defusing major economic and financial risks***
- 6) Stabilizing grain output and advancing rural revitalization***
- 7) Continuing the transition to green development***

8) Meeting people's basic living needs and developing social programs

These priorities show that the Chinese leadership puts priority on improving the livelihood of ordinary people which had been battered during the pandemic. While this is commendable, not enough clear analysis has been made on the remaining economic and financial risks and how to deal with them.

3. Addressing economic and financial risks

In Li Keqiang's speech China acknowledged that it needs to deepen reform of the financial system, improve financial regulation, and see that all those involved assume their full responsibilities to guard against regional and systemic financial risks. China should ensure effective risk prevention and mitigation in high-quality, leading real estate enterprises, help them improve debt-to-asset ratios, and prevent unregulated expansion in the real estate market to promote its stable development.

To prevent and defuse local government debt risks, China should improve the mix of debt maturities, reduce the burden of interest payments, and prevent a build-up of new debts while working to reduce existing ones. Intimately linked to the local governments financial performance is the performance of rural banks which had rising NPLs and need for financial support.

In order to capture these overarching risks and address them in a comprehensive fashion the creation of a single Central Financial Regulatory Authority is being envisaged. This comes on top of a Financial Stability and Development Commission (FSDC). So far financial regulation and supervision has followed the 'twin peak' model. The FSDC has been responsible for systemic risk management, whereas individual sectoral regulators regulate and supervise sectors as well as players.

Banks and insurance were the responsibility of the Banking and Insurance Regulatory Commission (CBIRC), brokers and securities market were the responsibility of the Securities Commission (CSRC). Non-bank financial business, including holding companies such as Ant Finance were regulated and supervised by the People's Bank of China (PBC). However, as there were gaps in regulation and supervision, the new regulatory authority directly under the CPC should ensure that no entity creating financial risk could escape the system, as well as prevent regulatory arbitrage and ensure regulatory compliance.

It is argued here that establishing yet another body for risk control is adding another layer on regulation and supervision, dealing with the manifestation of risks, while the roots of economic and financial risks are found elsewhere. Some of these are well within the control of Chinese authorities whereas others a well beyond their power.

Risks are found in the incomplete restructuring of state enterprises, as they perform central planning mandates while operating in a market environment. They were given priority in President Xi Jinping's speech to the 20th CPC Congress, while being given the responsibility for solving the employment problem as well as market failures such as bubbles in the real estate sector. This ambiguous role for SOE is part of the business climate becoming politicised.

Secondly, the abolition of the zero covid 19 policy has not eliminated the risk of a resurgence of the pandemic. The annual work report is silent about what can and should be done in such case. A reintroduction of restrictions or even lockdown carries major risks for

the economy and finance which are well outside the mandate of the new risk control framework.

The disruption of supply chains is a risk for foreigners relying on timely supplies of Chinese products but also for Chinese production. This is tied in with rising US-China trade tensions or even decoupling, which could seriously disrupt supply chains. This risk is well beyond the authority of a new risk assessment authority.

Avoiding arbitrary regulatory interpretations and shifting regulatory compliance requirements are well within the power of Chinese authorities. It is part of what Premier Li has called excess bureaucracy, such as some officials failing to fulfill their duties, act arbitrarily, or work in an oversimplified way. Some are detached from reality, go against the public will, or disregard the legitimate rights and interests of the people. Corruption remains a common problem in some fields, sectors, and localities. As a result they continue pose economic and financial risks.

The next risk is in the area of employment and wage costs. Making private consumption a priority requires boosting employment and household purchasing power. State enterprises have been mandated to help with creating jobs, but the major providers of employment, particularly youth employment are private investors. They have been bruised by recent regulatory crackdown and they are sitting on the fence, being repeatedly assured by the authorities. Wages have been stuck rather than boosted by the monetary policy liquidity boost which has gone mainly to SOE.

The real estate sector crisis has been addressed but not really solved. It was a classical bubble and needs all classical tools to deflate the bubble with increase in financial risk for financial as well as non-financial players, notably local governments involved.

The rectification of the real estate sector is intimately linked with the debt problems of local governments and rural banks. Local governments had to shoulder the burden of zero covid 19 policy, while being deprived of their usual income from real estate allocation. Similarly, rural banks were hit by the economic fallout from the real estate crisis which manifested itself in higher NPLs.

Finally, the behaviour of foreigners poses an economic as well as financial risk which is beyond the control of Chinese authorities. During the stagnation of 2022 foreign investors withdrew funds from the equity as well as the bond market, but also foreign banks withdrew funds from Chinese borrowers, banks as well as non-banks. In this way they expressed their view of increased risk of investment in China. China wooed these investors back in a Financial Summit in Hong Kong in November 2022. While most powerful investors supported their commitment to China, actions will speak louder than words. However, it has become more difficult to monitor their investment behaviour as the detailed balance of financial accounts does not get published any more by SAFE as from mid-2022.

Conclusion

While it is commendable to create a new financial regulatory authority to control the economic and financial risks in the economy, this deals with the manifestation rather than the roots of risk. In a market-based economy risks always exists. They cannot be regulated away. They can only be dealt with in a two-pronged approach.

According to Western understanding, regulations concern the individual economic agents which should act within a set of clear and transparent guidelines how to assess and manage their microeconomic risks. Regulatory ambiguity and arbitrage should be avoided as well as inadequate compliance. Even if all agents were managing their risks according to these guidelines, would that guarantee systemic stability? There has been substantial discussion on the subject with the conclusion that systemic financial stability cannot be guaranteed even by well managed regulation and compliance.

There are risks beyond individual players, such as natural disasters, externalities and lack of confidence in economic and financial developments. Emerging geopolitical risks which are well beyond any individual institution, or even beyond the power of a national economy, albeit an important one, have escalated in the recent past and loom big on the horizon.

Literature used

- AmChamChina (2023): China Business Climate Survey Report. www.amchamchina.org
- Chorzempa, Martin and Veron, Nicholas (2023): Will China's new financial regulatory reform be enough to meet the challenges? In: Breugel Policy Brief No 8/23 www.breugel.org
- European Chamber of Commerce in China (2022): European Business in China, Position Paper 2022/2023 www.europeanchamber.com.cn
- International Monetary Fund (2023): People's Republic of China 2022 ARTICLE IV CONSULTATION—PRESS RELEASE; STAFF REPORT; AND STATEMENT BY THE EXECUTIVE DIRECTOR FOR THE PEOPLE'S REPUBLIC OF CHINA, IMF Country Report 23/67, February www.imf.org/publications
- LI Keqiang (2023): Report on the Work of the Government (English translation). Delivered at the First Session of the 14th National People's Congress of the People's Republic of China on March 5, 2023 www.fmprc.gov.cn
- Poenisch, Herbert (2023): China is putting its economy back on track. www.omfif.org
- Xi Jinping (2022): Speech by President Xi Jinping to the 20th National Congress of the CPC www.gov.cn
- Von der Leyen (2023): Speech by President von der Leyen on EU-China relations to the Mercator Institute for China Studies and the European Policy Centre, 30 March www.ec.europa.eu/commission/presscorner

Excessive Consumer Credit Not Good to Boost Consumption*

By LI JIANJUN *

The Central Economic Work Conference which was held in December said that boosting domestic demand will be a key task of the government in 2023, which means the government will take measures to help increase Chinese people's consumption and create favorable conditions for sale of consumer goods.

Given that the global economy is likely to fall into recession this year, weakening external demand could hurt the Chinese economy. Therefore, stimulating consumption is important to promote China's economic recovery. And many claim that developing consumer credit is a good way to expand consumption.

Consumer credit is a financial service provided by both financial and non-financial institutions to help consumers enjoy intertemporal consumption. In recent years, thanks to the popularity of digital technologies such as cloud computing, big data and artificial intelligence, China's digital consumer credit has seen rapid development.

Compared with traditional consumer credit, digital consumer credit has a wider ambit, and can ensure the delivery of consumer credit services to lower-tier markets and effectively allocate credit resources so as to better promote the development of the real economy.

True, consumer credit has played a key role in increasing residents' consumption. But can consumer credit be used to facilitate rapid consumption growth?

As far as the consumer credit mechanism promoting residents' consumption is concerned, its most important role is to support effective intertemporal fund allocation. Consumer credit can provide consumers with funds to maintain their existing consumption level even if their income is insufficient for the time being, because in case a consumer's income declines unexpectedly, consumer credit can supplement that income gap, allowing the consumer to maintain his/her optimal consumption level in accordance with his/her normal income.

But irrespective of the situation, only if consumers repay the credit, for which they have to raise their income in the future, can the increase in consumption due to consumer credit be sustainable. From this perspective, consumer credit is only a tool to ensure intertemporal allocation of funds. The most important factor that can boost consumption is increased incomes of residents.

In the long run, however, excessive consumer credit will crowd out the funds needed for real investment, while insufficient investment could inhibit consumption growth if residents' incomes do not increase.

More important, international experience shows that consumption supported by consumer credit is full of risks. The "credit card" crises in Japan and the Republic of Korea, and the subprime mortgage crisis in the United States all reflect that rapid development of consumer credit, especially short-term consumer credit, cannot ensure the sustainable growth of consumption. Instead, it could cause serious negative impacts on the entire economy.

* Published on China Daily on February 9 2023

* Li Jianjun, vice-president of Central University of Finance and Economics

Personal consumer credit services such as digital consumer credit and credit payment are related to a wide variety of consumption scenarios, and risks such as excess debt and irrational consumption cannot be ignored. Also, since individual consumer credit institutions pursue profits when promoting consumer credit products and services, they can at times induce consumers to spend beyond their means.

For young people and low-income groups, once they form the habit of relying on credit consumption to maintain their consumption level, they can be over-burdened with debt within a relatively short time.

As an important tool to encourage consumption and inject new vitality into the consumer market, moderate consumer credit can better release the consumption potential of residents. On the other hand, excessive consumer credit may prevent the smooth, sustainable growth of consumption, and slow macroeconomic development.

Thus balancing the relationship between boosting consumption and controlling risks is essential for consumer credit to play a positive role in the economy. So measures need to be taken to promote the healthy development of consumer credit.

It is also necessary to establish an effective mechanism for consumer credit self-compensation and a system to punish people for dishonesty and cheating, and help consumers enhance their knowledge about "responsible lending".

As for consumer credit institutions, they should ensure that the consumer credit products and services they provide are well within the repayment capability of the consumers. They can also use cloud computing, big data, artificial intelligence and other digital technologies to get a more accurate idea of the real economic condition of the consumers, improve the applicability and accuracy of credit services, and further reduce the risks associated with credit funds.

And consumers should honestly evaluate their own economic condition, how much credit they can repay, and make efforts to increase their incomes and reduce expenditure. In short, they should rationally use the intertemporal allocation of consumer credit, and refrain from blind borrowing and blind consumption.

How Will the Chinese Yuan Fare in 2023 as Fed Keeps on Tightening? *

By GUAN TAO[—]

In 2022, the US Federal Reserve aggressively raised interest rates and shrank its balance sheet, kicking off the fastest and steepest monetary tightening cycle in 40 years. Although the Chinese yuan exchange rate has undergone some adjustment and volatility, it has smoothly transitioned to two-way fluctuation now.

In 2023, the spillover effects of Fed's tightening monetary policy are expected to continue. Deepening the market-oriented reform of the exchange rate and maintaining the flexibility of the exchange rate will secure China's high-quality development and high-level opening-up against external shocks.

Chinese yuan in 2022 underwent the fastest and deepest adjustment since the major reform of the country's foreign exchange formation system in 1994. The Chinese yuan against the US dollar fell more than 13 percent in eight months - from 6.3 in March to 7.3 in November. The maximum amplitude of the central parity rate of the yuan exchange rate was equal to 73.2 percent of the average maximum amplitude of the central parity rate of other seven reserve currencies, including the US dollar, euro, yen, pound, franc, Canadian dollar and Australian dollar.

In the wide-range two-way fluctuation of Chinese yuan, China's foreign economic sector has shown growing resilience.

First, the accumulative surplus of foreign exchanges settlement by all Chinese lenders during March-November period reached \$60.1 billion.

Second, the leverage adjustment function of the exchange rate is in full play. In 2022, the main body of China's foreign exchange market will become more rational. Especially from September to October, when the yuan fell below 7 against the greenback, investors did not rush to buy foreign exchanges, but instead used their own foreign exchanges for external payments.

Third, the international balance of payment has maintained an autonomous balance, which was not impacted by increase in short-term net capital outflow.

It is expected there will be three possible scenarios for the Fed's trajectory of tightening in 2023. First, Fed will likely increase its tolerance for economic recession due to the decline in potential economic output this year. The monetary tightening may last longer than expectations, and the US dollar is likely to usher in a second phase of rise. Under the condition that other conditions remain unchanged, the yuan exchange rate will continue two-way fluctuations.

The second scenario is that at this stage, Fed is overemphasizing the benefits of monetary tightening, and the central bank may make another mistake, as excessive tightening will lead to a deep recession across the US economy.

Under the combination impact of high inflation and high unemployment, there is a high probability that the Fed will cut interest rates slowly in late 2023, and the trend of the dollar will be strong first and then weak through the year.

As the Chinese economy is more deeply integrated into economic and financial globalization than it was during the 2008 international financial crisis, the spillover impact of

* This article first appeared on Global Times on January 23, 2023.

— Guan Tao, BOC International's global chief economist and a former official at the State Administration of Foreign Exchange.

the Fed's monetary tightening on China will evolve into shock, and the yuan exchange rate will come under rising pressure.

The third scenario is that the Fed's excessive tightening may also lead to the bursting of the US assets bubble, leading to a deep economic recession like a financial crisis, and a rapid decline in inflation or even deflation. In 2023, the Fed may cut interest rates sharply, and the dollar will initially strengthen due to risk aversion, and then fall sharply. Under such circumstances, China will encounter the double impact of finance and trade, and the yuan will be under greater pressure.

However, in 2023, the rise and fall of yuan will not depend on the strength of the US dollar or the interest rate difference between China and the US, but on China's economic fundamentals. The Central Economic Work Conference held in December 2022 emphasized that in 2023, China must focus on stabilizing growth, employment, and prices. The three major indicators of growth, employment, and inflation will be an important reference for accurately judging the strength of China's economic fundamentals. With the optimization of pandemic responses and relaxed real estate regulation, the accelerated restart of the economy, domestic and foreign investors are mostly optimistic about the prospects for China's economic recovery and the growing value of the yuan.

This is a favorable condition for the strengthening of the yuan exchange rate trend in 2023. All parties should, on the basis of strengthening macroeconomic situation analysis and cross-border capital flow monitoring and early warning system, do a good job in scenario analysis, stress testing, and formulate response plans.

China should continue to enhance the autonomy of monetary policy and support finance to better serve the real economy. China should continue to reduce its reliance on administrative intervention and promote the establishment of a new development pattern for increase dual circulation. And, China should continue to promote balance of payments and macroeconomic stability to better safeguard national economic security.

Global Economy

Global Economy to Slow Further Amid Signs of Resilience and China Re-opening^{*}

By PIERRE-OLIVIER GOURINCHAS ^{*}

The fight against inflation is starting to pay off, but central banks must continue their efforts

The global economy is poised to slow this year, before rebounding next year. Growth will remain weak by historical standards, as the fight against inflation and Russia's war in Ukraine weigh on activity.

Despite these headwinds, the outlook is less gloomy than in our October forecast, and could represent a turning point, with growth bottoming out and inflation declining.

Economic growth proved surprisingly resilient in the third quarter of last year, with strong labor markets, robust household consumption and business investment, and better-than-expected adaptation to the energy crisis in Europe. Inflation, too, showed improvement, with overall measures now decreasing in most countries—even if core inflation, which excludes more volatile energy and food prices, has yet to peak in many countries.

Elsewhere, China's sudden re-opening paves the way for a rapid rebound in activity. And global financial conditions have improved as inflation pressures started to abate. This, and a weakening of the US dollar from its November high, provided some modest relief to emerging and developing countries.

Accordingly, we have slightly increased our 2022 and 2023 growth forecasts. Global growth will slow from 3.4 percent in 2022 to 2.9 percent in 2023 then rebound to 3.1 percent in 2024.

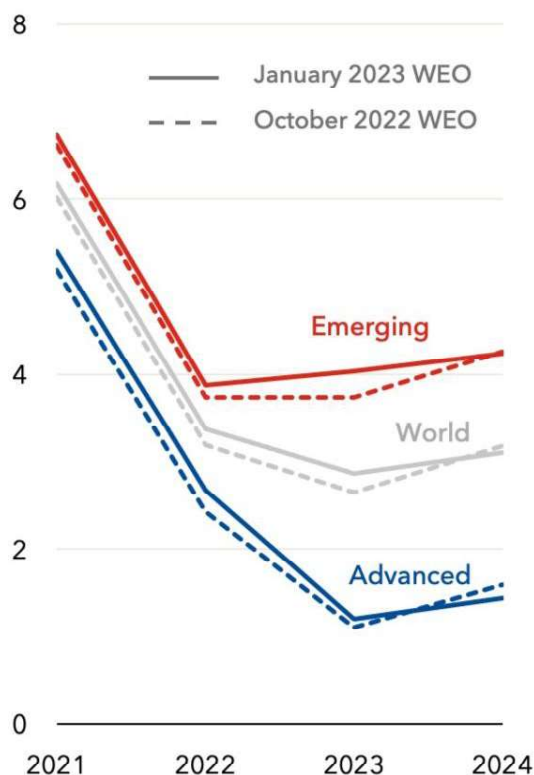
^{*} This article was published on the IMF website on January 30, 2023.

^{*} Pierre-Olivier Gourinchas, Economic Counsellor and the Director of Research of the IMF.

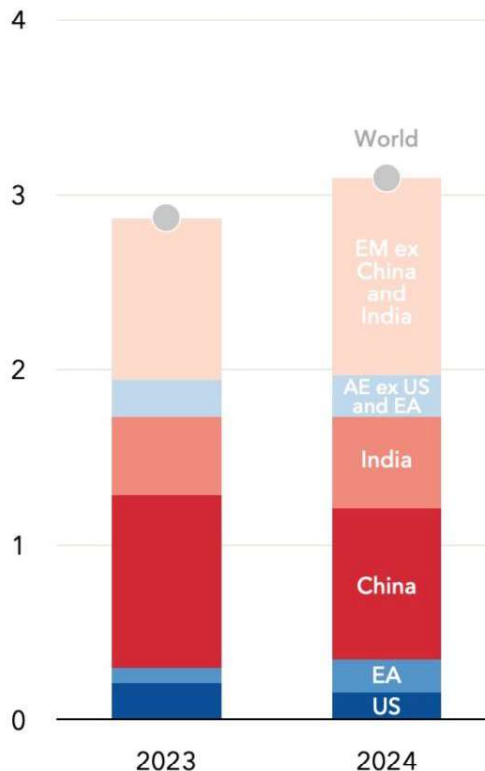
Global growth

China and India will be the major engines of growth this year.

Growth projections
(percent; year over year)



Contribution to world GDP growth
(percent share of world growth)



Sources: IMF, WEO January 2023 Update; and IMF staff calculations.

Note: AE = Advanced economies. EM = Emerging economies. EA = Euro area.

IMF

For advanced economies, the slowdown will be more pronounced, with a decline from 2.7 percent last year to 1.2 percent and 1.4 percent this year and next. Nine out of 10 advanced economies will likely decelerate.

US growth will slow to 1.4 percent in 2023 as Federal Reserve interest-rate hikes work their way through the economy. Euro area conditions are more challenging despite signs of resilience to the energy crisis, a mild winter, and generous fiscal support. With the European Central Bank tightening monetary policy, and a negative terms-of-trade shock—due to the increase in the price of its imported energy—we expect growth to bottom out at 0.7 percent this year.

Emerging market and developing economies have already bottomed out as a group, with growth expected to rise modestly to 4 percent and 4.2 percent this year and next.

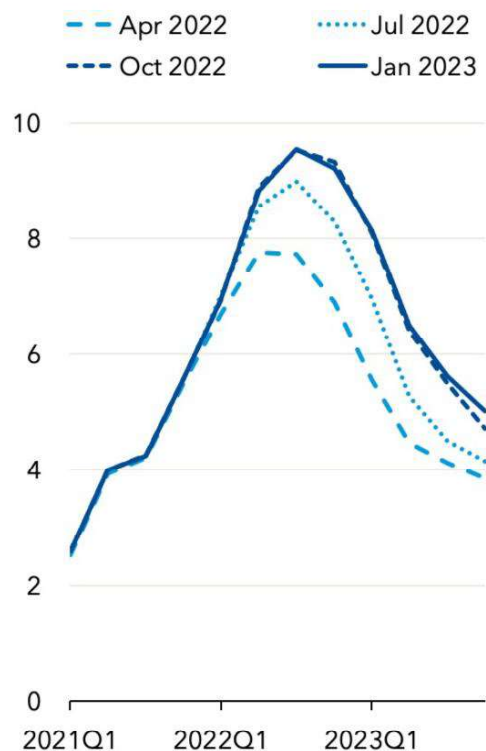
The restrictions and COVID-19 outbreaks in China dampened activity last year. With the economy now re-opened, we see growth rebounding to 5.2 percent this year as activity and mobility recover.

India remains a bright spot. Together with China, it will account for half of global growth this year, versus just a tenth for the US and euro area combined. Global inflation is expected to decline this year but even by 2024, projected average annual headline and core inflation will still be above pre-pandemic levels in more than 80 percent of countries.

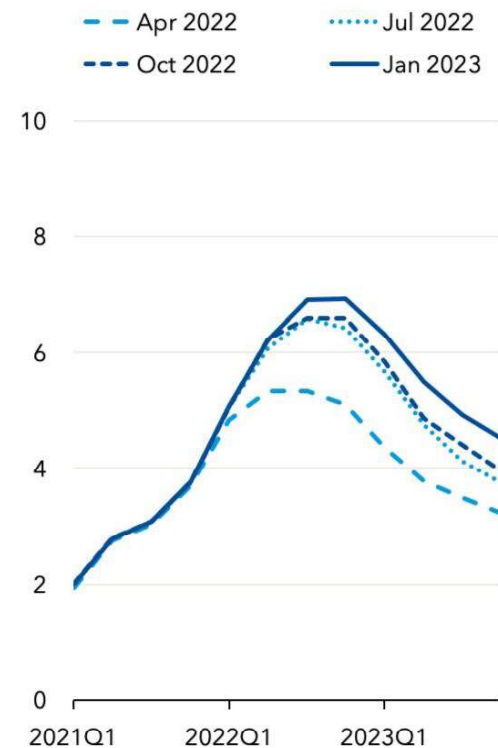
Inflation

Headline inflation is falling in many countries, but core inflation has been revised upwards.

Global headline CPI inflation
(percent; year over year)



Global core CPI inflation
(percent; year over year)



Sources: IMF, *World Economic Outlook*; and IMF staff calculations.

IMF

The risks to the outlook remain tilted to the downside, even if adverse risks have moderated since October and some positive factors gained in relevance.

On the downside:

- China's recovery could stall amid greater-than-expected economic disruptions from current or future waves of COVID-19 infections or a sharper-than-expected slowdown in the property sector
- Inflation could remain stubbornly high amid continued labor-market tightness and growing wage pressures, requiring tighter monetary policies and a resulting sharper slowdown in activity
- An escalation of the war in Ukraine remains a major threat to global stability that could destabilize energy or food markets and further fragment the global economy
- A sudden repricing in financial markets, for instance in response to adverse inflation surprises, could tighten financial conditions, especially in emerging market and developing economies

On the upside:

- Strong household balance sheets, together with tight labor markets and solid wage growth could help sustain private demand, although potentially complicating the fight against inflation

- Easing supply-chain bottlenecks and labor markets cooling due to falling vacancies could allow for a softer landing, requiring less monetary tightening

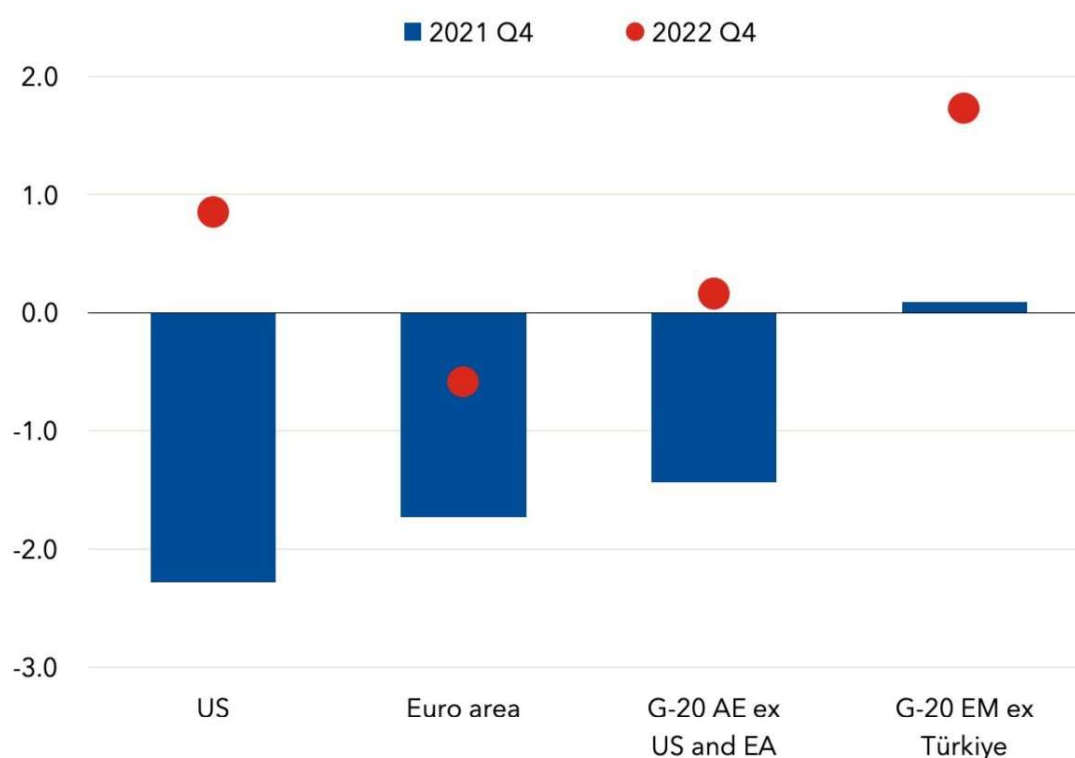
Policy priorities

The inflation news is encouraging, but the battle is far from won. Monetary policy has started to bite, with a slowdown in new home construction in many countries. Yet, inflation-adjusted interest rates remain low or even negative in the euro area and other economies, and there is significant uncertainty about both the speed and effectiveness of monetary tightening in many countries.

Real rates

Real policy rates remain low in some countries and, in the euro area, negative.

(nominal policy rate minus 3-yr ahead CPI inflation; percent)



Sources: Consensus Forecast; Haver Analytics; IMF, World Economic Outlook January 2023 Update; and IMF staff calculations. Note: Aggregates are 2022 PPP GDP weighted averages. AE = Advanced economies. EA = Euro area.



Where inflation pressures remain too elevated, central banks need to raise real policy rates above the neutral rate and keep them there until underlying inflation is on a decisive declining path. Easing too early risks undoing all the gains achieved so far.

The financial environment remains fragile, especially as central banks embark on an uncharted path toward shrinking their balance sheets. It will be important to monitor the build-up of risks and address vulnerabilities, especially in the housing sector or in the less-regulated non-bank financial sector. Emerging market economies should let their currencies adjust as much as possible in response to the tighter global monetary conditions. Where appropriate, foreign exchange interventions or capital flow measures can help smooth volatility that's excessive or not related to economic fundamentals.

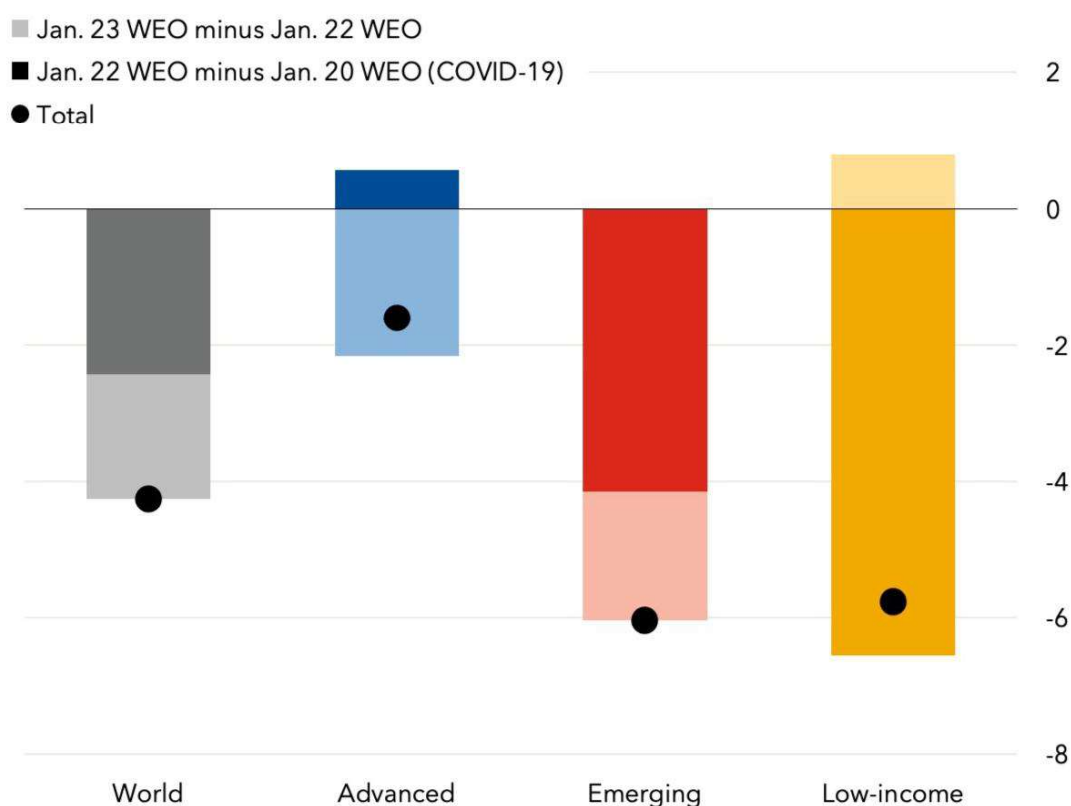
Many countries responded to the cost-of-living crisis by supporting people and businesses with broad and untargeted policies that helped cushion the shock. Many of these measures have proved costly and increasingly unsustainable. Countries should instead adopt targeted measures that conserve fiscal space, allow high energy prices to reduce demand for energy, and avoid overly stimulating the economy.

Supply-side policies also have a role to play. They can help remove key growth constraints, improve resilience, ease price pressures, and foster the green transition. These would help alleviate the accumulated output losses since the beginning of the pandemic, especially in emerging and low-income economies.

Scarring since the pandemic

Output losses have increased since last year's forecast.

(output losses relative to pre-pandemic trend, 2024, percent deviation)



Sources: IMF, World Economic Outlook January 2023 Update; and IMF staff calculations.

Note: Bars show the difference in real output in 2024 since 2019 and anticipated output for the same period prior to the pandemic for the indicated regional group.

IMF

Finally, the forces of geoeconomic fragmentation are growing. We must buttress multilateral cooperation, especially on fundamental areas of common interest such as international trade, expanding the global financial safety net, public health preparedness and the climate transition.

This time around, the global economic outlook hasn't worsened. That's good news, but not enough. The road back to a full recovery, with sustainable growth, stable prices, and progress for all, is only starting.

Looser Financial Conditions Pose Conundrum for Central Banks^{*}

By TOBIAS ADRIAN, CHRISTOPHER ERCEG AND FABIO NATALUCCI[—]

Despite sharp monetary policy tightening, financial conditions have eased around much of the globe, posing a challenge for central banks

Central banks aggressively hiked interest rates last year as inflation in many countries rose to the highest levels in decades. Now, falling energy prices are reducing headline inflation and fueling optimism that monetary policy may be eased later this year.

Such expectations have caused a sharp decline in global longer-term interest rates and boosted financial markets in advanced economies and emerging markets alike.

Though this may make it tempting to conclude that monetary policy is becoming overly restrictive and poised to cause an unnecessary economic contraction, investors may be too sanguine about progress on disinflation. While headline inflation has indeed fallen, and core inflation has receded slightly in some countries, both remain far too high. Central banks must therefore be resolute in their fight against inflation and ensure policy remains appropriately tight long enough to durably bring inflation back to target.

Aggressive tightening

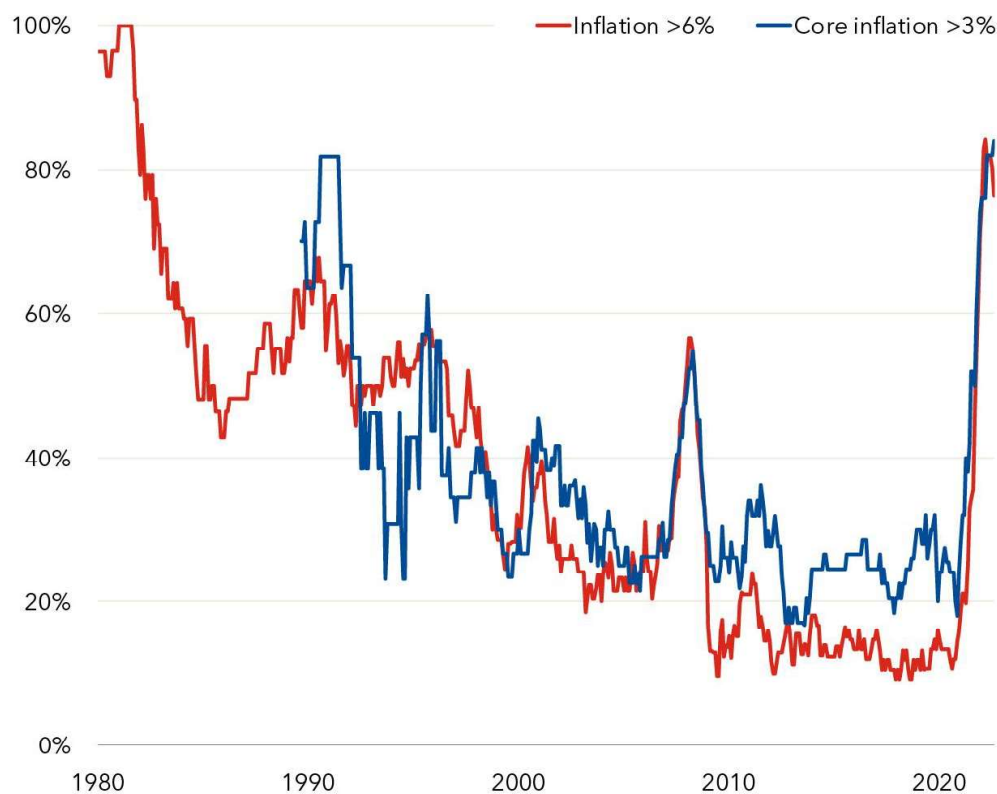
After many years of low inflation, the surge in inflation during the pandemic recovery came as a surprise. Key factors driving inflation included supply disruptions, high energy prices following Russia's invasion of Ukraine, and massive monetary and fiscal stimulus that fueled spending on housing and durable goods. Inflation topped 6 percent in more than four-fifths of the world's economies, while increasingly broad-based price gains lifted expectations for further increases to multi-decade highs.

^{*} This article was published on IMF Blog on February 2, 2023.

[—] Tobias Adrian, Financial Counsellor and Director of the IMF's Monetary and Capital Markets Department. Christopher Erceg, Deputy Director in the Monetary and Capital Markets Department of the IMF. Fabio M. Natalucci, Deputy Director of the Monetary and Capital Markets Department of the IMF.

Inflation pressures

The share of economies experiencing rapid price increases surged throughout last year.



Source: Bloomberg, IMF staff calculations.

IMF

Central banks in emerging markets responded by sharply tightening policy beginning in 2021, followed by their counterparts in advanced economies. This led to a tightening of financial conditions globally through the fall of last year. As a result, global economic growth is now expected to slow this year, with divergent views on the extent to which unemployment would likely need to rise to cool hot labor markets.

Investor optimism

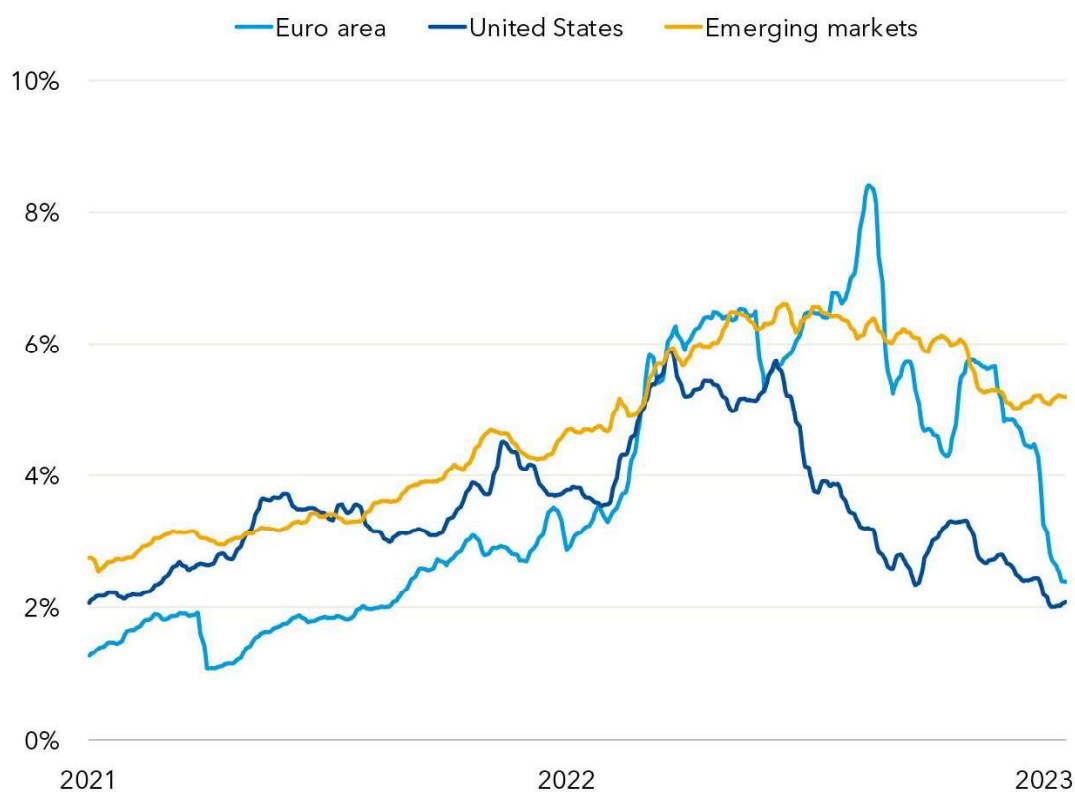
Since late last year, however, financial markets have rebounded strongly on retreating energy prices and signs that inflation may have peaked. In some economies, prices for goods included in core inflation measures, such as autos and furniture, have fallen.

These signs of progress in reducing inflationary pressures amidst continued strength in labor markets have offered reason to believe that policymakers may have succeeded in taming inflation with little cost to economic growth, a so-called soft landing.

In the United States and the euro area, market-based measures of inflation one year ahead have returned to near the central banks' 2 percent target from 6 percent last spring. Gauges for several other advanced economies have seen similar drops. In emerging markets, such market-based measures of inflation one year ahead have also been falling, albeit at a slower pace.

Inflation expectations

Market-based measures of inflation one-year-ahead have declined sharply, especially in the United States and euro area. (5-day moving average)



Source: Bloomberg, IMF staff calculations.

Note: Emerging markets series is the average of 1-year zero coupon inflation swap of Brazil, Chile, Colombia, Mexico, Poland, Thailand and South Africa.

IMF

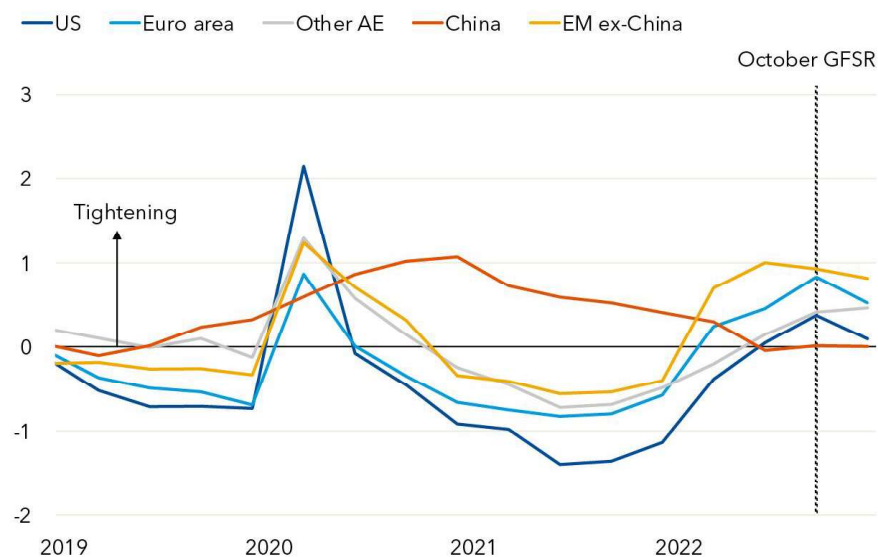
Expected easing

These disinflation hopes have been accompanied by growing expectations that central banks will soon not only stop tightening policy but also reduce rates fairly quickly. In many economies, this has led to yields on long-dated government debt falling below short-dated maturities. Historically, such an inversion of the yield curve often precedes recessions. Analyst assessments in fact point to significant recession risk in many economies, but the expectation is that recessions, should they occur, will be mild.

Policymakers' conundrum

Financial conditions have been easing globally, potentially offsetting the impact of central bank interest-rate hikes.

(standard deviations from the mean)



Source: Bloomberg Finance L.P.; Haver Analytics; national data sources; and IMF staff calculations.

Note: The IMF financial conditions index is designed to capture the pricing of risk. It incorporates various indicators, including home prices, and omits balance sheet and credit growth metrics. EMs exclude Türkiye and Ukraine. Standard deviations are calculated over 1996-present.

For details, see the October 2018 Global Financial Stability Report annex.

AE = Advanced economies. EM = Emerging markets.

IMF

Growing expectations for lower interest rates and only a shallow economic slowdown have fueled a significant easing in financial conditions in recent months—despite central banks continuing to raise rates. Markets have reflected this relatively benign picture: stock markets have rallied, and credit spreads narrowed considerably.

Conundrum for central banks

This easing of financial conditions during a central bank tightening cycle creates a conundrum for policymakers.

On the one hand, financial markets are signaling that disinflation may occur without meaningful increases in unemployment. Policymakers could embrace that view, and in effect ratify the loosening of financial conditions. Many observers concerned that central banks will be overzealous about tightening monetary policy—and will cause an unnecessarily painful economic downturn—are endorsing such a view.

Alternatively, central banks could push back against investor optimism, emphasizing the risks that inflationary pressures may be more persistent than expected. This risk-management approach would require restrictive interest rates for longer, until there's tangible evidence of a sustained decline in inflation.

While doing so could induce a repricing of the policy path and of risk assets in financial markets—possibly causing equity prices to fall and credit spreads to widen—there are three reasons why such an approach is needed to ensure price stability.

- History shows high inflation is often persistent—and may possibly ratchet up further—without forceful and decisive monetary policy actions to reduce it.
- While goods inflation has come down, it seems unlikely that the same will happen for services without significant labor-market cooling. Crucially, central banks must avoid misreading sharp declines in goods prices and easing policy before services inflation and wages, which adjust more slowly, have also moderated markedly.

- Experience suggests that prolonged periods of rapid price gains make inflation expectations more susceptible to de-anchoring as such an inflationary mindset becomes more entrenched in the behavior of households and firms.

Policymakers must continue to be resolute

Central banks should communicate the likely need to keep interest rates higher for longer until there is evidence that inflation—including wages and prices of services—has sustainably returned to the target.

Policymakers will likely face pressure to ease policy as unemployment rises and inflation keeps falling. These challenges could be particularly acute for emerging market economies.

To be sure, this is an unusual period in which many special factors are affecting inflation, and it is possible that inflation comes down more quickly than policymakers envision. However, loosening prematurely could risk a sharp resurgence in inflation once activity rebounds, leaving countries susceptible to further shocks which could de-anchor inflation expectations. Hence, it is critical for policymakers to remain resolute and focus on bringing inflation back to target without delay.

Everything Everywhere All at Once - Responding to Multiple

Global Shocks^{*}

By FABIO PANETTA[—]

We are still going through a sequence of global shocks that are disrupting economies around the world. In just three years we have seen a pandemic, severe supply chain disruptions, a war, an energy crisis and now tensions in banking markets.

The resulting swings in activity and prices have presented policymakers with the challenge of identifying turning points in their underlying dynamics at a time of disruption in the economy and the financial sector. Inevitably, we need to navigate between the risk of underreacting – which could prolong the inflationary effects of these shocks – and that of overreacting, which could turn volatility into instability.

There are no simple solutions to these complex problems.

We need to adapt our policies to the overlapping effects of the shocks, to geopolitical developments, to the risk of financial amplification and to spillovers from other jurisdictions.

Three principles can help guide our monetary policy decisions in this context.

First, given the prevailing uncertainty and the ground we have already covered in tightening our policy, we must remain fully data-dependent and avoid pre-committing to any specific policy path. We should be guided by our reaction function, taking stock of inflation developments, underlying inflation dynamics and the strength of monetary policy transmission, also given the possible risks for the medium term outlook stemming from both the real economy and the financial sector. This way we can ensure that we calibrate our measures in the light of the incoming information.

Second, we need to monitor the effects of our measures and the way our different instruments interact with each other. In particular, we should continuously assess the combined effect of raising rates and reducing the size of our balance sheet. The experience of other jurisdictions suggests that abrupt adjustments could make it more difficult for investors to adapt to evolving market conditions.

We need to maintain our disinflationary stance until we see convincing signs that inflation is returning to our target, in line with the “separation principle”: delivering the appropriate policy stance should not come at the cost of impairing its transmission.

And third: given the global nature of the shocks we are facing, we need to consider how they are transmitted across markets and economies as well as the potential *spillovers* from policies adopted abroad. But we should remain focused on our primary mandate of ensuring price stability in the euro area, without being overly conditioned by other jurisdictions.

I will start by illustrating the global shocks and the uncertainty they create. I will then turn to the policy response to these shocks and their spillovers across jurisdictions. And I will outline what this means for our monetary policy in the current environment.

^{*} Speech at a panel on “Global shocks, policy spillovers and geo-strategic risks: how to coordinate policies” at The ECB and its Watchers XXIII Conference in Frankfurt am Main on March 22 2023.

[—] Fabio Panetta, Member of the Executive Board of the ECB

Global shocks and uncertainty

Over the past three years we have faced considerable uncertainty from both domestic and global shocks, complicating the policy diagnosis and increasing the risks of either underreacting or overreacting.

Global shocks, their pass-through and their unwinding

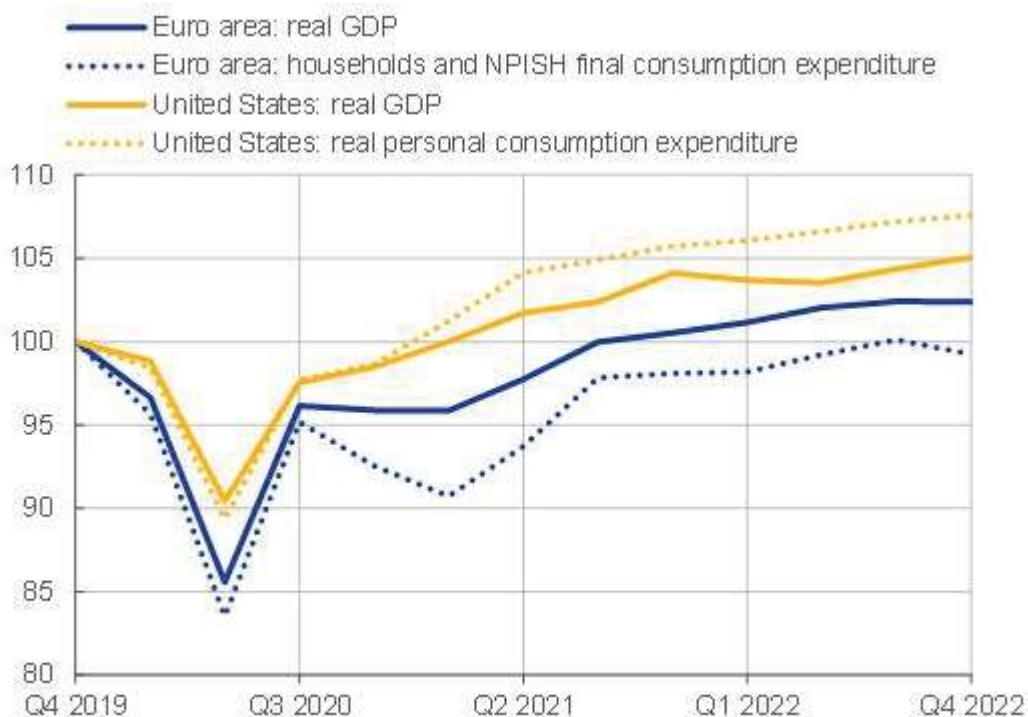
A major source of uncertainty surrounding both inflation and economic activity relates to the pass-through of global shocks and their unwinding. For example, the unprecedented sequence of domestic and global shocks makes it difficult to distinguish supply-demand imbalances triggered by the pandemic and the energy crisis from persistent, self-sustained inflationary dynamics.

Pandemic-related shocks

The reopening of the economy after the pandemic gave a sudden boost to demand (Chart 1) at a time when supply disruptions had not yet been resolved, leading to persistent bottlenecks. Firms reacted by building up inventories and hoarding labour, fuelling inflationary pressures. As a result, both demand and supply contributed to inflation in 2022.

Chart 1

**Evolution of real GDP and private consumption in the euro area and the United States
(index: Q4 2019 = 100)**

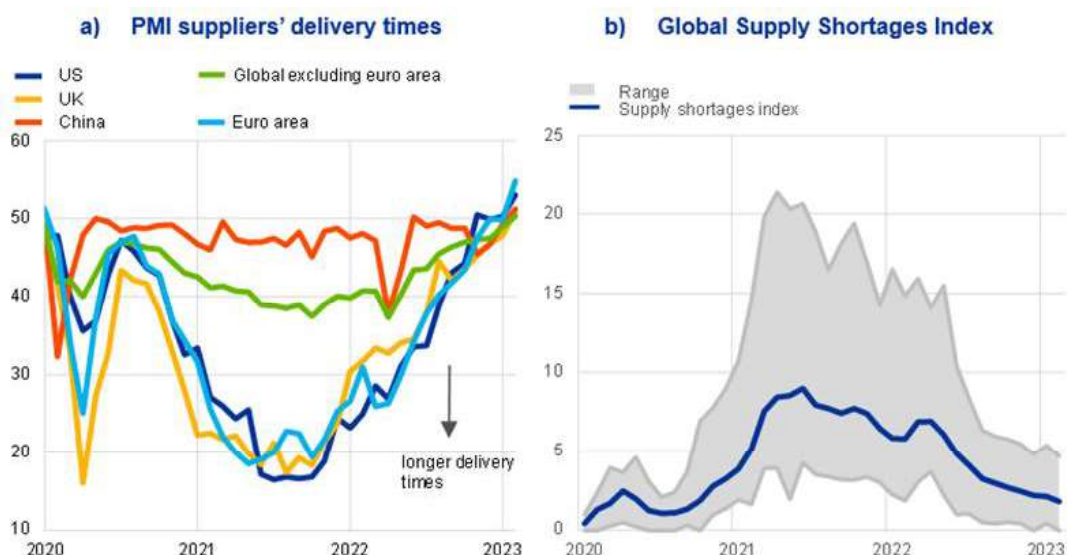


Sources: Eurostat, FRED and ECB staff calculations.

Note: NPISH stands for “non-profit institutions serving households”.

The boost to activity from the reopening is now fading. Supply bottlenecks have largely faded out (Chart 2) and firms are starting to run down their inventories (Chart 3). This should dampen price pressures.

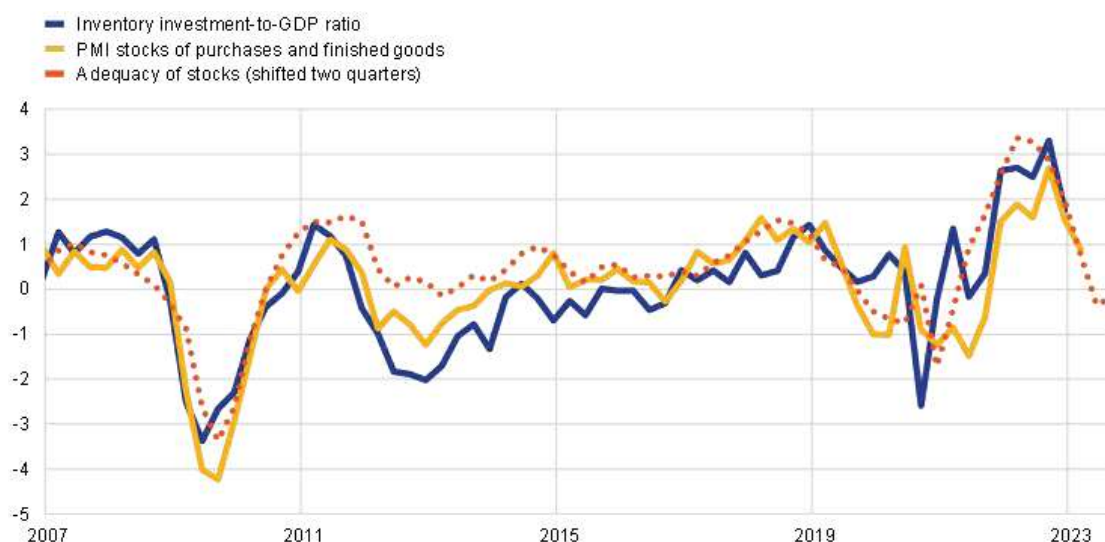
Chart 2
Easing of supply chain bottlenecks
(diffusion indices)



Sources: S&P Global, Markit and ECB staff calculations.

Notes: The Global Supply Shortage Index measures how many selected items have been in short supply against their long-run average for each month. The long-run average refers to value 1 of the index. The shaded area refers to the 5th-95th percentile range across 20 items (e.g. chemicals, electrical items, packaging, steel and textiles). The latest observations are for February 2023.

Chart 3
Inventory-to-GDP ratio and related survey indicators in the euro area
(standard deviation from historical (1999-2019) mean)



Sources: Eurostat (inventory investment-to-GDP ratio), S&P Global (PMI stocks of purchases and finished goods), European Commission (adequacy of stocks) and ECB calculations.

Note: The latest observations are for the fourth quarter of 2022 for the inventory investment-to-GDP ratio and the first quarter of 2023 for PMI stocks and adequacy of stocks.

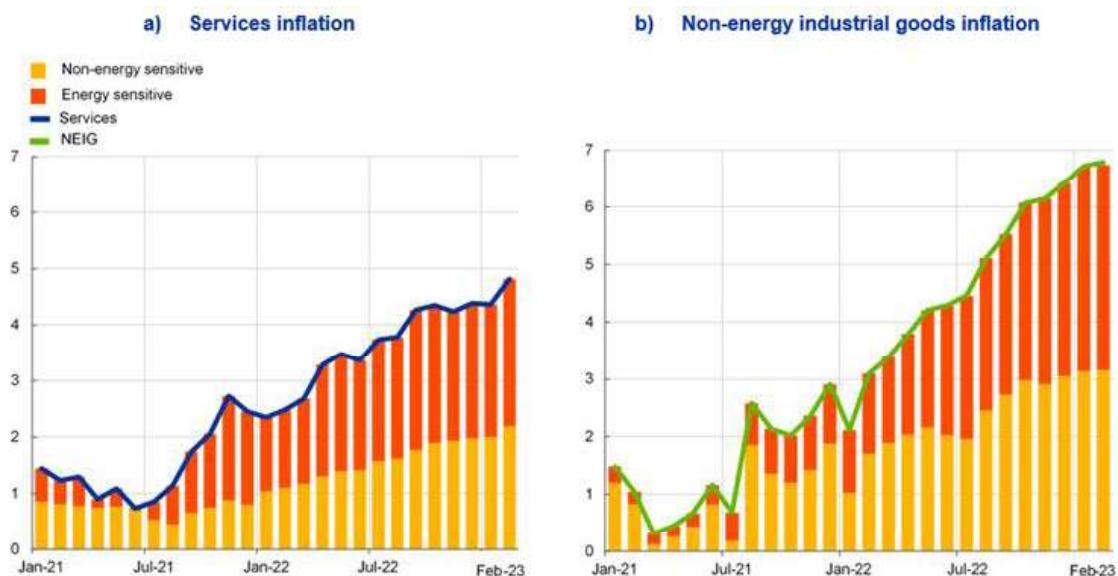
The energy crisis

The energy crisis has had similar effects. The sharp increase in wholesale energy and commodity prices has raised not only energy and food inflation but also – indirectly – core goods and services inflation (Chart 4).

Chart 4

Contributions of energy-sensitive components to goods and services inflation in the euro area

(annual percentage changes and percentage point contributions)

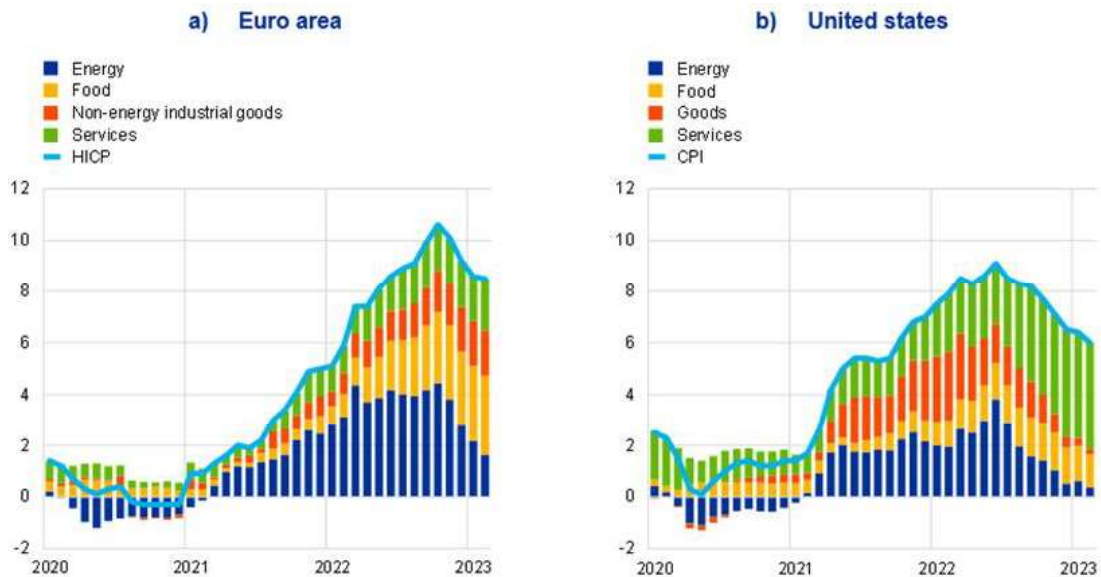


Sources: Eurostat and ECB staff calculations.

Notes: The term “energy-sensitive component” reflects items with a share of energy in direct costs above the average share of energy across services items (panel a) and non-energy industrial goods (NEIG) items (panel b). The latest observations are for February 2023.

These effects are starting to be reabsorbed. Lower energy and commodity prices have translated into lower energy inflation (Chart 5). And they should eventually pass through to food and core inflation – consistent with the easing in pipeline price pressures (Chart 6). This is compressing medium-term consumer inflation expectations, and might temper catch-up wage demands. But how quickly these effects will be reflected in the inflation data is uncertain. And concerns about inflation persistence make projecting core inflation particularly challenging.

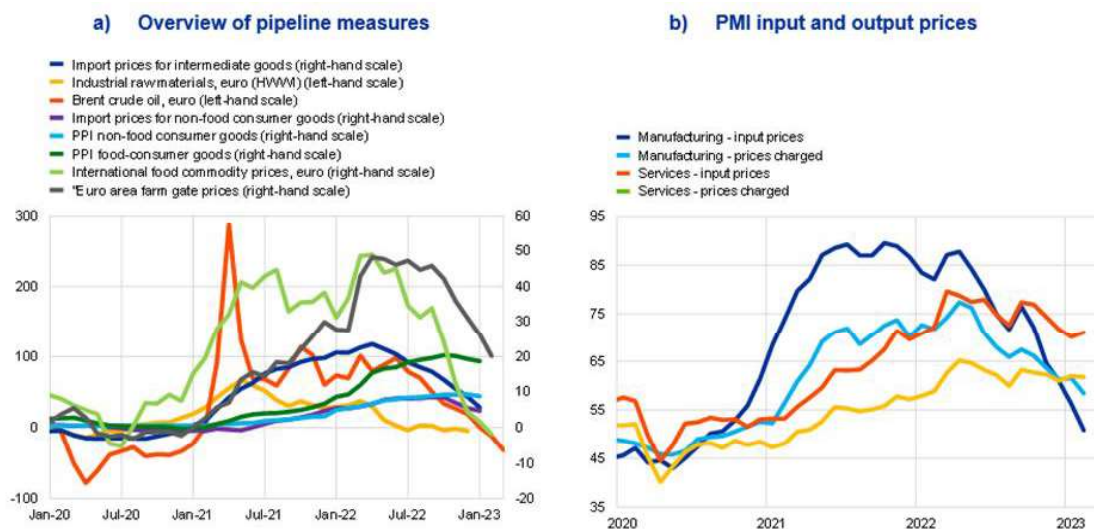
Chart 5
Headline inflation and components in the euro area and the United States
(annual percentage changes and percentage point contributions)



Sources: Eurostat, US Bureau of Labor Statistics and ECB calculations.

Note: The latest observations are for February 2023.

Chart 6
Pipeline pressures and input/output prices
(panel a): annual percentage changes; panel b): diffusion index)



Sources: panel a): Eurostat and Refinitiv and Hamburg Institute of International Economics (HWI), panel b): Markit.

Notes: Panel a): For Brent crude oil in euro, the monthly value represents the average of the data available (working days up to the day of the update). The latest observations are for 15 March 2023 for Brent crude oil in euro, February 2023 for euro area farm gate prices and international food commodity prices and January 2023 for the other items. Panel b): The latest observations are for February 2023.

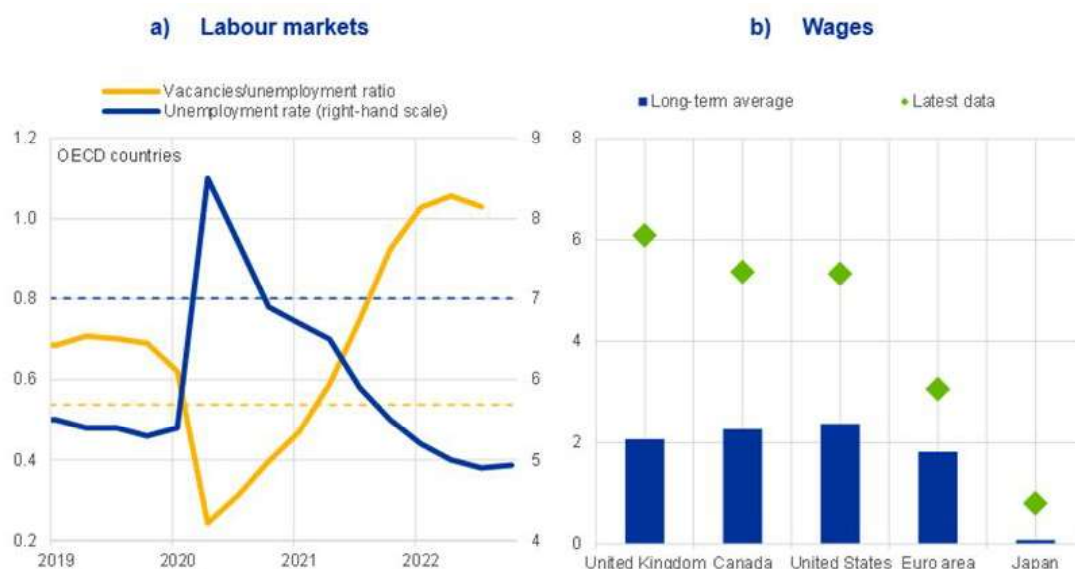
The risk of inflation becoming entrenched

The unwinding of inflationary pressures has triggered concerns about the risk of second-round effects in the form of a de-anchoring of inflation expectations or a wage-price spiral, especially in view of the tight labour market conditions in advanced economies (Chart 7).

Chart 7

Labour markets are still tight

(panel a): percent; panel b): annual percentage changes)



Sources: OECD, Haver and ECB calculations.

Notes: Panel a): the OECD aggregate for the vacancy ratio is based on the United States, United Kingdom, Japan, South Korea, euro area (excluding Italy), Canada, Sweden, Switzerland, Poland, Romania, Czech Republic, and Hungary. The dashed lines refer to long-term averages (2010-2019). The latest observations are for the third quarter of 2022 for the vacancy ratio and the fourth quarter of 2022 for the unemployment rate. Panel b): wage growth series are not harmonised, so comparability across country data is limited. Wages refer to average hourly wages for the United States and Canada and to average weekly regular earnings (excluding bonuses) for the United Kingdom. For the euro area and Japan, wage data track negotiated and scheduled wages respectively. The long-term average refers to 2010-2019. The latest observations are for February 2023 for the United States and Canada, January 2023 for Japan and the United Kingdom and December 2022 for the euro area.

In the euro area, medium-term inflation expectations remain anchored at our target. This reflects the ECB’s clear commitment to stamp out inflation. As President Lagarde stated this morning, “the public can be certain about one thing: we will deliver price stability, and bringing inflation back to 2% over the medium term is non-negotiable.”

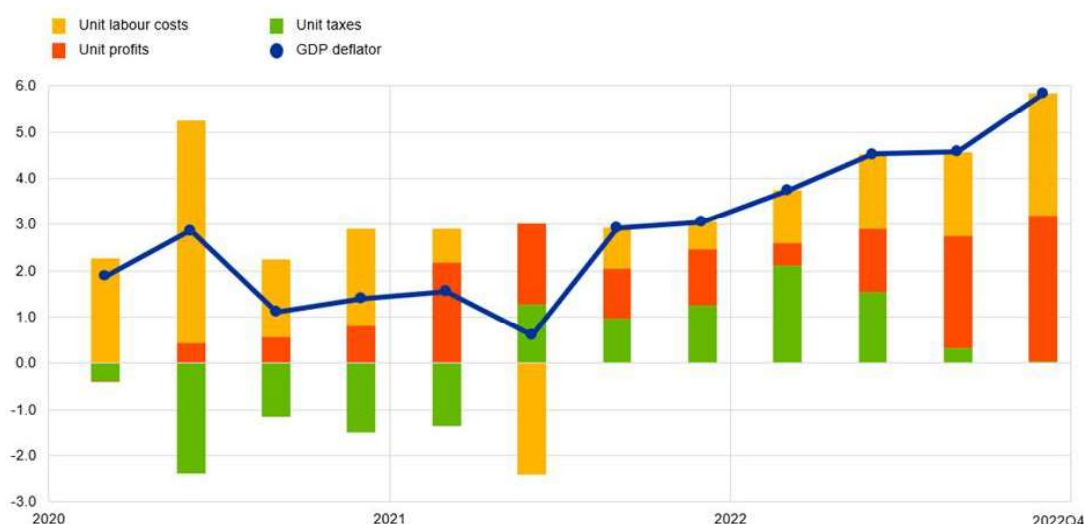
Robust wage growth over the next three years is also consistent with our projections, which indicate that inflation will gradually fall to around 3% by the end of 2023 and around 2% by the middle of 2025.

The risk is rather that wage and price-setting dynamics could make high inflation stickier and eventually feed into inflation expectations. Wages are still accelerating, and we cannot rule out a

scenario in which stronger and persistent wage increases take hold. This risk needs to be closely monitored.

Opportunistic behaviour by firms could also delay the fall in core inflation. In fact, unit profits contributed to more than half of domestic price pressures in the last quarter of 2022 (Chart 8). In some industries, profits are increasing strongly (Chart 9) and retail prices are rising rapidly, in spite of the fact that wholesale prices have been decreasing for some time. This suggests that some producers have been exploiting the uncertainty created by high and volatile inflation and supply-demand mismatches to increase their margins, raising prices beyond what was necessary to absorb cost increases. We should monitor the risk that a profit-price spiral could make core inflation stickier.

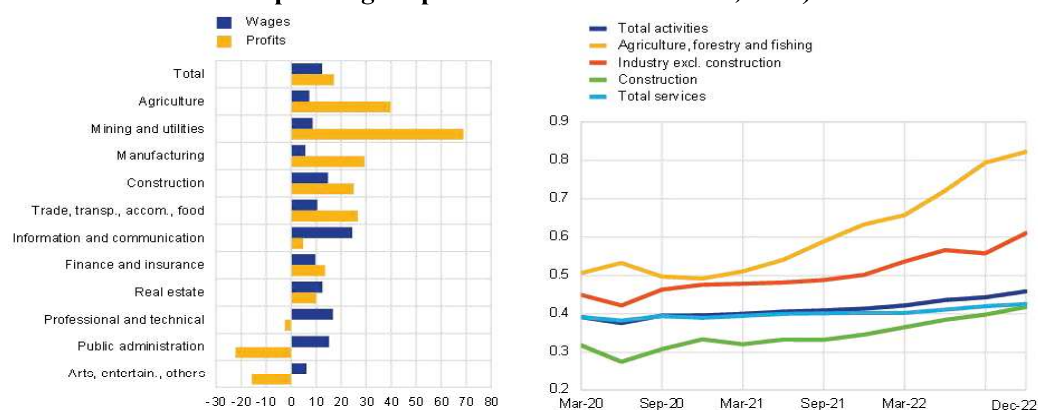
Chart 8
GDP deflator at market prices
(annual percentage changes; percentage point contributions)



Sources: Eurostat and ECB calculations.

Note: The latest observations are for the fourth quarter of 2022.

Chart 9
Sectoral wage and profit developments
(left-hand panel: percentage change from Q4 2019 to Q4 2022; right-hand panel: gross operating surplus over real value added, level)



Sources: Eurostat and ECB calculations.

Notes: Wages refer to compensation of employees, and profits to gross operating surplus. Income for self-employed people is included in wages. The latest observations are for the fourth quarter of 2022.

Looking ahead, a normalisation of profits would help bring down core inflation and reduce the risk of second-round effects, as wage demands could be accommodated without leading to an increase in prices in response.

Global supply-demand mismatches

Uncertainty about global supply and demand conditions is still high – and is now exacerbated by the financial tensions that have recently emerged.

Demand is showing signs of weakness in both the United States and the euro area.

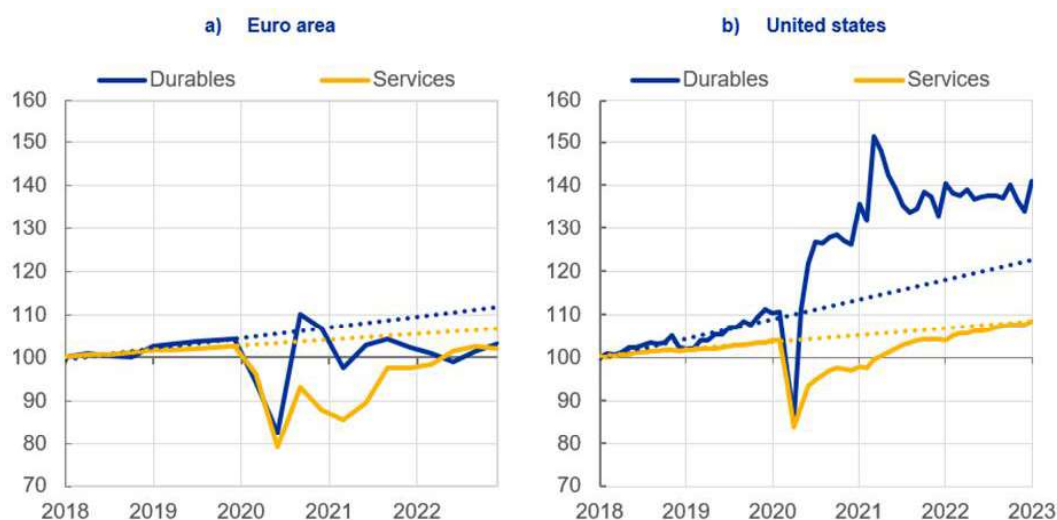
In China, the end of zero-COVID policies has been followed by a downturn and then a rebound, which could still be slowed down by headwinds emanating from the property market. The reopening will have an ambiguous overall effect on global inflation: it could dampen prices in sectors where China is a net exporter – such as goods – and increase prices in sectors where it is a net importer, such as commodities.

The global policy response and its spillovers

A second source of uncertainty relates to the global policy responses to the shocks, and the spillovers from these responses.

We have already seen clear examples of these spillovers. For instance, the outsized fiscal stimulus implemented in the United States in response to the pandemic boosted the demand for durable goods (Chart 10) but led to a negative supply shock in other countries. In the euro area, this supply shock contributed to pushing up inflation and hit the economy at an early stage of its recovery.

Chart 10
Individual consumption – durables and services
(panel a): index: Q1 2018 = 100; panel b): January 2018 = 100)

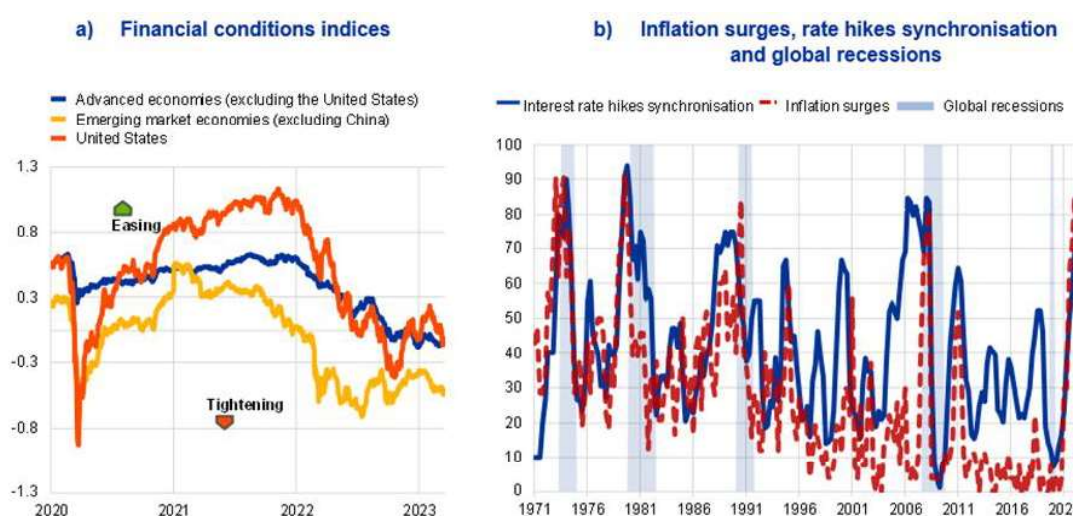


Sources: ECB and Federal Reserve System.

Notes: Dotted lines denote the linear trend (from the first quarter of 2018 to the fourth quarter of 2019). Durables and services for the euro area are approximated using a bottom-up aggregation of available country-level data.

We are now facing a simultaneous and rapid global tightening of financing conditions (Charts 11), which is creating financial and policy spillovers (Chart 12). For example, monetary tightening in the United States is also resulting in tighter financing conditions in other jurisdictions, including the euro area. This adds to the risk of overtightening if central banks do not factor in the feedback loops they create.

Chart 11
Global tightening of financing conditions
(panel a): standardised indices; panel b): percentages of countries)

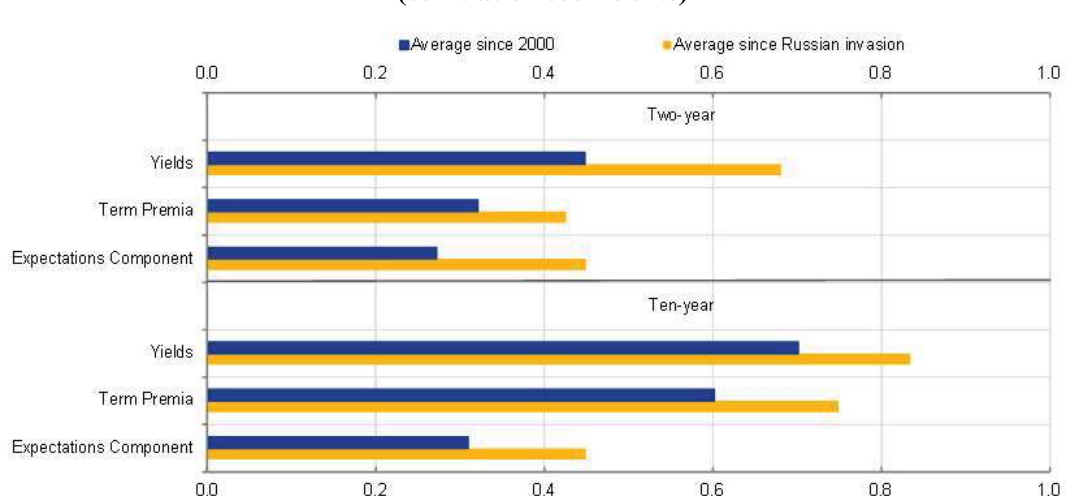


Sources: Panel a) Refinitiv Datastream and ECB staff calculations; Panel b): Haver and ECB staff calculations.

Notes: Panel a): Country-level indices are aggregated as a weighted average using GDP purchasing power parity percentage shares. An increase reflects loosening financial conditions. A decrease reflects tightening financial conditions. The latest observations are for 17 March 2023.

Panel b): The global “inflation surges” index shows the share of countries which, at time t , are experiencing contemporaneously (1) year-on-year inflation that is higher than the time $t-1$ and (2) year-on-year inflation that is above a certain threshold. In this case, the threshold is given by the average of the year-on-year inflation in the post-Volcker period, from the first quarter of 1984 to the fourth quarter of 2022. The global “rate hikes synchronisation” index is constructed using BIS data on policy rates set by central banks and shows the share of countries that are tightening at time t . Both the indices cover 30 countries across advanced economies and emerging market economies. Global recessions are periods with (1) an annual world GDP per capita that is negative or close to zero, and (2) a high share of countries in a technical recession. The latest observations are for the fourth quarter of 2022.

Chart 12
Global component in yields
(correlation coefficients)

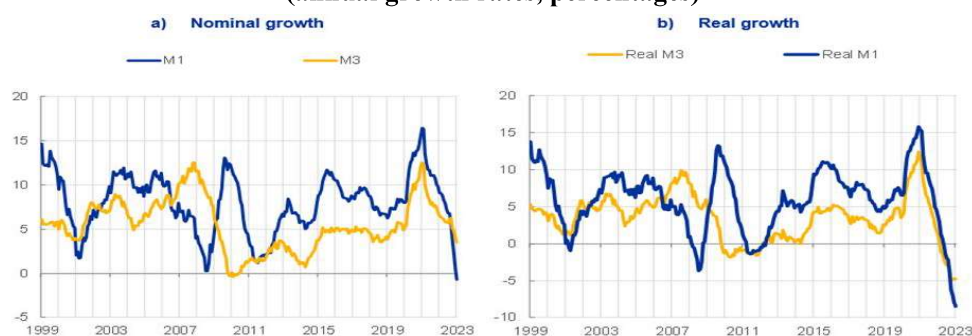


Sources: Datastream and Haver Analytics.

Notes: The sample consists of ten advanced economies (Australia, Canada, Denmark, euro area, Japan, New Zealand, Sweden, Switzerland, United Kingdom and United States). The bilateral correlation coefficients are averaged across these countries and time periods. The term premia and expectations components are the average of estimates from three models (dynamic Nelson-Siegel, rotated dynamic Nelson-Siegel and dynamic Svensson-Soderlind). The latest observations are for 9 March 2023.

In the euro area, the effects of monetary tightening are already visible, although they are only expected to fully materialise in the coming months due to the usual lag in the transmission of monetary policy. The monetary aggregates M1 and M3 are slowing down rapidly. In real terms their growth rates are in negative territory and at historic lows, below the levels of 2008 and 2011 (Chart 13). Bank credit is also decelerating rapidly (Chart 14). As a result, it is declining as a share of GDP – faster, in fact, than in previous tightening episodes – and markets expect it to decline significantly further this year (Chart 15). These developments are largely related to our policy normalisation. But the size and the speed of the adjustment indicate that the transmission of our monetary policy to the economy may have become stronger.

Chart 13
Growth of monetary aggregates M1 and M3 in the euro area and the United States
(annual growth rates, percentages)



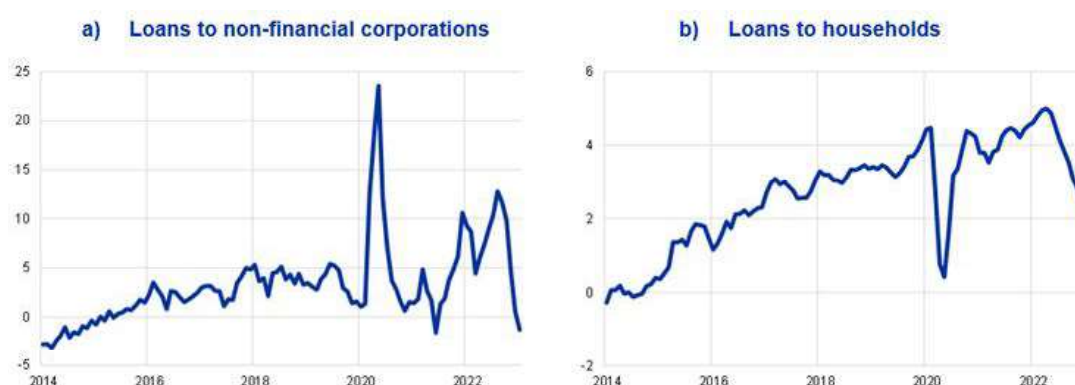
Sources: Panel a): ECB (BSI); panel b): ECB (BSI and ICP).

Notes: Solid lines show the annual growth rates of the index of notional stocks, i.e. a measure of flows normalised by outstanding amounts in the previous month. With this method, valuation changes and reclassifications are excluded from the computation of annual growth rates, and thus jumps in the annual growth series are avoided. Dotted lines show the annual growth rates of outstanding amounts. This method avoids the risk of distortion in the ratio of the money stock over price index that is implicit in the calculation of the real rates. In panel b), M3 and M1 are deflated by the HICP index. The latest observations are for January 2023.

Chart 14

Credit growth in the euro area

(three-month annualised percentage changes, seasonally adjusted)



Source: ECB (BSI).

Notes: In panel a), MFI loans are adjusted for sales, securitisation and cash pooling activities. In panel b), MFI loans are adjusted for sales and securitisation. The latest observations are for January 2023.

Chart 15

Bank loans to the non-financial private sector in the euro area

(percentages of GDP)



Sources: ECB (BSI, MNA), Refinitiv (I/B/E/S), ECB projections, individual banks' financial statements and ECB calculations.

Notes: The orange marker shows the median forecast for year-end 2023, and the whiskers represent values within one standard deviation around the median (10th and 90th percentiles), as

reported by market analysts and sourced through I/B/E/S. The distribution is weighted by realised loan volume for each bank as of year-end 2022 and based on an underlying sample of 143 forecasts covering 44 banks, submitted between 20 January and 10 March 2023. In each quarter, GDP is calculated by multiplying quarterly, seasonally adjusted flows by four; the figure for 2023 is based on the March 2023 ECB staff macroeconomic projections for the euro area. The latest observations are for the fourth quarter of 2022 for BSI and MNA, while market expectations refer to the fourth quarter of 2023.

The global tightening may also be amplified by the recent financial tensions in global banking markets. Aside from their impact on confidence, these tensions will make banks more sensitive to deposit outflows, inducing them to transfer the rate hikes more rapidly – and to a greater extent – to their customers on both sides of the balance sheet. For a while, banks may also become more prudent about lending and decide to retain cash as a precautionary measure. In the euro area, our bank lending survey was already pointing to a tightening of lending standards for firms and households before the recent tensions, and this tightening may aggravate the drop in credit growth in the coming months.

In addition, major central banks have been simultaneously raising rates and reducing the supply of liquidity through quantitative tightening policies. This could make the policy adjustment bumpier. There is no reliable experience we can draw on to examine the combined effects of rate hikes and quantitative tightening. It is hard to assess how a contraction of the balance sheet of the central bank affects financial markets – especially if it happens in conjunction with an abrupt increase in interest rates. The liability-driven investment crisis in the United Kingdom and the crisis of Silicon Valley Bank in the United States suggest that sudden adjustments may have an impact on the transmission of monetary policy and even give rise to severe financial tensions.

In the current context, weakening growth prospects and heightened uncertainty may lead investors to move from risky assets to risk-free assets. And when the supply of liquidity is contracting quickly, this may spur a “dash for cash”, reinforcing the effects of the sharp increase in policy rates and exacerbating financial vulnerabilities. In fact, in the United States, high quality liquid assets are unusually offering higher returns than risky assets (Chart 16) at a time when liquidity is being withdrawn from the system.

Chart 16
Inverse price/earnings ratio, six-month risk-free rate and excess reserves in the euro area and the United States
(left-hand scale: percentage points, right-hand scale: EUR trillions)



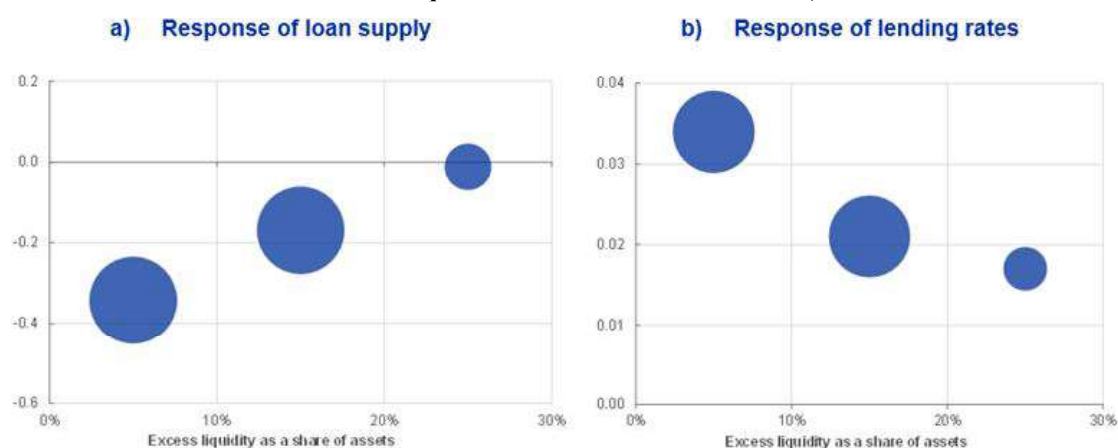
Sources: Panel a): Refinitiv and ECB calculations; panel b): Refinitiv, Federal Reserve, and ECB calculations.

Notes: The inverse price/earnings ratio is a gauge of the earnings yield of holding stocks, shown here in comparison to risk-free rates. In panel a), excess liquidity is calculated as banks' current account and deposit facility holdings minus their minimum reserve requirements. In panel b), excess reserves are calculated as reserves of depository institutions minus required reserves (the latter are set to zero in 2020). The latest observations in panel a) are 13 March 2023 for financial market data and 8 March 2023 for excess liquidity. The latest observations in panel b) are 13 March 2023 for financial market data and January 2023 (monthly data) for excess reserves.

As available liquidity shrinks, both in aggregate and for most banks, the supply of lending could also contract rapidly. Estimates by ECB staff suggest that banks with lower excess liquidity are more likely to reduce their supply of credit in response to policy rate hikes, and the increase in their lending rates is likely to be larger (Chart 17).

Chart 17

Response of loan supply and lending rates to a policy rate hike by level of excess liquidity (percentage points of supply-driven loan growth (panel a) and change in lending rates (panel b) over three months for each percentage point increase in the deposit facility rate; size of bubbles equal to volumes of loans to firms)



Sources: Panel a): ECB (AnaCredit, iBSI, MOPDB) and ECB calculations; panel b): ECB (AnaCredit, iBSI, iMIR, MOPDB) and ECB calculations.

Notes: Supply-driven loan growth at the bank level is identified applying the methodology of Mary Amiti and David Weinstein to the euro area credit register (see Amiti, M. and Weinstein, D. (2018), "How Much Do Idiosyncratic Bank Shocks Affect Investment? Evidence from Matched Bank-Firm Loan Data", *Journal of Political Economy*, Vol. 126, No 2, pp. 525-587). The chart reports coefficients from regressions of the supply-driven loan growth (panel a) and bank-level changes in new lending rates to firms (panel b) three months ahead on the level of excess liquidity interacted with the change in the deposit facility rate over the same period, distinguishing between observations before and after December 2021 and with the excess liquidity-over-assets ratio between the levels indicated on the x-axis. The specification includes bank and country time fixed effects and controls for bank assets. The size of the bubbles measures the outstanding amounts of loans to firms for banks belonging to each category. The latest observations are for November 2022.

Implications for the ECB's monetary policy

So how should monetary policy operate in an environment characterised by high uncertainty, strong spillovers and financial vulnerabilities?

Adapting to the current environment

First, monetary policy must remain fully adaptable to changing developments, given the prevailing uncertainty, the lags with which it operates and the risk of sudden financial tensions. This requires a data-dependent approach that does not prejudge future policy decisions and that reflects the risks on both sides.

Second, our tightening must be calibrated prudently. This is because it is already having a strong impact on financing conditions and because we want to avoid undesirable financial volatility. And this prudent approach holds truer still as our policy rates move more firmly into restrictive territory, inflationary forces ease and the risks to the inflation outlook become balanced. At times like this, abrupt policy moves are not necessary.

Third, in order to avoid financial tensions which could hamper our disinflationary policies, we should rely on our policy rate as the key instrument to steer our stance and we should be measured and predictable in the normalisation of our balance sheet. We should continuously monitor investors' exposure to interest rate risk and liquidity risk and carefully analyse the impact that the decline in liquidity may have on the supply of credit.

We must stand ready to intervene in a timely manner to counter possible market dysfunctions. We have the instruments to adjust the provision of liquidity and ease collateral conditions as necessary, in line with what we have done during the pandemic. And we need to remain committed to our three lines of defence against financial fragmentation within the euro area.

Finally, all policymakers should be tackling inflation on all fronts. It is not a task for central bankers alone. Thanks to public intervention, we had an unusual recession – one with high profits. This means that firms have the buffers to absorb a catch-up in labour costs without increasing prices in response, also in view of the fall in the cost of other inputs, like energy.

Persistently opportunistic profits should not put a dampener on disinflation. Profiteering strategies that increase inflation and the risk of second-round effects would trigger a monetary policy reaction. But other authorities should also intervene. The appropriate response to excess corporate profits is not more fiscal support to compensate consumers for high prices of goods and services. Rather, it is to intervene to prevent any abuse of market power.

Addressing spillovers

Let me now turn to how monetary policy should address spillovers.

We must take into account all the relevant information when taking decisions, and that includes developments outside the euro area. Given the global nature of the shocks we are facing, we need to consider how they are transmitted across markets and economies, alongside the potential *spillovers* from the policy response to those shocks. This is what we have done. And in response to tensions in international funding markets, we have worked with other major central banks to enhance the provision of US dollar liquidity via our standing liquidity swap line arrangements.

At the same time, we need to tailor our policy response to the outlook for the euro area and avoid passively importing financing conditions from abroad through policy spillovers to interest

rate expectations and long-term interest rates. We have the necessary autonomy to steer financing conditions in a way that reflects the differences between the euro area and other jurisdictions.

We can reconcile these two objectives – factoring in spillovers but tailoring our policy to domestic conditions – if we calibrate our policy appropriately and communicate our reaction function clearly.

Our measures need to be calibrated in such a way that they achieve the appropriate domestic stance. To use a metaphor – if outside temperatures start falling after a period of hot weather, we have less need for air conditioning because temperatures inside will gradually cool, too. If we then apply this approach to our current situation, when calibrating our measures we should consider the restrictive impulse coming from the global tightening and from the vulnerabilities that are emerging in the financial sector abroad.

The clarity of our communication is also crucial, especially in view of the current financial tensions. In order to communicate our policy intentions clearly and consistently at a time when we must remain data-dependent and adapt to new developments, we need to set out a clear reaction function and stick to it. Accordingly, in our latest monetary policy statement we emphasised that “The elevated level of uncertainty reinforces the importance of a data-dependent approach to our policy rate decisions, which will be determined by our assessment of the inflation outlook in light of the incoming economic and financial data, the dynamics of underlying inflation, and the strength of monetary policy transmission.”

Conclusion

A string of shocks has created uncertainty for economies around the world. While the effects of some of these shocks are starting to unwind, it may be some time yet before we see volatility in activity and prices subside, and a new equilibrium settle in.

Notably, my remarks today have focused on the current economic situation. But we may well see longer-lasting changes to economic structures as supply chains are reconfigured to increase resilience to global shocks and align with shifting geopolitical strategies.

In the meantime, monetary policy must perform a difficult balancing act.

Faced with an exceptionally complex environment, we need to acknowledge the uncertainty prevailing in the economy. And we need to continuously assess the combined effect of our different policy instruments, the risks of non-linear effects and the spillovers from policies adopted elsewhere. This means our monetary policy should be data-dependent and adaptable. And it requires us to shape our communication on the basis of our monetary policy reaction function.

In a speech last month I summarised my thinking by saying that we do not want “to drive like crazy at night with our headlights turned off”. The recent financial tensions have made this conviction even stronger.

Accelerating Productivity Growth can Save the Global

Balance Sheet*

By JAN MISCHKE *

Inflation and geopolitics have brought about a new era

As the world enters a new geo-economic era, the growth of the global balance sheet – the value of all real assets that constitute net worth, as well financial assets and liabilities of households, corporations, governments and financial institutions – may come to an end.

The pandemic accelerated the multi-decade expansion of the global balance sheet, but the spike in inflation exacerbated by Russia's invasion of Ukraine in 2022 and the corresponding rise in interest rates may finally have led us to an inflection point. How leaders manage the way ahead will be critical for growth, wealth and financial stability.

For several decades, the world's balance sheet has grown inexorably. From 2000-21, global wealth – at \$630tn in 2022 – has grown by 170 percentage points relative to gross domestic product. This has been mostly due to asset price inflation (more than three-quarters) rather than net new investment (less than one-quarter of wealth growth).

Real estate prices have climbed to 5.1 times GDP from 3.8 on the back of declining real interest rates. Equity prices were pushed up by low rates and higher earnings as the labour share of income declined; the value of all equity grew to 2.3 times GDP from 1.2. At 2.7 times GDP in 2021, debt reached levels well above the highs of the 2008 financial crisis. Net new debt growth exceeded net investment by a factor of two, and debt is now equivalent to 90% of the value of all produced assets on the planet.

Far from knocking this growth in wealth and debt off course, the pandemic – or rather the response of governments to it – accelerated the rise in 2020 and 2021. In those two years, the world added another \$100tn to wealth 'on paper'. This owed primarily to unprecedented levels of government support for economies they feared were imploding as the pandemic took hold. Asset prices soared, and net worth relative to GDP grew the fastest in nine decades. Around \$50tn in new debt and \$39tn in new currency and deposits were created, and debt growth exceeded net investment by a factor of 3.4.

In 2022 as political and economic turbulence erupted, early signs of a possible inflection point appeared. As inflation and interest rates rose, global equity, bond and real estate prices came under pressure and servicing debt became more costly. While these developments may prove transitory, there is also a scenario where shifts in geopolitics and global supply chains, energy system transitions and ageing populations mean that tighter labour markets, higher inflation and higher interest rates become more entrenched.

The ramifications for the global balance sheet and global wealth are enormous. In a significant and sustained policy-tightening scenario, the world could experience large and persistent corrections in asset prices and a drawn-out period of deleveraging. In a stagflation scenario the global balance sheet would converge back to historic levels relative to GDP by means of higher

*This article first appeared in OMFIF Commentary on February 10, 2023.
*Jan Mischke, Partner and Senior Fellow at McKinsey Global Institute.

inflation. Only a scenario of accelerated productivity growth would set the balance sheet onto a more desirable pathway.

These balance sheet pathways are critical for financial institutions. Central banks are key actors in managing the path ahead. Asset managers will need solid, long-term scenarios to understand implications for portfolio allocation, long-term balance sheet risks and long-term asset and revenue growth. Banks face vastly different scenarios for growth and economically sustainable lending in 2023, but they have an important role to play in channelling funds to productive uses.

China's Impact on the Fate of the Global Balance Sheet^{*}

By ANDREW SHENG AND XIAO GENG[†]

Just as a corporate balance sheet can provide insights into a company's financial health, a "global balance sheet" (GBS), tallying the assets and liabilities of governments, corporations, households, and financial institutions, can do the same for the world economy. That logic drove the McKinsey Global Institute (MGI) to begin compiling, and regularly updating, a GBS covering 10 countries that together represent more than 60 percent of the world GDP.

MGI's first GBS, released in late 2021, showed that during the first 20 years of this century, global assets grew faster than output. In 2020, assets on the world's balance sheet totaled more than \$1.5 quadrillion (about 18.1 times their GDP) — about triple the total in 2000 (when assets amounted to about 13.2 times the GDP). The growth of global wealth also outpaced (rather tepid) GDP growth, implying that wealth became increasingly concentrated among those with real estate and financial assets.

In 2020 and 2021 — the first two years of the COVID-19 pandemic — these trends accelerated, with the global balance sheet swelling even as GDP growth stalled. In fact, despite billions of dollars in income losses, \$100 trillion was added to global wealth during this period, fueled largely by unprecedented fiscal and monetary expansion. As \$39 trillion in new currency and deposits were minted, asset prices skyrocketed. Meanwhile, debt liabilities grew by about \$50 trillion, and equity liabilities by \$75 trillion.

Since the beginning of the 21st century, the expansion of the financial sector, mainly through debt creation, has played a major role in boosting net worth (assets minus liabilities), mostly via the price effect. In the 2000-21 period, 50 percent of the increase in net worth came from asset-price increases above inflation, 29 percent from general inflation, and only 23 percent from net investment. So, although global net worth grew, investment in the real economy remained relatively low. Excessive financialization thus undermined productivity growth.

The picture changed significantly in 2022. While financialization continued, the GBS shrank relative to GDP for the first time in decades.

The Russia-Ukraine conflict, which has driven up energy and food prices, exacerbated inflation, spurring major central banks to hike interest rates. Real global equity and bond prices declined by about 30 percent and 20 percent, respectively, sapping net worth in many countries, especially Australia, Canada, China, Germany, and Sweden. Meanwhile, a declining real-estate market reduced not only net worth (wealth), but also consumption, particularly in China, where real estate constitutes some 60 percent of household assets.

As 2023 begins, the obvious question is: Will 2022 mark a turning point, after which the GBS will continue its slide, or will global assets and wealth resume their climb relative to GDP? The answer depends significantly on policies in China, which accounted for 18 percent of world GDP and global net worth in 2021.

Judging from the recent Central Economic Work Conference — where the economic-policy agenda is decided each year — Chinese policymakers will focus on stimulating demand, stabilizing the housing market, and supporting growth using fiscal and monetary tools. For example, Vice-Premier Liu He announced plans to boost fiscal support and increase liquidity for the stressed real-estate sector.

A global slowdown may also be a drag on global aggregate demand, hurting Chinese trade, while continued supply-chain disruptions will compound the damage. And then there is the demand-crushing impact of natural disasters, which are becoming increasingly likely as climate change progresses.

^{*} Published on China Daily on January 31 2023

[†] Andrew Sheng, a distinguished fellow at the Asia Global Institute at the University of Hong Kong, is a member of the UNEP Advisory Council on Sustainable Finance.

Xiao Geng, chairman of the Hong Kong Institution for International Finance, is a professor and director of the Institute of Policy and Practice at the Shenzhen Finance Institute at The Chinese University of Hong Kong, Shenzhen.

Making matters worse, economic relations with the United States are becoming increasingly fraught, with the US implementing measures — such as restrictions on sales of semiconductors and the machines that produce them — aimed at starving China's economy of advanced technologies and components. That is why China's leaders have signaled support for private business and State-owned enterprises, including the easing of regulatory actions that disrupted business confidence in various sectors.

US policies targeting China point to a bigger problem: international economic cooperation is becoming increasingly difficult to sustain. But the GBS shows that, while policy mistakes in large, systemically important economies can push down the entire global economy, no single economy today can lift it. In other words, cooperation is vital to prevent a classic balance-sheet recession (when asset markets deflate, and liquidity is tightened).

Cross-border Payments have Reached an ‘Inflection Point’ *

By LEWIS MCLELLAN*

G20 roadmap update sets new out practical initiatives

The G20 roadmap for enhancing cross-border payments has undergone a radical overhaul. The Bank for International Settlements’ Committee on Payments and Market Infrastructures believes that the roadmap is at an inflection point and is moving into a new phase of pursuing practical implementation.

The 19 building blocks of the comprehensive approach that defined the roadmap’s first two years have been replaced by three interconnected themes: payments system interoperability and extension; legal, regulatory and supervisory frameworks; and cross-border data exchange and messaging standards.

Many of the original building blocks can be mapped to these three themes, but the update reflects a more focused, targeted approach to tackling the problems of high costs, low speed, insufficient transparency and lack of access. The new G20 roadmap has laid out concrete actions to be carried out over the next few years with the aim of achieving the quantitative targets agreed upon by the CPMI in 2021.

OMFIF held a roundtable to discuss these aims with Thomas Lammer, deputy head of the secretariat CPMI, Nasreen Quibria, senior director and head of cross-border policy engagement at Visa, and Saskia Devolder, strategic programme director for cross-border payments at Swift.

One of the CPMI’s main priorities in the roadmap is to promote fast payments systems that can be easily interlinked. The CPMI will establish a forum where central banks can share information and experiences on the process of upgrading their payment systems in an effort to ensure that new fast payments systems and central bank digital currencies are developed with the international dimension in mind.

The CPMI also plans to host a workshop to showcase existing interlinking arrangements, in the hope that the technical and operational prerequisites become widely known and incorporated into the development process for new systems.

The CPMI does not intend to do all the work itself. Partnerships with the private sector are an important part of the strategy for improving cross-border payments.

This is particularly in evidence with regard to the promotion of the ISO 20022 framework. While the framework has already been widely adopted for some types of payments, particularly those processed by Swift, there is more work required to extend it and develop a range of application programming interfaces to ensure that ISO 20022 payments are as accessible as possible to the broadest range of users.

To help with this, the CPMI and Payments Market Practice Group have established a joint task force, which is working to ensure that payments system operators and market practice industry groups align with the ISO 20022 harmonisation requirements on schedule.

* This article first appeared on OMFIF on March 6, 2023.

* Lewis McLellan, Editor of the Digital Monetary Institute, OMFIF.

Work also needs to be done to smooth some of the frictions in the patchwork of various know your customer, anti-money laundering and countering the financing of terrorism regulations in different jurisdictions. And payment providers face challenges in obtaining licences to operate across multiple jurisdictions. These frictions make it more difficult for providers to offer their services to as many users as possible, which reduces competition in the market and worsens outcomes for users. Fixing this is one of the actions prescribed by the roadmap.

The Financial Stability Board has set up a working group to develop recommendations to make the supervisory requirements for institutions providing cross-border services more consistent. This will be followed by standards-setting bodies adapting their guidance to conform to the FSB's recommendations and a further period for national authorities to evaluate how to change their own frameworks.

House Prices Continue to Fall as Borrowing Costs Rise*

By HITES AHIR, PRAKASH LOUNGANI AND KARAN BHASIN*

Property markets should enjoy greater stability when central banks slow or pause their campaign of raising interest rates to tame inflation

Global housing markets are retreating after years of steady gains. The Chart of the Week shows widespread declines in inflation-adjusted housing prices for two-thirds of the countries with recent data from the Organisation for Economic Co-operation and Development.

The moves underscore how housing markets are adjusting to rising interest rates as central banks try to contain inflation. Policy rates have increased on average by 4 percentage points across major economies, to levels that prevailed prior to the global financial crisis.

In the United States for instance, the Federal Reserve has increased the target rate to a range of 4.5–4.75 percent from near zero a year ago, the fastest pace of rate increases in two decades. This in turn led to a sharp increase in the average 30-year fixed mortgage rate, which rose to a two-decade high of 7.1 percent late last year.

Interest rates play a critical role in driving house prices, along with income and population growth on the demand side and various supply factors like construction costs and regulations. A rule of thumb based on cross-country evidence is that every 1 percentage point increase in real interest rates slows the pace of house price growth by about two percentage points.

Prior to the recent tightening cycle, interest rates had been on a downward trend. Lower rates rationally led to an increase in housing demand by lowering the cost of borrowing to finance the purchase of a house or to build on to existing houses. Now the process has been thrown in reverse. Every percentage point increase in the mortgage rate raises monthly interest payments for the average US homebuyer by \$100, and the impacts can be more dire for buyers in countries with a predominance of adjustable rate mortgages.

How long the decline in housing prices continues will depend on whether the rate hikes by central banks have already curtailed inflationary pressures. The IMF's latest World Economic Outlook update forecasts inflation to be lower this year than it was in 2022 for about 85 percent of countries. Global inflation is expected to slow from almost 9 percent last year to about 6.5 percent this year and decelerate further next year, driven by the impact that rate hikes have already had on easing the imbalances between demand and supply.

If central banks slow or pause rate hikes, housing prices should then see greater stability.

* This article was published on IMF Blog on March 15, 2023.

* Hites Ahir is a senior research officer in the IMF's Research Department. His areas of research expertise are housing markets and forecast assessment. He previously worked at the Inter-American Development Bank where he assisted with analysis of the Southern Cone economies. He did his graduate work in economics at Johns Hopkins University.

Prakash Loungani is Assistant Director and Senior Personnel Manager in the IMF's Independent Evaluation Office. He is a co-author of *Confronting Inequality: How Societies Can Choose Inclusive Growth* (Columbia University Press, 2019). Previously, he headed the Development Macroeconomics Division in the IMF's Research Department and was co-chair of the IMF's Jobs and Growth working group from 2011-15. He is an adjunct professor at Johns Hopkins University's Carey School of Business and Senior Fellow at the Policy Center for the New South, a think-tank based in Rabat, Morocco.

Karan Bhasin is a young economist who holds a master's degree from TERI School of Advanced Studies and a bachelor's degree in economics from The University of London. He is presently a graduate student and is currently based out of New York. He has diverse research interests spanning areas such as Macroeconomics, Monetary Economics, and political economy. He has worked with multiple think tanks, government agencies and multilateral institutions in the past. A regular columnist, he writes for major digital publishing platforms, leading Indian magazines and newspapers.

Recent Financial Stability Crisis

Silicon Valley Bank Collapse Reverberates through Financial System^{*}

By MARK SOBEL^{*}

It isn't supposed to work this way

The collapse of Silicon Valley Bank and Signature Bank and the *US federal government's rescue of all depositors* through the invocation of a systemic exemption will unleash a lasting torrent of recrimination, introspection and commentary, going well beyond the rescue itself. A plethora of issues will need to be assessed and those set out here will undoubtedly already be on the table.

Outrage that the rescue is a bank bailout and will foment moral hazard are already being loudly heard. Up against bailout criticisms, the Federal Reserve and Treasury will feel compelled to defend their actions, reverting to the standard argument that shareholders will get wiped out and others hurt, so the rescue should not be seen as a bailout. But, of course, uninsured depositors are being protected.

Authorities are quite mindful of moral hazard and the adverse incentives spawned by their actions. But just as has been the case, whether Republicans or Democrats were in power such as in 2008-09, the immediate need to protect the global and/or US economic and financial systems from severe harm and runs is rightly seen as far outweighing moral hazard concerns.

Authorities can focus on corrective actions tomorrow. Today's job is crisis management and stopping the run.

Already, some analysts are recalibrating views on US monetary policy. An emerging consensus suggests the Fed will no longer consider hiking by 50 basis points in two weeks, but 25bp. Some are even suggesting there will be no hike in March. Yet inflation remains sticky, with some holding to an expected terminal rate above 5.5%. Meanwhile, Treasury rates – especially short-term rates – are plummeting and the yield curve's inversion has been substantially reduced, largely reflecting a run to safety.

For many years, Fed officials and leading practitioners have stated there should be separation between monetary and financial stability policies. Monetary policy should target the dual mandate, while financial stability should be tackled through sound micro- and macroprudential policy. The tools to implement that division were argued to be largely in place in the wake of the Dodd-Frank Wall Street Reform and Consumer Protection Act and post-2008 financial crisis measures.

To listen to commentators and judging by market action, that view has been seemingly obliterated within a span of 48 hours.

There are key issues for the US regulatory system. Under the US deposit insurance system, depositors are protected up to \$250,000. But all SVB and Signature Bank depositors are being protected. Depositors were also heavily protected in the 2008 financial crisis, including money market funds.

SVB was the US's 16th largest bank. It was not seen as systemic. Yet, the financial contagion spawned by market fears and interconnectedness are obviously systemic. Bear Stearns and Lehman in and of themselves were not seen as systemic, and yet they were. A family fund, Archegos Capital Management, set off huge market ructions last year.

^{*} This article first appeared in OMFIF Commentary on March 13, 2023.

^{*} Mark Sobel, US Chair of OMFIF

Many US regional banks are enormous in terms of their assets. *Legislation put forward in 2018* meant that banks under \$250bn – not \$50bn – in assets no longer needed to comply with enhanced prudential standards and associated supervisory rigour – stress testing and liquidity, for example.

The US needs to consider whether the thresholds for what counts as systemic are appropriate. History clearly suggests that authorities have persistently underestimated contagion and that a much longer list of banks should be subjected to enhanced prudential standards. Inevitably, there should be an examination of whether tougher capital and liquidity standards are needed, especially for medium-sized and regional banks. The banks will continue their furious lobbying of Capitol Hill against doing so, but this week's runs should be chastening.

One fallout from SVB is that the concentration of the US banking system may further increase. Depositors in small- and medium-sized or regional banks are undoubtedly asking whether they should rethink their holdings. The largest banks, such as JP Morgan and Citi, will most likely seem safer and more attractive. Their portfolios are diverse. Their capital is stronger. They are too big to fail.

Are on-the-ground regulators up to snuff? Analysts are already pointing to myriad flaws in SVB's practices, even apart from the concentrated nature of its relationship with the valley's venture capital and tech firms. Deposits soared at a much-faster-than-average pace. SVB relied enormously on funding from Federal Home Loan Banks. Its long-term bond holdings were relatively large and unhedged. These practices should have been red flags for regulators.

Ahead of the 2008 financial crisis, US regulators missed red flags as well. They didn't understand the complexity of structured products and risks building up on bank balance sheets.

One can argue that SVB wouldn't have been so badly hit if not for the Fed rate hiking cycle. But other financial institutions are being impacted and weathering the turbulence.

Bank failures will always happen. But a serious investigation needs to be undertaken on why the regulators missed red flags, whether they were complacent and/or subject to regulatory capture and what needs to be overhauled.

These are but a few issues to be spawned by the aftermath of SVB's collapse. Undoubtedly, more will follow in the days ahead.

Reform of International Monetary System

Central Banks are Reassessing Foreign Exchange Reserves^{*}

By GARY SMITH ^{*}

The International Monetary Fund's Currency Composition of Foreign Exchange Reserves data for the third quarter of 2022 has revealed another drop in global foreign exchange reserves. The headline number declined by around \$500bn in the quarter, taking the cumulative decline to almost \$1.5tn since Q3 2021. It is important to note that during the third quarter the dollar appreciated by around 5% on a trade-weighted basis. Since non-dollar reserves are converted to a dollar value for the purpose of the IMF report, that would have been a substantial headwind.

Last year was truly unusual because Russian reserves were frozen as a result of sanctions announced in response to the invasion of Ukraine. A weaponised dollar has long been a topic of discussion for reserve managers, but the sanctions announced in March 2022 were noteworthy because the weaponisation involved the dollar, euro, sterling, yen and Canadian dollar.

The dollar weight in foreign exchange reserves has fallen to around 60% in the latest data from 71% at the turn of the century (there was a tiny rise in the latest data, helped by the valuation effect). This decline reflects portfolio diversification decisions by a wide range of central banks. IMF data highlight that much of the shift away from the dollar in recent years has been into currencies that were previously considered to have insufficient scale and liquidity to qualify as candidates for international reserves.

However, it is not just the new currencies that are growing. Sterling's role appears to have not only survived the UK's departure from the European Union but has actually grown modestly. The Japanese yen has also grown, and the Swiss franc has maintained a small but stable presence. It seems as though currencies do not disappear from this list. In a more fractured global political environment, and a world in which a higher value might be placed on local trade relationships, a greater number of reserve currency options for central banks appears to be welcome. Weaponisation of finance did not trigger this trend for diversification into smaller currencies, but it might now help that trend continue.

But the situation is complex. The weight of China in global trade should lend support to further growth in the weight of the renminbi, but we may discover that the multinational sanctions placed on Russia in 2022 force a rethink on which currencies are safe havens. The renminbi may have benefitted from an anti-dollar vote in recent years (especially as the Central Bank of Russia switched out of dollars) but the sanctions placed on Russia may prompt a pause, and consideration of what a further deterioration in China-US relations might entail for holders of renminbi assets. In the future we may talk less about global trends, and more about the individual national appetite for currency diversification.

^{*}This article was published on OMFIF website on January 4, 2023

^{*} Gary Smith, Managing Director of Sovereign Focus

Weaponisation of finance may also support the argument for gold. The World Gold Council reported that gold purchases by central banks in 2022 were the highest for 50 years – a trend highlighted by OMFIF in 2016. No doubt the spike in global inflation rates helped the buying trend in 2022, but the biggest (undeclared) buyers were probably Russia and China. The largest named buyer in 2022 was Turkey, a Nato nation with a complex relationship with the US friendship circle. The other large named buyers in 2022 were Uzbekistan, India, Qatar and Egypt – all nations which abstained on the vote to expel Russia from the United Nations Human Rights Council in April last year. It seems clear that politically inspired buying of gold was a factor in 2022.

It is also worth noting that the trend for gold to be repatriated and stored in vaults in the home nation is a politically defensive action that has financial consequences in addition to the obvious transport, security and storage costs. ‘Home gold’ might be safe from seizure or freeze, but it is not as useful as gold that is stored at the Federal Reserve or the Bank of England because it will be more difficult to use for repurchase and swap operations. Furthermore, a nation under sanction will find that it cannot use the US centric global financial system to process gold sale proceeds. Gold stored in a national vault may consequently be worth less than gold stored at the Bank of England or New York Fed.

Central bank foreign exchange reserves are high-profile, state-owned investments. It should not be surprising that in a more fractured geopolitical world, many nations will reassess how these assets are managed. The discussion of global trends (for example, into or out of the dollar) may become less relevant as individual national choices are aligned with nations which are political and economic partners. Weaponisation of finance will give impetus to the continued development of a more multi-polar international monetary system, and for further currency diversification in central bank reserves holdings.

Markets Exploring Alternative Currencies despite Dollar

Dominance*

By JULIAN JACOBS *

The outlook for foreign exchange markets in 2023 will be heavily shaped by the course of the global economy and especially relative monetary policy stances. What should economists expect?

In the aftermath of Covid-19, a period of war-kindled inflation appears to be easing in many countries. While further monetary policy tightening may be due in key economies, there are signs that the global economy may prove more resilient – albeit sluggish – than previously thought and interest rate hikes may not necessarily induce a deep recession (or hard landing) as feared.

And yet, the consequences of the slowdown in labour markets, elevated interest rates and high energy prices may be slow to emerge and latent in their effects.

On 23 January, OMFIF hosted an off-the-record roundtable to discuss the outlook for foreign exchange markets in 2023. Led by Mark Sobel, OMFIF US chair, the panel included Christian Kopf, head of fixed income at Union Investment, Rebecca Patterson, former chief investment strategist at Bridgewater Associates, and Ebrahim Rahbari, global head of foreign exchange analysis at Citi.

At the core of this discussion was whether conditions in the macroeconomy might be improving and how uncertain macroeconomic policies and geopolitical events might be shaping foreign exchange markets. Panellists first noted that the apparent slowdown of inflation was an auspicious signal, which might encourage the Federal Reserve to reduce the pace of its interest rate increases. There was some concern that tightening monetary policy might weigh on the economy. But the panellists also commented that it was unlikely the Fed would reverse course by lowering interest rates in 2023, as many market participants expect.

The discussion underscored the difficulty in deciphering global macroeconomic conditions. One panellist noted that, earlier in 2022, the German economy was expected to contract sharply this year but is now expected to experience an expansion in late 2023. Others pointed to several potentially damaging macroeconomic hazards that might portend a latent downturn. This includes not only the spike in energy costs, but also the accumulation of household debt. As companies and families burn through their savings, the prospect of rising interest rates creates the potential for recessionary pressure.

Various panellists noted that, with the Fed approaching its terminal rate and slowing down the pace of hikes, the dollar had come off its highs and had scope for further easing. They also indicated an expectation that the euro would appreciate against the dollar slightly by the end of 2023, borne in large part from improving conditions in the European macroeconomic forecast. The European Central Bank was seen as more hawkish than the Fed at the moment, which would also support the euro against the dollar. Meanwhile, one panellist predicted that the yen would

* This article first appeared in OMFIF Commentary on February 8, 2023.

* Julian Jacobs, Economist at OMFIF

appreciate through 120/\$ largely due to more favourable rate differentials. Yen strength and Bank of Japan tightening would depend on domestic inflation, they said.

There was more uncertainty regarding sterling. One panellist putting a positive spin on it commented that a resurgence would ultimately be contingent on the ability of the UK economy to overcome self-inflicted wounds, including its departure from the European Union, a poor pandemic response and the loss of international credibility brought on through travails in the Conservative party leadership. There are obvious difficulties in accomplishing such a feat, and the International Monetary Fund has predicted that the UK will be the only western economy to fall into recession this year.

What do these elements mean for the dollar's longer-term role in the global monetary and financial system? The panel broadly maintained that dollar dominance would persist. It also noted that central banks may be moving towards several alternative assets – such as the Australian and Canadian dollars – but that these currency allocations would remain largely on the margins.

The panel predicted that Chinese attempts to improve the global standing of the renminbi would continue but remain hampered by countries' geopolitical concerns and China's economic woes. Many emerging markets appear to be increasing their allocation of gold, which does not have the liquidity of US treasuries (bonds generally) but is offering emerging markets and China an opportunity to attain some modest diversification, including protection against 'western' sanctions.

And so, the panel's 2023 foreign exchange prediction in short: continued dollar systemic dominance but some weakening off from its late-2022 highs, a stronger euro, a potentially strengthening yen and exploration of alternative currencies and commodities by several emerging markets.

Financial Regulation

Big Techs in Finance: Forging a New Regulatory Path^{*}

By AGUSTÍN CARSTENS^{*}

Bigtechs and data

We at the BIS have been closely following large technology firms (bigtechs) and their advances into finance¹. Bigtechs' reach extends across a wide range of industries, with existing core businesses grounded in e-commerce and social media, among others. From this base, they have expanded into finance.

To understand how bigtechs can easily make forays into finance, one must grasp the key role of data. Indeed, bigtechs have fully embraced the centrality of data in the digital economy. This is what distinguishes them from other firms. It also shapes their unique characteristics. Let me mention those that are particularly relevant for policymakers.

First, bigtechs can overcome limits to scale in financial services provision by using user data from their existing businesses. Their business model revolves around users' direct interactions and the data generated as a by-product of these interactions.

They use that data to offer a range of services that exploit the inherent network effects in digital services, a phenomenon where more users attract ever more users. In this way, bigtechs can establish a substantial presence in financial services very quickly through what we call the 'data-network-activities' (DNA) loop.

Second, bigtechs collect different types of data from the various business lines they straddle². They are uniquely positioned to combine that data to uncover patterns and insights that can help them improve their services or offer new ones³.

This combination of different types of data across sectors carries efficiency gains and is key to bigtechs' provision of digital services.

Third, bigtechs are unrivalled experts in data management and analysis. They devote significant resources to developing or acquiring state-of-the-art technologies. After all, access to large troves of data generates value only if you also have the technological capabilities to analyse it and monetise it.

Bigtechs have been pioneers in leveraging artificial intelligence techniques for this purpose⁴. To be sure, these capabilities have high fixed costs, but once that is overcome the marginal cost of handling more data is negligible.

Therefore, bigtechs benefit from significant economies of scale in their use of data. For other firms, reaping the benefits of such economies of scale is a tall order.

Data management is thus at the core of bigtech activities, and the financial sector is all about managing information. Coupled with bigtechs' relentless drive to expand, their growing and already substantial footprint in financial services should come as no surprise.

Moreover, the trend towards greater digitalisation, which the COVID-19 pandemic has accelerated, has allowed bigtechs to fortify their market positions even further.

Public policy challenges

Given their size and customer reach, bigtechs' entry into finance could trigger rapid change in the industry, generating both opportunities and challenges. The potential benefits of bigtechs'

^{*} This article first appeared on BIS on February 8, 2023.

^{*} Agustín Carstens, General Manager of the Bank for International Settlements

entry into finance include improved customer outcomes, increased financial market efficiency and enhanced financial inclusion.

For example, BIS research has shown that access to innovative (QR code-based) payment methods provided by bigtechs helps micro firms build up credit history, and the use of bigtech credit can ease access to bank credit⁵. And there are many more examples.

But it's not all roses in the garden. The economic features that make bigtechs powerful in lowering costs and supporting financial inclusion also create new challenges for policymakers⁶.

First, data governance. Bigtechs have large amounts of personal data, and their use comes with a trade-off between data efficiency and privacy. While detailed data may help align products on offer with consumer preferences and lower costs, there are risks to consumers, especially when sensitive data are shared.

Moreover, bigtechs can engage in price discrimination, making consumers worse off⁷. Restricting the use of data may help, but could have costs for allocative efficiency⁸.

Second, competition is at threat in the presence of bigtechs. While bigtechs can initially bring greater competition, network effects allow them to quickly build positions of dominance in specific market segments, for example by increasing user switching costs or raising barriers to entry. And the resulting concentration dynamics have a direct effect on market contestability and consumer welfare. Thus, new entry may not increase market contestability. Moreover, in the case of network industries market failures and externalities may arise.

Last, but certainly not least, there are important financial stability considerations which fall squarely within the mandates of central banks and financial regulators. Let me elaborate on specific concerns around the financial stability risks arising from bigtechs in finance.

One concern centres on bigtechs' potential systemic importance. Financial services currently represent a relatively small part of bigtechs' overall activities, but this can change rapidly through the DNA loop. They may quickly become 'too big to fail'.

This gives rise to concerns about the emergence of dominant firms with excessive concentration of market power and a possibly systemic footprint in the financial system.

A second concern is emerging around the risks from substantive interdependencies inherent in bigtech activities⁹. These arise between bigtech entities because they share data and provide relevant services to each other. They also share technological platforms and applications and use a common payment infrastructure¹⁰.

Meanwhile, interdependencies with outside parties arise from joint ventures with financial institutions in providing financial services. These partnerships can entail an opaque distribution of responsibilities that diffuses accountability and hinders adequate oversight. They also have the potential to intensify operational, reputational and consumer protection risks as well as moral hazard issues.

Then there is a third concern around the role of bigtechs as providers of critical services. Financial institutions have come to heavily depend on bigtech technology services, and this is exacerbated by bigtechs' tendency towards market concentration.

While these services bring many advantages, the widespread dependency on them is forming single points of failure, and hence creating new forms of systemic risk at the technology services level. This type of risk is particularly evident in the market for cloud computing, which is highly concentrated and now dominated by a handful of bigtechs¹¹.

As a consequence, disruptions in the operations of one bigtech could have a substantial impact on the financial system¹². In other words, greater operational risks can translate into greater financial stability risks, especially when critical services are highly concentrated.

The concerns I have just discussed are aggravated by shortcomings in the current regulatory approach, which is not fully fit for purpose to deal with the unique set of challenges arising from bigtechs' entry into financial services.

The current regulatory approach and its shortcomings

Most financial activities in which bigtechs engage are governed by sectoral regulations. And the existing ones can at best partially address the risks I outlined earlier.

These regulations are grounded on the main supervisory concerns in each sector, be they the protection of depositors, policyholders or investors. They were not designed with bigtechs in mind

and therefore are not geared towards possible spillover effects across all the activities bigtechs perform, or their potential systemic relevance.

And yet they determine the applicable regulatory treatment for bigtechs' financial activities, the width of the regulatory perimeter and the reach of supervisory oversight.

Importantly, such regulations tend to follow an activity-based approach, where providers must hold licences for specific business lines¹³. Activity-based regulation constrains an activity on a standalone basis by imposing restrictions on how it can be performed.

It does not vary according to the type of entity that performs the activity. It also does not consider possible spillover effects from other activities performed by the same entity¹⁴.

In contrast, entity-based regulation constrains a combination of activities at the entity level by imposing restrictions on an entity's characteristics that affect the likelihood and repercussions of its failure. Such combinations of activities affect an entity's resilience.

The financial stability risks of such combinations cannot be addressed by constraining individual activities, without any controls on the critical interactions across bigtech entities and their activities. In short, a purely activity-based framework for regulation is ill suited to address the policy challenges bigtechs pose.

Forging a new regulatory path

Without a doubt, a regulatory re-think is warranted, and we need a new path to follow. One that considers the key role of data in bigtechs' DNA-based business model. One that strikes the right balance between benefits and risks.

We at the BIS have argued for some time now that we have to go one step further and regulate bigtechs directly¹⁵. More concretely, we need to consider how best to complement existing activity-based rules under sectoral regulations with group-wide entity-based requirements that would allow authorities to address financial stability risks emerging from the interactions between the different financial and commercial activities that bigtechs perform¹⁶.

It is high time to move from theory to practice and consider tangible options for regulatory actions. Now let me attempt to put forward a blueprint for thinking about what such options could look like.

Recent BIS publications have identified three regulatory approaches that could serve as a basis for a new regulatory framework for bigtechs in finance¹⁷.

First, the restriction approach would prohibit bigtechs from engaging in regulated financial activities. It follows the logic inherent in the traditional separation of commerce and banking that prevails in many jurisdictions.

This approach radically alleviates financial stability concerns as bigtechs would be left only with their non-financial business lines. Yet it would deprive them from using big data to solve asymmetric information problems, for example assigning credit scores to small and opaque firms that do not have collateral¹⁸. It would therefore remove the numerous benefits that bigtech services in finance have brought.

Second, the segregation approach would require a bigtech's financial services to be grouped together under the umbrella of a financial holding company. This financial subgroup would have to meet prudential and other requirements. And it would be ring-fenced to mitigate the potential for contagion effects from non-financial to financial activities.

This could be achieved by banning the use of common group-wide technological platforms and any form of data-sharing between the financial and non-financial parts of the bigtech group.

This approach is conceptually simple, increases the transparency of a bigtech's organisational structure and facilitates oversight. Yet it would prevent bigtechs from realising synergies and economies of scale, and from generating insights from data generated across sectors.

It would therefore come with some of the shortcomings of the restriction approach. In all likelihood, this would lead – at least some – bigtechs to exit financial services altogether.

Third, the inclusion approach would make bigtechs with significant financial activities subject to group-wide requirements on governance, conduct of business, operational resilience and, only when appropriate, financial soundness.

This is because most bigtech risks are not strictly related to their financial soundness but their data-driven business model. Requirements would be levied on the group as a whole, including the bigtech parent.

This approach is tailored to existing business models. It acknowledges the fundamental role of data within bigtech groups and their tendency to use them to achieve dominant market positions.

As such, it would not prevent bigtechs from making efficient use of data collected from different activities, like the previous two approaches, as long as they observe sound data governance principles and effective pro-competition rules on a group-wide basis.

However, the inclusion approach is more complex than the segregation approach, as it requires effective monitoring of global groups that conduct a large variety of activities.

The segregation and inclusion approaches are to some extent mutually compatible, and in practice a combination of both may be desirable. Such a holistic approach could combine a prudential sub-consolidation of the financial part of a bigtech group (as under the segregation approach) with group-wide requirements on governance, conduct of business and operational resilience (as under the inclusion approach). Importantly, it would avoid efficiency losses in the use of data that (too) tight ring-fencing measures could cause.

Regardless of the approach chosen, the implementation of any comprehensive entity-based regulatory framework for bigtechs is beset with challenges and raises a host of practical questions.

One is how to ensure effective cooperation and information-sharing between financial, data and competition authorities at the local and crossborder level.

Another is whether any one authority has the expertise required to serve as lead supervisor for global groups that engage in a wide set of data-driven financial and non-financial activities.

Yet another is about enforcement and extraterritoriality, especially when bigtech services are performed by entities incorporated in foreign jurisdictions. This, together with unavoidable political considerations, may also explain why progress towards a new framework has been slow¹⁹.

And, I'm afraid to say, as we are working on devising an adequate policy response to bigtechs, challenges will continue to emerge. Innovation never rests, as recent advancements in artificial intelligence and the emergence of quantum computing make clear. But I am confident that the international community will find ways to address current and coming challenges.

Conclusion

To support the search for answers, a thorough international policy debate is essential. After all, international standards are the only way to shape a consistent policy response. As the saying goes, policymaking is poetry, implementation prose. But before we can even think of implementation, we need to consider the right policies.

Crypto Contagion Underscores Why Global Regulators Must Act Fast to Stem Risk*

*By BO LI AND NOBUYASU SUGIMOTO**

Stronger financial regulation and supervision, and developing global standards, can help address many concerns about crypto assets

Introduction

The already volatile world of crypto has been upended anew by the collapse of one its largest platforms, which highlighted risks from crypto assets that lack basic protections.

The losses punctuated an already perilous period for crypto, which has lost trillions of dollars in market value. Bitcoin, the largest, is down by almost two-thirds from its peak in late 2021, and about three-quarters of investors have lost money on it, a new analysis by the Bank for International Settlements showed in November.

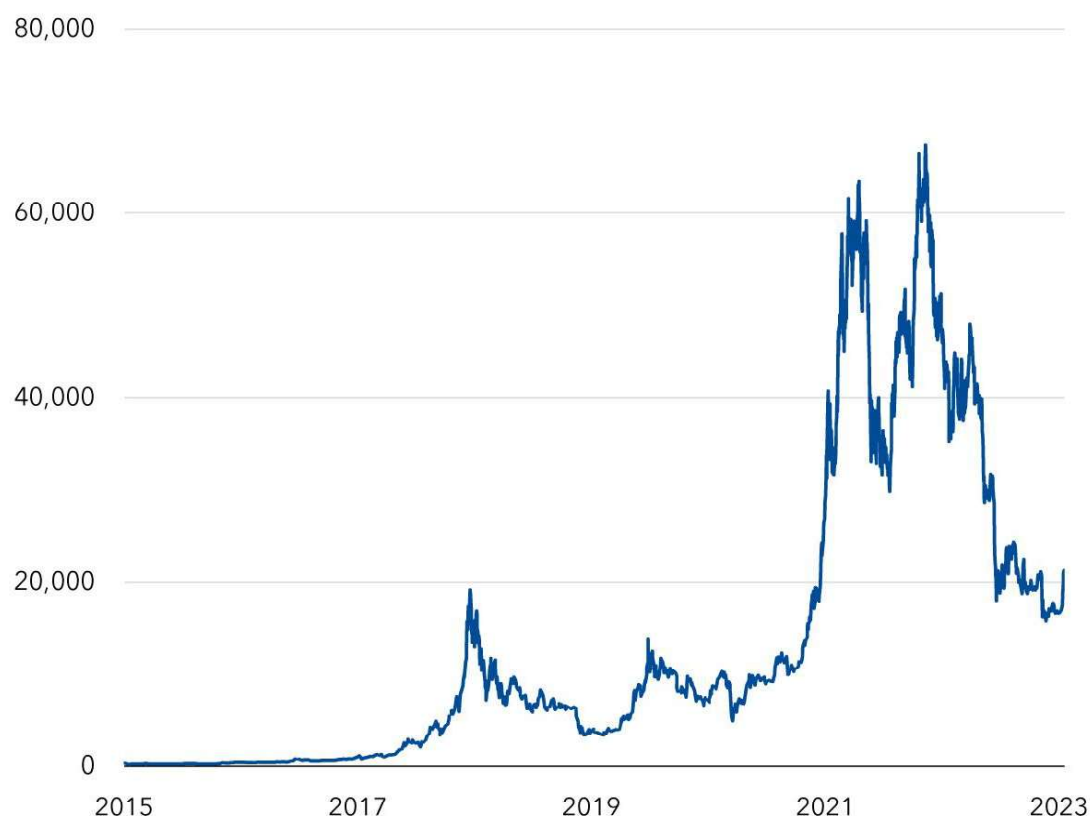
*This speech was given at IMF on January 18 2023

* Bo Li, Deputy Managing Director and Nobuyasu Sugimoto, Deputy Division Chief of IMF Financial Supervision and Regulation Division

Boom and bust

Bitcoin's value soared, extending gains during the pandemic, but since late 2021 has lost nearly three-quarters of its worth.

(Bitcoin price, US dollars)



Source: CoinDesk Bitcoin Price Index.

IMF

During times of stress, we've seen market failures of stablecoins, crypto-focused hedge funds, and crypto exchanges, which in turn raised serious concerns about market integrity and user protection. And with growing and deeper links with the core financial system, there could also be concerns about systemic risk and financial stability in the near future.

Many of these concerns can be addressed by strengthening financial regulation and supervision, and by developing global standards that can be implemented consistently by national regulatory authorities.

Two recent IMF reports on regulating the crypto ecosystem are especially timely amid the severe turmoil and disruption in many parts of the crypto market and the repeated cycles of boom and bust for the ecosystem around such digital assets.

Our reports address the issues noted above at two levels. First, we take a broad approach, looking across key entities that carry out the core functions within the sector, and hence, our conclusions and recommendations apply to the entire crypto asset ecosystem.

Second, we focus more narrowly on stablecoins and their arrangements. These are crypto assets that aim to maintain a stable value relative to a specified asset or a pool of assets.

New challenges

Crypto assets, including stablecoins, are not yet risks to the global financial system, but some emerging market and developing economies are already materially affected. Some of these countries are seeing large retail holdings of, and currency substitution through, crypto assets, primarily dollar-denominated stablecoins. Some are experiencing cryptoization—when these assets are substituted for domestic currency and assets, and circumvent exchange and capital control restrictions.

Such substitution has the potential to cause capital outflows, a loss of monetary sovereignty, and threats to financial stability, creating new challenges for policy makers. Authorities need to address the root causes of cryptoization, by improving trust in their domestic economic policies, currencies, and banking systems.

Advanced economies are also susceptible to financial stability risks from crypto, given that institutional investors have increased stablecoin holdings, attracted by higher rates of return in the previously low interest rate environment. Therefore, we think it's important for regulatory authorities to quickly manage risks from crypto, while not stifling innovation.

Specifically, we make five key recommendations in two Fintech Notes, *Regulating the Crypto Ecosystem: The Case of Unbacked Crypto Assets* and *Regulating the Crypto Ecosystem: The Case of Stablecoins and Arrangements*, both published in September.

1. Crypto asset service providers should be licensed, registered, and authorized. That includes those providing storage, transfer, exchange, settlement, and custody services, with rules like those governing providers of services in the traditional financial sector. It's particularly important that customer assets are segregated from the firm's own assets and ring-fenced from other functions. Licensing and authorization criteria should be well defined, and responsible authorities clearly designated.

2. Entities carrying out multiple functions should be subject to additional prudential requirements. In cases where carrying out multiple functions might generate conflicts of interest, authorities should consider whether entities should be prohibited to do so. Where firms are permitted to, and do carry out multiple functions, they should be subject to robust transparency and disclosure requirements so authorities can identify key dependencies.

3. Stablecoin issuers should be subject to strict prudential requirements. Some of these instruments are starting to find acceptance beyond crypto users, and are being used as a store of value. If not properly regulated, stablecoins could undermine monetary and financial stability. Depending on the model and size of the stablecoin arrangement, strong, bank-type regulation might be needed.

4. There should be clear requirements on regulated financial institutions, concerning their exposure to, and engagement with, crypto. If they provide custody services, requirements should be clarified to address the risks arising from those functions. The recent standard by Basel Committee on Banking Supervision on the prudential treatment of banks' crypto assets exposures recently is very welcome in this respect.

5. Eventually, we need robust, comprehensive, globally consistent crypto regulation and supervision. The cross-sector and cross-border nature of crypto limits the effectiveness of uncoordinated national approaches. For a global approach to work, it must also be able to adapt to a changing landscape and risk outlook.

Containing user risks will be difficult for authorities around the world given the rapid evolution in crypto, and some countries are taking even more drastic steps. For example, sub-Saharan Africa, the smallest but fastest growing region for crypto trading, nearly a fifth of countries have enacted bans of some kind to help reduce risk.

While broad bans might be disproportionate, we believe targeted restrictions offer better policy outcomes provided there is sufficient regulatory capacity. For instance, we can restrict the use of some crypto derivatives, as shown by Japan and the United Kingdom. We can also restrict crypto promotions, as Spain and Singapore have.

Still, while developing global standards takes time, the Financial Stability Board has done excellent work by providing recommendations for crypto assets and stablecoins. Our Fintech Notes draw many of the same conclusions, a testament to our close collaboration and shared observations on the market. For its part, the IMF will continue to work with global bodies and member nations to help leading policy makers working on this topic to best serve individual users as well as the global financial system.

—This blog reflects research contributions by Parma Bains, Fabiana Melo, and Arif Ismail

Effective Crypto Regulation Starts at Layer 1*

By MICHAEL KANOVITZ*

Take a moment to empathise with cryptocurrency regulators. We've tasked them with managing a constantly morphing ecosystem that is both plagued by lawlessness and built atop blockchain technology that thwarts outside control. The effort required to identify and apprehend pseudonymous criminals makes enforcement impracticable for most blockchain crimes, and no amount of effort can stop an automated decentralised autonomous organisation like Tornado Cash.

As a result, regulators are relegated primarily to know-your-customer processes via fiat on-/off-ramps to accomplish enforcement. In a decentralised, permissionless environment, relying on KYC alone is like attempting to tame the ocean by damming a few rivers. Effective regulation requires the full capabilities of law enforcement to protect property rights, remedy breaches of contract and intervene to stop crimes in progress.

Such capabilities are available through layer 1 protocols that enforce the law on-chain. These protocols obviate the need to seize private keys from pseudonymous criminals by enabling direct action on wallets and smart contracts. Officials invoke these protocols by obtaining a court order, just as they would for off-chain enforcement. For example, the US Treasury could shut down Tornado Cash by demonstrating cause to enjoin its smart contracts, or could seize assets by obtaining a warrant.

On-chain enforcement was unthinkable to most even a year ago but, having endured weekly hacks for hundreds of millions of dollars and frauds for tens of billions more, the blockchain community is ready to embrace it. Most market participants not only acknowledge the need for effective law enforcement but are demanding it. Many see on-chain enforcement as the best hope to thaw the crypto winter and establish blockchain as the backbone of mainstream commerce and the decentralised internet.

Adoption is already underway. Bitcoin SV (a top-50 blockchain proclaiming dedication to 'Satoshi's vision') recently implemented a protocol for blockchain authorities to enforce court-ordered transfers of BSV coins. The community hopes this development ingratiates it with regulators and diverts users from legacy bitcoin. Similarly, Jurat's layer 1 protocol enables consensus about the meaning of court orders so that nodes can execute them autonomously. The premise for on-chain enforcement is strong. More blockchains will follow.

There are several objections to on-chain enforcement, but none should give regulators pause.

First is the fear that tyrannical officials will seize digital assets. It is worth noting that those expressing this concern also own houses, cars and bank accounts, all of which the government leaves alone. Due process is an excellent protector of property rights, so limiting on-chain enforcement to valid court orders will keep digital property as sacrosanct as physical.

Potential for abuse by intermediaries is a second objection, but an exaggerated one. Bitcoin SV chooses trusted 'notaries' (assumedly solicitors) to interpret and publish court orders to the network. Jurat, by contrast, eliminates intermediaries by generating machine-readable hashes for judges to include in their docketed orders.

Third is concerns about ledger immutability. These misunderstand the on-chain enforcement process. Courts do not rewrite ledgers. Rather, they enforce the law through a new remedial transaction that changes the effect of a prior (illegal) one. They do not alter the ledger itself.

Regulators have multiple paths forward. Mandating minimum enforcement standards is one, but the multijurisdictional nature of public blockchains makes this impracticable. A second option is to do nothing. Self-interest should drive adoption given that property becomes more valuable as legal protections are strengthened. A third is for influential agencies like the US Treasury and the Securities Exchange Commission to offer a regulatory sandbox when providers use blockchains with on-chain enforcement. The move is justified because oversight is reduced when private actors

* This article was originally published in the Digital Monetary Institute Annual 2023 on March 17 2023.

* Michael Kanovitz, Chief Executive Officer at Jurat.

can enforce legal rights (think of shareholder suits for fraud). This approach will also hasten legal protections on-chain – the ultimate goal for any regulatory scheme.

Sustainable Growth

Scaling up Climate Finance for Emerging Markets and Developing Economies*

By BO LI *

Good afternoon. It is an honor to join you here in Luxembourg for the first ever European Investment Bank Group Forum.

As we gather to discuss how we can address the challenges of climate change, let me first take stock of the wider economic context.

We expect 2023 to be another challenging year for the global economy. In our latest IMF World Economic Outlook, we expect global growth to fall from an estimated 3.4 percent in 2022 to 2.9 percent in 2023.

In the Euro Area, the slowdown is even more pronounced—from 3.5 percent in 2022 to an expected 0.7 percent this year before a modest rebound to 1.6 percent in 2024. And despite the recent drop in energy prices, we expect energy security concerns will continue to loom large in Europe.

This speaks to the importance of the green transition—away from fossil fuels that are subject to supply disruptions and volatility, and towards renewables such as wind and solar energy.

The growing impact of global warming reminds us of the urgency. From heatwaves in Europe and wildfires in North America, to droughts in Africa and floods in Asia: last year saw climate disasters on all five continents. The effects of climate change are all around us.

Without decisive action, things are set to get worse because we are clearly not on the right trajectory for cutting global emissions.

We need to cut global emissions by 25-50 percent by 2030 compared to pre-2019 levels to contain temperature rises to between 1.5 and 2 degrees celsius.

IMF analysis of current global climate targets shows, unfortunately, they would only deliver an 11 percent cut—less than half of the minimum reduction that is needed. And so we need *higher ambition, stronger policies, and more finance* for implementation.

This last point is where I will focus my remarks today.

Financing needed to meet adaptation and mitigation goals are estimated **at trillions of US dollars annually until 2050.**

But so far, we are seeing only around **630 billion dollars a year in climate finance across the whole world**—with only a fraction going to developing countries.

This is particularly concerning—because emerging and developing economies have vast needs for climate finance. And it underlines why it's so important for advanced economies to meet or exceed the pledge of providing \$100 billion per year in climate finance for developing countries.

This is not just the right thing to do, it is the smart thing to do.

Why? Because under a business-as-usual scenario middle- and low-income countries are expected to account for 66 percent of global CO2 emissions by 2030, up from 44 percent in 1990.

In other words, because climate change is a global problem, it requires coordinated global solutions.

So, what can we do to boost financing?

*This speech was given by Deputy Managing Director Bo Li at EIB Group Forum 2023 on February 27, 2023.

* Bo Li, Deputy Managing Director

First, focus on the policies that can redirect investment flows from high-carbon projects towards climate friendly opportunities. Here, think of smarter regulation, price signals and well targeted subsidies that incentivize low-carbon investment while paying attention to each country's unique fiscal and macro-financial characteristics.

The **second** priority is to build capacity. We need to strengthen public financial management and public investment management related to climate projects for policymakers to implement needed reforms. Countries need the capacity to identify, appraise and select good quality projects, as well as to manage relevant fiscal risks.

There is a significant scarcity of high quality and reliable data, harmonized and consistent set of climate disclosure standards, and taxonomies to align investments to climate-related goals. So, capacity building is needed to strengthen the climate information architecture that will help develop and deepen the capital markets and improve the bankability of projects.

Innovative financial structures can also catalyze technical assistance programs to support the creation of new markets for climate finance by developing guidelines, providing training programs for local stakeholders, and facilitating the adoption of the principles and international best practices in emerging markets.

This brings me to my **third** priority: **innovative financial mechanisms including de-risking instruments and a broader investor base.**

At a more granular level, investors who want to deploy capital into emerging and developing economies must overcome a host of constraints. These include high upfront costs and long timeframes associated with climate investments, lack of liquid markets, foreign exchange risk, and scarcity of well-planned and scalable projects.

Overcoming these obstacles requires a **change of mindset** – from the public sector, the private sector, and multilateral institutions – to revamp the financial architecture so more private finance is pulled towards climate projects. That means being flexible -- ready to complement a *national* strategy with a *regional* strategy as appropriate; or adopt a *programmatic* approach in addition to the traditional *project-based* approach in implementation to suit institutional mandates and needs.

Above all, **public-private synergies** will be critical.

Consider green bond funds that can tap into the vast resources of institutional investors by using relatively limited public resources. Such funds have great potential, as the example of the Amundi Planet Emerging Green One fund shows.

Set up with the support of the International Finance Corporation (IFC) and EIB, the Amundi green fund successfully leveraged private capital by several multiples. And let's not forget the investors who contributed to that success by taking calculated risks, including the IFC and EIB which invested in the equity and senior tranches of this fund.

But this isn't the only way that multilateral development banks can help.

Blended finance can play an important role to **crowd in public and private sector investors**. Public sector, including national governments and multilateral development banks like the EIB, could provide **first-loss** investments, **equity capital**, or **credit enhancements**. And by prioritizing equity over debt, development partners and multilateral development banks would also avoid adding to the sovereign debt burdens of developing countries.

At the IMF, we have stepped up and embraced the mindset change that is required to tackle climate change. We have put climate at the heart of our work – in surveillance, capacity development, lending, and in data and diagnostic tools, including the climate information architecture,

In collaboration with the World Bank, the Bank for International Settlements, and the OECD, the Fund is developing operational guidance on the G20 high-level principles for sustainable finance alignment approaches. And the new G20 Data Gaps Initiative will help develop detailed statistics on climate finance and forward-looking physical and transition risks indicators.

On the lending side, our new Resilience and Sustainability Trust (RST) will provide longer-term affordable financing for our vulnerable low- and middle-income members.

Our goal is that – through the RST – policy reforms, capacity development, and financing arrangement can be delivered in a package used to improve the policy and capacity environment and scale up climate finance by crowding in large-scale private capital.

For example, capacity development can empower policymakers to better identify, appraise, and select good quality projects. And climate-friendly public financial management and public investment management promote accountability, transparency, and more effective spending.

Such measures can not only help governments manage potential relevant fiscal risks from the various financing options – they can also give investors greater certainty that their funds are spent effectively and bring in new, interested donors through improved transparency and governance.

In addition, with the IMF’s expertise in macroeconomic and financial sector issues, we are hopeful that we can gather national authorities, multilateral development banks, and the private sector including institutional investors, export credit agencies, and others to identify and explore solutions to broaden the investor base and scale up private finance.

We are already working with some of these partners to see how the RST—by leveraging sound policies and creating additional fiscal space—can promote financing arrangements or facilities that could mobilize large scale private capital.

Let me conclude.

To deliver on our shared climate goals, we must **combine policy reforms, capacity development, and financing arrangements**. What we need today is **unprecedented cooperation and coordination**.

That is why this inaugural forum is so important.

People gathered here have expertise in public and private investment, structuring financial instruments, R&D, and low-carbon technologies among others.

And each of us has a unique role to play – and we must all step up.

Because if we do not deliver on the financing needs of emerging markets and developing economies, we cannot hope to meet the goals of the Paris Agreement.

Carbon Finance is at the Core of Climate Goals*

By MARCUS PRATSCH AND FRANK SCHEIDIG *

Many countries are looking to carbon markets and SLBs to address climate change

Without fast and deep emission reductions in all sectors, limiting global warming to 1.5 degrees Celsius is not achievable. Effective action requires concerted and sufficient investment, knowing that the costs of inaction will be far higher. The good news is we have all the tools and the knowledge required to limit warming. However, we need to speed up. This also means that market instruments must be expanded and applied more broadly and equitably to support immediate emissions reduction and encourage innovation.

Nationally determined contributions are at the core of the Paris agreement and key to the achievement of its long-term goals. According to the Intergovernmental Panel on Climate Change, developing countries alone require up to \$6tn by 2030 to finance not even half of their climate action goals. While financial flows are three to six times lower than levels needed by 2030 to limit warming to below 2 degrees Celsius, there is sufficient global capital and liquidity to close investment gaps.

Many countries are looking to carbon markets as part of the answer. Issuing green bonds is another solution for financing climate change mitigation and adaptation. So far, Europe has been the first (and the only) continent to promote the use of carbon markets to reduce emissions and of the green bond segment to finance the transition to low-carbon economies.

During COP27, Mike Bloomberg, founder and CEO of Bloomberg, said ‘Carbon markets were perceived like the wild west in the past. But now they [will] become the new sheriff in town.’

This underscores that carbon finance will be crucial for the implementation of NDCs. Carbon pricing provides mitigation incentives and indirectly reduces the vulnerability of the economy to climate change. According to a report from the World Resources Institute, interest in carbon markets is growing around the globe: 83% of countries intend to make use of international market mechanisms to reduce greenhouse gas emissions.

To support climate action on a large scale, building integrity into carbon markets is key. Emissions reduction and removal must be real and consistent with a country’s NDC. The institutional and financial infrastructure for carbon market transactions must be transparent. And there must be adequate social and environmental safeguards to mitigate adverse effects as well as protect positive project impacts, including the respect of human rights.

A vibrant sustainable bond market can be instrumental to monetise sustainable policies and national commitments such as the NDCs.

Climate-related projects often require long-term financing which cannot be channelled by the banking industry alone. This is where green bonds can be an effective solution. They can finance renewable energy and energy efficiency projects at lower costs for a long tenure. In addition, funds raised through green bonds usually have fewer restricting covenants, compared to bank loans, and are therefore a much more attractive source of climate-related finance.

* This article first appeared on OMFIF website on January 11, 2023.

* Marcus Pratsch is Head of Sustainable Bonds and Finance and Frank Scheidig is Global Head of Senior Executive Banking, DZ BANK.

Another way to link sustainable sovereign financing with NDCs could be through sovereign sustainability-linked bonds. These bonds are for general budget spending like any other government debt, but with a link to a refinancing mechanism if NDCs or other targets are met. By issuing the world's first sovereign SLB in March 2022, Chile successfully demonstrated that sustainable bonds could monetise not just sustainable public expenditure and infrastructure but also sustainable policies and national commitments such as the NDCs.

Transition bonds are another promising instrument in the sustainable bond market. Both as a use-of-proceeds and as a target-linked variant, they offer issuers the opportunity to raise capital for the funding of projects that will help them align with their local country's NDCs.

The need for transition financing to successfully implement the Paris agreement is undisputed. We cannot achieve a decarbonised and more sustainable world by focusing exclusively on economic activities, business models and sectors that are already 'dark green'. We can have a much greater positive impact on the global sustainability agenda by helping to make 'brown' economic activities, business models and industries 'light brown' or 'light green', rather than painting already 'dark green' activities, models and sectors one shade greener.

Both carbon market instruments and sustainable bonds are effective financial instruments for the implementation of NDCs. They are complementary, as we can only create a green and low-carbon economy by allocating large amounts of capital towards a more sustainable future. As we are running out of time, this can only be done by using different instruments in parallel.

Working Paper

Dancing with Dragon: the RMB and Developing Economies' Currencies*

By HE QING, LIU JUNYI AND YU JISHUANG *

Abstract

In this paper we analyse Chinese RMB co-movements with the currencies of other developing economies using daily data from January 1, 2006 to December 31, 2020. We find that the RMB plays an important role in East Asia & Pacific. Bilateral trade significantly increases the probability of RMB co-movements with other currencies while inflation differential decreases it. Additionally, the currencies of the economies that are more inclined to adopt a pegging system are less likely to co-move with the RMB. We further divide the sample into three sub-periods based on two major China's currency reforms and the results are consistent with our main finding. We also investigate the nonlinear determinants of RMB co-movements in high and low volatility regimes, respectively, and show the different patterns. Last but not least, we find that RMB currency swap and the Belt and Road Initiative amplify RMB co-movements in larger and more developed economies.

Keywords: the RMB, Co-movement, Belt and Road Initiative

JEL Classification: E58, F31, F33, F41

* Published in *Research in International Business and Finance*, 64 (2023) at February 2023

* He Qing, Senior Research Fellow of IMI, China Financial Policy Research Center & School of Finance, Renmin University of China. Liu Junyi, Soka University of America. Yu Jishuang, School of Finance, Renmin University of China

1. Introduction

With the enhancement of China's economy and the gradual opening of China's financial market, the renminbi (RMB) has gradually become an important currency for international trade settlement and financial transactions, especially for countries that have close trade with China. According to the data from the Society for Worldwide Interbank Financial Telecommunication (SWIFT), the payments share of the RMB in the global market has increased to 1.88 percent, making it the fifth-most-used payment currency after the US dollar, the euro, the pound, and the yen as of December 2020. Most of those payments have involved developing economies. For instance, the payments denominated in RMB that flow between China and Thailand, Indonesia, and India increased over 2014-2018 by 35 percent, 58 percent and 106 percent, respectively (SWIFT, 2020). The internationalization of the RMB is also reflected by its growing weight in a basket of reference currency of other economies (Kawai and Pontines, 2016; Ito, 2017). However, the status of the RMB does not match that of China in the international economy (He et al., 2016). A natural question follows: what is the current international status of the RMB and what determines it?

To gauge the internationalization of the RMB, a number of studies have investigated the extent of RMB co-movement¹ with other currencies, mainly located in Asia. While most of the studies find significant co-movements between the RMB and Asian currencies (Ho et al., 2005; Balasubramaniam et al., 2011; Henning, 2013; Subramanian and Kessler, 2013; Kawai and Pontines, 2016; Ito, 2017), no consensus was reached on the status of the RMB in Asia. Henning (2013) and Subramanian and Kessler (2013) obtain the results that co-movements between the RMB and Asian currencies are larger compared to the US dollar and conclude that there has been a RMB bloc in Asia. On the contrary, Kawai and Pontines (2016) claim that the US dollar is still the dominant anchor currency but the RMB's influence is rising in the currency baskets of economies in East Asia in recent years.

What is missing from above literature is determining factors of the weight of the RMB within these regions. In addition, it remains unknown the effects of RMB outside Asian countries. We investigate the determinants of the strength of RMB's co-movement with all developing economies given data availability, paying particular attention to the Chinese policy impacts. Our research proceeds in three steps. First, we estimate the co-movements between the RMB and developing economies currencies. Second, we study the determinants of the co-movements, and find that bilateral trade significantly increases the probability of the co-movement, while inflation differential and the choice of adopting a fixed exchange rate regime reduce it.

Lastly, we investigate how two policies of China, RMB currency swap and the Belt and Road initiative (BRI), may affect our main results. The currency swap started in China in 2009 amid the great financial crisis aiming for liquidity, stability, and bilateral trade and investment. Bahaj and Reis (2020) find that RMB currency swap enhances the role of the RMB in bilateral trade, which is the most important determinant of currency co-movement. BRI, another policy factor, was initiated in 2013 serving the purpose of integrating China's economy with the developing economies along the "belt and road", and strengthening China's economic influence in the region (Wang, 2016). We hence include both policies in the model and find that the likelihood of RMB co-movement in larger and more developed economies increases after the two policies are in place.² In other words, currency swap and BRI amplify RMB co-movement.

This study contributes to the existing literature in two ways. First, while several studies focus on the RMB co-movements in Asia (Chen and Peng, 2010; Balasubramaniam et al., 2011; Henning, 2013; Subramanian and Kessler, 2013; Shu et al., 2015; Kawai and Pontines, 2016; Keddad, 2019; McCauley and Shu, 2019), none has thoroughly investigated the RMB co-movements in developing economies and their determinants. This academic study is, to the best of our knowledge, the first that attempts to fill that gap by presenting the degree of the RMB co-movements in developing economies, and the finding that the RMB co-movements are driven mainly by trade and restrained by inflation concern as well as exchange rate regime choice.³ Secondly, we enrich the literature of RMB currency swap's impact on bilateral trade and settlement (Zhang et al., 2017; McDowell, 2019; Song and Xia, 2020; Bahaj and Reis, 2020), and that

1 Due to the China's increasing share and influence in the global economy, it is more pronounced that the co-movements emerged from the reason that the values of other currencies are driven by the RMB (McCauley and Shu, 2019).

2 Please note, the data of Belt and Road policy have to be hand-collected due to its limited data availability.

3 Subramanian and Kessler (2013) explore the determinants of the co-movement between the RMB and other currencies using the cross-section data of 50 economies and focusing on trade factor. Our study covers not only trade factor but also all relevant factors investigated in the following literature, Alesina and Barro (2002), Meissner and Oomes (2009), Plümper and Neumayerm (2011), Ghosh (2014) and Fischer (2016), as well as other determinants derived from optimal currency area theory, time inconsistent theory, and Mundell-Fleming-Dornbusch model. In addition, our panel data is superior to cross-sectional data for the added variance in time within economy.

of BRI's influence on cross-border trade and finance (Du and Zhang, 2018; Bastos, 2020; Foo et al., 2020; Liu et al., 2020), by pointing out the amplifying role of the two policies on RMB co-movement.

The remainder of the paper is structured as follows. Section 2 reviews the related literature. Section 3 introduces research design and the data. Section 4 reports and discusses the empirical results. Results of robustness and extension are reported in section 5. Section 6 concludes the paper.

2. Literature review

Frankel and Wei (1994) find no statistically significant evidence to support a yen bloc in East Asia in the mid-1980s, showing that nine of the ten East Asian countries they studied assigned heavy weights to the US dollar; and Singapore assigned weights to both the yen and the US dollar. The dominant US dollar gained a dynamic junior partner in the euro from 1999 onward. Their status as the reigning international currencies went unchallenged till the 2007–8 global financial crisis, which caused emerging economies to question the current dollar-euro monetary system and take steps to form a multi-polar one (Dobson and Masson, 2009; Cheung et al., 2010; Kenen, 2011).

Most of the widely discussed options for a third polar currency are Asian, which can be attributed to the emergence of Asia as the world's new economic powerhouse (Eichengreen, 2010; Angeloni and Sapir, 2011). Fratzscher and Mehl (2014) contend that the RMB has been the locomotive of the movements of major currencies in Asia since the mid-2000s, especially after the global financial crisis in 2007-8. Subramanian and Kessler (2013) note that the RMB overshadows the US dollar in East Asia, pointing to seven currencies out of ten in the region that co-move more closely with the RMB than with the US dollar. Ito (2017) confirms the increasing weight of the RMB in Asian countries' currency basket, but further investigates the growing influence of the RMB in both private and public sector of Asia. Evaluating the ways the RMB fulfills the two basic roles of a currency, Ito writes that "non-fully-convertible" RMB has served more as a "store of value" than it has as "a medium of exchange," crediting this phenomenon to the heavier hand of Chinese monetary policy and its lesser subjugation to market forces.

Chow (2014), on the contrary, argues that the US dollar still retains a dominant influence in the region, but concedes how the role of the RMB in East Asian currencies' determination has increased after the 2007-8 financial crisis. Kawai and Pontines (2016) echo Chow's finding by showing that the US dollar continues to be the dominant anchor currency, further undermining the hypothesis of an RMB bloc in East Asia. They heartily maintain the thesis of US-dollar dominance, even while noting that the RMB has increased its influence in the implicit currency baskets of several East Asian economies at the expense of the yen.

Any consensus that an RMB bloc in Asia exists is difficult to reach because of the various methods employed in past studies. Subramanian and Kessler (2013), for example, look at the two periods, July 2005-August 2008 and July 2010-July 2013, during which the RMB fluctuated relative to the US dollar, showing that the average weight of the RMB in East Asia is 60 percent higher than the US dollar. Henning (2013) selects two different intervals, July 22, 2005-July 2, 2009 and June 18, 2010-December 30, 2011, asserting that the RMB has become an anchor currency in East Asian countries. The caveat of this type of method is that during the period when the RMB is assumed to fluctuate vis-à-vis the US dollar, the RMB is de facto pegged to a basket of currencies largely dominated by the US dollar, which undermines his assertion.

There have been various attempts to partially control for the US dollar's influence on the RMB movement through econometric setups. Balasubramanian et al. (2011), for instance, adopt a two-step regression method, regressing the RMB on the US dollar and using the residual obtained as a proxy variable for the RMB. Their finding is that although the RMB has acquired certain anchorages, the US dollar remains dominant in East Asia. Kawai and Pontines (2016) point out that existing techniques fail to address the problem of severe multi-collinearity in estimations of Frankel–Wei regression model, in that the movements of the US dollar and the RMB are both included on the right-hand side of the equation. To provide stable and robust results, Kawai and Pontines (2016) propose a simple modification of Frankel–Wei regression model to estimate the RMB's weight in an economy's implicit currency basket and show that this new method yields results that are superior to those obtained by existing techniques.

A simpler way to filter out the influence of the US dollar on the RMB's movement is to use the US dollar as the denomination currency. Ho et al. (2005) present exchange rates of the currencies as per US dollar, then place the RMB-to-US dollar rate on the right side of standard Frankel-Wei model, finding that the RMB was assigned a significant weight in the currency baskets of the won, the New Taiwan dollar, the

Singapore dollar and the Thai baht even before the exchange rate reform of China in 2005. Similarly, Shu et al. (2015) studies the impact of exchange rate of the RMB on other East Asian currencies, all denominated in the US dollar, upon the onshore and offshore RMB markets, and find that the two markets perform significantly differently.

We base our empirical model on Frankel and Wei's approach to investigate co-movements between developing economies' currency and the RMB. Recognizing the multi-collinearity issue raised in Subramanian and Kessler (2013) and Shu et al. (2015), we also use the US dollar as the denomination currency and choose the period when the RMB fluctuated relative to the US dollar. Further, we investigate the determinants of RMB co-movements and analyze the impact of China's international policy.

One strand of literature on determinants of the co-movements between the RMB and other currencies is focused on the weight of the RMB in currency baskets (McCauley and Shu, 2019). Others consider anchor currency theory, which can be another important factor of co-movements (Alesina and Barro, 2002; Meissner and Oomes, 2009; Plümper and Neumayer, 2011; Ghosh, 2014; Fischer, 2016).

Optimal Currency Area (OCA) theory (Mundell, 1961) has been widely applied to the optimal exchange rate regime and anchor currency analysis. Alesina and Barro (2002) point out that the key determinant of adopting another economy's currency is the trade-off between trade expansion and independent monetary policy. Trade share is empirically found to be an imperative factor of anchor currency choice and hence currency co-movements (Galati, 2001; Subramanian and Kessler, 2013; Fischer, 2016). Output asymmetry and inflation differential are close to monetary policy independence. The larger the output asymmetry and inflation differential, the higher cost is incurred for pegging to the anchor currency.

Besides, Ghosh (2014) finds that economy size and development level exert significant influence on the choice of exchange rate system. Frieden (1991) argues that central banks peg their currencies to the anchor currency to rein in high inflation. Plümper and Neumayer (2011) find that the economies with a history of high inflation are more likely to peg their currency to the US dollar than to the Swiss franc or the Deutsche mark even facing low and less volatile inflation. Based on the Mundell–Fleming–Dornbusch model (MFD), real shocks and nominal shocks are also important. For the economies where real shocks dominate nominal shocks, they prefer float exchange rate regimes. And the rest lean toward fixed exchange rate regimes (Meissner and Oomes, 2009). Ghosh (2014) also documents that geographic size makes a significant impact on the choice of exchange rate regimes.

3. Research design and data

3.1 Co-movement estimation

To measure the degree of currency relatedness, researchers often look at co-movements of currencies (Frankel and Wei, 1994; Frankel and Xie, 2010), especially since most monetary authorities do not divulge information about national currency baskets to the public. Following Frankel and Wei (1994) and McCauley and Shu (2019), we use the logarithmic daily return of a developing economy currency denominated in the US dollar as the dependent variable, and the logarithmic return (also denominated in the US dollar) of the RMB, the Japanese yen, the euro, and the pound as the independent variables to eliminate the multi-collinearity between the RMB and the US dollar. Other control variables include global risk appetite and fluctuations in energy price which are generally considered as important factors of exchange rate movements (Fratzscher and Mehl, 2014; Keddad, 2019). Global risk appetite correlates with international capital flow and hence influences exchange rates. For energy importers and exporters, fluctuations in energy price are likely to affect exchange rates and possibly co-movements since most international energy commodities are mainly invoiced and settled in the US dollar. The baseline model is as follows

$$e_i = \delta_i + \beta_{i,1}e_{RMB} + \beta_{i,2}e_{EUR} + \beta_{i,3}e_{GBP} + \beta_{i,4}e_{JPY} + \beta_{i,5}e_{oil} + \beta_{i,6}vix + \varepsilon_i \quad (1)$$

where e_i , e_{RMB} , e_{EUR} , e_{GBP} , and e_{JPY} denote logarithmic daily returns of developing currency i , the RMB, the euro, the pound, and the Japanese yen per US dollar, respectively⁴. ε is the error term. Global risk appetite and fluctuations in energy price are proxied by the Chicago Board Options Exchange Market

⁴ We use the CNY (onshore) rates in the baseline model. Note that onshore and offshore RMB rates indeed are not determined in the same exchange rate system, in that offshore RMB rate, as part of international exchange market, reflects international market status of the RMB, while onshore RMB rate is mainly managed and largely determined by the PBOC (He and McCauley, 2013). Onshore and offshore RMB rates in general show similar pattern but differ in short periods due to regulatory and geographical differences (Shu et al., 2015). We hence use CNH in the robustness check.

Volatility Index (vix) and logarithmic daily return of Brent crude oil price (e_{oil}), respectively. The coefficient, $\beta_{i,1}$, measures the co-movements between the RMB and currency i .

3.2 Determinants of the co-movements

To analyze the determinants of RMB co-movements, we regress equation (1) in each calendar year and obtain annual estimate of $\beta_{i,1}$. Since co-movements usually refer to the positive linkage, we only retain $\beta_{i,1}$ that is significantly positive at the 5% level, and replace others with 0. The new variable is $Comove_{i,t}$. We then create a dummy variable, $I(Comove_{i,t} > 0)$, which equals 1 when currency i co-moves with the RMB,

Following the literature reviewed in section 2, we add such determinants as *Trade dependence*, *Output asymmetry*, *Inflation differential*, *Size*, *Development*, *High inflation*, *Real shock*, *Nominal shock*, and *Land*.

Trade dependence is measured by the ratio of total trade with China over total trade with the world. *Output asymmetry* is measured by the standard deviation of the difference in the growth rate of real output between other economies and China during the previous 10 years. *Inflation differential* is measured by the absolute value of the difference in inflation between other economies and China.

We include the logarithm of real PPP GDP as *Size* and the logarithm of per capita PPP GDP as *Development*. *High inflation* equals 1 when the economy has experienced high inflation above 50 percent between the current year and 1980 and current inflation is below 20 percent. *Real shock* is the standard deviation of the ratio of government expenditure over nominal GDP during 5 years and *Nominal shock* is the standard deviation of the growth rate of the broad money supply over 5 years. *Land* is measured by the natural logarithm of land area (square kilometres).

The regression is constructed as followed:

$$I(Comove_{i,t} > 0) = \alpha_0 + \alpha_t + \rho x_{i,t} + u_{i,t} \quad (2)$$

where $x_{i,t}$ is a vector of the determinants discussed above and α_t is the year fixed effects.

3.3 Data and summary statistics

The reform of China's exchange rate system in 2005 is a milestone of the marketization of the RMB. From 1994 to 2005, the exchange rate of the US dollar vis-à-vis the RMB had been fixed to 8.24 yuan per dollar. But on July 21, 2005, the People's Bank of China (PBOC), the central bank of China, announced an end to the RMB/USD peg and adopted a managed floating exchange rate regime that made use of a "reference basket" of currencies. The de jure depegging of the RMB from the US dollar on 21 July 2005 has encouraged some countries to include the RMB in their currency basket, especially for developing economies (He et al., 2021c), which also makes it possible and necessary to study co-movements between the RMB and other currencies (Kawai and Pontines, 2016; Ito, 2017; Keddad, 2019). Due to limited availability of data, we sample 83 economies: 14 in East Asia & Pacific, 20 in Europe & Central Asia, 14 in Latin America & Caribbean, 12 in Middle East & North Africa, 5 in South Asia, and 18 in Sub-Saharan Africa⁵.

The exchange rate data are the daily nominal exchange rates in the Bloomberg database from January 1, 2006 to December 31, 2020. Since the RMB was de facto pegged to the US dollar from July 2008 to June 2010 and as such no statistically meaningful results can be obtained during that period, we trimmed the sample accordingly.

The distribution of currencies that significantly co-move with the RMB by year and region is reported in Table 1. Figure 1 shows the time-varying regional averages of co-movements between currencies and the RMB.)

Table 1 The distribution of currencies co-moving with the RMB by year and region

This table displays the distribution of currencies co-moving with the RMB by year and region. The first column reports the number of the currencies in each region and the next five columns report the number of currencies that show co-move with RMB significantly at the 5% significance level.

# of currencies	2006	2007	2008	2009	2010
-----------------	------	------	------	------	------

⁵ The detailed regional distribution is reported in Appendix II.

East Asia & Pacific	14	7	1	4	--	5
Europe & Central Asia	20	4	4	1	--	4
Latin America & Caribbean	14	1	1	0	--	0
Middle East & North Africa	12	3	0	1	--	1
South Asia	5	2	0	1	--	2
Sub-Saharan Africa	18	1	2	2	--	5
Total	83	18	8	9	--	17

	# of currencies	2011	2012	2013	2014	2015
East Asia & Pacific	14	4	5	1	1	5
Europe & Central Asia	20	4	2	0	1	0
Latin America & Caribbean	14	2	0	0	0	1
Middle East & North Africa	12	2	0	0	1	1
South Asia	5	3	0	0	0	1
Sub-Saharan Africa	18	2	0	1	1	0
Total	83	17	7	2	4	8

	# of currencies	2016	2017	2018	2019	2020
East Asia & Pacific	14	7	4	8	9	7
Europe & Central Asia	20	6	3	4	6	6
Latin America & Caribbean	14	3	2	3	6	4
Middle East & North Africa	12	0	0	0	2	1
South Asia	5	1	1	2	2	1
Sub-Saharan Africa	18	3	3	6	4	3
Total	83	20	13	23	29	22

Figure 1 Regional co-movements between currencies and the RMB

This figure presents the time-varying regional averages of co-movements between currencies and the RMB.

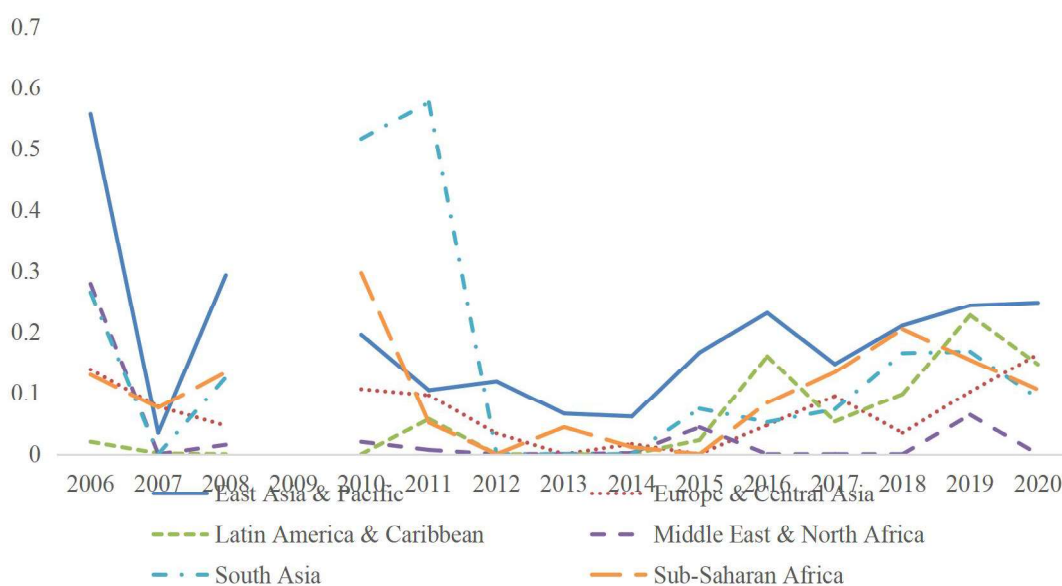


Table 2 provides summary statistics of the co-movements between currencies and the RMB and the determinant variables. In around 17 percent of all currency-year observations, currencies of developing economies significantly co-move with the RMB and the average co-movement is 0.094. Both percentage

and degree of RMB co-movement suggest that the RMB had yet been influential on developing economies in the sample period.

Table 2 Summary statistics

This table provides summary statistics of co-movements between currencies and the RMB and the determinant variables. Variable definitions are presented in Appendix I.

	N	Mean	Std. Dev.	p25	p50	p75
<i>Comove</i>	1162	0.0937	0.2740	0	0	0
<i>I(Comove>0)</i>	1162	0.1695	0.3754	0	0	0
<i>Trade dependence</i>	1162	0.1266	0.1131	0.0490	0.0952	0.1692
<i>Output asymmetry</i>	1162	0.0348	0.0477	0.0206	0.0272	0.0378
<i>Inflation differential</i>	1162	0.0491	0.0642	0.0137	0.0291	0.0604
<i>Size</i>	1162	25.5478	1.8996	24.3306	25.5462	26.9797
<i>Development</i>	1162	9.2568	1.0222	8.5637	9.3759	9.9455
<i>High inflation</i>	1162	0.4363	0.4961	0	0	1
<i>Real shock</i>	1162	0.0228	0.0369	0.0099	0.0155	0.0254
<i>Nominal shock</i>	1162	0.0694	0.0604	0.0298	0.0519	0.0907
<i>Land</i>	83	12.0665	2.0776	10.8437	12.2058	13.5875

4. Empirical results

4.1 Co-movements

Table 3 presents the estimation results of the co-movements between four major international currencies and developing economy currencies from January 1, 2006 to December 31, 2020.

In the case of East Asia & Pacific, some currencies, such as Cambodian riel (KHR), Solomon Islands dollar (SBD), and Vietnamese Dong (VND), co-move with no currency as their corresponding R-square of regressions are close to 0, which may reflect the fact that these currencies were de facto pegged to the US dollar during the sample time. For the rest, estimation coefficients of the euro, the pound, and the yen are relatively small in value, regardless of significance level, and coefficients of the RMB are significantly positive and relatively large in value, owing to these economies' deeper trade and financial integration with China.

The euro is found to be the predominant currency in Europe & Central Asia, and its co-movements with other currencies in the region can be explained by a higher degree of economic and geopolitical integration in the region. The RMB, however, exerted significant influence on some economies such as Belarus and Bulgaria.

In Latin America & Caribbean, South Asia, and Sub-Saharan Africa, the RMB has also demonstrated as influential as the euro, but stronger than the pound and the Japanese yen. Similar to East Asia & Pacific, some currencies in this area were estimated with zero R-square in our model indicating they were also de facto pegged to the US dollar.

Finally, Algeria dinar (DZD) is the only currency in Middle East & North Africa that slightly co-moves with the RMB while most of the other economies in the area are oil exporters and hence chose to peg their currencies to the US dollar so as to facilitate oil-related transactions and stabilize their economy. This finding is consistent with that of Ilzetzki et al. (2019).

Table 3 Exchange rate co-movements throughout the entire period

This table presents the estimation results of the co-movements between four major international currencies and developing economy currencies from January 1, 2006 to December 31, 2020. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Currency	EUR	GBP	JPY	RMB	R-squared	Observations
BND	0.230*** (0.011)	0.111*** (0.011)	0.054*** (0.011)	0.343*** (0.009)	0.40 (0.026)	3142
FID	0.201*** (0.022)	0.042* (0.022)	0.019 (0.022)	0.179*** (0.018)	0.07 (0.054)	3107
IDR	0.094*** (0.021)	0.128*** (0.021)	-0.074*** (0.021)	0.480*** (0.017)	0.11 (0.051)	3142
KHR	0.008 (0.012)	0.002 (0.012)	-0.007 (0.011)	0.010 (0.009)	0.00 (0.028)	3068
KRW	0.218*** (0.020)	0.156*** (0.020)	-0.037** (0.019)	0.658*** (0.016)	0.22 (0.047)	3142
MNT	0.002 (0.012)	-0.009 (0.012)	0.003 (0.012)	0.005 (0.010)	0.00 (0.029)	3112
MYR	0.130*** (0.017)	0.112*** (0.017)	-0.049*** (0.017)	0.355*** (0.013)	0.16 (0.040)	3126
PHP	0.127*** (0.014)	0.065*** (0.014)	-0.054*** (0.014)	0.336*** (0.011)	0.12 (0.033)	3142
SGD	0.255*** (0.010)	0.122*** (0.010)	0.057*** (0.010)	0.315*** (0.008)	0.47 (0.024)	3142
SBD	-0.042 (0.033)	0.051 (0.033)	-0.024 (0.032)	-0.125 (0.026)	0.00 (0.078)	3020
THB	0.121*** (0.012)	0.051*** (0.012)	0.039*** (0.011)	0.350*** (0.009)	0.19 (0.027)	3142
VND	-0.002 (0.006)	-0.000 (0.006)	0.001 (0.006)	0.020 (0.005)	0.00 (0.014)	3108
VUV	-0.018 (0.033)	-0.005 (0.033)	-0.017 (0.032)	0.155** (0.026)	0.00 (0.079)	3119
WST	-0.014 (0.061)	0.025 (0.061)	-0.039 (0.059)	0.253* (0.048)	0.00 (0.144)	3124
ALL	0.845*** (0.012)	-0.025** (0.012)	0.004 (0.012)	0.063** (0.010)	0.71 (0.030)	3142
AZN	0.003 (0.016)	-0.001 (0.016)	0.035*** (0.016)	-0.016 (0.013)	0.00 (0.038)	3134
BGN	0.969*** (0.006)	-0.004 (0.006)	0.009** (0.005)	0.037*** (0.004)	0.94 (0.013)	3142
BAM	0.888*** (0.013)	-0.011 (0.013)	0.007 (0.012)	-0.017 (0.010)	0.73 (0.030)	3140
BYN	0.068*** (0.017)	-0.002 (0.017)	-0.032** (0.017)	0.323*** (0.013)	0.06 (0.041)	3119
CZK	1.064*** (0.013)	0.050*** (0.013)	-0.018* (0.013)	0.091*** (0.010)	0.79 (0.031)	3142
GEL	0.013 (0.019)	-0.004 (0.019)	0.003 (0.019)	0.092** (0.015)	0.00 (0.046)	3129
HRK	0.999*** (0.006)	0.003 (0.006)	0.009* (0.006)	0.003 (0.005)	0.93 (0.015)	3142
HUF	1.183*** (0.021)	0.098*** (0.021)	-0.149*** (0.020)	0.070 (0.016)	0.65 (0.049)	3142
KZT	0.026 (0.017)	-0.006 (0.017)	0.007 (0.017)	0.169*** (0.014)	0.03 (0.041)	3140

KGS	0.015	(0.016)	-0.022	(0.016)	0.011	(0.013)	0.073*	(0.039)	0.01	3081
MDL	0.048**	(0.020)	0.010	(0.020)	0.008	(0.016)	0.022	(0.048)	0.01	3133
MKD	0.517***	(0.019)	-0.004	(0.019)	-0.017	(0.015)	0.382***	(0.046)	0.30	3141
PLN	1.138***	(0.018)	0.109***	(0.018)	-0.124***	(0.014)	0.095**	(0.043)	0.70	3142
RON	1.042***	(0.012)	0.025**	(0.012)	-0.063***	(0.009)	0.032	(0.029)	0.80	3142
RUB	0.327***	(0.033)	0.129***	(0.032)	-0.136***	(0.026)	0.378***	(0.078)	0.21	3142
RSD	0.856***	(0.019)	-0.019	(0.019)	-0.015	(0.015)	-0.071	(0.046)	0.51	3127
TJS	-0.008	(0.009)	0.006	(0.008)	0.000	(0.007)	-0.000	(0.020)	0.00	3003
TRY	0.454***	(0.035)	0.156***	(0.034)	-0.254***	(0.028)	0.368***	(0.084)	0.13	3142
UAH	0.060*	(0.034)	-0.008	(0.033)	0.025	(0.026)	0.117	(0.080)	0.00	3136
ARS	0.066***	(0.025)	0.004	(0.024)	-0.044**	(0.019)	0.225***	(0.059)	0.01	2962
BRL	0.384***	(0.040)	0.141***	(0.039)	-0.112***	(0.031)	0.289***	(0.094)	0.10	3093
CLP	0.260***	(0.025)	0.120***	(0.024)	-0.106***	(0.020)	0.464***	(0.059)	0.16	3140
COP	0.143***	(0.030)	0.178***	(0.029)	-0.138***	(0.023)	0.548***	(0.070)	0.17	3140
CRC	0.022*	(0.012)	-0.040***	(0.012)	0.005	(0.009)	-0.042	(0.029)	0.01	3142
DOP	-0.018	(0.016)	0.018	(0.016)	0.021*	(0.013)	0.004	(0.038)	0.00	3140
GTQ	0.003	(0.007)	0.004	(0.007)	-0.002	(0.005)	-0.021	(0.016)	0.00	3140
HNL	0.003	(0.006)	-0.003	(0.006)	0.003	(0.004)	0.009	(0.014)	0.00	3140
MXN	0.317***	(0.028)	0.230***	(0.028)	-0.194***	(0.022)	0.249***	(0.068)	0.18	3142
NIO	0.001	(0.012)	-0.008	(0.012)	0.001	(0.009)	-0.024	(0.028)	0.00	3142
PEN	0.050***	(0.012)	0.045***	(0.012)	-0.044***	(0.010)	0.205***	(0.029)	0.07	3138
PYG	0.012	(0.019)	0.018	(0.018)	0.009	(0.015)	-0.002	(0.045)	0.00	3132
TTD	0.000	(0.013)	-0.004	(0.013)	0.009	(0.010)	-0.045	(0.031)	0.00	3128
UYU	0.066***	(0.022)	0.007	(0.022)	-0.028	(0.018)	0.232***	(0.053)	0.02	3142
AED	0.000	(0.000)	-0.000*	(0.000)	0.000*	(0.000)	-0.000	(0.001)	0.00	3142
DZD	0.268***	(0.025)	-0.005	(0.024)	-0.002	(0.020)	0.102*	(0.059)	0.06	3142
EGP	-0.006	(0.010)	0.018*	(0.010)	0.007	(0.008)	-0.017	(0.025)	0.00	3142
JOD	0.001	(0.006)	-0.001	(0.006)	-0.001	(0.005)	0.015	(0.014)	0.00	3142
KWD	0.095***	(0.003)	0.014***	(0.003)	0.025***	(0.003)	0.010	(0.008)	0.38	3142

Latin America & Caribbean

Middle East & North Africa

LBP	0.009*	(0.005)	-0.002	(0.005)	0.003	(0.004)	-0.014	(0.013)	0.00	3113
LYD	0.055**	(0.026)	0.010	(0.025)	0.000	(0.020)	-0.024	(0.061)	0.00	3140
MAD	0.735***	(0.006)	-0.006	(0.006)	-0.003	(0.005)	-0.067***	(0.014)	0.89	3142
OMR	0.001	(0.001)	-0.001	(0.001)	0.000	(0.001)	-0.001	(0.003)	0.00	3142
QAR	0.001	(0.005)	-0.005	(0.005)	-0.004	(0.004)	-0.001	(0.012)	0.00	3142
SAR	-0.001	(0.001)	-0.000	(0.001)	0.001	(0.001)	0.000	(0.002)	0.00	3142
TND	0.610***	(0.020)	0.023	(0.020)	0.016	(0.016)	0.062	(0.049)	0.34	3136
BDT	0.024*	(0.013)	-0.015	(0.013)	0.003	(0.010)	0.052*	(0.030)	0.00	2942
INR	0.132***	(0.018)	0.099***	(0.018)	-0.080***	(0.014)	0.362***	(0.043)	0.11	3013
LKR	-0.002	(0.009)	0.006	(0.009)	0.003	(0.007)	0.025	(0.022)	0.00	3109
NPR	0.069***	(0.019)	0.028	(0.018)	-0.060***	(0.015)	0.254***	(0.044)	0.03	3132
PKR	0.010	(0.013)	0.007	(0.013)	-0.008	(0.010)	-0.034	(0.031)	0.00	3142
AOA	0.019	(0.020)	-0.030	(0.019)	0.009	(0.015)	-0.001	(0.047)	0.00	3142
BIF	0.012	(0.021)	-0.014	(0.020)	0.007	(0.016)	0.077	(0.049)	0.00	3140
BWP	0.320***	(0.028)	0.128***	(0.028)	-0.033	(0.022)	0.516***	(0.067)	0.14	3125
XAF	0.953***	(0.017)	0.004	(0.017)	-0.008	(0.013)	0.131***	(0.041)	0.63	3133
CDF	-0.003	(0.023)	0.025	(0.023)	-0.002	(0.018)	-0.006	(0.057)	0.00	2961
CVE	0.739***	(0.019)	-0.038**	(0.019)	-0.008	(0.015)	0.139***	(0.046)	0.44	3071
GHS	-0.051	(0.032)	-0.016	(0.031)	0.004	(0.025)	0.129*	(0.076)	0.00	3140
KES	0.022	(0.017)	0.018	(0.017)	-0.002	(0.014)	0.031	(0.041)	0.00	3139
MGA	0.098**	(0.044)	-0.017	(0.044)	-0.001	(0.035)	0.196*	(0.106)	0.00	2952
MUR	0.087***	(0.025)	-0.051**	(0.024)	-0.019	(0.019)	0.111*	(0.059)	0.01	3133
NAD	0.560***	(0.039)	0.297***	(0.038)	-0.222***	(0.030)	0.665***	(0.092)	0.22	3140
NGN	-0.012	(0.023)	0.019	(0.022)	0.010	(0.018)	0.073	(0.054)	0.00	3142
RWF	0.035	(0.027)	-0.032	(0.026)	0.003	(0.021)	0.034	(0.063)	0.00	3128
SCR	0.061	(0.065)	-0.032	(0.064)	0.043	(0.051)	0.295*	(0.156)	0.00	3091
TZS	-0.004	(0.021)	0.007	(0.021)	-0.016	(0.017)	-0.033	(0.051)	0.00	3135
UGX	0.014	(0.019)	0.031*	(0.018)	-0.037**	(0.015)	0.082*	(0.045)	0.01	3140
ZAR	0.560***	(0.039)	0.297***	(0.038)	-0.222***	(0.030)	0.665***	(0.092)	0.22	3140

ZMW	0.120***	(0.043)	0.008	(0.042)	-0.013	(0.034)	0.018	(0.102)	0.01	3136
-----	----------	---------	-------	---------	--------	---------	-------	---------	------	------

4.2 Determinants of exchange rate co-movements

We report in Table 4 the regression results of the determinants of RMB co-movement. *Year* are year-level dummies controlled for in column (5) - (7). Results of three methods, OLS, logit and probit, are presented in column (1)-(5), (6) and (7), respectively. In column (6) and (7) we show the average marginal effects of independent variables in the logit model and probit model. As shown in Table 4, our results are consistent in various specifications. We hence focus on the results of OLS in this section.

Trade dependence increases the probability of RMB co-movement while *Inflation differential* decreases it, which is consistent with OCA argument. The more trade with China, the more beneficial it is for developing economies to place the RMB in their currency baskets. Higher inflation differential reflects larger cost of maintaining the consistency of the two countries' monetary policies, and hence less chances of RMB co-movement. *Output asymmetry* has not statistically significant effects suggests that central banks may focus more directly on inflation than on economic growth in determining exchange rate policy. *Size* and *Development* are found to increase the chances of RMB co-movement. And it is consistent with the view that larger economic size and higher economic development level increase the probability of adopting an intermediate regime, where the RMB can be placed into a currency basket, relative to a fixed regime with the US dollar as the anchor currency (Meissner and Oomes, 2009). For example, Cambodia and Vietnam both peg their currencies to the US dollar. In Cambodia, the US dollar has dominated all aspects of currency circulation. On the contrary, Singapore, a high-income economy, adopts an exchange rate system where the Singapore dollar is managed against a basket of currencies of its major trading partners.

High inflation is negatively correlated with RMB co-movements, because developing economies tend to peg their currencies to the US dollar fearing for another hyperinflation (Plümper and Neumayer, 2011). Similarly, *Nominal shock* increases the possibility of an economy adopting a fixed exchange rate system, thus reducing the possibility of co-movements between the economy's currency and the RMB.

Table 4 The determinants of co-movements between currencies and the RMB

This table reports the determinants of whether other currencies co-move with the RMB. *Year* represents year-level dummies, controlled for in the column (5) – (7). The results of three methods, OLS, logit and probit, are presented in column (1) - (5), (6) and (7), respectively. Results in column (6) and (7) reports average margin effects of independent variables in the logit model and probit model. Robust standard errors in parentheses. Significance level: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Variable definitions are presented in Appendix I.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	OLS	OLS	OLS	OLS	Logit	Probit
<i>Trade dependence</i>	0.181** (0.088)	0.194** (0.087)	0.219** (0.086)	0.253*** (0.092)	0.233** (0.093)	0.254*** (0.095)	0.234** (0.095)
<i>Output asymmetry</i>	-0.109 (0.216)	-0.131 (0.216)	-0.321 (0.313)	-0.266 (0.315)	0.127 (0.305)	0.350 (0.434)	0.283 (0.416)
<i>Inflation differential</i>	-0.564*** (0.123)	-0.642*** (0.128)	-0.442*** (0.136)	-0.425*** (0.134)	-0.491*** (0.144)	-0.676*** (0.244)	-0.632*** (0.222)
<i>Size</i>	0.014** (0.007)	0.018** (0.007)	0.015** (0.007)	0.027** (0.012)	0.025** (0.011)	0.015 (0.011)	0.014 (0.010)
<i>Development</i>	0.048*** (0.013)	0.045*** (0.012)	0.042*** (0.012)	0.031** (0.015)	0.031** (0.014)	0.042*** (0.015)	0.042*** (0.014)
<i>High inflation</i>		-0.077** (0.022)	-0.057** (0.023)	-0.055** (0.023)	-0.058** (0.022)	-0.043* (0.022)	-0.045** (0.022)
<i>Real shock</i>			0.403 (0.413)	0.436 (0.415)	-0.088 (0.390)	-0.251 (0.569)	-0.221 (0.540)
<i>Nominal shock</i>			-0.646*** (0.155)	-0.605*** (0.156)	-0.555*** (0.167)	-1.059*** (0.370)	-0.958*** (0.343)
<i>Land</i>				-0.013 (0.009)	-0.011 (0.009)	-0.004 (0.008)	-0.005 (0.008)
Constant	-0.632*** (0.161)	-0.673*** (0.161)	-0.550*** (0.166)	-0.587*** (0.172)	-0.481*** (0.171)		
Year	No	No	No	No	Yes	Yes	Yes

Adj./Pseudo R ²	0.033	0.042	0.049	0.050	0.096	0.142	0.140
Observations	1,162	1,162	1,162	1,162	1,162	1,162	1,162

4.3 Sub-period

On 21 July 2005, the People Bank of China (PBOC) decided to adopt a managed floating exchange rate regime with reference to a basket of currencies, indicating an end to the era when the RMB was fixed to the US dollar. On June 19, 2010 and on August 11, 2015, the PBOC announced that it would “further the reform of exchange rate regime and enhance the flexibility of RMB exchange rate⁶”. On the latter date, the PBOC made an announcement claiming that it would “improve quotation of the central parity of RMB against US dollar” and “the quotes of central parity that market makers report to the China Foreign Exchange Trade System (CFETS) daily before market opens should refer to the closing rate of the inter-bank foreign exchange market on the previous day⁷”. The two reforms divided the entire sample into 3 periods and the RMB’s flexibility in each period is different. Thus, we regress equation (2) in 3 periods to explore the impact of the reforms on determinants of RMB co-movements. Results are shown in Table 5.

In 2006-2008, *Nominal shock* reduces the co-movement as expected while *Trade dependence* is irrelevant, which can be due to the small room of the RMB’s flexibility at that time weakening the effect of trade sector on the RMB. Further evidence is shown in both 2010-2015 and 2016-2020 when RMB’s flexibility jumped up by market-oriented reforms: *Trade dependence* increases the co-movement statistically and economically significant in both later periods.

Table 5 Sub period

This table reports the determinants of whether other currencies co-move with CNY in three subperiods. Year represents year-level dummies, controlled in all three periods. Robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Variable definitions are presented in Appendix I.

	(1) 2006-2008	(2) 2010-2015	(3) 2016-2020
<i>Trade dependence</i>	0.064 (0.170)	0.224* (0.123)	0.343** (0.173)
<i>Output asymmetry</i>	3.261* (1.706)	-0.260 (0.286)	0.426 (0.725)
<i>Inflation differential</i>	-0.563 (0.391)	-0.050 (0.182)	-1.086*** (0.255)
<i>Size</i>	0.008 (0.023)	0.018 (0.015)	0.039* (0.022)
<i>Development</i>	-0.014 (0.027)	0.007 (0.019)	0.086*** (0.030)
<i>High inflation</i>	-0.019 (0.047)	-0.029 (0.028)	-0.107** (0.045)
<i>Real shock</i>	-0.453 (1.294)	0.375 (0.404)	-0.315 (0.912)
<i>Nominal shock</i>	-1.079*** (0.271)	-0.410* (0.219)	-1.157** (0.550)
<i>Land</i>	-0.023 (0.016)	-0.024** (0.012)	0.020 (0.019)
Constant	0.440 (0.365)	0.018 (0.228)	-1.684*** (0.304)
Year	Yes	Yes	Yes
Adj. R ²	0.065	0.058	0.151
Observations	249	498	415

5. Robustness and extension

6 Available at <http://www.pbc.gov.cn/en/3688110/3688175/3707924/index.html>.

7 Available at <http://www.pbc.gov.cn/en/3688110/3688181/a13b2cb0/index89.html>.

5.1 Alternative specifications

In the benchmark model, we construct *Comove* through retaining the estimates of $\beta_{i,1}$ that are significantly positive at the 5% significance level, and replacing other values with 0. In order to avoid processing arbitrariness, we change the significance criterion to 10%. The corresponding results that are consistent with the main finding are presented in column (1) of Table 6.

Central banks and investors may pay special attention to the offshore RMB market due to its spatial separation, less regulation, and incomplete capital account information. (He and McCauley, 2013). The offshore RMB market has indeed scaled up rapidly since its inception in 2010. However, the offshore RMB exchange rate has also been inconsistent with the onshore one, and more importantly the impact of the two RMB rates on East Asian currencies are found to be both statistically and economically different (Shu et al., 2015). We hence replace the CNY (onshore) rates in equations (1) with the CNH (offshore), and construct *Comove* the same way as in the baseline model. The coefficients of the determinants of RMB co-movement using CNH are shown in column (2) of Table 6. Results of column (2) are consistent with our main findings.

Column (3) of Table 6 reports the results of the determinants of *Comove*. All coefficients show same statistically significant signs except for those of *Trade dependence*, *Size* and *Development*, which are still positive but insignificant. In general we argue that this may be because the choice of placing and the way of weighing the RMB in the currency basket are two different decision-making processes.

Specifically, larger and more developed economy tend to adopt an intermediate exchange rate regime (discussed above), under which an economy normally includes multiple currencies in the basket so the weight of the RMB is more likely to be affected by the economic relationship between home economy and other non-China economies than by *Size* and *Development*. The statistically insignificant correlation between *Trade dependence* and *Comove* suggests that although trade can increase the probability of RMB co-movement, it has no influence on the degree of the co-movement. Similar story can be found in the early internationalization of the US dollar. United States was the world's largest exporter in 1912, while the US dollar did not become an international currency until 1944 (Bahaj and Ries, 2020).

We also add two additional control variables, *Reserve* and *Financial development*, to the model and present the result in Column (4) of Table 6. *Reserve* is a ratio of actual foreign reserve over M2, and *Financial development* is another ratio of M2 over nominal GDP. The economic rationale for those two additional variables are: 1. Once foreign reserve is depleted pegging exchange rate is expected to die out as pointed out by Krugman (1979); 2. Countries with more advanced financial system is normally more attractive to international capital and hence more inclined to maintain independent monetary policy, which leaves no room for pegging exchange rate system. The results are as expected. The coefficient of *Reserve* is negative though statistically insignificant, and that of *Financial development* is statistically positive, showing that the degree of financial development is positively correlated with RMB co-movement.

Besides, we re-estimate the variable of *Comove* using the method in Kawai and Pontines (2016). Specifically, we use the Swiss franc (CHF) as the unit currency, logarithmic returns of the RMB exchange rate as the dependent variable, and logarithmic returns of the US dollar, the euro, the pound, and the Yen as independent variables, so as to “purify” the variance of the RMB in the following way:

$$e_{CNY} = \eta + \gamma_1 e_{USD} + \gamma_2 e_{EUR} + \gamma_3 e_{GBP} + \gamma_4 e_{JPY} + \mu \quad (3)$$

Then the estimated error term, $\hat{\mu}$, will be the proxy of the RMB replacing e_{CNY} as in (4):

$$e_i = \alpha_i + \beta_{1,i} e_{USD} + \beta_{2,i} e_{EUR} + \beta_{3,i} e_{GBP} + \beta_{4,i} e_{JPY} + \beta_{i,5} \hat{\mu} + \beta_{i,6} e_{oil} + \beta_{i,7} vix + \varepsilon_i \quad (4)$$

Kawai and Pontines (2016) take further steps to stabilize the RMB coefficient as follows, $\beta_{i,1} + \beta_{i,2} + \beta_{i,3} + \beta_{i,4} + \beta_{i,5} = 1$. We accordingly transform (4) into (5):

$$e^i - \hat{\mu} = \alpha_i + \beta_{1,j} (e_{USD} - \hat{\mu}) + \beta_{2,j} (e_{EUR} - \hat{\mu}) + \beta_{3,j} (e_{GBP} - \hat{\mu}) + \beta_{4,j} (e_{JPY} - \hat{\mu}) + \beta_{i,6} e_{oil} + \beta_{i,7} vix + \varepsilon_i \quad (5)$$

The final estimated RMB coefficient is $\beta_{i,5} = 1 - (\beta_{i,1} + \beta_{i,2} + \beta_{i,3} + \beta_{i,4})$. After we repeat the same steps in our baseline regression, replacing *Comove* with $\beta_{i,5}$, the result reaffirms the robustness.

Based on Ilzetzki et al. (2019), we category our sample by exchange rate regime as follows: 25 countries in our sample peg their currency to another international currency, 36 adopt crawling peg, 20 are managed floating, 1 is freely floating, and 1 country has dual market in which parallel market data is missing. To control for exchange regime effect, we added regime dummies in the regression, corresponding to the above 5 exchange rate regimes. The result presented in column (6) of Table 6 reaffirms the main conclusion.

Table 6 Robustness checks

This table reports robustness checks of changing the significance criteria in define *Comove*, using CHN rates instead of CNY rates, using *Comove* as the independent variable, adding more control variables, using the CHF as the denomination currency, and adding exchange rate regime dummies, including de facto peg, crawling peg, managed floating, freely floating, and dual market in which parallel market data is missing. Year represents year-level dummies, controlled for in all columns. Robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Variable definitions are presented in Appendix I.

	(1) <i>p</i> =0.1	(2) CNH	(3) <i>Comove</i>	(4) Control	(5) CHF	(6) Regime
<i>Trade dependence</i>	0.244** (0.100)	0.305*** (0.110)	0.063 (0.062)	0.207** (0.100)	0.327*** (0.115)	0.195** (0.094)
<i>Output asymmetry</i>	0.160 (0.328)	-0.261 (0.360)	0.030 (0.198)	0.106 (0.345)	0.516 (0.323)	-0.071 (0.283)
<i>Inflation differential</i>	-0.510*** (0.162)	-0.733*** (0.203)	-0.295*** (0.096)	-0.310 (0.194)	-0.826*** (0.162)	-0.383** (0.174)
<i>Size</i>	0.026** (0.012)	0.049*** (0.015)	0.002 (0.009)	0.015 (0.013)	0.041*** (0.012)	0.020* (0.012)
<i>Development</i>	0.036** (0.015)	0.085*** (0.019)	0.011 (0.009)	0.036** (0.016)	0.005 (0.016)	0.026* (0.015)
<i>High inflation</i>	-0.058** (0.024)	-0.131*** (0.028)	-0.040** (0.016)	-0.048* (0.025)	-0.084*** (0.024)	-0.047** (0.023)
<i>Real shock</i>	-0.246 (0.422)	-0.169 (0.451)	-0.166 (0.263)	-0.578 (0.486)	-0.307 (0.418)	0.014 (0.368)
<i>Nominal shock</i>	-0.523*** (0.192)	-0.675*** (0.238)	-0.446*** (0.127)	-0.426** (0.196)	-0.011 (0.218)	-0.459*** (0.170)
<i>Land</i>	-0.016 (0.010)	0.014 (0.013)	0.003 (0.007)	-0.007 (0.011)	-0.020** (0.009)	-0.014 (0.010)
<i>Reserve</i>				-0.033 (0.028)		
<i>Financial development</i>				0.090** (0.044)		
Constant	-0.458** (0.184)	-1.776*** (0.218)	0.096 (0.186)	-0.341* (0.192)	-0.656*** (0.215)	-0.303* (0.178)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Exchange rate regime	No	No	No	No	No	Yes
Adj. R ²	0.087	0.169	0.052	0.092	0.107	0.095
Observations	1,162	830	1,162	1,123	728	1070

5.2 Nonlinear determinants

Evidently, the unusual exchange rate volatility may weaken the role of the RMB as a vehicle for cross-border transactions (He et al., 2021c). To make the issue more complicated, foreign currencies may respond asymmetrically to high and low volatility of home currency value, transnational trade competition level and domestic inflation pressure. Therefore, currency co-movement can be subject to nonlinear factors. In this section, we focus on the nonlinear determinants of RMB co-movement using threshold estimation

(Hansen, 2000). We use *Volatility*, measured by the annual standard deviation of exchange rate returns, as the threshold variable. The exchange rate is defined as units of each currency per CNY.

Table 7 reports the results of nonlinear determinants of RMB co-movement. The threshold value is 0.594 and the LM-test statistic for no threshold is 43.316, rejecting the null hypothesis of no threshold at the 10 percent level (Hansen, 2000). In the low volatility regime, the results are similar to those in the benchmark model: *Trade dependence* and *Size* stimulates the co-movement while *Inflation differential*, *High inflation* and *Nominal shock* restrain it. High volatility regime, however, presents a different pattern of the nonlinear determinants. Specifically, *Trade dependence* and *Size* decrease the probability of RMB co-movement even though the statistical significance level declines. High volatility of exchange rate usually reflects high volume of capital flow (Hutson and Laing, 2014; Forbes and Warnock, 2021), so the positive effect of bilateral trade on RMB co-movement may be diluted, which can even turn to a negative impact for high volatility of the capital market. Facing high exchange rate volatility, most currency co-movements are under market pressure (Clark et al., 2004), hence large economies that have resourceful ways of intervening in exchange rate market may end up with low RMB co-movement.

Table 7 Nonlinear determinants of co-movements between currencies and the RMB

This table reports nonlinear determinants of the RMB co-movement using threshold estimation. Volatility, measured by the annual standard deviation of exchange rate returns, is used as the threshold variable. The exchange rate is defined as units of the target currency per unit of CNY (Hansen, 2000). Year represents year-level dummies, controlled for in both columns. Robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Variable definitions are presented in Appendix I.

Panel A Testing result for threshold effects		
	Threshold value	0.594*
	LM-test for no threshold:	43.316
	Bootstrap P-value	0.053
Panel B Threshold regression		
	(1) Low volatility	(2) High volatility
<i>Trade dependence</i>	0.350*** (0.113)	-0.295* (0.167)
<i>Output asymmetry</i>	0.352 (0.385)	-0.699 (0.646)
<i>Inflation differential</i>	-0.440** (0.190)	-0.574** (0.252)
<i>Size</i>	0.038** (0.015)	-0.033* (0.018)
<i>Development</i>	0.023 (0.017)	0.057** (0.024)
<i>High inflation</i>	-0.056** (0.027)	-0.008 (0.044)
<i>Real shock</i>	-0.167 (0.744)	0.360 (0.657)
<i>Nominal shock</i>	-0.658*** (0.203)	-0.592* (0.326)
<i>Land</i>	-0.026**	0.046***

	(0.011)	(0.015)
Constant	-0.547**	-0.022
	(0.245)	(0.279)
Year	Yes	Yes
Adj. R ²	0.097	0.143
Observations	834	328

5.3 Bilateral local currency swap agreements

Currency swap stimulates currency co-movements through strengthening bilateral trade as long as home currency is used in trade invoicing (Bahaj and Reis, 2020; Gopinath and Stein, 2021), and through tightening financial links (Zhang et al., 2017). Starting from 2009, the PBOC has initiated a series of currency swap agreements to promote trade and investment and to strengthen financial relationship with other countries.

McDowell (2019) points out that RMB currency swap agreements function as a short-term liquidity backstop outside of the Bretton Woods institutions for China's partner countries in need. Song and Xia (2020) also show that RMB swap increases the number, value and proportion of the RMB settlement in cross-border trade.

As of the end of 2020, China had signed currency swap agreements with 39 monetary authorities and the amount exceeds 3.8 trillion RMB⁸. Based on the signing dates, we construct the dummy variable *Swap*, which equals 1 for the time posterior to the swap agreement, and 0 otherwise.

Column (1) in Panel A of Table 8 reports the impact of currency swap agreements on RMB co-movements. The possibility of RMB co-movements increases by 0.1 for the agreement. The amplifying effect need to be decomposed into various factors in distinct economies. Argentina, for example, exchanged its RMB reserves that came from currency swap agreement for the US dollar in 2015. Therefore, we dig deeper into the issue by including some economic characteristics: *Size*, *Development* and *High inflation*. Column (2)-(4) in Table 8 report those results. We find that *Swap* increases the probability of RMB co-movement with the currencies of larger and more developed economies. This is because larger and more developed economies tend to have more sophisticated financial systems that are able to fully utilize currency swap agreements to stabilize their exchange rate market.

Table 8 The impact of signing swap agreements

This table reports the impact of signing swap agreements on RMB co-movements. *Swap* is a dummy variable that equals 1 in the years after the economy signed a swap agreement with China and 0 otherwise. *Swap amount* equals the natural logarithm of the swap agreement amount plus: 1 for the years posterior to the agreement and 0 otherwise. Control represents the determinants in the baseline model. Year is year-level dummies, controlled in all columns. Robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Variable definitions are presented in Appendix I.

Panel A				
	(1)	(2)	(3)	(4)
<i>Swap</i>	0.110*** (0.036)	-1.871*** (0.592)	-1.024*** (0.346)	0.159*** (0.051)
<i>Swap * Size</i>		0.074*** (0.022)		
<i>Swap * Development</i>			0.116*** (0.036)	
<i>Swap * High inflation</i>				-0.100 (0.066)
<i>Size</i>	0.018 (0.011)	0.012 (0.012)	0.015 (0.011)	0.015 (0.012)
<i>Development</i>	0.025* (0.011)	0.029** (0.012)	0.017 (0.011)	0.027* (0.012)

⁸ We collect the data of currency swap from the official website of the PBOC.

	(0.014)	(0.014)	(0.014)	(0.014)
<i>High inflation</i>	-0.054**	-0.045**	-0.049**	-0.037
	(0.022)	(0.023)	(0.022)	(0.024)
Control	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Adj. R ²	0.104	0.113	0.112	0.106
Observations	1,162	1,162	1,162	1,162
Panel B				
	(1)	(2)	(3)	(4)
<i>Swap amount</i>	0.027***	-0.266**	-0.130*	0.034***
	(0.007)	(0.131)	(0.067)	(0.008)
<i>Swap amount * Size</i>		0.011**		
		(0.005)		
<i>Swap amount * Development</i>			0.016**	
			(0.007)	
<i>Swap amount * High inflation</i>				-0.015
				(0.012)
<i>Size</i>	0.013	0.010	0.010	0.010
	(0.012)	(0.012)	(0.011)	(0.012)
<i>Development</i>	0.023	0.026*	0.019	0.025*
	(0.014)	(0.014)	(0.014)	(0.014)
<i>High inflation</i>	-0.048**	-0.046**	-0.044**	-0.034
	(0.022)	(0.023)	(0.022)	(0.024)
Control	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Adj. R ²	0.113	0.117	0.117	0.114
Observations	1,162	1,162	1,162	1,162

In Panel B, we replace *Swap* with *Swap amount*, which equals the natural logarithm of the currency amount plus 1 for the time posterior to the agreement, and 0 otherwise. The results are consistent with those in Panel A.

5.4 The Belt and Road Initiative (BRI)

Since its inception in 2013 by the Chinese government, BRI has been nearly as controversial as it is consequential. It has influenced the landscape of trade across the world. Boosted by its central role in BRI and China's new phase of openness to foreign investment,⁹ the RMB has been expected by the Chinese government to meet the transactional needs of the BRI countries and fulfil its geopolitical mission (He et al., 2021b, Xu et al., 2022).

Liu (2015) and Wang (2016) forecast that trade and financial exchanges between China and the BRI countries will rise, which will push China's deeper integration into the world economy and expand China's influence in the region and even globally. Qian et al. (2019) point out that BRI is a good opportunity to accelerate the internationalization of the RMB through issuing RMB-denominated "Silk Road Bonds" to fund the infrastructure projects along the BRI regions. The deepening trade and financial relations between China and the BRI economies motivate us to test the BRI's impact on RMB co-movement (He et al., 2021a).

Since the BRI economies did not join the initiative at the same time, and even multiple signing dates of the same economy could also be documented, in the estimation we choose the date when an economy signed the BRI documents for the first time¹⁰. Based on the data, we construct the dummy variable *BRI*, which equals 1 for the time posterior, and 0 otherwise.

Table 9 reports the results of adding *BRI* and its interactive term with some economic characteristics to the baseline model. *BRI* is expected to positively correlate with RMB co-movement as it increases credit-based cross-border investments and facilitates bilateral trades (Enderwick, 2018; Ramasamy and

⁹ "China Speeds Up Opening of Market to Investment Bank Giants" on the Bloomberg website: <https://www.bloomberg.com/news/articles/2020-01-15/china-speeds-up-opening-of-market-to-investment-banking-giants>. Accessed on April 9, 2020.

¹⁰ We collect the data from the official website of BRI and cross-check them with other news reports and foreign official communications.

Yeung, 2019). The direct impact of BRI on RMB co-movement as reported in column (1) of Table 9, however, fail to support the view. This may be due to a considerable diversity of the BRI constituent countries in that they vary not only in income level but also in infrastructure potential as measured by land mass, population, road, and rail density.

We then extend the question to whether the impact of *BRI* on RMB co-movement relies on economic characteristics. The statistically positive interaction terms, *BRI * Size* and *BRI * Development*, suggest that BRI indeed catalyzes RMB co-movement, but only through size and development level of the receiver economy. Specifically, BRI increases RMB co-movement in larger and more developed economies, which may be contributable to their advanced financial system; while the administrative obstacles to business and poor infrastructure potentials of smaller and less developed countries may hinder BRI's influence on the co-movement (Du and Zhang, 2018).

Table 9 The impact of the Belt and Road Initiative

This table reports the impact of Belt and Road Initiative on co-movements. *BRI* is a dummy variable that equals 1 for the years after the economy signed relevant cooperation documents in the Belt and Road framework with China and 0 otherwise. Control represents the determinants in the baseline model. Year is year-level dummies, controlled for in all columns. Robust standard errors in parentheses. Significance level: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Variable definitions are presented in Appendix I.

	(1)	(2)	(3)	(4)
<i>BRI</i>	-0.022 (0.045)	-1.677*** (0.412)	-0.914*** (0.259)	-0.003 (0.060)
<i>BRI * Size</i>		0.064*** (0.016)		
<i>BRI * Development</i>			0.093*** (0.027)	
<i>BRI * High inflation</i>				-0.035 (0.062)
<i>Size</i>	0.025** (0.011)	0.015 (0.012)	0.025** (0.011)	0.024** (0.011)
<i>Development</i>	0.032** (0.014)	0.031** (0.014)	0.017 (0.014)	0.033** (0.014)
<i>High inflation</i>	-0.056** (0.023)	-0.049** (0.023)	-0.056** (0.022)	-0.049** (0.024)
Control	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Adj. R ²	0.095	0.108	0.104	0.095
Observations	1,162	1,162	1,162	1,162

6. Conclusion

In this paper we explore the co-movements between the currencies of developing economies and the RMB. We find that while the RMB plays an important role in East Asia & Pacific, it had yet been influential on developing economies.

We also investigate the determinants of RMB co-movement, and find that bilateral trade significantly increases, while inflation differential decreases, the probability of the co-movement. Additionally, the currencies of the economies that are more inclined to adopt a pegging system are less likely to co-move with the RMB.

We further divide the sample into three sub-periods based on two major China's currency reforms and find the consistent results supporting our main conclusion. We also investigate nonlinear determinants of RMB co-movement by dividing the sample into high and low volatility regimes and show that high volatility regime presents a different pattern of determinants. Finally, we find that RMB currency swap and the Belt and Road Initiative catalyst the co-movement in larger and more developed economies.

Appendix I Variable definitions and data sources

This table presents the abbreviation, definition and source of variables we have used.

Variable	Definition	Data source
Co-movements between currencies and the RMB		
$\Delta \log(x)$	Log daily return of USD/ x (x = RMB, EUR, JPY, GBP, and other currencies) exchange rates	FX, VIX, Oil data from Bloomberg
<i>VIX</i>	The Chicago Board Options Exchange Market Volatility Index	
<i>Oil</i>	Log daily return of Brent crude oil prices	
<i>Comove</i>	Estimated co-movements between developing economy currencies and the RMB	
Determinant		
<i>Trade dependence</i>	Total trade with China divided by that with the world	DOTS, IMF
<i>Output asymmetry</i>	The standard deviation of the difference of growth rates of real output between other economies and China in the previous 10 years	WEO, IMF and WDI, World Bank
<i>Inflation differential</i>	The absolute value of the difference of the inflation between other economies and China	
<i>High inflation</i>	= 1 when an economy has experienced a high inflation above 50 % between the current year and 1980 and current inflation is below 20%	
<i>Real shock</i>	The standard deviation of the government expenditure to GDP ratio during the previous 5 years	
<i>Nominal shock</i>	The standard deviation of growth rates of broad money supply during the previous 5 years	
<i>Size</i>	The logarithm of real PPP GDP (2017 international dollar)	
<i>Development</i>	The logarithm of per capita PPP GDP (2017 international dollar)	
<i>Land</i>	The natural logarithm of land area (square kms)	
<i>Reserve</i>	Reserves divided by M2	
<i>Financial development</i>	M2 divided by GDP	
<i>Exchange rate regime dummy</i>	Including de facto peg, crawling peg, managed floating, freely floating, and dual market in which parallel market data is missing	Ilzetzi et al. (2019)

Appendix II Economy sample and regional distribution

This table lists the economy sample we used and their regional distribution.

Region	Economy (Currency)
East Asia & Pacific	Brunei (BND), Fiji (FJD), Indonesia (IDR), Cambodia (KHR), Korea, Rep. (KRW), Mongolia (MNT), Malaysia (MYR), Philippines (PHP), Singapore (SGD), Solomon Islands (SBD), Thailand (THB), Vietnam (VND), Vanuatu (VUV), Samoa (WST)
Europe & Central Asia	Albania (ALL), Azerbaijan (AZN), Bulgaria (BGN), Bosnia and Herzegovina (BAM), Belarus (BYN), Czech Republic (CZK), Georgia (GEL), Croatia (HRK), Hungary (HUF), Kazakhstan (KZT), Kyrgyz Republic (KGS), Moldova (MDL), North Macedonia (MKD), Poland (PLN), Romania (RON), Russian Federation (RUB), Serbia (RSD), Tajikistan (TJS), Turkey (TRY), Ukraine (UAH)
Latin America & Caribbean	Argentina (ARS), Brazil (BRL), Chile (CLP), Colombia (COP), Costa Rica (CRC), Dominican Republic (DOP), Guatemala (GTQ), Honduras (HNL), Mexico (MXN), Nicaragua (NIO), Peru (PEN), Paraguay (PYG), Trinidad and Tobago (TTD), Uruguay (UYU)
Middle East & North Africa	United Arab Emirates (AED), Algeria (DZD), Egypt (EGP), Jordan (JOD), Kuwait (KWD), Lebanon (LBP), Libya (LYD), Morocco (MAD), Oman (OMR), Qatar (QAR),

	Saudi Arabia (SAR), Tunisia (TND)
South Asia	Bangladesh (BDT), India (INR), Sri Lanka (LKR), Nepal (NPR), Pakistan (PKR)
Sub-Saharan Africa	Angola (AOA), Burundi (BIF), Botswana (BWP), Central African Republic (XAF), Congo, Dem. Rep. (CDF), Cape Verde (CVE), Ghana (GHS), Kenya (KES), Madagascar (MGA), Mauritius (MUR), Namibia (NAD), Nigeria (NGN), Rwanda (RWF), Seychelles (SCR), Tanzania (TZS), Uganda (UGX), South Africa (ZAR), Zambia (ZMW)

References:

- Alesina, A., & Barro, R. J. (2002). Currency Unions. *The Quarterly Journal of Economics*, 117(2), 409-436.
- Angeloni, I., & Sapir, A. (2011). The International Monetary System Is Changing: What Opportunities and Risks for the Euro? *Bruegel Working Papers*, 2011/11.
- Bahaj, S., & Reis, R. (2020). Jumpstarting an International Currency. *Bank of England Working Papers*, 874.
- Balasubramaniam, V., Patnaik, I., & Shah, A. (2011). Who Cares About the Chinese Yuan? *NIFPF Working Papers*, 89.
- Bastos, P. (2020). Exposure of Belt and Road Economies to China Trade Shocks. *Journal of Development Economics*, 145, 102474.
- Chen, H., & Peng, W. (2010). The Potential of the Renminbi as an International Currency. In *Currency Internationalization: Global Experiences and Implications for the Renminbi* (pp. 115-138). Springer.
- Cheung, Y.-W., Chinn, M. D., & Fujii, E. (2010). Measuring Renminbi Misalignment: Where Do We Stand? *Korea and the World Economy*, 11(2), 263-296.
- Chow, H. K. (2014). Is the Renminbi Asia's Dominant Reference Currency? A Reconsideration. *China Economic Policy Review*, 3(1).
- Clark, P. B., Wei, S.-J., Tamirisa, N. T., Sadikov, A. M., & Zeng, L. (2004). A New Look at Exchange Rate Volatility and Trade Flows. International Monetary Fund.
- Dobson, W., & Masson, P. R. (2009). Will the Renminbi Become a World Currency? *China Economic Review*, 20(1), 124-135.
- Du, J., & Zhang, Y. (2018). Does One Belt One Road Initiative Promote Chinese Overseas Direct Investment? *China Economic Review*, 47, 189-205.
- Eichengreen, B. (2010). Lessons of the Crisis for Emerging Markets. *International Economics and Economic Policy*, 7(1), 49-62.
- Enderwick, P. (2018). The Economic Growth and Development Effects of China's One Belt, One Road Initiative. *Strategic Change*, 27(5), 447-454.
- Fischer, C. (2016). Determining Global Currency Bloc Equilibria: An Empirical Strategy Based on Estimates of Anchor Currency Choice. *Journal of International Money and Finance*, 64, 214-238.
- Foo, N., Lean, H. H., & Salim, R. (2020). The Impact of China's One Belt One Road Initiative on International Trade in the Asean Region. *The North American Journal of Economics and Finance*, 54, 101089.
- Frankel, J., & Wei, S. J. (1994). Yen Bloc or Dollar Bloc? Exchange Rate Policies of the East Asian Economies. In T. Ito & A. Krueger (Eds.), *Macroeconomic Linkage: Savings, Exchange Rates, and Capital Flows, Nber-Ease Volume 3* (pp. 295-333). University of Chicago Press.
- Frankel, J., & Xie, D. (2010). Estimation of De Facto Flexibility Parameter and Basket Weights in Evolving Exchange Rate Regimes. *American Economic Review*, 100(2), 568-572.
- Fratzscher, M., & Mehl, A. (2014). China's Dominance Hypothesis and the Emergence of a Tri-Polar Global Currency System. *Economic Journal*, 124(581), 1343-1370.
- Frieden, J. A. (1991). Invested Interests: The Politics of National Economic Policies in a World of Global Finance. *International Organization*, 45(4), 425-451.
- Forbes, K. J., & Warnock, F. E. (2021). Capital Flow Waves—or Ripples? Extreme Capital Flow Movements since the Crisis. *Journal of International Money and Finance*, 116.
- Galati, G. (2001). The Dollar-Mark Axis. *Weltwirtschaftliches Archiv*, 137(1), 36-57.
- Ghosh, A. (2014). A Comparison of Exchange Rate Regime Choice in Emerging Markets with Advanced and Low Income Nations for 1999–2011. *International Review of Economics & Finance*, 33, 358-370.

- Gopinath, G., & Stein, C. J. (2021). Banking, Trade, and the Making of a Dominant Currency, *The Quarterly Journal of Economics*, 136(2), 783-830.
- Hansen, B. E. (2000). Sample Splitting and Threshold Estimation. *Econometrica*, 68(3), 575-603.
- He, D., & McCauley, R. N. (2013). Transmitting Global Liquidity to East Asia: Policy Rates, Bond Yields, Currencies and Dollar Credit. *BIS Working Papers*, 431.
- He, Q., Korhonen, I., Guo, J., & Liu, F. (2016). The Geographic Distribution of International Currencies and Rmb Internationalization. *International Review of Economics & Finance*, 42, 442-458.
- He, Q., Liu, J., & Zhang, C. (2021a). Exchange Rate Exposure and International Competition: Evidence from Chinese Industries. *Journal of Contemporary China*, 30(131), 820-840.
- He, Q., Liu, J., & Zhang, C. (2021b). Exchange Rate Exposure and Its Determinants in China. *China Economic Review*, 65, 101579.
- He, Q., and Wang, W. and Yu, J. (2021c). Exchange rate co-movements and corporate foreign exchange exposures: a study on RMB.
- Henning, C. R. (2013). Choice and Coercion in East Asian Exchange Rate Regimes. In Benjamin J. Cohen & E. M. P. Chiu (Eds.), *Power in a Changing World Economy* (pp. 103-124). Routledge.
- Ho, C., Ma, G., & McCauley, R. N. (2005). Trading Asian Currencies. *BIS Quarterly Review*.
- Hutson, E., & Laing, E. (2014). Foreign Exchange Exposure and Multinationality. *Journal of Banking & Finance*, 43, 97-113.
- Ilzetzki, E., Reinhart, C. M., & Rogoff, K. S. (2019). Exchange Arrangements Entering the Twenty-First Century: Which Anchor Will Hold? *The Quarterly Journal of Economics*, 134(2), 599-646.
- Ito, T. (2017). A New Financial Order in Asia: Will a Rmb Bloc Emerge? *Journal of International Money and Finance*, 74, 232-257.
- Kawai, M., & Pontines, V. (2016). Is There Really a Renminbi Bloc in Asia?: A Modified Frankel–Wei Approach. *Journal of International Money and Finance*, 62, 72-97.
- Keddad, B. (2019). How Do the Renminbi and Other East Asian Currencies Co-Move? *Journal of International Money and Finance*, 91, 49-70.
- Kenen, P. B. (2011). Currency Internationalisation: An Overview. In Bank for International Settlements (Ed.), *Currency Internationalisation: Lessons from the Global Financial Crisis and Prospects for the Future in Asia and the Pacific* (Vol. 61, pp. 9-18). Bank for International Settlements.
- Krugman, P. (1979). A Model of Balance-of-Payments Crises. *Journal of Money, Credit and Banking*, 11(3), 311-325.
- Liu, M., Su, C., Wang, F., & Huang, L. (2020). Chinese Cross-Border M&As in the “One Belt One Road” Countries: The Impact of Confucius Institutes. *China Economic Review*, 61, 101432.
- Liu, W. (2015). Scientific Understanding of the Belt and Road Initiative of China and Related Research Themes. *Progress in Geography*, 34(5), 538-544.
- McCauley, R. N., & Shu, C. (2019). Recent Renminbi Policy and Currency Co-Movements. *Journal of International Money and Finance*, 95, 444-456.
- McDowell, D. (2019). The (Ineffective) Financial Statecraft of China's Bilateral Swap Agreements. *Development and Change*, 50(1), 122-143.
- Meissner, C. M., & Oomes, N. (2009). Why Do Countries Peg the Way They Peg? The Determinants of Anchor Currency Choice. *Journal of International Money and Finance*, 28(3), 522-547.
- Mundell, R. A. (1961). A Theory of Optimum Currency Areas. *American Economic Review*, 51(4), 657-665.
- Plümpert, T., & Neumayer, E. (2011). Fear of Floating and De Facto Exchange Rate Pegs with Multiple Key Currencies. *International Studies Quarterly*, 55(4), 1121-1142.
- Qian, Z., Gan, J., Tu, Y., & Wang, F. (2019). International Policy Coordination and Rmb Internationalisation: Theory and Historical Experience. *Economic and Political Studies*, 7(1), 87-105.
- Ramasamy, B., & Yeung, M. C. H. (2019). China's One Belt One Road Initiative: The Impact of Trade Facilitation Versus Physical Infrastructure on Exports. *The World Economy*, 42(6), 1673-1694.
- Shu, C., He, D., & Cheng, X. Q. (2015). One Currency, Two Markets: The Renminbi's Growing Influence in Asia-Pacific. *China Economic Review*, 33, 163-178.
- Song, K., & Xia, L. (2020). Bilateral Swap Agreement and Renminbi Settlement in Cross-Border Trade. *Economic and Political Studies*, 8(3), 355-373.
- Subramanian, A., & Kessler, M. (2013). The Renminbi Bloc Is Here: Asia Down, Rest of the World to Go? *Journal of Globalization and Development*, 4(1), 49-94.

Wang, Y. (2016). Offensive for Defensive: The Belt and Road Initiative and China's New Grand Strategy. *Pacific Review*, 29(3), 455-463.

Xu, Q., Yu, J., Shi, X., & Collinson, E. (2022). The Potential of Energy Cooperation between China and Australia under the Belt and Road Initiative. *Economic and Political Studies*, 1-18.

Zhang, F., Yu, M., Yu, J., & Jin, Y. (2017). The Effect of Rmb Internationalization on Belt and Road Initiative: Evidence from Bilateral Swap Agreements. *Emerging Markets Finance and Trade*, 53(12), 2845-2857.

Digital Financial Capability and Household Entrepreneurial Performance*

By LUO YU, PENG YUCHAO AND ZENG LIANYUN *

Abstract

In the context of fast digitization of commercial and financial ecosystem in China, this study explores the impact of digital financial capability on household entrepreneurial performance. Utilizing China Household Finance Survey 2017 data, this paper is among the first to define and measure digital financial capability, showing that it has significant and positive influence on household business ownership, innovation and financial performance. The results still hold after addressing endogeneity. Furthermore, we illustrate how digital financial capability impacts household entrepreneurial performance by scrutinizing indirect effects of both commercial and financial channels. In addition, heterogeneity regarding vulnerable populations is also examined for deepening understanding of such relationships. This study calls attention to the importance of digital financial capability to better look upon the opportunities and challenges in real-time micro economic lives in China and beyond, providing insights on whether and how digital financial capability affects household entrepreneurial performance, as well as implications for emerging economics who are going through similar developing stages.

Keywords: digital financial capability; household entrepreneurial performance; business ownership; business innovation; business financial performance

JEL classification codes: L26, L96, G53

* Published in International Review of Economics and Finance 76 (2021) at February 2023.

* Luo Yu, IMI Research Fellow, School of Finance, China Banking Research Center, China Financial Policy Research Center, Renmin University of China; Peng Yuchao, IMI Research Fellow, School of Finance, Central University of Finance and Economics; Zeng Lianyun, School of Finance, Chinese Academy of Financial Inclusion, Renmin University of China

1. Introduction

With the fast penetration of digital technology into economic lives, financial services have not only gone through an unprecedented digitization process, but also interacted with more and more daily commercial scenarios, which keep bringing new chances for inclusive growth (Manyika et al., 2016; Siddik and Kabiraj, 2020; Zetzsche, Buckley, and Arner, 2019). In China, the tremendous volume of digital transactions has been eye-catching, imposing disruptive changes to the commercial ecosystem. As a result, the ability to cope with those changes has been steadily becoming crucial for potential and existing business owners. Such situation stood out during the COVID-2019 pandemic, where online businesses better survived and served households during the sudden and strict quarantines.

However, not all populations are prepared for the benefit and upcoming opportunities. Only with adaptive capability can people make full use of the products and services that have the potential to change lives. Otherwise, they may well be relatively deprived and left behind. Therefore, we need to pay attention to the opportunities and gaps in the digital era from a micro level, and explore the economic changes that capability building can bring to the underrepresented.

It is worth noting that, with continuous development and application of financial technologies, we seem to have come to a stage where it is difficult to separate digital technologies with people's everyday financial activities. Latest international meetings, like T20 in Japan and 2019 ADBI annual conference, have already signaled global concerns on the inseparability of digital technologies from financial services, and raised it to the considerations of future education, work, and SME policies. As a result, the concept of digital financial literacy was brought up by the think tank (Morgan, Huang and Trinh, 2019), which generally refers to knowledge of using digital financial services, including, what the digital financial products or services are available, what the risks are, how to control such risks, as well as how to settle consumer disputes.

It is no doubt a timely breakthrough to modify traditional concept of financial literacy, so as to take into account prominent changes in the digital age (Lyons et al., 2020). Nevertheless, as argued by Atkinson, McKay, Collard and Kempson (2007) and Johnson and Sherraden (2007), financial literacy might not work well if people just know about it, but do not actually realize financial behaviors. Thus, based on the concept of financial capability, which also puts emphasis on realization of behaviors, we propose to define the concept of digital financial capability and look at its impact on household entrepreneurial activities.

Using the China Household Finance Survey 2017 data, this paper specifically studies the impact of digital financial capability on household entrepreneurial performance. We make three important contributions to the existing literature. First, this paper is among the first to draw attention to the emergence of digital financial capability as an important component of human capital in the digital era, and define it explicitly. Second, we provide detailed discussions on whether and how digital financial capability impacts household entrepreneurial performance, by dealing with endogeneity and examining both commercial and financial mediation channels through which digital financial capability makes differences. The dependent variables used to depict household entrepreneurial performance are multidimensional, including, business ownership, business innovation and financial performance, which help create a good picture of the role digital financial capability plays in households' entrepreneurial decision making and performance. Last but not the least, we illustrate the heterogeneity of impacts by different populations, so as to provide policy implications for vulnerable groups, as well as experience for economies who are going through similar stages.

The remainder of this paper is as follows. The second section reviews the literature and demonstrates how we extend existing literature, which is followed by a section introducing the data and variables. The fourth and fifth sections present our methodology and results respectively. The final section includes conclusions and discussion.

2. Literature review and background

To illustrate how we complement the existing studies, we review the literature from three perspectives, namely, financial capability and household entrepreneurial performance, digitization and household entrepreneurial performance, as well as the rising importance of digital financial capability.

2.1 Financial capability and household entrepreneurial performance

Financial capability adds to financial literacy with emphasis on attitudes and behaviors, shedding light on the actual interaction between financial consumers and the financial sector (Johnson and Sherraden, 2007). Since there is very limited comprehensive evidence on how financial capability impacts household entrepreneurial performance, it is necessary to explore the literature on how those different dimensions of financial capability impacts household entrepreneurial activities.

Financial knowledge & skills have significant and positive impact on households' entrepreneurial decisions (Ćumurović, and Hyll, 2019; Yin, Song, Wu, and Peng, 2015). The argument is that, with proper financial knowledge & skill, households would make better use of borrowing opportunities, their risk tolerance would change, their demand for and accessibility to formal credit would increase, which help make their entrepreneurial decisions into being. Besides, evidence is also found around the association between financial knowledge & skills of entrepreneurs and financial performance (Kojo Oseifuah, 2010). However, specific discussion on the impact of financial knowledge & skills on business innovation is scarce, which we surmise to be a neglected booster of business performance.

While few studies explore the relationship between financial attitudes and household entrepreneurship, we suppose there might be indirect association through financial behaviors, as evidence is shown by Atkinson and Messy (2012) that there is positive correlation between financial attitudes and behaviors.

When it comes to financial behaviors, the key argument is whether they help mitigate liquidity or credit constraint, while there are also function channels concerning confidence and behavioral preferences (Aghion, Fally, and Scarpetta, 2007; Blanchflower and Oswald, 1998; Evans and Jovanovic, 1989; Kerr and Nanda, 2009). We review findings around usage of loans, credit card, savings, insurance and other diversified investment behaviors as follows.

With respect to loans, opinions are divided on the impacts of different loan sources. While quite a few studies demonstrate positive impact of bank loan usage on business performance and innovation (Ayyagari, Demirgüç-Kunt, and Maksimovic, 2010, 2011; Demirgüç-Kunt, Klapper, and Panos, 2011; Hernández-Trillo, Pagán, and Paxton, 2005; Luo and Zeng, 2020), Beck, Lu and Yang (2015) indicates no significant relationship between formal loans and firm growth, but rather, confirms positive association between the use of informal loan and growth of microenterprises. Apart from that, examination around the impact of bank loan holding on household entrepreneurial decisions is still limited.

With respect to credit card usage, evidence shows that, extension of credit cards promoted business entries (Chatterji and Seamans, 2012). Consumer credit of entrepreneurs is also critical throughout stages of business development (Herkenhoff, Phillips, and Cohen-Cole, 2016). As a matter of fact, many studies point out the role of entrepreneur's personal credit as important supplement of business liquidity (Cole and Wolken, 1995). Shown by Luo and Zeng (2020), credit card usage also has positive association with business innovation.

With respect to savings, entrepreneurial households are found to have higher saving rates, so as to avoid external funding costs (Cagetti and De Nardi, 2006; Gentry and Hubbard, 2004; Quadrini, 2000). However, savings may play a less important role in business innovation (Luo and Zeng, 2020) and the impact of savings on business financial performance is not rigorously answered yet.

As for insurance and other financial investment behaviors, evidence is found on insurance's role in providing risk floor for potential entrepreneurs (Ilmakunnas and Kannianen, 2001; Luo and Zeng, 2020; Olds, 2016; Wellington, 2001), enabling them to be confident in starting their own businesses. Comparatively, studies demonstrate similar characteristic of portfolios held by entrepreneurial households that is short of diversification (Gentry and Hubbard, 2004), while Luo and Zeng (2020) further shows the negative association between diversified investment and household entrepreneurial decisions. Except that, empirical examination on the association between investment behaviors and business financial performance is still in need.

In general, there have been affluent literature regarding impacts of different dimensions of financial capability on household entrepreneurial performance, though comprehensive studies are scarce, especially those regarding business financial performance, which can be critical for survival of microenterprises, like most of those in this study. Thanks to the scattered but abundant existing findings, we are able to identify useful directions for our analysis of function channels.

2.2 Digitization and household entrepreneurial performance

Over the past decade, digitization in China and other emerging economies has been embedded with *smart* characteristics. Together with digital payment, e-commerce and social media have been penetrating

deeply into micro economic lives and vastly changing household entrepreneurial activities (Chen, 2016; Luohan academy, 2019). While there has been literature on the digital transformation of enterprises from perspective of management, rigorous evidence is limited on how digitization has hatched and promoted micro or individual businesses.

Digital payment is no doubt the stepstone for creation of business models (Bansal et al, 2018), on the ground of which came into being many other digital financial services, like digital credit and digital investment. Evidence shows that digital payment has significant and positive impact on different stages of entrepreneurship, from business entry, innovation to financial performance (Dalla Pellegrina, Frazzoni, Rotondi, and Vezzulli, 2017; Sekabira and Qaim, 2017; Yin, Gong, and Guo, 2019). However, little research examines what the function channels are, and how digital payment interacts with e-commerce and social media. Besides, how other digital financial services impact household entrepreneurial performance is still a nascent area.

E-commerce and social media have been impressively reshaping how the business world operates (Aral, Dellarocas, and Godes, 2013). With the rise of social commerce, it is now even hard to talk about one of them and leave the other alone. While observations have been made around the association between e-commerce/ social media and household entrepreneurial activities (Kapron and Meertens, 2017), there is still the need of empirical evidence on how they impact entrepreneurial performance in different stages.

In general, we can contribute to the existing literature by rigorously examining the relationships among e-commerce, social media and digital finance in household entrepreneurship, and provide policy implications not only for encouraging mass entrepreneurship and innovation, but also for optimizing financial performance and promoting survival of microenterprises.

2.3 The rising importance of digital financial capability

Under the background of 'gig' economy, where more and more people are becoming independent workers and getting used to temporary contracts, individuals have to be more responsible for their own lifelong finances. What is happening at the same time is the overwhelming trend of digitization of financial services, which means the need for financial consumers to be digitally sophisticated will keep growing, otherwise they may encounter problems ranging from accessibility of financial services, to fraud precaution (Morgan, Huang and Trinh, 2019). Thus, it is time to be aware about the different requirement of being financially capable in the digital age, and look seriously at the rising importance of digital financial capability.

In fact, there has already been scholarly insights related to digital financial capability, which may not be literally explicit, but the concerns have been clear. For example, OECD (2017) emphasizes the critical role of financial literacy to allow consumers and small businesses to make good use of increasingly digitized financial landscape. Lyons et al. (2020) shows the significant impact of both digital literacy and financial literacy on financial inclusion, and brings out the need to redefine traditional financial literacy to include digital literacy. To our knowledge, Morgan, Huang and Trinh (2019) was the first to mention the definition of digital financial literacy, and proposed four dimensions, namely, knowledge of digital financial products and services, awareness of digital financial risks, knowledge of digital financial risk control, and knowledge of consumer rights and redress procedures. From the structure of the definition, we can see Morgan, Huang and Trinh (2019) addresses the knowledge of key processes of using digital financial services, not covering relevant behaviors. Till now, there is scarcely any literature on the definition of digital financial capability.

In summary, previous to the definition of digital financial capability, impacts of some factors constituting financial capability on household entrepreneurial performance have been found. However, detailed examinations on whether and how those factors influence household entrepreneurial performance are still in need. In addition, while there have been observations on the changes that digitization has brought about, rigorous research on key relationships around household entrepreneurial activities is till now very limited. Furthermore, studies around the emergence and importance of digital financial capability in micro economic lives and business world have up to now been absent. Based on literature review above, we illustrate critical gaps in the domain, and key contributions we can make. Firstly, this paper is among the first to bring attention to the emergence of digital financial capability, and define it explicitly. Secondly, we provide detailed discussions on whether and how digital financial capability impacts household entrepreneurial performance, by employing instrumental variable and examining mediation channels through which digital financial capability makes changes. The dependent variables used to depict

household entrepreneurial performance are multidimensional, including, business ownership, business innovation and financial performance, which can help provide a good picture of household businesses. Last but not the least, we demonstrate the heterogeneity of impacts across different populations, so as to explore policy implications for vulnerable groups.

3. Data and variables

The data we make use of in this study are from the 2017 China Household Finance Survey (CHFS), which collected micro-level information on broad dimensions of household balance and economic activities (Gan, Yin, Jia, Xu, and Ma, 2013), covering 29 provinces and 40011 households. In comparison with the previous 3 versions of questionnaires, the fourth wave carried out in 2017 asked more about households' digital financial behaviors, which gives us the opportunity to investigate how digital financial capability influences household entrepreneurial performance. After clearing the data and dropping observations which missed key variables, we kept 38506 households as the entire sample, and 4973 households as the business sample, who were running businesses when surveyed. Variables are defined as follows.

3.1 Household entrepreneurial performance

This paper distinguishes itself from most studies focused on micro-small-medium enterprises (MSMEs) in that, it starts from the standpoint of households, and utilizes a sample large enough to describe actual situation in China, regarding how households made entrepreneurial decisions and how their businesses innovated and financially performed. On the ground of 2017 CHFS questionnaire, we were able to screen out four dependent variables in three dimensions to represent the performance of household entrepreneurial activities.

Business ownership

Regarding *Business ownership*, households were asked, "Is your family engaged in production and operation of industry and commerce, including individual business, leasing, transportation, online stores, and enterprises?" Based on the question, we code respondents' "Yes/ no" answers as a dichotomous variable made up of "1/0".

Business innovation

Regarding *Business innovation*, households were asked, "Compared with the situation of last year/first half of this year¹¹, are there any innovative activities concerned with products, technology, arrangement, culture, marketing, service, etc. such as R&D, new ideas, new methods, etc.?" We also code a dichotomous variable for the question.

Business financial performance

Regarding business financial performance, two dependent variables are utilized, including, *Business income*, and *Business profit*. For *Business income*, households were asked, "How much was the operating revenue of the project last year/first half of this year?" For *Business profit*, households were asked, "How much was the project gain/loss last year/for the first half of this year?" Natural logarithms were taken of the two monetary values in models for computation¹².

3.2 Digital financial capability

Based on the definition of financial capability provided by Atkinson, McKay, Collard, and Kempson (2007) and Perotti, Zottel, Iarossi, and Bolaji-Adio (2013), we define *Digital financial capability (DFC)* as, the ability of individuals or households to make full and reasonable use of digital financial products and services, concerning whether to make full use of the digital financial products and services that are beneficial to them, whether to properly deal with the digital financial risks, whether to reasonably safeguard their own rights and interests, and finally to fulfill informed household financial decisions.

Specifically, the independent variable, *DFC*, is measured by a multidimensional score. We decide each componential variable to be included by whether it incorporates both digital and financial elements. Overall, there are 6 componential variables that can be used, namely, household usage of self-service banking, online/mobile banking, computer payment, mobile payment, online financial investment, as well as credit card¹³. We generate dichotomous componential variables regarding whether respondents reported

11 Households were asked about the business situation of first half of this year if their businesses started from the year when surveyed.

12 Concerning negative profit, we first reverse the sign of the profit to obtain natural logarithm, and then reverse the obtained value again to measure the loss.

13 We tried to utilize a componential variable representing usage of digital credit services. While variables around online credit services were not available, we chose usage of credit card instead, which in fact was an early format of digital credit.

their families using those services, and then sum them up as the *DFC* score, which ranges from 0 to 6. As shown by the factor analysis adopting iterated principal-factor method in Table 1, only the first factor has eigenvalue greater than 1. The percentage of variability explained by factor 1 is 91.35%, accounting for most of the total variability, and the Kaiser-Meyer-Olkin test (Kaiser, 1974) shows the KMO index is 0.8537.

Table 1. Factor analysis for *Digital financial capability*

Factor	Eigenvalue	Cumulative	Componential variables	Factor1 loadings	KMO
Factor1	2.5587	0.9135	<i>Self-service banking</i>	0.6260	0.8665
Factor2	0.1469	0.9659	<i>Online/mobile banking</i>	0.8057	0.8152
Factor3	0.0630	0.9884	<i>Computer payment</i>	0.5498	0.8946
Factor4	0.0190	0.9952	<i>Mobile payment</i>	0.7975	0.8211
Factor5	0.0137	1.0001	<i>Online financial investment</i>	0.5034	0.8978
Factor6	-0.0002	1.0000	<i>Credit card</i>	0.5710	0.8989
	N=38,506		Overall		0.8537

3.3 Other variables

Benefiting from existing studies, we utilize two comprehensive sets of control variables respectively for both the business ownership model (The entire sample) and the business innovation and financial performance models (The business sample), shown by Table 2. According to Krasniqi (2009), determinants impacting household entrepreneurial activities include age, gender, marital status, education, family size, rural/urban residence, credit constraint, as well as industries and regions. Astebro, Herz, Nanda and Weber (2014) and Hvide and Panos (2014) also point out the impact of risk preference on entrepreneurial decisions. What's more, Yin, Gong, and Guo (2019) takes into consideration children, elders, health condition, as well as household asset. For the business sample, we add in variables capturing business characteristics, namely, business history in years, business motivations, online business models, whether the business cooperated with governments or received policy benefits, what their business forms are, natural logarithm of initial business investment, as well as industry dummies. Besides, both sets of control variables include numbers of entrepreneurial households in the community, and province dummies.

As for moderation and mediator variables, we identified three dimensions of channels that are closely related to *DFC*. The first is the digital dimension, testing whether *Online sale* is a significant mediation channel, and whether *Social media* is a significant moderation channel, where both variables measure whether the respondent used those digital services. The second is the borrowing channel, testing whether *Bank loan* or *Informal loan* are significant mediation channels, where *Bank loan* indicates whether the household held any bank loan; *Informal loan* indicates whether the household held any informal loan for business. The third is the investment channel, testing whether *Liquidity investment*, *Insurance investment* or *Other financial investment* are significant mediation channels, where *Liquidity investment* measures whether the household reported having deposit and monetary fund with value no less than 3-month household consumption; *Insurance investment* measures whether the household reported holding any commercial insurance; *Other financial investment* measures whether the household reported investing in any financial instrument other than deposit, monetary fund or insurance.

4. Methodology

4.1 Baseline models

To explore the impact of *DFC* on household entrepreneurial performance, we first adopt equation (1) to examine its marginal effects on the four dependent variables. For *Business ownership* and *Business innovation*, probit models are adopted; while for *Business income* and *Business profit*, linear models are utilized.

$$Entre_{i,j} = a_j + b_jDFC_i + \beta_jX_j + \varepsilon_{i,j} \quad (1)$$

where, $Entre_{i,j}$ represents household i 's entrepreneurial performance, $j=1\sim 4$, specifying *Business ownership*, *Business innovation*, natural logarithm of *Business income*, and natural logarithm of *Business profit*, respectively. DFC_i represents household i 's *DFC*; vector \mathbf{X}_1 represents the control variables for the entire sample, vector \mathbf{X}_2 contains the same variables as \mathbf{X}_3 or \mathbf{X}_4 , representing the control variables for the business sample, which captures more business characteristics, as described in table 2. For model j , a_j is the constant, b_j is the coefficient of DFC_i , β_j is the coefficients vector of control variables, $\varepsilon_{i,j}$ is the error term of household i . Subscripts for variables, coefficients and error terms in following equations adopt analogous settings.

What cannot be ignored is that, there can be two-way relationships between *DFC* and dependent variables. Though we propose to look at the impact of *DFC* on household entrepreneurial performance, it is likely for households to become business owners first, or carried out innovation activities first, and then acquire *DFC* in an effort to optimize business operation. Besides, it is also possible for the business owners to make money first, and gain *DFC* while becoming rich, through the process of financial management. To address such endogeneity, we utilize *Use the Internet*¹⁴ as the instrumental variable for *DFC*. Similar to that in Yin, Gong and Guo (2019), *Use the Internet* is directly related to *DFC*, since all its componential variables require the connection of the Internet, while not directly related to household entrepreneurial activities, but instead has to realize impact through channels like those componential variables constituting *DFC*. By checking IV strength by Kleibergen-Paap rk statistics, and exogeneity by DWH tests, we demonstrate the validity of model settings.

4.2 Function channels

To investigate how *DFC* impacts household entrepreneurial performance, we need to make assumptions on possible function channels.

Firstly, we surmise improvement of *DFC* would promote usage of *Online sale*, and then benefit household entrepreneurial performance. In the 2017 CHFS questionnaire, respondents were asked, "What do you usually do on the internet currently?" In the multiple-choice answer list, there was one answer related to *Online sale*, that is "Selling products and providing services (including selling agricultural products, applying for a job, publishing ads for house rent, publishing ads for individual lending, online auction, etc)". From the description we can see that, the answer actually measures whether the respondent utilized the Internet as the channel for seeking income, which can probably lead to entrepreneurial behaviors.

Secondly, improvement of *DFC* may result in easier credit accessibility, including both *Bank loan* and *Informal loan*. Among the overwhelming changes digital finance has brought about, data accumulation stands out as the key to mitigate the difficulty MSMEs access loans. Thus, we assume that borrowing is the second channel that *DFC* impacts household entrepreneurial performance.

Thirdly, improvement of *DFC* would also help households manage their portfolios, and influence *Liquidity investment*, *Insurance investment* as well as *Other financial investment* (Jack and Suri, 2011; Nandhi, 2012), which would no doubt impact their entrepreneurial activities, which, for households, are also sort of investment.

Apart from channels discussed above, Luo and Zeng (2020) shows that *Social media* is an important source of *Business innovation*, acting as a low-cost network of open innovation. We assume *Social media* can be a significant channel moderating how *Online sale* influences *Business innovation*, *Business income* and *Business profit*.

Therefore, we hypothesize that *DFC* impacts household entrepreneurial performance by broadening income-seeking channel through *Online sale*, increasing credit accessibility through *Bank loan* and *Informal loan*, influencing investment through *Liquidity investment*, *Insurance investment*, and *Other financial investment*, while *Social media* may act as a moderator.

We utilize generalized structural equation models (GSEM) to check validity of hypothesized function channels. The model processes are described by equation (2) to equation (5). Subscripts for variables, coefficients and error terms follow analogous formats as those in equation (1). For example, models subscripted by $j=1$ are all for examining functional channels through which *DFC* impacts *Business ownership*. Based on Hayes (2013), we calculate the direct and indirect effects of *DFC* on household *Business ownership*, *Business innovation*, *Business income* and *Business profit*.

14 In the 2017 CHFS questionnaire, respondents were asked, "Have you ever used the internet?" If the respondent answered "Yes", use the Internet was coded as 1, otherwise as 0.

$$Mediator_{i,j,k} = c_{j,k} + d_{j,k}DFC_i + \theta_{j,k}X_j + \epsilon_{i,j,k} \quad (2)$$

where, $j=1\sim 4$, representing the four model systems corresponding to the four dependent variables. The major cause leading to different coefficients in equation (2) are the control variables vector X_j . $k=1\sim 6$, representing the 6 mediator variables, namely, *Online sale*, *Bank loan*, *Informal loan*, *Liquidity investment*, *Insurance investment*, *Other financial investment*.

For $j=1$, $Entre_{i,j} = Business\ ownership_i$,

$$Business\ ownership_i = e_1 + f_1DFC_i + \sum_{k=1}^6 \gamma_{1,k} Mediator_{i,1,k} + \rho_1 X_1 + \mu_{i,1} \quad (3)$$

Based on Luo and Zeng (2020), *Social media* significantly impacts *Business innovation*, rather than *Business ownership*, thus, for $j=1$, $Online\ sale_{i,j} * Social\ media_{i,j}$ and $Social\ media_{i,j}$ are not included in the final equation, while for $j=2$, included.

For $j=2$, $Entre_{i,j} = Business\ innovation_i$,

$$Business\ innovation_i = e_2 + f_2DFC_i + \sum_{k=1}^6 \gamma_{2,k} Mediator_{i,2,k} + m_2 Online\ sale_i * Social\ media_i + n_2 Social\ media_i + \rho_2 X_2 + \mu_{i,2} \quad (4)$$

For $j=3$ and 4 , $Entre_{i,j}$ represents natural logarithms of *Business income_i* and *Business profit_i* respectively. As *Business innovation* can be an important source of better financial performance, we include it in the equation to examine functional channels of how *DFC* impacts *Business income* and *Business profit*.

$$Entre_{i,j} = e_j + f_jDFC_i + q_j Business\ innovation_i + \sum_{k=1}^6 \gamma_{j,k} Mediator_{i,j,k} + m_j Online\ sale_i * Social\ media_i + n_j Social\ media_i + \rho_j X_j + \mu_{i,j} \quad (5)$$

5. Empirical results

5.1 Descriptive statistics

Table 2 show the descriptive statistics of variables for both the entire sample and the business sample. In the entire sample for studying *DFC* and *Business ownership*, 13.87% of households owned businesses, the average *DFC* score was 1.36, relatively low concerning the max score being 6. Among the componential variables, *Self-service banking* had the highest adoption rate as 44.16%, while *Online financial investment* had the lowest adoption rate as 7.74%. What is worth noticing is that, the adoption rate of *Mobile payment* had exceeded that of *Online/mobile banking* and *Computer payment*. With regard to respondent and household characteristics, the average *Age* of respondents¹⁵ was about 54 years old, 49.47% of whom were *Female*, and 82.70% were *Married*. In the 2017 CHFS questionnaire, education level means whether the respondent had ever registered and entered that level of school, from which he/she may have graduated or not. We chose the level *High school or higher* because the compulsory education period in China is from primary school to junior middle school. *High school or higher* means the respondent had surely finished the compulsory education. Shown by the statistics, 35.98% of respondents reached that level of education. In addition, we use the variable *Risk tolerant*¹⁶ as the indicator for risk preference, which may well influence their probability of becoming entrepreneurs. The average family size was around 3 members. 31.35% of surveyed households lived in rural areas, 33.10% had at least one family member whose health was poor, 33.34% had at least one child 15 years old or below, and 52.45% had at least one elder 60 years old or above. The average household asset was 1,127,330 yuan. The numbers of entrepreneurial households in surveyed communities ranged from 0 to 23, with the average a little above 4.

In the business sample for studying *DFC*'s impact on *Business innovation*, *Business income* and *Business profit*, consisting of households who reported running businesses, 16.93% executed innovative activities, average annual *Business income* was 305,657.44 yuan, while average annual *Business profit* was 101,939.84 yuan, from which we can confirm that most businesses in the sample were very small or micro.

15 We adopt the demographics of the respondent who answered all the questions for the household, as required by the survey, the respondent should be the one who knew best about household economic conditions.

16 In the 2017 CHFS questionnaire, respondents were asked, "Which of the choice below do you want to invest most if you have adequate money?" We define Risk tolerant as 1 if the respondent reported preferring average or above risk and return.

With respect to *DFC*, the statistics went along with our expectation that the score and adoption rate of each componential variable were significantly higher than those in the entire sample. Regarding demographic characteristics, respondents were over 8 years younger than the entire sample on average, 2.12% fewer were *Female*, 4.33% more were *Married*, and 6% more entered *High school or higher*, 11.43% more were *Risk tolerant*. Nearly 10% fewer households lived in rural areas. The average number of entrepreneurial households for business sample was 6.81, 70% more than that of the entire sample. As for business characteristics, the average business history was 10.34 years, 9.17% of business owners had online businesses, 5.15% cooperated with government, and 12.40% received policy benefit. 27.46% of business owners started the business for the possibility to earn more, while 11.48% did it for ambition¹⁷ and 29.71% for freedom, which can act as one indicator for nonpecuniary benefits preference. 81.42% of surveyed businesses were individual businesses, while 8.42% of which were informally organized. Average business investment was 194628.08 yuan.

Table 2. Descriptive statistics on sample socioeconomic characteristics

Variables	N	Mean	Sd	Min	Max
Entire sample					
<i>Business ownership (%)</i>	38,506	13.87	34.57	0	100
<i>DFC (#)</i>	38,506	1.36	1.70	0	6
<i>Self-service banking (%)</i>	38,506	44.16	49.66	0	100
<i>Online/mobile banking (%)</i>	38,506	25.73	43.72	0	100
<i>Computer payment (%)</i>	38,506	10.82	31.06	0	100
<i>Mobile payment (%)</i>	38,506	27.61	44.71	0	100
<i>Online financial investment (%)</i>	38,506	7.74	26.72	0	100
<i>Credit card (%)</i>	38,506	19.69	39.76	0	100
Respondent and household characteristics					
<i>Age (years)</i>	38,506	53.89	15.06	16	90
<i>Female (%)</i>	38,506	49.47	50.00	0	100
<i>Married (%)</i>	38,506	82.70	37.82	0	100
<i>High school or higher (%)</i>	38,506	35.98	48.00	0	100
<i>Risk tolerant (%)</i>	38,506	26.09	43.91	0	100
<i>Family size (#)</i>	38,506	3.16	1.54	1	15
<i>Rural (%)</i>	38,506	31.35	46.39	0	100
<i>Poor health (%)</i>	38,506	33.10	47.06	0	100
<i>Has child (%)</i>	38,506	33.34	47.14	0	100
<i>Has elder (%)</i>	38,506	52.45	49.94	0	100
<i>Household asset (CNY)</i>	38,506	1127330.00	2291239.30	0	30000000
<i>Entre households in community (#)</i>	38,506	4.19	3.55	0	23
Business sample					
<i>Business innovation (%)</i>	4974	16.93	37.50	0	100
<i>Business income (CNY)</i>	4974	305657.44	985407.17	0	8000000
<i>Business profit (CNY)</i>	3996	101939.84	371772.88	-5000000	5000000
<i>DFC (#)</i>	4974	2.23	1.80	0	6
<i>Self-service banking (%)</i>	4974	62.48	48.42	0	100
<i>Online/mobile banking (%)</i>	4974	46.16	49.86	0	100
<i>Computer payment (%)</i>	4974	19.24	39.42	0	100
<i>Mobile payment (%)</i>	4974	49.72	50.00	0	100
<i>Online financial investment (%)</i>	4974	13.53	34.21	0	100
<i>Credit card (%)</i>	4974	31.77	46.56	0	100
Respondent and household characteristics					
<i>Age (years)</i>	4974	45.48	12.82	16	85
<i>Female (%)</i>	4974	47.35	49.93	0	100
<i>Married (%)</i>	4974	87.03	33.60	0	100
<i>High school or higher (%)</i>	4974	41.98	49.36	0	100
<i>Risk tolerant (%)</i>	4974	37.52	48.42	0	100
<i>Rural (%)</i>	4974	21.41	41.02	0	100

17 In the 2017 CHFS questionnaire, respondents were asked, "Why did your household start a business?" We define 'Business for ambition' as 1 if the respondent chose 'Ideal job/Entrepreneurial drive'.

<i>Entre households in community (#)</i>	4974	6.81	3.95	1	23
Business characteristics					
<i>Business history (years)</i>	4974	10.34	9.25	0	117
<i>Business online (%)</i>	4974	9.17	28.86	0	100
<i>Cooperated with government (%)</i>	4974	5.15	22.10	0	100
<i>Received policy benefit (%)</i>	4974	12.40	32.97	0	100
<i>Business for more money (%)</i>	4974	27.46	44.64	0	100
<i>Business for ambition (%)</i>	4974	11.48	31.88	0	100
<i>Business for freedom (%)</i>	4974	29.71	45.70	0	100
<i>Business form - Individual business (%)</i>	4974	81.42	38.90	0	100
<i>Business form - Informally organized (%)</i>	4974	8.42	27.78	0	100
<i>Business invest (CNY)</i>	4974	194628.08	822390.55	0	30000000

Notes: (1) For brevity, we do not list province and industry dummies in the table. (2) All monetary variables shown in the table were kept as CNY value upon survey time, and transformed by natural logarithm when computed in models in this paper.

5.2 Digital financial capability and household business ownership

Regression (1) in Table 3 shows the probit result on the association between *DFC* and household *Business ownership*, from which we can see that, having higher *DFC* was positively associated with being a business owner. The coefficients of control variables demonstrate expected relationships: the probability for a household to be a business owner rose with respondent's age first and went down later. Male and less-educated respondents¹⁸, households with more members and higher asset value, residing in rural areas or communities with more entrepreneurial neighbors, in good health condition, without children or elders, were more likely to be business owners.

Nevertheless, *DFC* may be endogenous concerning *Business ownership*. As discussed in the methodology section, it is possible that entrepreneurs gained *DFC* after the business had already been started. In order to address endogeneity, we adopt the instrumental variable *Use the Internet*, and carry out two-step IV probit estimation by Control Function Approach. From the Kleibergen-Paap rk statistics, we can conclude that there is no under identification or weak instrument issues. In order to confirm the necessity of IV estimation, Durbin-Wu-Hausman test was conducted. The statistics reject the null hypothesis that the explanatory variable is exogenous. Hence, the instrumental variable is valid and the IV regression is necessary. Shown by regression (2), with other variables at means, one-unit increase in *DFC* score from its mean results in a 1.56% increase in the probability of a household being a business owner, at 1% confidence level.

Table 3. Digital financial capability and household business ownership

Dependent variable:	(1)	(2)
<i>Business ownership</i>	Probit	IV Probit
<i>Digital financial capability score (DFC)</i>	0.0058*** (0.0013)	0.0156*** (0.0044)
N	38,506	38,506
Kleibergen-Paap rk LM statistic:	2765.30	
Kleibergen-Paap rk Wald F statistic:	2975.92	
- Stock-Yogo weak ID test critical values: 10% maximal IV size	16.38	
Durbin (score) chi2(1):	12.75 (p = 0.0004)	
Wu-Hausman F (1,38462):	12.74 (p = 0.0004)	

Notes: (1) All control variables were included. (2) Standard errors in parentheses, clustered at community level for the Probit model, obtained from bootstrapping with 1000 replications by Control Function Approach for the IV Probit model. Stars show the significance of marginal effects, *** p<0.01.

Table 4 presents the mediation channels through which *DFC* impacts *Business ownership*. All assumed channels but *Informal loan* have significant indirect effects at 1% confidence level. In order to compare the

¹⁸ Recall that the respondent was designed and required by the survey, to be the one who knew best about household economic conditions.

indirect effects with total effect, we calculate the percentage each mediation channel contributes. The direct effect of *DFC* accounts for 14.44% of total effect, while indirect effects take up as much as 85.56%. It is intriguing that there are both positive and negative mediation channels. The greatest indirect effect is through *Online sale*, that is, controlling for all other mediators in the model, *Online sale* contributes more than 100% of total effect. Comparatively, *Bank loan* only mediates 7.68% of total effect. With regard to the three investment channels, it is worth noting that *Insurance investment* contributes nearly twice the indirect effect of *Liquidity investment*, demonstrating that an important channel for *DFC* to promote *Business ownership* is through the provision of a risk floor so that households have more confidence to start their own businesses (Cole, Giné, and Vickery, 2017). Oppositely, *Other financial investment*, which often consists of medium or high-risk investment, mediates negatively nearly half of total effect. This goes along with the existing literature that, on one hand, business owners usually invest most of their surplus in their own businesses (Gentry and Hubbard, 2004); on the other hand, Luo and Zeng (2020) also shows negative relationship between diversified investment and household entrepreneurial decisions.

In brief, *DFC* positively promotes different sorts of household investment, however, different channels of investment can have both positive and negative impacts on *Business ownership*. From our examination, the net indirect effect through investment is negative. *Online sale* is the most prominent mediator, while those in the borrowing dimension account for relatively small percentage of total effect.

Table 4. Mediation channels through which digital financial capability impacts household business ownership

Dependent variable: <i>Business ownership</i> N=38,506			Effects	% in total effect
Direct effect	(1)	<i>DFC</i>	0.0173** (0.0075)	14.44%
	(2)	<i>Online sale</i>	0.1255*** (0.0102)	104.76%
	(3)	<i>Informal loan</i>	0.0710 (0.0792)	0.00%
	(4)	<i>Bank loan</i>	0.0092*** (0.0028)	7.68%
Indirect effects	(5)	<i>Liquidity investment</i>	0.0093*** (0.0022)	7.76%
	(6)	<i>Insurance investment</i>	0.0170*** (0.0044)	14.19%
	(7)	<i>Other financial investment</i>	-0.0585*** (0.0081)	-48.83%

Notes: (1) All results in the table were computed by generalized structural equation model (GSEM), control variables were included. (2) Standard errors in parentheses. Based on Hayes (2013), standard errors of indirect effects were obtained by bootstrapping with 5000 replications. Stars show the significance of GSEM effects, ** p<0.05, *** p<0.01.

5.3 Digital financial capability and household business innovation

Regression (1) in Table 5 presents the probit result on the association between *DFC* and household *Business innovation*, showing having higher *DFC* was also positively associated with *Business innovation*. To address endogeneity, we also utilize *Use the Internet* as the instrumental variable and adopt Control Function Approach to conduct IV probit regression. From the Kleibergen-Paap rk statistics, we can see that there is no under identification or weak identification issues. The results of Durbin-Wu-Hausman test reject the hypothesis that the explanatory variable is exogenous. Therefore, the IV is valid and it is necessary to deal with endogeneity. According to the result of regression (2), *DFC* improves the probability of *Business innovation* significantly. With other variables at mean values, one-unit increase in *DFC* score from its mean, results in a 7.25% increase in the probability of a business owner executing innovative activities at 1% confidence level.

Table 5. Digital financial capability and household business innovation

Dependent variable: <i>Business innovation</i>	(1) Probit	(2) IV Probit
<i>DFC</i>	0.0206*** (0.0033)	0.0725*** (0.0138)
N	4,974	4,974
Kleibergen-Paap rk LM statistic:		390.56
Kleibergen-Paap rk Wald F statistic:		418.30
- Stock-Yogo weak ID test critical values: 10% maximal IV size		16.38
Durbin (score) chi2(1):	8.4407 (p = 0.0037)	
Wu-Hausman F (1,4908):	8.3428 (p = 0.0039)	

Notes: (1) All control variables were included. (2) Standard errors in parentheses, clustered at community level for the Probit model, obtained from bootstrapping with 1000 replications by Control Function Approach for the IV Probit model. Stars show the significance of marginal effects, *** p<0.01.

Table 6 presents the mediation channels through which *DFC* impacts *Business innovation*. Among the six assumed mediator variables, *Informal loan* and *Liquidity investment* do not show significant indirect effects. For brevity, we do not list insignificant mediators in the table. Without the moderation of social media, direct effect of *DFC* constitutes nearly all of total effect, indicating mediators almost offset each other's indirect effect. Similar to that in Table 4, *Other financial investment* contributes negatively half the total effect, while *Insurance investment* and *Bank loan* contributes 34.63% and 16.93% respectively. The result indicates that, for business owners, investment in medium or high-risk financial instruments would decrease the probability that they execute innovative activities, which might also be seen as risky investment. Through both *Insurance investment* and *Bank loan*, *DFC* increases the propensity that business owners implement *Business innovation*. By taking *Social media* as a moderator of *Online sale*, the indirect effect of *Online sale* turns significant and contributes more than half of total effect if the respondent did use *Social media*, confirming it as a critical source of innovative activities for micro or small businesses.

In brief, *DFC* increases the probability of business owners implementing *Business innovation* through interaction with *Social media*, which may act as a low-cost network of open innovation (Huston and Sakkab, 2006). Apart from that, *DFC* also promotes *Business innovation* through improving accessibility of *Bank loan* and increasing confidence by promoting adoption of *Insurance investment* as a risk floor. By encouraging *Other financial investment*, *DFC* also leaves negative impact on *Business innovation*.

Table 6. Mediation channels through which digital financial capability impacts household business innovation

Dependent variable: <i>Business innovation</i> N=4,974		Effects	% in total effect	
			Not use social media	Use social media
Direct effect	(1) <i>DFC</i>	0.0638*** (0.0169)	99.07%	48.55%
	(2) <i>Online sale</i>	0.0222 (0.0425)	0.00%	---
	(3) <i>Online sale</i> - moderated by <i>Social media</i>	0.0670*** (0.0162)	---	50.99%
Indirect effects	(4) <i>Bank loan</i>	0.0109* (0.0064)	16.93%	8.30%
	(5) <i>Insurance investment</i>	0.0223** (0.0096)	34.63%	16.97%
	(6) <i>Other financial investment</i>	-0.0326* (0.0162)	-50.62%	-24.81%

(0.0180)

Notes: (1) All results in the table were computed by generalized structural equation model (GSEM), control variables were included. (2) Standard errors in parentheses. Based on Hayes (2013), standard errors of indirect effects were obtained by bootstrapping with 5000 replications. Stars show the significance of GSEM coefficients, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.4 Digital financial capability and household business financial performance

Regression (1) and (4) in Table 7 present the linear results on the relationships between *DFC* and household business financial performance, showing positive associations between *DFC* and *Business income*, as well as between *DFC* and *Business profit*. To deal with possible endogeneity, as discussed in the methodology section, we continue to conduct 2SLS regressions, adopting ‘*Use the Internet*’ as the IV for *DFC*. From the Kleibergen-Paap rk statistics, we can conclude that the instrumental variable is not weak. However, according to Durbin-Wu-Hausman tests, we cannot reject the hypothesis that the explanatory variable is exogenous, which means the results of OLS regressions would be more consistent.

To double check the validity of the 2SLS results, we utilize the Gaussian Copula Approach proposed by Park and Gupta (2012). With the prerequisite of the possibly endogenous regressor being non-normal, the Gaussian Copula Approach does not require IVs from outside, but instead models the joint distribution of the endogenous explanatory variable and the error term. Statistically, the endogenous part of the endogenous regressor is estimated and generated as an additional regressor, P^* . Similar to the way of Control Function Approach, P^* is added to the equation to control the endogeneity of the explanatory variable. Meanwhile, the significance of P^* 's coefficient indicates whether there is significant endogeneity. By confirming *DFC* non-normal, we estimate the 2SLS again by the Gaussian Copula Approach. From Table 7, we can see that the result is similar to that obtained by 2SLS and the significance of P^* 's coefficient indicates there is no significant endogeneity. Therefore, we should stick to the OLS results. At 1% confidence level, one-unit increase of *DFC* score from its mean, would result in 10.36% more *Business income*, and 13.31% more *Business profit*.

Table 7. Digital financial capability and household business financial performance

Variables	<i>Ln (Business income)</i>			<i>Ln (Business profit)</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	2SLS-Copula	OLS	2SLS	2SLS-Copula
<i>DFC</i>	0.1036*** (0.0275)	0.2192** (0.0885)	0.1965*** (0.0656)	0.1331** (0.0568)	-0.104 (0.1972)	-0.0741 (0.1371)
P^* (Gaussian Copula Approach)			-0.1762 (0.1185)			0.3978 (0.2449)
N	4974	4974	4974	3996	3996	3996
Kleibergen-Paap rk LM statistic:	390.56			308.05		
Kleibergen-Paap rk Wald F statistic:	418.3			328.35		
Durbin (score) chi2(1):	1.6034 (p=0.2054)			1.4368 (p=0.2307)		
Wu-Hausman	F (1,4908): 1.5826 (p=0.2084)			F (1,3930): 1.4135 (p=0.2345)		

Notes: (1) Stock-Yogo weak ID test critical value for 10% maximal IV size is 16.38. (2) All control variables were included. (3) Standard errors in parentheses, clustered at community level for the OLS and 2SLS models, obtained from bootstrapping with 1000 replications by Gaussian Copula Approach for the 2SLS-Copula models. Stars show the significance of marginal effects, ** $p < 0.05$, *** $p < 0.01$.

Table 8 shows the mediation effects for *Business income* and *Business profit*. Among the assumed mediator variables, *Informal loan* does not show significant indirect effect regarding *Business income*, while *Bank loan* and *Other financial investment* do not show significant indirect effects regarding *Business*

profit. For brevity, we do not list insignificant mediators. Since we include *Business innovation* as one of mediators for financial performance, the channel ‘*Online sale* → *Business innovation*’ means a serial mediation path from *DFC* through *Online sale*, *Business innovation* and finally to *Business income* or *Business profit*.

For *Business income*, significant mediation channels include *Business innovation*, *Online sale* moderated by *Social media* through *Business innovation*, *Bank loan*, *Bank loan* through *Business innovation*, *Liquidity investment*, *Insurance investment* through *Business innovation*, as well as *Other financial investment* through *Business innovation*. Among all the significant mediators, *Liquidity investment*, *Business innovation* and *Bank loan* are the variables that mediate most effects if the household did not use social media. Comparatively, if the household did use social media, the three most prominent mediators were *Liquidity investment*, *Online sale* moderated by *Social media* through *Business innovation*, as well as *Business innovation*.

For *Business profit*, significant mediation channels include *Business innovation*, *Online sale* moderated by *Social media* through *Business innovation*, *Informal loan*, *Liquidity investment*, as well as *Insurance investment* through *Business innovation*. Among all the significant mediators, *Liquidity investment*, *Informal loan* and *Business innovation* are the variables that mediate most effects no matter whether households used social media or not.

Table 8. Mediation channels through which digital financial capability impacts household business financial performance

Channels	<i>Ln (Business income)</i> % in total effect		<i>Ln (Business profit)</i> % in total effect	
	Not use social	Use social	Not use social	Use social
Direct effect				
(1) <i>DFC</i>	0.0626** (0.0270)	28.90%	0.1070* (0.0592)	30.33%
(2) <i>Business innovation</i>	0.0366*** (0.0124)	16.90%	0.0332** (0.0174)	9.41%
(3) <i>Online sale → Business innovation</i>	0.0128 (0.0220)	—	0.0116 (0.0205)	—
(4) <i>Online sale → Business innovation</i> - moderated by <i>Social media</i>	0.0385*** (0.0113)	17.77%	0.0349** (0.0178)	9.89%
(5) <i>Bank loan</i>	0.0334*** (0.0108)	15.42%		
(6) <i>Bank loan → Business innovation</i>	0.0063* (0.0037)	2.91%		
(7) <i>Informal loan</i>			0.0517* (0.0263)	14.65%
(8) <i>Liquidity investment</i>	0.0451*** (0.0100)	20.82%	0.1144*** (0.0229)	32.43%
(9) <i>Insurance investment → Business innovation</i>	0.0128** (0.0060)	5.91%	0.0116* (0.0073)	3.29%
(10) <i>Other financial investment → Business innovation</i>	-0.0187* (0.0113)	-8.63%		
N	4,974		3,996	

Note: 1. All results in the table were computed by generalized structural equation model (GSEM), control variables were included. Stars show the significance of GSEM coefficients, * p<0.1, ** p<0.05, *** p<0.01. 2. Standard errors in parentheses. Based on Hayes (2013), standard errors of indirect effects were obtained by bootstrapping with 5000 replications.

5.5 Heterogeneity across socioeconomic populations

Table 9 presents the marginal effects of *DFC* on the four dependent variables across socioeconomic populations, grouped by low/high income¹⁹, age cohorts and educational attainment. There are distinct patterns that should not be overlooked.

To be specific, *DFC*'s marginal effects on *Business ownership* are more pronounced for low-income, middle-aged populations, with lower educational attainment level. The rationality is embedded in the characteristics of both human capital and digital financial technologies. Generally, populations, who earn low income, with lower educational attainment level may find it harder to meet formal employment requirement. Regarding the middle-aged, the situation would be even harder for them than younger workers. Fortunately, the widely connected, efficient and low-cost features of digital financial services in China have helped create a well-functioning ecosystem to benefit them in running their own businesses. Such distinct patterns leave us inspirations for future policy emphasis, to promote *DFC* of those vulnerable populations.

With respect to *Business innovation*, greater marginal effects are seen for more populations, with those for low/high income, and low/high educational attainment being similar, that for the elder cohort even larger than the middle-aged, indicating *DFC* promotes *Business innovation* quite evenly across different populations, not necessarily benefiting the digitally sophisticated only.

As for financial performance, marginal effects are generally larger for high-income and younger populations, with lower educational attainment level. According to Table 2, those who attended junior high school or lower educational levels account for 64.02% of the entire sample and 58.02% of the business sample. The improvement of *DFC* seems to act as an opportunity for post-school human capital building, so that those who missed the chance of attaining much education before adulthood can be better included in the digital era.

Table 9. Heterogenous impacts of digital financial capability across different socioeconomic populations

Dependent variables	(1) Low income	(2) High income	(3) Age 16~35	(4) Age 36~59	(5) Age 60 & above	(6) Junior high or lower	(7) High school or higher
<i>Business ownership</i>	0.0579*** (0.0218)	0.0049 (0.0223)	0.0446 (0.0479)	0.0518** (0.0222)	-0.0016 (0.0184)	0.0426** (0.0165)	-0.0079 (0.0234)
<i>N</i>	19196	19276	5111	18318	15043	24624	13848
<i>Business innovation</i>	0.0684*** (0.0150)	0.0659** (0.0262)	0.0412 (0.0503)	0.0682*** (0.0186)	0.0868*** (0.0264)	0.0587*** (0.0136)	0.0598* (0.0356)
<i>N</i>	2098	2864	1180	3066	591	2865	2088
<i>Ln (Business income)</i>	0.0368 (0.0491)	0.0763** (0.0331)	0.1233* (0.0657)	0.0825** (0.0327)	0.1037 (0.0936)	0.1376*** (0.0315)	0.0752 (0.0473)
<i>N</i>	2110	2864	1180	3066	728	2886	2088
<i>Ln (Business profit)</i>	-0.0374 (0.1236)	0.1049* (0.0580)	0.2886** (0.1442)	0.0524 (0.0693)	0.2882** (0.1329)	0.2057*** (0.0658)	0.0741 (0.1001)
<i>N</i>	1463	2533	940	2464	592	2329	1667

Note: (1) Instrumental variable was utilized according to exogeneity tests above. (2) Standard errors in parentheses, for IV Probit regressions regarding *Business ownership* and *Business innovation*, we obtained standard errors by using Control Function Approach and bootstrapping with 1000 replications; for OLS regressions regarding business financial performance, standard errors were clustered at community level. Stars show the significance of marginal effects at means, * p<0.1, ** p<0.05, *** p<0.01. (3) Different sample sizes concerning the same population were caused by some variables not used for collinearities after the entire sample being split into different populations.

6. Conclusions

This study utilizes data from 2017 CHFS to investigate the relationship between *Digital financial capability (DFC)* and household entrepreneurial performance. Overall, *DFC* has significant and positive impact on *Business ownership*, *Business innovation*, *Business income* and *Business profit*. The results still hold after dealing with endogeneity issues. Concerning how *DFC* influences household entrepreneurial performance, mediation channels are not all the same regarding the four dependent variables. With respect to household *Business ownership*,

¹⁹ Low/ high income samples were split by the median value of household income per capita.

predominant mediation effect is contributed by *Online sale*, accounting for as much as 104.76% of total effect. Percentages taken by *Bank loan*, *Liquidity investment*, *Insurance investment* as well as *Other financial investment* are 7.68%, 7.76%, 14.19% and -48.83% respectively, indicating *Other financial investment* might be an important substitute for household business, which can also be regarded as a type of risky investment. With respect to *Business innovation*, *Online sale* moderated by *Social media* provides prominent mediation effect, contributing as much as 50.99% of the total effect, if the business owner did use social media. Percentages taken by *Bank loan*, *Insurance investment* and *Other financial investment* are 8.30%, 16.97% and -24.81% respectively. However, if household did not use social media, the total indirect effects took up less than 1% of total effect, because the mediation effect of *Online sale* was not significant when social media was not used, and percentages taken by *Bank loan*, *Insurance investment* and *Other financial investment* are 16.93%, 34.63% and -50.62% respectively, offsetting each other almost to 0. With respect to *Business income and Business profit*, *Liquidity investment* is the most standout mediation channel, while *Other financial investment* contributes much smaller negative indirect effects than those in the models for the first two dependent variables. It also draws attention that business innovation is a significant mediator for both *Business income and Business innovation*.

As for heterogeneity across different populations, *DFC* especially empowers those with low income to run their own businesses and implement innovative activities, while enabling those with lower education attainment to earn more.

Compared with previous studies, this paper extends the existing literature in three folds. Firstly, we are among the first to define *DFC*, in order to raise awareness that the capability to fully and properly make use of digital financial products and services has become increasingly important for micro economic lives in the digital era. Secondly, multidimensional dependent variables and functional channels are taken into consideration, which help provide a good exploration and description on how *DFC* impacts household entrepreneurial performance. Thirdly, heterogeneous impacts are also demonstrated for further policy implications.

It is important for financial inclusion policies, especially those targeted at MSME financial services, to be paired with capability building programs to promote *DFC*. It is pivotal for policy makers to be aware about the implication provided by our examination of mediation channels. By building households' *DFC*, households can make better use of *Online sale* to start and optimize their own businesses, and more easily access credit and investment products. The improvement of *DFC* usually starts with adopting basic digital financial services, like digital payment. By observing recent development in the area, it is possible that the simple adoption of digital payment can then evolve into usage of many other digital financial services, through the accumulation of payment data records. It would be forward-looking for national strategies to make and implement effective data regulations, in order to sustain an empowering environment for people to improve *DFC* and achieve better livings, through entrepreneurial, for example. It is also necessary to provide households with guidelines for risky asset holdings, so that households can better control risk levels and enjoy asset growth.

In our study, we have tried our best to ensure the robustness of measurement and regressions. However, our measure of *DFC* is still subject to data availability from existing surveys. For future studies, there is the need to keep the assessment of *DFC* up to latest development of the area.

This paper is distinguished from most studies around MSMEs finance in that, it sets out from the research subjects of households, as well as the real time characteristic of micro economic lives in the digital era, to depict the situation where people's adaptability to digitization is playing a more and more important role in their living-making, demonstrating detailed insights on how *DFC* influences household entrepreneurial performance. Above all, we provide an exploration and a starting point for future scholars and policy makers to take the challenges brought by evolution of financial industry seriously and profoundly.

References

- Aghion, P., Fally, T., & Scarpetta, S. (2007). Credit constraints as a barrier to the entry and post-entry growth of firms. *Economic policy*, 22(52), 732-779.
- Aral, S., Dellarocas, C., & Godes, D. (2013). Introduction to the special issue—social media and business transformation: a framework for research. *Information Systems Research*, 24(1), 3-13.
- Astebro, T., Herz, H., Nanda, R., & Weber, R. A. (2014). Seeking the roots of entrepreneurship: Insights from behavioral economics. *Journal of Economic Perspectives*, 28(3), 49-70.
- Atkinson, A., McKay, S., Collard, S., & Kempson, E. (2007). Levels of financial capability in the UK. *Public Money and Management*, 27(1), 29-36.
- Atkinson, A. and Messy, F. (2012). Measuring Financial Literacy: Results of the OECD/International Network on Financial Education (INFE) Pilot Study. *OECD Working Papers on Finance, Insurance and Private Pensions*, No. 15, OECD Publishing. http://www.oecd-ilibrary.org/finance-and-investment/measuring-financial-literacy_5k9csfs90fr4-en

- Ayyagari, M., Demirgüç-Kunt, A., & Maksimovic, V. (2010). Formal versus informal finance: Evidence from China. *The Review of Financial Studies*, 23(8), 3048-3097.
- Ayyagari, M., Demirgüç-Kunt, A., & Maksimovic, V. (2011). Firm innovation in emerging markets: The role of finance, governance, and competition. *Journal of Financial and Quantitative Analysis*, 46(6), 1545-1580.
- Bansal, Sukriti, Philip Bruno, Olivier Denecker, Madhav Goparaju, and Marc Niederkorn. (2018). Global Payments 2018: A Dynamic Industry Continues to Break New Ground. *McKinsey Global Banking Report*. <https://www.mckinsey.com/~media/McKinsey/Industries/Financial%20Services/Our%20Insights/Global%20payments%20Expansive%20growth%20targeted%20opportunities/Global-payments-map-2018.ashx>
- Beck, T., Lu, L., & Yang, R. (2015). Finance and growth for microenterprises: evidence from rural China. *World Development*, 67, 38-56.
- Blanchflower, D. G., & Oswald, A. J. (1998). What makes an entrepreneur?. *Journal of Labor Economics*, 16(1), 26-60.
- Cagetti, M., & De Nardi, M. (2006). Entrepreneurship, frictions, and wealth. *Journal of Political Economy*, 114(5), 835-870.
- Chatterji, A. K., & Seamans, R. C. (2012). Entrepreneurial finance, credit cards, and race. *Journal of Financial Economics*, 106(1), 182-195.
- Chen, L. (2016). From fintech to finlife: the case of fintech development in China. *China Economic Journal*, 9(3), 225-239.29-1139.
- Cole, R. A., & Wolken, J. D. (1995). Financial services used by small businesses: Evidence from the 1993 National Survey of Small Business Finances. *Federal Reserve Bulletin* 81: 629.
- Cole, S., Giné, X., & Vickery, J. (2017). How does risk management influence production decisions? Evidence from a field experiment. *The Review of Financial Studies*, 30(6), 1935-1970.
- Ćumurović, A., & Hyll, W. (2019). Financial literacy and self-employment. *Journal of Consumer Affairs*, 53(2), 455-487.
- Dalla Pellegrina, L., Frazzoni, S., Rotondi, Z., & Vezzulli, A. (2017). Access to credit for small innovative businesses. *Economic Notes: Review of Banking, Finance and Monetary Economics*, 46(3), 411-458.
- Demirgüç-Kunt, A., Klapper, L. F., & Panos, G. A. (2011). Entrepreneurship in post - conflict transition. *Economics of Transition*, 19(1), 27-78.
- Evans, D. S., & Jovanovic, B. (1989). An estimated model of entrepreneurial choice under liquidity constraints. *Journal of Political Economy*, 97(4), 808-827.
- Gan, Li, Zhichao Yin, Nan Jia, Shu Xu, Shuang Ma, and Lu Zheng. (2014). *Data You Need to Know about China*. Berlin/Heidelberg: Springer-Verlag.
- Gentry, W. M., & Hubbard, R. G. (2004). Entrepreneurship and household saving. *Advances in Economic Analysis & Policy*, 4(1), 1-55.
- Herkenhoff, Kyle and Phillips, Gordon M. and Cohen-Cole, Ethan. (2016). How Credit Constraints Impact Job Finding Rates, Sorting & Aggregate Output. *NBER Working Paper No. w22274*.
- Hernández-Trillo, F., Pagán, J. A., & Paxton, J. (2005). Start - up capital, microenterprises and technical efficiency in Mexico. *Review of Development Economics*, 9(3), 434-447.
- Huston, L., & Sakkab, N. (2006). Connect and develop. *Harvard Business Review*, 84(3), 58-66.
- Hvide, H. K., & Panos, G. A. (2014). Risk tolerance and entrepreneurship. *Journal of Financial Economics*, 111(1), 200-223.
- Ilmakunnas, P., & Kannianen, V. (2001). Entrepreneurship, Economic Risks, and Risk Insurance in the Welfare State: Results with OECD Data 1978-93. *German Economic Review*, 2(3), 195-218.
- Jack, W., & Suri, T. (2011). Mobile money: The economics of M-PESA. *NBER Working paper No. w16721*.
- Johnson, E., & Sherraden, M. S. (2007). From financial literacy to financial capability among youth. *Journal of Sociology and Social Welfare*, (34): 119.
- Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, 39(1), 31-36.
- Kapron, Z., & Meertens, M. (2017). Social networks, e-commerce platforms, and the growth of digital payment eco-systems in China: What it means for other countries. *Better Than Cash Alliance Research Series, Case Study*, 19th April, available at: <https://www.betterthancash.org/tools-research/case-studies/social-networks-e-commerce-platforms-and-the-growth-of-digital-payment-ecosystems-in-china>
- Kerr, W. R., & Nanda, R. (2009). Democratizing Entry: Banking Deregulations, Financing Constraints, and Entrepreneurship. *Journal of Financial Economics*, 94(1), 124-149.
- Kojo Oseifuah, E. (2010). Financial Literacy and Youth Entrepreneurship in South Africa. *African Journal of Economic and Management Studies*, 1(2), 164-182.

- Krasniqi, B. A. (2009). Personal, household and business environmental determinants of entrepreneurship. *Journal of Small Business and Enterprise Development*, 16 (1), 146-166.
- Luo, Y., & Zeng, L. (2020). Digital financial capabilities and household entrepreneurship. *Economic and Political Studies*, DOI: 10.1080/20954816.2020.1736373
- Luohan Academy (2019). Digital Technology and Inclusive Growth. https://gw.alipayobjects.com/os/antfincdn/DbLN6yXw6H/Luohan_Academy-Report_2019_Executive_Summary.
- Lyons, A. C., J. Kass-Hanna, F. Liu, A. J. Greenlee, and L. Zeng. (2020). Building Financial Resilience through Financial and Digital Literacy in South Asia and Sub-Saharan Africa. *ADBI Working Paper 1098*. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/building-financial-resilience-through-financial-digital-literacy-south-asia-saharan-africa>
- Manyika, J., Lund, S., Singer, M., White, O., Berry, C. (2016). Digital financial for all: powering inclusive growth in emerging economies. McKinsey Global Institute. Available at: <https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Employment%20and%20Growth/How%20digital%20finance%20could%20boost%20growth%20in%20emerging%20economies/MG-Digital-Finance-For-All-Full-report-September-2016.ashx>
- Morgan, P.J., Huang, B., and Trinh, L.Q. (2019). The Need to Promote Digital Financial Literacy for the Digital Age. *Realizing education for all in the digital age*. T20 Report, 40-46. <https://www.adb.org/sites/default/files/publication/503706/adbi-realizing-education-all-digital-age.pdf#page=56>
- Nandhi, M. A. (2012). Effects of mobile banking on the savings practices of low-income users—The Indian experience. *IMTFI Working Paper 2012-7*. Institute for Money, Technology and Financial Inclusion, University of California, Irvine.
- OECD. (2017). G20/OECD INFE report on adult financial literacy in G20 countries. Paris: OECD. <http://www.oecd.org/daf/fin/financial-education/G20-OECD-INFE-report-adult-financial-literacy-in-G20-countries>.
- Olds, G. (2016). Entrepreneurship and Public Health Insurance. *Harvard Business School Working Paper No. 16-144*.
- Park, S., & Gupta, S. (2012). Handling endogenous regressors by joint estimation using copulas. *Marketing Science*, 31(4), 567-586.
- Quadrini, V. (2000). Entrepreneurship, Saving, and Social Mobility. *Review of Economic Dynamics*, 3(1), 1-40.
- Sekabira, H., & Qaim, M. (2017). Can mobile phones improve gender equality and nutrition? Panel data evidence from farm households in Uganda. *Food Policy*, 73, 95-103.
- Siddik M.N.A., Kabiraj S. (2020). Digital Finance for Financial Inclusion and Inclusive Growth. In: George B., Paul J. (eds) *Digital Transformation in Business and Society*. Palgrave Macmillan, Cham
- Wellington, A. J. (2001). Health insurance coverage and entrepreneurship. *Contemporary Economic Policy*, 19(4), 465-478.
- Perotti, V., Zottel, S., Iarossi, G., & Bolaji-Adio, A. (2013). Making sense of financial capability surveys around the world: a review of existing financial capability and literacy measurement instruments. *Washington DC: The World Bank*.
- Yin, Z., Gong, X., & Guo, P. (2019). The Impact of Mobile Payment on Entrepreneurship—Micro Evidence from China Household Finance Survey. *China Industrial Economics*, (3), 119-137.
- Yin, Z., Song, Q., Wu, Y., & Peng, C. (2015). Financial Knowledge, Entrepreneurial Decision and Motivation. *Management World*, (1), 87-98.
- Zetzsche, D., Buckley, R., & Arner, D. (2019). FinTech for Financial Inclusion: Driving Sustainable Growth. In: Walker, J., Pekmezovic, A., Walker, G., (eds) *Sustainable Development Goals*. DOI:10.1002/9781119541851.

Call for Papers

International Monetary Review

International Monetary Review is an internal academic magazine sponsored by International Monetary Institute. Following the principle of including both Chinese and western merits with precise and practical academic spirit, International Monetary Review focuses on the cutting-edge theoretical researches in internationalization of RMB, reform of international monetary system, regional monetary and financial cooperation, China's international financial strategies, and other macro-financial theories and policies.

We welcome submissions by scholars, experts and practitioners in financial industry. Papers and articles should center on key financial issues and follow academic standard and scientific methodology. We welcome quality articles based on data analysis and theoretical model and other insightful articles with standard writing.

Prepare your article

General rule: Submitted manuscripts should be double-spaced texts in 10.5 point font, and formatted for paper of standard size with margins of at least 20mm on all sides. Pages should be numbered, and an abstract (of no more than 200 words), as well as keywords and complete author affiliations, should be included in the paper in the title page. A regular article should not exceed 50 pages.

Mathematics: Equations must be identified by consecutive Arabic numbers in parentheses on the right. Expressions should be aligned and compound subscripts and superscripts clearly marked if there is any potential for confusion.

Figures: Figures must be of professional quality and ready for reproduction. They should be numbered consecutively. Black-and-white versions of figures are required for printing purposes, but color figures can also be supplied for online dissemination.

Tables: Tables should be numbered consecutively throughout the article. Each table must include a descriptive title and headings to columns. Gather general footnotes to tables as "Note:" or "Notes:", and use a, b, c, etc., for specific footnotes. Asterisks * and/or ** indicate significance at the 5 percent and 1 percent levels, respectively, if used.

Reference style

Please follow the EPS Style Guide when preparing your article.
<http://eps.ruc.edu.cn/UserFiles/File/EPS%20Style%20Guide.pdf>

Further considerations

- Manuscript has been spell-checked and grammar-checked
- References are in the correct format for this journal
- All references mentioned in the reference list are cited in the text, and vice versa
- Permission has been obtained for use of copyrighted material from other sources

Submit your article

Manuscripts can be submitted via e-mail to imi@ruc.edu.cn

